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2023 Annual International Conference of KSAST

“저탄소 친환경 축산”
Low Carbon to become environment-friendly Animal Industry

광주 김대중컨벤션센터
2023년 7월 5일(수)~7일(금)

- 주 최 : ㈔한국축산학회
- 공동주관 : ㈔한국축산학회, 국립축산과학원, 서울대학교 축산과학기술연구소
- 후 원 : 한국과학기술단체총연합회, (재)광주관광재단, 한국관광공사
- 협 찬 : (주)카길애그리퓨리나, (주)이지홀딩스, (주)정농바이오, 농협경제지주 축산경제, (주)hy, 김유용 교수, (주)우진B&G, 일동바이오사이언스(주), 축산환경관리원, (주)에이피엠엔지니어링, 한우자조금관리위원회, CJ BIO, CJ Feed&Care(주), 지더블유바이텍(주), (주)동곡기정, (사)대한한돈협회, (주)농심, 풀무원다논(주)

(사) 한 국 축 산 학 회
Korean Society of Animal Science and Technology

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- 후 원 : 한국과학기술단체총연합회, (재)광주관광재단, 한국관광공사
- 협 찬 : (주)카길애그리퓨리나, (주)이지홀딩스, (주)정농바이오, 농협경제지주 축산경제, (주)hy, 김유용 교수, (주)우진B&G, 일동바이오사이언스(주), 축산환경관리원, (주)에이피엠엔지니어링, 한우자조금관리위원회, CJ BIO, CJ Feed&Care(주), 지더블유바이텍(주), (주)동곡기정, (사)대한한돈협회, (주)농심, 풀무원다논(주)

(사) 한 국 축 산 학 회
Korean Society of Animal Science and Technology

인 사 말 씀

안녕하십니까?

2023년 한국축산학회 정기학술대회에 오신것을 환영합니다. 한국축산학회는 지난 2022년 코로나 펜데믹이 끝나지 않았음에도 불구하고 제19차 아세아태평양축산학회를 성공적으로 개최하여 우리나라의 앞선 축산 연구와 기술을 재확인하였습니다. 그동안의 정기학술대회는 매년 전국 대학을 순회하며 개최하였으나, 이제 규모가 확장된 시설과 학술발표로 빛고을 광주 김대중컨벤션센터에서 여러분을 맞이합니다.

이번 정기학술대회의 키워드는 탄소저감 입니다. 기조강연을 맡아주신 연사님들이 이 주제와 관련된 내용을 발표해 주실 것입니다. 현재 축산에 대하여 잘못되고 과장된 탄소 배출 문제가 금번 학술대회를 통하여 바로 잡아 축산이 환경을 살리면서 나아가 국민 먹거리에 기여한다는 점이 올바르게 알려지길 희망합니다. 우리 축산분야 학자들과 학문 후속 세대들이 탄소저감에 대한 과학적인 실마리를 찾는데 도움이 될 것이라 생각됩니다.

학술대회에 적극적으로 참여해주신 학회 회원님들과 이사님, 그리고 학회 실무진 여러분께 감사드립니다. 또한 이번 학술대회를 전폭적으로 지원해 주시고 후원해 주신 광주관광재단과 강기정 광주광역시장님, 축산과학원 박범영 원장님, 그리고 학회 후원을 해주신 많은 분들께 감사의 말씀을 드립니다.

Greetings and welcome to the 2023 International Symposium & Annual Meeting of Korean Society of Animal Sciences & Technology (KSAST).

Despite the hard conditions we had the past 3 years of Covid-19, Korea's advanced animal science research remains stronger than ever and successfully hosted the 19th AAAP Animal Science Congress in 2022. We proudly welcome you to the expanded facilities venue of academic presentations at the Gwangju Kim Dae-jung Convention Center. In the past, the annual meetings were hosted by a diverse network of universities within Korea.

Given this years theme keyword, "Low Carbon," the keynote speakers will give presentations on this subject. Through this KSAST Annual Meeting, we hope to dispel myths and exaggerations about carbon emissions in animal husbandry and inform the public that the animal industry can contribute to the preservation of the environment while also providing produce for the nation. Additionally, we believe that this meeting will assist the members of the Korean Society of Animal Sciences and future generations of scholars in discovering scientific clues for carbon reduction.

This KSAST Annual Meeting would not have been possible without the extraordinary efforts of the Program Committee, volunteers, and sponsors. Also, many thanks to the GJTO and Kang Ki-jung, the Mayor of Gwangju City, for their assistance in creating a successful meeting and extended thanks to all our session chairs, speakers, presenters, and exhibitors.

2023년 7월

(사)한국축산학회 회장

오 세 종

환 영 사

2023년 한국축산학회 학술발표회가 우리 광주에서 열리게 된 것을 매우 뜻깊게 생각하며 축하드립니다.

광주를 찾아주신 모든 분께 감사와 환영의 인사를 드립니다. 더불어 행사준비에 애써주신 한국축산학회 오세종 회장님을 비롯한 학회원과 관계자 여러분께도 감사의 마음을 전합니다.

우리 광주는 지난해 말부터 최근까지 유례없는 가뭄위기를 겪으면서 기후위기의 심각성과 탄소중립사회로의 전환에 대한 필요성을 절감했습니다. 그래서 이번 학술발표회의 주제인 '저탄소 친환경 축산'에 대한 논의에 많은 관심을 갖고 이를 정책적으로 담아낼 방법을 깊게 고민할 것입니다.

우리 광주의 축산업 규모는 그리 크지 않지만, 육류 소비가 증가하면서 전국적으로 축산업이 확대되고 있습니다. 장점도 있지만, 그에 따른 위생과 환경문제에 대한 대책도 필요해 보입니다.

소 한 마리에서 발생하는 연 평균 메탄가스 배출량이 소형차 1대의 배출량과 같습니다. 저탄소 친환경 축산으로의 전환이 시급한 이유입니다.

우리시는 정부와 함께 지속 가능한 축산환경 조성을 위해 깨끗한 축산농장 지정, 적정사육두수 관리, 메탄 발생 저감사료 개발 보급, 가축분뇨 퇴·액비화 등 다양한 정책을 마련해 시행하고 있습니다.

앞으로 더 나은 대안과 방안을 마련해 가는데 이번 학술발표회가 큰 도움이 될 것으로 생각합니다.

풍성한 논의를 기대합니다. 광주에 계시는 동안 광주가 가진 맛과 멋도 마음껏 즐기시기 바랍니다.

감사합니다.

2023년 7월

광주광역시 시장

강 기 정

축 사

여러분 반갑습니다.

2023년 한국축산학회의 학술발표회 개최를 진심으로 축하드립니다.

한국축산학회는 1956년 10월 창립 하여 67년의 역사를 가진 우리나라 축산분야의 대표 학회입니다. 학회 설립 이후 지금까지 우리나라 축산업의 성장과 발전을 함께해 왔습니다.

한국농촌경제연구원의 농업전망에 따르면 축산업 생산액은 2021년 기준 약 24조 6천억 원으로 농업 생산액의 약 41.5%를 차지하고 있습니다. 또한 국내 육류 소비 증가와 가격 상승으로 2032년에는 28조 7,410억 원에 이르고, 농업 생산액 중 축산업의 비중은 45%까지 확대될 것으로 전망하고 있습니다.

하지만 이러한 성장 전망에도 현재 축산업의 상황은 안도할 수 없습니다. 우리 앞에는 기후변화 가속화, 고령화, 악성 가축질병의 상시 발생, 시장 개방 확대 등 많은 어려움이 놓여 있습니다. 또한 소비자들은 더 이상 생존을 위해서 식품을 섭취하기보다 탄소중립, 친환경, 동물복지 등을 고려하고 윤리와 가치를 담아 소비하는 경향이 늘어나고 있기 때문입니다.

이렇게 중요한 시점에‘저탄소 친환경 축산’을 주제로 심도 있는 논의를 할 수 있게 자리를 마련하신 한국축산학회 오세종 회장님을 비롯한 임직원 및 관계자 여러분께 감사드립니다.

최근 미 FDA 및 농무성은 유전자편집기술로 생산된 돼지고기와 연어고기 그리고, 세포 배양으로 생산된 닭고기 시판을 승인했습니다. 축산업에 주어진 난제 해결에 이러한 다양한 과학기술의 접목이 필요합니다. 한국축산학회 회원 여러분들의 역할이 간절히 요구되는 시기입니다.

국립축산과학원에서도 축산분야 온실가스 배출량 산정에 필요한 축종별 국가고유 배출계수 개발과, 반추가축 메탄 저감 사료 개발, 저탄소 사양관리 등 연구를 지속해오고 있습니다. 또한 축산 냄새 저감 기술과 가축분뇨의 비농업계 이용 확대를 위한 기술 개발에도 연구 역량을 집중하고 있습니다.

‘저탄소 친환경 축산’의 실현은 학계와 산업계, 정책기관이 모두 힘을 모으고 축산농가와의 공감대 형성이 되어야 가능할 것입니다.

오늘 종합학술대회 자리에서 최근 부각되고 있는 저탄소 축산물 생산, 환경 친화적인 축산물 생산과 관련된 최신기술들을 공유하고, 우리나라 축산업 발전방향을 모색하는 장이 되기를 기원합니다.

끝으로 축산업 발전을 위해 밤낮으로 애쓰시는 회원님들의 노고에 다시 한 번 감사드리며, 여러분 가정에 늘 행복이 충만하시길 기원합니다. 감사합니다.

2023년 7월

국립축산과학원 원장

박 범 영

행사장 안내도

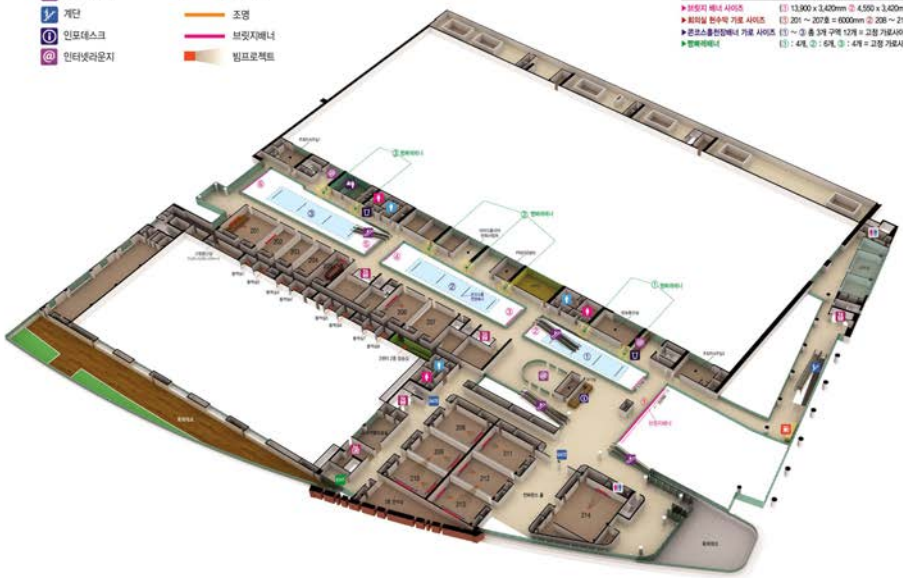
김대중컨벤션센터 1층

김대중컨벤션센터 2층

- 출입구
- 화장실
- 남자화장실
- 여자화장실
- 엘리베이터
- 화물용 엘리베이터
- 에스컬레이터
- 계단
- 인포데스크
- 인터넷라운지
- 비즈니스 센터
- 물건보관소
- (고정)정수기 위치
- 비상구
- 홀 나눔 칸막이
- 스크린
- 현수막봉
- 조명
- 브릿지배너
- 빔프로젝트

구분	Room No.	회의실 규격 (가로 x 세로 x 높이)	설치 빔프로젝터 (ANSI)	컨돔스크린	Room No.	회의실 규격 (가로 x 세로 x 높이)	설치 빔프로젝터 (ANSI)	컨돔스크린
중소회의실	201	12,130 x 9,630 x 4,200	4500ANSI	150"	208	11,300 x 8,120 x 4,200	6000ANSI	180"
	202	5,840 x 9,630 x 4,200	-	120"	209	11,300 x 8,120 x 4,200	6000, 8600ANSI	180"
	203	5,840 x 9,630 x 4,200	-	-	210	11,300 x 8,120 x 4,200	6000ANSI	180", 200"
	204	5,980 x 9,630 x 4,200	-	-	211	11,300 x 8,120 x 4,200	6000ANSI	180"
	205	5,730 x 9,630 x 4,200	4500ANSI	150"	212	11,300 x 8,120 x 4,200	6000, 8600ANSI	180"
	206	6,790 x 9,630 x 4,200	4500ANSI	150"	213	11,300 x 8,120 x 4,200	6000ANSI	180", 200"
	207	8,790 x 9,630 x 4,200	-	-	214	11,620 x 13,550 x 4,200	6000ANSI	200"

▶ 브릿지 배너 사이즈 ① 13,900 x 3,420mm ② 4,550 x 3,420mm ③ 7,000 x 3,420mm ④ 7,000 x 3,420mm ⑤ 6,250 x 3,420mm ⑥ 9,900 x 3,420mm)
▶ 회의실 현수막 가로 사이즈 ① 201 ~ 207호 = 6000mm ② 208 ~ 214호 = 5000mm)
▶ 콘코스홀천장배너 가로 사이즈 ① ~ ③ 총 3개 구역 12개 = 고정 가로사이즈 900mm)
▶ 컬럼배너 ① : 4개, ② : 6개, ③ : 4개 = 고정 가로사이즈 500mm)



김대중컨벤션센터 4층

- 출입구
- 화장실
- 남자화장실
- 여자화장실
- 엘리베이터
- 화물용 엘리베이터
- 에스컬레이터
- 계단
- (고정)정수기 위치
- 인터넷라운지
- 구내전화
- 물품보관소
- 홀 나눔 칸막이
- 스크린
- 현수막봉
- 조명
- 빔프로젝트

구분	규격	구분	규격
빔프로젝터(ANSI)	10,000ANSI(3층 방송실) 7,000ANSI(3층)	현수막 사이즈	15,000 x 900mm
컨돔식스크린	400"	홀천 사이즈(스크린 위쪽으로)	12,000 x 7,000mm
무대 사이즈	15,000 x 6,000 x 900mm	※컨벤션 홀 분할 사용시 이동식 빔프로젝트 및 스크린 별도문의	

목 차

구두 발표

구두 발표회 초록

포스터 발표

포스터 발표회 초록

학술대회 전체일정표

◆ 광주 김대중컨벤션센터 컨벤션홀 (4층)

2023년 7월 5일 (수)

장소 / 시간	김대중컨벤션센터 컨벤션홀 (4층)	
14:00 ~	등록 및 접수 (2층)	
15:00~15:20	개회사 : 오 세 종 (한국축산학회장) 환영사 : 강 기 정 (광주광역시장) 축 사 : 박 범 영 (국립축산과학원장)	
15:20~16:20	Plenary Lecture 1	
	김유용 교수 (서울대학교)	저단백질 양돈사료의 이용과 탄소중립
16:20~17:20	학회 시상 및 수상자 특강	
16:20~17:20	축산 관련 학과 학과장 간담회(주관: 국립축산과학원, 3층 307호)	
18:00~	축산 기업과의 소연(小宴) (홀리데이인호텔 3층 컨벤션1)	

2023년 7월 6일 (목)

장소 / 시간	김대중컨벤션센터 컨벤션홀 (4층)			
	208호 (2층)	214호 (2층)	209호 (2층)	212호 (2층)
08:00~	등록접수			
08:30~09:00	포스터 부착(08:30까지) *주의: 포스터 게시시간 엄수 (08:30~16:50)			
	Plenary Lecture 2 (컨벤션홀, 4층) 좌장: 길동용 교수 (중앙대학교)			
09:00~09:50	Dr. Mingan Choct (Univ. of New England, 호주)		Sustainable feed formulation for poultry	
10:00~12:30	마연구회 세션	영양사료 연구회세션	동물마이크로바이옴 연구회세션	JAST 학술윤리세션
12:30~13:20	정기총회 (컨벤션홀, 4층)			
12:30~13:30	점심식사 (점심 미제공, *상품권 대체)			
	Plenary Lecture 3 (컨벤션홀, 4층) 좌장: 김민석 교수 (전남대학교)			
13:30~14:20	Dr. Frances Cowley (Univ. of New England, 호주)		Triumphs and troubles in trying to reduce enteric methane from ruminants	
14:20~15:00	휴 식 (Coffee Break) 포스터발표회(Ⅰ): 우수포스터 심사 (장소: 4층 로비)			
15:00~17:00	카킬 애그리퓨리나 세션 (컨벤션홀, 4층) 좌장: 윤진현 교수(전남대학교)			
	김정훈 박사 (카길애그리퓨리나 지속가능경영본부장) 김동혁 박사 (카길애그리퓨리나 양돈연구기술부장) 오준표 박사 (카길애그리퓨리나 축우연구기술부장)		친환경 지속가능 경영 소개 지속가능축산을 위한 양돈연구 저메탄사료 개발과 산업에의 적용	

15:00~15:50	구두발표 I						
	208호(2층)	209호(2층)	210호(2층)	211호(2층)	212호(2층)	213호(2층)	214호(2층)
	단위영양 (ⅰ) 좌장 송민호 교수	단위영양 (ⅱ) 좌장 조진호 교수	단위영양 (ⅲ) 좌장 공창수 교수	동물생명공학 좌장 홍석만 박사	초지 및 환경 좌장 안희권 교수	축산물 이용 및 가공 좌장 정사무엘 교수	반추영양 좌장 서자겸 교수
16:00~16:50							번식 및 생리 좌장 이영주 교수

2023년 7월 7일 (금)

<table>
<tr><th>장소
시간</th><th colspan="7">김대중컨벤션센터 컨벤션홀 (4층)</th></tr>
<tr><td>08:00~</td><td colspan="7">등록접수</td></tr>
<tr><td>08:00~09:30</td><td colspan="7">*주의: 포스터 게시시간 엄수 (08:30~15:00)</td></tr>
<tr><td rowspan="4">09:30~12:00</td><td colspan="7">신진과학자 세션 좌장: 김현범 교수 (단국대학교)</td></tr>
<tr><td colspan="3">용해인 교수 (충남대학교)</td><td colspan="4">식육 및 식육가공품 내 대기압플라즈마의 적용</td></tr>
<tr><td colspan="3">장재철 교수 (경상국립대학교)</td><td colspan="4">정밀 사료 공급과 지속 가능한 양돈 생산</td></tr>
<tr><td colspan="3">김종혁 교수 (충북대학교)</td><td colspan="4">고온 및 밀집 사육 스트레스에 노출된 육계의 스트레스
저감 및 장벽 기능 강화를 위한 기능성 사료 물질 개발</td></tr>
<tr><td>12:00~13:00</td><td colspan="7">점심식사 (점심 미제공, *상품권 대체)</td></tr>
<tr><td rowspan="3">13:00~13:50</td><td colspan="7">구두발표 Ⅱ</td></tr>
<tr><td>208호(2층)</td><td>209호(2층)</td><td>210호(2층)</td><td>211호(2층)</td><td>212호(2층)</td><td>213호(2층)</td><td>214호(2층)</td></tr>
<tr><td>단위영양 (ⅰ)
좌장 김종혁 교수</td><td>단위영양 (ⅱ)
좌장 장재철 교수</td><td>단위영양 (ⅲ)
좌장 최정석 교수</td><td>동물생명
공학
좌장 오상현 교수</td><td>초지 및 환경
좌장 김진수 교수</td><td>축산물
이용 및 가공
좌장 용해인 교수</td><td>반추영양
좌장 김명후 교수</td></tr>
<tr><td>13:50~15:00</td><td colspan="7">휴 식 (Coffee Break)
포스터발표회(Ⅱ): 우수포스터 심사 (장소: 4층 로비)</td></tr>
<tr><td>15:30~16:00</td><td colspan="7">시상 및 폐회식 (컨벤션홀 4층)</td></tr>
</table>

[2023 Annual International Conference of KSAST]

Date: July 5 (Wed) - 7 (Fri), 2023
Place: Kimdaejung Convention Center, Gwangju
Theme: "Low carbon to become environment-friendly animal industry"

Wednesday, July 5 2023

Time \ Place	Kimdaejung Convention Center, Convention hall (4F)	
14:00 ~	Registration/reception (2F)	
15:00~15:20	Opening Speech : Sejong Oh (President of KSAST) Welcoming Speech : Kang Ki-jung (Mayor of Gwangju) Congratulatory Address : Beomyoung Park (President of NIAS)	
15:20~16:20	Plenary Lecture 1	
	Prof. Yoo Yong Kim (Seoul National University)	Utilization of Low-Protein Swine Feed and Carbon Neutral
16:20~17:20	The grand prize winner's presentation	
16:20~17:20	Discussion session with heads of animal science departments Hosted by NIAS Rm. 307 (3F)	
18:00~	Welcome Reception with livestock companies (Convention hall 1, 3F, Hotel Holiday Inn)	

Thursday, July 6 2023

<table>
<tr><td>Place / Time</td><td colspan="7">Kimdaejung Convention Center, Convention hall (4F)</td></tr>
<tr><td></td><td colspan="2">Rm. 208</td><td colspan="2">Rm. 214</td><td colspan="2">Rm. 209</td><td>Rm. 212</td></tr>
<tr><td>08:00~</td><td colspan="7">Registration/reception (2F)</td></tr>
<tr><td>08:30~09:00</td><td colspan="7">Poster Setup (until 08:30)
*Posters must be set between 08:30 AM ~ 16:50 AM</td></tr>
<tr><td colspan="8">Plenary Lecture 2
Convention hall (4F)</td></tr>
<tr><td>09:00~09:50</td><td colspan="3">Dr. Mingan Choct
(Univ. of New England, Australia)</td><td colspan="4">Sustainable feed formulation for poultry</td></tr>
<tr><td>10:00~12:30</td><td colspan="2">Horse Research Association</td><td colspan="2">Nutritional Feed Research Association</td><td colspan="2">Microbiome Research Association</td><td>JAST Editorial Meeting</td></tr>
<tr><td>12:30~13:20</td><td colspan="7">Regular General meeting
Convention hall (4F)</td></tr>
<tr><td>12:30~13:30</td><td colspan="7">Break Time
(Lunch not provided, *Receipt of gift certificates)</td></tr>
<tr><td colspan="8">Plenary Lecture 3
Convention hall (4F)</td></tr>
<tr><td>13:30~14:20</td><td colspan="3">Dr. Fran Cowley
(Univ. of New England, Australia)</td><td colspan="4">Triumphs and troubles in trying to reduce enteric methane from ruminants</td></tr>
<tr><td>14:20~15:00</td><td colspan="7">Break Time
Poster Presentation I : Poster review (Lobby, 4F)</td></tr>
<tr><td rowspan="3">15:00~17:00</td><td colspan="7">Cargill Agri Purina session
Convention hall (4F)</td></tr>
<tr><td colspan="4">Dr. Kim, Jeong-Hoon (Cargill Agri Purina Director of Sustainable Management)
Dr. Dong Hyuk Kim (Cargill Agri Purina Director of Swine Research and Technology)
Dr. Joonpyo Oh (Cargill Agri Purina Director of Cattle Research and Technology)</td><td colspan="3">Introducing eco-friendly sustainable management
Swine Research for Sustainable Livestock Farming
Development and Application of Low-Methane Feed in the Industry</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td rowspan="4">15:00~15:50</td><td colspan="7">Oral Presentation I</td></tr>
<tr><td>Rm. 208 (2F)</td><td>Rm. 209 (2F)</td><td>Rm. 210 (2F)</td><td>Rm. 211 (2F)</td><td>Rm. 212 (2F)</td><td>Rm. 213 (2F)</td><td>Rm. 214 (2F)</td></tr>
<tr><td rowspan="2">Monogastric Nutrition (i)</td><td rowspan="2">Monogastric Nutrition (ii)</td><td rowspan="2">Monogastric Nutrition (iii)</td><td rowspan="2">Animal Biotechnology</td><td rowspan="2">Forage Science and Environment</td><td rowspan="2">Utilization and Processing of Livestock Products</td><td>Ruminant Nutrition</td></tr>
<tr><td>16:00~16:50</td><td>Reproduction and Physiology</td></tr>
</table>

Friday, July 7 2023

<table>
<tr><th>Time \ Place</th><th colspan="7">Kimdaejung Convention Center, Convention hall (4F)</th></tr>
<tr><td>08:00~</td><td colspan="7">Registration/reception (2F)</td></tr>
<tr><td>08:00~09:30</td><td colspan="7">Poster Setup (until 08:30)
*Posters must be set between 08:30 AM ~ 16:50 AM</td></tr>
<tr><td rowspan="4">09:30~12:00</td><td colspan="7">Young scientist session</td></tr>
<tr><td colspan="3">Prof. Hae In Yong
(Chungnam National University)</td><td colspan="4">Application of Atmospheric Pressure Plasma in Meat and Meat Processed Products</td></tr>
<tr><td colspan="3">Prof. Jaecheol Jang
(Gyeongsang National University)</td><td colspan="4">Precision Feeding and Sustainable Swine Production</td></tr>
<tr><td colspan="3">Prof. Jonghyuk Kim
(Chungbuk National University)</td><td colspan="4">Development of Functional Feed Ingredients for Stress Reduction and Barrier Function Enhancement in Broilers Exposed to High Temperature and Crowded Conditions</td></tr>
<tr><td>12:00~13:00</td><td colspan="7">Break Time
(Lunch not provided, *Receipt of gift certificates)</td></tr>
<tr><td rowspan="3">13:00~13:50</td><td colspan="7">Oral Presentation Ⅱ</td></tr>
<tr><td>Rm. 208
(2F)</td><td>Rm. 209
(2F)</td><td>Rm. 210
(2F)</td><td>Rm. 211
(2F)</td><td>Rm. 212
(2F)</td><td>Rm. 213
(2F)</td><td>Rm. 214
(2F)</td></tr>
<tr><td>Monogastric Nutrition (ⅰ)</td><td>Monogastric Nutrition (ⅱ)</td><td>Monogastric Nutrition (ⅲ)</td><td>Animal Biotechnology</td><td>Forage Science and Environment</td><td>Utilization and Processing of Livestock Products</td><td>Ruminant Nutrition</td></tr>
<tr><td>13:50~15:00</td><td colspan="7">Break Time
Poster PresentationⅡ : Poster review (Lobby, 4F)</td></tr>
<tr><td>15:30~16:00</td><td colspan="7">The Grand Prize winner’s Presentation & Closing Ceremony
Convention hall (4F)</td></tr>
</table>

Poster Presentation Ⅰ

Thursday, July 6 2023 14:20~15:00(Convention hall : Lobby, 4F)

Date	Section	Number	Poster No.
6 (Thur)	Monogastric Nutrition	24	PA23001 ~ PA23024
	Animal Biotechnology	16	PB23001 ~ PB23016
	Ruminant Nutrition	23	PC23001 ~ PC23023
	Reproduction and Physiology	9	PD23001 ~ PD23009
	Breeding and Genetics	7	PE23001 ~ PE23007
	Forage Science and Environment	22	PF23001 ~ PF23022
	Utilization and Processing of Livestock Products	5	PG23001 ~ PG23005
	Total	**106**	

Poster Presentation Ⅱ

Friday, July 7 2023 13:50~15:00(Convention hall : Lobby, 4F)

Date	Section	Number	Poster No.
7 (Fri)	Monogastric Nutrition	23	PA23025 ~ PA23048
	Animal Biotechnology	16	PB23017 ~ PB23032
	Ruminant Nutrition	24	PC23024 ~ PC23047
	Reproduction and Physiology	10	PD23010 ~ PD23019
	Breeding and Genetics	7	PE23008 ~ PE23014
	Forage Science and Environment	22	PF23023 ~ PF23044
	Utilization and Processing of Livestock Products	5	PG23006 ~ PG23010
	Total	**107**	

Oral Presentation I

Thursday, July 6 2023 15:00~16:50 (Kimdaejung Convention Center : 2F)

※ 10min per each presenter / Q&A (5min)

Date	Section	Number	Oral presentation No.
6 (Thur)	Monogastric Nutrition	19	OA23001 ~ OA23019
	Animal Biotechnology	7	OB23001 ~ OB23007
	Ruminant Nutrition	4	OC23001 ~ OC23004
	Reproduction and Physiology	4	OD23001 ~ OD23004
	Forage Science and Environment	6	OF23001 ~ OF23004, OF23007, OF23008
	Utilization and Processing of Livestock Products	6	OG23001 ~ OG23006
	Total	**46**	

Oral Presentation II

Friday, July 7 2023 13:00~13:50 (Kimdaejung Convention Center : 2F)

※ 10min per each presenter / Q&A (5min)

Date	Section	Number	Oral presentation No.
7 (Fri)	Monogastric Nutrition	10	OA23020 ~ OA23029
	Animal Biotechnology	4	OB23008 ~ OB23011
	Ruminant Nutrition	3	OC23005 ~ OC23007
	Reproduction and Physiology	4	OF23005, OF23006, OF23009, OF23010
	Forage Science and Environment	3	OG23007 ~ OG23009
	Total	**24**	

The grand prize winner's presentation & Closing

- Date : Friday, July 7 2023 15:30
- Place : Convention hall, 4F
- Award : Sejong Oh (President of KSAST)
- Participants : all members and winner (prize draw event)

※ The oral presentation and poster presenters will have an award ceremony in the order of the closing ceremony, so please attend (No proxy award is available, and if the winner is absent, the next winner will be awarded).

세부 일정 (7월 5일)

종 합 심 포 지 엄

2023년 7월 5일(수) 14:00~18:00

주 제: 저탄소 친환경 축산

Low Carbon to become environment-friendly Animal Industry

시 간	개회식 및 시상식	
14:00 ~	등록 및 접수	
15:00~15:20	개회사 : 오 세 종 (한국축산학회장) 환영사 : 강 기 정 (광주광역시장) 축 사 : 박 범 영 (국립축산과학원장)	
15:20~16:20	Plenary Lecture 1	
	김유용 교수 (서울대학교)	저단백질 양돈사료의 이용과 탄소중립
16:20~17:20	학회 시상 및 수상자 특강	
16:20~17:20	축산 관련 학과 학과장 간담회(주관: 국립축산과학원, 3층 307호)	
18:00~	축산 기업과의 소연(小宴) (홀리데이인호텔 3층 컨벤션1)	

세부 일정 (7월 6일)

한국축산학회 산하 연구회 행사

2023년 7월 6일(목) 10:00~12:30

1. 마연구회

- **주 제 : 국내 말(馬) 과학 분야별 연구 성과**

사회 : 박정웅 박사 (경북대학교, 마연구회 학술위원장)

09:00~10:00	등 록	
10:00~10:10	개 회 / 회장인사 (회장: 윤민중 교수)	
연 사 및 제 목		
10:10~10:40 **(20분 발표/ 10분 질의 응답)**	최연주 (경북대학교)	Effects of training program and human-horse interaction on behavioral changes in young horses
10:40~11:10 **(20분 발표/ 10분 질의 응답)**	박정웅 (경북대학교)	Molecular biological analysis to investigate muscle injury recover related gene in horse derived cell
11:10~11:40 **(20분 발표/ 10분 질의 응답)**	유지현 (농촌진흥청)	말 방목 효과 및 초지 이용기간 증진 방법
11:40~12:10 **(20분 발표/ 10분 질의 응답)**	정용욱 (경북대학교)	Gentle rubbing induces hormone level-related pair bonding and stress relief in receiving horses and giving women
12:10~12:30	종 합 토 론 및 폐 회	

2. 영양사료연구회

● **주 제 : 영양사료 기술과 산업**

사회 : 김법균 교수 (건국대학교)

09:00~09:50	등 록	
10:10~10:20	개 회 / 회장인사 (회장: 김유용 교수)	
연 사 및 제 목		
10:20~11:00	백명기 (서울대학교)	한우 산업의 현황과 전망 및 근내지방 축적 조절 방안
11:00~11:40	김상호 (케이애니웰)	산란계 사육시스템과 영양
11:40~12:20	김동혁 (카길애그리퓨리나)	분만전후 모돈의 전환기 관리
12:20~12:40	종합토론 및 폐 회	

3. 동물마이크로바이옴연구회

● **주 제 : 동물마이크로바이옴을 활용한 축산의 새로운 도약**

사회 : 김영훈 교수 (서울대학교)

09:00~10:00	등 록	
10:00~10:10	개 회 / 회장인사 (회장: 이상석 교수)	
연 사 및 제 목		
좌장: 김종남 교수 (동서대학교)		
10:10-10:45	최양호 교수 (국립경상대학교)	Effects of nutritional and environmental conditions on broiler growth and cecal metagenome
10:45-11:20	김기현 박사 (국립축산과학원)	Pet nutrition and microbiome
11:20-11:55	김현범 교수 (단국대학교)	Understanding the pig microbiome: Principles & Applications
11:55~12:30	종 합 토 론 및 발전방안 토의	

포스터발표회 I

2023년 7월 6일(목) 14:20~15:00 (컨벤션홀: 4층 로비)

발표일	분 야	편 수	포 스 터 NO.
6일 (목)	단위영양	24	PA23001 ~ PA23024
	동물생명공학	16	PB23001 ~ PB23016
	반추영양	23	PC23001 ~ PC23023
	번식 및 생리	9	PD23001 ~ PD23009
	유전 및 육종	7	PE23001 ~ PE23007
	초지 및 환경	22	PF23001 ~ PF23022
	축산물이용 및 가공	5	PG23001 ~ PG23005
	소계	**106**	

구두발표회 I

2023년 7월 6일(목) 15:00~16:50 (김대중컨벤션센터: 2층)

※ 발표자 1인당 10분 발표 / 5분 질의 및 응답

발표일	분 야	편 수	구두발표 NO.
6일 (목)	단위영양	19	OA23001 ~ OA23019
	동물생명공학	7	OB23001 ~ OB23007
	반추영양	4	OC23001 ~ OC23004
	번식 및 생리	4	OD23001 ~ OD23004
	초지 및 환경	6	OF23001 ~ OF23004, OF23007, OF23008
	축산물이용 및 가공	6	OG23001 ~ OG23006
	소계	**46**	

세부 일정 (7월 7일)

신진 과학자 특강

2023년 7월 7일(금) 09:30~12:00

좌장: 김현범 교수 (단국대학교)		
시 간	**연 사**	**제 목**
09:30~10:10	용해인 교수 (충남대학교)	식육 및 식육가공품 내 대기압플라즈마의 적용
10:10~11:00	장재철 교수 (경상국립대학교)	정밀 사료 공급과 지속 가능한 양돈 생산
11:00~12:00	김종혁 교수 (충북대학교)	고온 및 밀집 사육 스트레스에 노출된 육계의 스트레스 저감 및 장벽 기능 강화를 위한 기능성 사료 물질 개발

구두발표회 II

2023년 7월 7일(금) 13:00~13:50 (김대중컨벤션센터: 2층)

※ 발표자 1인당 10분 발표 / 5분 질의 및 응답

발표일	분 야	편 수	구두발표 NO.
7일 (금)	단위영양	10	OA23020 ~ OA23029
	동물생명공학	4	OB23008 ~ OB23011
	반추영양	3	OC23005 ~ OC23007
	초지 및 환경	4	OF23005, OF23006 OF23009, OF23010
	축산물이용 및 가공	3	OG23007 ~ OG23009
	소계	**24**	

포스터발표회 II

2023년 7월 7일(금) 13:50~15:00 (컨벤션홀: 4층 로비)

발표일	분 야	편 수	포 스 터 NO.
7일 (금)	단위영양	23	PA23025 ~ PA23048
	동물생명공학	16	PB23017 ~ PB23032
	반추영양	24	PC23024 ~ PC23047
	번식 및 생리	10	PD23010 ~ PD23019
	유전 및 육종	7	PE23008 ~ PE23014
	초지 및 환경	22	PF23023 ~ PF23044
	축산물이용 및 가공	5	PG23006 ~ PG23010
	소계	**107**	

발표논문시상식 및 폐회식

- 일 시 : 2023년 7월 7일(금) 15:30
- 장 소: 컨벤션홀 4층
- 시 상 : 오세종 한국축산학회장
- 대 상: 전 회원 및 수상자(경품추첨행사)

※ 구두발표 및 포스터 발표자는 폐회식순에 시상식이 있으니 전원 참석하여 주시길 부탁드립니다.
(대리수상은 불가하며 수상자가 불참 시, 차 순위자에게 시상합니다)

구 두 발 표

제1발표분야 : 단위동물 영양 · 사양

OA23020 **육성비육돈 사료 내 조단백질의 수준별 첨가가 성장성적, 혈액성상, 영양소 소화율 및 악취 발생량에 미치는 영향**

아론 니욘사바, 김성호, 김유용

OA23021 **Exploring the impact of crating density and weather conditions during transit on preslaugher losses, meat quality and blood metabolites in broilers**

Myunghwan Yu, Jun Seon Hong, Elijah Ogola Oketch, Nuwan Chamara Chathuranga, Shan Randima Nawarathne, Venuste Maniraguha, Bernadette Sta Cruz, Eunsoo Seo, Jeseok Lee, Haeeun Park and Jung Min Heo

OA23022 **Correlation between reproductive performance and sow body weight change during gestation**

Sang Hun Ha, Hosseindoust Abdolreza, Bok Su Choi, Jong Wan Park, Sang In Park and Jin Soo Kim

OA23023 **Assessment of optimal methionine levels for growth performance in White Pekin ducks during 21 days of age**

Nuwan Chamara Chathuranga, Myunghwan Yu, Yu Bin Kim, Jun Seon Hong, Shan Randima Nawarathne, Elijah Ogola Oketch and Jung Min Heo

OA23024 **Assessing the impact of dietary violacein in broiler chickens affected by coccidiosis: effects on growth performance, oocyst excretion, and intestinal lesion severity**

Shan Randima Nawarathne, Myunghwan Yu, Hyun-Min Cho, Jun-Seon Hong, Yubin Kim, Kyu-Yeol Son and Jung-Min Heo

OA23025 **Comparative analysis of body weight and mortality in 10 crossbred Korean native chickens and commercial layers from hatch to 18 weeks of age**

Eunsoo Seo, Myunghwan Yu, Jun Seon Hong, Shan Randima Nawarathne, Oketch Elijah Ogola, Nuwan Chamara Chathuranga, Jeseok Lee, Bernadette Gerpacio Sta. Cruz, Venuste Maniraguha, Haeeun Park and Jung Min Heo

OA23026 **The effects of dietary phytase supplementation on growth performance, nutrient digestibility, and blood metabolites of weaned piglets**

Jun Young Mun, Tae Gyun Kim, Hye In Park, Se Rin Park and Jin Soo Kim

OA23027 **Water-based Korean wild ginseng and its effect on performance, panaxosides content, cytokine expression, and the microflora quantum of laying hen**

Habeeb Tajudeen, Hosseindoust Abdolreza, Gwang Mun Kim, Jun Young Mun, Sang Hun Ha and Jin Soo Kim

OA23028 **Sophorolipids ameliorate early weaning stress by strengthening gut integrity and mucosal layer with modulation of gut microbiome**

Min jin Kwak, Woongji Lee, Hyejin Choi, Daye Mun, An Na Kang, Mingeun Kang, Jeongkuk Park, Daniel Junpyo Lee, You-Bin Choi, Seon-hui Son, Junbeom Lee, Sei-hyun Lim, Ju Young Eor and Young hoon Kim

OA23029 **The effect of Soregen Technology® feed and water on egg production, egg quality, *Salmonella* enumeration, and small intestine morphometric of *Salmonella*-infected laying hens**

Listya Purnamasari, Hyun A Song, Joseph F. Dela Cruz, Dong Bin Lee, Jun Seong Kim, In Sik Nam and Seong Gu Hwang

제2발표분야 : 동물생명공학

OB23010 Molecular characterization of commensal *Lactobacillus* in weaning piglets supplemented with multi-strain probiotics

Woongji Lee, Hyejin Choi, Daye Mun, An Na Kang, Mingeun Kang, Jeongkuk Park, You-Bin Choi, Daniel Junpyo Lee, Seon-hui Son, Junbeom Lee, Sei-hyun Lim, Ju Young Eor, Min jin Kwak and YounghoonKim

OB23011 Effect of heat stress and vitamin E treatment on bovine muscle-derived stromal vascular cells *in vitro*

Bo-Mi Kim, Xue-Cheng Jin, Jun-Hee Lee, Jae-Sung Lee, Jin-Su Park, Jalil Ghassemi Nejad, Dong-Qiao Peng and Hong-Gu Lee

제3발표분야 : 반추동물 영양 · 사양

제4발표분야 : 번식 및 생리

제6발표분야 : 초지 및 환경

제7발표분야 : 축산물이용 및 가공

구 두 발 표 회 초 록

단위동물 영양 · 사양

OA23001 Effects of supplementing stimbiotic on gut health, immune response and intestinal microbiota in weaned piglets challenged with *Escherichia coli*

Dongcheol Song[1], Seyeon Chang[1], Jaewoo An[1], Hyunah Cho[1], Sehyun Park[1], Kyeonho Jeon[1], Jihong Jung[2] and Jinho Cho[1]
[1]Department of Animal Science, Chungbuk National University, Cheongju 28644, South Korea
[2]Nonghyupfeed Inc., Seoul 05398 Korea

The objective of this study was to determine the effects of dietary stimbiotic (STB) supplementation on growth performance, intestinal morphology, immune response and intestinal microbiota in weaned piglets. A total of 24 (Duroc × Yorkshire × Landrace) weaned pigs (initial body weight of 8.01 ± 0.38 kg and 28 ± 3 d old), were assigned to 4 treatments with 6 replicates per treatment. Pigs were housed in individual pens for 17 days, including 5 days adaption period and 12 days after the first E. coli challenge. The experiment was conducted in a 2 × 2 factorial arrangement of treatments consisting of two levels of challenge (challenge and non-challenge) and two levels of STB (0, 0.5g/kg diet). STB supplementation, which decreased ($p < 0.05$) the white blood cells, neutrophils, lymphocytes, and expression levels of tumor necrosis factor-alpha and interleukin-6. Supplementation STB improved ($p < 0.05$) the lymphocytes and neutrophils in piglets challenged with STEC on 12 dpi. Supplementation of STB also improved the villus height to-crypt depth ratio ($p < 0.05$) in piglets challenged with STEC. Supplementation with STB increased ($p < 0.05$) the expression levels of claudin-1. In conclusion, these findings indicated that STB supplementation could alleviate a decrease of the performance, immune response, and inflammatory response induced by the STEC challenge.

Key words : Stimbiotic, immune response, gut health, *E.coli*, intestinal microbiota

OA23002 Effect of single and complex probiotics on growth performance, odorous gas emissions in growing-finishing pigs

Kyeongho Jeon[1], Seyeon Chang[1], Dongcheol Song[1], Jaewoo An[1], Hyunah Cho[1], Sehyun Park[1], Hyuck Kim[1], Jinho Cho[1] and Jihong Jung[2]
[1]Department of Animal Science, Chungbuk National University, Cheongju 28644, Korea
[2]Nonghyupfeed Inc., Seoul 05398, Korea

This study was conducted that supplementation single and complex probiotics to investigate the effect on growth performance, nutrient digestibility, blood profile, maturity score, gas emissions, and fecal microflora in growing-finishing pigs. The 64 crossbred [(Landrace × Yorkshire) × Duroc] pigs with an initial BW of 18.75 ± 0.33 kg and the birth of 63 days were assigned to a completely randomized four treatment groups based on the initial BW (4 pigs in a pen with 4 replicate pens for each treatment). For 13 weeks, the dietary treatments were provided: 1) CON (basal diet), 2) T1 (CON + 0.2% *B. subtilis*), 3) T2 (CON + 0.2% *S. cerevisiae*), 4) T3 (CON + 0.2% *B. subtilis* + 0.2% *S. cerevisiae*). During the overall experimental period, T3 showed significantly improved ($p < 0.05$) FCR and ADG compared to other groups. The additive probiotics group showed significantly higher ($p < 0.05$) DM than the no additive group at 12 weeks. Supplemented with complex probiotics group improved ($p < 0.05$) H2S emissions and fecal microflora compared to the non-supplemented group. In summary, supplementation complex probiotics induced positive effects on growing-finishing pigs.

Key words : compost maturity, finishing pigs, growing pigs, probiotics

OA23003 Effects of the mono and multi-strain lactic acid bacteria probiotics on growth performance, intestinal morphology, blood profiles, and intestinal microbiota of weaning pig challenged with *Escherichia coli*

Sehyun Park[1], Dongcheol Song[1], Seyeon Chang[1], Jaewoo An[1], Hyunah Cho[1], Kyeongho Jeon[1], Jihong Jung[2] and Jinho Cho[1]
[1]Department of Animal Science, Chungbuk National University, Cheongju 28644, Korea
[2]Nonghyupfeed Inc., Seoul 05398, Korea

Probiotics can be used as alternatives of antibiotics by maintaining health conditions and improving growth performance of weaning pigs. Multi-strain or multi-species probiotics have been found to have more effective and consistent functionality than mono-strain or single-species probiotics. This study was conducted to evaluate the effect of mono and multi-strain probiotics (*Lactobacillus plantarum*, *Pediococcus acidilactici* K, *Pediococcus pentosaceus* SMFM2016-WK1 and *Pediococcus acidilactici* K+ *Pediococcus pentosaceus* SMFM2016-WK1) on growth performance, blood profiles, intestinal morphology and intestinal microbiota in weaning pigs. In Experiment, a total of 60 crossbred weaning pigs were randomly allotted to one of five dietary treatments. Experiments were conducted with two trials in a 2 × 5 factorial arrangement of treatments consisting of two levels of challenge (challenge and non-challenge) with E. coli and five levels of probiotics. Supplementation of LP and WK1 showed higher ADG and lower diarrhea score than other groups. Consequently, WK1 supplementation may contribute to improved gut health of weaned piglets.

Key words : *Escherichia coli*, *Salmonella enterica*, oral challenge, probiotics, weaning pigs

OA23004 Effects of supplementation of toxin binders in broiler breeder challenged with ochratoxin A

Hyunah Cho[1], Seyeon Chang[1], Dongcheol Song[1], Jaewoo An[1], Sehyun Park[1], Kyeongho Jeon[1], Hyuck Kim[1], Jihong Jung[2] and Jinho Cho[1]
[1]Department of Animal Science, Chungbuk National University, Cheongju 28644, Korea
[2]Nonghyupfeed Inc., Seoul 05398, Korea

This study was to investigate the effects of supplementation of toxin binders in broiler breeder challenged with ochratoxin A. A total of sixty 45-weeks-old Arbor Acres female broiler breeders with initial body weight (BW) of 3.65±0.35kg were used for 9 weeks (including a 1 week of adaptaion period). There were 10 replicate cages in each treatment group. The dietary treatments groups consisted of OTA free basal deit (NC), LPS+OTA (4mg/kg) without mycotoxin-deactivation product (PC), LPS+OTA (4mg/kg) with montmorillonite 0.05% of the diet (T1), LPS+OTA (4mg/kg) with montmorillonite 0.10% (T2), LPS+OTA (4mg/kg) with aluminosilicates 0.10% of the diet (T3), LPS+OTA (4mg/kg) with aluminosilicates 0.20% of the diet (T4). LPS challenge was performed on the first day of the experiment, 1mL of LPS E.coli O55:B5 per 1kg of body weight was intramuscularly injected. Feeding ochratoxin A (OTA) contaminated diets to broiler breeders negative affected ($p < 0.05$) laying performance, egg quality, relative organ weight, bone mineralization, blood profile and OTA accumulation in liver. However, supplementation of toxin binders mitigated ($p < 0.05$) the negative effects of OTA and even alleviated haugh unit, relative weight of liver and abdominal fat, total cholesterol, and HDL to similar value of non-challenged treatments which is NC group. In conclusion, the supplementation of toxin binders improved the health of broiler breeder with contaminated by OTA and 0.10% montmorillonite and 0.10% aluminosilicates are the most effective.

Key words : Toxin binder, Ochratoxin A, LPS Challenge, Clay mineral, broiler breeder

OA23005 Effects of dietary *Lactobacillus plantarum* on growth performance, blood indices, intestinal morphology, and ileal gene expression of weaned pigs

S. Ha, H. Kyoung, K. I. Park, Y. Kim, J. Ahn, J. I. Lee, J. Nam, K. Kim,
Y. Kang, Y. Park, I. Shin and M. Song
Division of Animal and Dairy Science, Chungnam National University, Daejeon 34134, Korea

This study was conducted to investigate the effects of dietary *Lactobacillus plantarum* on growth performance and health of weaned pigs. A total of 48 weaned pigs [average initial body weight (BW) = 6.61 ± 0.85 kg; 21 days old] were allotted to 2 dietary treatments (4 pigs/pen; 6 replicates/treatment) in a randomized complete block design (block: initial BW and sex) during 4 weeks. Dietary treatments were a basal weaner diet based on corn and soybean meal (CON) and CON + 0.02% *Lactobacillus plantarum* IDCC 3501 (LP). Blood samples were collected from randomly selected one pig per pen on days 1, 7, 14, and 28 for blood profiles, biochemical parameters, and immune responses. On the last day of the experiment, the randomly selected six pigs per treatment were euthanized to collect small intestinal segments for intestinal morphology and ileal gene expression. The LP had higher ($p < 0.05$) average daily gain from day 1 to 7 than the CON. Pigs fed LP had lower ($p < 0.05$) serum interleukin-6 and tumor necrosis factor-α on day 7 and had higher ($p < 0.05$) mean corpuscular volume on day 14 than those fed CON. In ileal gene expression, the LP upregulated ($p < 0.05$) claudin-1, claudin-4, and interferon-γ and downregulated ($p < 0.05$) tumor necrosis factor-α and interleukin-8 compared with the CON. In conclusion, the dietary LP improved growth performance and modulated immune responses and ileal gene expression of weaned pigs.

Key words : blood profiles, growth performance, ileal gene expression, immune responses, *Lactobacillus plantarum*, weaned pigs

OA23006 Effects of phytase and multicarbohydrase supplementation in available phosphorus and energy-deficient broiler diets

Bernadette Sta. Cruz, Myunghwan Yu, Oketch Elijah Ogola, Shan Randima Nawarathne, JunSeon Hong,
Nuwan Chaturanga, Venuste Maniraguha, Eunsoo Seo, Jeseok Lee, Haeeun Park and Jung Min Heo
Department of Animal Science and Biotechnology, Chungnam National University, Korea

Phytate or phytic acid is an anti-nutritional factor that contains 50-85% phosphorus in poultry diets. The present study investigated the efficiency of phytase with and without multicarbohydrase in available phosphorus (AP) and energy-deficient diets without compromising growth performance and tibia traits in broilers within 35 days of age. A total of 288-day-old Ross 308 broilers were randomly assigned to one of the six dietary treatments using a completely randomized design having 6 replicates with 8 birds per cage. The dietary treatments were: i) PC (Positive control, adequate nutrient diet without enzymes); ii) NC-1 (0.20% AP deficient diet); iii) NC-2 (0.25% AP deficient diet); iv) NCP-1 (NC-1 diet + 500 FTU/kg Genophos); v) NCP-2 (NC-2 diet + 750 FTU/kg Genophos); and vi) NCLEPN (NC-2 with 100 kcal/kg ME deficient diet + 1,000 FTU/kg Genophos and 100 g/MT Endopower). Improvements in growth performance were observed upon phytase and multicarbohydrase supplementation by exhibiting higher ($p < 0.05$) body weight, average daily gain, and lower feed conversion ratio compared to NC diets during the overall period (d 1-35). Phytase and multicarbohydrase also enhanced tibia mineralization as it showed higher ($p < 0.05$) ash, calcium, and phosphorus percent composition than NC diets on day 21 and 35. In conclusion, supplementation of phytase at 500 and 750 FTU/kg levels could compensate for the 0.20% and 0.25% AP levels, respectively, and can be further improved with carbohydrase to compensate for the 100 kg/kcal energy in poultry diets.

Key words : broiler, energy, enzyme, performance, phosphorus, tibia

OA23007 Effect of individual or combination of dietary glycine and betaine on the liver health and stress response in aged laying hens exposed to heat stress conditions

Deok Yun Kim, Hyun woo Kim, Eun Cheol Lee and Dong Yong Kil
Department of Animal Science and Technology, Chung-Ang University, Korea

This study aimed to investigate the effect of individual or combination of dietary glycine (Gly) and betaine (Bet) on the liver health and stress response in aged laying hens exposed to heat stress (HS) conditions. A total of 480 65-wk-old Lohmann brown laying hens were allotted to 4 dietary treatments. Each treatment had 8 replicates of 12 hens. Based on a 2 x 2 factorial arrangement, dietary treatments included two levels of Gly (0 and 0.65%) and Bet (0 and 0.2%) supplementation in diets. Hens were subjected to cyclic HS conditions for 12 wk. At the end of the experiment, 1 hen per replicate was selected and used for the analysis of the liver health and stress response. Results indicated that dietary supplementation of 0.65% Gly improved ($p < 0.05$) the liver color score. Dietary supplementation of either 0.65% Gly or 0.2% Bet decreased ($p < 0.05$) MDA concentrations in the liver. Additionally, dietary supplementation of either 0.65% Gly or 0.2% Bet reduced ($p < 0.05$) blood heterophil:lymphocyte ratio (H:L ratio). Likewise, dietary supplementation with 0.65% Gly, 0.2% Bet, or their combination reduced ($p < 0.05$) feather corticosterone concentrations. In conclusion, individual supplementation of 0.65% Gly or 0.2% Bet in diets improves the liver health and decreases stress response in aged laying hens raised under HS conditions with no distinguished synergistic effects at the current supplemental levels under our HS conditions.

Key words : aged laying hens, betaine, glycine, liver characteristic, stress biomarker

OA23008 Effects of chronic heat stress on growth performance, rectal temperature, respiratory rate, blood profiles, and immune responses of growing and finishing pigs

J. Lee, H. Kyoung, K. I. Park, Y. Kim, J. Ahn, S. Ha, J. Nam, K. Kim, Y. Kang, Y. Park, I. Shin and M. Song
Division of Animal and Dairy Science, Chungnam National University, Daejeon 34134, Korea

This study was conducted to investigate the effects of chronic heat stress on growth performance, rectal temperature (RT), respiratory rate (RP), blood profiles, and immune responses of growing and finishing pigs through two experiments (Exp). In Exp 1, 24 growing pigs [24.69 ± 0.52 kg of average initial body weight (BW)] were assigned to two environmental treatments [TN (23℃, 35%) and HS (33℃, 80%); 1 pig/pen; 12 replicates/treatment] in a randomized complete block design (block: BW) for 2 weeks. In Exp 2, 24 finishing pigs [49.74 ± 2.65 kg of average initial BW] are conducted in the same manner as in Exp1. The RT and RP were daily measured. Blood samples were collected from all pigs on days 0, 7, and 14 for blood profiles and immune responses. Data were analyzed using GLM procedure of SAS. The HS group had lower ($p < 0.05$) ADG and ADFI, but higher ($p < 0.05$) RT and RP than TN group in both Exp 1 and 2. Growing pigs under HS had lower ($p < 0.05$) MCH on day 14 than those under TN. In Exp 2, HS group had lower ($p < 0.05$) MCHC on day 7 and 14 than TN group. In Exp 1, HS increased ($p < 0.05$) serum IL-1β, but tended to decrease ($p < 0.10$) serum IL-6 on day 7 and 14 compared with TN. In Exp 2, HS increased ($p < 0.05$) serum IL-1β, but tended to decrease TGF-β 1 on day 14 compared with TN. In conclusion, chronic heat stress deteriorated growth and disrupted immune system of growing and finishing pigs.

Key words : blood profiles, growth performance, immune responses, rectal temperature, respiratory rate

OA23009

이유자돈 사료 내 베타글루칸과 비타민 E의 첨가가 성장성적, 혈액성상, 면역성상, 분내 미생물, 설사지수 및 영양소 소화율에 미치는 영향

박민수, 고태욱, 김홍준, 김유용
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본 실험은 이유자돈 사료 내 베타글루칸과 비타민 E의 첨가가 성장성적, 혈액성상, 면역성상, 분내 미생물, 설사지수 및 영양소 소화율에 미치는 영향을 검증하고자 수행되었다. 본 실험은 평균체중이 7.64 ± 0.741kg인 3원 교잡종 ([Yorkshire x Landrace] x Duroc) 이유자돈 200두를 선발하여 5처리, 4반복, 반복 당 10두씩 성별과 체중에 따라 난괴법(RCBD)으로 배치하였으며, 처리구는 베타글루칸과 비타민 E의 첨가 수준에 따라 1) CON: 기초사료, 2) LB: 기초사료 + 베타글루칸 0.1%, 3) LBE: 기초사료 + 베타글루칸 0.1% + 비타민 E 0.02%, 4) HB: 기초사료 + 베타글루칸 0.2%, 5) HBE: 기초사료 + 베타글루칸 0.2% + 비타민 E 0.02%로 나뉘었다. 실험결과, 비타민 E를 0.02% 첨가하지 않은 LB, HB 처리구보다 비타민 E를 0.02% 첨가한 LBE, HBE 처리구가 6주차 체중에서, 6주차 일당증체량에서 더 높은 것으로 나타났다 (VE; $p < 0.01$). 분내 미생물의 경우, 베타글루칸 0.1%와 비타민 E 0.02%를 첨가한 LBE 처리구의 분내 *yeast and molds*와 *proteobacteria*가 유의적으로 감소하는 것으로 나타났다 (Diet, $p < 0.05$). 설사지수의 경우, 베타글루칸 0.1% 및 0.2%와 비타민 E 0.02%를 첨가한 처리구가 대조구에 비해 3주차 및 6주차의 설사지수가 유의적으로 낮게 나타났다 (Diet, $p < 0.05$). 비타민 E 0.02%를 첨가하였을 때 이유자돈의 혈액 내 α-tocopherol의 농도를 증가하는 경향이 나타났다 (VE; $p < 0.08$). 결론적으로, 이유자돈 사료 내 베타글루칸 0.1%와 비타민 E 0.02%를 첨가하였을 때 장내 미생물 균총을 개선하고 설사 발생을 줄임으로써 이유자돈의 성장성적에 긍정적인 효과를 미치는 것으로 사료된다.

Key words : 베타글루칸, 비타민 E, *yeast and molds*, *proteobacteria*, 이유자돈

OA23010

포유모돈 사료 내 베타글루칸과 비타민 E 첨가가 포유모돈의 생리적 반응, 포유자돈 성장성적, 혈액성상, 면역성상 및 돈유성분에 미치는 영향

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본 실험은 포유모돈 사료 내 베타글루칸과 비타민 E의 첨가가 포유모돈의 생리적 반응, 포유자돈 성장성적, 혈액성상, 면역성상 및 돈유 성분에 미치는 영향을 검증하고자 수행되었다. 평균 체중 233.6 ± 4.3 kg인 2원 교잡종 (Yorkshire × Landrace) F1 모돈 50두를 선발하여 5처리, 10반복, 반복 당 1두씩 완전임의 배치법(CRD)으로 배치했다. 실험 처리구는 1) CON: 옥수수-대두박 위주의 기초 사료, 2) LB: 기초 사료 + 베타글루칸 0.1%, 3) LBE: 기초 사료 + 베타글루칸 0.1% + 비타민 E 0.02%, 4) HB: 기초 사료 + 베타글루칸 0.2%, 5) HBE: 기초 사료 + 베타글루칸 0.2% + 비타민 E 0.02%로 구성하였다. 실험 결과, 사료섭취량은 베타글루칸이 첨가된 모든 처리구에서 대조구와 비교했을 때 고도로 높았고 (Diet, $p < 0.01$), 베타글루칸 0.1% 첨가 처리구보다 0.2% 첨가 처리구의 사료섭취량이 고도로 높았다 (BG, $p < 0.01$). 포유자돈 성장성적과 관련하여, 베타글루칸 0.1% 첨가 처리구가 0.2% 첨가 처리구에 비해 포유 21일령 복당 자돈 체중, 일당증체량 및 자돈 이유체중에서 더 높은 경향을 보였다 (BG, $p = 0.07$; $p = 0.07$; $p = 0.07$). 혈액성상과 관련하여 포유 21일령에, 비타민 E 0.02% 첨가 처리구가 비타민 E 미첨가 처리구보다 포유모돈 혈액 내 비타민 E 농도가 고도로 높았고 (VE, $p < 0.01$), 자돈 혈액 내 비타민 E 농도에서도 높은 경향을 보였다 (VE, $p = 0.09$). 결론적으로 포유모돈 사료 내 베타글루칸 0.1%와 비타민 E 0.02%를 첨가하였을 때 모돈의 사료섭취량을 증가시키고 모돈 및 자돈에게 가장 효과적으로 비타민 E를 공급해 포유자돈의 성장성적에 긍정적인 효과를 보이는 것으로 사료된다.

Key words : 베타글루칸, 비타민 E, 포유모돈, 포유자돈, 포유자돈 성장성적

OA23011

Increasing feed allowance in the late gestation period improves the reproductive performance in sows

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The late gestation period plays a vital role in the growth and development of fetuses, directly impacting swine enterprises' profitability. This study aimed to examine the impact of increasing feeding allowance during late gestation on reproductive performance and farrowing behavior in sows of different parities. A total of twenty-eight sows were housed in a controlled environment. Sows received a feeding allowance of either 2.5 or 3.5 kg/d from 84 days of gestation until farrowing, and farrowing behavior was monitored using the DeepEyesTM M3SEN camera. The data were analyzed using the 2x2 factorial of the Statistical Analysis System (SAS, 2011, Version 9.3, SAS Institute, Cary, NC, USA) software. Results indicated a significant reduction in backfat loss among sows fed 2.5 kg. Increasing the feed allowance during the late gestation period had a significant positive impact on piglet birth weight and numerically higher results in total live births and other reproductive performance data, while re-estrus days decreased. No significant effect in the frequency and duration of standing before farrowing but the duration of standing after farrowing is significantly lower in sows fed with 3.5kg. Principal component analysis demonstrated differences of 43.9% and 42.4% in the partial least square discriminant analysis. In conclusion, increasing the feeding allowance during the late gestation period, regardless of parity, can potentially enhance sows' reproductive performance.

Key words : late pregnancy, feeding allowance, reproductive performance, farrowing behavior, backfat thickness

OA23012

Effect of milk supplementation on piglets growth performance and sows physiological conditions during lactation period

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Providing milk supplementation before or around weaning age increased the piglet's body weight at post-weaning, improved survival rate, and piglet performance in the weaning phase. This study investigated the effect of milk liquid and powder supplements on piglets' performance, drinking behavior, and sow back-fat thickness change during the lactation period. The study comprised four experimental groups (n = 18) and a control group (n = 6), the piglets were suckled from the sow. For the supplemental groups (n = 18), milk powder (MP), milk liquid by feeding trough (MLFT), and milk liquid feeding by the bucket (MLFB). Significant differences in average daily weight gain were observed between day 14 and weaning age for the MP and MLFT groups ($p < 0.05$). Approaches to the feeder were significantly higher in the MP and MLFT groups ($p < 0.05$). Based on the examination of sow back-fat thickness, the back-fat loss was minimal ($p < 0.05$) in the MP and MLFT compared to the MLFB and the control. The administration of milk supplements as powder and liquid via feeding troughs increased the average daily gain and body weight of the piglets on day 14 and the weaning day. Furthermore, the supplemental groups (MP and MLFT) exhibited significantly lower back-fat thickness reduction in the sows compared to the control group. Our findings provide the basis for additional studies on economics and reproduction related to giving milk supplementation in the farrowing house.

Key words : milk replacer, piglets, sow, at birth, at weaning

OA23013 Protocatechuic acid as feed additives on growth performance and economic analysis of growing pigs

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In South Korea, many feed additives have been studied to improve pig growth. This study evaluated the role of protocatechuic acid (PCA) on growth performance and economic analysis of growing pigs. Forty growing pigs [(Landrace x Yorkshire) x Duroc], at day 56 of age with an average body weight of 21.30 ± 0.13 kg (mean ± std.), were randomly divided into four equal treatments: a control group (standard basal diets) and control diets supplemented with PCA at levels of 0.015%, 0.035%, and 0.045% respectively. The pigs were individually reared in pens, with each pig serving as a replication unit. PCA at 0.045% level could increase ($p < 0.05$) average daily gain and reduce ($p < 0.05$) feed conversion ratio compared to the control group. However, no significant differences ($p > 0.05$) were observed on the feed intake and final body weight of the experimental pigs. The ratio of total feed cost to gain was lower in the PCA-supplemented groups compared to the control group, with the lowest ratio found in the group supplemented with PCA at 0.045% (Please check if the meaning and result are the same. The original text above is also okay). The saving efficacy is 11.8% higher in the PCA 0.045% group compared to the control group. Considering the higher body weight gain and economic importance, it is recommended to supplement the diet of growing pigs with PCA at the 0.045% level.

Key words : growing pigs, protocatechuic acid, feed additives, growth performance, economic analysis

OA23014 Prediction equations for *in vitro* nutrient utilization in bakery products for pigs

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The objectives were to determine *in vitro* ileal disappearance (IVID) of dry matter (DM) and crude protein (CP) and in vitro total tract disappearance (IVTTD) of DM and organic matter (OM) in commercial bakery products for pigs and to develop equations for predicting the *in vitro* nutrients utilization in bakery products based on the chemical composition. Ten bakery products were analyzed for IVID and IVTTD of nutrients based on 2- and 3-step *in vitro* procedures for pigs, respectively. Crude protein, ether extract, and neutral detergent fiber (NDF) concentrations in the bakery products ranged from 4.9 to 10.3%, 7.5 to 16.3%, and 17.0 to 55.9%, respectively, on a DM basis. The model for IVID of DM in bakery products was: IVID of DM (%) = 99 – NDF (%DM) × 1.19 with r^2 = 0.99 and $p < 0.001$. The model for IVID of CP was: IVID of CP (%) = 77 – NDF (%DM) × 0.30 with r2 = 0.47 and P = 0.028. The model for IVTTD of DM was: IVTTD of DM (%) = 100 – NDF (%DM) × 1.20 with r^2 = 0.98 and $p < 0.001$. The model for IVTTD of OM was: IVTTD of OM (%) = 102 – NDF (%DM) × 1.22 with r^2 = 0.98 and $p < 0.001$. In conclusion, the IVID and IVTTD of nutrients in bakery products for pigs can be estimated using the NDF concentration as a sole independent variable.

Key words : bakery product, *in vitro* digestibility, neutral detergent fiber, prediction equation, swine

OA23015 Growth performance of nursery pigs fed low protein diet

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This study evaluated the impact of reducing dietary crude protein (CP) on the growth performance of crossbred barrows and gilts during the nursery period. A total of 126 pigs (63 barrows and 63 gilts) with an average weight of 9.8 ± 1.62 kg were assigned to 3 dietary treatments with 6 replicates in a randomized complete block design, considering body weight (BW) and sex as blocking factors. Pigs were grouped into pens with 7 pigs per pen and provided with ad libitum access to water and diets for 4 weeks. Three experimental diets, with a 2% reduction in CP from the 18% upper limit, met or exceeded the nutrient recommendations of the National Research Council for swine. Feed leftovers and BW were recorded at 0, 2, and 4 weeks. Treatment means were compared using Tukey's HSD test. The reduction of dietary CP did not affect growth performance in the first 2 weeks. However, from weeks 2 to 4, pigs fed the CP 14% diet resulted in lower ($p < 0.05$) final BW, average daily gain (ADG), and gain-to-feed ratio (G:F) compared to the CP 16% and 18% diets. The CP 14% diet also exhibited lower ($p < 0.05$) average daily feed intake compared to the CP 16% diet. For the overall period, the CP 14% diet resulted in lower ($p < 0.05$) ADG and G:F than the 16% and 18% diets. In conclusion, the reduction of dietary CP by 2% from 18% did not affect the growth performance of nursery pigs but a 4% reduction had a negative impact.

Key words : amino acid, growth performance, low protein, pig

OA23016 Effect of supplementing essential oil or gallic acid in broilers challenged with coccidiosis

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This experiment was conducted to investigate the efficacy of different natural feed additives including gallic acid (GA) and essential oils (EO) in broilers with coccidia challenge. A total of 200 one-day-old Arbor Acres broilers (initial body weight of 37.65 ± 0.82 g) were used in this experiment for 32 days. All broilers were randomly allocated into four experimental groups and each group had twenty-five replicate pens with two broilers per pen. The dietary treatments were as follows: a basal diet without coccidia challenge (negative control, NC); a basal diet with coccidia challenge (positive control, PC); PC with supplementing GA at 100 mg/kg (T1); PC with supplementing EO at 100 mg/kg (T2). During the entire experimental period, the T1 and T2 groups improved ($p < 0.05$) impaired feed conversion ratio (FCR), FCR at 1.5 kg, and production index by coccidiosis challenge. The T1 group showed ($p < 0.05$) lower lesion scores in the upper and middle intestines at d 21 compared to the PC group. The T1 group significantly increased ($p < 0.05$) the villus height and crypt depth of the ileum compared to the PC group. In conclusion, the GA alleviates side effects such as reduced growth performance, damage to intestinal epithelial cells, decreased oocyst excretion, and imbalance of cecal bacteria caused by coccidiosis, and can be considered as effective alternative for the treatment of coccidiosis in broilers.

Key words : broiler, coccidiosis, essential oils, gallic acid

OA23017 Effect of supplemental protease on growth performance, fecal score, nutrients digestibility, blood profiles, odor emission, nitrogen utilization with different crude protein levels in weaned pig

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The purpose of this study was to investigate the effects of different crude protein (CP) levels and supplementation of protease (PT). A total of 24 7-week-old barrow weaned pigs with an initial weight of 10.94 ± 1.26 kg were performed in the 2-week experiment. Experiments were performed in a 2 x 2 factorial with 2 levels of CP (18.78, 16.92%) and supplementation of 2 levels of PT (0, 0.1%). No difference ($p > 0.05$) was showed due to CP and PT in growth performance. In the fecal score, a decrease ($p < 0.05$) in the incidence of diarrhea due to CP and PT was showed. The apparent total tract digestibility ATTD of dry matter (DM) was increased ($p < 0.05$) on the LP diet at 1 week. At 2 week, DM increased ($p < 0.05$) in the LP diet and CP increased in the PT10. BUN and H2S gas showed to decrease ($p < 0.05$) in the LP diet and PT10. At 2 week, total nitrogen excretion decreased ($p < 0.05$) in the LP and PT10, and nitrogen retention ratio increased ($p < 0.05$). In this study, supplementation of PT in the LP diet can improve weaned pig's protein utilization, incidence of diarrhea, digestibility, BUN, and H2S odor emission.

Key words : protease, protein levels, nutrients digestibility, nitrogen uitilization, weaned pig

OA23018 Effect of mangosteen peel powder and extract on the performance and gut health of coccidiosis vaccine challenged broiler chickens

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The effect of mangosteen peel powder (MSPP) and extract (MSPE) on the performance and gut health in broiler chickens challenged with coccidiosis was investigated. A total of 480 day-old mixed-sex broiler chicks (Ross 308) were randomly distributed into 40 pens of 12 birds each (keeping 16 pens/control group and 8 pens/treatment group until 21 days post-hatch) and raised for 28 days. The experimental diets were formulated by mixing a corn and soybean meal-based control diet with MSPP (20 g per kg of diet) or MSPE (0.5 g and 1 g per kg of diet). At 21 days post hatch, half (n = 8) of the control and all groups fed MSPP and MSPE were challenged by a 15-fold dose of mixed Eimeria species vaccine (FORTEGRA®). During days 21 to 28, the feed conversion ratio was significantly lower in the non-challenged chickens than other groups (p=0.007). Eimeria-specific lesions were noted in duodenum ($p < 0.001$), jejunum ($p = 0.009$), and ceca ($p < 0.001$), but dietary MSP did not affect the Eimeria-induced gut lesion scores. The cecal branched-chain fatty acids levels were significantly increased in the MSPE group compared with the non-challenged group ($p = 0.016$). We conclude that dietary MSP have a minimal effect on the growth performance of chickens challenged with coccidiosis vaccine.

Key words : lesion, growth performance, coccidiosis, mangosteen peel, broiler chickens

OA23019

Effects of supplementing nursery diets with fermented soybean meal on growth performance, immune status, and diarrhea score of pigs under commercial rearing conditions

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The study aims to evaluate the effect of supplementing nursery diets with fermented soybean meal (FSBM) on growth performance, immune status, and diarrhea score of pigs under commercial rearing conditions. A total of 240 nursery pigs (28 ± 2d of age with 7.01±0.09kg BW) were allotted to four dietary treatments in four replicates per treatment with fifteen pigs per pen based on BW and sex. Dietary treatment consist of replacing the sources of animal-based protein toward plant-based protein as follows: 1) CON, a control diet containing 5% fish meal and 2% spray dried porcine plasma (SDPP); 2) T1, 5% FSBM + 2% yeast protein; 3) T2, 5% FSBM + 0.5% yeast protein + 1.5% fish meal; 4) T3, 5% FSBM + 0.5% yeast protein + 1.5% SDPP. There were no significant differences between treatments during the entire experimental periods on ADFI, ADG, and BW. The feed efficiency (gain-to-feed ratio) did not show a significant difference between 0-2 weeks, but T2 showed greater G/F ratio in 2-5 weeks 2-5 weeks ($p < 0.05$). The contrast analysis (Con versus T1, and T2 versus T3) showed that T2 showed greater ($p < 0.05$) G:F ratio compared with T3, indicating FM showed better feed efficiency compared with SDPP when supplemented with plant-based SBM. In the results of blood analysis, pigs fed CON diets showed greater ($p < 0.01$) tumor necrosis factor (TNF-α) in the 0-2 week period, and pigs fed T1 diets showed the lowest. Diarrhea frequency did not show a significant difference in all treatment groups. The result from our study suggest that replacing animal protein in pig feed with plant-based protein sources, such as FSBM and yeast protein, improved feed efficiency and immune responses.

OA23020

육성비육돈 사료 내 조단백질의 수준별 첨가가 성장성적, 혈액성상, 영양소 소화율 및 악취 발생량에 미치는 영향

아론 니욘사바, 김성호, 김유용
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본 실험은 사료 내 조단백질의 수준별 첨가가 육성비육돈의 성장성적, 혈액성상, 영양소 소화율 및 악취 발생량에 미치는 영향을 알아보고자 수행되었다. 평균 체중 38.56 ± 0.53 kg인 3원 교잡종 ([Yorkshire × Landrace]) × Duroc) 육성돈 126두를 선발하여 6처리, 3반복, 반복 당 7두씩 체중과 성별을 고려하여 난괴법 (RCBD, Randomized Completely Block Design)으로 배치하였다. 실험 처리구는 조단백질 첨가 수준에 따라 phase 1: 14%, 15%, 16%, 17%, 18%, 19%; phase 2: 13%, 14%, 15%, 16%, 17%, 18%; phase 3: 12%, 13%, 14%, 15%, 16%, 17%; phase 4: 11%, 12%, 13%, 14%, 15%, 16%로 구성하였고, 각 처리구에 첨가된 라이신, 메티오닌, 트레오닌, 트립토판의 양은 동일하다. 14주간의 사양실험 결과, 체중, 일당사료섭취량, 사료효율에서 처리구 간 유의적인 차이가 나타나지 않았지만 ($p > 0.05$), phase 4의 조단백질을 14% 첨가한 group D에서 일당증체량이 높았다 (quadratic, $p = 0.04$). 혈액성상 중 혈중요소태질소 농도는 조단백질 수준이 증가함에 따라 유의적으로 증가하였다 (linear, $p < 0.01$). 영양소 소화율과 관련하여, 분과 뇨로 배출되는 질소의 양과 질소 축적률이 조단백질 수준이 증가함에 따라 유의적으로 증가하였다 (linear, $p < 0.01$). 또한 조지방의 소화율은 조단백질 수준이 증가함에 따라 감소하는 경향을 보였지만 (linear, $p = 0.07$), 건물, 조단백질, 조회분의 소화율에는 영향을 미치지 않았다 ($p > 0.05$). 악취 발생량과 관련하여, 조단백질 수준이 증가함에 따라 악취 유발 기체인 아민, 암모니아, 황화수소의 발생이 유의적으로 증가하였다 (linear, $p < 0.01$). 결론적으로, 성장단계별 아미노산 요구율을 충족시킨다면, 육성전기는 14%, 육성후기는 13%, 비육전기는 12%, 비육후기는 11%까지 조단백질 함량을 낮추는 것이 양돈장의 경제적 이익과 돈육품질을 고려할 때 최선의 사양방법으로 사료된다.

Key words : 조단백질, 육성비육돈, 성장성적, 혈액성상, 악취 발생량

OA23021 Exploring the impact of crating density and weather conditions during transit on preslaugher losses, meat quality and blood metabolites in broilers

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The study aimed to investigate the impact of crating densities and weather conditions on the preslaugher losses, meat quality, and blood metabolites in broilers. A total of 900 Ross 308 broilers, aged 35 days with an average body weight of 1.88kg, were assigned to a 2×3 factorial arrangement based on weather conditions (Summer, Winter) and crating densities (20, 25, 30 birds per crate). Results revealed that a crating density of 25 birds per crate led to lower ($p < 0.05$) body weight loss than a density of 20 birds per crate. Moreover, transportation during Summer resulted in lower body weight loss than transportation during Winter, while broilers transported with a density of 20 birds per crate during winter exhibited heavier ($p < 0.05$) body weight loss. Transportation during Summer showed lower pH and water-holding capacity values and higher lightness than during Winter, nevertheless, transportation during winter showed higher concentrations ($p < 0.05$) for glucose, lactate, and cortisol. Broilers transported at densities of 30 birds per crate during Summer recorded the higher ($p < 0.05$) glucose concentration among the other crating densities during Summer. In conclusion, excessively higher or lower crating densities are generally unfavorable for minimizing preslaughter losses, maintaining meat quality, and regulating blood metabolites. Therefore, adjusting density slightly lower during Summer and higher in colder temperatures is advisable.

Key words : broiler, crating density, transportation, weather

OA23022 Correlation between reproductive performance and sow body weight change during gestation

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This study aimed to examine the correlation between piglet performance and sow body weight gain (BWG) across three periods: 35-70, 70-105, and 35-105 days. A total of 100 sows were utilized in this study to assess sow BWG, backfat thickness (BF), caliper score (CAL), feed intake (FI), and weaning-to-estrus interval (WEI). Once these variables were measured, the data was categorized according to the three aforementioned periods. The results demonstrated that piglet birth weight, weaning weight, and average daily weight gain (ADG) were correlated with sow body characteristics such as BF and CAL, with the strongest correlation observed with BWG. Piglet mortality was found to be closely associated with BF. Piglet birth weight, weaning weight, and ADG were positively correlated with sow BWG, particularly during the 35-70 day period. Additionally, sows with higher BWG during the 70-105 day period, which also exhibited higher BWG from 35-70 days, recorded greater ADG in piglet weights and higher weaning weights. These trends became more pronounced as the sow's BWG increased during the 70-105 day period. Piglet mortality rose when the sow displayed lower BWG during both the 35-70 and 70-105 day periods. No significant observations were found regarding the number of stillborns, piglets born alive, and weaned piglets, and no interaction effects were detected between these periods. In conclusion, our analysis underscores the significance of sow BWG during the early stages of gestation in improving piglet performance from birth to weaning.

Key words : sow body weight, reproductive performance, average daily weigh gain, correlation, mortality

OA23023

Assessment of optimal methionine levels for growth performance in white pekin ducks during 21 days of age

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This study investigated the standard ileal dietary methionine requirements of White Pekin ducks from hatch to 21 days of age, based on their growth performance. A total of 384 one-day-old male White Pekin ducklings were randomly allotted into one of six dietary treatments by completely randomized design. The methionine was supplemented to have six diets according to different supplemental levels (0.30, 0.35, 0.40, 0.45, 0.50, and 0.55%). Each treatment consisted of eight replicates and stocked eight birds per pen. The study revealed that body weight and average daily gain increased with increasing dietary methionine levels until 0.50% and then declined ($p < 0.05$). Although average daily feed intake was not impacted, the feed conversion ratio showed a decreasing pattern when increasing the methionine level until 0.50% and then increased ($p < 0.05$). Furthermore, the methionine requirements were estimated by a linear plateau; 0.50%, 0.50%, and 0.49%, quadratic-plateau; 0.51%, 0.52%, and 0.50%, for final body weight, average daily weight gain, and feed conversion ratios, respectively. In conclusion, dietary methionine levels of 0.505, 0.510, and 0.495 % were recommended for maximum final body weight, daily weight gain, and feed efficiency, respectively, for White Pekin ducks from hatch to 21 d based on both liner- and quadratic-plateau models.

Key words : growth performance, methionine, plateau, recommended

OA23024

Assessing the impact of dietary violacein in broiler chickens affected by coccidiosis: Effects on growth performance, oocyst excretion, and intestinal lesion severity

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The effect of supplementing different concentrations of violacein (10, 15, and 20 ppm) on alleviating coccidiosis in broilers were investigated for 21 days. One-day-old broiler chicks (n = 336) were randomized to six dietary treatments with seven replicates and eight birds per cage. Dietary treatments were: 1) NC [unchallenged birds+untreated diet], 2) PC [challenged birds+untreated diet], 3) SAL [challenged birds+6 ppm salinomycin], 4) VI [challenged birds+10 ppm violacein], 5) V2 [challenged birds+15 ppm violacein], and 6) V3 [challenged birds+20 ppm violacein]. On day 14, all groups were challenged (except for NC) with sporulated oocysts inoculum to induce coccidiosis. Results revealed that, a diet supplemented with violacein upto 20 ppm improved growth performance of coccidiosis infected broilers ($p < 0.05$) including body weight, average daily gain, average daily feed intake, and feed conversion ratio compared to the PC group and had no difference ($p > 0.05$) with the SAL group, for the overall experimental period. Infected broilers fed violacein at 15 ppm had reduced overall lesion scores compared to other violacein concentrations ($p < 0.05$) and were comparable to SAL ($p > 0.05$). Besides, infected broiler chickens fed V2 reported a reduced oocysts count (OPG) in feces (5.64; $p < 0.05$) than those fed V1 (5.77) and V3 (5.74), where was not differ with the SAL (5.60; $p > 0.05$). In conclusion, violacein could serve as a natural alternative to antibiotics for mitigating coccidiosis, and a concentration of 15 ppm appears effective in suppressing deleterious effects in challenged broilers.

Key words : broiler chicken, coccidiosis, deleterious effects, growth performance, suppress, violacein

OA23025 Comparative analysis of body weight and mortality in 10 crossbred Korean native chickens and commercial layers from hatch to 18 weeks of age

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The body weight (BW) and mortality in 10 crossbred Korean native chickens (KNCs) layers compared to commercial layers (Hy-Line Brown) from hatch to week 18 were evaluated. A total of 528 one-day-old chicks were allocated to have 10 crossbred groups (i.e., A2, A3, A4, B1, B3, B4, C1, C2, D1, D2) and Hy-Line Brown with 6 cages each and 8 birds per cage. All the birds were provided with commercial diets and fresh drinking water at all times. All data were measured bi-weekly for 18 weeks. Data were analyzed using one-way ANOVA by Tukey's test ($p < 0.05$) in SPSS (Version 26; IBM SPSS Statistics, 2019). There were significant difference in BW among the 11 groups from hatch to 16 weeks ($p < 0.05$). Hy-Line Brown had significantly higher BW at week 1 and 16, whereas the B1 had the highest BW from week 2 to 14 ($p < 0.05$). By the end of the growing period (week 18), no differences in BW were observed ($p > 0.05$). Considering the mortality, differences were noted among the KNC groups, with B1 having the lowest number of deaths (5 birds) while A2 had the highest (14 birds). Overall, our results suggest that the B1 had comparable values to Hy-Line Brown from hatch to week 18 in terms of higher BW ($p < 0.05$) and lower mortality. Therefore, the future development of the B1 crossbreed is recommended based on our data.

Key words : body weight, crossbreed, Korean native chicken, layer, mortality

OA23026 The effects of dietary phytase supplementation on growth performance, nutrient digestibility, and blood metabolites of weaned piglets

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This research aims to evaluate the impact of phytase on the growth performance, fecal score, nutrient digestibility, and blood and feces characteristics of weanling pigs. We studied 240 newly weaned pigs, each with an initial average body weight of 5.57 kg and age of 21 days. These pigs were randomly assigned to five dietary treatments following a completely randomized block design and were grouped according to the weaning group, body weight, and gender, with the experiment running for six weeks. We implemented a three-phase feeding schedule: phase 1 (days 1-7), phase 2 (days 8-21), and phase 3 (days 22-35). The dietary treatments included two control diets. The positive control (PC) group received the basal diet, while the negative control (NC) group received a diet with reduced total calcium (Ca) and phosphorus (P) levels. Both control diets were formulated without microbial phytase, following the NRC's (2012) recommendations for total Ca and P. Three other treatments, each containing 500, 1,000, or 1,500 FTU/kg of phytase, replicated the NC diet. Our findings suggest that the final body weight was significantly higher in the PC group compared to the NC group, and it linearly increased when phytase was supplemented ($p < 0.005$). Additionally, Ca and P levels were notably increased in the phytase-supplemented diets compared to the NC diet during phase 2 ($p < 0.05$). The phytase-supplemented diets also led to a significant increase in myo-inositol levels compared to the NC diet in phases 2 and 3 ($p <0.05$). Conversely, the level of InsP6 was significantly lower in the phytase-supplemented diets compared to both PC and NC diets during phases 2 and 3 ($p < 0.001$). Based on these results, we recommend the inclusion of phytase in weanling pigs' diets at levels between 1,000 to 1,500 FTU/kg to promote better growth performance and enhance the overall efficiency and sustainability of animal production.

OA23027 Water-based Korean wild ginseng and its effect on performance, panaxosides content, cytokine expression, and the microflora quantum of laying hen

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This 24-week study examined the influence of water-based Korean wild ginseng supplementation on the egg quality, cytokine expression, ginsenoside concentration, and microflora quantity in ISA brown laying hens. The experimental setups compared a basic feed with the basic feed supplemented with 0.05% (WG1), 0.1% (WG2), and 0.5% (WG3) wild ginseng in drinking water. At the conclusion of the study, hen-day egg production (HDEP), average egg weight (AEW), and egg mass (EM) were observed to have significantly increased in the WG3 group at the 12-week mark (p <0.05). Ginsenoside content in egg yolks increased significantly among the hens in the WG3 treatment at week 12 (p <0.05). Additionally, relative expression of tumor necrosis factor alpha (TNF-α) decreased notably in the WG3 group at week 12 (p <0.05). Between weeks 8 and 12, there was a significant increase in the fecal microflora quantity of Lactobacillus in the WG3 group (p <0.05), while the count of Escherichia coli decreased considerably in the WG2 and WG3 groups at week 12 (p <0.05). The results suggest that the improvements in HDEP, AEW, and EM might be due to the increased ginsenoside content, which appears to enhance TNF-α expression and alter the fecal microflora quantity, particularly Lactobacillus and E. coli, in the WG3 supplemented diets. Thus, we recommend using wild ginseng at an application level of 0.5% in drinking water to achieve optimal laying performance in layer hens.

OA23028 Sophorolipids ameliorate early weaning stress by strengthening gut integrity and mucosal layer with modulation of gut microbiome

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Weaning is a biggest stressful condition that animals face for the first time in their lives and it can critically affect their growth performance in whole lives and productivity. Sophorolipids (SPL), a glycolipid-type biosurfactant, is known as a dietary supplementation, and our previous study demonstrated that it could accelerate the proliferation of human enterocytes by upregulation of tissue remodeling markers. Therefore, we conducted two experiments with rats and pigs to investigate the therapeutic effect of SPL on gut dystrophy by early weaning, and to elucidate the mechanism of the healing process induced by sophorolipids. Thirty early-weaned SD rats (14-day-old) and one hundred forty L x Y x D early-weaned piglets (21-day-old) were used and the jejunum and cecum samples were obtained at the end of the experiment. In rat experiment, dietary SPL increased villus height and goblet cell count with lower permeability, and the concentration of acetate and butyrate was increased by dietary SPL addition. In accordance with rat study, pig experiment indicated that dietary SPL supplementation could improve growth performance, and gut histological indices including villus height and mucin-secreting cells. Moreover, SPL increased the population of Prevotella with an increment of total short-chain fatty acid production. Collectively, SPL could restore gut dystrophy by early weaning and it led to improved growth performance.

Key words : rat, pig, sophorolipid, early weaning, gut

OA23029

The effect of Soregen Technology® feed and water on egg production, egg quality, *Salmonella* enumeration, and small intestine morphometric of *Salmonella*-infected laying hens

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This study was designed to investigate the effects of Soregen Technology® feed and water (ST-FW) on egg production, egg quality, *Salmonella* enumeration, and small intestine morphometric of *Salmonella*-infected laying hens. Soregen Technology® proposed that exposure to a quantum entanglement signal program improves the function and characteristics of the materials. A total of 80 Isa Brown laying hens (70-72 weeks) infected with *Salmonella* were randomly distributed into two treatment groups (Control and ST-FW) for 4 weeks of treatments. The results showed that egg weights were consistent in both treatments and did not show statistically significant differences ($p > 0.05$). The hen day egg production and haugh unit in the ST-FW laying hens was significantly higher ($p < 0.05$). *Salmonella* spp. counts in the excreta, spleen, liver, ovary, and cecum of laying hens treated with ST-FW were numerically lower than the control diet, both 7 and 14 dpi. However, the difference reached a statistical significance ($p < 0.05$) of only 14 dpi. Observations of the small intestine of laying hens showed that ST-FW improves the small intestine morphology ($p < 0.05$). The beneficial effect of ST-FW having similar biologically active components as other feed additives or probiotics from quantum entanglement properties. These results indicate that ST-FW improves egg performance and reduces the effect of *salmonella* without causing health issues.

Key words : Soregen Technology® feed and water; *Salmonella*-infected, egg performance

동물생명공학

OB23001 Studies on identifying pivotal amino acid residues of ANP32A for influenza A virus polymerase activity

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Modification of cellular host factors involved in viral proliferation is one of the most effective methods to prevent avian influenza infection. The acidic nuclear phosphoprotein 32 family member A (ANP32A), one of the cellular host factors, interacts with viral polymerase (vPol) of avian influenza virus (AIV). Additional 33 amino acids, duplicated from 149-175 amino acid residues, exist in avian ANP32A. We found that identity of 27 amino acids (149-175) in human ANP32C (hANP32C), dispensable host factor for AIV, with hANP32A was lower than that of human ANP32B (hANP32B), implying that amino acid residues responsible for interacting with viral polymerase are located in the 33 amino acids. We found that Asp149 and Asp152 in hANP32A are key residues that support vPol activity and viral replication. The substitution of these residues into those of hANP32C resulted in the reduction of interaction between hANP32A and vPol. Furthermore, precise substitution of chicken ANP32A amino acid residues (Asp149, Asp152 and duplicated Asp182, Asp185) into those of hANP32C in chicken ANP32A knockout cells resulted in significantly reduced viral replication. These results indicate that Asp149 and Asp152 of ANP32A play critical roles in viral replication and modification of these residues in ANP32A can be a key to developing the AIV-resistant animal development.

Key words : ANP32A; host factor; influenza virus

OB23002 Studies on signaling pathway-related gene expression during mitotic arrest in male chicken germ cells through single-cell transcriptome analysis

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Chicken male germ cells undergo mitotic arrest asynchronously on embryonic day 14 (E14) during differentiation from primordial germ cells (PGCs))to sex-specific germ cells. After 10 weeks of hatching, they re-enter the cell cycle and initiate differentiation. Understanding the signaling pathways that regulate mitotic arrest is important for male germ cell development. Signaling pathways related to germ cell differentiation, such as TGF-β, JAK–STAT, and Hedgehog, have been studied at different stages of chicken embryo development. However, research on the signaling pathways that regulate male germ cell-specific differentiation, including mitotic arrest, during in vivo development is lacking. Therefore, we investigated the signaling pathways regulating male embryonic germ cells during mitotic arrest through a single-cell transcriptomic approach using a germ cell tracing chicken models expressing germ cell-specific fluorescent markers (GFP). We found that BMP, Notch, and JAK–STAT signaling pathways were down-regulated at the mitotic arrest while MAPK, Hedgehog, and thyroid-hormone signaling pathways were consistently up-regulated after mitotic arrest. As a result, our findings suggest that signaling pathways that are involved in mitotic arrest distinctly regulate mitotic arrest during embryonic development and following quiescent state after hatching.

Key words : chicken, male germ cell, mitotic arrest, signaling pathways, single-cell RNA sequencing

OB23003 Molecular characteristics and functionality of newly isolated rumen-derived extracellular vesicles in host-microbe interactions

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The rumen is inhabited by a diverse range of microorganisms such as bacteria, protozoa, fungi, and viruses. These microorganisms play a key role in the rumen by fermenting the primarily consumed forage and providing nutrients. As part of their metabolic activity, these microorganisms release various extracellular vesicles (EVs). This study aims to investigate the function of rumen EVs and their interaction with the host. The structure of rumen EVs was examined using transmission electron microscopy, and the size of the particles was determined through Nanoparticle Tracking Analysis. The size of rumen EVs ranged from 100 nm to 400 nm and consisted of microvesicles, microparticles, and ectosomes. Using the *Caenorhabditis elegans* model, we assessed the interplay between the host organism and EVs derived from the rumen. The exposure of *C. elegans* to rumen EVs did not significantly increase longevity; however, exposure to pathogenic bacteria *E. coli* O157 and *S. aureus* significantly increased lifespan. Furthermore, transcriptome analysis revealed alterations in gene expression in *C. elegans* exposed to rumen EVs, particularly in metabolic pathways, fatty acid degradation, and biosynthesis of cofactors. This study provides valuable insights into the interaction between rumen EVs and the host, offering new perspectives for the discovery of biotherapeutic agents in the animal industry.

Key words : rumen fluids, extracellular vesicle, biotherapeutic agents

OB23004 Probiotics supplementation alleviate on body weight of obese canines by promoting the energy metabolism and reshaping their gut microbiota

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Due to the close proximity of companion animals to people, conditions like obesity and overweight that were previously thought to be unique to humans are actually common among companion animals. This led the range of the companion animal industry to be broadened every year, and health supplements based on microorganisms have been particularly active research. Therefore, we studied how probiotics (*Enterococcus faecium* IDCC 2102 and *Bifidobacterium lactis* IDCC 4301) regulate gut microbiota against obesity in this work. In hyperlipidemic *Caenorhabditis elegans* strain VS29 and obese canines fed a high-fat diet, lipid accumulation was decreased by IDCC 2102 and IDCC 4301 administration. Obesity-related systemic inflammation and hormonal disturbance were also decreased. In addition, they altered the obese microbiota by activating pyruvate metabolism in lactic acid bacteria, such as *Lactobacillaceae*, *Ruminococcaceae*, and S24-7. IDCC 4301 promoted glycolysis and contributed to ATP synthesis with bacterial short-chain fatty acids and carboxylic acids; IDCC 2102 synthesized bacterial byproducts such as butyric and acetic acids, and dopamine in obese canines, and improved glucose and insulin tolerance. In conclusion, IDCC 2102 and IDCC 4301 treatment reduced systemic inflammation brought on by the high-fat diet. They avoided lipid accumulation and restored fecal microbiota equilibrium in response to high caloric intake.

Key words : domestic animals, metabolic diseases, dietary probiotics

OB23005 Isolation of methane-metabolizing bacteria from Holstein rumen

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Ruminants possess large biological fermentation chambers called rumens, which house over 20 billion bacteria in just 1 mL of volume.Biopolymers such as cutin and cellulose enter the rumen, where they undergo degradation into smaller molecules and get absorbed by the rumen microbiome. The fermentation process in the rumen produces methane, a potent greenhouse gas that contributes to global warming. In this study, an experiment was conducted to isolate methanotrophs, which are microorganisms that utilize methane as their energy and carbon source. The rumen fluid acquired from healthy Holstein was diluted 100 times with NMS media, and then methane at a concentration of 50% was introduced into the headspace. The bottle was incubated for 20 days at 39°C, resulting in the emergence of a distinct microbial consortium in samples. Several strains were isolated through serial dilution, and ten candidates of methanotroph strains were obtained. Among them, Brevibacillus spp. MeLD10 had the ability to grow under both conditions: NMS medium supplemented with methanol or methane. Gas chromatography analysis confirmed the methane-oxidizing activity by Brevibacillus spp. MeLD10 under moderately thermophilic conditions (above 40°C). This strain has the potential as a valuable bacterium of cattle origin for mitigating methane emissions and addressing climate change concerns.

Key words : methanotroph, methane mitigation, methane

OB23006 Effect of L-leucine on cell viability, gene expression, protein synthesis and apoptosis under heat stress condition in bovine mammary epithelial cells *in vitro*

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The study aimed to investigate the effects of L-leucine (Leu) on protein synthesis and apoptosis under heat stress (HS) in bovine mammary epithelial cells (MAC-T). Cells were exposed to HS at 39, 41, and 43℃ for 2 hours after 3 days of differentiation. Leu was added at dosages ranging from 0.45, 0.9, 1.8, and 3.6mM during the differentiation phase. Data were analyzed using the GLM procedure of SAS. Result showed that HS at 39℃ increased cell viability, but decreased at 41 and 43℃ ($p < 0.05$). HS at 39℃ increased HSP70 and decreased PKRAA1 gene expression ($p < 0.05$). HS at 41℃ increased HSP70, BAX, eIF4EBP1 and decreased Bcl-2, PRKAA1, eIF4E gene expression ($p < 0.05$). HS at 43℃ increased HSP70 and decreased Bcl-2, PRKAA1 gene expressions ($p < 0.05$). HS reduced cellular protein levels at 41 and 43℃ ($p < 0.05$). Futhermore, cell viability increased with the addition of Leu up to 1.8mM at 41℃ ($p < 0.05$). Leu at 1.8mM decreased HSP70, BAX and eIF4EBP1 and increased Bcl-2 gene expressions($p < 0.05$). mTOR protein level increased with the addition of Leu up to 1.8mM at 41℃ ($p < 0.05$). P-mTOR protein level increased with the addition of Leu up to 0.9mM at 41℃ ($p < 0.05$). β-casein protein level increased with the addition of Leu up to 1.8mM under HS at 41℃ ($p < 0.05$). These findings suggest that HS at 41 and 43℃ can decrease cell viability, increase apoptosis, and reduce protein synthesis in MAC-T ($p < 0.05$). Furthermore, the addition of 1.8, 3.6mM Leu enhanced cell viability and protein synthesis, reduced apoptosis, and mitigated the effects of HS ($p < 0.05$). In conclusion, HS reduces cell viability, inhibits protein synthesis and induces apoptosis in MAC-T. Leu supplementation effectively enhancesd cell viability and protein synthesis, reduces apoptosis, and alleviates the impact of HS.

Key words : heat stress, L-leucine, protein synthesis, apoptosis, bovine mammary epithelial cell

OB23007 Evaluation of *Fusarium venenatum*-based microbial protein as a potential alternative protein for animal feeds

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In Korea, nearly 30% of households raise companion animals. As more people raise companion animals, there is a growing interest in pet nutrition and well-being. Mycoprotein, derived from the fermentation of fungi such as *Fusarium venenatum*, is a whole food source. Mycoprotein produced from *F. venenatum* is rich in protein and fiber, yet low in fat, making it a promising protein source for companion animal feed. It holds great potential as a protein source for functional companion animal feed, offering the ability to improve health and prevent obesity. To investigate the potential of *F. venenatum* as an anti-obesity agent, we conducted a mice experiment, using a comprehensive analysis through a multi-omics approach. The result showed that *F. venenatum* could improve lipid profiles and reduce fat accumulation in both liver and adipose tissue. This was achieved through a decrease in the expression of lipogenesis-related genes. In addition, high concentrations of primary bile acid and cholesterol were detected in the feces by feeding *F. venenatum*. This suggests that *F. venenatum* increased the excretion of primary bile acid and cholesterol which may have led to a reduction of lipid digestion and hepatic fat accumulation. In conclusion, *F. venenatum* shows great promise as a protein source for companion animal feed, particularly for animals suffering from metabolic diseases such as obesity.

Key words : microbial protein, *F. venenatum*, animal feed, lipid metabolism, alternative protein

OB23008 Evaluation of the probiotic properties of lactic acid bacteria and yeast strains isolated from Kefir for manufacturing dairy foods

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Kefir is a fermented milk product that contains a diverse group of microorganisms, including lactic acid bacteria, yeasts, and acetic acid bacteria. Among them, *Lactobacillus kefiri* and *Kluyveromyces marxianus* are bacteria and yeast commonly found in kefir, which can grow under facultative anaerobic conditions and produce functional metabolites. In this study, we isolated 44 strains of LAB (*L. kefiri*, *L. fermentum*, *L. paracasie*, and *Lactococcus lactis*) and 43 strains of yeast (*K. marxianus* and *Saccharomyces serevisiae*). We also indicated that the selected *L. kefiri* and *K. marxianus* have probiotic characteristics compared to positive controls *Lacticaseibacillus rhamnosus* GG and *Saccharomyces boulardii*. Additionally, we evaluated their anti-aging and toxicity effects using *Caenorhabditis elegans* as a surrogate host, and the results showed that several strains of *L. kefiri* and *K. marxianus* significantly increased the longevity of *C. elegans*. Furthermore, we conducted genome analysis of kefir LAB and yeast using whole genome sequencing (WGS) and determined their synergistic effect on the flavor development of dairy foods. Overall, our study suggests that *L. kefiri* and *K. marxianus* could be potential probiotic stains for manufacturing dairy foods including yogurt, cheese, and kefir beveages.

Key words : kefir, probiotic, *Lactobacillus kefiri*, *Kluyveromyces marxianus*, *Caenorhabditis elegans*, dairy foods

OB23009 The combination of probiotic *Escherichia coli* Nissle 1917 and straw biochar influences on the rumen metabolism via enhanced hydrogen and acetate production

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Escherichia coli strain Nissle 1917 (EcN) is extensively employed as a probiotic in human due to its anti-inflammatory effects, but its effect mechanism is still unclear. This study conducted an experiment to improve the ability to produce hydrogen, assuming that the anti-inflammatory effect of EcN is caused by its ability to produce hydrogen. Activated carbon (biochar), which is harmless to livestock even if consumed, was applied as an additive to improve hydrogen production. Biochar could improve the biohydrogen-producing ability by 136 % when it coincubated with EcN. The short-chain fatty acids (especially acetate) and ethanol production was increased by biochar coincubation with EcN. Moreover, RNA-sequencing analysis indicated that enzymes related to acetate production were significantly increased by biochar coincubation with EcN (*poxB*, *pta*, *akaA*). Next, acetate production enzyme knockout mutation was performed using multiplex automated genome engineering. A significant reduction in hydrogen production was observed in the acetate production gene (*poxB*) knockout mutant. Collectively, this study found that EcN with biochar could increase the production of acetate and hydrogen, and the gene named poxB has a vital role in the generation of acetate and hydrogen. The combination of probiotic bacteirum and biochar could be applied as alternative feed addictives for new strategy of rumen metabolic pathway-based methane mitigation.

Key words : *Escherichia coli*, Nissle 1917, EcN, hydrogen production, biochar, biohydrogen, acetate, MAGE, RNA-seq, anti-inflammatory effect

OB23010 Molecular characterization of commensal *Lactobacillus* in weaning piglets supplemented with multi-strain probiotics

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Probiotics are known to enhance host health by improving intestinal function, preventing infections, and increasing nutrient digestion efficiency, which are mirrored in changes to the gut microbiota and bacterial metabolite production. The present study targeted to evaluate the effect of dietary multi-strain probiotics (MSP; *L. acidophilus*, *L. salivarius*, *L. plantarum*, *L. fermentum*, ca 10^{10} CFU/kg of diet) supplementation and discover pivotal bacteria and their metabolites of gut environments in piglets. he MSP inclusion increased the abundance of *Lactobacillus*, and this result indicated that the MSP could improve growth performance by influencing specific metabolic pathways via modulation of *Lactobacillus* species in piglet gut microbiota. Metabolomic results showed that the MSP supplement increased concentrations of amino acids such as valine, isoleucine, and proline. These alterations were found to be crucial for energy-synthesizing metabolic pathways, including branched-chain amino acid (BCAA) metabolism and coenzyme A biosynthesis with enhancement of gut barrier function. Next, we isolated commensal Lactobacillus, increased by MSP supplement in piglet gut microbiome using culturomic approaches and selected potential probiotic strains. Importantly, these strains could be associated with gut metabolism and physiology. Collectively, these results indicated that commensal Lactobacillus enriched by MSP supplement were related to BCAA and energy metabolism which could enhance growth performance and gut barrier function.

Key words : multiomics, gut microbiome, piglets, Commensal *Lactobacillus*

OB

OB23011 Effect of heat stress and vitamin E treatment on bovine muscle-derived stromal vascular cells *in vitro*

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This study investigated the effects of vitamin E treatment (VT) on stromal vascular cells derived from bovine muscle (BMSV) under heat stress on myogenic regulatory factors (MRFs), heat shock proteins (HSPs), apoptosis regulators, and antioxidant enzyme genes. During the differentiation stage, the cells were subjected to a one-day HT (Normal: 37°C; Mild: 39°C, and Severe: 41°C), and VT were also administered with either 0 μM (No VE) or 1 μM of vitamin E (VE). On D1, after one-day HT, elevation in HSP70 and HSPB1 gene expressions were observed ($p < 0.05$). HSPB1 increased in No VE in mild ($p < 0.05$). Likewise, BAX expression increased by HT was observed in No VE in Severe group ($p < 0.05$), but not at VE. Mild HT increased SOD1 in No VE, and GPX1 increased in both VE groups after HT at Severe ($p < 0.05$). However, MRFs expressions remained unchanged by HT or VT on D1. On D6, MYF5 expression was higher in the 1 μM group at Normal and Severe ($p < 0.05$). Additionally, the highest total protein levels were found at Mild ($p < 0.05$). The lowest protein levels and fusion index were found in Severe ($p < 0.05$). In conclusion, a one-day HT at 41°C facilitates apoptosis, triggers antioxidant enzymes, and hampers myogenic development in BMSV cells. This results suggest that regulation of vitamin E concentration could mitigate the negative effect of heat stress on the muscle development of BMSV cells.

Key words : heat stress, apoptosis regulators, myogenesis, vitamin E, antioxidants

반추동물 영양 · 사양

OC23001

Heat stress effects on ruminant microorganisms and the role of protein or energy levels in rumen fermentation properties

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This study aimed to explore the effects of heat stress (HS) on ruminant microorganisms, regardless of the host, and to determine the appropriate protein level to mitigate HS. Rumen inoculum was collected from 2 fistulated Holstein heifers (BW 683.3 ± 30.2 kg) and assessed using a closed batch culture system. The experimental model employed a 2×5 factorial arrangement using temperature levels set at 39°C and 41°C, with protein levels set at 12.0, 13.5, 15.0, 16.5, and 18.0% of DM in trial 1 or with energy levels set at 2.4, 2.5, 2.6, 2.7, and 2.8 Mcal/kg of DM in trial 2. The results revealed that when incubation temperatures increased from 39°C to 41°C, NH3-N production rose, and TVFAs increased up to 12 h under HS ($p < 0.05$). Protein amounts of liquid-associated bacterial (PLAB) decreased by 24% at 24h due to HS in trial 1 and 33.3% after 48 h of HS in trial 2 ($p < 0.001$). In trial 1, protein level of 15.0% onwards, NH_3-N increased, the C2% rose, the C3% declined and the A:P ratio increased ($p < 0.05$). In trial 2. the increased in energy level led to a decrease in C2 and an increase in C3 from 6 to 48 h of fermentation. Particularly as the C4 increased linearly with the energy level. In conclusion, our study revealed a increase in NH_3-N and TVFA production indicating the impact of HS on ruminant microorganisms, regardless of the host. However, we did not observe any significant interaction between HS and protein or energy levels. Consequently, our findings suggest that adjusting protein and energy levels may not be necessary to enhance ruminal fermentation and microbial protein synthesis under HS conditions.

Key words : energy, heat stress, protein, rumen fermentation properties, ruminal microbes

OC23002

In vitro evaluation of rumen fermentation and methane-reducing potential for red seaweed species in Korea

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This study aimed to evaluate the potential of 38 different species of red seaweed to mitigate methane (CH_4) production and their impact on rumen fermentation. Additionally, the effects of various drying methods on CH_4-reducing effectiveness and dose-dependent effects were also examined *in vitro* for the most promising species. Rumen fluids from two cannulated cows were incubated with each red seaweed for 48 h in a semi-closed batch culture system. Among all the species, six species mitigated CH4 production while two species decreased the CH_4 proportion. The selected red seaweed which reduced CH_4 production and proportion by 31% and 20%, respectively, were further studied under 4 drying methods (freeze- vs. oven-drying at 45, 60, or 105℃) and at 7 dosages (ranging from 0 to 20% of incubated organic matter). Drying at 105℃ resulted in the largest reduction of CH4 production (18 to 46%) and proportion (12 to 35%). No halogenated compounds were detected in any samples dried by different methods. The CH4 production started to decrease (19 to 31%) from 5% of the inclusion level, and the highest dosage reduced CH_4 production by 45 to 73%, without adverse effects on rumen fermentation characteristics. These findings suggest that the hot-air-dried red seaweed species have the potential as a CH_4-mitigating feed additive, but further research is needed to identify the specific substance responsible for CH_4 reduction.

Key words : rumen, methane, red seaweed, *in vitro* fermentation

OC23003

Effect of different forage-to-concentrate ratio diets on methane emissions from pregnant Hanwoo heifers

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This study investigated the effect of different forage-to-concentrate ratios on methane (CH_4) emissions and rumen fluid characteristics in pregnant Hanwoo heifers. Twenty-five Hanwoo heifers with an initial body weight of 343±24.6 kg were divided into two groups based on their gestation age and assigned to either the control group (CON; n=15), which received *ad libitum* forage only, or the treatment group (TRT; n=10), which received *ad libitum* forage plus 4 kg concentrate. After 18 days of adaptation, CH_4 concentrations were measured using with a laser methane detector (LMD) for two days per animal, with measurements taken four times daily. Feed intake was recorded throughout the experimental period. Rumen fluid were collected from each animal three times over three consecutive days, and pH, ammonia (NH_3-N), and volatile fatty acid (VFA) were analyzed. Dry matter and NDF intakes were higher ($p < 0.05$) in TRT than in CON. Methane emissions per kg DMI, from both respiration and eructation, were lower ($p < 0.05$) in TRT. The TRT had higher ($p < 0.05$) total VFA, butyrate, valerate, and iso-valerate concentrations and lower ($p < 0.05$) acetate concentrations in their rumen fluid compared to the CON. In conclusion, supplementing forage with concentrate can reduce CH_4 emission per kg DMI in Hanwoo heifers by modulating rumen characteristics such as pH, NH_3-N, and VFA production.

Key words : methane, laser methane detector, forage to concentrate mix ratio, Hanwoo

OC23004

2022 한우 품질이력 인사이트 레포트 리뷰

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본 연구는 우리나라에서 생산 및 도축된 한우의 품질과 이력정보 데이터 분석을 통해 인사이트를 발굴하고 농가의 사양관리와 개량, 정책 및 연구방향에 도움을 주기 위해서 실시되었다. 2016년부터 2022년까지 총 99,850개 농가에서 도축된 5,330,267마리의 한우 품질 및 이력데이터가 사용되었으며 탐색적 데이터 분석을 통해 한우산업의 분포, 지역별 특성 및 기타 통계를 분석하였다. 그 결과 거세비육, 미경산 및 경산우를 각각 2022년 연간 평균 12두 이상 출하한 농가들의 출하성적(도체중, 등심단면적, 등지방두께, 근내지방도, 월 평균 증체량, 1+이상 출현율, 1++ 출현율 및 C등급 출현율) 평균을 구하고, 거세비육, 미경산우 및 경산우의 각 도체성적 지표들의 백분위를 제시하였다. 사육개월령에 따른 C등급 출현율, 도축월별 출생월 분포를 제시하였다. 또한 한우의 사육개월령을 기준으로 생체중을 예측하기 위해 각 성별로 회귀분석을 실시하였으며, 이를 기준으로 각 성별(거세, 암소 및 비거세) 2022년 기준 10-32개월령까지의 체중증가 및 근내지방도 침착 곡선을 제시하였다. 암소의 마지막 출산 이후 도축까지 걸린 개월령 대비 성적분포를 분석한 결과, 도체중의 경우 0-1개월에서 평균 328.7kg정도로 이후 2달 만에 20kg 가까이 증가하고 이후 시간이 지날수록 증가폭이 줄어드는 추세를 보였다. 또한 본 연구를 통해 최고가 거세우의 공통점, 송아지 출생월 별 도축성적, 육종가 코드(도체중, 등심단면적, 등지방두께 및 근내지방도) 별 성적 및 유전코드 조합별 경락가격 등을 제시하였다. 본 연구를 통해 한우산업 전체의 특성을 분석하고 빅데이터 기반의 정책 및 사양관리에 대한 방향을 도출할 수 있을 것으로 보인다.

Key words : 한우, 축산물이력제, 축산물품질, 빅데이터

OC23005

옥수수 부분 대체 비트펄프 급여가 한우 거세우의 메탄가스 생성, 근내지방 세포 크기 및 유전자 발현에 미치는 영향

이상현, 김상엽, 이재성, 정진우, 오준석, 임세윤, 경준성,
Kamburawala Kankanamge Tharindu Namal Ranaweera, 백명기
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비트펄프는 사탕무의 가공 부산물로, NDF와 펙틴을 비롯한 소화율이 높은 섬유소를 많이 함유하고 있어서 아세트산 생성 촉진 등 반추위 발효 안정화를 위한 사료로 평가되고 있다. 본 연구에서는 비육후기 한우 거세우 사료 내 옥수수의 부분 대체로 비트펄프 급여가 메탄가스 생성, 지방세포의 크기 및 유전자 발현에 미치는 영향을 분석하였다. 비육후기 한우 거세우 18두(체중 636±10.9kg; 개월령 25.9±0.25)를 옥수수 플레이크(CF) 그룹과 비트펄프(BP) 그룹으로 나누었다. 건물기준 약 89%는 농후사료로, 나머지 11%는 톨페스큐 건초를 급여하였다. CF 및 BP 그룹의 총 농후사료 중 각각 78%와 72%는 농후사료로, 나머지 22%와 28%는 각각 옥수수 플레이크 또는 비트펄프를 급여하면서 총 20주간의 사양실험을 수행하였다. CO2법으로 측정한 메탄가스 발생량은 두 그룹 간의 차이가 없었다 (p = 0.16). 등심 내 지방구 세포를 크기별로 구분하여 분석한 결과, 가장 크기가 작은 40~50μm에서 BP 그룹이 CF 그룹보다 낮은 비율을 보였고, 크기가 큰 100~130, 160~170 및 180~190μm 구간에서는 BP 그룹이 더 높은 비율을 보였다 ($p \leq 0.04$). 지방분해 유전자인 adipose triglyceride lipase의 발현량은 BP 그룹이 CF 그룹보다 낮았다 (p = 0.02). 결론적으로, 비육 후기 한우에 비트펄프 대체 급여는 메탄가스 발생량에 부정적인 영향을 미치지 않으면서, 일부 지방 분해 유전자 발현량을 감소시켜서 등심내 지방 세포 크기를 증가시키는 효과가 있는 것으로 판단된다.

Key words : 비트펄프, 옥수수 플레이크, 메탄가스, 지방구 세포 크기, 지방분해 유전자

OC23006

Effect of probiotics including *C. militaris* supplement on rumen fermentation, growth performance and carcass characteristics in Hanwoo-steers

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This study investigated the effects of probiotics including *C. militaris* (PC) on rumen fermentation, growth performance and carcass characteristics in Korean-native steers. In an *in vitro* experiment, different levels of PC (0, 0.0015, 0.03, 0.06, 0.12, 0.24 and 0.48% dry matter basis) were added to the diet with rumen fluid using Ankom^{RF} gas production system for 12, 24 and 48h. Data were analyzed using the mixed procedure of SAS. Total gas production increased in the PC groups with the highest response observed in the 0.06% group at 48h of incubation (linear, p = 0.02; quadratic, p < 0.01). Regarding rumen fermentation parameters, the total volatile fatty acid (TVFA) tended to increased in all of the PC groups (p = 0.07). The concentrations of butyrate, iso-butyrate and iso-valerate were significantly increased in all of the PC groups (p < 0.05). In an *in vivo* experiment, we selected a dosage of 0.07% dry matter basis of PC based on the results of the *in vitro* experiment. Twenty-three Korean native steers were allocated to each group: (1) Control and (2) Control + 0.07% PC, in a randomized complete-block design based on body weight (Ave. BW = 641.96kg, p = 0.80) and feed intake (Ave. FI = 13.96kg, p = 0.08) lasted for 252 days. Average daily gain was decreased in treatment groups compared to control group (p < 0.01). Dry matter intake show no significant differences between control and treatment group (p = 0.49). Backfat-thickness was significantly decreased in the treatment group (p = 0.03) whereas meat color tended to increase (p = 0.07). In conclusion, the supplementation of PC at 0.07% in the diet did not influence growth performance, health performances and carcass characteristics in Korean native steers.

Key words : Hanwoo-steers, probiotics, feed-additive, ruminants, carcass characteristic

OC

OC23007 Effects of Probiotics Supplementation on Enteric Methane Emission in Cattle: A Meta-Analysis

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While the livestock industry plays a crucial role in meeting the global demand for human nutrition, its environmental impact cannot be neglected. In particular, in ruminant animals, enteric methane is a highly concerning greenhouse gas due to its global warming potential. Recently, the use of probiotics to reduce methane emissions from cattle has gained popularity among researchers. In this sense, the objective of this study was to perform a meta-analysis of probiotic interventions aiming to reduce enteric methane emissions from cattle. From 362 articles retrieved from scientific databases, 85 articles were appraised independently by 2 reviewers, and 23 articles representing 57 comparisons were deemed eligible for review and meta-analysis. In each study, data such as mean, standard deviation, and effect sizes of both the control and probiotic interventions group were extracted. The main outcomes of interest were methane emission, methane yield, and methane intensity. For the meta-analysis, effect sizes were pooled using a fixed effect or a random effect model depending on the heterogeneity levels. Afterward, outlier removal, the Leave one out method, and the trim and fill bias correcting techniques were conducted to confirm the robustness of the findings. Overall pooled standardized mean differences (SMD) with their confidence (CIs) and prediction (PIs) intervals did not detect significant differences in methane emission (SMD = –0.08; 95% CI [–0.27; 0.10]; PI [–0.43; 0.26]; p = 0.374), methane yield (SMD = –0.09; 95% CI [–0.25; 0.06]; PI [–0.25; 0.06]; p = 0.834), and methane intensity (SMD = –0.21; 95% CI [–0.50, 0.07]; PI [–1.43; 1.00]; p = 0.129) between cattle supplemented with probiotics and the control group. However, subgroup analyses revealed that multiple-strain probiotics (SMD = –0.41; 95% CI [–0.76; –0.11]; p = 0.009), specifically the combination of bacteria involved in reductive acetogenesis and propionate production (SMD = -0.71; 95% CI [–1.04; –0.36]; p = 0.001), emerged as better interventions. Likewise, steers (SMD = –1.91; 95% CI [–3.47; –0.35]; p = 0.016) and crossbreeds (SMD = –0.91; 95% CI [–1.54; –0.26]; p = 0.006) exhibited a more favorable response to the treatments. Furthermore, meta-regression models demonstrated that longer periods of supplementation were leading to significant reductions in methane emissions (p = 0.001), yield (p = 0.037), and intensity (p = 0.012) effect sizes. Taken together, the results of the current study suggest that cattle responses to probiotic interventions are highly dependent on the studies' features and designs. Therefore, extended trials performed on beef cattle with multiple-strain probiotics are showing the most promising results. Also, probiotics formulations containing bacterial strains involved in alternative hydrogen sink pathways may result in more effective ruminal methane mitigation. Ideally, further trials focusing on the use of probiotics to reduce ruminal methane in cattle should be conducted in order to complete the available literature.

번식 및 생리

OD23001 Effects of Nesting Material Provision and Vitamin C Supplementation on Follicular Development in Hyperprolific Sows

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The aim of this study was to examine the impact of coconut coir mat provision and vitamin C supplementation on follicular development in hyperprolific (HP) sows. In HP sows, the progress of follicular development can be impeded as a result of increased oxidative stress caused by metabolic burden during lactation. Sixteen sows were assigned to four groups 4 days prior to the expected farrowing date: 1) control diets (C; n = 4), 2) control diets containing 2000ppm of vitamin C (V; n=4), 3) control diets and mat (M; n = 4), 4) control diets containing 2000ppm of vitamin C and mat (MV; n = 4). Transrectal ultrasound examinations were conducted to measure the diameters of the five largest follicles in both ovaries. Our results indicated that providing nesting material to stimulate nest-building behavior did not influence follicle size after weaning (p = 0.820). Conversely, vitamin C supplementation as an antioxidant inhibited follicle growth on day 5 (p = 0.083). Previous studies have demonstrated that high doses of vitamin C can increase oxidative stress by facilitating iron-induced Fenton reaction. In this study, supplementing vitamin C on basal diets containing sufficient antioxidants can lead to increased oxidative stress, which disrupts follicle development after weaning. However, further studies are required to establish a link between increased oxidative stress during lactation and the inhibition of follicle development after weaning.

Key words : follicle size, oxidative stress, reproductive performance, transrectal ultrasonography, weaned sow

OD23002 The effect of feed intake during lactation on the period of return to estrus

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The objectives of this study were to investigate the relationship between daily feed intake during the lactation period and the return to estrus of sows and to determine the optimum quantity of daily feed intake required for a normal period of return to estrus. Data on daily feed intake were collected from 640 lactating sows using an automatic feeding system. The return to estrus for each sow was also recorded. Based on this information, the sows were divided into seven groups based on daily feed intake levels ranging from 3,260 g/d to 8,292 g/d. The period of return to estrus had negative correlations ($p < 0.05$) with parity (r = –0.129) and daily feed intake (r = –0.124). As daily feed intake increased, the return to estrus period decreased ($p < 0.001$) in a quadratic manner. A non-linear regression analysis revealed that a minimum daily feed intake of approximately 6.0 kg was necessary for a normal period of return to estrus. In conclusion, this study highlights the importance of daily feed intake during the lactation period influencing the return to estrus of sows. Proper feed management practices should be implemented to ensure a minimum daily feed intake of at least 6.0 kg for optimal return to estrus of sows.

Key words : lactating sow, daily feed intake, return to estrus.

OD23003 The influence of litter size-induced stress on nursing behavior in sows

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Genetic selection aimed at increasing litter sizes in pigs has resulted in a higher number of piglets being born alive. However, large litter sizes can induce stress during gestation and lactation, leading to reduced maternal bonding with offspring and lower piglet viability. This study aimed to assess salivary cortisol concentrations in sows with normal and large litter sizes and investigate its potential relationship with maternal behavior. A total of 24 sows (Landrace × Large white × Duroc) were used in this study. The sows were divided into two groups: NORMAL (n = 8), with litter sizes ranging from 7 to 14, and LARGE (n = 16), with litter sizes ranging from 15 to 20. Saliva samples were collected from each sow at 35, 21 and 7 days before farrowing, and at 1, 7 and 28 days after farrowing to analyze cortisol concentrations. Sows and their offspring were observed for 24 h from 3 days after parturition to assess nursing behavior. LARGE showed higher cortisol concentrations than those in NORMAL ($p < 0.05$). Moreover, the frequency of successful nursing behavior was lower in LARGE sows compared to NORMAL sows ($p < 0.05$). Based on these findings, we can speculate that poor nursing behavior might be attributed to elevated cortisol levels induced by large litter size. However, further study will be needed to demonstrate the causal relationship between litter size and nursing behavior.

Key words : cortisol, hyperprolific sows, lactation performance, nursing behavior, sow welfare

OD23004 Effects of exogenous gonadotropins on reproductive performance of gilts

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Gonadotropin products are available for inducing estrus of gilts. A concern is a potential negative effects of the estrus inducer on the farrowing performance. This study aimed to evaluate the effects of an estrus-inducing agent on gilt productivity in a commercial farm setting. A total of 60 gilts that had not shown estrus for more than 14 days were treated with an estrus inducer. Among these gilts, 51 exhibited estrus and underwent artificial insemination. Additionally, 64 gilts naturally went into estrus and were also artificially inseminated during the same period. The farrowing performance was recorded and the data were analyzed using Chi-square test. The conception rates for the natural estrus group and the estrus inducer treatment group were 93.7% and 92.2%, respectively, showing no difference. Furthermore, there were no significant differences observed in farrowing performance between the two groups, including total litter size (11.5 vs. 11.4), stillbirths (0.38 vs. 0.42), fostering piglets (11.1 vs. 11.1), and number of weaned piglets (10.9 vs. 10.7). Return to estrus after weaning also did not differ between the two treatments. Taken together, estrus inducers do not have detrimental effects on the productivity of gilts.

Key words : the number of mating, exogenous gonadotropin, gilts, planned production

초지 및 환경

OF23001 The impact of different housing systems on appearance, behaviour, haematological parameters, and egg quality of laying hens

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Given the highly variable cage-free systems and welfare environments, understanding the differences between enriched caged and aviary systems is essential with the global trend towards cage-free housing systems in the poultry industry. The aim of the current study was to evaluate the impact of enriched cage systems and aviary systems on the appearance, behaviour, haematological parameters and egg quality of laying hens. Behaviour (n = 210) and appearance (n = 200) of laying hens (28 week of age) were evaluated in accordance with the Welfare Quality (2009) protocol. Blood parameters (n = 50) were analyzed from samples collected from the brachial wing vein and processed on the same day. Egg quality was assessed the day after lay (n=50). Hens in the AS showed higher avoidance distance test scores than those in the ECS ($p < 0.001$). The ECS showed higher head and neck appearance scores than hens in the aviary system (AS; $p < 0.001$). Similarly, hens in ECS exhibited more elevated hematocrit levels and platelet count than in AS ($p < 0.001$). In contrast, hens in AS produced higher Haugh units, but lighter yolk weight compared to those in ECS ($p < 0.001$). However, no difference was found in Heterophil/Lymphocyte ratio. The results indicate that the application of AS may have a better approach to cope with the stress of laying hens compared to ECS, thereby possibly improving their welfare and the quality of eggs.

Key words : aviary system, avoidance distance test, enriched cage system, stress level, poultry welfare

OF23002 The importance of brooding box for lactating sows and suckling piglets

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Lactating sows require a cooler environment to optimize feed intake and lactation performance, while newly farrowed piglets require a warmer environment critical for their survival, as they are unable to maintain their body temperature initially. Thus, farrowing houses should be maintained cool and provided with an ideal microenvironment for piglets. In this study, 28 lactating sows and their litters were randomly assigned to two groups and housed in a controlled environment with and without a brooder box during the lactation period. The body condition and lactation performance of the sows were evaluated based on the growth performance of the litters. The growth performance of the piglets on the third day after birth and at weaning, as well as the litter size at weaning, were not significantly affected ($p > 0.05$) by the provision of a brooder box during lactation period. There was no significant difference in the body weight of sows at weaning. However, sows without a brooder box experienced significantly higher ($p < 0.05$) body weight loss, which was reflected in their backfat thickness at weaning. From these results, it can be concluded that the brooder box may not improve the performance of the litter in a controlled environment. Nevertheless, it could be beneficial in reducing the loss of body condition in sows during the lactation period.

Key words : lactating sow, piglets, microclimate, brooder box

OF23003

Effects of training program and human-horse interaction on behavior of young horses

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Horses are recognized as highly social animals that learn through their experiences, including social interactions. Understanding how human-horse interactions influence their behavior is crucial for developing positive relationships and enhancing the well-being of horses. Therefore, the present study aimed to investigate how the behavior of young horses can be altered through a training program and interactions with the handlers. The study involved 13 Quarter horse weanlings that were six months old. Each weanling was paried with a specific handler, and this pairing remained unchanged througout the training program. The training method employed in the study was a combination of positive and negative reinforcement, known as sympathetic horsemanship. The training program spanned for 3 months from September to December in 2022. The weanlings received training for two hourse per day, twice a week during this period. Behavior assessments were conducted at three points: the beginning, middle, and end of the training period. Horse temperament traits were evaluated using a 10-point scale. The results showed significant changes in these traits following the training program. Specifically, calmness, confidence, and friendliness significantly increased, while excitability, stubborness, and curiosity significantly decreased. Interestingly, the experience and gentleness of the handlers influenced the performance of the weanlings during the program. In conclusion, the study demonstrated that a horse training program combined with human-horse interaction can induce positive behavioral changes in young horses. Further research is needed to optimize the positive impact of training programs on the behavior and well-being of young horses.

Key words : behavior, human-horse interaction, training, young horses

OF23004

축산환경개선을 위한 가축분뇨 고체연료

정종민, 이동준, 이동현, 최예빈, 김중곤, 박소연, 김현종
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지속적으로 증가하고 있는 가축분뇨의 양과 가축분뇨를 수용하기 위한 토지의 감소, 그리고 가축분뇨로부터 발생되는 환경문제로 인한 각종 환경 규제 때문에 가축분뇨의 비농업계 활용에 대한 논의가 지속되어왔다. 이를 해결하기 위해 가축분뇨를 에너지화 하기 위한 많은 노력들이 있었고 가축분뇨 내의 탄소원을 에너지로 활용하기 위해서 열적 처리 기반의 에너지화 기술이 제안되었다. 그 중에서 연소는 유기물의 산화로부터 발생하는 열을 직접 사용하기 때문에 효율이 높고 가장 전통적이면서 보편적인 열적 처리 방법으로 여겨진다. 고체연료는 건조/성형의 비교적 단순한 처리 과정을 통해 생산되고 기존 처리 공정 대비 처리 시간을 극단적으로 단축시킬 수 있다. 또한 직접 화석연료를 대체 함으로써 온실가스를 저감 시킬 수 있다. 하지만 여러 장점에도 불구하고 가축분뇨 고체연료 사업의 확장을 위해서는 많은 문제의 해결이 필요하다. 대표적으로, 가축분뇨의 높은 수분 함량으로 인한 추가적인 건조비용, 수요처 확보 문제, 고체연료 생산시설 마련 등이 있다. 또한 가축분뇨의 특성상 별도의 소각로가 필요하며, 가축분뇨 내의 질소, 황 성분 때문에 고체연료 연소 후 배출되는 대기오염물질을 방지하기 위해 다른 연료들보다 강화된 방지시설이 필요하다. 더군다나 고체연료의 회분 함량이 높다는 점을 고려하였을 때 가축분뇨 연소 후 소각재의 처리는 또 다른 환경 문제를 야기할 수 있다는 단점이 있었다. 이러한 문제점들을 해결하기 위해 가축분뇨 고체연료 사업의 단계를 4단계로 분류 하여 문제점에 대한 분석을 실시하였다. 특히 각 단계 별 중요한 핵심 요소는 배출단계에서의 분뇨의 발열량 조절, 생산 단계에서 건조방법, 가축분뇨 연소 시설, 소각재 활용방안 등의 많은 연구가 필요할 것으로 사료된다. (사사)본 성과물은 농촌진흥청 연구사업(과제번호: PJ01719901)의 지원에 의해 이루어진 것임.

Key words : 가축분뇨, 고체연료, 생산시설, 활용시설, 소각재

OF23005 Mitigation of ammonia emission in grassland

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Livestock manures are an important organic resource as eco-friendly organic fertilizer containing nitrogen, phosphorus, potassium, and other nutrients. But also this manure contributes considerably to global emission of ammonia and greenhouse gases. It is estimated that 79.8 of the annual emission of ammonia occurs in the agricultural. The generation of ammonia mainly occurs in livestock barn, manure storage and processing, application and grazing. Ammonia, along with hydrogen sulfide, is a representative odor component and an alkaline corrosive substance that causes serious damage to respiratory system. Although ammonia is itself not a greenhouse gas, following deposition to soil it may be converted to nitrous oxide which one of greenhouse gas. Ammonia gas react with sulfur oxide (SOx) and nitrogen oxide (NOx) in the atmosphere to form particulate matter by water-soluble aerosolizing such as ammonium sulfate and ammonium nitrate. Various method has been studied to mitigate ammonia emission. Direct injection of pig slurry to soil decreased by 40%. Soil amendment such as charcoal and zeolite reduced ammonia emission by 22%, and 16%, respectively, when pig slurry was applied. Acidified pig slurry application decreased ammonia emission by 55%. Pig slurry application with urease and nitrification inhibitor decreased ammonia emission by 30% and 16%, respectively. The management of ammonia from agriculture manure is expected to contribute to the growth and quantity of forage by increasing nitrogen use efficiency, while mitigating hazardous environmental impacts.

Key words : acidification, ammonia, inhibitor, manure, zeolite

OF23006 Grassland management for sustainable livestock to respond to climate change

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Global warming occurs climate changes such as drought, heatwaves, heavy rain, and floods, leading to frequent natural disasters and environmental problems for agricultural practices worldwide. Among the environmental factors, water is one of the most important limiting crop and grassland production. The prolonged shortage of soil water causes drought. Also, periodic water shortages are becoming more frequent. A prolonged drought occurs predominantly in spring in Korea which already belongs to the group of countries with the water-scarcity. Drought causes the deterioration of the conditions for growth and development and the reduction of crop and grassland yields. Grasslands have functions to enhance biodiversity, conserve soil, contribute to ruminant production, and improve sequestering carbon. In addition, forage plants provide multiple benefits feed for livestock and wild animals, beautiful landscapes, and protection of the environment. Therefore, the study on grassland response to drought is of great significance. In response to drought, a decrease in water availability for transport-associated processes leads to changes in the concentration of many metabolites, followed by disruption to amino acid and carbohydrate metabolism. In addition, drought results in an increase in phenolic compounds including lignin, tannins, flavonoids, coumarins, and phenolic acids. Thus, a comprehensive understanding of these drought responses would provide significant information to be used in drought mitigation management.

Key words : grassland, sustainable livestock, climate change

OF23007

RCP 4.5 시나리오에 따른 기계학습모델을 이용한 IRG의 피해량 산정

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연구목적 본 연구팀은 World Meteorological Organization (WMO)와 Representative Concentration Pathways (RCP) 시나리오로 이상기상에 따른 IRG(Italian Ryegrass)의 피해량 산출연구를 하고 있다. 본 실험은 RCP 4.5 기후변화 시나리오를 이용하여 이상기상에 따른 IRG의 피해량을 산정할 목적으로 수행하였으며 기계학습모델을 이용하였다. 재료 및 방법 기계학습모델 구축에 사용된 IRG의 데이터수는 1,384개이다. 기상데이터는 기상청의 기상자료개방포털에서 수집하였다. 기계학습모델 기법은 xDeepFM 기법을 이용하였다. RCP 4.5 시나리오 데이터는 농촌진흥청의 국립원예특작과학원에서 발행한 시군별 농업용 미래상세 기후정보를 이용하였다. 정상기상은 종관기상대가 있는 지역의 평년 기온과 강수량을 기준으로 계산하였으며 이상기상은 각 지역 정상기상에서 2050년과 2100년 기상요인 값의 변동을 주어 설정하였다. 이상기상에 따른 피해량은 정상기상의 건물수량(Dry matter yield; DMY) 예측값과 이상기상의 DMY 예측값 간 차이로 산정하였으며 산술적으로 평가하였다. 결과 및 고찰 월평균 기온에 따른 피해량은 2050년 및 2100년 모두 발생하지 않았다. 이는 이상기상에 따른 겨울철 기온 상승이 IRG의 월동에 긍정적인 영향을 미친 것으로 생각된다. 강수에 따른 피해량은 2050년 및 2100년 모두 전라북도에서만 발생하였다. 이를 통해 국내에서 IRG 재배 시 온도에 의한 이상기상보다 강수에 의한 이상기상에 대비하는 것이 중요할 것으로 보인다.

Key words : Italian ryegrass, RCP 4.5 scenario, deep learning model, dry matter yield, damage

OF23008

호흡챔버를 이용한 돼지의 장내발효 메탄배출계수 개발

김대훈, 이승훈, 신진호, 이양준, 안희권
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국내 온실가스 배출량은 2019년 기준 연간 약 7억 1,400만톤으로 그중 돼지의 장내발효 메탄배출량은 7.2%를 차지한다. 국내 돼지의 메탄 배출계수는 자체적으로 개발된 바가 없어 IPCC Refinement(2019) Tier 1 default 값인 1.5kg(두/년)을 사용하고 있다. 따라서 본 연구에서는 성장단계별로 72두의 돼지를 대상으로 3기의 메탄호흡챔버를 제작하여 장내발효 메탄배출계수 및 메탄전환계수를 개발하였다. 환기시스템은 각 챔버별로 Ring blower를 이용하여 평균 301L/min으로 환기하였고, Mass flow meter를 이용하여 실시간 유량을 측정하였다. 메탄농도는 메탄모니터링시스템을 사용하여 측정하였다. 본 실험이 진행되기 전 챔버의 가스 회수율을 확인하기 위해 각 챔버별로 3회의 회수율 실험을 진행하여 회수율은 평균 99.7±2.62%로 측정되었다. 사료는 각 사육단계별 사료를 무제한 급이 하였고, 음수는 자동급수장치를 통해 자율적으로 음수가 가능하게 하였다. 연구결과 각 사육단계별 장내발효 메탄배출량은 2개월 미만 자돈 0.15±0.04kg/head/year, 2~4개월 육성돈 0.31±0.05kg/head/year, 4~6개월 비육돈 1.45±0.60kg/head/year, 6~8개월 모돈, 웅돈 2.99±1.25kg/head/year, 8개월 이상 모돈, 웅돈 4.25±1.05kg/head/year을 배출하였다. 메탄전환율은 2개월 미만 자돈 0.16%, 2~4개월 육성돈 0.15%, 4~6개월 비육돈 0.33%, 6~8개월 모돈, 웅돈 0.75%, 8개월 이상 모돈, 웅돈 0.97%로 산정되었다. 국내 돼지 사육두수를 반영한 장내발효 메탄 배출계수는 0.98kg/head/year, 메탄전환계수는 0.58%로 산정되었다. 본 연구결과는 국가 고유의 배출계수로써 향후 가축동향 자료를 바탕으로 배출계수 산정 시 국가 지표로 활용이 가능 할 것으로 판단된다.

Key words : 돼지, 장내발효, 호흡챔버, 메탄배출계수, 메탄전환계수

OF23009 Characterization of immune genes-mediated Ca^{2+} signaling in disease resistance in *Xanthomonas-Brassica* napus pathosystem

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Ca^{2+} signaling in plants' innate immune signaling is crucially involved. In contrast, immune-related genes-mediated Ca^{2+} signaling in plant resistance is not well characterized. To characterize the several immune-related genes, cellular Ca^{2+} level, and signaling for resistance mechanism in *Xanthomonas campestris* pv. *campestris* (*Xcc*)-*Brassica napus* pathosystem, *Xcc* was inoculated in a resistant cultivar of *Brassica napus* (cv. Capitol). The tiniest yellowish was visible after the *Xcc*-inoculation at the early phase (3 days post inoculation; 3 DPI) but did not progress to necrosis at a later 9-15 DPI. In addition, a pattern-triggered immunity-related gene, *botrytis-induced kinase1* (*BIK1*) was significantly induced at early 3 DPI. Whereas effector-triggered immunity (ETI)-related resistance gene (R-gene), hop (Hrp-dependent outer protein) Z-activated resistance 1 (*ZAR1*) was expressed significantly at 9-15 DPI. This indicates that *BIK1* and *ZAR1* were involved in plant resistance in the early and later phases separately. Additionally, cellular Ca^{2+} was increased gradually at the early and later phases of *Xcc*-infection where there is no symptom progression. Ca^{2+} signaling gene, Ca^{2+} *ATPase* expressed a similar pattern of Ca^{2+} level. In contrast, the calcium-dependent kinase 5 (*CDPK5*) was induced significantly at 3 DPI and gradually decreased at 9-15 DPI. *CDPK5* was negatively regulated by the immune-related genes indicating that Ca^{2+} signaling might involve in susceptibility by different Ca2+ independent pathways. And Ca^{2+} *ATPase* was dependent on cellular calcium which involves plant resistance in both the early and later phases of *Xcc*-infection. Taken together, *BIK1* and *ZAR1* might regulate the accumulation of cellular Ca^{2+} and signaling gene Ca^{2+} *ATPase* as a response to pattern-triggered immunity and effector-triggered immunity in cv. Capitol.

Key words : calcium signaling, plant resistance, *Brassica napus*, *Xanthomonas campestris* pv. *campestris*

OF23010 Salicylic acid priming-induced sugar accumulation by activating of sucrose synthesis pathway is important for drought stress tolerance in *Brassica napus* L.

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Sugars play important roles in plant growth and development, as well as responses to abiotic stress. Salicylic acid (SA) is a multifunction hormone, which involved in the regulation of plant stress responses. However, the extract mechanism by which SA regulates sugars accumulation is largely unknown in plants. Here, we characterize the hormonal regulation of drought-responsive sugar metabolism, focusing on SA-mediated sucrose modulation with regard to the drought resistance mechanism. Under drought stress, the accumulation of soluble sugar, especially sucrose, would be derived at least partly from the enhanced hexose level with the depressed expression of hexokinase gene *HXK1* and, starch degradation under the highest expression of ABA-dependent sucrose signaling gene *SnRK2.2*. In the presence of SA, an additional sucrose accumulation occurred with further enhancement of sucrose phosphate synthase (SPS) activity and starch degradation-related genes *AMY3* expression, according to the depression of *SnRK2.2*. These results indicate that antagonistic shifting from ABA- to SA-mediated sucrose accumulation is an important process in regulating osmotic potential.

Key words : *Brassica napus*, drought stress, invertase, salicylic acid, sucrose

축산물이용 및 가공

OG23001 Predictive modeling of chicken spoilage using chemometric analysis

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This study confirmed the possibility of predicting the spoilage point through the metabolites of chicken breast meat. The chicken breast meat was vaccum packaged and stored for 13 days at 4℃ and meat quality (pH, drip loss, color and VBN), microbial characteristics (total aerobic couts [TAB], 16S rRNA sequencing), and metabolites (2D ^{1}H-^{13}C Hetero-nuclear Single Quantum Coherence [HSQC], ^{1}H zg30 NMR) were examined. Chemometric analysis (univariate, multivariate, pathway analysis) was performed using the metabolites and quality attributes observed in chicken breast meat during storage. The spoilage point of chicken was determined at day 7 (VBN > 20 mg/100 g or TAB > 7 log CFU/g). Based on the chemometric analysis, nine metabolites (proline, methionine, glutamate, threonine, acetate, uridine 5'-monophosphate, hypoxanthine, glycine, and glutamine) were strongly contributed to the spoilage point and establishment of binary logistic regression model with a high area under the receiver operating characteristic curve value (0.992). These metabolites were related to the number of energy metabolism, amino acid metabolism, and nucleotide metabolisms by pathway analysis. Thus, these nine metabolites could be used to predict spoilage points in chicken breast meat.

Key words : chicken meat, meat quality, spoilage point, metabolomics, prediction model, pathway analysis

OG23002 Quality measurement of stored chicken meat treated with plasma-activated gallic-lactic acid using hyperspectral imaging

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The aim of this study was to evaluate the potential of hyperspectral imaging (HSI) in measuring the quality of stored chicken meat (breasts and drumsticks) treated with plasma-activated gallic-lactic acid (PLGA). Samples were randomly assigned to four treatment groups (n = 216); meat treated with deionized water (DDW), a mixture of 0.3% lactic and 0.3% gallic acids (LGA), plasma-treated deionized water (PAW), and plasma-treated LGA (PLGA). The samples were stored separately under aerobic conditions at 4 ± 0.5°C and analyzed at 0, 4, and 8 days of storage. The PLGA reduced total bacterial count (TBC) and thiobarbituric acid reactive substance (TBARS) values as antimicrobial and antioxidant properties during storage ($p < 0.05$). HSI was utilized at 930 nm image to extract the regions of interest. Partial least squares regression was used to model chicken meats, and then the leave-one-out cross-validation method was applied to predict meat quality. The TBC exhibited the highest prediction values (R^2) for chicken breasts and drumsticks, with values of 0.933 and 0.751, respectively. In contrast, the R^2 values for pH, TBARS, water holding capacity, and moisture were lower than 0.5 in both chicken breasts and drumsticks. In conclusion, the PLGA holds great potential in preserving the quality and safety of chicken meat, while the HSI has demonstrated reliable results in measuring the TBC of chicken meat throughout the storage period.

Key words : plasma-treated water, lactic acid, gallic acid, prediction model, spectroscopy

OG23003 Edible insects as future protein sources: investigating their application in pork patties

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In this study, the quality characteristics and storage stability of pork patties added with edible insect powder (EIP) of four species (*Tenenbrio molitor*, *Protaetia brevitarsis*, *Gryllus bimaculatus*, *Allomyrin dichotoma*) as meat substitute proteins were evaluated. EIP (20 g each, T1-T4) in the same ratio was added to pork patties and compared to a positive control (ascorbic acid 0.1 g, PC) and negative control (no EIP, NC). Chemical composition, water holding capacity, cooking loss, pH, meat color, texture properties, and sensory properties of the products were compared on 0 days. As a storage stability experiment, 2-thiobarbituric acid reactive substances (TBARS), total microbial count (TMC), and DPPH radical scavenging activity (DPPH) were compared (0, 3, and 7 days). The addition of EIP decreased water content and increased protein, fat, carbohydrate, and ash content. In addition, water holding capacity and cooking loss improved ($p < 0.05$) but sensory evaluation and storage stability were negatively affected. Texture properties were improved in all treatments added with EIP, and T3 with the addition of two-spotted cricket (*Gryllus bimaculatus*) powder was significantly the highest ($p < 0.05$). Even in the case of antioxidant activity (DPPH), T3 was higher or similar to PC with ascorbic acid added ($p < 0.05$). These results indicate that EIP has great potential as a quality improvement, antioxidant, and substitute protein for pork patties. However, when adding EIP to meat products, the addition amount and the addition of other sub-materials must be considered.

Key words : edible insects, entomophagy, substitute protein, quality characteristics, storage stability

OG23004 Effects of Ecklonia cava crude polysaccharides on Hanwoo primary muscle satellite cells for development of cultured meat

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Ecklonia cava is a brown algae that grows in the warm Pacific Ocean and is rich in vitamins, minerals, protein, and fiber. In this study, the crude polysaccharides of *Ecklonia cava* were applied to Hanwoo primary muscle satellite cells (HMSCs) for development of cell-cultured meat and its value as a growth promoter was evaluated. The cells were isolated from Hanwoo muscle tissues. The HMSCs were sorted by positive antibodies (CD31-, CD45-, CD56+, CD29+). *Ecklonia cava* was homogenized with water mixed cellulase and freeze-dried. The dried *ecklonia cava* was suspended in ethanol and centrifuged to obtain supernatant (crude polysaccharide 1, CPS1) and precipitate. The precipitate was homogenized in water and ethanol, and centrifuged to obtain supernatant (CPS2) and precipitate. This process is repeated to obtain supernatant (CPS3) and precipitate (CPS4). HMSCs were cultured in basal medium (control) or with CPS1, 2, 3, 4 at 10, 50 and 100 μg/mL. Proliferation, migration, and differentiation of HMSCs were high in CPS3 and CPS4.

Key words : Ecklonia cava, Hanwoo primary muscel cell, proliferation, differentiation

OG23005 High-pressure processing on beef: A study focusing on protein digestibility in an infant *in vitro* digestion model

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The effect of high-pressure processing (HPP) on the physicochemical properties and the protein digestibility of beef in an infant *in vitro* digestion model was monitored. Beef (*semitendinosus*) at 48 h postmortem was vacuum-packed and treated with HPP at 100, 200, and 300 MPa for 3 min at 21°C, and the untreated beef was regarded as 0.1 MPa. HPP at 200 and 300 MPa significantly reduced intrinsic tryptophan fluorescence intensity ($p < 0.05$) of myosin and actin fractions and actomyosin content ($p < 0.05$) compared to 0.1 MPa. In the secondary structure of myosin and actin fractions, only 300 MPa showed a lower α-helix ($p < 0.05$) and a higher β-sheet ($p < 0.05$) contents than 0.1 MPa. Also, HPP at 200 and 300 MPa decreased calpain activity ($p < 0.05$) while cathepsin B activity increased ($p < 0.05$). The 10% trichloroacetic acid-soluble α-amino group content increased in 200 and 300 MPa ($p < 0.05$). The beef was subjected to *in vitro* digestion in an infant digestion model. In the digesta, 200 and 300 MPa had the highest α-amino group content and the content of proteins in the fraction with molecular weight lower than 3 kDa among treatments ($p < 0.05$). However, HPP at 300 MPa significantly increased thiobarbituric acid reactive substance value compared to 0.1 MPa ($p < 0.05$) while 200 MPa had no change ($p > 0.05$). Therefore, HPP at 200 MPa can be an appropriate condition to improve beef protein digestibility for complementary foods.

Key words : high-pressure processing, beef, protein digestibility, infant digestion model

OG23006 The influence of gamma ray and electron beam irradiation on structural and functional properties of myofibrillar protein

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Irradiation is effective technology to eliminate microorganisms in foods without thermal processing, and that effect can correlated with irradiation dose. meanwhile, irradiation can cause fragmentation or aggregation of myofibrillar protein (MP) in meat, and these modifications are influenced by the radiation type and dose. The objective of this study is to investigate the effects of irradiation on conformational modification and proteion functionality of MP. The extracted MP from pork ham was irradiated by gamma ray and electron beam at 2.5, 5, and 10 kGy. The intermolecular bonds, protein solubility, particle size, zeta potential, surface hydrophobicity, secondary and tertiary structure, foaming and emulsifying properties were characterized. The intermolecular bonds in MP was affected by irradiation, resulting in an increase in viscoelasticity and a decrease in protein solubility. Protein solubility was the highest in 2.5 kGy gamma ray irradiated MP among treatments. The secondary and tertiary structure of soluble MP after irradiation were altered, resulting in an decrease of mean particle size and an increase in zeta potential. The foaming and emulsifying properties were enhanced by irradiation, however the 10 kGy irradiation resulted in a decrease of protein solubility and emulsion capacity. Taken together, the gamma ray irradiation at 2.5 kGy on MP can positively affect its functionality by structural modification.

Key words : irradiation, gamma ray, electron beam, myofibrillar protein, protein denaturation, protein functionality

OG23007 Effects of temperature and oxygen conditions on cell culture for cultured meat production

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Culture temperature and oxygen concentration are important physical factors that affect cells during cell culture conditions. Therefore, in this experiment, the effect of temperature and oxygen conditions on cell culture was studied using C2C12 cells. The experimental design was different in culture temperature and oxygen concentration, and consisted of CON (37℃, O_2 20%), T1 (37℃, O_2 2%), T2 (39℃, O_2 20%) and T3 (39℃, O_2 2%). After 5 days of growth culture, cell counting, immunofluorescence, and MTS assay were performed to measure proliferation capacity. After 4 days of differentiation culture, differentiation capacity was measured by performing immunofluorescence staining, RT-qPCR, and western blotting. During growth, both MTS and cell number showed low values when the culture temperature was 39℃. As for differentiation, the fusion index of myotubes was significantly higher at T3 than at T1, and in western blotting, Myosin, MyoD, Myogenin, and Myoglobin, which are related to myotube formation, were significantly higher at T2 and T3. In addition, in RT-qPCR, the above 4 genes were significantly higher in T3. As a result of this study, it is considered that increasing the culture temperature and lowering the oxygen concentration can improve myotube formation in differentiation during cell culture meat production.

Key words : cell culture, C2C12, differentiation, culture temperature, oxygen concentration

OG23008 Bovine colostrum-derived extracellular vesicles ameliorates non-alcoholic steatohepatitis by modulating hepatic lipid metabolism

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Non-alcoholic steatohepatitis (NASH), characterized by severe fatty liver-induced liver inflammation and liver cells damage, is a significant precursor to cirrhosis and hepatocellular carcinoma. The pathogenesis of NASH remains still unclear, but the leading theory suggests excessive hepatic fat accumulation causing lipid peroxidation and mitochondrial dysfunction. Bovine colostrum-originated extracellular vesicles (BCEVs) contain bioactive substances that regulate cellular processes and have been reported to possess anti-inflammatory properties. However, there is limited research on the role of BCEVs in the pathology and involved pathways of NASH. To investigate the potential protective effect of BCEVs against NASH, 8-week-old mice were fed a NASH-inducing diet for 3 weeks while simultaneously receiving oral administration of BCEVs. The BCEVs group exhibited a significant decrease in liver weight relative to body weight and a notable reduction in total hepatic lipid. The analysis of liver lipid metabolism revealed significant reductions in both liver triglycerides and total cholesterol levels within the BCEVs group. No significant difference was found in HDL levels, but treatment with BCEVs notably decreased LDL levels. In conclusion, BCEVs show potential as a functional dietary substance for managing NASH by improving hepatic lipid metabolism.

Key words : non-alcoholic steatohepatitis, bovine-colostrum derived extracellular vesicles, lipid metabolism

OG23009 Genome-based molecular characterization of newly isolated *Salmonella* phage SLAM_phiST1N3 in *Cornellvirus* genus from fecal sample of weaning pig

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Salmonella is a common foodborne pathogen frequently detected in pork products, causing diarrhea, fever and stomach cramps in humans. Bacteriophages, viruses that infect specific bacterial strains, have been proposed as a potential alternative to antibiotics in controlling pathogenic bacteria in food products. In this study, we isolated SLAM_phiST1N3, a bacteriophage infecting *Salmonella* Typhimurium isolated from fecal sample of weaning pig. We analyzed characteristic analysis including classification using various bioinformatics and conducted *in vitro* experiments of SLAM_phiST1N3. Comparative genomics and phylogenetic analysis revealed that SLAM_phiST1N3 belonged to the *Cornellvirus* genus. The genome of SLAM_phiST1N3 was 41,191 bp in length, consisting of 69 open reading frames and no tRNA. Host range tests revealed that SLAM_phiST1N3 did not infect other pathogenic bacteria or probiotics. The results of the liquid inhibition test and the C. elegance killing assay showed the ability of SLAM_phiST1N3 to inhibit S. Typhimurium. pH and temperature stability experiments showed whether SLAM_phiST1N3 can withstand pig industrial processes and digestion. Importantly the addition of SLAM_phiST1N3 influence on the microbial diversity in Fermentation of the Intestinal Microbiota Model (FIMM) system as artificial intestinal environments of pigs as well as specific inhibition of S. Typhimurium. Furthermore, in our animal food applications, exposure to SLAM_phiST1N3 significantly reduced the survival rate of S. Typhimurium at lower concentrations in pork meat. Therefore, SLAM_phiST1N3 could serve as a new anti-microbial agent in the swine industry.

Key words : *Salmonella* Typhimurium, Bacteriophage, *Cornellvirus* genus, FIMM, Antibiotic substitute

포 스 터 발 표

제1발표분야 : 단위동물 영양 · 사양

PA23011 Effects of polyphosphate on carcass quality, anti-inflammation, and cecum microbiota in broiler chickens

Yi Qiang-Chang, Yan Qing-Wang, Seung-Gyu-Moon, Soo-Hyun Kim and Soo-Ki Kim

PA23012 Effects of different chain lengths of polyphosphate on anti-microbial and anti-biofilm activities in animal pathogenic bacteria

Yan-Qing Wang, Min-Gyung Choi, Seung-Gyu Moon, Sang-Min Park, Yi-Qiang Chang and Soo-Ki Kim

PA23013 Environmental enrichment materials in different types of floor: their effects on exploratory behaviors in growing pigs

Hyerin Sin, Huimang Song, Geonil Lee, Kyoungwon Kang and Jinhyeon Yun

PA23014 사료 내 조단백질 및 phytase 첨가 수준이 육계 후기 소화율에 미치는 영향

홍의철, 김현수, 손지선, 채한화, 김희진, 이우도, 윤연서, 신혜경, 강환구

PA23015 Comparison of the performance, egg quality and hatchability of woorimatdag breeder hens fed the dietary levels of metabolic energy in late laying period

Chun Ik Lim, Yong Sung Kim, Hyeon Kwon Kim, Are Sun You, Kang Nyeong Heo and Hyo Jun Choo

PA23016 Effects of dietary carvacrol-thymol blend and stocking density on growth performance, jejunum morphology, and blood parameters in growing pigs

Yoo-Bhin Kim, Min ji Kim, Jin Young Jeong and Nam Geon Park

PA23017 한국가축사양표준 4차 개정판_양돈

김유용, 김홍준, 장민혁, 오희경

PA23018 Nutritional evaluation of animal protein sources in pet foods

Ju Lan Chun, Kangmin Seo, Ki Hyun Kim, Min Young Lee and Hyun-Woo Cho

PA23019 Effect of dietary mangosteen peel extract and stocking density on growth performance, jejunum morphology, biochemical parameter, and cytokine profiles in growing pigs

Minji Kim, Yoo-Bhin Kim, Jin Young Jeong and Nam Geon Park

PA23020 Microbial of the ceca from layer pullets affected by feeding *Bacillus subtilis* and oregano oil

Hee-Jin Kim, Hyun-soo Kim, Jiseon Son, Woo-Do Lee, Yeon Seo Yun, Hyekyoung Shin, Eui-Chul Hong, Ik Soo Jeon and Hwan-Ku Kang

PA23021 이유자돈 사료 내 혈장단백질 대체원료로써 동애등에의 수준별 첨가가 성장성적, 혈액성상 및 설사 빈도에 미치는 영향

김홍준, 노수덕, 신혜원, 김유용

PA23022 Effects of environment temperature on blood characteristics and volatile fatty acid from feces in growing pigs

Jo Eun Kim, Ye Jin Min, Yong Dae Jeong, Hyun Ju Park, Yong Min Kim and Yo Han Choi

PA23023 Change of boar taint in fat tissues of entire and castrated male pigs fed with or without inulin

Yong Dae Jeong, Hyun Ju Park, Jo Eun Kim, Ye Jin Min, Yo Han Choi, Eun Seok Cho, Doo Wan Kim and Hyunju Jin

PA23024 Effect of air velocity on performance and physiological responses in heat-stressed broilers

Hyeran Kim, Jungeun Kim, Jisoo Wi, Pilnam Seong and Sungdae Lee

PA23025 Effect of individual or combination of dietary glycine and betaine on immune response and intestinal barrier function in aged laying hens raised under heat stress conditions

Deok Yun Kim, Hyun Woo Kim, Ji Hye Lee, Kang Hyun Kim and Dong Yong Kil

PA23026 Effects of different temperature and humidity conditions based on THI on growth performance, rectal temperature, respiratory rate, blood profiles, and immune responses of growing pigs

J. Lee, H. Kyoung, K. I. Park, Y. Kim, J. Ahn, S. Ha, J. Nam, K. Kim, Y. Kang, Y. Park, I. Shin and M. Song

PA23027 이유자돈 사료 내 생균제 프로비온 포르테와 스포아자임 포르테의 첨가가 이유자돈의 성장능력에 미치는 효과

박민수, 페니여, 김성호, 김유용

PA23028 육성비육돈 사료 내 베타글루칸과 비타민 E 첨가가 육성비육돈의 성장성적, 혈액성상, 면역성상, 돈육품질, 돈육풍미 및 경제성 분석에 미치는 영향

장민혁, 고태욱, 김홍준, 김유용

PA23029 Impact of bump feeding in sows during the late gestation period on milk yield and piglet growth performance

Keiven Mark B. Ampode, Hong-Seok Mun, Veasna Chem, Eddiemar Lagua, Hae-rang Park, Young-Hwa Kim and Chul-Ju Yang

PA23030 Backfat thickness before farrowing: a predictor of milk production and piglet growth in lactating sows

Eddiemar Lagua, Hong-Seok Mun, Hae-rang Park, Keiven Mark B. Ampode, Veasna Chem, Young-Hwa Kim and Chul-Ju Yang

PA23031 Effects of protocatechuic acid feeding on pig productivity and economics in piglets

Hae-rang Park, Hong-Seok Mun, Keiven Mark B. Ampode, Shad Mahfuz, Veasna Chem, Eddiemar Lagua, Young-Hwa Kim, Jin-Gu Kang and Chul-Ju Yang

PA23032 Effects of drying methods on nutrient utilization in black soldier fly larvae based on *in vitro* assays for pigs

Junghyun Oh, Kwanho Park, Hansol Kim and Beob Gyun Kim

PA23034 섬유소 급여가 삵의 영양소 소화율 및 장내미생물 균총에 미치는 영향

정지연, 송태욱, 김성우, 최용준

PA23035 Growth performance of growing pigs fed low protein diet

In Ho Cho, Su Hyun An, June Hyeok Yoon, Chae Won Lee, Yun Ji Jeon and Changsu Kong

PA23036 Effects of dietary supplementation of *Bacillus subtilis* and oregano essential oil on production performance, egg quality, and intestinal morphology in late-phase laying hens

Hyunsoo Kim, Hee-Jin Kim, Yeon Seo Yun, Woo-Do Lee, Hyekyoung Shin, Jiseon Son, Eui-Chul Hong, Ik Soo Jeon and Hwan-Ku Kang

PA23037 A study on canine hematological characteristics by dietary various protein sources and age of dogs

Ki Hyun Kim, Hyun-Woo Cho, Min Young Lee, Ju Lan Chun and Kangmin Seo

PA23038 Effects of dietary hydrolyzed porcine intestinal mucosa on growth performance and fecal score in nursery pigs

Hansol Kim and Beob Gyun Kim

PA23039 The impact of environmental enrichment materials on the growth performance and occurrence of body wounds in fattening pigs housed on slatted and solid floors

Huimang Song, Hyelim Jeon, Hyeonwook Shin, Juho Lee, Junsik Kim, Kyoungwon Kang, Geonil Lee and Jinhyeon Yun

PA23040 Development of image-based algorithm for body weight prediction of Ross 308 broiler chickens

Woo-Do Lee, Hyunsoo Kim, Eui-Chul Hong, Jiseon Son, Hee-Jin Kim, Dohyeon Yoon, Hyungmin Jun and Hwan-Ku Kang

PA23041 Evaluation of nutrient digestibility on various ingredient as a protein source in pet food by dogs age

Kangmin Seo, Hyun-Woo Cho, Min Young Lee, Ju Lan Chun and Kihyun Kim

PA23042 2022년도 국내 제조 유통 · 수입 · 사료 중 유해물질 잔류/오염 실태조사

장은희, 김대중, 김효영, 나태웅, 박자영, 이승화, 한국탁

PA23043 Effect of dietary concentrations of metabolic energy and crude protein on the performance and behavior of ducks

Hyeonkwon Kim, Hyojun Choo, Chunik Lim, Yongseong Kim, Aresun You and Kangnyeong Heo

PA23044 Decreasing in dietary protein concentration reduced fecal odor compounds in 15- and 30-kg pigs, but reductions of slurry odor compounds were observed only in the 15-kg pigs

Jeonghyeon Son, Siyoung Seo and Beob Gyun Kim

PA23045 Fatty acid composition in animal protein sources of pet foods

Ju Lan Chun, Kangmin Seo, Ki Hyun Kim, Min Young Lee and Hyun-Woo Cho

PA23046 A technology to improve marketted-pigs from high-yielding sows

Young-Hwa Kim, Hong-Seok Mun, Hae-rang Park, Keiven Mark B. Ampode, Veasna Chem, Eddiemar Lagua and Chul-Ju Yang

PA23047 The effect of Soregen Technology® Feed on blood biochemistry profile and excreta noxious gasses of broiler chickens and laying hens

Song Hyun A, Listya Purnamasari, Joseph F. Dela Cruz, Lee Dong Bin, Kim Jun Seong and Hwang Seong Gu

PA23048 The sustainable and reliable artificial-GIT model mimicking the digestive conditions of domestic animals

Seungeun Lee, Damee Park, Min Ah Park and Jun-ok Moon

제2발표분야 : 동물생명공학

PB23011 Effects of *Lactiplantibacillus pentosus* on gut microbiota composition in weaning pigs

Hyeun Bum Kim, Eun Sol Kim, Gi Beom Keum, Hyunok Doo, Jinok Kwak, Sriniwas Pandey, Sumin Ryu, Yejin Choi, Juyoun Kang, Seungjin Yun, Haram Kim, Yeongjae Chae and Sheena Kim

PB23012 Development of a rapid and sensitive method for the detection of African swine fever virus (ASFV) by combining recombinase polymerase amplification (RPA) with a lateral flow strip assay

Ki-Duk Song, Truong Anh Duc, Sujung Kim, Tran Thanh Ha, Dang Vu Hoang, Jae-Young Heo and Hay-Kyo Lee

PB23013 Dietary synbiotics are associated with shifts in oropharyngeal, proximal colonic, and vaginal microbiomes of Korean native pigs

Jaeyoung Heo, Andrew Wange Bugenyi, Ma-Ro Lee, Ki-Duk Song and Hak-Kyo Lee

PB23014 배아줄기세포 배양액이 소 체외수정란 생산에 미치는 영향

권대진, 최세령, 김승하, 박경도, 이학교

PB23015 성견과 노견의 장내미생물 군집 비교 분석

조현우, 서강민, 이민영, 김기현, 천주란

PB23016 The difference of gut microbiome composition in Crested gecko lizard (*Correlophus ciliatus*) according to the growth stage

Dong Uk Ha, Hyunhee Seo and San Kim

PB23017 High throughput screening for mitigating deoxynivalenol-induced apoptosis by FOXO3a signaling pathway in porcine intestinal epithelial cells

Tae Hong Kang and Sang In Lee

PB23018 Multiomic-based evaluation of probiotics properties of spore-forming *Clostridium* ssp. isolated from weaned piglets

Seon-hui Son, Woongji Lee, Hyejin Choi, Daye Mun, An Na Kang, Mingeun Kang, Jeongkuk Park, You-Bin Choi, Daniel Junpyo Lee, Junbeom Lee, Sei-hyun Lim, Ju Young Eor, Min jin Kwak and Younghoon Kim

PB23019 The antioxidant activity and cell surface hydrophobicity of Kimchi-derived *Limosilactobacillus fermentum* JNU532

Ziyao Meng and Sejong Oh

PB23020 Establishment of canine mammary gland tumor cell lines harboring PI3K/Akt activation as a therapeutic target

이찬호, 박서영, 이창민, 박상익, 김성학

PB23021 Isolation and identification of *Ligilactobacillus salivarius* strain with soy protein-degrading capability

Jae Seung Lee, Ji Hoon Song, Yong Hee Lee and Dae-Kyung Kang

PB23022 *Latilactobacillus curvatus* BYB3 isolated from *Latilactobacillus curvatus* BYB3 extract inhibited the activity of B16F10 and alleviated the immune organ damage caused by B16F10

Dingyun Li ,Xing Wang, Ziyao Meng, Kiyeop Kim and Sejong Oh

PB23023 Pig house management 2nd generation decision-making support model using the breeding and environmental information of the finishing pigs

Hong-Seok Mun, Hae-rang Park, Keiven Mark B. Ampode, Veasna Chem, Eddiemar Lagua, Young-Hwa Kim and Chul-Ju Yang

PB23024 Gut microbiota of rats as affected by deoxynivalenol

Jin Young Jeong, Minji Kim, Hye Ran Kim, Yoo-Bhin Kim and Nam-Geon Park

PB23025 Gene expression profile of innate immune responses through pattern recognition receptor in gene-edited cells

Hyoung Ju Ryu, Ki Hyeon Kim, Seung Pyo Shin, Si Eun Kim, In Su Ha, Ji Hun Park and Tae Sub Park

PB23026 Complete genome sequence of *Limosilactobacillus fermentum* JNU 532 as a chorismate synthase (aroC) mutant

Ziyao Meng and Sejong Oh

PB23027 A comparative study of extracellular vesicles isolation methods using bovine serum

Eun-Yeong Bok, Sudu Hakuruge Madusha Pramud Wimalasena, Han Gyu Lee, Eun ju Kim, Yoon Jung Do, Tai-Young Hur and Young-Hun Jung

PB23028 Evaluation of mucin-binding activity and HT-29 cell attachment in 11 strains of lactic acid bacteria

Jihyun Kim and Sejong Oh

PB23029 Effects of ribonucleic acids in yeast extract on the viability of probiotic candidates

Hyoju Park and Sejong Oh

PB23030 스마트 축산 모델 구축을 위한 돼지 생체와 환경 상호관계 조사

김훈섭, 노유진, 남철환, 구민정, 최영선

PB23031 Mitigating heat stress in chicken cells: the protective effects of the amino acid blend on protein denaturation and oxidative

Han Wool Kim, Yuji Shin, Eunseon Oh, Min Ah Park, Jieun Kim, Min Jeong Gu and Jun-ok Moon

PB23032 Exploring the distinctive functionalities of CJ amino acids assessed via the CJ 29+ ANH application platform

Jieun Kim, Min Jeong Gu, Han Wool Kim, Eunseon Oh, Min Ah Park and Jun-ok Moon

제3발표분야 : 반추동물 영양 · 사양

PC23011 Effects of chemical compounds on *in vitro* rumen fermentation characteristics and methane production

Byul Kim, Pilnam Seong, Yookyung Lee, Jisoo Wi, Jungeun Kim and Seongshin Lee

PC23012 단백질 사료 원료의 일반성분 및 반추위 *in situ* 분해율과 이를 통한 반추위미분해단백질 평가

이나균, 우준식, 백열창, 이종화, 김정훈, 이홍구, 박근규

PC23013 코발트(Co-glucoheptonate) 첨가 급여가 홀스타인종 젖소 생리 특성에 미치는 영향

박지후, 김동현, 이지환, 임동현

PC23014 Supplemental effects of bypass fat, soybean meal, and heat-treated soybean meal on performance of Hanwoo steers in early-fattening period under heat stress

Jun Sik Woo, Na Kyun Lee, Youl Chang Baek, Jong Hwa Lee, Jeong Hoon Kim, Hong Gu Lee and Keun Kyu Park

PC23015 Estimation of greenhouse gas emissions from the livestock sector in Korea

YK Lee, PN Seong, JS Wi, SS Lee, B Kim and JY Song

PC23016 Multi-omics studies on changes in rumen metabolic and microbial population in Korean native goats under heat stress

Jun Sik Eom, Youyoung Choi, Shin Ja Lee, Hyun Sang Kim, Seong Uk Jo, Dongryeoul Bae and Sung Sill Lee

PC23017 하계조사료 종류별 한우 반추위 *in vitro* 메탄발생량 평가

위지수, 성필남, 이유경, 이성신, 김정은

PC23018 AI 행동 인지 센서를 통한 포유기 송아지의 이유(weaning) 수준 측정 기술 개발

김나연, 최윤철, 허태준, 신민용, 김성진

PC23019 Dose-response effects of natural nonionic surfactant (sucrose cocoate) on ruminal methane production, fermentation, and microbial abundance on *in vitro*

Seong Uk Jo, Shin Ja Lee, Hyun Sang Kim, Jun Sik Eom, Youyoung Choi, Gyo Moon Chu and Sung Sill Lee

PC23020 NMR-based metabolite profiling of rumen fluid during *in vivo* fermentation time

Hyun Sang Kim, Shin Ja Lee, Jun Sik Eom, Youyoung Choi, Seong Uk Jo, Sang Suk Lee, Sam Churl Kim and Sung Sill Lee

PC23021 The effects of feeding levels at different stages of gestation on body weight, body condition score, and postpartum calf condition of Hanwoo heifers in Korea

Myungsun Park, Sunsik Jang, Gisuk Jang, Sung-Jin Moon, Kyung-Hwan Um and Hyun-Jeong Lee

PC23022 Mineral supplementation strategies to ameliorate the negative effects of heat stress in Holstein dairy cows

A-Rang Son, Seon-Ho Kim, Michelle A. Miguel, Ye Pyae Naing, Min-Jung Ku and Sang-Suk Lee

PC23023 **Relationship between single nucleotide polymorphisms and biological indicators in lactating Jersey and Holstein cows exposed to heat stress**

····· Dong-Hyun Lim, Kwang-Seok Ki, Dong-Hyun Kim, Ji-Hoo Park, Eon-Tae Kim, Jun-Kyu Son, Ji-Hwan Lee, Kyung-Rim Yu, Eun-Jung Jeon, Seok-Jin Kang, Seung-Min Ha and Moo-Young Jung

PC23024 **Effects of L-glutamine supplementation according to HSPB1 genotype on hepatic metabolism and gluconeogenesis in Hanwoo heifers**

····· Xue-Cheng Jin, Jin-Su Park, Tai-Zhong Liu, Dong-Qiao Peng, Jalil Ghassemi Nejad, Jae-Sung Lee and Hong-Gu Lee

PC23025 **근내지방도 육종가 및 rumen-undegradable protein 급여 수준이 한우 거세우의 반추위 발효 성상 및 혈액 지표에 미치는 영향**

····· 정진우, 김상엽, 이재성, 임세윤, 오준석, 이상현, 경준성, Kamburawala Kankanamge Tharindu Namal Ranaweera, 백명기

PC23026 **Small molecule MCR187 inhibitorreduces *in vitro* ruminal methane production**

····· Cheol-Ju Park, Hyeon-Su Seon, Seung-hyeun Sim, Min-seok Kim, Seong-ju Jeong, Seung-hyeun Moon, Minseok Kim, Young Ki Min, Miok Kim and Chang Hoon Lee

PC23027 **대용유 자동포유 시스템을 활용한 사육 방식의 차이가 한우 송아지의 성장성적에 미치는 영향**

····· 김성우, 정왕용, 나영준, 최용준

PC23028 **Effect of rumen-protected vitamin C supplementation on the productivity of Hanwoo steers classified by genomic estimated breeding value**

····· Jun Sang Ahn, Jae Yong Song, Joong Kook Park, Suk Jun Yun, Jeong Heon Lee, Gyo Moon Chu, Byung Ki Park, Gi Hwal Son and Kyung Hoon Lee

PC23029 **Effects of colostrum replacer and/or immunoglobulin Y supplementation on immunity and growth in Hanwoo calf**

····· Jun Sang Ahn, Joong Kook Park, Jae Yong Song, Suk Jun Yun, Jeong Heon Lee, Gyo Moon Chu, Byung Ki Park and Gi Hwal Son

PC23030 **Effect of nutritional metabolic imprinting on cows from late pregnancy to suckling period on growth performace and microbiome of calves in Hanwoo**

····· So Hee Lee, Gi Hwal Son, Min Ho Song, Young Lae Kim, Na Hui Kim, Hwan Hee Lee, Seung Uk Shin, Joong Kook Park, Jae Yong Song, Suk Jun Yun, Gyo Moon Chu, Jeong Heon Lee, Jun Sang Ahn, Jong Suh Shin and Byung Ki Park

PC23031 **Animal productivity monitoring of two breeds (Holstein and Jersey cow) for advancement of feeding management in Jersey lactating cow**

····· Eunjeong Jeon, Ji-Hoo Park, Dong-Hyun Lim, Eun-Tae Kim, Seungmin Ha, Gyeonglim Ryu, Kwang-Seok Ki and Dong-Hyeon Kim

PC23032 **Effect of GABA supplementation on the growth performance, blood metabolites, and carcass characteristics of Hanwoo heifers**

····· Young Lae Kim, Gi Hwal Son, So Hee Lee, Min Ho Song, Na Hui Kim, Hwan Hee Lee, Hyeon Tae Choi, Joong Kook Park, Jae Yong Song, Suk Jun Yun, Gyo Moon Chu, Jeong Heon Lee, Jun Sang Ahn, Jong Suh Shin and Byung Ki Park

PC23033 Effects of TDN and crude protein levels in formula feed on growth performance and blood metabolites of early fattening Hanwoo steers

···· Hyeon Tae Choi, Gi Hwal Son, So Hee Lee, Min Ho Song, Young Lae Kim, Do Young Hwang, Seung Uk Shin, Joong Kook Park, Jae Yong Song, Suk Jun Yun, Gyo Moon Chu, Jeong Heon Lee, Jun Sang Ahn, Jong Suh Shin and Byung Ki Park

PC23034 Effects of high energy and crude protein feeding before and after calving on the reproduction efficiency of cows and growth performance of calves in Hanwoo

····· Na Hui Kim, Gi Hwal Son, So Hee Lee, Min Ho Song, Young Lae Kim, Do Young Hwang, Seung Uk Shin, Joong Kook Park, Jae Yong Song, Suk Jun Yun, Gyo Moon Chu, Jeong Heon Lee, Jun Sang Ahn, Jong Suh Shin and Byung Ki Park

PC23035 Effect of ɣ-aminobutyric acid (GABA) on the growth performance, blood metabolites and carcass characteristics of Hanwoo steers

····· Min Ho Song, Gi Hwal Son, So Hee Lee, Young Lae Kim, Na Hui Kim, Hwan Hee Lee, Hyeon Tae Choi, Jae Yong Song, Joong Kook Park, Suk Jun Yun, Jeong Heon Lee, Gyo Moon Chu, Jun Sang Ahn, Jong Suh Shin and Byung Ki Park

PC23036 Effects of types and levels of protein materials on productivity of late fattening Hanwoo steers

····· Seung Uk Shin, Gi Hwal Son, So Hee Lee, Min Ho Song, Young Lae Kim, Hyeon Tae Choi, Do Young Hwang, Jae Yong Song, Joong Kook Park, Suk Jun Yun, Jeong Heon Lee, Gyo Moon Chu, Jun Sang Ahn, Jong Suh Shin and Byung Ki Park

PC23037 Effect of nutritional manipulation according to genotype on productivity of Hanwoo steers

····· Gi Hwal Son, So Hee Lee, Min Ho Song, Young Lae Kim, Hyeon Tae Choi, Jae Yong Song, Joong Kook Park, Suk Jun Yun, Jeong Heon Lee, Gyo Moon Chu, Jun Sang Ahn, Jong Suh Shin and Byung Ki Park

PC23038 사료 내 조단백질 수준 및 칼슘인 비율이 거세한우의 성장성적 및 도체특성에 미치는 영향

····· 류채화, 백열창, 이성대, 이슬, 김혜란

PC23039 Characterization of heat stress based on South Korean climate conditions in mid lactating Holstein cows using blood hormone levels and gene expression in peripheral blood mononuclear cell and hair follicles

····· J. H. Jo, J. GhassemiNejad, J. S. Lee, Y. R. Kim, M. S. Ju, M. K. Choi, T. Z. Liu, H. R. Kim and H. G. Lee

PC23040 Characterization of *in vitro* goat ruminal fermentation using fermenatation strains

····· Dong-kyo Kim, Eun-Do Lee, Bong-Hwan Choi, Seal Lee, Ga-Eun Kim, Byungho Chae and Kwan-Woo Kim

PC23041 Effects of rice feeding on Hanwoo steers weaning period on intramuscular fat delicacy

····· Sunsik Jang, Hyunjeoung Lee and Gisuk Jang

PC23042 Effects of lysozyme and zeolite supplementation on rumen fermentation characteristics and methane emission in Hanwoo steers

····· Michelle Miguel, Seon-Ho Kim, A-Rang Son, Janine Berdos, Ye Pyae Naing, Kwang-Wook Park and Sang-Suk Lee

제4발표분야 : 번식 및 생리

PD23012 Effect of glycerol equilibration time on sperm characteristics after thawing frozen semen in chicken

Jae-Yeong Lee, Yeoung-Gyu Ko, Chan-Lan Kim, Seyeong Lee, Gayeong Lee and Daehyeok Jin

PD23013 Effects of music exposure on physiological characteristics in domestic riding horses

Yoonjeong Jang, Na-Young Kim, Jong-An Lee, Yong-Jun Kang, Moon-Cheol Shin, Hyeon-Ah Kim, In-Cheol Cho, Jiwoong Lee and Jae-Young Choi

PD23014 Detection of sow's gestational sac in ultrasound image using Yolov4-CSP

Y. M. Kim, Y. H. Choi, J. E. Kim, Y. J. Min, Y. D. Jeong, H. J. Park, J. S. Hong, S. J. Sa, T. K. Kim and H. C. Cho

PD23015 Effect of different sperm numbers and estrus heat detection patch on pregnancy rate in timed artificial insemination in Hanwoo cattle

Sung-Sik Kang, Ui-Hyung Kim, Myung-Suk Lee, Seok-Dong Lee, Yong-Hwan Kim, Jeong-Il Won, Shil Jin, Sun-Sik Jang, Sang-Rae Cho, Seung-Hoon Lee and Sungwoo Kim

PD23016 The effects of nitric oxide on the longevity and acrosome cap reaction of rooster semen under hypoxia condition

Ga-Yeong Lee, Sung Woo Kim, Chan-Lan Kim, Yeoung-Gyu Ko and Jae-Yeong Lee

PD23017 The effects of 2-deoxy-D-glucose on the motility of bovine spermatozoa

Yonghwn Kim, Sung-Sik Kang and Sung Woo Kim

PD23018 The growth rate affects on the testis size of Hanwoo bullocks in elite population

Sung Woo Kim, Yonghwan Kim and Sung-Sik Kang

PD23019 Reference intervals for hematology and clinical chemistry for the domesticated elk (*Cervus canadensis*) in Korea

Chan-Lan Kim, Yongjae Lee, Jaeyoung Lee and Yeoung-Gyu Ko

제5발표분야 : 유전 및 육종

PE23012 Significant association between FSVs in *MYH3* gene and muscle collagen content in the crossbred population (Landrace x Jeju native pig)

Yong-Jun Kang, Sang-Geum Kim, Su-Yeon Kim, Hyeon-Ah Kim, Jong-An Lee, Jae-Young Choi, Ji-Hyun Yoo, Jin-Hyoung Kim and In-Cheol Cho

PE23013 Estimation of genetic parameters for primal cuts weight traits of Hanwoo in Pyeongchang county

Nam Young Kim, Jeong Il Won, Shil Jin, Seok Hong Ki and Byoungho Park

PE23014 디지털 정보 기반 닭의 깃털 색 정밀 표현형 연구

허선영, 박종호, 조성현, 차지혜, 진대혁, 김영국, 고영준, 이승환, 이준헌

제6발표분야 : 초지 및 환경

PF23012 Effect of teff grass sowing time on growth characteristics and production in the central regions of Korea

Baehun Lee, Boram Choi, Mirae Oh and Hyungsoo Park

PF23013 육계 사육밀도에 따른 행동 특성 분석

김찬호, 손지선, 임세진, 전중환, 양가영, 김기현, 천주란, 이민영

PF23014 Prediction of moisture and chemical composition of Alfalfa using near-infrared spectroscopy

Mirae Oh, Hyung Soo Park, Jae Hoon Woo, Bae Hun Lee and Kyu Chea Jo

PF23015 Development of building energy simulation model to estimate cooling & heating loads of mechanically-ventilated broiler house

Byeonghyeon Kim, Kyeong-seok Kwon, Jong-bok Kim, Dong-hwa Jang and Vandet Pann

PF23016 A study on ventilation measurements in mechanically ventilated pig house

Soyean Park, Joshua nizel halder, Okhwa Hwang, Siyoung Seo and Junsu Park

PF23017 Characteristic of odor substances from hens farms

Junsu Park, Soyean Park, Minwoong Jung and Si Young Seo

PF23018 Ammonia reduction in swine slurry with PPDA

siyoung Seo, Junsu Park, Soyean Park and Gwangsoo Yoon

PF23019 Effects of *Sasa quelpaertensis* Nakai as feed additive on changing odor substance in pig slurry

Hyeon-Ah Kim, Si-Young Seo, Jong-An Lee, Jae-Young Choi, Yong-Jun Kang, Ji-Hyun Yoo, Sang-Min Shin, Mi-Young Won, Jong-Eun Park, In-Cheol Cho, Hee-Chung Ji, Jin-Hyoung Kim and Moon-Cheol Shin

PF23020 Lowering dietary protein concentration considerably reduces slurry nitrogen concentrations in growing-finishing pigs without negative effects on growth performance

Hyunseok Do, Hansol Kim and Beob Gyun Kim

PF23021 Performance evaluation of pig lying behavior detection using deep learning model

Dong-Hwa Jang, Jong-Bok Kim, Kyeong-Seok Kwon, Byeonghyeon Kim and Vandet Pann

PF23022 축사 배기구 미세먼지 및 초미세먼지 배출 저감 연구

노유진, 최영선, 구민정, 김훈섭, 정지영

PF23023 Analysis of piglet productivity and energy consumption according to the use of renewable energy heat pumps in summer

Veasna Chem, Hong-Seok Mun, Young-Hwa Kim, Eddiemar Lagua, Hae-rang Park, Keiven Mark B. Ampode, Geon Jo and Chul-Ju Yang

PF23024 The impact of age-related change on the appearance and hematological parameters of laying hens in aviary systems

Taein Eom, Hyelim Jeon, Junsik Kim, Hyeonwook Shin, Juho Lee, Geonil Lee, Jungwon Lee and Jinhyeon Yun

PF23025 생물반응조 고도제어기술의 양돈농가 환경개선 효과 실증

오현윤, 이주환, 심수민, 김승수, 곽정훈, 원승건, 나창식

PF23026 양돈분뇨 개별정화처리 시설의 양분 저감 효과

이주환, 오현윤, 심수민, 김승수, 곽정훈, 원승건, 나창식

PF23027 개의 카밍시그널에 대한 고찰

양가영, 천시내, 유금주, 정소희, 임세진, 김찬호, 전중환

PF23028 흑염소 농가 기술 지원을 위한 유튜브 채널 운영 효과분석

남철환, 정지영, 최영선, 구민정, 김훈섭, 노유진

PF23029 Changes in fermentation characteristics of whole crop rice haylage according to the storage period

Boram Choi, Mirae Oh, Jaehoon Woo and Kiwon Lee

PF23030 깔짚 사용 방법에 따른 마사 내 바닥 깔짚 탄질비 변화

유지현, 최재영, 이종안, 신상민, 김현아, 원미영, 강용준, 지희정, 조인철, 김진형

PF23031 소, 돼지, 닭 농장별 차단방역 수준 점검 및 위해요소 평가

정영훈, 김은주, 이한규

PF23032 Evaluating productivity and economic impact of single and combined heat pumps for renewable energy in pig houses

Hong-Seok Mun, Hae-rang Park, Keiven Mark B. Ampode, Veasna Chem, Eddiemar Lagua, Young-Hwa Kim and Chul-Ju Yang

PF23033 Effects of probiotics on malodor reduction in pig farms

M Park, HJ Jang, SJ Lee, DH Kim, J Heo and Y Kim

PF23034 Comparative analysis of audio feature extraction methods for pig vocalization classification using deep learning

Vandet Pann, Jong-Bok Kim, Kyeong-Seok Kwon, Byeonghyeon Kim and Dong-Hwa Jang

PF23035 Comprehensive method for probiotics effect in pig farms

Jun-Hyeong Seo, Hyun-Jun Jang, Eun Ryul Oh, Dae-Hyuk Kim and Yangseon Kim

PF23036 한우분뇨와 돼지(비육돈)분뇨 내 연간질소배출량에 대한 국가고유계수 개발

김중곤, 이동준, 장선식, 김법균, 박소연, 이동현, 김현종, 정종민

제7발표분야 : 축산물이용 및 가공

포 스 터 발 표 회 초 록

단위동물 영양 · 사양

PA23001 The Effect of a probiotic mixture supplementation on litter performance, backfat thickness and heart girth in sows

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During pregnancy and lactation, providing sows with probiotic supplementation promotes gut health, leading to improved milk quality and health condition of sows and preweaning piglets. The present study aimed to examine the effect of a probiotic compound on backfat thickness, heart girth, and litter performance in sows. A total of 20 sows were allocated to either the control group (n=11) or the probiotic group (n=9). The sows in the control group were fed a basal diet, while those in the probiotic group received a diet supplemented with 2g/kg of a probiotic mixture (*Lactobacillus fermentum*, *Lactobacillus curvatus*, *Lactobacillus brevis*, *Lactobacillus plantarum*, *Bifidobacterium animals*) starting 4 days prior to the expected parturition date until weaning. Piglet weights were measured immediately after birth and 24 h later. Backfat thickness and heart girth in sows were measured 4 days before parturition (D-4), and on days 1 (D1), 7 (D7) and 28 (D28) after parturition. The probiotic group showed a lower piglet crushing rate compared to the control group 24 h after birth ($p < 0.05$). Moreover, from D1 to D28 and D7 to D28, the probiotic group experienced significantly less reduction in heart girth compared to the control group ($p < 0.05$). These findings suggest that the supplementation of probiotics in sow feed can improve the body condition of lactating sows and the survival rate of neonatal piglets.

Key words : feed additive, piglet crushing, nursery pig, lactating sow, reproductive performance

PA23002 Effects of dietary supplementation of *Lactobacillus plantarum* on blood profiles, immune responses, and ileal gene expression of weaned pigs

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This experiment was performed to verify the effects of dietary supplementation of *Lactobacillus plantarum* on blood profiles, immune responses, and ileal gene expression of weaned pigs. A total of 90 weaned pigs [7.91 ± 0.83 kg average initial body weight (BW); 28 days old] were assigned to 2 dietary treatments (5 pigs/pen; 9 replicates/treatment) in a randomized complete block design (block: initial BW). Dietary treatments were a basal weaner diet based on corn-soybean meal (CON) and CON + 0.02% probiotics *Lactobacillus plantarum* SKO-001 (LP) and fed for 4 weeks. Blood samples were collected from randomly selected one pig per pen on days 1, 7, 14, and 28 to measure blood profiles and immune responses. Randomly selected six pigs per treatment were euthanized to collect each segment of small intestine for measuring ileal gene expression. Pigs fed LP tended to have lower ($p < 0.10$) number of white blood cell and hematocrit on day 7 than those fed CON. The LP had higher ($p < 0.10$) concentration of serum IL-10 than the CON on day 28. Pigs fed LP had upregulated ($p < 0.05$) expression of CLDN-3 and OCLN genes in ileum than those fed CON. The LP had downregulated ($p < 0.05$) expression of TNF-α, TGF-β, INF-α, IL-1α, IL-1β, IL-6, and IL-8 genes in ileum than the CON. In conclusion, the addition of *Lactobacillus plantarum* in weaner diets modulated immune responses and ileal gene expression of weaned pigs.

Key words : blood profiles, ileal gene expression, immune responses, lactobacillus plantarum, weaned pigs

PA23003 Effects of dietary *Lactobacillus plantarum* on growth performance, serum biochemical parameters, and intestinal morphology of weaned pigs

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This study was conducted to investigate the effects of dietary *Lactobacillus plantarum* on growth performance, serum biochemical parameters, and intestinal morphology of weaned pigs. Weaned pigs [n = 90; 7.91 ± 0.83 kg of initial average body weight (BW); 28 days of age] were allocated to two treatments (5 pigs/pen; 9 replicates/treatment) in a randomized complete block design (block: BW and sex) for four weeks. Dietary treatments were a basal weaner diet based on corn and soybean meal (CON) and CON + 0.02% *Lactobacillus plantarum* SKO-001 (LP). On the last day of the experiment, blood samples were collected to measure serum biochemical parameters from randomly selected six pigs per treatment. The six pigs were euthanized to collect small intestinal segments for measuring intestinal morphology. Pigs fed LP had higher ($p < 0.05$) feed efficiency from day 1 to 7 than those fed CON. Pigs fed LP tended to have lower ($p < 0.10$) frequency of diarrhea from day 1 to 14 than those fed CON. Pigs fed LP tended to have lower ($p < 0.10$) concentration of magnesium than those fed CON. The LP increased ($p < 0.05$) VH:CD in the duodenum. In addition, the LP increased ($p < 0.05$) the number of goblet cells in the jejunum. In conclusion, the dietary *Lactobacillus plantarum* improved growth performance and intestinal morphology of weaned pigs.

Key words : growth performance, intestinal morphology, *Lactobacillus plantarum*, serum biochemical parameters, weaned pigs

PA

PA23004 이유자돈 사료 내 어분 대체원료로 동애등에의 첨가수준이 성장성적, 혈액성상 및 설사빈도에 미치는 영향

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본 실험은 이유자돈 사료 내 어분의 대체 원료로서 동애등에 첨가가 이유자돈의 성장성적, 혈액성상 및 설사빈도에 미치는 영향으로 어분 대체 가능성을 검증하고자 수행되었다. 평균 체중 7.47 ± 0.020kg인 삼원 교잡종 [(Yorkshire × Landrace) × Duroc] 이유자돈 160두, 4처리 5반복 반복당 8두로 공시하였다. 실험처리구는 어분과 동애등에의 첨가 수준에 따라 1) CON: 어분 4%, 2) BSF25 : 어분 3% + 동애등에 1%, 3) BSF50 : 어분 2% + 동애등에 2%, 4) BSF100 : 동애등에 4%로 설계되었다. 사양실험 결과, 이유자돈 사료 내 동애등에 첨가 수준이 증가함에 따라 실험 전체 기간의 일당사료섭취량이 선형적으로 증가하는 경향을 보였고 (P=0.09), 사료효율이 선형적으로 감소하는 경향을 보였다 (P=0.06). 혈액성상 중 2주차 creatinine 농도는 동애등에 첨가 수준이 증가함에 따라 선형적으로 감소하였고 (P=0.02), 4주차 albumi, total protein 및 glucose 농도는 선형적으로 증가하였다 (P=0.05; P=0.05; P=0.02). 하지만 동애등에의 수준별 첨가에 따른 설사빈도의 유의적인 차이가 나타나지 않았다 (P>0.05). 결론적으로 이유자돈 사료 내에 어분의 2%를 동애등에로 2% 대체하는 것이 가장 적합한 첨가 수준이라고 판단된다.

Key words : 동애등에, 어분, 성장성적, 이유자돈

PA23005 Effects of different temperature and humidity conditions based on THI on growth performance, rectal temperature, respiratory rate, blood profiles, and immune responses of finishing pigs

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This study was conducted to investigate the effects of different temperature and humidity conditions based on THI on growth performance, rectal temperature (RT), respiratory rate (RP), blood profiles, and immune responses of growing pigs. A total of 48 finishing pigs [48.68 ± 3.31 kg of average initial body weight (BW)] were assigned to four environmental treatments [comfort (23-24℃, 35%), mild (26-27℃, 50%), moderate (29-30℃, 65%), and severe (32-33℃, 80%); 1 pig/pen; 12 replicates/treatment] in a randomized complete block design (block: BW) for 2 weeks. The pigs had ad libitum access to a basal diet. The RT and RP of each pig were daily measured. Blood samples were collected from all pigs on days 0, 7, and 14 for blood profiles and immune responses. Data were analyzed using the GLM procedure of SAS. The group of severe had lower ($p < 0.05$) ADG and ADFI than the comfort group. After day 0, RT and RP of pigs under moderate and severe were higher ($p < 0.05$) than those under comfort and mild. Pigs under severe had lower ($p < 0.05$) serum interleukin-6 on day 14 than those under comfort. In conclusion, high temperature and humidity decreased the growth performance whereas increasing RT and RP and disrupting immune system of finishing pigs.

Key words : blood profiles, growth performance, immune responses, rectal temperature, respiratory rate, THI

PA23006 Insects as feed ingredients for broiler chickens

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Insects are gaining attention as potential protein sources for broiler diets, offering comparable nutritional and environmental benefits compared to plant-based protein sources. Various insect species have been used in broiler diets, including mealworm (or superworm), dried crickets, dried grasshoppers, black soldier fly larvae, silkworm pupa, blood worm, and housefly maggot. We investigated experiments for 7 species of insect-based broiler diets. In the previous experiments, dietary mealworm larvae supplementation improved growth performance and beneficial bacteria in the gut, and reduced mortality and harmful bacteria in the gut of broiler chickens. Feeding diets containing black soldier fly larvae improved growth performance and unsaturated fatty acid in muscle of broiler chickens. Dietary silkworm pupa supplementation increased growth performance of broiler chickens. Feeding diets containing housefly maggot meal improved growth performance and nutrient digestibility of broiler chickens. However, there has been a lack of evidence about the effects of dietary dried crickets, dried grasshoppers, and blood worm supplementation on performance and health of broiler chickens. Although research is lacking in some insects, a variety of insects are utilized in broiler diets. In conclusion, dietary supplementation of various insects can be a potential solution to improve growth performance and gut health of broiler chickens with no reduction health.

Key words : broiler diet, broiler chicken, growth performance, gut health, insect

PA23007 Adaptation of functional feed materials to improve intestinal barrier function and to reduce stress of broiler chickens raised under heat stress and high stocking density

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Stress is appreciated seen as a biological symptom as a consequence of animal's exposure to an unfavorable and harmful environment. In addition, stress represents environmental conditions that adversely affect performance and health of broiler chickens. Typical types of stress in broiler chickens include heat stress and high stocking density. These stresses lead to decreased intestinal barrier function and increased stress in broiler chickens. Therefore, we investigated functional feed materials that can enhance intestinal barrier function and reduce stress in broiler chickens. Functional feed materials to improve intestinal barrier function and to reduces stress of broiler chickens were classified into amino acid, vitamins, and minerals. The types of amino acids in diets for improving intestinal barrier function and reducing stress in broiler chickens raised under heat stress and high stocking density were classified into glutamine, glutamic acid, γ-aminobutyric acid, tryptophan, arginine, and threonine. Vitamins were classified into vitamin A, vitamin C, and vitamin E. In minerals, minerals are classified as chromium, selenium, and zinc. After classification, the productivity changes and positive effects for measurements were summarized. Therefore, it is expected that the discovery and adaptation of various functional feed materials may enhance intestinal barrier function and reduce stress of broiler chickens raised under heat stress and high stocking density.

Key words : broiler chicken, functional feed materials, heat stress, high stocking density, intestinal barrier function, stress

PA23008 사료 내 조단백질 수준이 모돈의 번식성적, 포유자돈의 성적, 돈유성분 및 혈액성상에 미치는 영향

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본 실험은 사료 내 조단백질 수준별 첨가가 모돈의 체형변화, 번식성적, 포유자돈 성적, 돈유성분 및 혈액성상에 미치는 영향을 검증하고자 수행되었다. 본 실험은 평균체중이 238.0 ± 4.65kg인 2원 교잡종 (Yorkshire × Landrace) F1 모돈 48두를 선발하여 6처리, 8반복, 반복 당 한 두씩 완전임의 배치법(CRD)으로 배치하였으며, 처리구는 사료 내 조단백질 첨가수준에 따라 1) CP15 2) CP16, 3) CP17, 4) CP18,5) CP19, 6) CP20로 나뉘었다. 실험결과, 사료 내 조단백질 첨가 수준에 따라 분만 24시간이내 및 포유 21일령의 체중 및 등지방 두께에서 처리구 간 유의적인 차이가 나타나지 않았다 ($p > 0.05$). 또한, 총 산자 수, 사산두수, 생존자돈 수, 포유개시 두수, 이유두수, 복당 생시체중 및 복당 이유체중에서 처리구 간 유의적인 차이가 나타나지 않았다 ($p > 0.05$). 사료 내 조단백질을 20% 첨가하였을 때 유단백질에서 quadratic 반응이 나타났다 (quadratic, P=0.04). 포유자돈의 혈액성상에서 유의적인 차이가 나타나지 않았으며 ($p > 0.05$), 포유 21일령 모돈 혈액 중 총 단백질 수치에서 조단백질 수준이 증가할수록 선형적으로 감소되었지만 BUN는 선형적으로 증가하였다 (linear, $p = 0.02$; linear, $p = 0.01$). 조단백질 첨가수준이 증가함에 따라 아민, 암모니아 및 황화수소를 포함한 악취 발생이 선형적으로 증가하였다 (linear, $p = 0.01$). 결론적으로, 사료 내 조단백질 수준이 20%에서 15%까지 감소하여도 모돈의 체형변화, 번식성적 및 포유자돈 성장에 부정적인 영향을 미치지 않은 것으로 판단되며 단백질이 낮은 사료를 포유돈에게 급여할 때 단백질의 체내이용율를 개선하여 악취 발생을 줄일 수 있는 것으로 사료된다.

Key words : 조단백질, 번식성적, 악취 발생, 포유모돈, 포유자돈

PA23009 Standardized ileal digestibility of amino acids in various black soldier fly larvae fed to pigs and prediction equations for digestible amino acid concentrations using *in vitro* ileal disappearance of crude protein

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The objectives were to determine standardized ileal digestibility (SID) of crude protein (CP) and amino acids (AA) in black soldier fly larvae (*Hermetia illucens*; BSFL) fed to pigs and to develop prediction equations for estimating digestible AA concentrations in the BSFL using *in vitro* ileal disappearance (IVID) of CP. Twelve barrows with an initial body weight of 75.6 ± 4.2 kg surgically fitted with a T-cannula at the distal ileum were assigned to 6 experimental diets in a replicated 6 × 5 incomplete Latin square design. Five experimental diets including 5 BSFL products as the sole source of AA were prepared. A nitrogen-free diet was also prepared to determine the basal endogenous losses of CP and AA. All diets contained 0.5% chromium oxide as an indigestible index. Each period consisted of 4 days of adaptation and 2 days of ileal digesta collection. Equations for estimating SID AA concentration on a dry matter basis were: SID Lys (%) = –0.26 × IVID of CP (%) + 24.73 (r^2 = 0.75), SID Met (%) = –0.10 × IVID of CP (%) + 8.68 (r^2 = 0.81), SID Thr (%) = –0.12 × IVID of CP (%) + 11.86 (r^2 = 0.66), and SID Trp (%) = –0.06 × IVID of CP (%) + 5.69 (r^2 = 0.68). In conclusion, digestible amino acid concentrations in the black soldier fly larvae can be predicted based on *in vitro* ileal disappearance of crude protein.

Key words : amino acids, black solider fly, equations, pigs, standardized ileal digestibility

PA23010 Crude protein and organic matter utilization of soybean products based on *in vitro* assays for pigs

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The objective of the present work was to determine nutrient utilization of soybean meal (SBM), fermented SBM (FSBM), and soy protein concentrate (SPC) products based on *in vitro* assays for pigs. Two-step and 3-step in vitro assays were employed to determine *in vitro* ileal disappearance (IVID) of crude protein (CP) and total tract disappearance (IVTTD) of organic matter, respectively. Additionally, a modified 2-step procedure was conducted to determine the IVID of CP in nursery pigs by reducing incubation time and enzyme (50% of the conventional procedure). Test ingredients were SBM (48.5% CP in as-is), 3 sources of FSBM (A, 52.6% CP; B, 55.1% CP; and C, 49.8% CP in as-is), and SPC (58.4% CP in as-is). In the conventional procedures for growing pigs, the IVID of CP in SBM was less than that in other soybean products (89.4% vs. 91.9 to 92.8%; $p < 0.05$). The IVTTD of organic matter in FSBM C was greater than that in FSBM A, FSBM B, and SPC (94.2% vs. 88.6 to 92.8%; $p < 0.05$), but did not differ from that in SBM (94.2% vs. 93.5%). In the modified procedures for nursery pigs, IVID of CP in the 3 source of FSBM was greater than that in SBM and SPC (85.4 to 86.8% vs. 80.1% and 79.5%; $p < 0.05$). Based on the present experiments, proteins in fermented soybean meal are better utilized at the ileal level compared with those in soybean meal by nursery and growing pigs.

Key words : crude protein, *in vitro*, organic matter, soybean products, swine

PA23011 Effects of polyphosphate on carcass quality, anti-inflammation, and cecum microbiota in broiler chickens

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Polyphosphate(Poly-P) have antibacterial activity, but the effect of Poly-P with different chain lengths varies. One-day-old male broilers were randomly assigned to four pens of ten birds each: NC(Basal diet group), P3(Short chain Poly-P, SCPP), P14(Medium chain Poly-P, MCPP) , and P130(Long chain Poly-P, LCPP). Standardized rearing for 5 weeks was performed. The addition of Poly-P did not improve the carcass weight of broiler chickens. IL-1β expression progressively decreased with increasing chain length in both ileum and jejunum, but increased in the cecum environment. Throughout the growth phase, the microbiota in the cecum was dominated at the genus level by Bacteroidetes and Firmicutes. At the level of class, Bacteroidia and Clostridia were dominant. No differences were presented between the control and experimental groups in terms of genus and class. The experimental group with the addition of LCPP differed from the control group in terms of microbiota similarity, but it is worth mentioning that MCPP greatly contributed to the abundance of microbiota in the intestine. Finally, although Poly-P did not contribute to carcass weight in broilers, they did, to some extent, enrich the microbiota and have an anti-inflammatory effect, stemming from the biofunctional activity of Poly-P themselves. In summary, The results suggest that Poly-P can be used as feed additives.

Key words : polyphosphate, broilers, antimicrobial activity, anti-inflammation, microbiota

PA23012 Effects of different chain lengths of polyphosphate on anti-microbial and anti-biofilm activities in animal pathogenic bacteria

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This study was to investigate the effects of different chain lengths of Polyphosphate(Poly-P) on anti-microbial activity, growth inhibition and anti-biofilm activity of pathogens. Three kinds of Poly-P(P3, P14 and P130) were used for the experiments on animal pathogens such as *Listeria monocytogenes*, *Shigella sonnei*, *Salmonella enterica* ser. Gallinarum, *Klebsiella pneumoniae*, *Salmonella enterica* ser, Pullorum, and *Escherichia coli* O157:H7. The results showed that different chain lengths of Poly-P had different anti-microbial activities against pathogens. Poly-P medium chain (P14) and long chain (P130) showed anti-microbial activity against all pathogens except for *Listeria monocytogenes*, *Salmonella enterica* ser. Gallinarum and *Klebsiella pneumoniae*, and P14 showed stronger anti-microbial activity. With the increase of added concentration, the growth inhibition effect of Poly-P on pathogens was also enhanced. Different Poly-P chain length had different anti-biofilm effects on different pathogens and some show concentration dependence, in which different concentrations of P14(125, 312.5, 625.5 mg/L) had 32%, 34% and 35% anti-biofilm activity effects, respectively on Pseudomonas aeruginosa. These results including other reports suggest that Poly-P in bacterial cells can improve biofilm formation and regulate virulence as well as responses to nutritional and environmental stresses.

Key words : polyphosphate, anti-microbial activity, anti-biofilm activity

PA23013 Environmental enrichment materials in different types of floor: their effects on exploratory behaviors in growing pigs

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The provision of environmental enrichment materials (EEMs) is a primary strategy for stimulating instinctive behavior of pigs. However, the application of EEMs vary depending on the type of EEMs and floor systems. This study aimed to investigate the effects of sling belts, rice straw silage, and sawdust as EEMs on the behavior of growing pigs in different floor systems. The growing pigs were allocated to four treatments: Control (n = 88); SB (n = 88) with 10 sling belts on a slatted floor; RS (n=84) with a rice-straw silage bedding on a solid floor; and SD (n = 84) with a sawdust bedding on a solid floor. Exploratory behaviors of growing pigs were assessed for 24h video recordings at 0, 3, 5, 8, and 11 weeks. The combined exploration and investigation ratio was highest in the SD group at weeks 0 and 11 ($p < 0.05$, for both), and highest in the RS group at weeks 3 and 5 ($p < 0.01$, for both). However, the provision of sling belts did not yield positive effects on pig behavior. This might be attributed to the limited opportunities for pigs to engage in exploratory behavior due to the small amount of sling belts compared to the other bedding materials. In the meantime, bedding materials consistently stimulated explorative behavior in pigs throughout their whole growing phase. Nevertheless, since the use of bedding materials is restricted to specific floor systems, further studies are required to identify suitable EEMs for diverse floor systems.

Key words : bedding material, behavioural enrichment, fattening pig, instinctive behavior, pig welfare

PA23014 사료 내 조단백질 및 phytase 첨가 수준이 육계 후기 소화율에 미치는 영향

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본 연구는 사료 내 조단백질과 phytase 첨가 수준이 육계 후기의 소화율에 미치는 영향을 구명하기 위하여 실시하였다. 3주령 육계 수컷 180수(721.8±31.86 g)를 2주 동안 사육하였으며, 시험설계는 사료 내 조단백질 3수준(19%, 18%, 17%), phytase 3수준(1,000, 800, 500 ppm)의 3×3 복합요인으로 총 9처리구, 처리당 4반복, 반복(칸)당 5수씩 완전임의 배치하였다. 일반 성분(수분, 조단백질, 조지방) 및 질소와 인의 소화율은 조단백질 수준 17%에서 낮게 나타났으나($p < 0.05$), phytase 첨가 수준에 따른 차이는 없었다. 필수 아미노산 중 arginine, histidine, iso-leucine, leucine, lysine, threonine 및 valine의 소화율은 조단백질 수준 17%에서 낮게 나타났으며($p < 0.05$), 19%와 18% 사이에서 유의적인 차이가 없었다($p > 0.05$). Phenylalanine의 소화율은 조단백질 수준 19%일 때 유의적으로 높게 나타났으며($p < 0.05$), 17%일 때는 낮게 나타났다($p < 0.05$). Methionine의 소화율은 조단백질 수준에 따른 유의차를 보이지 않았으며, 필수 아미노산의 소화율은 phytase 수준에 따른 유의차가 없었다. 비필수 아미노산 중 alanine, aspartic acid, cystine, glutamine, proline, serine 및 tyrosine의 소화율은 조단백질 수준 17%일 때 낮게 나타났으나($p < 0.05$), glycine의 소화율은 조단백질 수준에 따른 유의차를 보이지 않았다. Glycine, proline, serine의 소화율은 phytase 500ppm에서 낮게 나타났으며($p < 0.05$), 다른 비필수 아미노산 소화율은 phytase 수준에 따른 유의적 차이가 없었다. 결론적으로, 사료 내 조단백질 및 phytase 첨가 수준이 낮을 때 일반 성분 및 아미노산의 소화율이 감소되었다.

Key words : 육계, 조단백질, 일반 성분, 아미노산, 소화율

PA23015 Comparison of the performance, egg quality and hatchability of woorimatdag breeder hens fed the dietary levels of metabolic energy in late laying period

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This study was conducted to investigate the effect of dietary levels of the metabolic energy (ME) on the performance, egg quality, and hatchability of Woorimatdag breeder hens in late laying period. A total of eighty Woorimatdag breeder hens were equally allocated into individual cages from 48 to 64 weeks of age. Groups were consisted of two dietary levels of ME (2,500 and 2,700 kcal/kg) having four replicates of ten birds. The results showed that there were no statistical differences with ME levels on the body weight and feed intake of breeder hens. The higher ($p < 0.05$) egg production was confirmed in breeder hens fed 2,500 kcal/kg ME than in those fed 2,700 kcal/kg ME from 48 to 52 weeks of age. However, the egg production observed similar values in both groups from 52 to 64 weeks of age. There were no significant differences between groups with respect to egg weight, eggshell thickness, and eggshell strength of breeder's eggs. It was confirmed no difference in the fertility and hatchability between groups. In conclusion, 2,500 kcal/kg could be considered to meet Woorimatdag breeder hens requirement in late laying period.

Key words : performance, egg quality, hatchability, metabolic energy, Woorimatdag breeder hens

PA23016 Effects of dietary carvacrol-thymol blend and stocking density on growth performance, jejunum morphology, and blood parameters in growing pigs

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The present study was conducted to evaluate the effects of dietary carvacrol-thymol blend (CB) in growing pigs raised in high stocking density (HSD) on growth performance, jejunum morphology, and serum parameters. A total of 120 male growing pigs [(Landrace x Yorkshire) x Duroc] with an average initial body weight of 43.64 ± 0.45 kg were randomly assigned in a 2 x 2 factorial arrangement to 4 treatments (6 replicates per treatment) with stocking density, 0.82 m2/pig (normal stocking density; NSD) or 0.55 m2/pig (HSD), and dietary CB, 0 or 1 g/kg. Experiment lasted for 42 days. The HSD group decreased ($p < 0.05$) final body weight, average daily gain, and average daily feed intake compared with the NSD group. Neither stocking density nor dietary CB affected the jejunum morphology. The HSD vs. NSD decreased IL-10 in serum ($p < 0.05$). Dietary CB increased blood urea nitrogen and decreased phosphorus ($p < 0.05$). In conclusion, dietary CB or stocking density had no interactive effect on the growth performance, cytokines, and blood parameters in growing pigs. Dietary CB did not affect growth performance and cytokines but adverse effect on blood parameters regardless of stocking densities.

Key words : carvacrol-thymol blend, stocking density, growing pigs

PA23017

한국가축사양표준 4차 개정판_양돈

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국내에는 2002년을 처음으로 4개 축종의 사양 표준과 표준사료성분표를 제정한 '한국가축사양표준'이 발간되었고 2002년 이후에는 2007년 1차, 2012년 2차, 2017년 3차 그리고 2022년 4차 등 5년 주기로 개정되어 발간되고 있다. 양돈 4차 개정판에서는 국내 양돈축사양의 기술발달 이용성과 국내·외 양돈사양에 관한 자료를 비교 및 수집함으로서 국내환경에 어울리는 가축사양환경 및 체계를 수정 및 보완하였다. 양돈 4차 개정판에서 다룬 중점내용 중 단백질 챕터에서는 온실가스 배출 저감을 위한 저단백질 사료 내용 보완, 및 다산성 모돈 단백질·아미노산 요구량 내용을 추가하였다. 원료사료 챕터에서는 돼지내장분말은 헤파린 생산 부산물로서 고품질 단백질 양돈원료사료로 대체 가능성에 대해 추가 및 동애등에 및 거저리 유충'등을 포함한 곤충사료 내용을 보완 하였다. 영양소 배출 및 냄새발생 최소화 챕터에서는 양돈산업 분뇨로 인한 환경오염 및 냄새민원 내용 추가 및 성장단계별 사양, 액비재순환 시스템 연구결과를 반영하여 보완하였다. 영양소 요구량 영향요인 및 모형 설정 챕터에서는 암퇘지와 거세돼지의 경우 표준 ME 섭취량 곡선이 비슷했으며, 실제 환경에서의 돼지들의 일반적인 사료섭취량을 설명할 수 있게 보정 회귀식을 추가 하였다. 특히, 질소배출량 저감을 위한 저단백질 사료 내용을 보완하였으며, 라이신, 메티오닌, 트레오닌 및 트립토판과 같은 필수아미노산이 보충된 저단백질 사료를 이유자돈부터 비육돈에게 급여 시, 돼지의 체중에 상관없이 사료 내 조단백질 함량이 낮아짐에 따라 일반사료 대비 총 질소 배출량이 크게 감소한 연구결과 보완 및 배합사료 내 조단백질 1% 감축에 따른 분 및 뇨 일일 질소 배출량은 각각 평균 3.8 및 9.4% 감소하는 내용이 추가되었다. 따라서, 한국가축사양표준을 농가에 현장 적용 가능하고, 가축사양의 전문가 또는 농민들이 이해할 수 있도록 쉽고, 구체화되어 양돈사양표준 활용성을 증진하고자 하였다.

Key words : 한국가축사양표준 4차 개정판, 양돈, 저단백질 사료, 질소 배출량, 온실가스 배출 저감

PA23018

Nutritional evaluation of animal protein sources in pet foods

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Alternative formats include new processing methods for pet food, such as "Raw", "Fresh cooked" and "New wet" options. Raw meat-based diets are considered a minimally processed alternative format in pet food. As part of the premiumization trend, protein has been a major ingredient in pet food, leading to the growing market for raw meat-based diets. In light of this, we conducted an investigation into the nutritional values of different meats which are used as major protein sources in pet food. The common animal protein sources found in commercial pet foods were salmon (21%), chicken (18%), lamb (9%), and duck (3%). We analyzed the nutritional content of these meats including crude protein (CP), ether extract (EE), crude fiber (CF), ash, and energy. The finding showed that duck had a CP content of 24.8%, chicken had 23.0%, salmon had 21.0%, and lamb had 13.8%. The EE content was 18.9% in lamb, 16.7% in salmon, 1.8% in chicken and 1.6% in duck. CF was only 0.2% in duck and 0.1% in lamb but it was below detectable levels in chicken and salmon. The ash content was 1.8% in salmon, 1.5% in chicken, 1.4% in duck, and 0.81% in lamb. In terms of energy value, lamb had the highest energy value at 3,216kal/kg, while chicken had the lowest value at 1,532kal/kg. Considering these values, salmon, chicken and duck appeared to be good sources of CP. However, using lamb as a protein source in pet food it would be necessary to consider the total amount of fat intake for pets.

Key words : low meat-based diets, nutrition, pet food, animal protein source

PA23019 Effect of dietary mangosteen peel extract and stocking density on growth performance, jejunum morphology, biochemical parameter, and cytokine profiles in growing pigs

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The aim of the study was to investigate the effect of stocking density and extract from mangosteen peel (MPE) on growth performance, jejunum morphology, biochemical parameter, and cytokine profiles in growing pigs. A total of 120 male, growing pigs (43.68 ± 0.48 kg) were randomly arranged in a 2 x 2 factorial design with stocking density (high; HD, 0.55 m2/pig and normal; ND, 0.82 m2/pig) and dietary MPE (0 or 5g/kg) as factors. Six replicate pens were allocated to each treatment. The HD vs. ND clearly lowered ($p < 0.05$) final body weight, average daily gain, and average daily feed. None of the factors affected jejunum morphology. Dietary MPE, but not stocking density, increased ($p < 0.05$)IL-10 and blood urea nitrogen in serum compared with non-supplemented control diet. In conclusion, no interaction between dietary MPE and stocking density on growth performance, biochemical parameter, and cytokine profiles. Our finding suggests that dietary MPE is effective in improving cytokines profiles, but the effect is independent to stocking density.

Key words : mangosteen peel extract, stocking density, growth performance

PA23020 Microbial of the ceca from layer pullets affected by feeding *Bacillus subtilis* and oregano oil

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Additives like Bacillus subtilis and oregano oil improve poultry health and performance by enhancing cecal microbial communities. This study demonstrated the modulation of the cecal microbiome in pullets following the feeding of *Bacillus subtilis* (BS, $3x10^8$ cfu/kg) and oregano oil (ORO, 0.3 g/kg). There were no statistically significant differences ($p > 0.05$) observed in Chao1 and Simpson's evenness indices. However, the microbial richness, as measured by Faith's PD, was significantly higher in the BS group ($p = 0.0317$) and the ORO group ($p = 0.008$) compared to the Control group. After the ORO treatment, researchers observed a notable decrease in Firmicutes and an increase in Bacteroidetes within the chicken ceca microbiota. As a result of the LDA analysis conducted that the phyla *Bacteroidetes* and *Desulfobacterota* were found to be enriched in the ORO group($p < 0.05$). Genera *Clostridia* vadinBB60 group, *Erysipelotrichaceae*, *Clostridia*, and *Incertae Sedis* Firmicutes were enriched in the ORO group. Genera unclassified Erysipelotrichaceae and Lachnoclostridium were enriched in the BS group. The supplementation of Bacillus subtilis and oregano oil was found to have a significant modulatory effect on the composition of the microbiota. Moreover, this supplementation led to an improvement in the abundance of several beneficial candidates within the gut microbial communities.

Key words : layer pullets, bacillus subtilis, oregano oil, microbial

PA23021 이유자돈 사료 내 혈장단백질 대체원료로써 동애등에의 수준별 첨가가 성장성적, 혈액성상 및 설사빈도에 미치는 영향

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본 연구는 사료 내 에너지-단백질 수준이 육성-비육돈의 성장성적, 혈액성상, 돈육품질 및 사료비 절감에 미치는 영향을 규명하기 위해 수행되었다. 평균 체중 8.12 ± 0.010 kg의 3원 교잡종 ([Yorkshire × Landrace]) × Duroc) 192두, 4처리 6반복 반복당 8두로 공시하였다. 처리구는 1) CON: 옥수수-대두박 위주 기초사료 (혈장단백), 2) BSF25: 옥수수-대두박 위주 기초사료 + 동애등에 25 % 대체, 3) BSF50: 옥수수-대두박 위주 기초사료 + 동애등에 50 % 대체, 4) BSF100: 옥수수-대두박 위주 기초사료 + 동애등에 100 % 대체로 설계되었다. 실험결과, 2주차 체중에서 BSF25 처리구가 가장 높은 것으로 나타났다 ($p < 0.01$). 또한, 동애등에 첨가수준이 증가함에 따라 2주차 일당 증체량과 사료효율이 선형적으로 감소하는 것으로 나타났다 (linear, p=0.03; p=0.03). 혈액성상에서 4주차 albumin 수치에서 대조구와 BSF25 처리구가 유의적으로 가장 높게 나타났으나 ($p < 0.01$), 동애등에 첨가수준이 증가함에 따라 albumin 수치가 선형적으로 감소하였다 (linear, $p < 0.01$). 설사빈도에서 동애등에를 수준별로 첨가하였을 때 BSF50 처리구의 설사빈도가 감소하는 경향이 나타났다 ($p < 0.10$). 결론적으로, 이유자돈 사료 내 혈장단백질 대체원료로써 동애등에를 25%까지 대체가 가능한 것으로 사료된다.

Key words : 이유자돈, 동애등에, 혈장단백질, 성장성적, 혈액성상

PA23022 Effects of environment temperature on blood characteristics and volatile fatty acid from feces in growing pigs

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This study was conducted to investigate effects of environment temperature on blood characteristics and volatile fatty acid from feces in growing pigs and secure basic data for the development of technology to reduce the generation of odor substances. A total 16 pigs(Landrace×Yorkshire×Duroc, average body weight 56.49±0.47kg) were randomly assigned to two treatments. Treatments consisting of thermal-neutral(TN) and heat stress condition(HS), respectively. The experiments was conducted for two weeks and average temterature-humidity index(THI) were 68.91±0.09 at TN, and 85.98±0.08 at HS, respectively. The serum BUN, total protein, cholesterol, triglyceride, NEFA, Glucose, IgG did not be affected by environment temperature($p > 0.05$). Acetic acid tended to decrease, but there was no significant difference($p = 0.0856$). Other volatile fatty acid(VFA) from feces did not change signifiantly during the experiments. It seems that the high temperature environment did not affect blood characteristics and VFA from feces in growing pigs. However, in order to derive more accurate research results, additional investigations on indicators related to heat stress such as body temperature, respiratory rate, and Cortisol. are considered necessary.

Key words : pig, heat stress, blood characteristic, VFA

PA23023

Change of boar taint in fat tissues of entire and castrated male pigs fed with or without inulin

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For preventing boar taint, swine farm has been working commonly surgical castration in male piglets. However, the castration is criticized by animal welfare issues. Therefore, this study was to estimate effect of dietary inulin on boar taint in fat tissues from entire male (EM) and castrated male (CM) finishing pigs. A total of twenty-six pigs (LYD; EM, n = 18 and CM, n = 8) were prepared as experiment animals. Treatment groups were composed of four groups as EM (EM0) and CM (CM0) with 0% inulin; EM (EM3) and CM (CM3) with 3% inulin. Fat tissues were collected from neck, back and belly fat. Indole level in back fat was decreased in the CM3 group compared with the EM0 group ($p < 0.05$), but did not affected in neck and belly fat. Average indole level in all fat tissues was decreased in the EM3, CM0 and CM3 groups compared with the EM0 group ($p < 0.05$). Skatole level in back fat was reduced in the CM0 and CM3 groups compared with the EM0 group ($p < 0.05$). Similarly, the CM3 group showed decreased skatole level than the EM0 and EM3 groups in neck fat or average fat tissues ($p < 0.05$). However, androstenone levels in all fat tissues were not statistically changed by dietary inulin. In conclusion, feeding inulin had a positive effect to decrease skatole and indole levels in fat tissue in EM or CM pigs.

Key words : boar taint, Inulin, castrated pigs, entire male pigs

PA23024

Effect of air velocity on performance and physiological responses in heat-stressed broilers

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The adverse effect of heat stress (HS) on production in the poultry industry has been a global concern. High environmental temperature leads to metabolic changes, reduced body weight, and increased mortality in chickens. The objective of this study was to evaluate the impact of different air velocities on the growth performance, respiration rate, rectal temperature, and blood traits of broilers exposed to HS. A total of 240 broilers were divided into 3 treatment groups, each consisting 4 replicates of 80 birds, with similar average weights. The air velocity (AV) treatments included a control (0.0 m/s), low AV (1.0 m/s), and high AV (2.0 m/s). The birds were housed in pens within a the controlled-environment chamber and acclimated to 24℃ for 1-week. After the adaptation period, birds were subjected to a daily cyclic HS consisting of 9 h at 33℃ returning to 26℃ for the remaining 15 h/D for 2-weeks from 25 to 38 days of age. Regarding performance parameters, feed intake and body weight gain were significantly increased ($p < 0.05$) in the group subjected to AV of 2.0 m/s compared to control group. Additionally, as the AV increased, both the respiration rate and rectal temperature decreased significantly ($p < 0.05$). Serum electrolyte K+ levels were significantly increased ($p < 0.0.5$) in birds subjected to AV (1.0 and 2.0 m/s) compared to control group. In conclusion, AV significantly influenced the performance and physiology of broilers, with an AV of 2.0 m/s proving to be optimal under heat stress conditions.

Key words : heat stress, air velocity, broiler, performance, physiological response

PA23025

Effect of individual or combination of dietary glycine and betaine on immune response and intestinal barrier function in aged laying hens raised under heat stress conditions

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The objective of this experiment was to investigate the effect of individual or combination of dietary glycine (Gly) and betaine (Bet) on immune response and intestinal barrier function in aged laying hens raised under heat stress (HS) conditions. A total of 480 65-wk-old Lohmann brown laying hens were allotted to 1 of 4 dietary treatments with 8 replicates per treatment. Each replicate had 12 hens. The experiment was performed using a completely randomized design with 2 × 2 factorial arrangements, including 2 supplemental levels of Gly (0 and 0.65%) and Bet (0 and 0.2%) in diets. All hens were raised under cyclic HS conditions at 31.7 ± 1.7℃ for 8 h/d and 27.2 ± 1.3℃ for the remaining time. Experiment lasted for 12 wk. Results indicated that dietary supplementation of 0.2% Bet alone improved ($p < 0.05$) immune response as a measure of cutaneous basophil hypersensitivity (CBH) test in aged laying hens under HS conditions. For intestinal barrier function, dietary supplementation of either Gly alone or a combination of 0.65% Gly and 0.2% Bet improved ($p < 0.05$) transepithelial electrical resistance (TER), indicating a decrease in intestinal permeability. In conclusion, dietary supplementation of 0.20% Bet alone or a combination of 0.65% Gly and 0.20% Bet improves the immune response and intestinal barrier function in aged laying hens raised under HS conditions.

Key words : aged laying hens, betaine, glycine, immune response, intestinal barrier function

PA23026

Effects of different temperature and humidity conditions based on THI on growth performance, rectal temperature, respiratory rate, blood profiles, and immune responses of growing pigs

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This study was conducted to investigate the effects of different temperature and humidity conditions based on THI on growth performance, rectal temperature (RT), respiratory rate (RP), blood profiles, and immune responses of growing pigs. A total of 48 growing pigs [23.56 ± 1.11 kg of average initial body weight (BW)] were assigned to four environmental treatments [comfort (23-24℃, 35%), mild (26-27℃, 50%), moderate (29-30℃, 65%), and severe (32-33℃, 80%); 1 pig/pen; 12 replicates/treatment] in a randomized complete block design (block: BW) for 2 weeks. The pigs had ad libitum access to a basal diet. The RT and RP of each pig were daily measured. Blood samples were collected from all pigs on days 0, 7, and 14 for blood profiles and immune responses. Data were analyzed using the GLM procedure of SAS. The severe group had lower ($p < 0.05$) ADG and ADFI than the comfort group. RT and RP of pigs under moderate and severe were higher ($p < 0.05$) than those under comfort and mild. Pigs under severe had lower ($p < 0.05$) serum interleukin-6 on day 14 than those under comfort. In conclusion, high temperature and humidity decreased the growth performance whereas increasing RT and RP and suppressing immune system of growing pigs.

Key words : blood profiles, growth performance, immune responses, rectal temperature, respiratory rate, THI

PA23027 이유자돈 사료 내 생균제 프로비온 포르테와 스포아자임 포르테의 첨가가 이유자돈의 성장능력에 미치는 효과

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본 실험은 이유자돈 사료 내 생균제 프로비온 포르테와 스포아자임 포르테의 첨가가 이유자돈의 성장능력에 미치는 효과를 검증하고자 수행되었다. 본 실험은 28 ± 3일령에 이유한 평균체중이 7.84 ± 0.15kg인 3원 교잡종 ([Yorkshire x Landrace] x Duroc) 이유자돈 144두를 선발하여 3처리, 6반복, 반복 당 8두씩 성별과 체중에 따라 난괴법(RCBD)으로 배치하였으며, 처리구는 생균제 첨가 형태에 따라 1) Control: basal diet; 2) A: basal diet + 프로비온 포르테 0.05%; 3) B: basal diet + 스포아자임 포르테 0.05%로 나뉘었다. 실험 결과, 이유후기 6주차 프로비온 포르테를 0.05% 첨가한 A처리구의 일당증체량은 다른 처리구에 비해 높은 경향이 나타났다 (p = 0.06). 혈액성상에서 이유전기 3주차 자돈 혈액 내 BUN 농도는 프로비온 포르테를 0.05% 첨가한 A처리구에서 가장 낮게 나타났으며 (p = 0.01), 스포아자임 포르테를 0.05% 첨가한 B처리구의 IgG 농도는 다른 처리구에 비해 높은 경향이 나타났다 (p = 0.05). 분 중 미생물 조성에서 이유전기 3주차 스포아자임 포르테를 0.05% 첨가한 B처리구에서 분 중 *total aerobic bacteria* 수치가 가장 높게 나타났다 (p = 0.01). 이유후기 6주차 프로비온 포르테를 0.05% 첨가한 A처리구가 다른 처리구와 비교하였을 때 분 중 *coliforms* 수치가 높게 나타났다 (p = 0.01). 결론적으로 프로비온 포르테를 0.05% 이유자돈 사료에 첨가했을 때 성장성적 및 면역능력을 뚜렷하게 향상시킬 수 있는 것으로 사료된다.

Key words : 프로비온 포르테, BUN, IgG, *total aerobic bacteria*, 이유자돈

PA23028 육성비육돈 사료 내 베타글루칸과 비타민 E 첨가가 육성비육돈의 성장성적, 혈액성상, 면역성상, 돈육품질, 돈육풍미 및 경제성 분석에 미치는 영향

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본 실험은 육성비육돈 사료 내 베타글루칸과 비타민 E의 첨가가 육성비육돈의 성장성적, 혈액성상, 면역성상, 돈육품질, 돈육풍미 및 경제성 분석에 미치는 영향을 검증하고자 수행되었다. 평균 체중 34.43 ± 2.362 kg인 3원 교잡종 ([Yorkshire × Landrace]) × Duroc) 육성돈 140두를 선발하여 5처리, 4반복, 반복 당 7두씩 난괴법 (RCBD)으로 배치하였다. 실험 처리구는 1) CON: 옥수수-대두박 위주의 기초사료, 2) LB: 기초사료 + 베타글루칸 0.05%, 3) LBE: 기초사료 + 베타글루칸 0.05% + 비타민 E 0.02%, 4) HB: 기초사료 + 베타글루칸 0.1%, 5) HBE: 기초사료 + 베타글루칸 0.1% + 비타민 E 0.02%로 구성하였다. 실험 결과, 베타글루칸 또는 비타민 E를 첨가하면 일당증체량과 사료효율이 비육 전기에는 유의적으로 높아졌고 (Diet, p = 0.01; p = 0.01), 전체 비육 기간 동안은 높아지는 경향을 보였다 (Diet, p = 0.06; 0.05). 혈액성상과 관련하여, 베타글루칸 0.05% 첨가는 베타글루칸 0.1% 첨가보다, 9주와 12주 혈중 lymphocyte 농도를 고도로 증가시켰다 (BG, p < 0.01; p < 0.01). 또한 비타민 E 첨가는 혈중 비타민 E 농도를 3주와 12주에 증가시켰고 (VE, p < 0.01; p = 0.04), 6주와 9주에 증가시키는 경향을 보였다 (VE, p = 0.07; p = 0.09). 경제성과 관련하여, 베타글루칸 0.1%와 비타민 E 0.02%를 첨가하면 출하도달 일령이 가장 짧고 총 사료비가 가장 낮았다. 결론적으로, 육성비육돈 사료 내 베타글루칸 0.1%와 비타민 E 0.02%를 첨가하였을 때 비타민 E가 가장 효과적으로 공급되었고 베타글루칸의 효과로 건강 상태를 개선하여 긍정적인 성장성적과 경제성을 보인 것으로 사료된다.

Key words : 베타글루칸, 비타민 E, 육성비육돈, 성장성적, 경제성

PA23029

Impact of bump feeding in sows during the late gestation period on milk yield and piglet growth performance

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The increase in litter size has been associated with a decrease in individual piglet birth weight, prompting the exploration of various nutritional strategies to enhance piglet birth weight. This study aimed to investigate the effects of increased feed allowance during the late gestation period on sow milk yield and the growth performance of piglets. A total of twenty-eight sows were housed in a controlled environment and allocated a feeding allowance of either 2.5 or 3.5 kg/d from 84 days of gestation until farrowing. Individual piglet weights were measured at birth and 72 hours later. The results revealed that bump feeding during the late gestation period had no significant effect on milk yield. Moreover, the diet had no significant impact on litter size at weaning. Sows provided with a higher feed allowance during the late gestation period significantly increased piglet birth weight and a numerically higher number of weaned piglets in their litters. The principal component analysis revealed differences of 69.7% and 59.6% in the partial least square discriminant analysis, with the major differences observed in livability rate, litter size and milk yield. The positive effect on the growth performance of piglets is positively correlated with the increased feed allowance during the late gestation period. In conclusion, optimizing feed allowance during the late gestation period has the potential to improve nutritional management practices and increase piglet production per sow per year.

Key words : litter size, piglet birth weight, feed allowance, late gestation period, milk yield

PA23030

Backfat thickness before farrowing: a predictor of milk production and piglet growth in lactating sows

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The importance of backfat thickness in sows lies in its correlation with nutritional status, reproductive performance, and overall health. Identifying the optimum backfat thickness is crucial for determining the ideal energy reserves needed to support successful reproduction and lactation. This research aimed to determine the optimal backfat thickness of sows in relation to reproductive and lactation performance. In this study, 35 lactating sows were assigned to four groups based on their backfat thickness before farrowing: <17.00 mm, 17.00-17.99 mm, 18.00-18.99 mm, and >19.00 mm. The sows were housed in a controlled environment from 7 days before expected farrowing until 28 days of the lactation period. Backfat thickness of sows at weaning showed significant differences among the groups, which were associated with the backfat thickness before farrowing. Body weight loss and backfat loss were not significantly affected. Notably, the return-to-estrus interval was longer in sows with thin backfat compared to those with thick backfat. Sows with <17.00 mm, 17.00-17.99 mm, 18.00-18.99 mm, and >19.00 mm backfat thickness came into estrus 7.17, 6.25, 5.31, and 5 days after weaning, respectively. These results conclude that sows with at least 18.00 mm backfat thickness before farrowing are ideal for increasing the lifetime productivity of sows.

Key words : lactating sow, piglets, backfat thickness, non-productive days

PA23031 Effects of protocatechuic acid feeding on pig productivity and economics in piglets

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PA

Korea is conducting extensive research on feed additives to enhance livestock productivity. Various feed additives, such as probiotics, amino acids, immune enhancers, and natural extracts, are being explored. Among them, Protocatechuic Acid (PCA) is known to be extracted from natural plants such as green tea, quince, and raspberry. PCA is recognized for its antioxidant, immune-enhancing, antimicrobial, and intestinal health benefits. To investigate the potential productivity effects of feeding PCA to livestock, a study was conducted specifically on piglets. The treatment group was divided into a control group and a PCA 0.05% treatment group. The general management practices are the same and the study was conducted for four weeks. In the treatment group fed with PCA, weight gain increased by 0.12 kg, while feed intake was measured to be 2.42 kg lower. The feed conversion ratio was measured at 1.51, indicating an improved effect compared to the control group. An analysis of feed costs over the four-week period revealed savings of 1,166 won per piglet in the PCA 0.05% treatment group. These results suggest the effectiveness of PCA in enhancing piglet productivity, emphasizing the need for further detailed research.

Key words : piglets, protocatechuic acid, productivity, economics, feeding

PA23032 Effects of drying methods on nutrient utilization in black soldier fly larvae based on in vitro assays for pigs

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The objective was to determine the effects of different drying methods on nutrients utilization of black soldier fly larvae (*Hermetia illucens*; BSFL) using in vitro assays for pigs. Two-step *in vitro* ileal disappearance (IVID) and three-step *in vitro* total tract disappearance (IVTTD) assays were employed to simulate the digestion and absorption in the gastrointestinal tract of pigs. Four BSFL products were prepared using the following drying methods: (1) hot-air-dried at 65°C for 24 h, (2) microwave-dried at 700W for 5 minutes 3 times, (3) freeze-dried at –40°C for 72 h, and (4) infrared-dried at medium infrared region (3.5 ㎛) and 95°C for 12 min. Dry matter (DM), ether extract, and nitrogen concentrations in the dried-BSFL ranged from 94.6 to 96.8%, 49.2 to 52.8%, and 4.8 to 5.9%, respectively, on an as-is basis. Microwave-dried BSFL had a greater ($p < 0.05$) IVID of DM compared with freeze-dried or infrared-dried BSFL with no difference compared with hot-air-dried BSFL. Additionally, infrared-dried BSFL had the lowest IVID of nitrogen and IVTTD of DM and organic matter. In conclusion, hot-air-dried and microwave-dried BSFL are better utilized compared with freeze-dried or infrared-dried BSFL for pigs.

Key words : black soldier fly larva (BSFL; *Hermetia illucens*), *in vitro* digestibility, drying methods

PA23034

섬유소 급여가 삵의 영양소 소화율 및 장내미생물 균총에 미치는 영향

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본 연구는 섬유소 급여가 삵의 영양소 소화율 및 장내미생물 균총에 미치는 영향을 알아보기 위해 수행하였다. 실험은 서울대공원 동물원 종보존센터의 삵 7마리(평균 체중, 47.2±0.73 kg)를 공시하여 닭고기 다짐육과 5% 알팔파가 혼합된 닭고기 다짐육을 각각 대조구와 처리구로 설정하여 실시하였다. 먹이는 잔량이 발행하지 않도록 암컷과 수컷 각각 250 및 350g/일(as fed basis)로 제한급여 하였고, 먹이 적응기간 및 샘플링기간을 각각 7 및 4일로 설정하여 교차디자인으로 실험을 수행하였다. 분은 0.5% 티타늄디옥사이드를 지시제로 첨가하여 색 변화가 나타난 분만 샘플링하였다. 본 연구의 통계분석은 SAS MIXED procedure 내 TTEST 옵션을 이용하여 *t*-test를 수행하였으며, 유의성은 0.05 수준에서 평가하였다. 연구 결과, 삵의 개시체중, 종료체중, 일당증체량, 일평균먹이섭취량 및 사료효율에서는 대조구와 10% 알팔파 혼합 처리구간에 유의적인 차이를 나타내지 않았다($p > 0.05$). 영양소 소화율은 대조구의 건물 소화율이 10% 알팔파 혼합 처리구에 비하여 유의적으로 높게 나타났다($p = 0.024$). 조단백질과 조지방 소화율은 대조구와 10% 알팔파 혼합 처리구간에 유의적인 차이를 나타내지 않았다.클로스트리디움(Clostridium; $p = 0.093$) 및페니클로스트리디움(Paeniclostridium; $p = 0.080$) 속 미생물은 섬유소를 첨가 급여함에 따라 유의적으로 감소하고 섬유소가 없는 먹이를 급여하면 유의적으로 증가하는 경양성을 나타냈다. 삵에서 섬유성 물질의 급여는 식이섬유를 이용하는 장내 유익균의 수를 증가시켜 고양이과 동물의 장내 건강에 긍정적인 영향을 줄 수 있을 것으로 기대된다.

Key words : leopard cat, fiber, alfalfa, digestion rate

PA23035

Growth performance of growing pigs fed low protein diet

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This study evaluated the impact of reducing dietary crude protein (CP) on the growth performance of crossbred barrows and gilts during the growing period. A total of 90 pigs (45 barrows and 45 gilts) with an average weight of 30.6 ± 2.31 kg were assigned to 3 dietary treatments with 6 replicates in a randomized complete block design, considering body weight and sex as blocking factors. Pigs were grouped into pens with five pigs per pen and provided with ad libitum access to water and experimental diets, for 5 weeks. The experimental diets, with a 2% reduction in CP from the 16% upper limit, met or exceeded the nutrient recommendations of the National Research Council for swine. Feed leftovers and body weight were recorded at 0, 3, and 5 weeks. Treatment means were compared using Tukey's HSD test. There were no significant effects of the reduction of dietary CP on growth performance. In conclusion, the reduction of dietary CP by 4%, from 16% to 12%, did not have a negative impact on the growth performance of the growing pigs.

Key words : amino acid, growth performance, low protein, pig

PA23036 Effects of dietary supplementation of Bacillus subtilis and oregano essential oil on production performance, egg quality, and intestinal morphology in late-phase laying hens

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This study was conducted to investigate the effects of *B.subtilis*-based probiotics and oregano essential oil of late-phase laying hens on production performance, egg quality, and intestinal morphology. A total of 150 sixty-nine-week laying hens were assigned to two groups based on the difference in egg production (high(H) or average(A)) and were treated with control, *B.subtilis* (BS), and oregano essential oils (OEO), respectively. The experimental treatments included: HCON, a basal diet; HBS, basal diet plus $3x10^8$ cfu/kg feed BS; HOEO, basal diet plus 0.3 g/kg feed OEO; ACON, a basal diet; ABS, basal diet plus 3x108 cfu/kg feed BS; AOEO, basal diet plus 0.3 g/kg feed OEO. Both ABS and AOEO improved egg production compared to the ACON ($p < 0.05$). HOEO improved eggshell strength more significantly than in the HCON ($P<0.05$), and ABS improved eggshell strength more significantly than ACON ($p < 0.05$). In addition, Both HBS and HOEO significantly increased villus height to crypt depth ratio in the ileum compared to the HCON ($p < 0.05$), and both ABS and AOEO also significantly increased villus height to crypt depth ratio in the ileum compared to ACON ($p < 0.05$). These results suggest that supplementation of *B.subtilis* and oregano essential oil in the diet of laying hens in the late laying period could be a potential strategy to improve egg production, egg quality, and gut health.

Key words : laying hens, probiotics, essential oil, production performance

PA23037 A study on canine hematological characteristics by dietary various protein sources and age of dogs

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This study was conducted to investigate the effect of various protein sources in pet food and the age of dogs on hematological characteristics. A total of eight healthy adult beagle dogs and five senior dogs were assigned. The nutritional composition of the pet food was identically designed, and six experimental diets were prepared using different protein ingredients. Hematological characteristics were analyzed after feeding each experimental diet for 14 days. Depending on the protein sources, WBC and NEU in leukocytes, and MCHC in erythrocytes were significantly affected. In terms of age, senior dogs showed higher levels of WBC, NEU, and MON, and lower levels of LYM in leukocytes. In erythrocytes, senior dogs had lower RBC, HGB, HCT, MCHC, and RDW-CV, and higher MCV and MCH compared to adult dogs. All platelet parameters were observed to be significantly higher in senior dogs. In the results of biochemistry, the protein sources in pet food affected the serum T-CHO and NEFA as lipid-related indicators. Regarding age, senior dogs had higher levels of serum T-PRO, ALT, T-CHO, Ca, Mg, AMY, and LIP, ALPIF, while the serum ALB and CREA were lower in senior dogs compared to adult dogs. The results of this study suggest that the hematological characteristics of dogs are affected by the protein source in pet food and age, and provide basic data on changes in hematological characteristics used as health indicators in adult and senior dogs.

Key words : pet food, protein, age, complete blood count, biochemistry

PA23038 Effects of dietary hydrolyzed porcine intestinal mucosa on growth performance and fecal score in nursery pigs

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The objective was to determine the effects of supplementing hydrolyzed porcine intestinal mucosa (HPM) on growth performance and fecal score in nursery pigs. A total of 144 barrows (6.5 ± 0.8 kg body weight) were assigned to one of 3 dietary treatments in 6 replicates with 8 pigs per pen in a randomized complete block design. The diets were mainly consisted of corn, soybean meal, and whey with 0, 2, and 4% HPM at the expense of soybean meal. Body weight and feed intake were recorded on days 7, 14, and 28. Fecal score was recorded daily to categorize fecal consistency. Polynomial contrasts were performed to analyze linear and quadratic effects of HPM supplementation on growth performance. Fecal score data were analyzed using repeated measures analysis over time. From days 0 to 7, gain to feed ratio (G:F) was linearly increased (p = 0.026) with increasing dietary HPM. During any other experimental periods, however, no effects of HPM supplementation on growth performance in nursery pigs were observed. Fecal score of pigs fed the 4% HPM diet was greater (p = 0.064) than those fed the 0% and 2% HPM diets from days 7 to 14, but no differences were observed among the experimental diets during the other experimental period. In conclusion, the effects of HPM on G:F and fecal score were observed during the first 1 or 2 weeks after weaning but not during later periods.

Key words : fecal score, growth performance, hydrolyzed porcine intestinal mucosa, swine

PA23039 The impact of environmental enrichment materials on the growth performance and occurrence of body wounds in fattening pigs housed on slatted and solid floors

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The utilization of environmental enrichment materials (EEMs) has been proposed as a strategy to reduce negative behavior and redirect aggression in pigs. However, the implementation of EEMs is often challenging due to diverse flooring systems in pig farms. Therefore, this study aimed to evaluate the impact of sling belts, rice-straw silage and sawdust on the growth performance and incidence of body wounds in fattening pigs, taking into account the different floor types. A total of 344 pigs were allocated to 4 groups: Control (C, n = 88), with 50% slatted and 50% solid floor, Sling belt (SB, n = 88), with 50% slatted and 50% solid floor and the provision of 10 sling belts, Rice-straw silage (RS, n = 84), with 100% solid floor and a 7 cm layer of rice-straw silage, Sawdust (SD, n = 84), with 100% solid floor and a 7 cm layer of sawdust. During the late fattening period, the RS group showed a tendency toward having the lowest body weight (p = 0.08). The RS group and the SD group, along with the SB group showed a lower incidence of body wounds compared to the C group (p < 0.01). These results indicate that the provision of EEMs has the potential to reduce body wounds caused by aggressive behaviours among pen mates, as they redirect their aggressive behaviors towards the provided EEMs. Nevertheless, further study is needed to investigate alternative EEM options and optimize their application in various housing environments.

Key words : aggression, enrichment materials, floor type, pig welfare

PA23040 Development of image-based algorithm for body weight prediction of Ross 308 broiler chickens

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Recently, various ICT technologies are being developed to solve problems such as expansion of farm scale, aging of workers, and decrease in labor force. In this study, an image-based broiler weight prediction algorithm was developed. A total of 700 1-day-old Ross 308 broilers were used, and rearing conditions were maintained according to the general Ross 308 guidelines. In particular, a test bed equipped with a 3D video camera was fabricated for image collection and deep learning according to growth. Images were randomly selected from 40 chickens per day from the start of the experiment to the end. First, each actual body weight was measured and images were collected at four different heights. In addition, two cameras with masked R-CNN image segmentation networks in the rearing facility were mounted on the ceiling to predict body weight through cluster images. Predicted weight was calculated through an area-weight correlation analysis algorithm. A total of 2,880 individual images and 464 flock images were collected during the testing period. The predicted weight through the area weight correlation algorithm showed an error of up to 36% and at least 3% compared to the actual weight (final working weight 1,767g, predicted weight 1,710g). In conclusion, the weight prediction through the image area of the photographed object showed high accuracy, but it is judged that more image data collection and algorithm improvement are needed to accurately identify the object during the rearing period and reduce the error of the predicted weight.

Key words : broiler, predict body weight, algorithm, smart farm, rearing management

PA

PA23041 Evaluation of nutrient digestibility on various ingredient as a protein source in pet food by dogs age

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In pet food, protein is known to be an important nutrient that constitutes the body and affects not only the quality but also the price of dog food. However, protein sources available for dog foods are very limited. Therefore, this study was conducted to examine protein sources that can be used in dog foods. Experimental diets were formulated to meet the AAFCO nutrient requirements. Chicken (CM), beef (BM), black soldier fly larvae (BSFL), mealworm (MW), dried pollack (DP), and isolated soy protein (SP) were used as protein sources. The experiment was carried out with eight adult dogs (Beagles, 3.3 years old, neutered) and five senior dogs (Beagles, 10.5 years old, neutered). The experimental diets were provided based on the maintenance energy requirement for inactive adult dogs proposed by AAFCO (kcal/d 132×kg $BW^{0.75}$). Apparent total tract digestibility was evaluated using the indicator method with 0.5% chromium oxide. The results showed significant differences in the digestibility of major nutrients among all protein sources ($p < 0.05$). Animal-based proteins (CM, BM, and DP) exhibited slightly higher digestibility of major nutrients compared to insect-based proteins (BSFL, MW) and plant-based protein (SP). Additionally, although there was no significantly difference on the digestibilities of major nutrients, CP digestibility tended to be higher in adult dogs ($p = 0.096$). In conclusion, not only conventional animal-based protein sources (CM, BM) but also DP, BSFL, MW, and DP showed to be have potential value as protein sources in pet food. However, further research is required to ensure sufficient supply of essential amino acids for companion animals.

Key words : canine, protein, ingredient, apparent total tract digestibility, age

PA23042 2022년도 국내 제조·유통·수입 사료 중 유해물질 잔류/오염 실태조사

장은희, 김대중, 김효영, 나태웅, 박자영, 이승화, 한국탁
국립농산물품질관리원 시험연구소 성분검정과

이 연구는 국내 사료의 안전 수준을 파악하기 위해 유해물질의 잔류/오염 실태를 조사하였다. 국내 사료의 원료부터 최종 제품까지 안전수준을 알아보기 위해 2022년 3월부터 11월까지 단미사료(원료) 199점, 배합사료(최종제품) 172점, 보조사료 59점을 국내 제조·유통 사료(150점), 수입(280점) 단계로 구분하여 수거하였다. 사료에서 발견될 수 있는 유해물질 종류 및 국내외 허용기준 설정 항목 등을 고려하여 잔류 농약 330성분, 동물용의약품 121성분, 곰팡이독소 7성분, 유해미생물 3종, 중금속 6성분, 멜라민, 이산화황을 분석하였다. 유해물질의 검출 비율은 사료의 종류 특성 및 분석항목 수에 따라 나타났다. 유해물질별로 중금속(62.9%), 잔류농약(42.2%), 곰팡이독소(20.9%), 동물용의약품(4.7%), 유해미생물(1.6%) 순으로 나타났으며, 특히 과거에 문제된 멜라민, 이산화황의 경우 모든 시료에서 검출되지 않았다. 일부 유해물질 종류에서 검출률은 높았으나, 검출 농도는 낮아 실제 허용기준을 초과하지 않았다. 특히 중금속의 경우 사료에서 광물질을 원료로 사용하고 있어 검출 비율이 높게 나타난 것으로 추정되었다. 이는 미국(AFFCO)이나 EU(EFSA)의 모니터링 결과와 유사한 수준이었으며, 분석 항목이 다른 국가에 비해 훨씬 많은 점을 감안하면 전반적으로 안전한 수준으로 판단되었다.

Key words : 사료, 모니터링

PA23043 Effect of dietary concentrations of metabolic energy and crude protein on the performance and behavior of ducks

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The present experiment was conducted to evaluate the effect of dietary metabolic energy (ME) and crude protein (CP) on the performance and behavior of ducks. A total of 720, 1day-old ducks were divided into 3×2 factorial arrangements (6 replicate pens/group; 20 ducks/pen) and were assigned to the diet containing dietary levels of ME (1-21 d: 11.93, 12.14, 12.35 MJ/kg and 22-42 d: 12.77, 12.98, 13.19 MJ/kg) and CP (1-21 d: 21, 22% and 22-42 d: 17, 18%) respectively. Dietary interaction of 12.35 MJ/kg ME and 22% CP containing diet did increase ($p < 0.05$) weight gain and walking behavior and did decrease ground pecking and feeding behaviors at first 21d. During the 22-42 d, there was interaction of increase effect ($p < 0.05$) between 13.19 MJ/kg ME and 18% CP on the drinking behavior. In the main effects of each ME or CP, the higher ($p < 0.05$) weight gain and walking behavior and the lower ($p < 0.05$) ground pecking behavior were confirmed in ducks fed with 12.35 MJ/kg ME than in those fed with 11.93 and 12.14 MJ/kg ME at 1-21 days of age. Drinking behavior increased ($p < 0.05$) in ducks fed a diet with high CP content (1-21 d: 22% and 22-42 d: 18%) than those fed a diet with normal CP content (1-21 d: 21% and 22-42 d: 17%). Therefore, the results suggest that 12.35 MJ/kg ME and 22% CP for 1-21 days of age is effective for enhancing growth performance without causing any adverse effects on the behavioral needs of ducks.

Key words : metabolic energy, crude protein, performance, behavior, ducks

PA23044 Decreasing in dietary protein concentration reduced fecal odor compounds in 15- and 30-kg pigs, but reductions of slurry odor compounds were observed only in the 15-kg pigs

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The aim of this study was to determine the effects of lowering crude protein (CP) concentrations of pig diets with supplemental amino acids (AA) on volatile fatty acids and volatile organic compounds in feces and slurry. Four experiments were conducted using 12 barrows with an initial body weight of 15.2, 29.9, 50.2, and 78.2 kg (standard deviation = 0.7, 1.8, 2.2, and 3.7). Three experimental diets were formulated for each experiment, and the diets were formulated to have a graded decrease in CP concentration by 2 percentage units. The experimental diets with the highest CP concentration in phase 1, 2, 3, and 4 were 19.4%, 16.8%, 16.8%, and 15.1%, respectively. All experimental diets were supplemented with indispensable AA to meet all indispensible AA requirements. The fecal butyric acid, valeric acid, and p-cresol obtained from 15-kg pigs linearly decreased ($p < 0.05$) with decreasing dietary CP concentrations. The fecal isobutyric acid, isovaleric acid, and p-cresol linearly decreased ($p < 0.05$) with decreasing dietary CP concentrations in 30-kg pigs. The slurry acetic acid and butyric acid linearly decreased ($p < 0.05$) as dietary CP concentrations decreased in 15-kg pigs. In conclusion, the decrease in dietary protein concentrations resulted in reduced fecal odor compounds in 15-kg and 30-kg pigs, but reductions of slurry odor compounds were observed only in the 15-kg pigs.

Key words : crude protein, volatile fatty acids, volatile organic compounds, swine

PA23045 Fatty acid composition in animal protein sources of pet foods

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The protein sources used in pet food come from a variety of meats, including chicken, duck, beef, and salmon. These meat ingredients contain more than just protein; they also contain varying levels of fat. We analyzed the fatty acid content of 26 meat ingredients commonly used in pet food. Linolenic acid is an essential fatty acid that needs to be included in the diet because animals cannot synthesize it on their own. Salmon fillets were found to have the highest content of linolenic acid, with 2.06 g/100 g. Arachidonic acid is another essential fatty acid, particularly important for carnivores like cats. It is crucial to have a good source of arachidonic acid in the diet for the overall health of these animals. Duck liver had the highest content of arachidonic acid, with 0.44 g/100 g. Furthermore, salmon fillets were found to contain the highest number of fatty acids among the analyzed ingredients, with 31 different fatty acids. Beef brisket and beef liver followed closely, containing 26 fatty acids. This indicates that salmon fillet, beef brisket, and beef liver are rich sources of a wide range of fatty acids. Considering the variations in fatty acid profiles, it is important to select a diverse range of protein sources in pet food to ensure that animals receive a well-rounded nutritional profile. Including different meat ingredients helps provide a variety of essential fatty acids, ensuring the overall health and well-being of our pets

Key words : fatty acids, nutrition, pet food, animal protein sources

PA23046

A technology to improve marketted-pigs from high-yielding sows

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The domestic pig farming industry has been continuously developing. However, it is still far from matching European pig production levels. Denmark's Piglet per Sow per Year (PSY) is 33.9 heads, and Marketted-pigs per Sow per Year (MSY) is over 31.6 heads, which shows a significant difference compared to Korea's PSY of 22 heads and MSY of 19 heads. In Korea, there is an increasing number of farms introducing high-yielding sows, resulting in an increase in MSY. The top-performing farms have improved their MSY to over 30 but there is high variation of MSY in the country that have been observed. Therefore, it can be analyzed that pig farms in Korea are potentially producing high number of piglets, but the piglets' survival until market is decreasing. Various management practices were employed on the piglets of high-yielding sows. Their litters were raised in a container pig house and supplemented with liquid feed or milk substitutes. The results of the study showed that survival rate of the piglets was improved and it was correlated to low level of ammonia which was lower by 47%. Reduction was due to improving room environment by utilizing slurry as liquid fertilizer. In conclusion, MSY can be improved by providing good farm environment and piglet management.

Key words : high-yielding sows, piglet, treatment management, raising, technology

PA23047

The effect of Soregen Technology® Feed on blood biochemistry profile and excreta noxious gasses of broiler chickens and laying hens

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This study was designed to investigate the effects of Soregen Technology® feed (ST-feed) on blood biochemistry profiles and excreta noxious gas emission in broiler chickens and laying hens. Soregen Technology® proposed that exposure to a quantum entanglement signal program improves the function and characteristics of the materials. A total of 96 (Arbor Acres) one-d-old broiler chickens and 88 Isa Brown laying hens (70-72 weeks) were reared for 5 weeks. The birds were randomly distributed into two treatment groups (Control and ST-feed). The birds had ad libitum access to feed and drinking water. Based on our results, it can be stated that ST-Feed did not influence blood biochemistry profile parameters so it did not cause health issues. In the experiment with ST-Feed, a significant difference in excreta noxious gas was found ($p < 0.05$). Quantum information in the ST feed may inhibit pathogenic microorganisms' growth and reduce excreta noxious gas emissions. Further tests are needed for more general explanations and recommendations for evaluating ST-Feed as poultry feed. It would be appropriate to perform other studies to verify the effect on animals with infected animals.

Key words : Soregen Technology® feed, blood biochemistry profile, excreta noxious gas

PA23048

The sustainable and reliable artificial-GIT model mimicking the digestive conditions of domestic animals

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A variety of anti-nutritional factors (ANFs) present in animal feedstuffs hinder the digestion of dietary feed in domestic animals. As a solution to this issue, there has been increasing interest in incorporating ANF-degrading enzyme supplements into animal diets. Additionally, due to the fluctuating prices of carbohydrate and protein sources like corn and soybean meal, there is a growing emergence of alternative feed ingredients that can be produced consistently. Despite the increasing need for evaluating feed additives, such as enzyme efficacy and nutrient digestibility, most standardized assays fail to fully reflect *in vivo* studies. Moreover, conducting *in vivo* studies often requires significant time, costs, and even the sacrifice of animals. To reliably assess feed ingredients and additives in animal digestion and achieve sustainability by reducing reliance on *in vivo* studies, the CJ 29+ Animal Nutrition & Health (ANH) Platform was developed, capable of mimicking digestion in the animal gastrointestinal tract (GIT). Firstly, by characterizing the behavior of enzymes in the GIT, we gain insights into their efficacy during the sequential digestion process and evaluate enzyme activity under various digestive conditions. Secondly, the Artificial GIT System provides valuable insights for predicting digestibility parameters such as viscosity, ANF digestibility, and protein digestibility. The CJ 29+ ANH Platform effectively simulates swine and poultry digestion conditions and exhibits a strong correlation between the results of *in vitro* and *in vivo* studies.

Key words : animal nutrition, feed enzyme, alternative protein source, artificial, anti-nutritional factor, NSPase

동물생명공학

PB23001 Effects of omega-3 as feed additive on quail and eggs

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The increasing demand for healthy functional foods has sparked interest in investigating the effects of high-quality omega-3 supplementation on quails and their eggs. In this study, 360 six-week-old quails were assigned to four groups: control (without any additives), T1 (0.05% omega-3), T2 (0.1% omega-3), and T3 (0.2% omega-3). The blood cholesterol and egg yolk fatty acid ratio were analyzed in this study. Egg production rates were increased for the T1 and T2 groups in the fourth week ($p < 0.05$). Additionally, compared to the second week, total cholesterol levels decreased in the fourth week for both control and T1 ($p < 0.01$) in the serum. Notably, the T3 exhibited the highest levels of HDL (high-density lipoprotein)($p < 0.0177$). Also, in the fourth week, T3 displayed a significant reduction in LDL (low-density lipoprotein) compared to the second week ($p < 0.05$). The fourth-week egg yolk showed higher levels of PUFA (polyunsaturated fatty acid), DHA (docosahexaenoic acid), omega-3, and omega-6, while having lower levels of MUFA (monounsaturated fatty acid) compared to the second-week ($p < 0.01$). Moreover, the T3 consistently demonstrated the highest levels of DHA and omega-3 ($p < 0.01$). These findings highlight the positive impact of omega-3 supplementation on quail egg production and nutrient composition, demonstrating its potential to enhance the health-functional properties of both quail and their eggs.

Key words : omega-3, quail egg, fatty acid, cholesterol, HDL

PB23002 Whole-genome sequence analysis and probiotic potential of *Bacillus velezensis* strain BC07 isolated from pickled mangoes

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In this study we isolated the strain BC07 from Vietnamese pickled mangoes and characterised it with respect to its probiotic potential in animals. Whole genome sequencing was performed on the FLO-MIN106 and MIN-101B platform. The strain was confirmed to be *Bacillus velezensis* based on its 16S rRNA gene sequence and an average nucleotide identity (ANI) score > 97.88% compared to the *Bacillus velezensis* type strain. The BC07 genome was found to consist of a 3,929,778 bp long circular DNA strand containing 3,977 protein coding sequences and no plasmid. In *silico* analysis revealed 8 gene clusters corresponding to secondary metabolite synthesis as well as a 3-gene operon and a 12-gene operon related to biosynthesis of riboflavin and exopolysaccharides, respectively. Additionally, we neither found genes related to production of toxins (emetic- and enterotoxins) nor horizontally transferable antimicrobial resistance (AMR) thus ruling out safety concerns in this strain. On evaluation of its probiotic properties, BC07 demonstrated a tolerance to heat treatment; acidity, and bile salts in the mammalian gut; as well as an ability to adhere to mammalian epithelial cells. Overall, *B. velezensis* strain BC07 is a safe, potential probiotic that also has an ability to synthesize biopolymers of industrial and biomedical importance.

Key words : *Bacillus velezensis* strain BC07; whole-genome sequence; probiotics

PB23003 Lauric acid reduces apoptosis by inhibiting FOXO3a-signaling in Deoxynivalenol-treated IPEC-J2 cells

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Deoxynivalenol (DON) is produced by *Fusarium* species, is found in feed ingredients derived from grains such as corn, barley, and wheat. Intake of DON-contaminated feed has been known to induce to damage in small intestine. Lauric acid (LA) is a medium chain fatty acid, which has been used for antimicrobial activity and reduction of inflammatory response and oxidative stress in the intestine of monogastric animal. However, the molecular mechanism by which LA exerts it effects on the DON-induced apoptosis in small intestine has not been studied. Therefore, we investigated a mitigation effect of LA to DON-induced apoptosis via FOXO3a signaling pathway in small intestine epithelial cells. We confirmed that LA alleviates to DON-induced cytotoxicity and apoptosis. In addition, LA mitigated the DON-induced translocation of FOXO3a into nucleus. These results suggest that lauric acid attenuates the small intestine damage by DON-induced apoptosis via FOXO3a signaling pathway in small intestine epithelial cells. This study may help to research to mitigation of deoxynivalenol-mediated damage and could be used as a feed additive for productivity improvement in pig industry.

Key words : IPEC-J2 cells, deoxynivalenol, lauric acid, apoptosis, FOXO3a signaling pathway

PB

PB23004 TLR/MyD88-Mediated Inflammation Induced in Porcine Intestinal Epithelial Cells by Ochratoxin A Affects Intestinal Barrier Function

Jung Woong Yoon and Sang In Lee
경북대학교

The intestinal epithelium maintains normal homeostasis by nutrient uptake and protection against harmful substances. However, impaired intestinal epithelium causes various symptoms such as diarrhea, weight loss, and immune and barrier dysfunction. Ochratoxin A (OTA), a metabolite produced by several fungi, is exposed in the main raw material of livestock feed and is a potential target for intestinal epithelium. Thus, we confirmed molecular alterations caused by OTA using an intestinal epithelial cell line (IPEC-J2) as an in vitro model. In gene expression profiling, we confirmed that OTA treatment induced upregulation and downregulation of differentially expressed genes. Based on these DEGs, we further performed in genes related to TLR/MyD88 signaling in IPEC-J2 treated with OTA. MyD88 activation and mRNA changes of various inflammation-related genes were induced, and the tight junction and intestinal barrier function were damaged. We also confirmed whether inflammatory cytokine and intestinal barrier function were affected by MyD88 regulation. Cotreatment of OTA with MyD88 regulation mitigated inflammatory cytokine and impairment of tight junction and intestinal barrier function. These results may provide essential clues for understanding OTA exposure in porcine small intestinal epithelial cells and discovering biomaterials capable of mitigating OTA toxicity.

Key words : IPEC-J2 cells, Ochratoxin A, gene expression profiling, Intestinal barrier, TLR/MyD88 signaling

PB23005 Can a bolus sensor measure the water intake consumption of each Holstein dairy cattle?

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The aim of this study was to predict individual water intake in Holstein dairy cattle using a bolus sensor. Twelve male Holstein dairy cattle (8 ± 5.3 months of age, 352 ± 5.9 kg of BW) were fitted with a bolus sensor and divided into two groups. Six calves had access to an automatic water supply, while other calves were provided with water that was weighed before being given to them. All calves were given water (20 ± 1.4°C) at three times (09:00, 13:00, and 17:00) a day. Changes in rumen temperature were monitored when calves consumed water, and the area under the curve (AUC) was analyzed. Using the collected data, an estimated regression equation was established to estimate individual water intake as follows: $y = 0.0562x + 4.4569$, $R^2 = 0.7272$, where y represents estimated water intake and x represents AUC. Based on this finding, we obtained an accuracy of 73.9% by comparing between the calculated water intake by estimated regression equation and water intake we measured. Beside, an accuracy of between water intake by estimated regression equation and that by automatic-recorded water supply was 63.0%. Taken together, we suggest that estimated regression equation based on the rumen temperature changes in response of water consumption using a bolus sensor can be useful to predict individual water intake in Holstein dairy cattle and to monitoring health of ruminant.

Key words : water intake, bolus sensor, rumen temperature, Holstein dairy cattle

PB23006 Bioinformatics analyses of liver transcriptomes of the Ogye chickens

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In this study, we compared the transcriptomes of Ogye and Cornish chickens to understand the transcriptional mechanisms related to liver function. We analyzed RNA-sequencing data from liver samples of 5-week-old and 10-week-old Ogye and Cornish chickens to identify differentially expressed genes (DEGs) using EdgeR. Further bioinformatics analysis, including gene ontology (GO) and pathway analysis, was performed using DAVID. For 5-week-old Ogye livers, the most enriched GO terms for biological processes (BP) were related to translation (GO:0006412), cytoplasmic translation (GO:0002181), and ribosomal small subunit assembly (GO:0000028). In 10-week-old Ogye livers, the most enriched GO terms for BP were fibrinolysis (GO:0042730), cellular response to cAMP (GO:0071320), plasminogen activation (GO:0031639), and regulation of inflammatory response (GO:0050727). In terms of molecular function (MF), the most enriched GO terms for 5-week-old Ogye livers included structural constituent of ribosome (GO:0003735), DNA-directed RNA polymerase activity (GO:0003899), and poly(A) RNA binding (GO:0044822). For 10-week-old Ogye livers, the most enriched MF terms were heparin binding (GO:0008201), extracellular matrix binding (GO:0050840), cysteine-type peptidase activity (GO:0008234), and cytokine receptor activity (GO:0004896). Additionally, KEGG pathway analysis revealed significant enrichment of the Ribosome pathway (gga03010), Oxidative phosphorylation (gga00190), and Lysosome (gga04142) for 5-week-old Ogye livers. For 10-week-old Ogye livers, the enriched pathways included Amino sugar and nucleotide sugar metabolism (gga00520), Glutathione metabolism (gga00480), and Fatty acid degradation (gga00071). Further research is necessary to validate the differential expression of DEGs and explore their functions. These findings will provide valuable genomic resources for understanding liver function and improving Ogye chickens.

Key words : ogye, cornish, livers, bioformatics analysis, transcriptomes

PB23007

Designing a decision-making support model for gestational pig breeding using breeding and environmental information of sows

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Determining the productivity of a pig farm starts with sow management. Artificial insemination during the normal estrus of pregnant sows marks the beginning of the decision-making process. Unlike fattening pigs, gestational pigs require individual breeding management, so they are raised individually in separate stalls. However, since normal heat does not occur 100% of the time as managed by the manager, some farms conduct heat observation even at night to increase farm productivity. Smart technologies are being developed to solve these challenges in the field, but most of the first-generation smart livestock equipment focuses on obtaining environmental information. Consequently, a significant amount of data is generated on pig farms as well. General first-generation information can be typically divided into specification information and environmental information. Breeding information can be classified into feed intake, water intake, date of return estrus, and more. Environmental information typically includes temperature, humidity, and ammonia levels. In the history of pregnancy or mating, it is crucial to determine the timing of mating for waiting pigs. A model has been designed to provide an alarm by using the current breeding information and environmental data as input. The final decision on the optimal time for mating will be accomplished by integrating artificial intelligence technology.

Key words : sows, breeding information, environmental information, decision support, artificial intelligence

PB23008

Hydrolysis protein isolated from the black soldier fly improve the gut function and has an anti-inflammatory effect

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Hermetia illucens (Linnaeus) larvae-derived hydrolysis protein (HP) represents a valuable source of compounds for the feed and food industry. This study aimed to assess the functional role of HP in enhancing nutritional quality. Comparative analysis with *Tenebrio molitor* hydrolysis protein (TP) revealed that HP significantly improved protein efficiency ratio, net protein ratio, net protein utilization, and biological value. Furthermore, HP exhibited the ability to modulate plasma levels of immunoglobulin G (IgG), interferon-gamma (IFN-γ), histamine, and immunoglobulin E (IgE). In addition, HP stimulated cell migration and proliferation while suppressing mRNA expression of pro-inflammatory cytokines interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-α), and interleukin-1β (IL-1β) in gastrointestinal epithelial cells. These findings emphasize the potential of HP as a promising nutritional protein source, offering anti-allergic and anti-inflammatory properties for various applications in the feed and food industry.

Key words : anti-inflammatory, *Hermetia illucens*, hydrolysis protein

PB23009 Regulation of adipogenesis signaling events by *Momordica cochinchinensis* extracts to abrogate accumulation of plasma lipids and adipose tissue mass

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Momordica cochinchinensis (MC) is a unique tropical fruit with culinary and medicinal significance in Southeast Asia. This study investigated the effects of oral administration of MC on plasma lipoprotein levels and associated adipogenesis signaling events in a high-fat diet (HFD)-induced obesity mouse model. The results showed that MC significantly induced body weight loss and reduced the weights of epididymal and retroperitoneal white adipose tissues in obese mice. Furthermore, MC treatment effectively decreased the plasma levels of total cholesterol, cholesterol ester, and free cholesterol induced by HFD. It also inhibited the HFD-induced increases in free fatty acids, triglycerides, and low-density lipoprotein, while preventing the decrease in high-density lipoprotein levels. In the liver tissue of HFD-induced obese mice, MC treatment abrogated the phosphorylation of AKT, mTOR, and PPARγ, as well as the expression of FAS, which are involved in adipogenesis signaling. Histological analysis revealed that MC significantly reduced lipid droplet enlargement in the liver and white adipose tissues of HFD-fed mice. These findings suggest that MC exhibits anti-obesity effects by regulating triglyceride and cholesterol metabolism, as well as modulating adipogenesis signaling events, thereby reducing lipid accumulation. These results contribute to the understanding of MC's potential as a dietary intervention for obesity and associated metabolic disorders.

Key words : adipogenesis, *Momordica cochinchinensis*, obesity

PB23010 Frequency of beta-casein gene polymorphism in Jersey cows in Korea

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The most common types of beta-casein in cow's milk are A1 and A2, which differ by one amino acid (A1; histidine, A2; proline) at position 67 of the chain. Recently, there has been an increased demand for milk produced from cows with the A2A2 genotype (A2 milk). This study aimed to investigate the frequency of A1 and A2 alleles of the β-casein gene in Jersey cows in Korea. Blood samples were collected from a total of 41 Jersey cows on a dairy farm located in Cheonan, Korea, in December 2022. All cows were housed in compost-bedded pack barn and were milked by an automatic milking system (Lely, Astronaut). As a result, out of the 41 individuals, 30 (73.17%) were of the A2A2 genotype, and 11 (26.83%) were of the A1A2 genotype. No cows with the A1A1 genotype were found. These results suggest that Jersey cows can be considered an attractive breed for marker-assisted selection to create A2A2 herds due to the high frequency of the A2 variant.

Key words : A2 milk, beta-casein, genotype frequency, Jersey

PB23011 Effects of *Lactiplantibacillus pentosus* on gut microbiota composition in weaning pigs

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Stress during the post-weaning period in pigs can lead to an imbalance in th gut microbiota, which in turn can cause negative effects on the growth performance. This study examined the effects of feeding different concentrations of *Lactiplantibacillus pentosus* (*L. pentosus*) on pig gut microbiota. A total of 20 pigs were randomly assigned to four groups (5pigs/group). The pigs were fed diets containing 0%, 0.1%, 0.2%, and 0.3% of L. pentosus for 21 days, and fresh fecal samples were collected at the end of the experiment. Total DNA of the feces was extracted, and V5 to V6 regions of 16S rRNA genes were amplified using PCR. The barcoded 16S rRNA gene amplicons were sequenced using the Illumina MiSeq platform. The sequences were analyzed using QIIME2 and STAMP. At the phylum level, taxonomic analysis showed that the 0.2% treatment group had a higher relative abundance of Proteobacteria. At the genus level, the treatment group showed a lower relative abundance of *Terrisporobacter*, a pathogenic strain associated with intestinal inflammation, and *Methanobrevibacter*, an indicator of methane production. With increasing treatment concentration, the abundance of *Anaerotrucus*, which is known to produce short-chain fatty acid butyrate, was higher. These finding suggests that *L. pentosus* strain may have a beneficial effect on weaning pig digestion and health while also inhibiting the proliferation of harmful bacteria.

Key words : weaning pig, microbiome, gut microbiota, 16s rrna gene, *Lactiplantibacillus pentosus*

PB23012 Development of a rapid and sensitive method for the detection of African swine fever virus (ASFV) by combining recombinase polymerase amplification (RPA) with a lateral flow strip assay

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A rapid and specific method based on recombinase polymerase amplification (RPA) was developed for detecting African swine fever virus (ASFV), the causative agent of African swine fever. This method combines RPA of the ASFV p72 gene with lateral flow detection (LFD). The primers were designed to target the conserved region of the ASFV p72 gene. Reaction conditions were optimized by varying temperatures (25℃ to 39℃) and times (1 min to 5 min). The test showed high specificity to ASFV and no cross-reactivity with other porcine viruses. Using recombinant plasmid DNA containing the ASFV p72 region, the amplified product could be detected in less than 20 minutes, with a detection limit of 1.63×10^2 copies DNA/reaction. Analysis of 100 field samples demonstrated 100% agreement in the positive rate between RPA-LFD and real-time PCR. Overall, the RPA-LFD method provides a simple, sensitive, and specific approach for on-site detection of ASFV.

Key words : African swine fever virus, recombinase polymerase amplification, laternal flow strip, Real-time PCR, on-site detection

PB23013 Dietary synbiotics are associated with shifts in oropharyngeal, proximal colonic, and vaginal microbiomes of Korean native pigs

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Dietary probiotics and prebiotics have nutritional and health benefits which are commonly attributed to a modulatory effect on the gut microbiome of the host. However, involvement of extraintestinal microbiomes in such regimens remain unexplored, especially in rare breeds such as the Korean native pigs. Here, we evaluated the modulatory effect of synbiotics on the oropharyngeal, proximal colonic, and vaginal microbiomes of the Korean native pigs using 16S rRNA gene sequencing. We found increased abundances of an unclassified deltaproteobacterial genus in oropharyngeal communities of pigs supplemented with a *Lactobacillus*-based synbiotic. These pigs also had increased abundances of unclassified genera of *Tremblayales* and *Lactobacillales* in their proximal colons. In another group, pigs supplemented with a *Bacillus*-based synbiotic had increased *Megasphaera* and reduced *Campylobacter* within their oropharyngeal microbiota. And their vaginal microbiota had increased *Clostridium*, and *Halalkalibacillus* as well as reduced *Filifactor* and *Veillonella*. We then explored changes in the predicted microbial functionality, associated with the synbiotics. The results confirm that dietary synbiotics modulate the microbiome in not only the proximal colons but also the oropharyngeal cavities, and vaginal tracts of these pigs.

Key words : Bacillus, Lactobacillus, fructo-oligosaccharide, Synbiotics, Microbiome, Korean native pigs

PB23014 배아줄기세포 배양액이 소 체외수정란 생산에 미치는 영향

권대진, 최세령, 김승하, 박경도, 이학교
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배아줄기세포는 배반포의 내부세포괴(Inner Cell Mass, ICM)으로부터 확립되며, 모든 세포로 분화될 수 있는 능력이 있어 재생의학, 번식공학을 비롯한 다양한 분야에서 활발히 연구되고 있는 세포다. 최근 상용화된 줄기세포 배양액(mTeSR1)을 이용하여 안정적으로 배양 가능한 소 배아줄기세포 확립 방법이 개발되어 소 줄기세포를 이용한 생식세포 생산을 비롯한 다양한 연구가 활발히 진행되고 있다. 본 연구에서는 소 체외수정란 생산에 있어서 mTeSR1 첨가에 따른 배반포 생산성과 배반포의 질적 특성을 검토하였다. 체외수정된 난자는 0 (대조군), 1, 2.5, 5%의 mTeSR1이 첨가된 mSOFaa 배양액으로 배양하며 수정란의 발달률 및 배반포의 유전자 발현 양상을 검토하였다. 분할율(2-cell) 및 8-cell 발육율은 모든 시험구에서 차이가 없었으며(65.48-73.17% 및 41.18-50.00%), 배반포 발육율 또한 27.38-33.75%로 처리구간 차이가 없었다. 하지만 배양 3일차 8-세포기를 기준으로 하였을 경우 배반포 발육율은 대조구보다 처리구에서 유의적으로 높았으며(64.29 vs 80.00-82.50%, $p < 0.05$), 배양 7일차 해칭율의 경우 첨가 농도가 높을수록 증가하는 경향을 보였다(17.39-47.37%, $p < 0.05$). 배양 7일차 배반포를 이용하여 줄기세포 관련 인자들의 발현 양상을 검토하였다. Pou5f1, Sox2, Nanog, c-Myc, and ZFP42 유전자의 발현은 대조구보다 처리구에서 유의적으로 높게 나타났으며($p < 0.05$), 세포사 억제 유전자도 처리구에서 높게 나타났다. 본 연구결과 질적으로 우수한 체외수정란 생산을 위해 mTeSR1이 효과적으로 활용될 수 있을 것으로 사료된다.

Key words : 체외수정란, 줄기세포배양액, embryo quality, pluripotency, cattle

PB23015

성견과 노견의 장내미생물 군집 비교 분석

조현우, 서강민, 이민영, 김기현, 천주란
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본 연구는 성견과 노견의 장내미생물 데이터베이스 구축 및 연령에 의한 장내미생물의 변화를 비교분석 하기 위해 수행했다. 장내미생물 분석을 위해 동일한 환경(식단, 주거환경, 온도, 생활패턴 등)에서 양육된 성견(6세)과 노견(13세)의 분변샘플을 활용했다. 모든 반려견들은 질병이 없고 건강했으며, 성견은 총 22마리로 비글(n = 16), 시추(n = 2), 포메라니안(n = 2), 요크셔테리어(n = 2)였고, 노견은 비글(n = 4), 말티즈(n = 5), 푸들(n = 6), 슈나우저(n = 2)로 총 17마리였다. 동시간대에 채취한 39개의 분변샘플에서 DNA 추출 후, 16s rDNA내 V3-V4 영역의 염기서열을 활용했고, 염기서열 데이터는 QIIME2(version, 2020.11)로 분석했다. 장내미생물의 다양성 분석에서 Shannon 지수 (p = 0.044)와 Simpson 지수 (p = 0.022)에서 샘플 간의 차이가 있었고, unweighted Unifrac distance (p = 0.017), Jaccard distance (p = 0.001), Bray-Curtis distance (p = 0.013)에서 연령 차이에 의해 장내미생물 생태계가 다른 것을 확인했다. 그리고 문 수준의 장내미생물인 *Bacteroidetes*, *Firmicutes, Fusobacteriota* 순서로 성견에서 군집의 비율이 우세했지만, 노견에서는 *Bacteroidetes*, *Firmicutes, Proteobacteria*의 순서로 군집 비율이 우세했다. 속 수준에서는 14개의 알려진 장내미생물의 비율이 통계적으로 차이가 있는 것을 확인했다. 국내 반려견 산업의 비약적인 규모 증가는 양적 성장뿐만 아니라 질적으로도 지속적인 성장세를 유지하고 있다. 따라서 본 데이터는 반려견의 장내미생물에 대한 이해를 증진시킬 수 있을 뿐만 아니라, 반려동물 산업의 발전을 위한 기반 데이터로써 활용가치가 있을 것으로 생각된다.

Key words : canine, microbiome, age, gut microbiota, dog

PB

PB23016

The difference of gut microbiome composition in Crested gecko lizard (*Correlophus ciliatus*) according to the growth stage

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The gut microbiome plays an important role in the digestive and immune systems of host animals. The domestic reptile market is expanding as a high-value-added industry. Lizards mainly eat fruits and insects and excrete feces and uric acids through the cloacal cavity. Due to these differences, the gut microbiota composition and digestive physiology for Gecko lizards were less known compared to mammals. Therefore, a total of 14 excreta samples from Crested geckos (*Correlophus ciliatus*) were analyzed to determine the gut microbiota composition. Excreta samples were from 6 juvenile geckos (BW: 3-5g) and 8 adult geckos (BW: 32-36g) were collected. No difference was detected in alpha diversity. However, a difference was found in beta diversity (0.02; PERMANOVA). At the phylum level, the relative abundance was 97.0% for *Proteobacteria*, *Firmicutes*, and *Bacteroidetes* in juveniles, and *Bacteroidetes*, *Firmicutes*, and *Proteobacteria* accounted for 93.8% in adults. At the genus level, the relative abundance was in the order of *Unclassfied*, *Bacteroides*, *Lactobacillus*, *Citrobacter*, and *Alistipes* in juveniles and *Bacteroides*, *Unclassified*, *Parabacteroides*, *Odoribacter*, and *Alistipes* in adult. Overall, the microbiota composition in Crested geckos varies depending on the growth stage. Further research is needed to investigate microbiota composition according to species, diet, light intensity, and humidity.

Key words : microbiome, reptile, crested gecko, growth stage

PB23017 High throughput screening for mitigating deoxynivalenol-induced apoptosis by FOXO3a signaling pathway in porcine intestinal epithelial cells

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Deoxynivalenol (DON) is a one of the mycotoxins that receive worldwide attention because it causes to growth delay, nutrient malabsorption, weight loss, emesis, and reduction of feed intake in livestock. Deoxynivalenol contaminated feedstuff is firstly absorbed in gastrointestinal track. However, molecular mechanism to small intestine damage by DON is not completely understood. Therefore, we profiled gene expression in porcine intestinal epithelial cells treated with DON. Additionally, we investigated the molecular function in vitro. Based on these results, we hypothesized that DON could induce the apoptosis via FOXO3a signaling pathway in intestinal epithelial cells. When DON was treated, apoptosis and apoptosis related genes (TRAL, BCL-6, CASP8, and CASP3) were significantly increased compared to untreated group. DON induces the translocation of FOXO3a into nucleus. Moreover, apoptosis and apoptosis related genes were significantly decreased when FOXO3a was knock-down using a siRNA. ERK1/2 inhibitor treatment suppressed the translocation of FOXO3a into the nucleus. Based on these results, to mitigating by DON-induced apoptosis via FOXO3a, we performed the high throughput screening. Ivangustin alleviated the DON-induced cytotoxicity. Also, it decreased DON-induced apoptosis and mRNA expression level of apoptosis related genes. In addition, when Ivangustin was treated, it inhibited translocation of FOXO3a into the nucleus. Based on these results, we confirmed to mitigation effects of Ivangustin to apoptosis according to FOXO3a signaling pathway by DON. Our study may improvement understanding to DON-induced damage mechanism. It may help research on novel alternative to mitigation cytotoxicity of DON and may be applied as a feed additive for productivity improvement in the pig industry.

Key words : apoptosis, deoxynivalenol, differentially expressed genes, Forkhead box

PB23018 Multiomic-based evaluation of probiotics properties of spore-forming Clostridium ssp. isolated from weaned piglets

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After the use of antibiotics for livestock has been banned due to the emergence of antibiotic-resistant bacteria, the demand for seeking an alternative to antibiotics increased. Especially probiotics have attracted numerous attention, however, there has been constraint related to susceptibility during storage. Therefore, we isolated novel probiotics candidates with spore-forming ability including *Clostridium* genus from weaned-pig feces. Spores can endure harsh environments like feed processes, so they can be used as feed additives. Based on culturomics results, we isolated *Clostridium sporogenes*, *Clostridium beijerinckii*, *Clostridium baratii*, *Clostridium hiranonis*, and *Clostridium butyricum* from the swine's feces. They showed probiotics functionalities including acid tolerances, bile tolerances, and gut adhesion abilities. Next, we conducted an experiment using *Caenorhabditis elegans* to investigate the biological function of spore-forming *Clostridium*. The result of *C. elegans* experiment indicated that spore-forming *Clostridium* can increase the immune response as well as longevity. Moreover, the supplementation of probiotic *Clostridium* influence on the microbial diversity in Fermentation of the Intestinal Microbiota Model (FIMM) system as artificial intestinal environments of pigs. Collectively, this study showed that spore-forming Clostridium has probiotics properties, and it could be used as a novel feed additive in the swine industry.

Key words : probiotics, feed additive, *Clostridium*, spore-forming bacteria, weaned pig

PB23019 The antioxidant activity and cell surface hydrophobicity of Kimchi-derived *Limosilactobacillus fermentum* JNU532

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Limosilactobacillus fermentum has been identified as a potential probiotic and is used in food as a gut microbe probiotic to prevent and treat various health problems. Cell surface hydrophobicity of a probiotic strain is a measure of its intestinal colonization, that is, adhesion and persistence once they have entered the intestinal cavity. In previous studies, it has been confirmed that *Limosilactobacillus fermentum* JNU532 has acid and bile acid tolerance. In this study, hemolytic activity and cell surface hydrophobicity (bacterial adhesion to hydrocarbons (BATH), cellular auto-aggregation, and co-aggregation) of *L. fermentum* JNU532 were measured. The *L. fermentum* JNU532 exhibited cell-surface hydrophobicity of 10.43%, auto-aggregation of 16.42%, and co-aggregation of 16.6%. The antioxidants in the cell-free supernatant (CFS) of *L. fermentum* JNU532 were evaluated. The lipid peroxidation activity of CFS at 300 μg/mL is 19.75%. The superoxide dismutase (SOD) activity of CFS at 300 μg/mL was 5.74%, and the scavenging of hydroxyl (OH-) radicals by CFS at 300 μg/mL was 16.01%. *L. fermentum* JNU532 had γ-hemolytic activity. Therefore, it has a good prospect for the development of probiotics in dairy products, cosmetics, health products, etc.

Keywords: antioxidant, *Limosilactobacillus fermentum*, probiotic, superoxide dismutase.

PB

PB23020 Establishment of canine mammary gland tumor cell lines harboring PI3K/Akt activation as a therapeutic target

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Canine mammary gland tumors (MGT) have a poor prognosis in intact female canines, posing a clinical challenge. This study aimed to develop novel canine mammary cancer cell lines from primary tumors and to characterize their cellular and molecular phenotypes to identify potential therapeutic drugs. The MGT cell lines demonstrated rapid cell proliferation and colony formation in an anchorage-independent manner. Real-time PCR analysis showed that CDH1 expression was significantly reduced or eliminated in MGT cell lines as compared to normal canine kidney (MDCK) cells, while Vimentin and α-SMA levels were significantly increased. GSEA demonstrated that epithelial-mesenchymal transition (EMT) phenotypes and tumor-associated pathways, particularly the PI3K/Akt signaling pathway, were elevated in MGT cell lines. BYL719 (Alpelisib), a PI3K inhibitor, was also tested for cytotoxicity on MGT cell lines, and it significantly reduced their in vitro growth. Overall, our findings indicate that these MGT cell lines might be useful in future studies on tumor development, progression, metastasis, and treatments.

Key words : canine mammary gland tumors, cell lines, PI3K-Akt signaling, characterization, establishment

PB23021 Isolation and Identification of *Ligilactobacillus salivarius* Strain with Soy Protein-Degrading Capability

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Soy protein is a valuable source of essential amino acids with high nutritional value and functional properties for animal feed, but its complex structure can limit its usefulness. Feed usability can be improved by enhancing the availability and digestibility of soy protein by harnessing the soy protein-degrading ability of bacterial strains. In this study, we aimed to enhance the usability of soy protein by bacterial strains with soy protein-degrading ability. We isolated soy protein-degrading strains from feces of a healthy adult by incubating on Soy Protein Isolate (SPI) agar. Soy protein degradation activity of the isolate was confirmed by SDS-PAGE(Sodium dodecyl sulfate polyacrylamide gel electrophoresis) analysis. α- and α'-subunits of β-conglycinin and the acidic polypeptide of glycinin, which are major components of soy protein, were degraded by the isolate E1. E1 strain was identified as *Ligilactobacillus salivarius* species by 16S rRNA gene analysis. This study indicates that *L. salivarius* E1 can be a promising candidate for enhancing the usability of soy protein.

Key words : soy protein, degradation, lactic acid bacteria

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PB23022 *Latilactobacillus curvatus* BYB3 Isolated from *Latilactobacillus curvatus* BYB3 extract inhibited the activity of B16F10 and alleviated the immune organ damage caused by B16F10

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Latilactobacillus curvatus BYB3, a species of lactic acid bacteria (LAB) formerly known as *Latilactobacillus curvatus*, was isolated from kimchi. Probiotics have been shown in recent years to have a variety of positive health impacts, including the ability to treat cancer. There aren't many studies on probiotic extracts, though. The most dangerous type of skin cancer that has received a lot of attention recently is melanoma, which has the traits of being both extremely metastatic and invasive. In the current investigation, B16F10 mouse melanoma cells were exposed to BYB3, LGG, and GP1B, three distinct probiotics. The results of the MTT assay shown that *Latilactobacillus curvatus* BYB3 significantly lowered the proportion of all live cells compared to the other two probiotics. The results of our subsequent in vivo and histochemical investigations revealed that BYB3 extract could lower the rate at which melanoma cells developed tumors and raise the survival of mice that had been injected with melanoma cells. It can be seen through histochemical research that BYB3 treatment of the liver, spleen, and kidney reduced the harm produced by melanoma cells. Our findings demonstrate that *Latilactobacillus curvatus* BYB3 extract should be researched as a melanoma adjuvant.

Keywords: *Latilactobacillus curvatus*, melanoma cell, tissue damage, survival rate

PB23023 Pig house management 2nd generation decision-making support model using the breeding and environmental information of the finishing pigs

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The domestic pig farming industry is progressively becoming more corporate in scale each year. As a result, the number of breeding heads on farms is gradually increasing. As the number of breeding heads increases, the workload for managers is also increasing, making precise management challenging. Advanced technologies are being developed to address these field difficulties, and first-generation smart livestock equipment is being introduced and operated in pig farms. Most of the first-generation smart livestock equipment focuses on monitoring the current situation. However, a method utilizing this data is desperately needed. General first-generation information can be divided into specification information and environmental information. Breeding information can be classified into weight gain, feed intake, and water consumption. Environmental information includes temperature, humidity, ammonia, hydrogen sulfide, and CO2 levels. In fattening pigs, proper environmental management is crucial to ensure optimal growth. A model has been designed to control the environment and provide appropriate environmental control for finishing pigs using the current breeding information and environmental information as input data. The decision regarding appropriate environmental management will be accomplished by applying artificial intelligence technology.

Key words : finishing pigs, breeding information, environmental information, decision support, artificial intelligence

PB23024 Gut microbiota of rats as affected by deoxynivalenol

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Deoxynivalenol produced by Fusarium species is a chemical contaminant that causes growth performance (e.g., repress appetite and growth inhibition) in animals and human. Therefore, we aimed to investigate the effect of subacute exposure to deoxynivalenol in cecal microbiota of rats fed different concentrations. Animals were administered by oral gavage with normal saline and deoxynivalenol during the experimental period. In this study, the body weight of rats contaminated with DON was significantly decreased compared with the control group, but not average daily feed intake. The microbiota of the cecal flora was altered by DON. We also found that DON induced damage to caecum and liver tissue as well as inhibition of growth performance. DON causes bacterial flora disorders in rats, such as changes in flora diversity and the relative abundance of dominant phyla. The changes in DON-induced cecal flora were associated with the immune system. In conclusion, these findings suggest that DON caused populations of cecal flora related to intestinal health.

Key words : deoxynivalenol, rat, microbiota

PB23025 Gene expression profile of innate immune responses through pattern recognition receptor in gene-edited cells

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The innate immune system functionally recognizes pathogen-associated molecular patterns (PAMPs). Pattern recognition receptors (PRRs) recognize PAMPs and evoke the innate immune responses. PRRs include retinoic acid-inducible gene 1 (RIG-1)-like receptors (RLRs). RIG-1 as a RLRs member can recognize RNA viruses and induce IFNs and proinflammatory cytokines. The antiviral function of RIG-1 has been broadly reported in many species including humans, grass carp, and ducks. However, it was reported that chickens do not have RIG-1 in the genome. In this study, we transduced duck RIG-1 gene into DF1 chicken cells. To examine RIG-1 functioanlity and regulatrory pathway in DF1 chicken cells, we induced PRR activations and responses by Poly(I:C) which is structurally similar to dsRNA. Cells were subjected to RNA-sequencing analysis, which identify differentially expressed genes and function of RIG-1-mediated responsive genes. This study suggests that RIG-1 could contribute to immune responses in chicken as well as ducks. Additionally, this study could provide some insights into the genes mediated by RIG-1 activation.

Key words : CRISPR-Cas9, gene-editing, pattern recognition receptor, immune response

PB23026 Complete genome sequence of *Limosilactobacillus fermentum* JNU 532 as a chorismate synthase (aroC) mutant

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Lactic acid bacteria isolated from kimchi was identified and named *Limosilactobacillus fermentum* JNU 532. Lactic acid bacteria have been reported to have various beneficial properties and are commonly used as probiotics. Lactic acid bacteria play a crucial role in areas of food fermentation, industrial lactic acid fermentation, and health and medicine. As a potential probiotic, Fermented food products of *Limosilactobacillus fermentum* are generally considered safe. In this study, we present the complete genome assembly of the bacterial strain JNU 532. The final complete genome sequence consists of one circular chromosome (2,077,416 base pairs) with GC ratio of 51.5%.

Keywords : *Limosilactobacillus fermentum*, JNU 532, complete genome sequence

PB23027 A comparative study of extracellular vesicles isolation methods using bovine serum

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Extracellular vesicles(EVs) are nano-sized biovesicles containing nucleic acid and protein that are released from various cell types. As EVs play an important role in the pathobiological process, serum EVs are increasingly being studied as a source of disease biomarker in the medical field. Since serum contains many serum proteins such as albumin and other antibodies, an EVs isolation with high yield and low contamination is required. However, standardization of bovine exosomes isolation method is still limited. Here, we aimed to compare the efficiency and purity of EVs from bovine serum using most commonly used isolation techniques, either alone or in combination; (I) ultracentrifugation (UC), (II) UC with size exclusion chromatography (UC+SEC), and (III) membrane affinity based kit (exoEasy). We found that particle diameter of UC and UC+SEC are in range of appropriate exosome size(50-150nm), but exoEasy showed relatively higher diameter, as determined by NTA. Although particle concentration obtained by UC were higher than those obtained by other two methods, UC+SEC showed the highest purity. Only EVs isolated from UC-SEC, showed exosome marker CD81 expression by immunoblotting and typical cup-shape morphology in TEM observation. Also particle-protein ratio, being used to determine the relative contamination of other proteins on the isolated EVs, shows the highest value in UC-SEC. Overall, this results could serve as a guide to select the optimal EVs isolation method using bovine serum in veterinary medicine.

Key words : extracellular vesicles(EVs), isolation method, bovine serum, ultracentrifugation, size exclusion chromatography

PB23028 Evaluation of mucin-binding activity and HT-29 cell attachment in 11 strains of lactic acid bacteria

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Adhesion plays an important role in the colonization and persistence of probiotic bacteria in the gastrointestinal tract. In general, two mehtods (mucin-binding evaluation and HT-29 cell attachment) provide valuable insights into the adhesive properties of probiotics, helping researchers assess their potential for beneficial interactions within the gastrointestinal tract. Mucin-binding is a method used to assess the ability of probiotics to attach to mucin, which is a major component of the mucus layer in the gastrointestinal tract. HT-29 cells are a commonly used cell line derived from human colon adenocarcinoma. HT-29 cells are often employed to study the interaction between probiotics and intestinal cells. This research was conducted to investigate the correlation between the two methods by comparing the mucin-binding method and the HT-29 cell attachment method in 11 strains of probiotic candidates. As a result of the correlation analysis, the Pearson correlation coefficient was 0.98, indicating a strong positive correlation between the two methods. Therefore, when assessing the adhesion activity of probiotic candidates, we recommend first examining the adhesion activity of test strains using the mucin-binding method. Then, select a few strains with high adhesion. Finally, using the HT-29 cell attachment technique, the adhesion activity of the selected probiotic candidates should be confirmed.

Key words : mucin-binding, HT-29 cell, lactic acid bacteria, adhesion, probiotics

PB23029 Effects of ribonucleic acids in yeast extract on the viability of probiotic candidates

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Yeast extracts are food flavorings made from the yeast culture (bread or beer) and are used as additives or nutrients in bacterial media. Yeast extracts are rich in nutrients and bioactive substances and have potential effects on enhancing the viability and functionality of probiotics. In this study, we used a total of 8 commercial yeast extracts to evaluate the ribonucleic acid content. And we selected the best yeast extract of *Limosilactobacillus fermentum* JNU532 cultivation. The nucleotides of 8 yeast extracts were analyzed using HPLC, and as a result of the analysis, the yeast extracts contained AMP(Adenosine monophosphate), CMP(Cytidine monophosphate), UMP(Uridine monophosphate), IMP(Inosine monophosphate), and GMP(Guanosine monophosphate). Among the eight kinds of yeast extracts, HY-501 had the highest content of AMP (28.6 mg/g) and of GMP (15.9 mg/g). The growth rate of *Limosilactobacillus fermentum* JNU532 was approximately 158% higher in HY-501 than in other yeast extracts due to HY-501's high ribonucleic acids content. These results suggest that the ribonucleic acids of yeast extract significantly affects the growth rate of the probiotic strains.

Key words：probiotics, yeast extract, ribonucleic acids

PB23030 스마트 축산 모델 구축을 위한 돼지 생체와 환경 상호관계 조사

김훈섭, 노유진, 남철환, 구민정, 최영선
전라남도농업기술원 축산연구소

축산업은 전업화, 규모화가 이루어지고 있어 노동집약적인 산업이다. 하지만 현재 축산농가는 신규 인력 부족, 고령화 등으로 인해 어려움이 있다. 스마트팜은 ICT 기술 및 자동설비를 원격으로 제어하여 가축 사양 및 환경을 적절하게 유지·관리를 실시 할 수 있어 축산업에 꼭 필요한 기술이다. 축산 ICT 장비는 대부분 외국산 중심으로 보급되고 있어 호환성 부족, A/S 문제 등 고비용, 저효율이 문제가 발생되고 있으며, 환경측정과 영상정보전달 등 단순시설에 많은 투자가 되어 있는 수준이다. 1세대 스마트팜은 편의성 향상을 위해 보급된 형태이며, IT 기술을 호라용하여 데이터 수집 및 가축 상태와 환경정보를 모니터링하고 스마트폰 및 PC로 원격제어하는 기능이 주된 기능으로 수집된 데이터의 활용도는 낮은 수준이다. 아으로 나아가야할 2세대 스마트팜은 1세대 모델에서 수집되는 빅데이터를 지능정보기술로 처리하여 의사결정을 할 수 있는 세대로 2세대 스마트팜 구현을 위해 환경정보(온도, 습도, 이산화탄소, 암모니아 등), 생체정보(체중, 체온, 행동, 음성 등) 등 데이터를 수집하고 있으며 성장, 경제성 등 상호관계를 조사하고 있다. 국내 연구기관에서는 돼지 영상정보와 영상분석기술을 통합하여 돼지의 성장상태 및 체중의 변화를 측정 할 수 있는 기술을 실증평가 하고 있다. 빅데이터 영상 및 생체정보 분석을 통해 가축 행동패턴을 파악하고 가축질병 객체를 알고리즘화하여 객체에 대한 딥러닝 기반의 객체검출분석으로 이상개체와 환경 이상 상황을 농장주에게 알려 의사결정을 지원하는 모델을 개발할 계획이다.

Key words : 스마트팜, 돼지, 2세대, 생체정보

PB23031 Mitigating heat stress in chicken cells: the protective effects of the amino acid blend on protein denaturation and Oxidative

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Heat stress poses a global challenge in livestock production, and its impact is expected to worsen with rising global temperatures. In poultry, heat stress elevates body temperature, leading to protein denaturation, oxidative stress, and osmotic stress in tissues and cells. In our study, we investigated the mechanisms of overcoming heat stress by treating chicken cells with betaine or an amino acid (AA) blend. Initially, we examined the expression of heat shock proteins (HSP) 40 and HSP70 to assess the prevention of heat stress-induced protein denaturation in chicken cells. Both betaine and the AA blend upregulated HSP70 expression under heat stress conditions. Interestingly, only the AA blend treatment group showed an increase in HSP40 expression. Furthermore, we assessed the ability of betaine and the AA blend to reduce oxidative stress by examining the expression of heme oxygenase 1 (HO-1). Both betaine and the AA blend induced HO-1 expression, with betaine demonstrating particularly notable efficacy. Lastly, to evaluate the osmotic regulation function of betaine and the AA blend, we investigated the induction of tonicity enhancer binding protein (TonEBP). Both betaine and the AA blend enhanced the expression of TonEBP. Collectively, these findings suggest that the AA blend effectively overcome heat stress by controlling protein denaturation, oxidative stress, and osmotic stress.

Key words : amino acid, heat stress, betaine, heat shock protein, chicken, oxidative stress, osmotic stress, protein denaturation

PB23032 Exploring the distinctive functionalities of CJ amino acids assessed via the CJ 29+ ANH application platform

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The CJ 29+ Animal Nutrition & Health (ANH) Application Platform encompasses Feed, GIT (aritifical Gastro-Intestinal Tract), and Cell application components. The Cell application platform features CJ's proprietary "Cell-based evaluation system," which examines the gut-health-promoting and immuno-modulatory effects of products at the cellular level in animals. This study focuses on evaluating the product's anti-inflammatory, anti-oxidant, and anti-heat stress activities, which enhance both the immune system and intestinal barrier function. As a result, we have established a portfolio of CJ Amino acids with properties that promote gut health, based on four evaluation indices: anti-inflammation, anti-oxidation, anti-heat stress, and cell growth, utilizing the application platform. Notably, the granule form of CJ Amino acids exhibited exceptional functional properties compared to powder forms of amino acids, including high-purity reagents. We hypothesize that the remarkable features of CJ Amino acids stem from metabolites and cells of gram-positive bacteria, specifically *Corynebacterium glutamicum*, which are present in the granule types developed through CJ's own fermentation process using *Corynebacterium*. Furthermore, it has been confirmed that both the culture supernatant and cells of *Corynebacterium*, which produce CJ Amino acids, exert anti-inflammatory and anti-oxidant effects on porcine intestinal epithelial cells. Therefore, we conclude that CJ Amino acids arepromising candidates for promoting gut health.

Key words : animal nutrition, amino acids, cell application platform, swine, anti-inflammation, anti-oxidation, anti-heat stress, cell growth, corynebacterium

반추동물 영양 · 사양

PC23001 Characterization of novel lytic bacteriophages, vB_SbRt-pBovineB21 and vB_SbRt-pBovineS21, as new members of *Fischettivirus* infecting *Streptococcus bovis/equinus* complex (SBSEC) from Korean ruminants

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Streptococcus bovis/equinus complex (SBSEC) is one of the most important lactic acid-producing rumen bacteria causing subacute ruminal acidosis. Despite the significance of the ruminal bacteria, lytic bacteriophages (phages) capable of infecting SBSEC in the rumen have been rarely characterized. Hence, we describe the biological and genomic characteristics of two lytic phages (designated as vB_SbRt-pBovineB21 and vB_SbRt-pBovineS21) infecting various SBSEC species, including the newly reported *S. ruminicola*. The isolated SBSEC phages were morphologically similar to Podoviridae and could infect other genera of lactic acid-producing bacteria, including *Lactococcus* and *Lactobacillus*. Additionally, they showed high thermal- and pH-stability, and those characteristics induce strong adaptation to the ruminal environment, such as the low pH found in subacute ruminal acidosis. Genome-based phylogeny revealed that both phages were related to *Streptococcus* phage C1 in the *Fischettivirus*. However, they had a lower nucleotide similarity and distinct genomic arrangements than phage C1. Moreover, both phages could prevent bacterial biofilms of various SBSEC strains and other lactic acid-producing bacteria in vitro. Thus, the newly isolated two SBSEC phages were classified as new Fischettivirus members and could be considered as potential biocontrol agents against ruminal SBSEC bacteria and their biofilms.

Key words : *Streptococcus bovis/equinus* complex (SBSEC), rumen, *S. ruminicola*, *Fischettivirus*, biofilm

PC

PC23002 배합사료의 조단백질 수준이 비육후기 한우 거세우의 성장률, 반추위액 성상, 혈액 대사물질, 메탄 배출량에 미치는 영향 평가

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본 연구는 배합사료의 조단백질 수준이 비육후기 한우 거세우의 성장률, 반추위액 성상, 혈액 대사물질, 메탄 배출량에 미치는 영향을 평가하기 위해 실시되었다. 한우 거세우 24두(717±50.1 kg, 26월령)를 체중에 따른 난괴법으로 4개 처리구에 배치하였다. 배합사료는 각 우방에 설치된 1대의 배합사료 자동급이기를 통해 1일 급여량을 6회에 나누어 자동급여하였으며, 조사료(톨페스큐)는 섭취량이 기록되는 사료조에 1일 2회(0800, 1800) 직접 급여하여 자유채식토록 하였다. 개체 별 섭취량은 배합사료 자동급이기와 조사료 조를 통해 매일 기록되었으며, 체중은 4주 간격으로 측정하였다. 실험 개시 12주 후 경정맥에서 혈액을 채취하였으며, 반추위 삽관 튜브를 이용하여 연속된 3일동안 3회(0700, 1100, 1400) 반추위액을 채취하였다. 메탄 배출량은 laser methane detector를 사용하여 측정하였다. 배합사료 섭취량, 성장률, 사료효율의 유의적인 차이는 없었으나, 조사료 섭취량 및 총 건물 섭취량은 조단백질 수준이 증가함에 따라 증가하는 경향을 보였다($p < 0.1$). 처리구 간의 반취위액 성상 및 혈액 대사물질은 유의적인 차이가 없었다($p > 0.05$). 조사료의 중성세제불용섬유소 섭취량 당 호흡 및 트림으로 배출되는 메탄 배출량(ppm/kg)은 배합사료의 조단백질 수준이 증가함에 따라 유의적으로 감소하였다($p < 0.05$). 결론적으로, 배합사료의 조단백질 수준 증가는 비육후기 거세우의 조사료 섭취량을 증가시키고, 메탄 배출량에 영향을 주는 것으로 나타났다.

Key words : 조단백질, 한우 거세우, 메탄 배출량, Laser methane detector

PC23003 한국가축사양표준(젖소) 4차 개정판의 특징

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한국가축사양표준(젖소)은 2002년도 시작하여 2022년 4차 개정판을 발간하였다. 본 4차 개정판은 우리나라 낙농 실정을 고려하여 국내·외의 젖소 관련 연구 자료들과 맞춤형 연구과제 수행 결과를 해석하여 개정하였다. 4차 개정판의 주요 변경내용은 2-3차 개정판은 CNCPS 개념이 활용되었지만 국내 실증 연구 데이터와 최신 국내·외 자료를 종합하여 목차 및 주요 내용이 변경되었다. 제 1장에서는 국외 정미에너지와 대사에너지 요구량 추정 모델의 시스템을 조사하여 적절성을 평가하고 비유 정미에너지 요구량 추정 모델을 검증하였다. 그리고 기존 정미에너지에서 대사에너지를 적용하여 모든 계산식을 변경하였다. 또한 연구결과를 바탕으로 새로운 젖소의 유지에너지 요구량 산출공식 도출하였고 탄수화물 분획을 추가로 세분화하여 전분과 용해성 섬유소를 구분하여 제시하였다. 제 2장에서는 건물섭취량 예측식의 정확도를 확인하였고 사료 배합 시 섬유질 요구량을 NRC (2021)의 내용을 반영하였다. 유효 섬유질, 조사료, 농후사료의 NDF 분류를 재정립하였다. 제 3장에서는 단백질 분획의 종류와 산출 계산식을 수정하였고 사료 단백질의 반추위 분해율과 소장 소화율에 대한 계산식을 추가하였다. 제 7장에서는 고품질 우유 생산을 위한 사양관리에 대하여 세부적으로 목차를 나누어 제시하였다. 그리고 새로 개발 중인 젖소 배합비 프로그램(V.1.3.220210.A)은 기존 프로그램과 다르게 사용자 우선의 인터페이스를 적용하여 접근성을 확장 하여 낙농관련 종사자들의 활용도를 높였다.
사사: 본 연구는 농촌진흥청의 지원을 받아 수행한 과제입니다(No. PJ016920).

PC

Key words : 한국가축사양표준, 젖소, 건물섭취량, 에너지, 단백질, 배합비 프로그램

PC23004 Effects of fermented soybean meal additives on in vitro fermentation parameters of Korean native goats

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This study investigated the effects of fermented soybean meal additives (SBM) on *in vitro* rumen fermentation of Korean native goats(KNG). *B. coagulans* KACC 10117 (BC), *L. paracasei* RNAL 010684 (LPA), *L. plantarum* ATCC 14917 (LP), a combination of BC and LPA, and a combination of BC and LP were used to anaerobically ferment SBM at 37°C for three days. Fermented SBM additives were mixed with the TMR, and used as a substrate for in vitro rumen fermentation. Therefore, the treatments used were: (CON) TMR; (T1) TMR+SBM+BC; (T2) TMR+SBM+LPA; (T3) TMR+SBM+LP; (T4) TMR+SBM+BC+LPA; and (T5) TMR+SBM+BC+LP. The results of *in vitro* experiment revealed that all SBM additives treatments had significantly lower ($p < 0.05$) pH than the CON group after 24h of fermentation. Moreover, acetate and propionate concentrations in the CON group were significantly lower ($p < 0.05$) after 12h of fermentation with concentrations of 48.019 mM and 23.506 mM, respectively. However, the A/P ratio was significantly lower ($p < 0.05$) in the SBM with fermentation additives from T1 and T5. Total VFA production was significantly higher ($p < 0.05$) in T3, T4, and T5 after 12h of fermentation. In conclusion, the SBM fermented with BC alone and the SBM with a combined BC and LP produced more VFA production, specifically propionate, during *in vitro* rumen fermentation in KNGs.

Key words : Korean native goats, *Bacillus coagulans*, *Lactobacillus paracasei*, *Lactobacillus plantarum*, Soybean meal

PC23005

한우에서 CO_2법을 이용한 질산염 급여의 메탄 저감 효과 검증

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본 연구는 한우에서 질산염 급여에 의한 메탄 발생 저감 효과를 검증하기 위해 수행하였다. 20마리 한우 거세우(평균 일령 352 ± 12 일, 평균 체중 348 ± 18 kg)를 대조구와 질산염 급여구로 공시하였다. 대조구는 티모시 건초와 농후사료를 각각 하루 4kg 급여하였고, 질산염 급여구는 대조구 사료(조사료+농후사료) 원물의 2.5%를 calcium ammonium nitrate로 추가 급여 하였다 (NO3−은 사료 건물 기준 1.58% 함유). 시험 사료는 23일 급여하였고, 사료급여 21일부터 3일간 CO_2법으로 메탄발생량을 측정하였다. 질산염 급여구는 대조구에 비해 일일 메탄발생량(L/day)이 감소하였고 ($p < 0.01$), 메탄발생 수율(L/kg DMI, L/$BW^{0.75}$) 또한 감소하였다 ($p < 0.05$, $p < 0.01$). CO_2법의 3일간 repeatability는 일일 메탄발생량에서 0.69 ($p < 0.01$), 메탄발생 수율(L/kg DMI, L/$BW^{0.75}$)에서 각각 0.7 ($p < 0.01$), 0.73 ($p < 0.01$)을 보였다. 본 연구를 통하여 한우에서 질산염 급여는 장내발효 메탄 발생을 저감하는 효과가 있음을 확인하였다. 아울러 CO_2법으로 in vivo 메탄발생량 변화를 검증할 수 있음을 확인하였다.

Key words : CO_2법, 질산염, 장내발효 메탄, 반추동물 메탄측정법, 온실가스

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PC23006

반추동물 장내 발효 메탄 저감을 위한 화합물 발굴 및 in vitro 검정

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메탄생성균에서는 메탄 생성 과정의 최종 단계에서 methyl-coenzyme M reductase (MCR) 효소의 작용으로 메탄이 생성된다. 3-nitrooxypropanol (3-NOP)은 MCR의 active site에 결합하여 메탄 생성을 억제한다. 본 연구에서는 3-NOP와 같이 MCR의 active site에 결합하여 메탄 생성을 억제할 가능성이 있는, methyl-coenzyme M과 구조적으로 유사한 후보 화합물들을 발굴하였다. 구매 또는 자체 합성한 화합물의 메탄 저감 효과를 in vitro 24시간 배양 후 검정하였으며, 일부 물질들의 메탄 저감 효과 ($p < 0.05$)를 확인하였다. Test한 화합물 중에서 sodium sulfite는 dose-dependent한 메탄 저감 효과 ($p < 0.05$)를 보였다. Sodium sulfite는 methyl-coenzyme M과 구조가 유사하여 methyl-coenzyme M과 경쟁적으로 MCR에 결합함으로써 메탄 생성을 저해할 가능성이 있다. 아울러 sodium sulfite 처리로 증가한 sulfite ion이 메탄 생성에 필요한 수소를 더 많이 소모하여 메탄 생성을 억제할 가능성도 있다.

Key words : 메탄 저감, 화합물, 반추동물, 장내 발효, *in vitro*, sodium sulfite

PC23007 A study on the use of probiotics for the production of low-moisture TMF

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This study explored the use of probiotics to improve the fermentation quality of low-moisture TMF (total mixes ration fermented, 35% moisture) for Hanwoo (Korean beef cattle). As probiotics for fermentation of TMF, “Mixed liquid culture” and “Yeast liquid culture” were respectively added at 0.4%, and .“Yeast liquid culture+Mixed powder” was added at 0.4%+0.1% of TMF as fed basis. For comparison, a control group without the addition of probiotics was placed. Mixed liquid cultures consisted of *Sacharomyces cerevisiae* (more than $1x10^7$ CFU/ml), *Lactobacillus planetarium* (more than $1x10^7$ CFU/ml) and *Bacillus subtilus* (more than $1x10^7$ CFU/ml). Yeast liquid cultures contained Sacharomyces cerevisiae (more than $1x10^7$ CFU/ml). A mixed powder contains more than $1x10^7$ CFU/gl each of *Saccharomyces cerevisiae*, *Lactobacillus planetarum* and *Bacillus subtilus*. It was prepared in 3 repetitions for each treatment group, and stored at room temperature. pH change and microbial growth were observed on 0, 2, 4, 6 and 8 days after preparation. During the TMF storage period, the pH decreased more than the control by adding probiotics. The pH of the mixed liquid culture group was lower than that of the other treatments on the 4th, 6th and 8th days of storage ($p < 0.05$). Growth of *Lactobacillus* sp. and yeast were also improved by adding probiotics. Yeast liquid culture+Mixed powder group was showed the highest levels compared to other treatments after the 4th day of storage ($p < 0.05$).

Key words : TMF, Total mixed ration fermented, probiotics,

PC

PC23008 성장형 유전체 육종가(GEBV) 적용이 거세한우의 성장 및 도체특성에 미치는 영향

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본 연구는 성장형 유전체 육종가(GEBV)를 적용하여 거세한우의 생시체중, 이유체중, 사육일수 및 도체특성에 미치는 영향을 알아보고자 수행하였다. GEBV는 illumina 50k chip 정보와 참조집단 16,000 두의 도체중 정보를 이용하여 추정하였다. 한우 수소 23두(29..7±3.2kg)를 선발하였으며, 성장형 유전체 육종가 낮은 그룹(LBV) 12두, 성장형 유전체 육종가 높은 그룹(HBV) 11두로 완전임의 배치하였다. 시험축은 인공포유 후 약 2개월령에 비육우 프로그램으로 사양하여 약 32개월령에 도축하였다. GEBV의 유효성을 알아보기 위해 생시체중, 이유체중, 사육일수 및 도체특성의 상관관계 분석을 진행하였다. 생시체중에서 두 그룹간의 유의적 차이가 없었으며, 이유체중에서는 HBV 그룹이 LBV 그룹 보다 10kg 높게 나타났다(p=0.011). 사육일수에서 HBV 그룹이 LBV 그룹보다 21일 단축되어 출하되었으나 유의적 차이는 없었다($p > 0.05$). 도체중에서 HBV 그룹이 LBV 그룹 보다 42kg 높게 나타났다($p = 0.045$). 등지방두께에서 HBV 그룹이 높게 나타났으며($p = 0.019$), 이로 인해 육량지수에서 HBV 그룹이 낮게 나타났다($p = 0.018$). 등심단면적과 근내지방도에서 HBV 그룹이 수치적으로 나타났으나 유의적 차이는 없었다. 육질등급판정 결과 HBV 그룹에서 1++등급 출현이 31% 높게 나타났으며, 육량등급판정 결과 HBV 그룹에서 C등급 출현 10% 높게 나타났다. 이는 등지방두께가 높아 육량등급 출현율이 낮아진 것으로 보여진다. 반면 GEBV 적용하여 비육 하였을 때 도체중은 42kg가 높아졌으며, 사육기간도 21일 단축되는 결과를 나타냈다. 결과적으로 GEBV 적용이 비육기간 단축과 성장율을 높이는 긍정적인 결과를 나타냈다.

Key words : Birth weight, fattening period, Hanwoo, GEBV, Weaning weight

PC23009 육질, 성장형 유전체 육종가(GEBV)가 거세한우의 도체성적 및 경락단가에 미치는 영향

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본 연구는 성장형과 육질형 유전체 육종가(Genomic Estimated Breeding Value; GEBV)에 따른 거세한우의 도체성적 및 경락단가에 미치는 영향을 구명하고자 수행되었다. GEBV는 illumina 50k chip 정보와 한우 참조집단 그룹 16,000두의 표현형 (도체성적) 정보를 활용하여 추정하였다. 일반적인 고급육 사양 프로그램으로 사육된 거세한우 28두를 이용하여 GEBV 중에 도체중 정보를 활용한 성장형 분석과 근내지방도 정보를 활용한 육질형 분석을 진행하였다. 성장형 분석의 경우에는 GEBV가 높은 그룹에서 건물섭취량(DMI)이 높게 나타났고(p = 0.014), 도축전 측정한 최종 체중(p = 0.072)과 도체중(p = 0.051)의 수치가 높게 나타났다. 하지만 근내지방도(p = 0.321)와 등심단면적(p = 0.913)에는 영향을 미치지 않았다. 경락단가에서도 성장형 GEBV가 높은 그룹에서 약 9.1%정도 높은 수익이 나는 것을 확인 할 수 있었다. 육질형 분석의 경우에는 GEBV가 높은 그룹에서 근내지방도가 높게 나타났고(p = 0.001), 도체중(p = 0.621)과 등심단면적(p = 0.418)에는 영향을 미치지 않았다. 또한 육질형 GEBV가 높은 그룹에서 1++등급 출현율이 64%로 GEBV가 낮은 그룹에 비해 50% 높게 나타난 것을 확인 할 수 있었다. 경락단가에서도 육질형 GEBV가 높은 그룹에서 약 11.4%정도 높은 수익이 나는 것을 확인 할 수 있었다. 본 분석을 통해 거세한우를 사육함에 있어 유전체 육종가(GEBV)를 활용한다면 농가의 소득을 높이는데 도움이 될 것으로 사료된다.

Key words : Genomic Estimated Breeding Value(GEBV), Carcass characteristic, Hanwoo steer

PC23010 Effects of seaweeds on *in vitro* ruminal fermentation and methane production

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The objective of the present study was to investigate the effects of seaweeds on *in vitro* ruminal fermentation and methane gas production. Five seaweeds were obtained from National Institute of Fisheries Science were used for this study: *Dictyota dichotoma* (DD), *Chrysymenia wrightii Yamada* (CW), *Codium fragile* (CF), *Sargassum fusiforme* (SF), and *Gracilaria vermiculophylla* (GV). The seaweeds were washed for 3 min by water at 2 different temperatures (low, 21°C vs. high, 70°C) except for DD (only washed by water of 21°C). After then, the washed samples were freeze dried. The ruminal fluids were collected from 3 rumen-cannulated Hanwoo steers (average 12-months-old). Subsequently, ruminal fluids were mixed with McDougall buffer in a ratio of 1:3 (v:v). The buffered ruminal fluids (50 mL) were incubated with substrates (0.4 g of concentrate and 0.1 g of rice straw in dry matter basis) and seaweeds (5% of substrates) at 39°C for 48 h. The seaweed supplementation did not affect total gas production and volatile fatty acids proportion (p > 0.05). The methane production (mL/g of digestible dry matter) was decreased in both the low and high CW and CF groups (p < 0.05). The present study showed a possibility to reduce *in vitro* methane production by supplementation of some seaweeds. Further in vivo studies are needed to test seaweeds as anti-methanogenic feed supplements.

Key words : seaweed, methane reduction, rumen fermentation, Hanwoo

PC23011 Effects of chemical compounds on *in vitro* rumen fermentation characteristics and methane production

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The present study was conducted to demonstrate the effects of chemical compounds on *in vitro* rumen fermentation characteristics and methane production. Treatments were as follows: 1) CON: control, 2) C1-22: Compound 1 stored at 22℃, 3) C1-8: Compound 1 stored at 8℃, 4) C2-22: Compound 2 stored at 22℃, 5) C2-8: Compound 2 stored at 8℃, 6) C3-22: Compound 3 stored at 22℃. Compounds were exposed for 10 days at each temperature and supplemented at 120 ppm based on a substrate (concentrate:forage ratio = 7:3; dry matter basis). Rumen fluid was collected from two cannulated Korean native steers and mixed with McDougall's buffer at a ratio of 1:3 (v:v). Fifty milliliters of buffered rumen fluid and a filter bag containing 0.5 g of substrate were dispensed into a 125 mL serum bottle. The serum bottles were incubated at 39℃ for 48 hours. Methane production per gram of digested dry matter was the lowest in C1-8 group ($p < 0.05$). *In vitro* dry matter digestibility (IVDMD) was the highest in C2-22 group ($p < 0.05$), and total volatile fatty acids (TVFA) was the highest in C2-22 and C2-8 groups ($p < 0.05$). Acetate to propionate ratio was the highest in CON. In conclusion, Compound 2 and 3 did not affect methane reduction, but Compound 2 improved IVDMD and TVFA. Compound 1 reduced *in vitro* methane production without the negative effects on IVDMD and TVFA.

Key words : chemical compound, methane reduction, rumen fermentation characteristics

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PC23012 단백질 사료 원료의 일반성분 및 반추위 *in situ* 분해율과 이를 통한 반추위미분해단백질 평가

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본 연구는 반추동물의 단백질 보완 제재 선정 및 급여 수준을 도출하기 위해 사료 원료의 일반성분분석, 반추위 내 *in situ* 건물 및 조단백질 분해율과 이를 통한 RDP 및 RUP 수치를 도출하였다. 사료 원료는 대두박, 열처리대두박, 소맥피, 임자박, 루핀을 2mm 크기로 분쇄 후 일반성분분석을 진행하였고, nylong bag에 담아 Holstein cows 2두의 반추위에서 0, 4, 8, 12, 24, 48 및 72시간 배양하였다. 대두박, 열처리대두박, 소맥피, 임자박, 루핀의 조단백질은 각각 52.55, 52.98, 16.12, 45.05, 35.39%였고, TDN은 79.15, 77.32, 75.13, 69.34, 86.71%로 나타났다. *In situ* 건물 분해율은 대두박 및 소맥피의 경우 반추위 배양 24시간에 92.03, 71.38%를 보였으며 열처리대두박, 임자박 및 루핀의 최종분해율(72시간)은 각각 85.90, 41.63 및 97.30%였다. 대두박, 열처리대두박, 임자박 및 루핀의 건물 분해율에 a 와 b fraction의 합은 각각 98.99, 85.90, 41.63 및 97.76%이었으며, ED는 각각 82.24, 64.72, 23.95 및 53.76%로 나타났다. *In situ* 조단백질 분해율은 대두박, 열처리대두박, 소맥피, 임자박 및 루핀의 최종분해율은 각각 96.63, 76.02, 97.31, 33.74 및 87.56%로 나타났다. 위 원료의 조단백질 분해율에 a와 b fraction의 합은 각각 96.63, 76.02, 97.31, 33.74 및 87.56%로 나타났다. 대두박, 열처리대두박, 소맥피, 임자박 및 루핀의 RUP는 각각 총 CP 함량의 33.44, 70.03, 27.41, 82.59 및 48.50%로 나타났다. 따라서 단백질 사료 원료 중 열처리대두박, 임자박은 RUP 제재로써 이용될 가치가 있을 것으로 판단된다. 하지만 사양실험을 통하여 생산성에 해당 사료 원료들이 얼마나 긍정적인 영향을 미치는지 검토가 필요하다.

Key words : 반추동물, *in situ*, 분해율, 단백질 원료, RDP, RUP

PC23013 코발트(Co-glucoheptonate) 첨가 급여가 홀스타인종 젖소 생리 특성에 미치는 영향

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본 연구는 사료 내 코발트 첨가가 홀스타인종 젖소의 생리 특성에 미치는 영향을 구명하기 위하여 수행하였다. 시험축으로는 홀스타인종 젖소 암소 10두(2.1±1.1산, 체중 727.2±79.1kg)를 공시하여 실시하였다. 시험사료는 한국가축사양표준(KFSD, 2017)의 영양소 요구량에 따라 국립축산과학원 낙농과에서 제조된 섬유질배합사료(TMR, total mixed ration)를 이용하였다. 사료에 첨가한 코발트는 Co-glucoheptonate를 활용하였고 처리구는 0.1 mg/kg(대조구, NRC 기준 코발트 권장량), 0.8 mg/kg(시험구)로 각 5두씩 배치하였다. 또한 환경온도에 따른 코발트 급여효과를 보고자 적온기(THI 67.2 ± 5.46)와 고온기(THI 79.09 ± 3.85)에 각 2주간 급여를 실시하였다. *t*-검정 분석 결과, 고온 환경에서 코발트 급여는 반추위 내 체온을 낮추는 효과를 보였다(Control: 39.59℃ ± 0.11, Treatment: 39.47℃ ± 0.09; p=0.001). 반추위 pH의 경우 코발트 급여 효과는 관찰되지 않았지만, 고온기의 pH가 적온기의 pH보다 유의적으로 낮았다(p = 0.01). 호흡수의 경우 코발트 급여 효과는 관찰되지 않았지만, 고온기의 호흡수가 적온기의 호흡수보다 유의적으로 높았다(p < 0.001). 직장온도의 경우 코발트 급여로 인해 낮아지는 효과가 관찰되었으며(p < 0.001), 고온기의 직장온도가 적온기의 직장온도보다 유의적으로 높았다(p = 0.03). 반추위내 total VFA는 고온기에서 적온기보다 낮았지만(p = 0.01), 코발트 급여그룹에서 높았다(p = 0.03). 반추위내 NH3-N은 고온기에서 적온기보다 낮았지만(p < 0.001), 코발트 급여그룹에서 높았다(p = 0.02). 이러한 연구 결과는 고온기 젖소 생리 대사를 개선하기 위한 미네랄 공급 방안으로 활용될 수 있을 것으로 사료된다.

Key words : dairy cow, cobalt, physiology characteristic, heat stress

PC

PC23014 Supplemental effects of bypass fat, soybean meal, and heat-treated soybean meal on performance of Hanwoo steers in early-fattening period under heat stress

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This study was conducted to determine the supplemental effect of bypass fat, soybean meal, and heat-treated soybean meal on growth performance in early-fattening Hanwoo steers under heat stress. Thirty-six Hanwoo steers (BW, 480.9 ± 5.7 kg; age, 15.9 ± 0.4 month) were randomly allocated to four dietary treatments in 12 pens (3 replications/treatment): Control (TDN 75%, CP 15%, RUP 38% of CP; no supplements), T-1 (82.5%, 15%, 38%; bypass fat), T-2 (82.5%, 16.5%, 38%; bypass fat, soybean meal), and T-3 (82.5%, 16.5%, 52%; bypass fat, heat-treated soybean meal). The average temperature-humidity index during entire experimental period of 112 days was 75.9 (1st period; July), 71.0 (2nd; August), 65.8 (3rd; September), and 53.6 (4th; October). Compared to 4th period, the DMI in 1st and 2nd showed a decrease of 31 and 12%, respectively, while no significant difference was noticed among the treatments. The ADG of T-2 and T-3 in 1st period showed higher than Control (p < 0.05). During the whole period, the ADG showed higher in the order of T-3 (1.23), T-2 (1.18), T-1 (1.11), and Control (0.98 kg/d) (p < 0.05). The FCR was lower in the order of T-3 (7.27), T-2 (7.61), T-1 (8.09), and Control (9.11) during the whole period (p < 0.05). In conclusion, supplemental feeding with 10% higher TDN and CP levels considering RUP level under heat stress had a positive effect on growth performance in early-fattening Hanwoo steers.

Key words : Hanwoo steer, early-fattening period, heat stress, energy, protein, RUP

PC23015 Estimation of Greenhouse Gas Emissions from the Livestock Sector in Korea

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According to the Framework Act on Low Carbon, Green Growth, the publication of an annual national greenhouse gas (GHG) inventory report is mandatory. In the livestock sector, the national GHG inventory was based on the 1996 IPCC Guidelines with the Tier 1 methodology. In 2020, the total GHG emission in the Republic of Korea was 656.2 million tCO_2e, and the net emission, including sinks, was 618.3 million tCO_2e. The total GHG emissions in the agriculture sector were 21.0 million tCO_2e in 2019 and 21.05 million tCO_2e in 2020, which accounted for 3.2% of the total national emissions in 2020. The rice fields sub-sector had lower emissions due to reduced rice cultivation area, but the livestock sub-sector had larger emissions because of a larger number of livestock, attributable to increased meat consumption. GHG emissions from the livestock sector in 2020 were 9.7 million tCO_2e, of which emissions from enteric fermentation were 4.7 million tCO_2e, higher by 60.2% than the value of 1990 mainly because of the higher beef cattle and goat population. On the other hand, GHG emissions from manure management in 2020 were 5.0 million tCO_2e, representing an increase of 75.4% compared to 1990 mainly due to increases in beef cattle, dairy cattle and poultry populations. Additional research is required to develop precise country-specific emission factors for GHG emissions from livestock in Korea.

Key words : enteric fermentation, livestock, manure management, national greenhouse gas inventory

PC

PC23016 Multi-omics studies on changes in rumen metabolic and microbial population in Korean native goats under heat stress

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Heat stress (HS) is a stressful event in ruminants that negatively affects their physiological and rumen microbial composition. However, a fundamental understanding of metabolomic and metagenomic mechanisms in goats under HS conditions is lacking. Here, we analyzed the rumen metabolomics and metagenomics of goats (n=10) under HS-free (OTP) and HS-exposed (HTP) conditions, to identify changes in key the rumen metabolites and microbiome induced by HS. Metabolomic analysis revealed that significantly different association with energy metabolism. Among them heat-stressed goats showed potential metabolic biomarkers likewise, butyrate, isopropanol, phenylacetate, and 2-oxoisocaproate ($p < 0.001$). Metagenomic analysis revealed that HS affected the alpha diversity measurements, including the Chao1 estimate and evenness ($p < 0.05$), than the OTP. Through the association of the rumen microbiome with the metabolome, we found that *Fibrobacter* and *Ruminococcus* were enriched in HTP and positively correlated with ruminal microbial metabolites, such as acetate. Our study provided fundamental insights into how HS affected the physiology and rumen microbial populations of goats and how both microbiome and host-dependent mechanisms contributed to these changes. These findings could potentially suggest strategies for mitigating the adverse under HS, including changes in the microbial population and energy metabolism disorders in goats.

Key words : goat, heat stress, metabolome, microbiome, multi-omics, rumen

PC23017 하계조사료 종류별 한우 반추위 *in vitro* 메탄발생량 평가

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반추동물에게 양질조사료를 급여하는 것은 다른 방법에 비해 경제적이며 토양 내 탄소축적량을 증대할 수 있어 지속가능한 장내발효 메탄저감 방법으로 평가된다. 이에 정부에서 발표한 2030 국가 온실가스 감축 로드맵은 양질조사료 보급 확대를 통한 한·육우 온실가스 감축계획을 포함하나, 이와 관련한 연구결과가 부족한 실정이다. 본 연구는 다양한 종류의 조사료가 한우 장내발효 메탄발생량 및 반추위 발효성상에 미치는 영향을 *in vitro* 환경에서 조사하기 위하여 수행되었다. 평가 대상 조사료로 볏짚, 옥수수(사일리지), 수수류(수수×수단그라스 사일리지)를 선정하였으며, 이를 McDougall 버퍼와 반추위액을 4:1로 혼합하여 만든 배양액과 39°C에서 48시간 동안 배양하였다. 건물소화율은 볏짚이 가장 낮았으며(44.5%), 옥수수(56.9%)와 수수류(54.3%)는 차이를 보이지 않았다. 또한 옥수수와 수수류는 볏짚보다 총 휘발성지방산을 비롯한 초산, 프로피온산, 뷰틸산의 생성량이 많았다($p < 0.05$). 그러나 총 가스 발생량 및 사료 건물소화량 당 메탄발생량은 조사료 종류에 따른 차이를 보이지 않았다($p > 0.05$). 조사료 종류별 한우 메탄배출량의 보다 면밀한 평가를 위해서는 이후 급여시험을 통해 볏짚 외 조사료의 높은 건물소화율이 증체량 등에 미치는 영향을 조사하여 한우 생산성 대비 메탄배출량을 제시하는 것이 필요할 것으로 사료된다.

Key words : Hanwoo, forage, greenhouse gases, enteric methane emissions, *in vitro*

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PC23018 AI 행동 인지 센서를 통한 포유기 송아지의 이유(weaning) 수준 측정 기술 개발

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송아지 시기부터 충분한 영양을 통한 성장 도모는 저탄소 축우 정밀사양의 시작이다. 본 연구의 목적은 포유 송아지의 이유(weaning) 진행 수준을 원활하게 평가할 수 있는 기술을 개발하는 데에 있다. 총 3개 실험이 진행되었다. ①포유기 송아지 10두의 입붙이기 사료섭취량과 사료섭취시간을 이유완료 시기인 생후 60일까지 3일 간격으로 측정하여 상관 및 회귀분석을 하였다. ②포유기 송아지 31두의 90일간 사료섭취시간을 관찰자가 직접 기록한 참값과 송아지 행동모니터링센서(farmer's hands, Bodit Inc., South Korea)에서 측정한 결과값과의 비교분석을 통해 센서 정확도(F1-score)를 분석하였다. ③이유 시기가 다른 두 농장(조기이유, 67두 vs 관행이유, 111두)에 대한 31~60일령 송아지의 모니터링 센서 기반 사료섭취시간 값의 경향을 파악하였다. 사료섭취량(g)과 사료섭취시간(sec) 사이의 상관계수는 0.91($p < 0.001$)로 강한 정의 상관관계를 나타냈으며, 회귀식은 Y=-95.842+0.188X 로 분석되었고 이 때의 결정계수(R^2)는 0.83이었다($p < 0.001$). 사료섭취시간에 대한 센서 F1-score는 90.02%였다. 센서로 측정한 두 농장의 31~60일령 송아지에 대한 일령 별 평균 사료섭취시간은 조기이유농장 32~111분, 관행이유농장 23~47분으로 집계되어 생후 1~2개월 사이 조기이유 송아지군 사료섭취시간이 관행이유 송아지군에 비해 월등히 늘어나는 양상을 확인할 수 있었다. AI 기반 송아지 행동 센서는 어린 송아지의 사료섭취시간을 높은 정확도로 모니터링 하였다. 이는 사료섭취량을 간접적으로 측정함으로써 포유기 송아지의 이유 진행 수준을 판별하는 효율적인 기술이 될 수 있음을 증명하였다.

Key words : Weaning calves, Feed intake, Artificial intelligence, Behavior monitoring technology, Precision farming

PC23019 Dose-response effects of natural nonionic surfactant (Sucrose cocoate) on ruminal methane production, fermentation, and microbial abundance on *in vitro*

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Considering the economic, environmental, and nutritional implications, mitigating enteric methane production from ruminants is of paramount importance, as these animals naturally generate substantial quantities of methane during their digestive processes. The objective of this study was to evaluate the potential of Sucrose cocoate (SUC) on ruminal methane production, fermentation, and microbial abundance using an in vitro batch culture system. The incubation was conducted with control (no SUC) and different concentrations of SUC (15, 45, and 75 mg/L of rumen fluid). The substrate incubated consisted of a mixture of timothy hay (600g/kg) and corn grain (400g/kg). After 24 hours, the total gas and methane production, and the methane proportion, showed a linear decrease with increasing doses of SUC. The acetate molar proportion decreased linearly and quadratically, while those of propionate and butyrate increased linearly with increasing doses of SUC after 24 hours. The absolute values of Ciliate protozoa, *Fibrobacter succinogenes*, and *Prevotella ruminicola* showed a linear decrease, while those of *Ruminococcus albus*, *Ruminococcus flavefaciens*, and *Butyrivibrio proteoclasticus* increased linearly with increasing doses of SUC after 24 hours. Before practical implementation, it is imperative to conduct in vivo feeding trials to validate these findings in animal experimental research.

Key words : nonionic surfactant, feed additive, methane, ruminal fermentation, microbial

PC23020 NMR-based metabolite profiling of rumen fluid during *in vivo* fermentation time

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Rumen fermentation undergoes rapid changes after feed intake. Previous research focused on feed additives and disease effects. In contrate, time-dependent metabolic changes have been understudied. Rumen fluid samples were collected from Hanwoo cattle, at 0h intervals from pre-feeding to 7h post-feeding, to analyze the metabolic trends using 1H-NMR and perform statistical analysis using MetaboAnalyst 4.0. The rumen pH decreased from 6.9 to 6.4 within 1-2h after feeding and then increased to 6.8 by the 7h. A total of 116-142 metabolites were identified at different feeding times. PCA results, there was a tendency for the samples from the 0 and 4-7h points to separate from those at 1, 2, and 3 hours post-feeding. Metabolites showing significant differences were determined using the criteria of p-value (<0.05), FC (>2 or <0.5), and VIP (<1.0). When comparing the 0h with the 1h, 39 metabolites (including glucose, trehalose, trimethylamine, etc.) showed significant differences. When comparing the 0h with the 3h, 23 metabolites (including aspartate, carnitine, succinate, etc.) showed significant differences. Comparing the 0h with the 5h, 31 metabolites (such as 3,5-Dibromotyrosine, formate, phenylacetate, syringate, etc.) showed significant differences. Lastly, comparing the 0h with the 7h, 17 metabolites (including methylamine, glycine, creatine, etc.) showed significant differences.

Key words : rumen fluid, fermentation time, metabolite, NMR

PC23021 The effects of feeding levels at different stages of gestation on body weight, body condition score, and postpartum calf condition of Hanwoo heifers in Korea

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This study examined the impact of more feeding regimens on body weight, body condition score (BCS), calf sex, body weight, and disease incidence in pregnant cattle. The control group received a consistent diet throughout the study, while the treatment group had an increased feed intake during the mid-late pregnancy period. Measurements were taken at different stages of pregnancy, and the study was replicated three times. The results revealed significant differences between the control and treatment groups. The treatment group exhibited significantly higher late gestation body weight (476 kg) compared to the control group (458 kg). In terms of calf sex and body weight, among the 162 control bulls, male calves had lower body weight (28 kg) compared to female calves (26 kg). Moreover, mid- and late-gestation BCS were significantly higher in the treatment group (3.4, 3.5) compared to the control group (3.2, 3.1) ($p < 0.05$). However, in the 156 treatment bulls, there was no significant difference in body weight between males (27 kg) and females (26 kg) ($p > 0.05$). Disease incidence was higher in the treatment group, but not statistically significant. In conclusion, increasing feed intake during pregnancy led to improved body condition scores and body weights in pregnant cows, particularly during the second trimester. These findings emphasize the importance of proper feeding and management practices for maintaining the health of pregnant cattle.

Key words : pregnant cow management, body condition score, correlation, body weight, disease incidence

PC23022 Mineral supplementation strategies to ameliorate the negative effects of heat stress in Holstein dairy cows

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This study was conducted to investigate the effects of high concentrations of organic minerals on chemical composition, fatty acids and heat shock proteins on milk and blood in Holstein dairy cows during heat stress (HS). This experiment was conducted at a commercial dairy farm in Suncheon, Korea during summer season. Twenty lactating Holstein cows (milk yield, 28.5 ± 2.33 kg/d) were used in this experiment and randomly divided into two groups (n = 10/group) : no mineral supplementation (CON) and high-concentration organic minerals (HOM) for 31 days. During the study period, the temperature-humidity index (THI) was 75.55±4.05, and milk yield and milk protein were numerically higher in HOM than in CON ($p > 0.05$). Cortisol in serum was 0.11 μg/dL numerically lower in HOM compared to the CON ($p > 0.05$). Zn concentration in serum was 93.44 μg/dL in HOM, which was significantly higher than CON ($p < 0.05$). HSP27, HSP70, and HSP90 in milk and plasma were numerically lower in HOM than compared to CON ($p > 0.05$), and the concentration of fatty acid in milk and plasma was not significantly affected by mineral treatment ($p > 0.05$). Overall, provision of high concentrations of organic minerals to Holstein dairy cows during HS increased serum zinc concentrations and numerically decreased cortisol and HSPs concentrations, which is thought to be helpful in preventing HS.

Key words : fatty acid composition, heat stress, heat shock protein, holstein dairy cow, mineral, milk yield

PC23023 Relationship between single nucleotide polymorphisms and biological indicators in lactating Jersey and Holstein cows exposed to heat stress

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Heat stress is a major factor that can negatively affect milk production of dairy cows. This study was to validate the relationship between genotype and biological indicators related to heat tolerance in Jersey and Holstein dairy cows for 13 single nucleotide polymorphisms. Heat tolerance was assessed in lactating Jerseys (n = 9) and Holsteins (n = 33) from the spring to autumn. For Jersey cows, regions of DEPDC7 were associated with rectal temperature and respiratory; regions of FYB, GOLGA4, CACNA1D, Hapmap58887-rs29013502, Hapmap47403-BTA-76048, Hapmap30420-BTC-039335, CAST, and EPAS1 were associated with milk composition; and regions of ACAT2 were associated with activity. For Holstein cows, regions of Hapmap47403-BTA-76048, ACAT2, CAST, and DEPDC7 were associated with rectal temperature; regions of GOLGA4, ARS-BFGL-NGS-458, Hapmap47403-BTA-76048, Hapmap30420-BTC-039335, ARL6IP1, and EPAS1 were associated with rumination time; and regions of CACNA1D, Hapmap30420-BTC-039335 and EPAS1 were associated with milk yield or composition. In conclusion, specific genotype related to biological traits during heat stress in Jersey and Holsteins were identified. These markers such as rectal temperature and rumination time that are not related to milk yield or composition may prove useful in genetic selection for heat tolerance in lactating dairy cows.

Key words : dairy cows, heat stress, genetic marker, biological indicator

PC

PC23024 Effects of L-glutamine supplementation according to HSPB1 genotype on hepatic metabolism and gluconeogenesis in Hanwoo heifers

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The objective of this study was to investigate the effects of dietary supplementation of L-glutamine (L-gln) according to heat-shock protein beta-1 (*HSPB1*) *g.111 T>C* genotype on hepatic metabolism and gluconeogenesis in Hanwoo heifers. A total of 44 Hanwoo heifers (23.7 ± 0.7 month of age; initial BW: 458 ± 68 kg), blocked by age, were used in a randomized complete block design, following a 3 × 2 factorial arrangement. Factors included L-gln supplementation (0%, 0.25%, and 0.5% of the diet DM) and *HSPB1* genotype (TC and CC type). The Experiment was conducted until slaughter (30.2 ± 0.8 month of age), and liver samples from the carcasses were collected for mRNA expression analysis. Data were analyzed using the MIXED procedure with Tukey's test by SAS 9.4 software, considering treatment, genotype, and the treatment × genotype interaction as fixed effects, and block as a random effect. There were no differences in HSPB1 expression across all groups ($p > 0.05$). Regarding glutamine metabolism, *GLS2* was significantly down-regulated in both the 0.25% and 0.5% groups following L-gln supplementation ($p < 0.05$). However, the expressions of *GLUD1*, *GOT2*, *GPT2*, and *GLUL* remained unchanged ($p > 0.05$). In terms of gluconeogenesis, both *PCK1* and *PCK2* were decreased in the 0.5% group, and *G6PC1* also showed a decrease in the 0.25% group ($p < 0.05$). Similarly, the 0.5% group exhibited lower *PC* expression compared to the 0.25% group ($p < 0.05$). Therefore, L-gln supplementation altered hepatic metabolism of glutamine and prevented excessive gluconeogenesis in Hanwoo heifers, irrespective of *HSPB1* genotype.

Key words: L-glutamine, Hanwoo heifers, liver, metabolism, gluconeogenesis

PC23025 근내지방도 육종가 및 rumen-undegradable protein 급여 수준이 한우 거세우의 반추위 발효 성상 및 혈액 지표에 미치는 영향

정진우, 김상엽, 이재성, 임세윤, 오준석, 이상현, 경준성,
Kamburawala Kankanamge Tharindu Namal Ranaweera, 백명기
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본 연구에서는 근내지방도 육종가 (genomic estimated breeding value of marbling score: gMS) 및 rumen-undegradable protein (RUP) 급여 수준이 한우 거세우의 반추위 발효 성상, 혈액 지표 및 초음파 형질에 미치는 영향을 조사하였다. 한우 거세우 36두(평균 일령 637±22 일, 평균 체중 609.6±87 kg)를 근내지방도 육종가 2 그룹 (low gMS vs. high gMS)으로 나누고, 각각을 RUP 수준 2 그룹 (low RUP vs. high RUP)으로 나누어, 총 12 주간의 사양실험을 수행하였다. 실험 시작 전과 실험 시작 후 4주 간격으로 반추 위액과 혈액 샘플을 채취하였다. 반추 위액 암모니아 농도는 high RUP구가 low RUP구보다 낮았으며(p = 0.02), gMS는 영향을 미치지 않았다. gMS 및 RUP 수준은 반추위 volatile fatty acid profile과 혈액 urea 수준에 영향을 주지 않았다. 초음파로 측정한 마블링스코어와 등심단면적은 high gMS구가 low gMS구보다 높았으며 ($p \leq 0.03$), RUP 수준은 영향을 미치지 않았다. 결론적으로 RUP 수준은 반추위 암모니아 농도에 영향을 주었고, 근내지방도 육종가는 초음파 측정 마블링스코어에 영향을 주었다.

Key words : 한우, 근내지방도 육종가, 반추위 미분해 단백질, 반추위 암모니아, 마블링스코어

PC

PC23026 Small molecule MCR187 inhibitorreduces *in vitro* ruminal methane production

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This study aimed to evaluate the impact of small molecule MCR187 inhibitor on the *in vitro* ruminal methane production. The MCR187 molecule was developed as an inhibitor for methyl-coenzyme M reductase from methanogenic archaea. The rumen fluid for the *in vitro* incubation was collected from three Hanwoo cattle using the stomach tubing method. The experimental group consisted of the following two diets: 1) the total mixed ration (control), and 2) the control diet supplemented with 0.001% of MCR187 inhibitor (treatment). After 24h incubation, *in vitro* dry matter digestibility (IVDMD), pH, total gas production, and methane production were determined. The IVDMD and total gas production were not different ($p > 0.05$) between the two groups, while the pH was greater ($p < 0.01$) in the treatment group than in the control group. The methane production (mL/g DM) was lower ($p < 0.01$) in the treatment group than in the control group. Our results suggest that the MCR187 molecule can be used as a potential additive to reduce methane emissions from ruminants.

Key words : Hanwoo, *in vitro*, MCR187 molecule, methane production, rumen

PC23027 대용유 자동포유 시스템을 활용한 사육 방식의 차이가 한우 송아지의 성장성적에 미치는 영향

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본 연구는 자동 포유 기계를 활용하여 대용유 사육 방식의 차이가 한우 송아지의 성장 성적에 미치는 영향을 알아보기 위해 수행하였다. 한우 송아지 총 18두(30.51 ± 3.31kg)로, 수송아지 9두(33.12 ± 1.6kg)와 암송아지 9두(27.89 ± 2.31kg)를 공시하여 실험에 이용하였다. 급여 횟수 실험 종료 후 18두의 한우송아지를 개별팬에서 60일간 사육, 넓은 운동장에서 60일간 사육 및 개별 팬에서 30일 넓은 운동장에서 30일 기르는 사육 방식으로 구분하여 실험을 수행하였다. 대용유섭취량(p = 0.021) 및 총건물섭취량(p = 0.021), 증체량(p = 0.013) 및 일당증체량(p = 0.013)에서 암송아지보다 수송아지가유의적으로크게나타났다. 사료섭취량, 사료요구율 및 체온을 제외하고 모든 처리구에서 시간에 따른 유의적인 효과가 나타났다(p < 0.05). 모든 처리구의 결과에서 인공포유 형태와 성별에 따른 효과의 상호작용이 나타나지않았다. 대용유 인공포유 방법에 따라 설사발생 횟수는 처리구간에 유의적인 차이를 나타내지 않았다. 대용유 인공포 유형태에 따라 송아지의 일반혈액 성분 및 건강지표에 미치는 부정적인 영향은 나타나지 않았다. 결과적으로 한우 송아지의 사육 방식의 차이는 대용유의 섭취량에 유의적인 영향을 주지 않았고, 개별 급이 방식이 대용유와 사료 섭취량 증가에 긍정적인 측면이 있으나, 송아지의 사회성을 높여줄 수 있는 혼합(개별+그룹) 사육 형태가 적합할 것으로 사료된다.

Key words : 한우 송아지, 인공포유, 자동포유 시스템, 대용유, 사육 방식

PC

PC23028 Effect of rumen-protected vitamin C supplementation on the productivity of Hanwoo steers classified by direct genomic values

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This study was conducted to investigate the effect of rumen-protected vitamin C (RPVC) supplementation in Hanwoo steers classified by direct genomic values (DGV). The experiment used 2 × 2 factorial design with DGV type (Yield, Quality) and additive (Control, RPVC). Thirty-six Hanwoo steers (Average body weight 693.6 ± 36.4 kg, approximately 24 months of age) were assigned randomly to one of four treatment. RPVC was fed 50g/head/d at the morning feeding time by top dressing method. The growth performance was not affected by DGV type and RPVC supplementation. Also, there were no differences in carcass weight, back fat thickness, and rib-eye area among treatment groups. Marbling score was significantly increased in the quality type compared to the yield type (p < 0.05), and showed a tendency to improve with RPVC supplementation (p = 0.07). Although DGV type and RPVC supplementation had no effect on economic efficacy, gross receipts and net income were highest in the quality type-RPVC group. Thus, this study suggests that the productivity of Hanwoo steers may vary depending on the DGV type. In addition, RPVC is considered to have a positive effect on meat quality improvement, and to be more effective in quality types.

Key words : direct genomic values, Hanwoo steers, rumen-protected vitamin C, marbling score

PC23029 Effects of colostrum replacer and/or immunoglobulin Y supplementation on immunity and growth in Hanwoo calf

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This study was conducted to investigate the effects of colostrum replacer and/or immunoglobulin Y (IgY) supplementation on blood immunoglobulin G (IgG) concentration, diarrhea occurrence rate and growth performance in Hanwoo calves. Fifteen Hanwoo calves (Birth weight 31.4 ± 3.3kg) were assigned to one of three treatments as follow: CON = maternal colostrum, T1 = maternal colostrum + colostrum replacer 100g, T2 = maternal colostrum + colostrum replacer 100g + IgY 10g. The average IgG concentration of maternal colostrum was 77.3 g/L, and that of colostrum replacer was 27.6 g/L. Blood IgG concentration of calves were not affected by colostrum replacer and IgY supplementation, but the diarrhea occurrence rate was the highest in the control group. Weaning weight, average daily gain, feed intake and feed conversion ratio were similar among treatments. Thus, it suggests that colostrum replacer supplementation to calves at birth have a positive effect on diarrhea prevention, whereas IgY supplementation is less effective.

Key words : Hanwoo calves, colostrum replacer, diarrhea, immunoglobulin Y

PC23030 Effect of nutritional metabolic imprinting on cows from late pregnancy to suckling period on growth performace and microbiome of calves in Hanwoo

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This study aimed to investigate the effects of prenatal and postnatal nutritional metabolic imprinting specifically total disgestable energy and protein of formula feed on rumen microbiome changes and growth performance of calves. Eight pregnant Hanwoo cows (429.7 ± 88.5 kg) and eight calves (30.2 ± 6.6 kg) where divided into two groups: a control group (crude protein [CP] : cow 13.0 %, calf 17.5 % and total digestible nutrients [TDN] cow 69.0 %, calf 69.5 %), and a treatment group (CP : cow 18.0 %, calf 21.0 % and TDN : cow 72.0 %, calf 75.0 %). Although there was a tendency for the treatment group to exhibit higher birth weight, average daily gain (ADG), dry matter intake (DMI), body length, wither height, and chest width compared to the control group, no significant differences were observed. At 3 and 6 months of age, the treatment group showed a higher tendency for *Ruminobacter amylophilus*, *Prevotella ruminicola*, and *Butyrivibrio fibrisolvens*, compared to the control group; however, no significant differences were observed. The treatment group (cow and the 3-month-old calf) showed a negative (-) correlation with the Bacteroidetes in the rumen ($p < 0.01$). In conclusion, nutritional metabolic imprinting from late pregnancy to suckling period is considered to positively affect birth weight, growth performace, and rumen proteolytic bacteria groups.

Key words : Hanwoo, nutritional metabolic imprinting, growth performace, microbiome

PC23031 Animal productivity monitoring of two breeds (Holstein and Jersey cow) for advancement of feeding management in Jersey lactating cow

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Jersey cows, which are in the introduction stage in Korea, are known to have better yields when manufacturing dairy products such as cheese due to the higher protein and fat content of milk produced than Holstein breeds, which are existing breeds. However, research on the feeding management is a lack of related information. This study aimed to provide basic data for the advancement of feeding management of Jersey via analyzing descriptive statistics data derived from robot milking machines on milk yield (MY), fat and protein corrected milk (FPCM), milk protein (MP), and milk fat (MF). Data from a total of 40 lactating cows (20 Holstein; 20 Jersey) were collected from 0 to 120 days after parturition, and 4031 data were finally used. Holstein had significantly higher ($p < 0.05$) than Jersey breeds average MY (42.3 vs. 26.3 kg), FPCM (39.9 vs. 25.6 kg/d), MP (3.05 vs. 3.43 %), and MF (3.68 vs. 3.73 %), except for days-in-milk (DIM, 68.4 vs. 66.6 d). In correlation analysis, both breeds showed a negative correlation between MY and MF, and numerically, the Holstein breed showed a relatively high negative correlation. On the other hand, FPCM showed a positive correlation regardless of breed, and numerically, a relatively high positive correlation was observed in Jersey breeds.

Key words : jersey, lactating cow, robotic milking, productivity, descriptive statistics

PC

PC23032 Effect of GABA supplementation on the growth performance, blood metabolites, and carcass characteristics of Hanwoo heifers

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This study aimed to investigate the effect of γ-aminobutyric acid (GABA) supplementation on the growth performance, blood metabolites, and carcass characteristics of Hanwoo heifers. A total of 18 Hanwoo heifers were allocated as experimental animals (172.3 ± 23.8 kg, 8.4 ± 1.2 months of age): control group (basal diet), T1 group (basal diet + 100 ppm of GABA), and T2 group (basal diet + 200 ppm of GABA). The GABA supplement was coated with Ca salt with palm oil. The average daily grain (ADG) was higher in the T2 than control and T1 groups ($p < 0.05$), and feed conversion ratio was lower in the T2 than in the control and T1 groups during 15 to 23 months of age ($p < 0.05$). ADG during whole period was significantly higher in the T2 than in the control and T1 groups ($p < 0.05$). From 24 to 30 months of age, the dry matter intake was slightly, but not significantly, higher in the T1 and T2 groups than in the control group. At 30 months of age, the leptin concentration in plasma was lower in the T2 than in the control and T1 groups ($p < 0.05$). The carcass weight was higher in the T2 than in the control and T1 groups ($p < 0.05$). The rib eye area and the marbling score were slightly, but not significantly, higher in the T2 than in the control and T1 groups. Therefore, the results of this study suggest that GABA supplementation had positive effects on the growth and carcass performance of Hanwoo heifers.

Key words : GABA, Hanwoo heifers, growth performance, blood metabolites, carcass characteristics

PC23033 Effects of TDN and crude protein levels in formula feed on growth performance and blood metabolites of early fattening Hanwoo steers.

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This study was conducted to investigate the effects of total digestible nutrients (TDN) and crude protein (CP) levels in formula feed on the growth performance and blood metabolites of Hanwoo steers. Twenty-four Hanwoo steers (301.0 ± 56.2 kg, 10.5 ± 0.2 months of age) were randomly assigned one of two treatment groups: control group fed formula feed with 73% of TDN and 14% of CP, and treatment group fed formula feed with 75% of TDN and 14.5% of CP. The treatment group had a higher average daily gain (ADG) and a lower feed conversion ratio (FCR) compared to those of the control group; however, no significant difference was observed. Non-esterified fatty acids concentration was slightly, but not significantly higher in the treatment group. However, concentrations of total protein, cholesterol, triglycerides, aspartate amino transferase, and creatinine tended to be higher in treatment group than in control group. The treatment group showed a higher marbling score tendency compared to the control group in the ultrasonic measurement traits at 20 months, while the backfat thickness showed no significant difference. Thus, the results of this study indicate that increasing TDN and protein levels in formula feed had a positive tendency on ADG and FCR performance of early fattening Hanwoo steers.

Key words : total digestible nurients, crude protein, Hanwoo steers, growth performance, blood metabolites

PC23034 Effects of high energy and crude protein feeding before and after calving on the reproduction efficiency of cows and growth performance of calves in Hanwoo

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This study was conducted to investigate the effect of high total digestible nutrients (TDN) and crude protein (CP) feeding 3 months before and after calving on the reproduction efficiency of cows and the growth performance of male calves in Hanwoo. In this study, 42 pregnant cows (524.9 ± 105.2 kg, 46.6 ± 22.2 months of age, 1.49 ± 1.45 of parity) and their 19 male calves were assigned for the experiment. Pregnant cows were randomly assigned to one of two dietary treatments: control group fed 78% TDN and 15% CP, treatment group fed 79% TDN and 19% of CP. The TDN content of the concentrates for calves was 76 and 79%, and the CP content was 19 and 23%, respectively. The effects of high TDN and CP feeding on average daily gain (ADG), dry matter intake, feed efficiency, body height, body length, and dystocia ratio of Hanwoo cows were small. The number of days to estrus ($p < 0.05$) and the number of service per conception were tended to be lower in the treatment group compared to the control group. Calf birth weight was similar between treatment groups; however, ADG, feed conversion ratio, and body length at weaning (3 months of age) were higher in the treatment group than in the control group ($p < 0.05$). Therefore, the present results suggest that the high TDN and CP feeding before and after calving had positive effects on the reproduction efficiency of cows and growth performance of male calves in Hanwoo.

Key words : Hanwoo, total digestible nutrients, crude protein, reproduction efficiency, growth performance

PC23035

Effect of ɣ-aminobutyric acid (GABA) on the growth performance, blood metabolites and carcass characteristics of Hanwoo steers

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This study aimed to investigate the effects of γ-aminobutyric acid (GABA) on the growth performance, blood metabolites, and carcass characteristics of Hanwoo steers. Twenty Hanwoo steers (489.1 ± 58.7 kg, 16.3 ± 0.6 months of age) were randomly assigned to one of three dietary treatment groups: control group fed formula feed + rice straw (basal diet), T1 group fed basal diet + 100 ppm of GABA, T2 group fed basal diet + 200 ppm of GABA. Body weight and blood metabolites were analyzed throughout 3 times at 16, 24, and 28 months of age. The average daily gain (ADG) and feed conversion ratio of T1 group were lower than control and T2 group from 16 to 24 months of age; However, from 24 to 28 months of age, ADG was higher in the T1 group than other groups ($p < 0.05$). Blood urea nitrogen (BUN) and inorganic phosphorus level were higher in T2 group than in control and T1 group at 24 months of age ($p < 0.05$). At the 28 months of age, BUN and calcium level were higher, in T1 group than in other groups ($p < 0.05$). Carcass weight and rib eye area were higher in the T1 group than in control and T2 group. Thus, results of this study indicate that GABA supplementation had positive tendency on growth and carcass performance of Hanwoo steers.

Key words : γ-aminobutyric acid, Hanwoo steers, growth performance, carcass weight, rib eye area

PC23036

Effects of types and levels of protein materials on productivity of late fattening Hanwoo steers

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This study was conducted to investigate the effects of types and levels of protein materials for growth performance and carcass characteristics in late fattening Hanwoo steers. Twenty-four Hanwoo steers (619.3±13.7 kg, 24.1±0.1 months of age) were randomly assigned to one of two treatment groups: control group and treatment group were categorized according to the level of soybean (4.0 and 5.2%, respectively), cottonseed (3.0 and 4.4%, respectively), lupine (0 and 1.6%, respectively), and crude protein (15.5 and 16.5%, respectively). Average daily gain (ADG) was higher in treatment group than in control group, although no significant difference was found. Treatment group showed lower plasma glucose and higher total protein concentration compared to the control group. Carcass weight and rib eye area tended to be higher in the treatment group than in control group; however, the difference was not significant. The treatment group had a high A grade appearance rate and auction price. Therefore, results of this study indicate that increasing proportion of protein materials and crude protein levels slightly affect growth and carcass performance of Hanwoo steers.

Key words : Hanwoo steers, protein materials, crude protein contents, growth performance, carcass traits

PC23037 Effect of nutritional manipulation according to genotype on productivity of Hanwoo steers

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This study aimed to investigate the effects of nutrition manipulation according to genotype on productivity of Hanwoo steers. Twenty-four early fattening Hanwoo steers (622.60 ± 59.36 kg, 21.8 ± 0.6 months of age) were classified based on their genotype via SNP chip analysis, and randomly assigned to one of the four treatment groups: general nutrition-quality (GQ), general nutrition-yield (GY), high nutrition-quality (HQ), and high nutrition-yield type (HN). General nutrition group fed formula feed with 15.5% of crude protein (CP), 73.2% of total digestible nutrient (TDN), and high nutrition group fed formula feed with 16.3% of CP and 73.8% of TDN. Dry matter intake was lower in high nutrition groups than in general nutrition groups, and lower in quality type groups than in yield type groups ($p < 0.05$). The average daily gain was high in the order of HY, HQ, GQ and GY ($p < 0.05$). The high nutrition groups showed a lower feed conversion ratio than in the general nutrition groups ($p < 0.05$). The high nutrition groups showed higher levels of plasma albumin, creatinine, cholesterol, and triglyceride than in general nutrition groups ($p < 0.05$). HY group resulted in a larger rib eye area due to the interaction effect of genotype and nutritional level ($p < 0.05$), while the marbling score was high in the order of HQ, HY, GQ and GY ($p < 0.05$). Therefore, nutritional manipulation according to the genotype of Hanwoo steers is considered as a strategy to improve growth and carcass performance.

Key words : nutritional manipulation, genotype, Hanwoo steers, growth performance, blood metabolites, rib eye area, marbling score

PC23038 사료 내 조단백질 수준 및 칼슘인 비율이 거세한우의 성장성적 및 도체특성에 미치는 영향

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본 연구는 사료 내 조단백질 수준 및 칼슘인 비율이 한우 거세우의 성장성적 및 도체특성에 미치는 영향을 확인하고자 수행되었다. 실험은 조단백질(CP) 2수준과 칼슘인 비율(CaP) 2수준을 2×2 완전요인설계법에 따라 총 4개의 실험구로 구성하였다: T1(CP 15%, Cap 2:1), T2(CP 15%, CaP 1:1.5), T3(CP 12.5%, CaP 2:1), T4(CP 12.5%, CaP 1:1.5). 실험동물은 24개월령 한우 거세우(650.8±16.27kg)를 실험구별 8두씩(총 32두) 공시하여 28개월령 출하시까지 진행되었다. 실험동물은 개시체중에서 실험구간 차이가 없도록 배치되었으며 사료는 볏짚과 배합사료를 1:9 비율로 급여하였다. 성장성적에서는 일당증체량, 사료요구율, 종료체중을 측정하였고, 도체특성에서는 도체중, 등심단면적, 등지방두께, 육량등급, 근내지방도 및 육질등급을 확인하였다. 성장성적은 일당증체량, 사료요구율 및 종료체중에서 실험구간 유의적 차이가 없었다. 도체특성의 도체중, 등심단면적, 등지방두께 및 근내지방도에서도 실험구간 유의적 차이가 없었으나, 육질등급은 T4에서 1+등급이상 비율이 76%로 다른 실험구(T1, 63%; T2, 63% 및 T3, 50%)보다 높은 결과를 보였다. 따라서, 사료내 조단백질을 낮추어도 성장 및 도체특성에 영향을 미치지 않았다. 또한 비육후기 거세한우의 칼슘인 비율조절이 성장성적과 도체특성에 부(-)의 영향이 없었던 것으로 보아, 단기간의 칼슘인 비율 조절은 생산성에 유의적 영향을 미치지 않는다고 생각된다.

Key words : 조단백질, 칼슘인 비율, 거세한우, 성장성적, 도체특성

PC23039 Characterization of heat stress based on South Korean climate conditions in mid lactating Holstein cows using blood hormone levels and gene expression in peripheral blood mononuclear cell and hair follicles

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This study aimed to investigate the effects of heat stress (HS) on hormone levels and gene expression in peripheral blood mononuclear cell (PBMC) and hair follicle of mid-lactating Holstein cows in the external environment of South Korea. Seventy mid-lactating Holstein cows (milk yield of 33.17 ± 0.67 kg/day; days in milk of 139 ± 3.5) were used in the study. Blood and hair follicle samples were collected at six different time points, corresponding to temperature-humidity index (THI) ranges of 85~87, 82~84, 78~80, 75~77, 72~74, and 69~71, which were consistently maintained for three days. Data were analyzed using the mixed procedure of SAS. The results indicated that mid-lactating Holstein cows exposed to an environment where the THI decreased from 85~87 to 69~71 exhibited decreased concentrations of cortisol, haptoglobin, and insulin in the blood ($p < 0.05$). The expression levels of heat shock protein (HSP)70 and HSPB1 in PBMC increased ($p < 0.05$) as the THI changed from 85~87 to 82~84 but decreased from 78~80 to 69~71. Similarly, in hair follicles, HSP70, HSP90, and HSPB1 increased from 85~87 to 82~84 and then decreased from 78~80 to 69~71 ($p < 0.05$). Overall, changes in hormone and gene expressions were observed during the metabolic chamber experiment, even in the presence of environmental stress at different THI stages. Considering that the effects of HS become increasingly severe over a specific period of time following exposure, it can be inferred that implementing a breeding management method capable of predicting HS in advance can alleviate the adverse effects of HS on mid-lactating Holstein cows.

Key words : blood hormone, breeding management, gene expression, heat stress, Holstein cows

PC

PC23040 Characterization of *in vitro* goat ruminal fermentation using fermenatation strains

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This study was conducted to analyze the effect of adding a fermentation strain to TMR feed on *in vitro* characteristics of goat rumen. Fermentation strains were carried out by varying the ratio of B. Subtilis and E. Faecium. The goat rumen fluid retained from slaughtered goat at the slaughterhouse in Hamyang, and the rumen fluid was mixed with McDougall's buffer at a ratio of 1:4 to maintain an anaerobic state. For rumen fermentation, 0.5 g of each basal feed was weighed and placed in a culture bottle, and 50 ml of prepared diluted rumen fluid and diluted mixed strain were dispensed. rumen fermentation was cultured at 39 ° C for 0, 3, 6, and 24 hours. The analysis items were total gas generation, pH, volatile fatty acid production, ammonia nitrogen production, and dry matter digestibility. Gas production increased when *E. Faecium* group, mixed *B. Subtilis* and *E. Faecium* group were at 6 hours of incubation. The pH of the rumen was low in the experimental group with high E. Faecium ratio at 3, 6 hours incubation. Ammonia nitrogen production was containing the experimental group than in the control group at 3 hours incubation. The total volatile fatty acid content showed higher values in the test group than the control group. Dry matter digestibility was higher in the experimental group than in the control group.

Key words : fermentation, goat rumen, volatile fatty acid, dry matter digestibility, *in vitro*

PC23041 Effects of rice feeding on Hanwoo steers weaning period on intramuscular fat delicacy

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In the current grading system centered on intramuscular fat, new evaluation factors are discovered and the need for standard improvement is raised, and an evaluation method for delicacy of intramuscular fat that can supplement the intramuscular fat content, which is the criterion for the existing meat quality grade, is being reviewed. In order to promote this study, 24 Korean cattle calves were announced at 3 to 4 months of age, blood was collected, and genes were analyzed using 50K Hanwoo chips, and intramuscular fat was also classified as low (Bv L) and high (Bv H) according to the ranking. Weaning specifications and breeding period specifications were carried out in order to be used for weaning and castration time determination tests. A test was conducted to investigate the correlation between weaning period, castration period, and energy-enhanced rice feed feeding, focusing on inbred breeders. Korean cattle calves were weaned at 5 and 10 weeks of age, castrated at 4 and 7 months of age, placed in 20 heads each, and then fattened and slaughtered until 29 months of age. At the beginning of the first published 5-month-old age, the weight ranged from 120 to 124 kg, and there was no significant difference in weight according to the breeding value of intramuscular fat. 576.17 and 604.17 kg, and weight at the end of 29 months were 720.73 and 756.25 kg, respectively, with no significant difference. On the other hand, there was no significant difference between treatments in backfat thickness, loin area, and intramuscular fat content, but carcass rate was significantly higher in 10-week weaning pigs than in 5-week weaning pigs, and intramuscular fat delicacy was higher in 5-week weaning trts regardless of genetic breeding value. It was analyzed as high as 0.32, and there was no significant difference between intramuscular fat mass and fineness.

Key words : Hanwoo, Steer, Weaning period, carcass charicteristics, intramuscular fat delicacy

PC23042 Effects of lysozyme and zeolite supplementation on rumen fermentation characteristics and methane emission in Hanwoo steers

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This study was conducted to evaluate the effects of lysozyme and zeolite supplementation on rumen fermentation characteristics and methane emission in Hanwoo steers. An *in vitro* ruminal fermentation experiment was conducted using a 4:6 ratio of commercial concentrate to bluegrass as substrate. Treatments included control (no supplementation), 0.3% lysozyme, and 0.3% zeolite. The results demonstrated that both 0.3% lysozyme and 0.3% zeolite significantly reduced total gas production compared to the control group at both 12 h and 24 h of incubation ($p < 0.05$). The molar proportion of acetate in the rumen decreased after 24 h of incubation with 0.3% zeolite supplementation. Meanwhile, at 12 h of incubation, the treatments supplemented with 0.3% lysozyme and 0.3% zeolite exhibited a higher molar proportion of propionate compared to the control group ($p < 0.05$). Methane concentration was reduced after 24 h of incubation with 0.3% lysozyme and 0.3% zeolite supplementation ($p < 0.05$). In comparison to the control, the supplementation of 0.3% lysozyme and 0.3% zeolite resulted in a reduction of methane concentration by 27.25% and 26.07%, respectively, after 24 hours of incubation. These findings suggest that the addition of 0.3% lysozyme and 0.3% zeolite has the potential to reduce methane emissions by decreasing acetate and increasing propionate levels in the rumen.

Key words : Hanwoo, lysozyme, methane, zeolite, rumen

PC23043

페널데이터 분석기법을 이용한 한우 거세 비육우의 도체가격과 도체 특성 요인과의 상관분석 연구

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본 연구는 2019년~2022년 사이에 출하된 거세 한우 총 1,647두의 농장별 도체특성을 데이터를 사용했다. 도체특성 변수의 차원 축소를 위해, 동일한 도체 등급별 가격을 적용하여 도체 판매가격을 산출하였다. 출하 연도를 시계열성 인자로 고려하여 패널데이터 분석을 실시하였다. 요인별 반복 단위는 비육 농장으로 하였고, 종속변수에는 농장 평균 도체 판매가격을 설정하였고, 독립변수에는 표준화된 도체특성 요인의 평균값과 표준편차 값을 사용하였다. 도체특성 요인의 더미변수로는 표준화된 도체중 × 등심단면적, 근내 지방도 / 등지방두께, 출하 개월을 사용하였고, 도체특성 편차 요인의 더미변수로는 각 도체특성 요인의 표준편차 값을 사용하였다. 분석 모형으로는 합동OLS, 고정효과, 확률효과 모형을 사용하였고, 모형 간 비교는 F test와 Hausman test를 사용하였다. 사료 형태를 구분하지 않은 데이터에서 합동OLS, 고정효과 및 확률효과 모형 간의 차이는 관찰되지 않았고, 고정효과 모형을 선택하였다. 농장 평균 도체 판매가격에 영향을 미치는 효과의 절대값 크기는 도체중 × 등심단면적, 출하월령 편차, 근내 지방도 / 등지방두께 그리고 출하월령 순으로 나타났다. 출하월령 편차 변수를 제외한 모든 변수들은 양(positive) 효과를 갖고 있었다.

Key words : 거세 한우, 경제성, 도체특성, 시계열, 패널데이터분석

PC

PC23044

Effects of dry matter intake on ruminal papillae development and body type measurements in Hanwoo calves

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This study was conducted to investigate the effect of dry matter intake of Hanwoo calves on the development of rumen papillae and body type measurements. Forty-three Hanwoo calves aged about 6 months were published and divided into 4 treatment groups (T1: dry matter intake = less than 5kg, T2: dry matter intake = 5~6kg, T3: dry matter intake = 6~7kg, T4: dry matter intake = more than 7kg) according to the level of dry matter intake. As dry matter intake increased in calves, the length of ruminal papillae decreased ($p < 0.05$). Although the effect of dry matter intake on the body type measurements was small, the T3 group showed the result of an increase in body weight ($p < 0.05$) and an improvement in the heart girth compared to the other treatment groups. Therefore, it is suggested that the increased in calves intake reduced the development of rumen papillae, but had a positive effect on the calves body weight and chest growth. However, it is suggested that additional research on fattening Hanwoo steers according to papillae development is necessary.

Key words : Hanwoo calves, dry matter intake, ruminal papillae, body type measurements

PC23045 Analysis of growth characteristics of fattening from growing period according to feed conversion ratio of Hanwoo cattle

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Maximizing the development of the muscular and rumen systems during the growth phase is crucial for effectively enhancing meat yield and quality characteristics during the pre-slaughter fattening period in ruminant species like Hanwoo cattle. This study aimed to investigate the feed intake and growth characteristics during the early and late stages of fattening, based on the feed conversion ratio (FCR) observed during the growing period. Thirty Hanwoo steers were utilized in this experiment, where they were provided with a total mixed ration (TMR) feed (Hapcheon Nonghyup). The groups in the experiment were categorized into three groups, namely Low (G1), Medium (G2), and High (G3), based on the FCR observed during the growing period. Subsequently, the feed intake and growth characteristics of the steers were analyzed until the time of slaughter. The results revealed that a low FCR during the growing period significantly contributed to increased weight, height, hip height, body length, and chest width during the initial stage of fattening ($p < 0.05$). Furthermore, it was observed that a low FCR during the growing period led to significant increases in weight, height, hip height, body length, chest width, chest depth, and chest girth during the later stage of fattening ($p < 0.01$). Therefore, it is recommended to implement a feeding regimen that aligns with the optimal FCR observed during the growing period as a beneficial strategy to enhance the productivity of Hanwoo farms.

Key words : Hanwoo, feed conversion ratio, growth characteristics, growing period, fattening period

PC23046 Comparative study of rumen methane production for various natural substances

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The object of this study was to compare and evaluate the rumen methane production of commercial feed additives including various natural substances. The feed additives used in the study contained Capsaicin, Essential oil, Plant extract, Algae extract, Saponin, DFM, and Activated charcoal. In all treatment groups, *in vitro* fermentation experiments were conducted by adding 0.2%, which is a level generally added to formulated feed. In addition, *in vivo* ruminal methane production analysis was conducted by selecting the top three additives selected through *in vitro* fermentation experiments, was measured using Greenfeed methane measurement equipment. Through *in vitro* fermentation experiments, Capsaicin, Plant extract, and Algae extract were evaluated as the lowest rumen methane production at 3.00, 3.82, and 4.05 mM/mL, respectively. In the *in vivo* experiment, feed additives were fed at 0.2% at treatments, There was no difference between Capsaicin, Plant extract and Algae extract feeding group in body weight and feed intake. The amount of methane production in the rumen was 202.0, 203.2 and 210.8 g/d, respectively. it is necessary to study the effect of methane reduction, rumen fermentation characteristics and animal productivity according to the feeding level of each additives.

Key words : rumen, methane production, natural substance, feed additive, Hanwoo

PC23047

Comparison of enzyme activity of commercially enzymes and application to ruminant feed

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This study was conducted to compare and analyze the enzyme activity of various commercially feed additive enzymes using the same analysis method and to compare the effect of each enzyme addition on the rumen fermentation. Sixteen feed additive enzymes were used in this study, and each enzyme was a mixture of 1 to 4 amylase, β-glucanase, cellulase, mannanase, protease and xylanase. Enzyme activity was analyzed by measuring reducing sugars and amino acids (tyrosine standard reagent) using 3,5-dinitrosalicyclic acid (DNS) and Folin-Ciocalteu reagent. The enzyme titer analyzed in this study was not the same as the enzyme titer provided by the commercially enzyme manufacturer. In vitro fermentation experiments were conducted by mixing the enzymes selected through the above analysis. There was no difference in gas production between the control and the experimental group with the addition of enzyme mixture. The 48-hour DM degradability showed a tendency to increase in all enzyme additive groups compared to the control. In the experimental group in which β-glucanase, mannanase, and protease were mixed, the DM was the highest at 50.62%, but there was no significant difference. e results of this study are expected to provide criteria for selection of enzymes in the manufacture of formulated feeds as analyzing and comparing the enzyme activity of various enzymes used same analysis method.

Key words : ruminant, commercial enzyme, enzyme activity, feed additive, analysis method

번식 및 생리

PD23001 한우 암소에서 FSH의 single injection에 따른 OPU 수정란 생산 효율성 비교분석

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이전 연구를 통해 low-dose follicle-stimulating hormone (mFSH)처리에 따른 OPU(Ovum pick-up) 수정란의 blastocyst rate이 증가하는 것을 확인하였다. 하지만 일반 농가에 직접 방문하여 OPU를 시술하는 과정에서 농가에서 FSH 주사의 번거러움이 있고 공란우가 빈번한 주사에 의한 스트레스를 받을 수 있다. 따라서 본 연구에서는 현장의 접목성을 높이고자 FSH의 single injection에 따른 효과를 비교분석 하였다. 시험축은 경북축산기술연구소의 한우 암소 45두(Control 20두, mFSH 15두, SI_mFSH 10두)를 intravaginal progesterone device를 활용한 super-ovulation 방법을 사용하여 동기화 하였다. Control group은 randome satge에 OPU방법을 통해 난자를 채란하였고, mFSH group는 intravaginal progesterone device를 질내에 삽입하고 estradiol benzoate를 2.0mg 근육 주사하였다. 4일째 5.0mg의 PGF2α를 근육 주사하고 5일째부터 12시간 간격으로 follicle-stimulating hormone을 4번에 나누어서 각각 36, 36, 24, 24mg 씩 근육주사 하였으며 7일째 OPU 방법을 통해 난자를 채란하였다. SI(single injection)_mFSH group은 mFSH group의 처치방법과 동일하나 5일째 120mg을 follicle-stimulating hormone을 한번에 근육주사 하고 OPU방법을 통해 난자를 채란하였다. OPU방법을 활용해서 초음파 장비를 통해 확인된 follicle 대비 회수된 난자의 비율을 비교하였다. Control은 8.5±1.2개, mFSH group은 12.7±1.3, SI_mFSH group은 11.4±2.2로 회수 되었으며 SI_mFSH group은 control에 비해서 높은 회수율을 보였으며 mFSH group과는 유사한 결과가 나타났다. blastocyst rate를 비교한 결과 Control은 31.2%(320/1026), mFSH group은 44.6%(152/341), SI_mFSH group은 40.5%(98/242)로 회수율과 유사하게 나타났다. 따라서 FSH single injection 방법은 현장 적용을 위한 보다 효과적인 방법이라고 판단되기 때문에 OPU 수정란의 생산성 향상에 도움이 될 것으로 기대된다.

Key words : follicle-stimulating hormone, Ovum pick-up, super-ovulation, synchronization, blastocyst rate, 한우 암소

PD

PD23002 Heat stress induced alteration in the plasminogen-plasminogen activator-plasmin system in bovine mammary epithelial cells and Holstein milk

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In this study, we investigated the effects of heat stress on the plasminogen-plasminogen activator-plasmin (PG-PA-PL) system in bovine mammary epithelial cells and Holstein milk to explain the decrease in milk protein under hyperthermia. Cells (5×10^4 cells/mL) were exposed to heat treatment (at 41℃ for 2 h) and then either recovered or not recovered at 37℃ for 8 or 24 h. The mRNA expression level of urokinase-PA (uPA) decreased in the absence of recovery, but increased following an 8 h recovery period. The expression of tissue-PA (tPA) remained unchanged during non-recovery whereas it increased after 8 and 24 h of recovery. Milk samples were collected from seven lactating Holstein cows on different dates with varying temperature-humidity index (severe-moderate, SM; moderate-mild, MM and mild-comfort, MC). The group with SM conditions had higher uPA concentrations (1.21 ng/mL) followed by the MM group (0.31 ng/mL), while no uPA concentration was detected in the MC group. Milk protein was lower in the SM group (3.14%) which was exposed to more heat stress, compared to MM and MC group. In conclusion, heat stress could alter PAs contents, especially uPA which was sensitively influenced by both recovery time and temperature-humidity index. Furthermore, these heat-induced mechanisms in PG-PA-PL system may provide an additional hypothesis to explain the decrease in milk protein in lactating dairy cows.

Key words : heat stress, plasminogen, plasminogen activator, plasmin, bovine mammary epithelial cell, milk protein

PD23003 Establishment of a chemical toxicity evaluation model based on boar spermatozoa

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Recently, as the 3Rs for experimental animals are emphasized, the welfare of experimental animals and alternative methods are being discussed. Spermatozoa are highly dependent on mitochondrial activity and ATP consumption for metabolism, including motility, and thus can be a suitable model for capturing the multiple modes of action and toxicity of chemicals. Therefore, this study is to establish a chemical toxicity evaluation model based on boar spermatozoa. To evaluate toxicity, sperm were exposed to 3,5,6-trichloro-2-pyridinol (TCP), a representative pesticide metabolite, and patterns in sperm dynamic parameters, cell membrane remodeling, and mitochondrial ATP metabolism were investigated. A dose-dependent significant reduction of motility and motion kinematics were observed in sperm incubated with TCP ($p < 0.05$). Sperm viability significantly decreased in sperm in the presence of TCP compared to the controls ($p < 0.05$). Defective acrosomal membranes were highly indicated in sperm incubated with TCP. Also, gene expression levels of ODF2, HSPA8, AKAP3 and AKAP4 associated with sperm movement decreased in sperm exposed to 50-200 μM TCP ($p < 0.05$). Consequently, boar sperm is easy to handle, and results such as membrane remodeling and metabolism can be obtained in a short time, thus it can be considered a suitable cell type for toxicity evaluation, suggesting that it can be used as a protocol for 3R-replacement.

Key words : Spermatozoa, toxicity, 3R-replacement, boar

PD

PD23004 국산 구제역 백신 접종에 따른 한우 암소 인공수정 수태율 및 급성면역반응 비교분석

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이전 연구를 통해 국산 및 외산 구제역 백신접종에 따른 배란지연을 분석한 결과 외산 구제역 백신(배란율 46.2%)에 비해서 국산 구제역 백신(배란율 58.3%)의 경우 배란지연 현상이 상대적으로 낮게 나타나는 것을 확인하였다. 본 연구에서는 이전 연구결과를 토대로 국산 및 외산 구제역 백신 접종에 따른 인공수정 수태율 및 급성면역반응 정도를 분석하였다. 시험축은 경상북도 축산기술연구소의 한우 암소 200두(Control_NS 23두, Control_Vehicle 25두, 국산 FMD백신 71두, 외산 FMD백신 81두)를 Ovsynch 방법을 통해 배란동기화 하여 실험에 활용하였다. 각 시험축은 인공 수정 2일전에 Control_NS은 0.9% normal saline 1ml 근육주사, Control_Vehicle은 국산 구제역백신에서 바이러스를 제외한 오일성분 1ml 근육주사, 국산 FMD백신((주)FVC)은 1ml 근육주사, 외산 FMD백신(힘백 FMD백신, (주)고려비앤피)은 2ml 근육주사 하였으며 백신 접종 2일 후 일괄 인공수정 하였다. 인공수정 50일 경과 후 경직장 초음파 검사를 통해 임신 감정한 결과 Control_NS 시험군은 52.2%(12/23), Control_Vehicle 시험군은 52.0%(13/25), 국산 FMD백신 시험군은 42.3%(30/71), 외산 FMD백신 시험군은 35.8%(29/81)의 수태율을 나타내었다. 그리고 각 시험축에 대해서 백신 접종일 기준 0, 1, 3, 6, 10, 15일에 채혈된 혈장 내 급성면역반응인자(haptoglobin, Serum amyloid A)를 분석한 결과 Control_NS 시험군을 제외한 모든 시험군에서 접종 후 약 3일까지 급격하게 상승하는 것을 확인하였고, 백신 접종 약 9일 후에 정상 수치로 회복되는 것을 확인하였다. 특히 외산 FMD백신 시험군의 경우 haptoglobin, Serum Amyloid A의 혈장 내 함량이 국산 FMD백신 시험군에 비해서 유의적인 차이를 보이며 높게 나타났다. 따라서 국산 구제역 백신은 외산 구제역 백신에 비해서 급성면역반응이 상대적으로 낮게 나타났기 때문에 배란지연 및 인공수정 수태율에 긍정적인 효과가 나타난 것으로 판단된다.

Key words : 국산 구제역 백신, 급성면역반응, Haptoglobin, Serum amyloid A, 배란지연, 배란동기화, 수태율, 인공수정, 한우 암소

PD23005 Effects of low-dose follicle-stimulating hormone on bovine oocytes, *in vitro* embryo production, and warming by ovum pick-up in Hanwoo cows

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Given the global demand for high-quality cattle, it is necessary to develop effective techniques for producing oocytes from high-quality cows. Ovum pick-up (OPU) methods play a significant role in oocyte collection worldwide and are the most efficient means of enhancing genetic advancement through maternal lines in cattle. This study aimed to establish an efficient OPU-derived transferable embryo production system. Oocytes were collected from 20 control and 15 follicle-stimulating hormone (FSH)-treated female Hanwoo. A combination of decreasing doses of FSH (36, 36, 24, and 24 mg, 12 h apart), progesterone, estrogen, and prostaglandin was administered to synchronize and mildly stimulate the animals. In vitro blastocysts were generated by in vitro maturation, fertilization, and culture. The FSH-treated group (1,125 oocytes) and the control group (1,022 oocytes) exhibited a higher proportion of Grade A and B oocytes (88.2%) than other grades ($p < 0.05$), with the majority of them in the germinal vesicle 2 stage (64.0%). Moreover, the FSH group had a significantly higher blastocyst rate (44.7%) than the control group (31.1%) ($p < 0.01$). After vitrification and in vitro culture warming, the embryos of the FSH group exhibited higher re-expansion rates (Grade 1: 86.9% and Grades 2 and 3: 57.9%) than the control group ($p < 0.01$). FSH treatment also reduces working hours, making it an efficient method for embryo production, freezing, and preservation.

Key words: follicle-stimulating hormone, insemination, ovum pick-up, superstimulation, synchronization, vitrification

PD

PD23006 한우 발정기 호르몬 변화에 대한 연구

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본 연구는 우리나라 고유 품종인 한우의 발정기 혈중 호르몬 농도 변화를 조사하기 위해 총 20두의 한우를 대상으로 Prostaglandin F2α를 이용하여 발정을 동기화하고 5일간 연속으로 경정맥에서 혈액을 채취하였다. 시험축의 발정 여부는 목걸이형 생체정보 수집장치(Bio-telemetry device)와 농장 관리자의 육안 관찰 방법을 이용하여 판별하였으며, 경산우 3두(월령: 40.7±5.5, 산차: 1.0±0.0)와 미경산우 5두(월령: 21.7±2.2)에서 발정이 최종 확인되었다. 발정이 확인된 개체의 Estradiol (E_2), Progesterone (P_4), Luteizing hormone (LH), Follicle stimulating hormone (FSH)의 농도를 Enzyme-linked immunosorbent assay (ELISA)방법으로 측정하였다. 그리고 발정이 확인된 날을 포함하여 발정 3일 전부터 발정 후 2일까지 총 6일간의 호르몬 농도를 비교분석한 결과, 모든 항목에서 유의적인 차이가 없는 것으로 나타났다($p > 0.05$). E_2와 FSH는 발정 2일 전에 증가하였다가 다시 감소하는 경향을 보였으며, LH는 발정 당일에 급격히 증가하면서 LH surge가 나타났던 것으로 생각된다. P_4의 경우 발정기동안 0.6~36.6 ng/mL로 편차가 매우 크게 나타났다. 개체간의 차이가 크고 혈액 채취 시간 간격이 넓어 통계적으로 유의적인 결과를 보이지 않은 것으로 판단된다.

Key words : estrus, hormone, Korea Native Cattle (Hanwoo)

PD23007

Effect of embryo splitting stage on development ability of bovine early embryo blastomere

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This study aimed to investigate developmental rate of blastocysts after splitting embryos. Embryos were isolated at different cell stages, and their ability to develop into blastocysts was assessed. IVF was performed using slaughter-derived ovary and frozen straws from Hanwoo cattle. The zona pellucida was removed by treating with 0.1% pronase for 60-90s. Embryo splitting was performed by pipetting after 5 minutes of relaxation in DPBS. At the 5-8cell stage's embryos were separated into multiple-blastomere form. The blastomeres were cultured in a serum-free medium based on mSOF. The developmental rate of blastcyst on day 8 (IVF=day 0) demonstrated the 1/2-cell stage at 37%(27/73), 1/3 to 1/4-cell at 14%(23/160), and the 1/5 to 1/8-cell at 6%(7/110). These results highlight the importance of selecting the optimal embryo splitting stage for blastocyst production. Further research is needed to develope additional factors influencing blastocyst quality and viability. These findings contribute to the advancement of reproductive technologies for selective production of cloned calves.

Key words : embryo spiltting, blastocyst development rate, selective production, cloned calves

PD

PD23008

The comparison of *in vitro* embryo production (IVEP) according to the estrous cycle in Jersey cows

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The Ovum pick-up (OPU) and *in vitro* embryo production (IVEP) techniques could be a potential alternative to traditional embryo production. The objective of this study was investigates the effect of estrous cycle (estrous and non-estrous cycle) on IVEP in Jersey cows. Total 10 Jersey cows were used as donors, and OPU were conducted 1-9 times from March 2022 to April 2023. The estrous cycle were determined by analyzing the serum progesterone levels. Progesterone levels above 1 ng/mL classified the non-estrous cycle, while levels below 1 ng/mL classified the estrous cycle. The good quality cumulus-oocyte-complexes (COCs) were selected, matured during 22h in maturation medium, fertilized with sexing semen, and cultured for 7 days in culture medium. There were no statistical differences among the number of collected oocyte during estrus/non-estrus cycle and subsequently cleaved embryos, but the number of developed blastocyst was significantly higher in non-estrous cycle than in estrous cycle ($p<0.05$). Based on the results, it can be suggested that the day of estrous cycle could be utilized as one of the strategic methods for IVEP through OPU.

Key words : estrous cycle, *in vitro* development, jersey, ovum pick-up

PD23009 Effects of body condition score on estrous behavior and pregnancy rate following frozen-thawed embryo transfer in Holstein dairy cattle

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The objectives of this study were to determine the relationship between Body Condition Score (BCS), estrus behavior and pregnancy per embryo transfer (P/ET) of estrus-synchronized Holstein-Friesian cattle. This retrospective study was conducted on our dairy center located in Cheonan, South Korea from November 2020 to February 2023. All data were collected from Excel spreadsheets included information of the cattle ID, estrous status, BCS and results of pregnancy diagnoses. All animals (n = 28) were estrus-synchronized using CIDR-Ovsynch methods for ET. Estrus was detected using Scratchcard and visual observation by farm staff. The frozen-thawed embryos were transferred into uterine horn to the CL using ET syringe 7 ± 1 days after the estrous detection. Pregnancy status was diagnosed by transrectal ultrasonography 50 days after ET. The statistical analysis were conducted using SPSS statistics 27 with t-test. First, We investigated the relationship between estrous behavior sign and BCS. All animals were divided into two groups : Group 1 animals (n = 9) do not exhibit estrous behavioral signs; Group 2 (n = 19) exhibited estrous behavioral signs. Group 1 had significantly higher BCS compared to Group 2 cows (3.28 vs. 3.08; $p < 0.05$). Second, We examined the effects of BCS on pregnancy rate following frozen-thawed ET. we also divided the animals into two groups based on pregnancy status. Non-pregnant group (n = 22; BCS 3.24) had significantly higher BCS compared to the pregnant group (n = 6; BCS 2.92). In conclusion, the BCS affects estrous behavior and pregnancy success in dairy cattle. Here we suggests that BCS management is an important factor in reproductive management of dairy cattle.

Key words : holstein cattle, body condition score, estrous behavior, pregnancy status

PD23010 Influences of providing nesting material and supplementing vitamin C on prepartum nest-building behavior in hyperprolific sows

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Nest-building (NB) behavior in prepartum sows is a crucial maternal instinct related to farrowing and lactating performance. However, conventional pig farms face limitations in encouraging NB behavior due to the lack of space and materials. This study aimed to compare the effect of providing a coconut coir mat as nesting material and supplementing vitamin C as an antioxidant on NB behavior in hyperprolific (HP) sows. In total, 35 sows were allocated to 4 treatments four days before the expected farrowing date: Control (C; n=9): basal diets, Vit-C (V; n=8): basal diets + vitamin C (40,000IU/kg feed), Mat (M; n=10): basal diets + coconut coir mat, Vit-C+Mat (VM; n=8): basal diets + vitamin C (40,000IU/kg feed) + coconut coir mat. Bout duration of NB behavior in the V group was significantly shorter than in the other groups 24-12 hours before farrowing ($p = 0.049$). In post-hoc contrast analyses, both total and bout duration of NB behavior in the M and VM groups were longer compared to the C and V groups 24-12 hours before farrowing ($p = 0.007$, $p = 0.005$, respectively). This study confirms that a coconut coir mat is a suitable nesting material that satisfies the desire to perform NB behavior, whereas vitamin C supplementation disrupts the expression of NB behavior in HP sows. Consequently, further research is needed to demonstrate a causal relationship between oxidative stress and NB behavior in HP sows.

Key words : bedding material, large litter size, maternal instinct, oxidative stress, prepartum sows

PD23011 Assessing physical indicators for identifying low-weight gain and IUGR piglets

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The rise in litter sizes has led to an increase in the number of underweight piglets and those with intra-uterine growth retardation (IUGR), which adversely affects productivity and welfare of pigs. On pig farms, workers directly involved in the care of these animals often euthanize such piglets without standardized criteria, as they have a lower potential for growth compared to healthy piglets. This research aimed to evaluate the potential of physical properties of piglets and a novel method for assessing intrauterine growth restriction (IUGR) as reliable indicators for piglet body weight (BW) and body weight gain (BWG). In this study, a total of 108 piglets from ten sows were examined for viability within first five days after birth, based on their low BW and BWG. Despite variations in BW and the incidence of IUGR, no piglet mortality was observed. Piglets weighing over 1 kg showed significantly higher scores in head morphology, rectal temperature, and body lengths compared to piglets weighing less than 1 kg ($p < 0.05$). The evaluation of IUGR piglets using conventional methods revealed that normal piglets had significantly higher scores for head morphology and overall IUGR compared to IUGR piglets ($p < 0.05$). In conclusion, this study suggests that assessing the head morphology score can be a valuable indicator for identifying low-weight gain and IUGR piglets based on their physical characteristics. Furthermore, regardless of piglet body weight, effective management practices were able to prevent piglet mortality, highlighting the importance of skilled workers in pig farms.

Key words : health management, IUGR piglets, neonatal mortality, piglet vitality

PD

PD23012 Effect of glycerol equilibration time on sperm characteristics after thawing frozen semen in chicken

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As livestock epidemics occur every year, native domestic livestock in Korea are recognized as national assets. Accordingly, the importance of genetic resource conservation is increasing. In particular, in the case of chickens, research on preserving reproductive cells is needed to respond to infectious diseases such as Highly Pathogenic Avian Influenza. Accordingly, in order to increase the utilization after thawing the frozen semen of Ogye, the vitality of sperm according to the glycerol equilibration time was evaluated. After the final dilution of semen, 20 minutes, 1 hour, 2 hours, and 3 hours of glycerol equilibration were given at 5°C. Motility was 48.85 ± 4.45, 50.99 ± 5.04, 72.35 ± 3.59, and 39.25 ± 4.63% in the equilibration time groups of 20 minutes, 1 hour, 2 hours, and 3 hours, respectively. It was confirmed that overall sperm motility was maintained at the highest level when the glycerol equilibration time was held at 5°C for 2 hours ($p < 0.05$).

Key words : chicken, semen, glycerol, preservation

PD23013 Effects of music exposure on physiological characteristics in domestic riding horses

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This study was conducted at the Subtropical Livestock Research Institute, focusing on eight domestic riding horses. The horses were exposed to classical music, rock, and new age, and their stress levels were compared through analysis of neurotransmitters and electrolytes. Salivary cortisol levels significantly increased during exposure to new age music ($p < 0.05$) and also significantly increased during rock ($p < 0.001$). Serum cortisol showed a significant decrease during exposure to classical music ($p < 0.05$) and also significantly decreased during new age ($p < 0.0001$). Dopamine only showed a significant decrease during new age ($p < 0.05$). Oxytocin significantly decreased during classical music ($p<0.05$) and also significantly decreased during rock ($p < 0.01$). Furthermore, electrolyte analysis revealed that creatine phosphokinase (CPK) significantly decreased during exposure to new age ($p < 0.05$). Aldolase significantly decreased during classical music ($p < 0.05$) and also significantly decreased during new age ($p < 0.01$). Considering that the behavior and psychological state of riding horses are crucial factors in horsemanship, minimizing stress and maintaining psychological stability in horses is important. Therefore, it is suggested that providing relaxing and calm genre of music can positively impact the behavior and emotions of domestic riding horses, leading to stress reduction, improvement of rearing environment, and enhancement of animal welfare.

Key words : horse, stress, music, neurotransmitter, electrolyte

PD23014 Detection of Sow's Gestational Sac in Ultrasound Image using Yolov4-CSP

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People's income levels and society's economic status have increased yearly. It resulted in a rise in meat consumption. However, there has been a continual decline in the number of individuals involved in livestock farming during the same period, and the average age of those engaged in the industry is also increasing. Consequently, meat production has been decreasing. To address this issue, Information and Communication Technology (ICT) was introduced to livestock farms starting in 2014. Various technologies have been implemented to provide valuable information to livestock farmers, particularly those needing efficient pregnancy diagnosis and confirmation of gestational sacs. In this study, the Yolov4-csp model, one of the deep learning models for object detection, was employed to detect sow's gestational sacs in ultrasound images. The model's performance was evaluated based on mean Average Precision (mAP) and Accuracy, yielding 82.6% mAP and 82% Accuracy results.

Key words : deep Learning, gestational sacs, sows, ultrasound images, Yolov4-csp

PD23015 Effect of different sperm numbers and estrus heat detection patch on pregnancy rate in timed artificial insemination in Hanwoo cattle

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In the present study, we examined effect of 10 million and 20 million number of sperm and estrus heat detection patch (EDP, Estrotect, Rockway Inc.,) on pregnancy rate after artificial insemination (AI). Estrus cycles of 212 number of Hanwoo cows were synchronized by CIDR insertion. After 7 days, CIDR was removed and 5.0 ml of PGF2a was injected to cows. EDPs were affixed to the tail head of each cows. AI was conducted at 2.5 and 3.5 days of PGF2a injection. Ten million number of sperm in a 0.25ml straw and 20 million number of sperm in 0.5ml straw were used for AI in 67 cows and 135 cows. Estrus intensity was evaluated by peeling percentages of EDPs at 2nd AI and divided into three groups as following: G1 (less than 25%), G2 (26 to 50%), and G3 (more than 50 to 100%). At 28 days after AI, pregnancy was examined by pregnancy associated glycoprotein ELISA kit (Aleryts rapid visual pregnancy kit, IDEXX). Ten million group showed 37.3% of pregnancy rate (25/47 cows), and 3 EDPs showed different pregnancy rates (G1, G2, and G3 vs. 0, 31.3, and 41.7%). The 20 million group showed 63% of pregnancy rates (85/135 cows), and 3 EDPs showed different pregnancy rates (G1, G2, and G3 vs. 52.3, 40.0, and 69.8%). In conclusion, it is suggested that increased EDP grade is acceptable to increase of pregnancy rate with 10 million number of sperm. Timed AI at G3 showed appropriate period when 20 million number of sperm used.

Key words : artificial insemination, Hanwoo, heat detection, sperm number

PD23016 The effects of Nitric Oxide on the longevity and acrosome cap reaction of rooster semen under hypoxia condition

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Nitric Oxide(NO) is a type of free radical and is known as a factor that performs various physiological functions. The NO plays an important role in mammalian sperm function that cause sperm motility and viability, but little information on avian spermre was reported. Therefore, this study observed the motility and longevity of sperm by treating S-Nitroso-N-acetyl-DL-penicillamine(SNAP) under hypoxia condition. The sealed Ogye fresh semen in 0.5ml staw was treated with SNAP, NO donor, and was refrigerated at 5℃ for 1, 3days. On day 1, treated with SNAP 25μM showed the highest motility (87.7±0.4% vs 85.6±0.8%). In addition, on 3 day, the motility of roorster semen with SNAP 25μM was increased than control (82.3±0.2% vs 70.3±0.2). The effects of SNAP on acrosome cap was measured by histochemical staining with CBB, the proportion of intact acrosome cap of SNAP 25μM treated sperm was not different to fresh semen (95.7±1.3%), however that of preserved sperm at 5℃ for 1 day l was reduced to 89.0±1.3%. These results show that the motility of fresh semen is considered to be maintained with SNAP 25μM treatment under hypoxia condition and NO is involved in the acrosome damage of rooster semen.

Key words : Nitric Oxide, Hypoxia, rooster semen

PD23017 The effects of 2-deoxy-D-glucose on the motility of bovine spermatozoa

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Glucose is one of monosaccarides for sperm glycolysis metabolism that enable tail for vigorous movement and survival. So, the bovine semen diluents contains glucose or fructose to extend sperm longevity at cryopreservation process. In this study, we observed the motility and longevity of hanwoo sperm by treating 2-deoxy-D-glucose (DDG) that inhibits glucose-6-phophatase with different concentration. The motility of frozen/thaw spermatozoa that was treated with 1mM DGG was significantly reduced than 1 mM glucose and 1mM fructose. The longevity of DGG treated spermatozoa also decreased with significance. Even in the lower concentration of 50 μM DDG, 1 h treatment significantly reduced the sperm motility from 70.6% to 37.8~51.2%. Also the acrosome was damaged 3 h treatment of 50μM DGG. The rate of intact acrosome was significantly reduced than control. The effects of DDG on acrosome was measured by histochemical staining with CBB dye. The ratio of intact acrosome of DGG 50μM treated sperm was significantly different to fructose treated group (30.2±2.6 vs 45.7±5.9). These results show that the motility of bovine spermatozoa is regulated by glycolysis and DGG 50μM treatment could reduce the motility via blocking glucose 6 phophorylation.

Key words : 2-deoxy-D-glucose, bovine, spermatozoa

PD23018 The growth rate affects on the testis size of Hanwoo bullocks in elite population

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The growth rate of Hanwoo cattle is important factor for selection of breeding bulls for genetic improvement. To establish a elite population of Hawoo line, we selected two bulls from embryo transferred 18 individuals. The family was created by embryo transfer from elite cow and Korean proven bull's semen. The elite cow was selected from breeding farm of Gyeongsangnam-do area and used for oocyte donor of OPU procedures. One of chosen male calf was shown the increased body weight (258.6±26.7 kg vs 297.0±28.8 kg) and larger testis size at 8-month-age (11.5 cm vs 13.1 cm in scrotal circumference (SC). As a result of castration, the testicular weight of elite bullock was also heavier than normal sized bullock (104.9 g vs 162.4 g). In the case of normal Hanwoo bullock, the SC grows rapidly at 5 month to 15 month and maximized at 25 month age with 35 cm SC. With regards on SC, the elite bullock of 8 month had the size of SC of 12 month. These results show that the elite calf grow up fast than normal hanwoo population and also reach at puberty early. So the elite population from OPU-ET procedures could be used for genetic breeding system with short generation interval.

Key words : 2-deoxy-D-glucose, bovine, spermatozoa

PD23019

Reference Intervals for Hematology and Clinical Chemistry for the domesticated elk (*Cervus canadensis*) in Korea

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For the evaluation of clinical tests in veterinary laboratories a reference basis of normal values of clinically healthy farm animals is essential. It is well known that variables such as breed, age, gender, reproductive status, stress and seasonality have an influence on many blood parameters. The aim of this study was to generate hematology and clinical chemistry reference intervals(RIs), using blood samples from the zero-grazing domesticated elk(*Cervus canadensis*) in South Korea. Hematology RIs were derived from EDTA whole blood samples(n=65) using a hematology analyzer (IDEXX, ProCyte DxTM, USA). Clinical chemistry RIs were generated from the results of fresh serum samples(n=43) using automated analyzers (IDEXX, Catalyst DxTM, USA). RIs were calculated by RefVal program(Norway). Hematology RIs were: RBC 6.51–11.60 M/μL, HCT 25.3-53.5%, HGB 10.6–20.8 g/dL, MCV 34.2–49.2 fL, MCH 14.6–19.8 pg, MCHC 38.9-44.8 g/dL, PLT 129-417 K/μL, WBC 1.61-6.97 K/μL, neutrophils 0.84–4.37 K/μL, lymphocytes 0.68-2.61 K/μL, monocytes 0.01–0.11 K/μL, eosinophils 0.02–1.84 K/μL, basophils 0.00–0.41 K/μL. Clinical chemistry RIs were: glucose 43-206 mg/dL, creatine 1.2-2.6 mg/dL, BUN 18-31 mg/dL, phophate 5.1-8.8 mg/dL, calcium 7.5-9.3 mg/dL, total protein 5.8-8.4 g/dl, albumin 2.5–3.9 g/dL, globulin 3.0–4.8 g/dL, ALT 22-153 U/L, ALP 33–562 U/L, GGT 22–53 U/L, total bilirubin 0.1-1.1 mg/dl, cholesterol 25-88 mg/dl, BUN/Cr ratio 8-18, Alb/Glob ratio 0.6-1.0. These RIs will be helpful in the future management of injured or diseased elks in Korea.

Key words : Elk, reference interval, blood chemistry, hematology

PD

유전 및 육종

PE23001 Imputed whole-genome sequence-based association study and biological network analysis to identify positional candidate genes affecting hematological traits in pigs

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Hematological traits can be implicated in robustness and disease defense functions in livestock. This study was performed to identify quantitative trait locus (QTL) and positional candidate genes that affect the hematological traits in pigs by using imputed whole-genome sequence-based association study. A total of 543 purebred Yorkshire pigs were genotyped using 10,623,433 single nucleotide polymorphisms (SNP) markers located throughout the autosomes. The Genome wide rapid association using mixed model and regression (GRAMMAR) approach was used to identify QTL. In this GWAS, we revealed that 689 SNPs were associated with hematological traits. We detected 47 genes as positional candidate genes for hematological traits. We conducted analysis of biological pathways to investigate the functionality of positional candidate genes in the vicinity of SNPs that affect phenotypic variation ($p < 0.01$), and network analysis was performed to confirm the interaction between the genes. The results can play an important role in understanding genetic architecture of hematological traits variation in pigs.

Key words: imputed whole-genome sequence-based association study, hematological trait, robustness, pig

PE23002 Genome-wide association studies on pH trait of meat quality in Hanwoo

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Consumption characteristics such as tenderness and juiciness of beef have a great influence on consumers' beef purchasing decisions. pH has a close relationship with the protein content, shear force, tenderness, juiciness, and water holding capacity(WHC) of meat, and has an important influence on the meat quality. The WHC increases significantly as the pH increases, and the protein content decreases significantly as the pH increases. Existing studies on meat quality have been conducted with a focus on marbling. Characteristics such as tenderness and juiciness of beef have not been studied much yet, so more research is needed. In this study, a genome-wide association study (GWAS) was performed to detect significant variants and candidate genes related to pH trait. In this process, the BLUPF90 family programs and the GRAMMAR method were used. Phenotypic and genomic data of 136 heads of Hanwoo were used. A total of 44 potential SNPs were identified as significantly associated with the pH trait, and these SNPs were located at or near 67 candidate genes. We identified biological pathways to predict the biological functions of candidate genes. We found that candidate genes PPP2R5E, CTTNBP2NL are involved in regulating phosphorylation and dephosphorylation of proteins. It affects protein degradation and tenderization of meat. In addition, genes such as MYO1D and MYO3B were found to be related to WHC and myofibrillar proteins. And C3, SERPINI1 affect protein degradation and increase in basicity (pH). All of these genes are related to meat quality and consumption traits. Therefore, the discovery of these genes will contribute to the improvement of beef meat quality and provide the basis for research on the genetic characteristics of Hanwoo in the future.

Key words : Hanwoo, Genome-wide association study(GWAS), pH, SNPs

PE23003 지역별 한우 탄소발자국 현황과 생산 기간 단축에 따른 탄소발생량 저감 현황 분석

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정부는 2021년 9월, 탄소중립 사회로의 이행을 위해 '기후 위기 대응을 위한 탄소중립 녹색성장 기본법'을 제정하였다. 또한 '2030 국가 온실가스 감축목표(NDC) 상향안'을 수립함으로써, 2018년 대비 전체 온실가스 40%를 감축하는 목표가 확정되었다. 농축수산분야의 경우 2030년 18백만톤CO_2eq을 배출하여 18년 대비 27.1%를 감축해야 한다. 2020년 국가 온실가스 총배출량은 656.2백만톤 CO_2eq이며 농업 분야에서는 총 배출량의 3.2%를 차지하는 21.1백만톤 CO_2eq으로 측정되고 있다. 그 중 축산 분야의 배출량은 장내발효 4.7백만톤 CO_2eq, 가축분뇨처리 5.0백만톤 CO_2eq으로 농업분야의 약 46%를 차지하고 있다. 최근 축산분야에서는 저탄소 축산물 인증제 기준안을 마련하여 탄소배출량 저감을 위한 노력을 진행중에 있다. 이를 위해 계량화가 가능한 저탄소 농업기술 적용에 따른 배출량을 산정하고 기준배출량을 기준으로 평가와 인증을 위한 시범사업을 추진중에 있다. 가대상 농장의 도체중 1kg당 온실가스(장내발효, 분뇨처리, 에너지) 배출량을산정하며, 평균배출량(13.01kg/CO_2eq)의 27.1% 감축 수준인 기준 배출량(9.48kg/CO_2eq)을 만점으로 평가대상 농장의 실적을 평가한다. 본 연구는 축산물품질평가원을 통해 한우의 도축정보를 제공받아 전국단위의 한우 탄소발자국 현황을 분석하였으며, 생산기간 단축을 통한 탄소발생 저감 현황을 분석하였다. 본 연구결과는 보다 효율적인 탄소 배출 저감 방안 모색을 위한 중요한 기초자료가 될 것이다.

Key words : 한우, 탄소중립, 탄소발자국, 저탄소축산물인증제

PE

PE23004 Selection of SNP markers combination for discrimination between Holstein and Jersey breed

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Frequently, food products that are priced low and have poor quality become targets of fraudulent labeling by producers. For example, Korean native cattle (known as Hanwoo) are regarded as expensive premium beef in Korea due to their high marbling scores. This has led to faudulent producers falsely labeling meat from other cheaper breeds as Hanwoo beef and selling it to consumers at a higher price. Recently, the number of heads of Jersey breeds, one of the dairy cattle in Korean, has been gradually increasing. Jersey milk is more expensive than other commercial milk in Korea due to its scarcity and high milk protein and fat percentage. The objective of this study is to identify SNP markers to prevent the adulteration of Jersey milk and dairy products with cheaper Holstein milk and products. In this study, the Illumina bovine SNP 50K chips (Illumina Inc., San Diego, CA) were used for SNP genotyping in Holstein-Friesian (n = 1044) and Jersey (n = 179) cattle to analyze the breed-specific SNPs. The genotyping data were ranked based on the probability of breed discrimination using Wright's Fst, which apportions the standardized variance in allele frequencies between breed populations. SNPs were ranked in descending order of probability, and then combinations of markers were formed, starting from the highest ranked SNP. Finally, we discovered a combination consisting of four SNPs that can completely discriminate Holstein and Jersey cattle. Here, we suggest that in the future, if the number of Jersey cows raised increases in South Korea, our identified markers can be used to detect fraudulent labeling of other commercial milk as Jersey milk by fraudulent producers.

Key words : Holstein, Jersey, milk, single nucleotide polymorphism, breed discrimination

PE23005

The growth traits in endangered Hanwoo genetic resources; Chikso, Heugu, and White Hanwoo

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The objective of this study was to compare the performance of growth traits such as birth, weaning, 6, 12, 18, 24, and 36 months of age weights and body measurement traits in Endangered Hanwoo Genetic Resources; White Hanwoo, Chikso, and, Heugu. The number of individuals at various age was 16-46 heads for White Hanwoo, 20-54 heads for Chikso, and 5-20 heads for Heugu, respectively. Body weight in Korean Traditional Cattle were quite similar to those of birth, but was the heaviest in White Hanwoo at 12 month and was the lightest in Chikso. Body weight of cows at 24 month was the heaviest in Heugu and was the lightest in Chikso. Body weight of bulls at 36 months was similar to Heugu, Chikso and White Hanwoo. The values of body measurement traits in Korean Traditional cows were quite similar to those of Hanwoo at 24 month of age in cows but were much lower at 36 month in Hanwoo cows. This result seems to be due to the effects of improvement of Hanwoo breeding effect.

Key words : Korean traditional cattle, White Hanwoo, Chikso, Heugu, growth trait

PE23006

The regional demographics of the pet dog population by age and species in South Korea

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Accurate identification of the number of pets is important for predicting the size and growth of the domestic companion animal industry. To lay the groundwork for the pet market, the distribution of domestic companion dog breeds and age was investigated. Breed and age data were collected from 17 administrative districts, including 1 special city, 6 metropolitan cities, 8 provinces, 1 special self-governing province, and 1 special self-governing city, using the animal registration status provided by the Animal and Plant Quarantine Agency. The growth stages were classified as follows: puppies (<2 years old), adults (2-7 years old), and seniors (8-20 years old). A total of 3,164,021 dogs of 178 breeds were investigated. The most common breeds were Maltese (19.07%), mixed dogs (16.03%), Poodles (12.86%), and Pomeranians (9.44%). Across all breeds, the age distribution ratio was 5.92% for puppies, 44.8% for adults, and 49.28% for seniors.Depending on the region, the proportion of senior dogs was higher in cities, while the proportion of adult dogs was higher in local provinces. These regional demographics of the pet dog population by age and species in South Korea provide valuable basic data for the domestic companion animal industry.

Key words : companion dog, breed, growth stage

PE23007 Identification of copy number variations (CNVs) in Hanwoo cattle using SNP Beadchip array

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In recent years, copy number variation (CNV) can be recognized using next-generation sequencing and single nucleotide polymorphism-based microarray technology in the research on the analysis of its connection with economic traits in livestock breeding. In this study, we analyzed CNVs and evaluated the relationship between copy number variable regions (CNVRs) and economic traits investigated in Hanwoo steer (n = 473) using the Illumina Hanwoo SNP 50K beadchip. The PennCNV software was used to identify CNVs, followed by the use of CNV Ruler software to locate different CNVRs. Additionally, bioinformatics analysis was performed using Biomart tools. We established a total of 2575 CNVs and 416 CNVRs. A significant association was determined between CNVRs and economic traits using CNV Ruler software. Upon analyzing the restriction of minor alleles frequency > 0.05 for economic trait relation, 6 CNVRs in the carcass weight, 2 CNVRs in the marbling score, 3 CNVRs in the backfat thickness, and 2 CNVRs in the longissimus muscle area were connected to the economic traits. In conclusion, our results verified that the CNVs in Hanwoo are associated with their economic traits. These results contributed to the greater understanding of CNV in Hanwoo and its role in genetic variation among cattle livestock.

Key words : copy number variation, Hanwoo, economic traits, CNV region

PE

PE23008 ROH (Runs of homozygosity) analysis of Yeonsan Ogye chicken population using 600K SNP chip information

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Yeonsan Ogye is a native Korean chicken breed with an utterly black appearance. In the present study, Runs of Homozygosity (ROH) status was investigated in the Yeonsan Ogye population to identify ROH-based inbreeding coefficient and the correlations with other various inbreeding estimations and analyze the genetic characteristics using 600K single nucleotide polymorphism (SNP) Chip information of 189 chickens. A total of 20,371 ROHs were identified in this population. The average number of ROHs was about 107 (63 - 160), the total length of the average ROH was about 171 Mb (47 Mb – 286 Mb), and the average ROH length was 1.605 Mb (0.8 Mb - 2.3 Mb). The length of ROH was mostly short ROH less than 8 Mb, which could be evidence of reflecting bottleneck in the past. The average of the inbreeding coefficient (F_{ROH}) calculated based on ROH was 0.184 and showed various correlations with other inbreeding coefficients, which were estimated with allele frequencies. 18 ROH islands are detected which regions over the threshold of the top 1% of SNPs among the SNPs present in ROHs. A total of 165 genes were annotated in the ROH islands, some of which are candidate genes associated with economic traits and hyperpigmentation in chickens. In addition, a comparison of the overlapping region between the ROH island region with quantitative trait locus (QTL) involved that most of the QTLs were related to production traits. The results of this study will help for the basement data of the optimization and direction of the conservation strategy of Yeonsan Ogye.

Key words : chicken, 600K SNP, runs of homozygosity, inbreeding coefficient

PE23009 Estimation of selection index of Hanwoo cows using genomic breeding value based on carcass traits of Hanwoo cow's offspring

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To estimate the selection index of Hanwoo cows using Carcass weight(CW), Eye muscle area(EMA), Backfat thickness(BF), Marbling score(MS), and Price traits, A regression analysis was conducted on the genomic estimated breeding values (GEBVs) for 107 Hanwoo cow's offspring with an accuracy of over 99% out of a total of 443,655 offspring, using the carcass trait breeding values of selected individuals. To estimate the genetic merits of offspring, a statistical model was applied using the 932,532 Hanwoo steers born from 2006 to 2015, with farm location and slaughter year-month as a fixed effect and slaughter age as a covariate fixed effect. The genetic variances in the multivariate analysis were estimated as 0.57±0.01 for CW, 0.44±0.01 for EMA, 0.48±0.01 for BFT, 0.57±0.01 for MS, and 0.51±0.01 for Price. The same phenotypic data and statistical model were used for estimating the breeding values. The SNP data consisted of 45,732 SNPs from 5,944 individuals after quality control. The correlation between Price GEBV and the other carcass GEBVs was estimated as 0.81 for CW($p < .001$), 0.79 for EMA($p < .001$), -0.02 for BFT($p = .81$), 0.73 for MS($p < .001$), indicating a significant correlation among the carcass traits except for BFT. Based on these correlations, regression coefficients were estimated for Price GEBV in the other carcass GEBVs, 16.403±0.416 ($p < .0001$) for CW, 17.643±2.020 ($p < .0001$) for EMA, -48.474±3.714 ($p < .0001$) for BFT, and 353.321±10.544 ($p < .0001$) for MS. Therefore, the selection index using GEBVs for Hanwoo cows was proposed by the estimated regression coefficients as following formula:

Key Words: Hanwoo cows, carcass traits, selection index

PE

PE23010 Analysis for utilization of six microsatellite markers in Hanwoo

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This study was conducted to determine the utilization of six microsatellite (MS) markers in Hanwoo. Four tri-nucleotide repeats, one tetra-nucleotide repeat, and one MS marker with a combination of tri and tetra repeats were utilized. A total of 1,106 Hanwoo at the Hanwoo Research Center of the National Institute of Animal Science were used for the analysis. As a result of this study, all six markers had sufficient polymorphism with a polymorphic information content (PIC) value of more than 0.5. These six markers were able to be multiplexed with 11 di-nucleotide repeats markers currently used in Hanwoo beef traceability. The probability of identity (PI) analyzed using the six markers were PI 5.05×10-7, $PI_{halfsibs}$ 1.73×10-5, and PI_{sibs} 3.61×10-3. The probability of exclusion (PE) was estimated with PE_1 0.98482, PE_2 9.57242, and PE_3 more than 0.99. The six markers can be used in combination with the existing 11 di-nucleotide repeats markers to improve individual identification and probability of paternity in Hanwoo.

Key words : Hanwoo, microsatellite, MS, marker

PE23011 Comparative study of egg production and egg quality between egg-typed Korean native chicken and commercial chicken

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This study was conducted to compare egg productive performances between egg-typed Korean native chicken (egg-typed KNC) and commercial chicken (CC; Hyline brown hens). A total of 150, egg-typed KNC (four-crossbreed hens from Korean Rhode C, Korean Leghorn F, KNC Yellowish-brown, and Korean Rhode D) and CC were allocated to 20 to 60 weeks of experimental groups, respectively. Results showed that the egg production of the egg-typed KNC group was significantly ($p < 0.05$) decreased compared to that of the CC group from 26 to 60 weeks. Egg shape index of egg-typed KNC group was significantly ($p < 0.05$) lower than that of the CC group. Egg weight was lower ($p < 0.05$) in the egg-typed KNC group than in the CC group. Eggshell strength and eggshell thickness were lower ($p < 0.05$) in the egg-typed KNC group than in the CC group. Albumen weight ratio was lower ($p < 0.05$) in the egg-typed KNC group than in the CC group, whereas yolk weight ratio was higher ($p < 0.05$) in the egg-typed KNC group than in the CC group. There was no significant difference in yolk index between egg-typed KNC and CC groups. Accordingly, egg performance was lower in the egg-typed KNC group than in the CC group due to limitations of genetic resources in Korea. In the future, it is considered necessary to conduct a study on the selection of superior chickens and nutritional requirement for performance improvement.

Key words : egg production, egg quality, egg-typed Korea native chicken, Hyline brown laying hen

PE

PE23012 Significant association between FSVs in *MYH3* gene and muscle collagen content in the crossbred population (Landrace x Jeju native pig)

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This study examined the association between functional sequence variants (FSVs) of myosin heavy chain 3 (MYH3) genotypes and collagen content in a Landrace and Jeju native pig (JNP) crossbred population. A total 187 pigs, four muscles (*M. longissimus dorsi*, *M. semimembranosus*, *M. triceps brachii*, and *M. biceps femoris*) were used for the analysis of meat collagen content, and the same animals were genotyped for the FSVs of the *MYH3* gene by using PCR-RFLP (polymerase chain reaction-restriction fragment length polymorphism). We confirmed three FSVs of *MYH3* genotypes and frequencies of 0.358, 0.551, and 0.091 for *QQ*, *Qq*, and *qq*, respectively. *QQ* genotype animals for the FSVs of the *MYH3* genotypes showed higher values in their *M. longissimus dorsi* ($p < 0.001$), *M. semimembranosus* ($p < 0.001$), *M. triceps brachii* ($p < 0.001$), and *M. biceps femoris* ($p < 0.001$) than *qq* homozygous genotype animals. When we computed the percent variance of the *MYH3* FSVs as the effect size, we found that the *MYH3* FSVs explained up to 39.7% of phenotypic variance. Selection for pigs with the FSVs of *MYH3* genotypes can be a valuable genetic marker for improving collagen content in porcine muscles and can also be a valuable molecular genetic marker for increasing the amount of collagen for biomedical purposes.

Key words : muscle collagen content, genotype, pig, *MYH3*

PE23013 Estimation of genetic parameters for primal cuts weight traits of Hanwoo in Pyeongchang county

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According to a recent survey on Hanwoo beef consumption trends, the main cuts of Hanwoo beef purchased by consumers are loin, tenderloin, strip loin, and ribs, which account for 80% of the total purchase. Therefore, this study was carried out to estimated the genetic parameters of 10 primal cuts weight traits in castrated Hanwoo cattle. The data used for the analysis were 4,696 carcasses traits and 4,253 10 primal cuts traits of Hanwoo slaughtered between 2020 and 2022 provided by the Pyeongchang-Yeongwol-Jeongseon livestock cooperative. The pedigree data comprised 35,018 animals after tracing the pedigree. Genetic parameter estimation was analyzed as a multiple trait animal model using the BLUPF90 software package. The model used in the analysis included farmer, slaughterhouse, and slaughter date group as fixed effects and age at slaughter as a covariate. The results showed that the heritability estimates of tender loin, loin, strip loin and neck were 0.45, 0.47, 0.45, and 0.36, respectively. Among the 10 primal cuts, bottom round had the highest heritability (0.53), while neck had the lowest heritability. The genetic correlation of the 10 primal cuts ranged from 0.36 to 0.93. Genetic correlation was highest for shank and bottom round, and lowest for strip lion and rib. Genetic correlations between tender loin, loin, strip loin, and neck ranged from 0.59 to 0.78. The results of this study showed that the heritability of the cuts preferred by consumers was high, and it is expected that it might be utilized as an economic trait for improving Hanwoo cattle in the future.

Key words : Hanwoo, primal cuts, heritability, genetic correlation

PE

PE23014 디지털 정보 기반 닭의 깃털 색 정밀 표현형 연구

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가금 산업에서 깃털 색은 품종 구분 시 지표로 사용되며, 최근에는 특정 깃털 색이 생산성을 낮출 수 있는 feather pecking과 관련이 있다고 밝혀져왔다. 따라서 닭의 개량을 위해 깃털 색은 고려해야 할 중요 형질로 여겨지고 있다. 이에 따라 가금의 깃털 색에 대한 유전자원 및 변이를 찾기 위해 다양한 연구가 진행되었지만, 일반적으로 색은 질적 형질로 여겨져 이를 분류하는 기준이 주관적이라는 한계가 존재한다. 따라서 본 연구에서는 닭의 깃털 색을 수치화하기 위해 디지털카메라를 이용하여 깃털 이미지를 분석하였다. 이를 위해 검은색 깃털을 가진 연산 오계와 흰색 깃털을 가진 백색레그혼을 교차 교배하여 생산된 F2 집단을 사용하였는데, 연구자가 F2 집단 내의 깃털 색을 분류한 결과 총 10개의 카테고리로 분류할 수 있었다. 반면에, 몸통 깃털 색을 Red, Green, Blue (RGB) 평균값으로 정량화하여 분석한 결과, 전체 깃털 색이 쌍봉 분포를 나타내는 것을 확인하였다. 또한, 정량화된 값을 이용하여 K-means clustering을 실시하여 깃털 색 그룹을 두 개로 나눌 수 있었다. 본 연구에서 사용된 이미지 분석법을 통해 깃털 색상을 수치화했을 때, 기존의 연구자들에 의한 분류 방법보다 효율적이며 분류 시 연구자의 주관을 배제할 수 있다는 장점이 존재한다. 이 논문은 2023년도 정부(과학기술정보통신부)의 재원으로 정보통신기획평가원의 지원을 받아 수행된 연구이다 (No.RS-2022-00155857, 인공지능융합혁신인재양성(충남대학교)).

Key words : 닭, 깃털 색, 이미지 분석

초지 및 환경

PF23001 Development of intelligent ventilation control for second-generation smart poultry farms using computational fluid dynamics

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With the recent advancements in second-generation smart poultry farm using artificial intelligence technology, research is underway to provide appropriate growth environments in broiler houses. This study aims to analyze the temperature distribution and airflow using computational fluid dynamics simulations and develop a new ventilation algorithm based on the findings. The selected broiler house, intended for the development of second-generation smart poultry farms, incorporates eight zones where temperature and humidity are measured to control the microclimate. Furthermore, the house is equipped with 20 tunnel fans and a total of 60 air inlet, divided into eight groups, allowing for individual control. The existing ventilation method employed same opening of all air inlets, resulting in lower temperature in areas near the tunnel fans and uneven temperature distribution in different zones. Therefore, a new ventilation algorithm was designed to enhance uniformity across areas by adjusting variable inlets based on the temperature of each zone. The results showed that zones with larger inlet areas exhibited higher ventilation rates, and mitigated uneven temperature distribution. The new algorithm will be validated through field experiments in actual broiler houses and further refined through additional analysis for application in real farming environments.

Key words : smart farm, poultry, computational fluid dynamics, ventilation algorithm, zone-based control

PF23002 Estimation of annual phosphorus excretion from pigs in Korea based on phosphorus and phytate-phosphorus concentrations in commercial diets

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The objective was to estimate annual phosphorus (P) excretion from pigs in Korea based on the P and phytate-P concentrations in commercial swine diets. Fifty-eight commercial diet samples were collected from 16 pig farms and analyzed for P and phytate-P concentrations. The P concentrations ranged from 0.54 to 0.66%. The phytate-P contents in the nursery diets were less (0.19 and 0.22% vs. 0.28 to 0.31%; $p < 0.05$) than those in growing or sow diets. A sigmoidal curve was developed to estimate feed intake from suckling to finishing pigs, from birth to 116.4 kg body weight at days 0 to 175. Fecal P excretion was predicted using total P, phytate-P, and phytase concentrations as independent variables. The phytase content of all diets was assumed to be 500 FTU/kg. Urinary P excretion was estimated using the following equation: urinary P excretion ($g \cdot d^{-1}$) = body weight (kg) × 0.007 ($g \cdot kg^{-1} \cdot d^{-1}$). For market pigs, P excretion as feces and urine was estimated to be 1.67 $kg \cdot pig^{-1} \cdot year^{-1}$, which is equivalent to a pig with a body weight of 34.8 kg at 81 days of age. For gestating and lactating sows, P excretion as feces and urine was calculated to be 3.14 $kg \cdot pig^{-1} \cdot year^{-1}$ and 7.07 $kg \cdot pig^{-1} \cdot year^{-1}$, respectively. Assuming a population ratio of 87:11:2 for market pigs, gestating sows, and lactating sows, the annual P excretion from all market and breeding swine in Korea was estimated to be 1.96 $kg \cdot pig^{-1} \cdot year^{-1}$.

Key words : phosphorus, phosphorus excretion, phytate-phosphorus, swine

PF23003 Just Transition in Livestock Industry

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Agriculture, including livestock industry accounts for about 21% of global annual anthropogenic greenhouse gas emissions. Even though livestock industry as a part of food system faces challenges, its continuity remains important for food security. Unsustainable practices in livestock industry has been recognized as a threat to climate change. Recently, 'just transition' has become and established a conceptual framework to transition economic industries toward a low-carbon and climate-resilient future. 'Just transition' aims to maximize climate actions while minimizing negative social impacts, including environmental impacts. However, 'just transition' has been focused on sector energy, 'just transition' in agriculture, in particular livestock industry, has remained unknown and lack of information or researches. This paper reviews 'just transition' in livestock industry, as well as provides information how 'just transition' is taken into account as a measure for climate change adaptation and resilience for sustainable livestock practices.

Key words : just transition, sustainability, livestock, climate change resilience

PF23004 Application of Peat Moss to Reduce Emission in Livestock Practices

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Peat moss covers approximately 1-2% of earth surface and is usually found in peat land which is usually a wetlands such as bogs or fens. Peat land is known as natural carbon sink and carbon reservoir. However, due to its intensive use, including peat moss harvest, it is estimated that peat land contribute approximately 5% of global greenhouse gas (GHG) emissions. Peat moss has been a major component of growing medium for pot planting and soil amendment and is also used as bedding materials for house or poultry house. In livestock industry, peat moss has been used mostly as bedding materials for horse or poultry. Due to its characteristic, namely high adsorption, large pores, and low pH, application of peat moss as bedding material or added material in manure treatment may potentially reduce GHG emissions. Application of peat moss in this scenario will compensate the emission arisen from peat moss harvest, thus creating more sustainable use of peat moss. This paper provides information on peat moss potential in reducing GHG emissions from livestock manure management.

Key words : peat moss, livestock, greenhouse gas, sustainability

PF23005

한국형 바이오가스 시설

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바이오가스 시설은 친환경적인 저탄소 축산을 구현하기 위한 혁신적인 기술로, 식품 생산과 에너지 생산을 효율적으로 결합하는 방식을 제공합니다. 이러한 시설은 유기성 폐기물 및 축산 폐기물을 처리하고 바이오가스로 전환하여 친환경 에너지를 생산하는 동시에 온실 가스 배출을 감소시킵니다. 바이오가스 시설은 축산물의 유효 활용과 폐기물 관리의 문제를 해결할 수 있는 핵심적인 역할을 수행합니다. 축사에서 발생하는 분해되지 않은 유기물은 바이오가스 프로세스를 통해 메탄 가스로 전환되어 활용될 수 있습니다. 이는 온실 가스 배출량을 줄이고 친환경 에너지로 활용할 수 있는 잠재력을 제공합니다. 또한, 바이오가스 시설은 친환경 축산의 경제적 이점을 제공합니다. 생산되는 바이오가스는 열과 전기를 생산하는 데 사용될 수 있으며, 이는 축사 내부의 보온과 에너지 필요를 충족시키는 데 도움을 줍니다. 이를 통해 운영 비용을 절감하고 경제적인 이익을 창출할 수 있습니다. 저탄소 친환경 축산을 위한 바이오가스 시설은 지속 가능한 식품 시스템을 구축하는 데 중요한 역할을 합니다. 친환경 에너지 생산과 온실 가스 감축을 통해 기후 변화에 대한 대응을 강화하고 환경 보호를 실현할 수 있습니다. 또한, 친환경 축산의 경제적 이점과 자원의 효율적 활용은 농가와 소비자에게도 긍정적인 영향을 미칩니다. 따라서, 바이오가스 시설을 활용한 저탄소 친환경 축산은 에너지 생산, 온실 가스 감축, 경제적 이익 등 다양한 측면에서 가치를 지니며, 지속 가능한 식품 시스템을 구현하는 데 큰 잠재력을 가지고 있습니다.

Key words : 바이오가스, 유기성 폐기물, 온실 가스, 친환경 에너지, 혐기소화조, 유기태킬레이트, 화학적 탈황장치

PF23006

Potential of livestock industry in circular bio-economy towards sustainability

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Livestock is an important global industry that contributes significantly to a country's economy. It provides food security and livelihoods for a majority of populations around the world. Driven by population and income growth plus urbanization, the demand for livestock products is growing rapidly. Since livestock activities have a significant impact on all aspects of the environment, including air and climate change, land and soil, water, and biodiversity, the rise in animal product demand has alarmed anti-livestock activists, who are opposed to livestock activities without taking into account the livestock industry's vital role in human life. Up to this point, valuable studies have been presented related to control and mitigation of destractive effects on environment caused by livestock activities, among which circular bio-economy is the most practical solutions towards sustainable development goals. Circular bio-economy approaches not only minimize the environmental damages caused by the livestock industry, but also reduce the demand of other industries for primary resources by producing more sustainable products such as biofuels, which is a big step towards the sustainability of today's industries. Thus, this study investigates the livestock industry's potential for sustainability in the framework of a circular bioeconomy.

Key words : livestock industry, anti-livestock activists, circular bio-economy, sustainable development goals

PF23007 Estimation of productivity and height of cool season grassland

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In temperate regions, cool season grass growth is highly seasonal and unpredictable. Research had shown that there is a high correlation between grass height and productivity.Grass measurements determine the amount of grazing that is available, assist in accurately rationing stock, and maintain swards at the ideal height for growth. It also helps maintain the proper grazing stocking rate. The model was developed using a database containing the data from the field adaptability study (RDA, 2017~2022, n=273). The grassland productivity prediction model (GPP) equation is $Dry matter\ yield = 1.5402 \times Grass\ height^{1.2828}$. The GPP equation showed slightly higher precision ($R^2 = 0.7949$).

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PF23008 Impact of extreme weather affecting silage corn (Zea mays L.) yield in central inland regions of Korea: yield damage and relative contribution

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This study was conducted with the aim of confirming the impact and relative contribution of extreme weather occurring in the central inland region of Korea affecting dry matter yield (DMY) of silage corn. Silage corn data on the central inland area (n = 1,812) were collected from various new species adaptability experimental reports conducted by the Rural Development Administration from 1978 to 2018. As for the weather variables, mean temperature, accumulated precipitation, maximum wind speed, and sunshine duration were collected from the Korea Meteorological Administration. To detect extreme weather, a box plot was used, and DMY comparison was used for a t-test with a significance level of 5%, and a R2 change in multiple regression analysis was used for the relative contribution evaluation. As a result, DMY damage to silage corn occurred mainly in the rainy season in summer and autumn. Here, DMY damage (kg/ha) caused by summer and autumn rainy seasons was 1,500-2,500 and 1,800, respectively, and the relative contribution was 40% and 60%. Therefore, when harvesting silage corn after late August, attention should be paid to the impact of autumn monsoon season. This study is meaningful in that it not only estimated the DMY damage of silage corn due to extreme weather in central inland region of Korea, but also estimated the relative contribution of the damage for the first time.

Key words : silage corn, extreme weather, dry matter yield, central inland region, relative contribution

PF23009 Damage and relative contribution of extreme weather on silage maize yield in Gangwon-mountainous area of Korea

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This study was conducted with the aim of confirming the effect and contribution of extreme weather occurring in mountainous areas in Gangwon, centered on the Taebaek Mountains in Korea, to the dry matter field (DMY) of silage maize. Silage maize data (n = 207) in the Gangwon-mountain area were collected from various new species adaptability experimental reports conducted by the Rural Development Administration from 1978 to 2018. As for the weather variables, mean temperature (MT), accumulated precipitation (AP), maximum wind speed (MW), and sunshine duration (SD) were collected from the Korea Meteorological Administration. To explore extreme weather, a box plot was used, a DMY comparison used a t-test with a significance level of 5%, and an important ratio of the neural network model for relative contribution calculation. As a result, various extreme weathers appeared in the mountainous area of Gangwon. Here, only high-extreme APs appeared. High-extreme APs appeared in early May, late May, early June, mid-July, late July, early August, and early September. DMY damage by high-extreme AP was 2,229kg/ha in mid-July alone ($p < 0.05$). The damage caused by low-extreme MT was 3,767 kg/ha from late August and early September. DMY damage (kg/ha) by high-extremity MW was 3,391, 917, 3,391 and 917 in mid-May, mid-July, mid-August and late August, respectively ($p < 0.05$).

Key words : Silage maize, Yield damage, Relative contribution, Extreme weather, Gangwon-mountainous area

PF23010 The characteristics and yield productivity of different cultivars of Sorghum-Sudangrass hybrids grown in various regions of South Korea

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Sorghum-Sudangrass hybrids (SSH) are the fifth most important cereal after maize, wheat and barley, and are an excellent source of feed for livestock. The present study evaluates the characteristics and productivity of different SSH cultivars like Dairyman's Dream and Superdan and Supergreen at different regions including Jeju, Cheonan, and Pyeongchang in south Korea in 2022. Different SSH was sown in Jeju on April 8, Cheonan on May 3, and Pyeongchang on April 29. SSH was investigated by harvesting twice for stem diameter, height and yield, and the first harvest dates of SSH were at July 13 in Jeju, August 4 in Cheonan and July 19 in Pyeongchang, respectively. The second harvest dates were at September 7 in Jeju, September 13 in Cheonan and September 30 in Pyeongchang, respectively. Across all regions, there are no significant differences in stem diameters between both SSH cultivars at first and second cuts. But, there were significant differences in height between cultivars, harvest stages, and cultivated regions. In Pyeongchang, Dairyman's Dream, Supergreen and Superdan harvested at the first cut had higher plant heights than Cheonan and Jeju ($p < 0.05$). The second cut of Dairyman's Dream, Supergreen and Superdan cultivated in Cheonan showed higher plant height than Pyeongchang or Jeju ($p < 0.05$). The second cut yields of SSH cultivars in Cheonan and Jeju were higher than in Pyeongchang. At first cut, there is no significant difference in yield between SSH cultivars in any of the regions. Results showed that SSH cultivars from different regions showed different levels of growth productivity and distinct characteristics, but cultivars from Cheonan and Jeju showed a significant productivity at all levels.

Keywords: Sorghum-Sudangrass hybrids, different cultivars and regions, yield and productivity

PF23011

Effects of ceramic filter and ozone water spray on odor reduction in farrowing and growing pig barn

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This study was conducted to investigate the effect of ceramic filter and ozone water spraying on odor reduction in pig farms. A double ceramic filter was installed inside the side wall in the scrubber in farrowing and growing pig barn, and the ammonia reduction effect was compared by spraying water and ozone water while the exhaust air passed through the scrubber. Ceramic filters installed inside the side wall scrubber in the farrowing and growing pig barn were found to reduce the ammonia concentration in the exhaust air by about 60% ($p < 0.01$), and ozone water spraying was also found to have a better ammonia concentration reduction effect than water spraying ($p < 0.01$). The effect of reducing ammonia in the air generated inside the pig barn and discharged to the outside of the pig barn by about 60% was recognized when the ceramic filter was double installed inside the side wall scrubber in the farrowing and growing pig barn and the ozone water was sprayed between the exhaust fan and the ceramic filter ($p < 0.01$). Therefore, ceramic filter and ozone water spraying can significantly reduce odor compounds generated inside the pig barn and discharged out of the pig barn through exhaust air. In conclusion, scrubbers installed ceramic filter and ozone water spraying to be efficient odor reduction facilities that can be used in the pig farms.

Key words : ceramic filter, ozone water, odor, farrowing and growing pig barn

PF

PF23012

Effect of teff grass sowing time on growth characteristics and production in the central regions of Kroea

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Teff grass (*Eragrostis tef*) is native to Ethiopia and has been used as a food crop. Teff grass is a summer feed crop that can be used after growing Italian ryegrass, a winter forage crop. This study was conducted to examine the effect of Teff grass on growth characteristics and productivity by sowing time. This study was conducted from May to August 2022 at the test field of the National Institute of Animal Science located in Cheonan, Chungcheongnam-do. The test plant species were Teff grass Boise cultivars. The sowing date was 6 times at 10-day intervals from May 12 to July 5, 2022. The seeding amount was 12kg/ha, the seeding method was drilling, and the seeding width was 20cm. The amount of Fertilization was 70-200-70 kg/ha (N-P_2O5-K_2O). Harvesting was performed at the heading stage. Teff grass took 77 to 83 days from sowing to harvesting. The plant height was 129.6 cm in the area sown on May 12, which was the most significant during the sowing period treatment ($p < 0.05$). The dry matter yield was 3,214.7~11,140.0 kg/ha, showing a significant difference between treatments ($p < 0.05$). As the sowing time was delayed, dry matter yield tended to decrease, and in the Cheonan area, late May to early June is judged to be the most appropriate sowing time rather than mid-May. The dry matter content was higher than in some treatments because the harvest date was delayed due to the summer rainy season.

Key words : teff grass, sowing time, growth charcteristics

PF23013

육계 사육밀도에 따른 행동 특성 분석

김찬호, 손지선, 임세진, 전중환, 양가영, 김기현, 천주란, 이민영
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본 연구는 육계의 국내 일반 사육농가와 동물복지 인증농가의 사육밀도에 따른 육계의 행동에 대하여 평가하고, 육계의 행동패턴을 이해하고자 수행하였다. 전북 장수소재의 일반 사육농가 와 전남 보성소재의 육계인증 농가에서 COBB 육계를 공시축으로 사용하였다. 사육밀도는 각각 20.3수/m^2 (n = 33,750) 및 16.7수/m^2 (n = 27,000) 이였다. 사료와 물은 자유 채식하였으며, 총 29일동안 사육하였다. 육계의 행동 평가 항목은 서있기, 탐험, 앉아있기, 움직임, 섭식 및 음수 행동 6항목 이었다. 서있기, 탐험 부분은 사육밀도에 따른 유의적인 차이는 나타나지 않았으나, 앉아있는 행동과 움직임 햄동은 사육밀도가 증가한 동물복지 인증농가에서 유의적으로 ($p < 0.05$) 감소하거나 증가하였다. 또한 섭식 및 음수행동 역시 사육밀도가 증가한 동물복지 인증농가에서 유의적으로 ($p < 0.05$) 높음을 알 수 있었다. 결론적으로 육계의 사육밀도가 증가함에 따라 육계의 욕구 행동을 표출 할 수 있다고 생각된다.

Key words : 육계, 동물복지, 사육밀도, 행동

PF23014

Prediction of moisture and chemical composition of Alfalfa using Near-infrared spectroscopy

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The objective of this study was to explore the accuracy of near-infrared spectroscopy (NIRS) for the prediction of moisture and chemical composition of Alfalfa. A population of 107 Alfalfa representing a wide range in moisture and chemical composition was used in this study. The Alfalfa samples in intact fresh condition were scanned using wavelengths between 680 and 2500 nm in reflectance, and the optical data was recorded as log 1/Reflectance (log 1/R). Calibration models were developed between chemical and NIRS spectral data using partial least squares (PLS) multivariate analysis in conjunction with spectral math treatments to reduce the effect of extraneous noise. The optimum calibrations were selected on the basis of the highest coefficients of determination in cross validation (R^2) and the lowest standard error of cross validation (SECV). The results of this study showed that NIRS predicted the moisture with a very high degree of accuracy (R^2=0.96, SECV=2.92%). The R^2 and SECV were 0.71(SECV: 1.12%), 0.50(SECV: 2.73%), and 0.58(SECV: 1.91%) for crude protein, neutral detergent fiber, and acid detergent fiber, respectively. The results showed the possibility of using NIRS as a routine feed value evaluation for Alfalfa, specifically to predict the moisture and chemical composition.

Key words : Alfalfa, near-infrared spectroscopy, moisture, chemical composition

PF23015 Development of Building energy simulation model to estimate cooling & heating loads of mechanically-ventilated broiler house

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Building Energy Simulation model was developed to quantitatively estimate the periodic and maximum heating & cooling energy loads of mechanically-ventilated commercial broiler house in Korea. Sensible and latent heat generation from broilers, dynamic operation of ventilation system according to environment variations were adopted. Estimation of the energy loads was carried out according to various design conditions such as the regional location, building specification, number of rearing heads, and insulation characteristics of walls and roofs. From the simulation, it was found that variation of periodic heating loads was relatively higher than that of periodic cooling loads according to thickness changes of wall and roof. Assuming that broiler was raised at every even-month, periodic heating and cooling loads were 6 and 18% lower, respectively than odd-month raising condition. When recommendation rules of insulation characteristics (wall and roof thickness) by the Ministry of Land, Infrastructure and Transport was adopted, periodic heating load of Jeju-si was 20.3 % higher than national average values.

Key words : broiler house, building energy simulation, energy loads, prediction model

PF23016 A Study on ventilation measurements in mechanically ventilated pig house

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Ventilation in a barn plays an important role in improving the breeding environment, such as internal oxygen supply, ammonia, and dust removal, and the environment in the facility(temperature and humidity). In addition, it is very important to accurately measure the ventilation rate in order to understand the emission of various pollutants generated in the barn. There are various methods of measuring the ventilation rate, and the data may vary according to each method. Therefore, in this study, a micromanometer (model: DPClaic 5825; TSI Incorporated, MN, USA) and a multi-channel anemometer (Anemomaster 1560, KANOMAX) were used to measure the amount of ventilation in mechanically ventilated pig house according to each operation rates of fan (30, 50, 70, 99%). In addition, the measured ventilation rate according to the length of the duct was compared with the case without the duct (control group). As a result of the experiment, it was confirmed that the ventilation measurement value decreased by more than 40% on average compared to the control group when there was a duct. On the other hand, the lower the operation rate of the ventilation fan, the lower the ventilation rate was measured compared to the control group. This suggests that the error rate of the ventilation measured using the duct may be high when the internal ventilation is low.

Key words : mechanical ventilation, ventilation rate, emission rate

PF23017

Characteristic of odor substances from hens farms

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Recently, pollutants generated from livestock have been emitted to the outside, affecting the environment and human life. Most studies mainly cause the odor of pig farm, but studies are also needed in livestock species such as cows and chickens. Therefore, the main aim of this study is to evaluate odors generated in the hens farm and to analysis the distribution of major odorous substances. We were performed by investigating complex odor and the concentration of volatile fatty acids (acetic acid, propionic acid, n-butyric acid, i-valeric acid, n-valeric acid), ammonia, acetealdehyde and calculating odor activity value(OAV). The samplings were measured by three different farms, and the locations were sampled near the farm boundary, manure storage, and ventilation fans (outlet) of each farm. And, the collected samples were converted into concentrations through gas chromatography, and finally, they were converted into OAV and analyzed. As a result, the OAV at the sampling point was trimethylamine (69.8 %), acetaldehyde (20.4), and ammonia (3) in farm boundary. As a result, the OAV at the sampling point was trimethylamine (69.8), acetaldehyde (20.4), and ammonia (2.7) in farm boundary. In the case of manure storage was trimethylamine (31.9), butyric acid (33.2), and ammonia (25.9), and the ventilation fans (outlet) were trimethylamine (48.1), ammonia (32.7), and butyric acid (6.3). Finally, trimethylamine was the highest in all sample areas in the hens farms, followed by ammonia, and butyric acid.

Key words : livestock, odor, hens, odor activity value (OAV)

PF23018

Ammonia reduction in swine slurry with PPDA

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With growth of the livestock industry, it brings increase of livestock manure and complaints of odor. Especially ammonia is main pollutant gas which is odor substances as well as precursor of particulate matter. Most ammonia gas emitted from swine farm. To reduce this gas, many treatment was applied in swine farm. Phenyl phosphorodiamidate(PPDA) is one of urease inhibitor which can inhibit ammonia formation from urea. In this study, Urease inhibitor was used to reduce ammonia from swine slurry in pilot scale experiment. The study was based on a case-control approach. In the chamber, slurry was filled with 20 L slurry from swine farm and PPDA was applied in control chamber. Urea was injected 3 times a week and ammonia concentration was monitored by photoacoustic spectroscopy equipment. Results showed that ammonia concentration was reduced in chamber with treatment. Average ammonia concentration was 103.69 ppm in control, 47.70 ppm in treatment chamber. Reduction rate was 22.80 ~ 69.76% and average reduction rate was 53.12%. It showed more than 40% reduction rate after intial stabilization.

Key words : ammonia, urease inhibitor, swine, slurry, reduction

PF23019

Effects of Sasa quelpaertensis Nakai as feed additive on changing odor substance in pig slurry

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This study aimed to investigate the effect of crushed Sasa quelpaertensis Nakai (SQN) additives in pig diets on the concentration of odor substances changes such as SCFA (Short Chain Fatty Acids), BCFA (Branch Chain Fatty Acids), Penols, and Indoles in the pig slurry. The reason for using SQN is that SQN grows naturally under trees or at the foot of mountains and inhibits the growth of other plants, thereby hindering biodiversity maintenance. A total of 48 pigs with an average body weight of 45.11±6.16 kg were assigned to four treatments with different levels of crushed SQN addition; basal diet (control), a basal diet supplemented with 2% SQN (T1), 4% SQN (T2), and 6% SQN (T3). The compound feeds were given ad libitum for 100 days. The SQN additive treatment groups reduced one BCFA, iso-valeric acid value ($p < 0.05$). In addition, significant differences in p-Cresol and indole values were observed among treatment groups depending on the control and T1~T3 ($p < 0.05$). No statistically significant differences in propionic acid and skatole but these values tended to decline. However, the values of acetic acid, iso-butyric acid, n-butyric acid, and n-valeric acid did not differ between treatment groups. This may help formulate increased management strategies for improving the pig housing environment using SGN.

Key words : Sasa quelpaertensis Nakai, slurry, feed additive, odor substance, pig

PF

PF23020

Lowering dietary protein concentration considerably reduces slurry nitrogen concentrations in growing-finishing pigs without negative effects on growth performance

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The objective was to estimate the influence of dietary crude protein (CP) concentrations on nitrogen (N) concentrations in slurry and growth performance based on the literature data. Data were collected from 10 experiments in 8 papers that determined the slurry N and growth performance of growing-finishing pigs fed various doses of CP (12.0 to 22.0%, as-fed basis). Experimental diets consisted of a normal-CP diet as a control diet and one or more low-CP diets that contained less protein supplements with supplemental amino acids to meet the amino acid requirement estimates. In each experiment, relative values (%) were calculated for slurry N concentrations, average daily gain (ADG), average daily feed intake (ADFI), and gain-to-feed ratio (G:F) in a low-CP diet group compared with the control group. A linear slope within an experiment was calculated and pooled within a response criterion to calculate the mean slope and their 95% confidence interval (CI). A reduction of dietary CP concentration at 1 percentage unit decreased slurry N concentrations by 5.12% (95% CI ranged from 3.35 to 6.89%) with no major changes in ADG, ADFI, or G:F. Taken together, lowering dietary protein concentration with amino acids supplementation reduces slurry N concentrations with no negative effects on growth performance of pigs.

Key words : crude protein, nitrogen excretion, slurry, swine

PF23021 Performance evaluation of pig lying behavior detection using deep learning model

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By accurately detecting when pigs have lying behavior, farmers can carefully monitor the health and welfare of individual pigs, quickly identifying any problems or discomfort and taking necessary action. This study aims to propose the feasibility of automated monitoring of pig lying behavior detection using a deep learning model. In this study, the training dataset comprised 1,000 images, with an average of 12 pigs. Each pig was labeled as either a lying pig or a non-lying pig. The performance of the pig lying detection model, trained with Yolov8, was evaluated using k-fold validation (k = 5). The mean average precision (mAP@0.5) achieved detection accuracies of 98.6% and 93.2% for lying and non-lying pigs, respectively. To evaluate the practicality of the pig detection model, we compared the counts of lying pigs and non-lying pigs determined by humans and those obtained using the model. The test dataset comprises 10,080 images of pig breeding taken at 2-minute intervals. Each image contains ten pigs. As a result of evaluating the performance of the model, the Mean Average Precision for the counts of lying pigs and non-lying pigs were 1.16 and 0.83, respectively. Additionally, the Root Mean Square Error for the lying and non-lying pigs counts were 1.60 and 1.37, respectively. This work was carried out with the support of "Cooperative Research Program for Agriculture Science & Technology Development (Project No. PJ01681003)" Rural Development Administration, Republic of Korea.

Key words : pig, lying behavior, deep learning, monitoring

PF23022 축사 배기구 미세먼지 및 초미세먼지 배출 저감 연구

노유진, 최영선, 구민정, 김훈섭, 정지영
전라남도농업기술원 축산연구소

최근 미세먼지(PM10 ,PM2.5)에 대한 관심이 증가하면서 위해성 및 저감 대책에 대한 다양한 연구 결과가 보고되고 있다 (Kim et al., 2020). 미세먼지는 대기의 주요 오염물질 중 하나이며, 기후, 가시성 및 인간 건강에 대한 악영향을 미치고 있다는 연구가 진행되고 있다 (Kim et al., 2020). 본 연구는 환경 융복합 기술을 무창축사에 적용하여 축사 배기구에서 배출되는 악취 및 오염물질의 원인인 미세먼지와 초미세먼지의 배출량 저감 평가를 하기 위해 실시하였다. 전라남도에 위치한 비육돈 1,000두 이상 사육 규모의 두 농가를 현장실증 농가로 선정하여 안개분무 시설을 이용해 전라남도농업기술원 축산연구소에서 개발한 축산 냄새저감 미생물 3종 분무, 공기 정화 장치인 플라즈마 발생장치 및 바이오필터 장치를 적용하였다. 퇴비사와 비육돈사에서 발생하는 미세먼지, 초미세먼지 배출 저감 평가를 하기 위해 4주에 1일 간격으로 배출되는 미세먼지와 초미세먼지의 수치를 측정하였다. 퇴비사와 비육돈사에서 미세먼지와 초미세먼지 평균 배출량은 큰 차이가 없었지만, 환경개선 기술이 투입된 후 12주차에서 미세먼지와 초미세먼지 배출 저감률을 확인해 보았을 때 비육돈사에서 미세먼지 66.2%, 초미세먼지 69.0%로 퇴비사보다 높은 저감률을 확인할 수 있었다. 환경개선 기술이 투입되기 전과 후를 비교했을 때 퇴비사에서 미세먼지가 62.6%, 초미세먼지가 76.9% 감소한 것을 확인하였으며 비육돈사에서는 미세먼지가 70.1%, 초미세먼지는 76.3% 감소한 것을 확인하였다. 환경개선 기술을 축산농가에서 지속사용한다면 배기구에서 배출되는 미세먼지와 초미세먼지의 저감에 긍정적인 영향을 줄 것으로 사료된다.

Key words : fine dust, fine particulate matter, odor, livestock manure, microbe

PF23023 Analysis of Piglet Productivity and Energy Consumption According to the Use of Renewable Energy Heat Pumps in Summer

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As abnormal weather patterns appear around the world, the highest summer temperatures in Korea continue to rise. As the temperature increases, livestock are increasingly exposed to high temperatures, which affects productivity on farms. In particular, pig farming is vulnerable to high temperatures, leading to potential delays in growth or even death. To ensure proper temperature management during the summer, a renewable energy heat pump is used to create an optimal breeding environment, improving pig productivity and minimizing energy consumption. A specification test was conducted with 30 piglets during the summer period in August 2022. Both geothermal and air heat pumps were used for the renewable energy heat pump. The experiment results showed a significant increase in weight gain of 2.78 kg ($p < 0.05$). Feed intake also increased by 2.93 kg, and although the feed conversion rate improved, the difference was not statistically significant ($p > 0.05$). The treatment area, which utilized geothermal and air heat pumps, showed improvements in pig house temperature, humidity, and carbon dioxide levels. The highest electrical energy consumption was observed with the geothermal heat pumps, while the control group had the lowest energy consumption. The analysis indicated that maintaining an appropriate environment during the summer improved pig farming productivity, although it was noted that a significant amount of electrical energy was utilized. Further research in this area is warranted.

Key words : piglet, productivity, energy consumption, renewable energy, summer

PF

PF23024 The impact of age-related change on the appearance and hematological parameters of laying hens in aviary systems

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The aviary system has emerged as a viable alternative to the conventional cage system with increasing welfare issues. The implementation of an aviary system provides sufficient space for the movement of the laying hen, allowing the expression of behavioral needs and thereby preventing stress and frustration. In this study, the welfare parameters of laying hens were evaluated based on their laying period. The hens were randomly collected from 5 flocks on a commercial farm, which consisted of 12 flocks of 5,000 hens each in a four-floored aviary system. We observed the body damage and collected blood samples from laying hens at 28 weeks and 38 weeks of age. The heterophils/lymphocytes ratio and neutrophil percentage were higher at 28 weeks compared to 38 weeks ($N = 25$, $p < 0.01$, for both). Laying hens at 38 weeks showed more damage to the head, neck, and back plumage than those at 28 weeks ($N = 100$, $p < 0.01$, for all). In conclusion, we speculate that stress levels were high during the early laying phase due to egg-laying onset and intense interaction with unfamiliar flocks. However, this stress was diminished as the laying hens established a social hierarchy or pecking order during mid laying phase.

Key words : feather pecking, housing system, laying phase, poultry welfare, social stress

PF23025

생물반응조 고도제어기술의 양돈농가 환경개선 효과 실증

오현윤, 이주환, 심수민, 김승수, 곽정훈, 원승건, 나창식
강원대학교 동물산업융합학과, 대구대학교 동물자원학과

최근, 많은 농가에서 운영 중인 액비순환시스템은 분뇨의 성상을 개선하여 슬러리 피트 내 분뇨의 악취 발생을 억제하는 효과가 탁월한 것으로 알려져있지만, 현장에서는 거품, 색도 및 냄새 등을 관능적으로 관찰하여 생물반응조를 관리함에 따라 불량한 품질의 액비가 순환되는 등 액비순환시스템 운영에 어려움을 겪고 있다. 이러한 문제를 해소하기 위해서는 액비의 상태를 실시간 진단하여 순환공정을 질적 · 양적으로 최적화 할 수 있는 기술이 현장에 보급되어야 한다. 따라서 본 연구는 ORP와 pH 측정을 통해 액비의 상태를 시스템 스스로 진단하고, 진단 결과에 따라 액비 순환과 원수 처리를 실시간으로 최적화 할 수 있는 고도 제어기술을 개발하여 현장 실증하였다. 현장의 생물반응조에는 ORP 및 pH 모니터링을 통해 액비의 상태진단 및 순환을 실시간 제어할 수 있도록 알고리즘 기반 제어시스템을 구축하였으며 돈사 내 NH_3 및 H_2S 모니터링 시스템을 설치하여 고도제어기술 적용에 따른 악취저감효과를 평가하였다. 액비순환시스템 고도제어기술을 5개월간 연속 운전한 결과, 슬러리피트 유효용적의 약 630%에 해당하는 부숙액비의 순환이 이루어 졌으며, 이에 따라 실증 농가의 슬러리분뇨 내 NH_4-N 농도는 실험 초기 1805.1mg/L에서 334.4mg/L로 크게 감소하였다. 그 결과, 고도제어기술 적용 전 돈사 내 NH_3와 H_2S는 각각 10, 1ppm 수준이었으나 적용 4개월 이후부터는 3, 0.1ppm 수준으로 감소하였다. 따라서, 본 연구를 통해 개발된 액비순환시스템 고도제어기술이 보급 · 확산된다면 현장의 액비순환시스템 운영애로를 해소하고 액비순환시스템의 악취저감효과를 향상시키는데 크게 기여할 수 있을 것으로 판단된다.

Key words : 양돈분뇨, 액비순환시스템, 고도제어, 악취, 액비상태

PF23026

양돈분뇨 개별정화처리에 따른 양분 저감 효과

이주환, 오현윤, 심수민, 김승수, 곽정훈, 원승건, 나창식
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가축분뇨 발생량의 증가와 살포지 감소로 인한 국내 토양 내 양분과잉 문제로 인해 가축분뇨의 처리는 퇴 · 액비화 중심의 자원화에서 농업 환경 내 양분관리와 탄소저감을 위한 처리방법 다양화로 전환되었다. 정부에서는 가축분뇨 내 양분의 핵심 삭감방법으로 가축분뇨 정화처리를 주목하고 있으며, 5천두 이상의 대규모 양돈농장에서는 가축분뇨 발생량의 일정 비율 이상을 처리할 수 있는 정화처리시설의 설치 의무화가 추진되고 관련 사업을 확대하고 있다. 이에, 국내 양돈산업에서의 정화처리 확대 시 계획적인 추진을 위한 기반 데이터 구축 및 자료 확보가 필수적이다. 본 연구에서는 개별정화처리시설 방법별 단위공정과 전체공정의 운영실태 조사 및 양분 거동 분석을 통한 주요 양분의 잔류계수를 산출하여 양분삭감 효과를 분석하였다. 전국의 10개 양돈농가의 정화처리공정을 분석한 결과, 전체 공정의 양분 제거효율은 BOD 97.7%, T-N 90.4%, T-P 82.3%로 나타났다. 양돈분뇨 내 T-N과 BOD는 주처리 공정을 거치면서 가장 높은 처리효율을 보이는 것으로 분석됬으며, 호기조 전과 후에서 탈질반응을 유도하는 복합탈질공정에서 BOD 94%, T-N 56%로 가장 높은 제거효율을 보여줬다. T-P와 SS는 전처리와 후처리 공정에서 많이 제거 되는 것으로 조사되었으며, 전처리에서는 약주 벨트프레스, 후처리에서는 RO를 운영함으로써 높은 제거효율을 얻을 수 있었다. 분석 결과를 종합하여 양돈농가 개별정화처리시설의 세부 공정별 양분잔류계수를 산정한 결과, 전처리는 BOD 0.60, T-N 0.83, T-P 0.65, 주처리는 BOD 0.17, T-N 0.58, T-P 1.11, 후처리는 BOD 0.48, T-N 0.43, T-P 0.65로 나타났다. 이에 양돈분뇨 내 주요 양분 대부분이 정화처리로 제거될 수 있어 축산업계의 대표적인 양분삭감 기술로 인정될 것으로 기대되며, 본 연구결과가 효율적인 양돈분뇨 유래 양분의 관리를 위한 개별정화처리시설 설치 시 설계 기초자료로 활용될 수 있을 것으로 사료된다.

Key words : 양돈분뇨, 개별정화처리시설, 방류, 양분 삭감, 양분잔류계수

PF23027

개의 카밍시그널에 대한 고찰

양가영, 천시내, 유금주, 정소희, 임세진, 김찬호, 전중환
농촌진흥청 국립축산과학원 동물복지연구팀

주로 개의 행동에서 관찰되는 카밍 시그널은 인간과 동물 사이의 비언어적 의사소통의 핵심 측면으로 중요성을 얻는다. 이 연구는 카밍 시그널의 실제 적용 및 사람과 동물의 상호 작용을 개선할 수 있는 잠재력과 관련된다. 카밍시그널은 스트레스나 불안의 순간에 개가 표시하는 비언어적 신호를 포함하며, 사회적 상호 작용을 규제하고 갈등을 방지하는 적응적 전략 역할을 한다. 예를 들면 입술 핥기, 하품, 돌아서기, 정지하기, 땅 냄새 맡기 등이 있다. 사람도 유사한 비언어적 신호와 카밍시그널을 인식하고 해석하면, 사람과 동물 간의 상호 작용을 강화하고 이해를 촉진할 수 있다. 이러한 신호에 적절하게 대응함으로써 사람은 동물에게 안전하고 편안한 환경을 조성할 수 있다. 이러한 이해는 동물의 정서적 안정을 고려하면서 긍정적 강화 기술을 사용할 수 있는 동물 훈련에서 특히 유용하다. 카밍시그널의 적용은 직접적인 상호 작용을 넘어 수의학, 동물매개치유 및 동물 행동 전문가에게 도움이 된다. 카밍시그널을 인식하고 반응함으로써 스트레스 수준을 줄이고 신뢰를 구축하며 관련된 동물과 사람 모두에게 긍정적인 경험을 제공할 수 있다. 카밍시그널을 이해하는 것은 책임감 있는 애완동물 소유의 기본이며, 소유자가 애완동물의 요구를 충족하고 더 강한 관계를 구축할 수 있도록 한다. 또한 개의 카밍시그널을 인식하고 존중하면 스트레스를 완화하고 복지를 증진하는 데 도움이 된다. 카밍시그널에 대한 연구는 개의 종간 커뮤니케이션과 감성 지능에 대한 통찰력을 제공하며 동물의 감정을 이해하고 사람과 동물의 유대감을 깊게 하는 데 있어 미묘한 단서와 몸짓의 중요성을 강조하기도 한다. 결론적으로 개의 카밍시그널을 이해하고 존중하는 것은 사람과 동물의 상호 작용에서 매우 중요하다. 이러한 카밍시그널에 대한 추가 연구 및 보급은 공감, 신뢰 및 상호 이해를 향상시켜 사람과 동물 간의 보다 조화롭고 풍요로운 관계를 조성할 것이다.

Key words : 개, 복지, 카밍 시그널, 행동

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PF23028

흑염소 농가 기술 지원을 위한 유튜브 채널 운영 효과분석

남철환, 정지영, 최영선, 구민정, 김훈섭, 노유진
전라남도농업기술원 축산연구소

기타 가축 흑염소는 100두 미만 사육농가가 90% 이상('21)으로 영세하고, 사육환경이 열악한 편이며, 사양기술이 표준화되어 있지 않다. 2021년 연구소에서 실시한 흑염소 농장 경영 실태 조사에서는 공통적으로 20% 이상의 높은 가축 폐사율과 사양기술 정보 취득의 어려움에 대한 개선 방안을 요청하였다. 전라남도농업기술원 축산연구소에서는 흑염소 농가 정보 접근성 개선 및 적극적 소통을 통한 축산인 서비스 향상에 기여하기 위해 흑염소 종합기술 소통 유튜브 채널 "신의염소"를 개설('21.7.)하였고, 현재('23.5.)까지 총 21.6만 건의 조회 수를 기록하였다. 분야별 영상 평균 조회 수는 개량 3,149회(37%), 사양 2,342회(27%), 질병 1,801회, 가격 651회, 식육 584회이고, 채널 유입 트래픽 소스는 탐색 기능(홈 화면 노출) 47.3%, 추천 동영상 13.8%, 키워드 검색 13.7%, 재생목록 13.1%로 조사되어 능동적인 키워드 자료 검색보다 무작위 홈 화면 노출을 통한 영상 시청이 비율이 높은 것을 알 수 있었다. 시청자 연령은 만 55~64세 44.0%, 만 45~54세 25.2%로 시청 연령대가 높은 편이었고, 시청자 성별은 남성이 89.2%로 대다수를 차지하였다. 시청 지역은 전남 43.2%, 경기 36.2%로 두 지역에서 많이 시청하였다. 영상 시청 기기는 휴대전화가 71.0%, 컴퓨터가 23.1%로 대다수가 휴대전화를 통해 시청을 하였고, 주요 이용 시간대는 19~21시로 조사되었다. 흑염소 전문 유튜브 채널 운영에 따른 염소농장 경영 개선 만족도 조사 결과 매우 만족(5)으로 응답한 참가자는 88%, 대체로 만족(4)은 12%으로 조사되어 유튜브 채널에서 제공되는 서비스가 축산인들의 경영 개선에 기여하고 있음을 확인할 수 있었다.

Key words : 흑염소, SNS, 유튜브

PF23029

Changes in fermentation characteristics of whole crop rice haylage according to the storage period

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Recently, there has been increasing interest in utilizing rice for animal feed due to rice surplus production and a decrease in consumption. While there have been numerous studies on the quality of whole crop rice silage based on the harvesting period, research on whole crop rice haylage is relatively limited. Therefore, this study aimed to investigate the quality characteristics of whole crop rice haylage according to the storage period. Whole crop rice (variety: Mogyang) was harvested on October 21, 2021 (yellow ripe stage) in Dangjin, Chungcheongnam-do, South Korea. The haylage was produced when the moisture content was between 40% and 50% after harvesting. Approximately 500g of haylage samples were collected after 3, 6, and 12 months of storage for analysis of chemical composition and fermentation characteristics. The pH of the haylage immediately after production was 6.77, and it was found to decrease to 4.00-4.12 after 3 to 12 months of storage, indicating a decrease in pH due to lactic acid fermentation. Organic acid analysis, which is closely related to haylage quality and storage stability, revealed that the lactic acid content was 4.24% DM and 4.63% DM at 3 and 6 months of storage, respectively, but decreased to 1.14% DM at 12 months of storage. Therefore, it can be inferred that the quality of haylage deteriorates with a longer storage period of 12 months due to a decrease in lactic acid fermentation by lactic acid bacteria. Further research is needed to clarify the relationship between storage period and haylage quality by analyzing the microorganisms in haylage samples.

Key words : whole crop rice, haylage, fermentation

PF23030

깔짚 사용 방법에 따른 마사 내 바닥 깔짚 탄질비 변화

유지현, 최재영, 이종안, 신상민, 김현아, 원미영, 강용준, 지희정, 조인철, 김진형
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본 연구에서는 깔짚 종류 및 사용량에 따라서 마사 내 바닥의 깔짚의 탄질비가 어떻게 변하는 지 조사하여 마사 깔짚 사용 기준 설정에 활용하고자 하였다. 다 자란 국내산 승용마(더러브렛×제주마) 12두를 약 2×2.5m 넓이의 마방에 각 1두씩 배치하여 약 3주간 사육하였다. 오차드그라스를 자율채식으로, 농후사료는 체중의 1% 수준으로 급여하였다. 깔짚 종류는 알톱밥(sawdust), 대팻밥(shavings), 우드펠릿(wood pellet), 짚(straw) 4종류를 선정하였고, 상용되는 깔짚을 사용하였다. 각 종류별로 마사 내에 높이가 5, 10, 20cm 수준이 되도록 하였다. 깔짚과 분뇨는 시료 채취 전 섞어주었고, 채취 후 탄질비를 분석하였다. 첫 분석 차시에, 우드펠릿의 탄질비가 가장 높았고 알톱밥과 대팻밥, 짚 순으로 나타나는 추세를 보였다. 물질의 종류에 따라 탄질비는 달라지는 데 우드펠릿은 탄질비가 높은 특성을, 짚은 낮은 특성을 보였고, 알톱밥과 대팻밥은 중간 수준으로 나타났다. 마지막 분석 차시에, 5cm 처리구에서는 21~42 정도로 탄질비가 나타나 일반적인 가축분뇨 퇴비화 시 적정 초기 탄질비(25～35)와 비슷해졌다. 하지만 10, 20cm 처리구에서는 50이상으로 나타나는 경우가 많아 가축분뇨가 좀 더 섞인 후 퇴비화를 시작해야 할 것으로 보인다. 시험이 진행되며 생산되는 말분뇨에 의해 총질소의 양이 증가하여 탄질비가 낮아지는 데 사용량이 많으면 초기 유기탄소 양도 많아 같은 기간에 탄질비 감소가 적었던 것으로 보인다. 본 연구 결과는 추후 깔짚 사용방법에 따른 퇴비화 시 이화학적 특성 변화 등의 결과와 함께 마사 내 적정 깔짚 사용 방법을 제시하는 데에 사용하고자 한다.

Key words : horse stable, bedding, C/N ratio

PF23031 소, 돼지, 닭 농장별 차단방역 수준 점검 및 위해요소 평가

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매년 발생되는 고병원성조류인플루엔자(HPAI), 19년 최초 발생이후 확산되고 있는 아프리카돼지열병(ASF), 최근 발생한 구제역(FMD) 등 악성전염병에 의한 피해가 증가되고 있다. 농장으로의 질병전파를 막는 것은 매우 중요하며 차단방역(Biosecurity)은 동물의 건강 및 식품 위생과 관련하여 발생하는 위험요소를 확인하고 관리하는 종합적인 대책으로 축산업 발전을 위해 필수적인 요소와 동시에 축군 내로 전염성 원인체의 도입과 확산을 예방하고 조절할 수 있는 가장 효과적인 수단이다. 하지만 농장의 차단방역 수준은 다양하지만 객관화된 방법을 제시하는 방법은 부족하였다. 본 연구는 소, 돼지, 닭 축종별 농장의 차단방역 이행을 점검하기 위해 방역점검 항목을 세분화하고 결과를 점수화하여 취약분야를 파악할 수 있도록 방역점검표를 고도화하기위해 수행되었다. 점검항목은 생축반입, 사료음수, 출입, 환경, 건강, 대장, 소독, 관리사.전실관리 등 8개 분야로 지정하고 축종별 특성에 맞게 약 100여개 점검 항목으로 분류하였다. 점검항목은 국내외 방역점검 항목을 참고하여 작성되었으며 양돈농장 8대 방역시설, 산란계 질병등급제 시설기준뿐만 아니라 강화된 방역기준을 참고하였다. 각 점검항목은 수치화하였으며 점겸 결과는 8개 점검항목별 시각화하여 농장의 방역취약분야를 쉽게 확인하도록 하였다. 소 농장 방역 평가항목은 생축시료반입 등 8개 분야 94개 항목으로 구분하였으며 번식을 할 경우 방역항목을 추가하였다. 돼지 농장은 109개 항목, 닭 농장은 116개 항목으로 구분하였다. 본 연구의 차단 방역 수준평가를 통하여 차단 방역 수준을 평가 및 개선하여 지속가능 축산에 기여할 것으로 사료된다.

Key words : biosecurity, risk, evaluation, livestock farm

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PF23032 Evaluating productivity and economic impact of single and combined heat pumps for renewable energy in pig houses

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Globally, all industries are reducing energy in line with carbon neutrality. In the livestock sector, the use of renewable energy is recommended to reduce energy consumption. Therefore, in this study, the annual economic feasibility was analyzed by synthesizing the research results using new and renewable energy in pig farming, and the results were analyzed based on the pig production cost. The analysis was divided into the case of using single renewable energy and the case of using complex new and renewable energy. Single renewable energy was analyzed by dividing it into solar power generation system (SPS), solar heating system (SHS), geothermal heating and cooling system (GHCS), and air thermal heating and cooling system (AHCS). In all systems except for GHCS, the savings per head ranged from 4,019 to 31,222 won. GHCS has improved productivity, but relatively high energy is used, so additional research on ways to lower energy is needed. The combine renewable energy system was analyzed by dividing into GHCS+SPS, SHS+AHCS, and AHCS+SPS considering the advantages and disadvantages of each system. In all systems, the savings per head ranged from 334 to 25,663 won. GHCS, which was used alone, was analyzed to be economical when used in combination with SPS. It seems that a detailed study on the complex system is needed.

Key words : pig house, renewable energy, single heat pump, combine heat pump, economic

PF23033 Effects of probiotics on malodor reduction in pig farms

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This study is to evaluate the effect of probiotics such as feed additives and combined spraying agents (for the pig barn and slurry) on the reduction of odor in pig farms. This study was conducted in a commercial pig farm with a breeding size of 1,800 heads for 35 weeks. The microbial products used in this study were mainly *Bacillus, Lactobacillus*, and yeast. Amine and ammonia levels inside the pig barns gradually decreased after the application of probiotics. After the application of feed additives alone and the combined spraying agents, amines (3.28% and 21.6%, respectively) and ammonia (10.58% and 44.69%, respectively) levels were significantly reduced ($p < 0.05$). Therefore, we proposed that the application of combined probiotics is more effective than feed additives alone in reducing amine and ammonia levels in pig farms.

Key words : pig, malodor, odor, probiotics

PF23034 Comparative analysis of audio feature extraction methods for pig vocalization classification using deep learning

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Pig vocalization detection and recognition play a crucial role in the management and welfare of modern group-house pig livestock. Choosing an appropriate audio feature extraction method significantly influences the performance when utilizing a deep learning network. This study compares the classification performance of three commonly used audio feature extraction methods in pig vocalization analysis: Spectrogram, Mel-spectrogram, and MFCC (Mel-frequency cepstral coefficients). These methods were applied to extract relevant features from the pig sound dataset, and the performance using the deep learning network of each method was assessed in terms of accuracy. A pig vocalization dataset was collected from real pig farms to conduct the experiments. The dataset contains 4,000 audio files(vocalization: 2,000, non-vocalization: 2,000), each lasting three seconds. By implementing these three methods and conducting rigorous experiments, the classification results were evaluated using k-fold cross-validation (k = 5) for Spectrogram, Mel-spectrogram, and MFCC yielded accuracies of 95.74%, 96.56%, and 94.78%, respectively. The results demonstrate that the Mel-spectrogram feature extraction method outperforms the other methods regarding pig vocalization classification in group-house pig livestock farming. This work was carried out with the support of “Cooperative Research Program for Agriculture Science & Technology Development (Project No. PJ01681003)” Rural Development Administration, Republic of Korea. This research was supported by the “RDA Research Associate Fellowship Program” of the National Institute of Animal Science, Rural Development Administration, Republic of Korea.

Key words : pig vocalization, livestock farming, sound classification, feature extraction, deep learning

PF23035

Comprehensive method for probiotics effect in pig farms

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In this study, probiotics products were applied to finishing pigs on 6 farms with an average of 1,200 pigs and their effects were analyzed. Probiotics are categorized into 3 typed products such as feed additives, sludgy-applicable, and environment-applicable type. The 6 farms were divided into groups A, B and C. The probiotics products were used in combination as feed supplement, sludgy-applicable and environment-applicable together in each group. The feed additive was used by mixing 0.5% with the feed. 0.5% sludgy-applicable type in feces was diluted 10 times with water and infused into the slurry pit. The environment-applicable was sprayed at a dilution of 100 times in water per 3.3 m2. The odor measurement inside the pig house was conducted every month before and after using probiotics. An officially designated odor were measured on 5, 7, 12, 17, and 19 months after probiotics application. From the mearsurement of ammonia, Group A showed a significant decrease of 52.1% on average, Group B 12.1% and Group C 41.2%. In the case of a sensual odor, Group A showed an average decrease of 88.7% and Group C showed a significant decrease of 85.3%. The growing rate increased significantly, up to 36.8% in Group A, 4.2% in Group B, and 5% in Group C. In conclusion, it is believed that probiotics can be used to increase livestock productivity and improve the livestock environment by reducing odor substances in the livestock.

Key words : probiotics, bacteria, livestock, pig, odor, growing rate, officially designated

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PF23036

한우분뇨와 돼지(비육돈)분뇨 내 연간질소배출량에 대한 국가고유계수 개발

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가축분뇨 내 연간질소배출량은 국내에서 배출되는 국가 온실가스 배출량 산정 시 가축분뇨 처리부분의 아산화질소 배출량 산정에 활용되고 있지만, 국내 국가고유계수가 개발되지 않아 IPCC가이드라인에서 제시하는 기본값을 사용하고 있다. 따라서 정확한 국내 가축분뇨 처리부문의 온실가스 배출량을 산정하기 위해서는 국내 현실에 맞는 우리나라 국가고유계수를 개발하여 이를 사용하여야 한다. 가축분뇨 처리부분의 국가온실가스 배출량 산정시 한우와 돼지에 대한 계수 기본값은 1996 IPCC 가이드라인에서 제시하는 북미지역 젖소를 제외한 소와 서유럽 지역의 돼지에 대한 기본값을 사용하고 있으며, 연간질소배출량 값은 (한우)70 kg N/head/yr과 (돼지)20 kg N/head/yr이다. 본 연구에서는 한우와 돼지(비육돈)분뇨 내 포함된 질소량을 분석하고, 한우와 돼지분뇨 배출원단위를 이용하여 한우와 돼지(비육돈)분뇨로부터 배출되는 연간질소배출량에 대한 국가고유계수를 개발하였다. 한우분과 뇨의 배출원단위는 각각 7.98 kg/head/day과 4.87 kg/head/day이고, 돼지 분과 뇨의 배출원단위는 각각 0.83 kg/head/day과 3.70 kg/head/day이다. 또한 한우 분과 뇨의 질소함량은 각각 0.65%와 1.73%이고, 돼지 분과 뇨의 질소함량은 각각 1.08%와 0.57%이었다. 본 연구를 통해 개발된 우리나라 한우와 돼지(비육)분뇨 내 연간질소배출량에 대한 국가고유계수 개발값은 각각 49.68 kg N/head/yr과 10.97 kg N/head/yr 이었다. 본 성과물은 농촌진흥청 연구사업(과제번호: PJ0170772023)의 지원에 의해 이루어진 것임. 본 연구는 2023년도 농촌진흥청 국립축산과학원 전문연구원 과정 지원사업에 의해 이루어진 것임

Key words : 한우분뇨, 돼지분뇨, 온실가스 국가고유계수, 연간질소배출량

PF23037

젖소 사육농가의 부가이익 창출을 위한 바이오가스 신재생에너지의 적용

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한국전력공사에서 발표한 농업관련 전력 판매량 자료에 따르면 어업용 전력 판매량은 2000년 5,306GWh에서 2021년 18,496GWh로 지속적으로 증가하고 있다. 농림어업분야의 전력 사용량이 증가함에 따라 한국전력공사는 2022년 4월과 10월, 두 번에 걸쳐 농사용 전기요금을 kWh당 12.3원씩 인상하였으며, 이중 축산농가에서 이용하는 농사용(을)의 인상률은 36%으로 산업용 16%, 교육용 13%, 일반용 12% 수준에 비해 크게 상승하였다. 전기요금은 2023년 1월에 한차례 더 인상되어 2월 현재, 농사용(을) 저압 기준 50.3원/kWh 이며, 2025년까지 57.9원/kwh로 인상될 예정으로 향후 농민들의 에너지 비용에 대한 부담이 크게 증가 할 것으로 전망되고 있다. 이에 본 연구에서는 젖소분뇨를 활용하여 소규모 농가형 바이오가스 생산을 통한 전력발전 및 에너지 생산 모델을 구축하고 시뮬레이션을 통해 에너지 생산량을 산정하였다. 소규모 농가형 바이오가스 생산시설을 운영할 경우, 1일 2톤의 젖소분뇨를 투입했을 때, 연간 65MWh의 전력생산이 가능하고, 이에 따라 5,600천원의 경제적 이익 창출이 가능하다. 또한 전력 생산 이후, 폐열을 활용한 온수 사용 등으로 연간 15,000천원의 석유대체 효과를 나타내었다. 사사 : 본 결과물은 농림축산식품부의 재원으로 농림식품기술평가원의 농업분야창의도전형 융복합모델개발사업의 지원을 받아 연구되었음(RS-2023-00233134)

Key words : 젖소사육농가, 부가이익, 농가형, 신재생에너지

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PF23038

알팔파에서 Sulfur 처리가 건물수량에 미치는 영향

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알팔파는 Sulfur(S)의 요구량이 높아 결핍이 발생할 수 있다(Undersander et al., 2015). 그러나 국내에서 알팔파 재배 시 S에 대한 연구는 수행된 적이 없어 안정적인 알팔파 생산을 위해 연구가 필요하다. 따라서 본 연구의 목적은 S의 시비수준이 알팔파 DMY에 미치는 영향을 확인하기 위해 수행하였다. 실험은 강원대학교 부속목장에서 수행하였다. 품종, 파종량, 파종일 및 파종방법은 각각 SW4113 (FD4), 20 kg/ha, 2020년 3월 25일 및 대상조파 였다. 실험디자인은 완전임의배치법, 처리는 S의 시용수준에 따라 0(S0), 25(S25) 및 50(S50) kg/ha였다. 수확은 알팔파가 개화 10%에 도달할 때 1차 수행하고 그 이후는 35일 간격으로 하여 1년차(2020년)과 2년차(2021년)는 각각 3 및 5회 하였다. 1년차 S0, S25 및 S50의 DMY는 각각 3,647, 3,977 및 4,163 kg/ha로 처리 간의 차이가 없었다 ($p>0.05$). Kim et al.(20210이 제시한 국내 알팔파의 평균 DMY보다 1년차 DMY가 낮았는데, 그 이유는 강수량이 알팔파 정착되는 봄에 낮았고 여름에는 평년보다 2.6 배 이상 높아 생육이 좋지 않았던 것으로 판단된다. 한편 2년차 S0, S25 및 S50의 DMY는 각각 21,324, 20,958 및 25,837 kg/ha로 S50이 S0와 S25보다 높았다 ($p < 0.05$). 2년 합계 DMY는 각각 24,971, 24,935 및 30,000 kg/ha로 S50이 S0와 S25보다 높았다 ($p < 0.05$). S50의 DMY가 S0와 S25보다 높은 이유는 알팔파는 토양수분이 낮으면 뿌리에서 토양의 SO_4^-를 이용하기 어려우므로(Razmjoo and Henderlong, 1997) 2년차의 강수량이 평년보다 낮아 S 시비수준이 높은 것이 영향을 받은 것으로 생각된다. 알팔파 DMY 증가를 위한 S 시비수준은 50kg/ha 인 것으로 생각된다.

Key words : Alfalfa, Sulfur, dry matter yield

PF23039 Evaluation of seasonal NH_3 and H_2S emissions from commercial swine barn with pit recharge system

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The pit recharge system is one of manure management methods which improve air quality in the swine barn by periodically recharging the pit with aerobically treated liquid manure. This study conducted to evaluate seasonal ammonia (NH_3) and hydrogen sulfide (H_2S) emissions from commercial swine finishing building equipped with pit recharge system. The swine building had 7 swine rooms, and each room had 240 pigs weighing 60~80 kg, and the stocking density was 0.79 m^2 $head^{-1}$. The pit of each swine room recharged with a total 12 m^3 (approximately 10 times the daily production of manure from 240 pigs) of aerobically treated liquid manure three times (6 A.M., 12 P.M., 6 P.M.) daily. The experimental period was 5 days in summer, fall and winter. During each experimental period, the gas concentrations and ventilation rates were measured every hour using real-time monitoring system. The ventilation in summer, fall and winter were 111.0, 43.5 and 21.3 m^3 h^{-1}·$head^{-1}$, respectively. The concentration of NH3 was lowest in summer(15.5±0.4 ppm), however, the highest emission (26.1 g $head^{-1}$·d^{-1}) observed due to high ventilation rate. The H2S concentration and emission were highest in summer, 154.2 ppb and 570.1 mg $head^{-1}$·d^{-1}, respectively.

Key words : swine confinement building, pit recharge system, ammonia, hydrogen sulfide, season

PF

PF23040 이산화탄소-촉매 열분해 활용 우분 유래 합성가스 증대연구

이동준, 정종민, 최예빈, 박소연, 김중곤, 이동현, 김현종
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축산업의 고도성장과 함께 대량으로 발생하는 가축분뇨는, 토양 및 수질 오염과 같은 환경문제를 부각시켰다. 따라서 본 연구는 폐기물-에너지화 처리의 한 방식으로, 우분으로부터 합성가스를 생산하는 연구를 수행하였다. 구체적으로 이산화탄소(CO_2)를 활용한 우분 열화학 공정(thermochemical process)를 통해, 합성가스 생산에 CO_2가 미치는 영향을 평가하였다. 열분해 실험 결과, ≤ 500℃에서 CO_2의 적용 효과가 나타나지 않은 것과 달리, ≥ 600℃ 이상의 온도 구간에서 CO 발생량이 크게 증가하는 것으로 나타났는데, 이는 CO_2와 우분 유래 휘발성 유기화합물(VOCs) 간의 균질화 반응(homogeneous reactions)에 기인한 것으로 나타났다. 추가적으로 낮은 온도 구간(≤ 500℃)에서 CO_2의 적용 효과를 높이기 위해 Co/SiO_2를 활용하여 촉매 열분해 실험을 추진하였다. 촉매를 활용한 CO_2 열분해 시 합성가스 발생량이 기존 공정 대비 86.1% 증가하는 것으로 나타났으며, 이를 통해 CO_2-촉매 열분해 공정이 가축분뇨-에너지화 처리의 한 방안으로 활용될 수 있을 것으로 판단된다. 본 연구는 농촌진흥청 공동연구사업(과제명 : 암모니아 저감형 가축분뇨 열분해 기술 개발, 과제번호 : PJ01699101의 지원에 의해 이루어진 것임)

Key words : 가축분뇨, 우분, 폐기물에너지화, 촉매 열분해, CO_2 활용

PF23041 돈사악취 모니터링 연구를 통한 돈사시설 악취 기여도 평가

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국내 악취민원은 2005년 악취방지법이 시행된 이후 지난 15년간 약 10배 증가하였으며, 전체 악취민원 중에서 50% 정도가 축산시설에서 발생되고 있는 실정이다. 축산시설 발생되는 악취는 비연속적이고 유동적으로 배출되고 악취물질간 상호작용으로 인해 배출원 규명이 어려운 특성이 있다. 기존 연구들에서 보고된 결과를 살펴보면 축산유래 주요 악취 원인물질로는 질소화합물, 황화합물, 지방산류, 페놀류 등으로 현행 악취방지법에서 지정하고 있는 22가지 악취 지정 물질을 축산시설에 적용하는 것인 효율적인 악취관리가 어렵다. 특히 Phenols과 Indoles는 다른 악취물질에 비해 매우 낮은 최소감지농도를 나타내므로 낮은 농도에도 높은 악취기여도를 나타낼 수 있는 물질이다. 본 연구는 축사형태를 고려한 돈사시설 4개소를 대상으로 현행 22종의 지정악취물질과 Indole, Skatol, p-Cresol을 포함한 총 25종의 악취물질을 측정하고 악취물질의 악취기여도 평가를 위하여 수행되었다.

Key words : 돈사, 악취 원인물질, 악취활성도, 악취기여도

PF23042 한우 및 젖소 가축분뇨 내 섬유소 분리 공정을 통한 깔짚 재활용 기술 적용

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한우 및 젖소 축사에는 톱밥, 수피 등 깔짚을 깔아 사육하고 있으며, 한우와 젖소의 먹이에는 식물이 포함되므로 가축분뇨에도 고액분리를 어렵게 하는 섬유소가 포함되어 있다. 섬유소는 일반적으로 시장에 나와있는 일반적인 고액분리기로는 분리가 되지 않고 필터의 막힘 등을 유발하여 고장을 발생시켜 사용되지 못하고 있는 상황이다. 가축분뇨 내 섬유소는 리그닌, 헤미셀룰로오스 등 미생물학적으로 분해 불가능한 성분으로 가축분뇨 처리 이전에 분리·제거하게 되면 가축분뇨의 단위 무게당, 단위 부피 당 자원화 가능한 유용 유기물의 양을 증대 시킬 수 있다. 자원화 가능량 증대를 위해서 가축분뇨 내 섬유소 등 조대입자의 분리 공정에 도입이 요구된다. 본 연구에서는 가축분뇨 내 조대입자, 섬유소를 물리적으로 분리할 수 있는 기술을 검토하였다. 우분 내 조대입자, 섬유소를 분리 후, 고형물은 건조 과정를 통해 다시 축사 내 깔짚으로 사용하고 액상물은 자원화를 통해 에너지를 회수하는 모델을 제시하고자 하였다. 사사 : 본 결과물은 농림축산식품부의 재원으로 농림식품기술평가원의 농업분야창의도전형 융복합모델개발사업의 지원을 받아 연구되었음(RS-2023-00233134)

Key words : 젖소사육농가, 부가이익, 농가형, 신재생에너지

PF23043

젖소 분뇨 고액분리 여액의 호기소화 특성

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본 연구는 젖소 분뇨를 고액분리한 후 여액의 처리를 위한 호기소화 특성을 알아보기 위하여 수행하였다. 젖소 분뇨 고액분리 여액은 가축분뇨 자원화 표준설계에 제시된 적정 기준에 따라 호기소화를 실시하였다. 젖소 분뇨 고액분리 여액을 균일하게 교반한 후 화학적산소요구량(COD)을 기준으로 약 10,000ppm으로 희석하였으며, 39°C 조건에서 교반을 실시하지 않았다. 폭기는 0.03m^3/min의 유속으로 실시하였고, 매일 증발된 수분은 액비와 비슷한 온도로 보충하였다. 총 30일동안 온도, pH, 암모니아 가스 발생량, COD, 부유고형물(SS), 총 질소(TN), 총 인산(TP), 총 칼륨(TK) 함량을 측정, 분석하였다. 본 연구 결과의 통계 분석은 SAS MIXED PROC의 CONTRAST 옵션을 이용하여 직교다항비교를 수행하였으며, 유의수준 $p < 0.05$에서 검정하였다. 젖소 분뇨 고액분리 여액을 30일간 호기소화 시 pH는 7.6에서 8.2까지 상승하였으며, 암모니아 가스는 7일차까지 증가한 후 30일까지 점차 감소하였고 COD는 약 79%, SS는 약 88%, TN은 약 68%, TP는 약 73%, TK는 약 13% 감소하는 결과를 나타내었다. 본 연구에서, 젖소 분뇨 고액분리 후 여액을 가축분뇨 자원화 표준설계에서 제시한 적정 COD를 기준으로 호기소화 시 84.5ppm의 암모니아가 발생할 것으로 예측되며, 유기물 20% 수준의 액비가 만들어질 것으로 사료된다. 본 연구는 농촌진흥청 연구사업(과제번호: PJ017077)의 지원과 2023년도 농촌진흥청 국립축산과학원 전문연구원 과정 지원사업에 의해 이루어졌습니다.

Key words : 호기소화, 젖소 분뇨, 고액분리 여액, 암모니아

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PF23044

RCP 8.5 시나리오에서 기계학습모델을 이용한 이상기상에 따른 사일리지용 옥수수의 피해량 산정

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Choi et al. (2022)는 기후변화 시나리오 중 RCP(Representative Concentration Pathway) 4.5 시나리오의 월평균기온과 강수량에 따른 사일리지용 옥수수(Whole Crop Maize: WCM)의 피해량을 제시하였으며 모든 도에서 피해량은 발생하지 않는 것으로 나타났다. 따라서 본 연구의 목적은 RCP 8.5 기후변화 시나리오로 WCM의 피해량을 산정하는 것이며 이는 Deep Learning을 통해 수행하였다. 연구에 이용한 Deep Learning 모델은 WCM 수량 데이터(1978~2017년, n=3,232) 및 기상데이터를 기반으로 학습하였으며, 8가지 모델 중 최종 이용 모델은 DeepCrossing 기법으로 해석력(R^2) 및 RMSE을 기준으로 선정하였다. 이상기상은 정상기상에 변동값을 더하여 계산하였다. 정상기상이란 WCM 수량데이터의 기상(40년) 평균값이며 변동값은 2050년 또는 2100년의 기상요인에서 2020년의 기상요인을 뺀 것이다. 기상요인은 월평균기온과 강수량을 이용하였다. 이상기상에 따른 피해량은 정상기상의 DMY(Dry Matter Yield) 예측값과 이상기상의 DMY 예측값 간 차이로 산정하여 산술적으로 평가하였다. 월평균기온에 따른 WCM 피해량은 2050년 및 2100년에 모든 도에서 발생하지 않는 것으로 나타났다. 이는 월평균기온이 높아진다고 해도 대부분 옥수수의 생육온도(5~35°C) 범위 내에 있어 피해량이 나타나지 않은 것으로 생각된다. 강수량에 따른 피해량은 2050년에는 경기도와 제주도를 제외한 도에서 발생하였지만, 2100년에는 모든 도에서 발생하지 않았다. RCP 8.5 시나리오의 월평균기온과 강수량에 따른 WCM의 피해량은 2050년에서 2100년으로 갈수록 감소하는 것으로 나타났다.

Key words : whole crop maize, RCP 8.5 scenario, deep learning model, dry matter yield, damage

축산물이용 및 가공

PG23001 Development of protein-rich anti-aging food with domestic black goat meat

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Aging can make it harder to chew food efficiently and make the elderly avoid eating red meat because of its tough texture. This can lead to nutrient deficiency. Therefore, the study aimed to develop an elderly-friendly protein-rich food using black goat meat with high protein. In this study, the quality characteristics of mousse containing thickeners, controls (2% gelatin), T1 (0.2% fig, 2% gelatin) and T2 (0.2% fig, 2% glucomannan) were examined. The results showed that brightness and yellow in T1 and T2 were significantly higher than in the control group, while redness was significantly higher in the control ($p < 0.05$). The crude protein in the control group was significantly higher than T1 ($p < 0.05$), whereas T2 was not significantly different from T1 and the control ($p > 0.05$). There was no significant difference in moisture, fat, and crude ash between the study groups. In the texture analysis, hardness, springiness, gumminess, chewiness, and cohesiveness were not significantly different between control and T1 while T2 using fig and glucomannan cannot measure the texture due to its “soft solid” form. In the sensory evaluation, T2 observed the highest scores for both flavor preference and overall acceptance. Overall, the mousse that contains fig and glucomannan can be a soft and easily digestible food option that may provide important nutrients for age-defying.

Keywords: elderly, high protein, mousse, gelatin, glucomannan, age-defying

PG23002 Immunomodulatory effects of fresh antler velvet extract in Cyclophosphamide-induced immunosuppressed animal model

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Deer antler velvet has been widely used in traditional functional food material due to its perceived health benefits. It has well-established that It is rich in bioactive compounds, including growth factors, amino acids, and minerals, which are believed to contribute to its improved immune response functional properties. Recent studies have shown that antler velvet is potentially beneficial improve the immune system. Therefore, we conducted a mouse experiment to investigate the effect of fresh antler velvet extract upper section (FAVU) in immune promotion. Mice were orally administered with FAVU for 28 days, and immunosuppression was induced with cyclophosphamide (CPA) for the 7 days from day 22 to 28. The FAVU administration group showed a tendency to recover growth compared to the CPA group. FAVU improved colon length and spleen weight. Moreover, serum biochemical analysis confirmed that FAVU exhibits an immunosuppression-alleviating effect. In conclusion, this study showed that FAVU alleviated CPA-induced immunosuppression by improving serum systemic immune-related factors (supported by IPET 321033-03-3-WT011).

Key words : Fresh antler velvet, immunomodulation, CPA-induced immunosuppression

PG23003

Non-destructive prediction of beef loin quality using artificial intelligence-based technology

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Predicting meat quality through non-destructive evaluation can be useful during meat consumption, as well as processing and distribution. In this study, we aimed to evaluate the accuracy of predicting meat quality characteristics (color, water-holding capacity, pH, tenderness, and intramuscular fat content) from beef loin images using deep learning technology, an artificial intelligence (AI)-based technology. The M. *longissimus thoracis* (LT) at the 13th *thoracic vertebra* of Hanwoo carcasses (n = 61, steer, 30-months-old, 477 kg weight) were imaged and used for evaluating meat quality at 24 and 48 h postmortem, respectively. Based on the hierarchical clustering analysis using meat quality traits, samples were classified into three to five groups. All image data of beef loin was applied to pre-trained deep learning models, such as GoogleNet and AlexNet with the following conditions: mini batches, 12; epoch, 100; learning rate, 0.0001; learning and test ratio, 7:3. The validation accuracy of GoogleNet and AlexNet were 83.02-96.00% and 65.79-98.15%, respectively. Among the traits of meat quality, drip loss showed the highest accuracy of classification regardless of the models used (98.15%), whereas yellowness (65.79%) and shear force (83.02%) had the lowest accuracy after applying GoogleNet and AlexNet, respectively. Therefore, these results suggest that meat quality (particularly water-holding capacity) can be accurately predicted by non-destructive evaluation using deep learning, a representative AI-based technology.

Key words : meat quality prediction, artificial intelligence, deep learning

PG

PG23004

Anticancer effect of Sangju Honey on oral cancer

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Since ancient times, honey has been used in traditional medicine owing to its pharmacological effects. It possesses anticancer properties. However, the therapeutic implications of Sangju honey in cancer remains unknown. Therefore, we aimed to demonstrate the potential anticancer effects of Sangju honey on human oral squamous cell carcinoma (OSCC), particularly focusing on epithelial–mesenchymal transition (EMT) and apoptotic and mitogen-activated protein kinase (MAPK) signaling pathways. Ca9-22 and YD-10B human OSCC cells were treated with 0.25% or 0.5% Sangju honey, and the cell viability was examined using the Cell Counting Kit-8 assay. Cell morphology studies were conducted to observe morphological changes, and the wound-healing assay was performed to evaluate the proliferation of honey-treated OSCC cells. Western blot analysis was conducted to investigate protein expression related to EMT and apoptotic and MAPK signaling pathways. Sangju honey reduced cell viability, induced morphological changes, and significantly suppressed the proliferation and migration of Ca9-22 and YD-10B cells. The expression of E-cadherin and N-cadherin was increased and decreased, respectively, in both OSCC cell lines. Moreover, Sangju honey stimulated apoptosis by increasing the expression of p21, p53, cleaved caspase 3, and caspase 9. Furthermore, it downregulated the expression of phospho (p)-extracellular signal-regulated kinases 1 and 2, p-c-Jun amino-terminal kinase, and p-p38 in Ca9-22 and YD-10B cells. Sangju honey inhibits Ca9-22 and YD-10B cell proliferation by regulating EMT, inducing apoptosis, and suppressing the MAPK signaling pathway. Thus, it is a potential anticancer agent for human OSCC.

Key words : anticancer, apoptosis, MAPK, squamous cell carcinoma, Sangju honey

PG23005 Quality properties of duck blood on addition of EDTA and organic acids

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The objective of this study was to determine the addition effect of EDTA and organic acids on the processing quality properties of duck blood. Control was duck blood that prepared without addition, while EDTA treatment was duck blood added with 0.01%. EDTA. In the case of organic acids treatments, sodium citrate, DL-sodium malate, sodium acetate, sodium propionate, and potassium sorbate were added in 1%, respectively. As a results, cooking loss shows the highest value in control (11.88%), but the lowest values in EDTA (4.01%) and sodium citrate (3.89%) ($p < 0.05$). The pH values of duck blood show in the order of control (7.45) > EDTA (7.40) > organic acids treatments (4.30~4.32). Lipid oxidation value was the highest in the control, while EDTA and sodium citrate showed the lowest values ($p < 0.05$). The emulsifying capacity was the highest in the EDTA and sodium citrate, and there was no significant difference between the other treatments. The number of total aerobic bacteria of control, DL-sodium malate, sodium acetate, sodium propionate, and potassium sorbate shows no significant differences. However, EDTA and sodium citrate shows the lowest number of total aerobic bacteria. Taken together, the EDTA and sodium citrate can be added to duck blood to improve its processing quality properties.

Key words : duck blood, EDTA, orgainc acids, quality properties

PG23006 Optimizing the cryoprotectant mixture to enhance the viability of *Bifidobacterium bifidum* and *Ligilactobacillus salivarius*

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Lyophilization (freeze-drying) is commonly used to preserve live probiotics. However, it can cause cell damage and decrease viability. The cryoprotectants play an important role in maintaining viability during lyophilization process. Generally, cryoprotectants have been used in non-reducing disaccharides, sugar alcohols, polysaccharides, amino acids, proteins, and skimmed milk, etc. The protective properties of cryoproetectants were ascribed to their interactions with proteins and membranes of cells. The aim of this experiment was to find out the optimum combination of component proportions that maximizes the viable cells of *Bifidobacterium bifidum*, *Ligilactobacillus salivarius* after freezing and freeze-drying. We investigated the viability of the cells of *B. bifidum, L. salivarius* in the presence of the cryoprotectants that consist of mono-sodium glutamate (MSG), trehalose, and whey powder. A mixture design having 1% as the smallest proportion of each component, which is close to a simplex-lattice axial design, was used to allocate treatment combinations in the experiment. Through modeling experimental data, the optimal component ratio combination of the cryoprotectant mixture for *B. bifidum* was established as 2% MSG, 3% trehalose, and 95% whey powder. For *L. salivarius*, the combination was 4% MSG, 38% trehalose, and 58% whey powder, as verified through a validation experiment.

Key words : *Bifidobacterium bifidum*, *Ligilactobacillus salivarius*, cryoprotectant, mixture design

PG23007

Assessing cortisol concentration in rainbow trout fish meat: implications for fish welfare and product quality

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Environmental changes can impact aquaculture industry. Fish species are highly sensitive to changes in water quality, which then stimulate cortisol secretion as a stress response indicator. The presence of cortisol residue in fish meat may be a concern for fish welfare and food quality. However, the average cortisol concentration in fish meat is limited due to lack of research on presence of cortisol in fish meat and its implications for human consumption and welfare assessment. Thus, this study was designed to measure cortisol concentration in fish meat products. Three rainbow trout (Oncorhynchus mykiss) fish meat, labeled as Trout 1, Trout 2, and Trout 3 purchased from the markets in Chuncheon, Korea in April 2023. Cortisol was extracted from 50 mg of fin (n = 24) and 50 mg of scale (n = 3) matrices using methyl alcohol and measured using an enzyme immunoassay. The concentration of cortisol in Trout 1, Trout 2, and Trout 3 were resulted as 64.01±35.78, 6.53±3.02, and 5.47±3.36 pg/mg, respectively. Trout 1 might have experienced some environmental or handling stressors during lifespan. In contrast, Trout 2 and 3 might have experienced minimal stress or better welfare condition. In conclusion, the measurement of cortisol residue in commercial trout meat may help in estimating the impact of environmental changes on fish farms, thereby improving the quality of fish products. Further studies are suggested to explore alternative stress indicators in fish meat and develop strategies to mitigate stress in aquaculture industry.

Key words : cortisol, fin matrix, quality indicator, stress indicator, trout fish meat

PG

PG23008

식물성 소재 첨가가 흑염소 육제품 품질특성에 미치는 영향

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흑염소는 체구가 작고 온순해 상대적으로 노동력이 적게 들어 소자본으로 접근이 쉽고, 산지 생태축산과 6차 산업에 적합하여 최근 사육두수가 증가하였다. 국내 흑염소 사육은 2021년 기준 11,400호, 451천두(추정)이며 특히 전라남도 흑염소 사육은 1,655호 105천두로 전국의 23%를 차지하며 전국에서 가장 많이 사육하고 있는 지역의 대표 특화 가축이다(농림축산식품부 기타가축통계). 또한 흑염소 생산액은 2020년 1,526억원으로 2015년 대비 2배 이상 급증하였으며, 이러한 추세를 미루어 본다면 향후 에도 지속적으로 증가해 산업 규모가 확대할 것으로 전망된다. 본 연구는 효소고활성 식물성 소재인 파인애플과 토마토 동결건조 분말을 활용하여 흑염소 육포 등 가공육제품을 제조한 후, 품질특성을 조사하고 흑염소 소비 촉진을 위한 육제품 개발 기초자료를 제공하기 위하여 실시하였다. 효소고활성 식물성 소재(파인애플, 토마토 동결건조 분말)를 활용한 흑염소 반건조 육포를 스틱 타입으로 제조하여 실험에 이용하였다. 식물성 소재를 이용한 흑염소 반건조 육포 전단력 분석 결과 파인애플 동결건조 분말, 토마토 동결건조 분말을 첨가한 T2 (4.82kgf) > T1(5.19kgf) > PC (6.87kgf) > NC (9.10kgf) 으로 T2(파인애플+토마토)에서 낮은 경도를 나타냈고, 수분활성도는 T2(파인애플+토마토)에서 8.69로 낮은 수분활성도 나타났다. 흑염소 반건조 육포는 반건조하였음에도 불구하고 낮은 수분 활성도와 연도가 부드러운 결과로 조사되었다. 이상의 결과 흑염소 고기에서 파인애플 등 천연물질을 첨가하여 육제품을 제조하였을 때 연도 개선 효과 등 육가공식품의 개발에 활용될 것으로 사료된다.

Key words : 흑염소, 흑염소고기, 육질특성

PG23009

축산물가공 사례연구와 소비자 지향 트렌드 전략

김곡미
연암대학교

현대 사회가 발전하며 축산시장도 고품질의 안전한 축산물 공급을 위해 지속적으로 연구개발을 하고 있다. 축산물은 가축사육을 통해 생산되며 대표적인 축산물에는 소고기, 돼지고기, 닭고기, 계란, 우유 등이 있고, 이외에도 다양한 축산물이 있으며 상품의 특성도 다양하다. 축산물은 살아있는 동물을 다루기 때문에 품종과 사육 방식에 따라서 품질의 차이가 나고, 부패성이 강한 특징을 갖고 있으므로 가공 및 유통에서 신선도를 유지하고 위생을 위해 특수한 시설을 이용해야 한다. 특히, 코로나 펜데믹 이후 최근에는 안전한 먹거리 공급뿐 아니라 윤리, 환경, 사회문제 등 지속가능경영을 실천하고자 축산분야에서도 변화의 움직임이 나타나고 있다. 온라인 배송가능한 포장저장기술이나 오프라인 매장 소비시장 구조의 변화에 대응하기 위해 새로운 아이템 개발이 시급한 실정이다. 본 연구는 축산물 가공 사례연구조사를 통해 축산물 시장이 나아가야 할 지속가능 축산경영 및 소비자 지향 트렌드를 반영한 축산물 개발 전략을 제시하는데 목적을 두고 축산시장의 활성화에 도움이 되기를 기대한다.

Key words : 축산물, 축산가공, 축산 소비자 트렌드, 지속가능 축산경영

PG23010

Nutrition analysis of feed ingredients for cats during processing

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Cats are obligate carnivores. In this regard, they require high amounts of protein, moderate amounts of fat, a minimal amount of carbohydrates, and more than a dozen other nutrients including vitamins, minerals, fatty acids, and amino acids. In this study, nutrition facts were analyzed in raw materials including beef, chicken, duck meat, goat meat, lamb, pork, salmon, dried green kernel black beans (Seoritae), and dried soybeans, the crude protein (CP) ratio of each raw material excluding moisture was 59.59%, 93.53%, 90.94%, 87.43%, 36.97%, 81.39%, 59.53%, 40.16%, and 37.15% and the crude fat (EE) ratio was 34.03%, 3.92%, 5.45%, 11.64%, 57.25%, 12.31%, 36.67%, 10.03%, and 10.46%. Subsequently a feed prototype was produced by the modified cat feed formula which substitute protein sources to exclusively beef, salmon, duck meat, or chicken. From the analysis of nutrition facts for the beef-based, salmon-based, duck meat-base, and chicken-based feed prototypes, the CP ratio was 24.48%, 26.65%, 23.92%, and 26.72% and the EE ratio was 11.16%, 10.88%, 11.51%, and 10.47%. From the comparison of amino acid composition among the feed prototypes, each feed prototype showed different amino acid composition. Our study could contribute to understanding the changes in nutrition balance by protein sources during processes of cat feed production.

Key words : cat, feed, protein, amino acid, nutrition

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2

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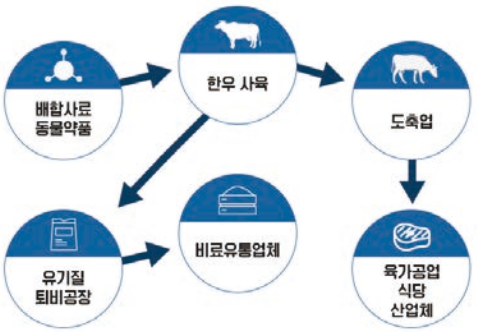

5

한우 부산물 어떻게 이용될까?

털	지방	피	분뇨
에어필터, 브러쉬, 펠트, 천, 단열재, 깁스	껌, 의약품, 화장품 양초, 크레용, 세제, 섬유유연제, 향수	파스타, 염료, 접착제, 의약품	비료, 토양개선제, 신재생에너지

뼈	뿔,발굽	가죽	내장
정제설탕, 유리	접착제, 깁스, 사진인화기	젤리틴, 캔디, 조미료(향료), 의약품, 벅지, 접착제	악기줄, 테니스 라켓 줄, 의약품, 건강보조식품

6

한우에 대한 편견은 NO!
환경과 한우, 함께 합니다

*출처: 강원대학교(연구책임자 박규현 교수), 2022년 「전과정 측면에서 한우의 환경적·산업적 특징 연구」

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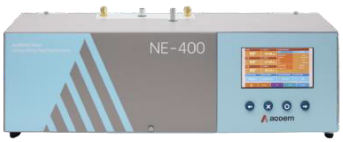

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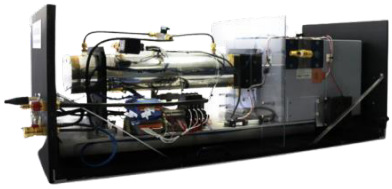
도심 내 온실가스 배출량 평가 및 온실가스 측정망 적용



Spectronus

Trace Greenhouse Gas & Isotope Analyzer

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실시간 동시 분석

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Livestock Environmental Management Institute

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