

PART I

저장/포장/유통

P1-01

Detection of adulterated red pepper powder by red dye and red pepper seed using hyperspectral technology

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In this study, shortwave-infrared (SWIR) technology was applied to determine whether red pepper powder was artificially adulterated with red dye and red pepper seed. First, the ratio of red pepper pericarp to seed was adjusted to 100:0 (P100), 75:25 (P75), 50:50 (P50), 25:75 (P25), and 0:100 (P0), respectively, and the red dye (Allura red) was added to the mixture of red pepper pericarp/seed at 0.05 (A), 0.1 (B), and 0.15% (C). When principal component analysis was performed using L, a, b value, hue angle, and chroma results, it was difficult to distinguish between pure red pepper powder (P100) and some unsuitable samples (P25B-C, P50B-C, P75A-C, and P100B-C). On the other hand, when PCA was performed on the spectra obtained from SWIR (1,000–1,700 nm) measurements, P100, P75, P50, and the remaining groups were separated, and the loading plots showed that the important wavelengths for the mixing ratio of pericarp/seed were 1,114 and 1,508–1,636 nm, and the important wavelengths indicating the presence of red dye were 1,205 and 1,559–1,618 nm. Machine learning techniques including linear discriminant analysis (LDA), linear support vector machine (LSVM), and K-nearest neighbors (KNN) were applied for classification, and LDA showed the best fit. In conclusion, the application of SWIR technology and machine learning was found to be an effective method for detecting red pepper powder mixed with red dye and red pepper seed.



P1-02

Effects of CA containerized export on the quality and metabolites of strawberries during distribution

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Exports of fresh agricultural products are on the rise as part of domestic market price and supply–demand control. However, the quality deterioration during long–distance transportation is becoming a factor that slows down the international competitiveness of our agricultural products. In order to overcome quality deterioration during ship transportation, CA containers capable of environmental control are being developed and distributed. This study investigated the effects of simulated transportation using CA containers for each coloring stage on quality and volatile organic compounds (VOCs). The CA container conditions were 12% CO₂, 5% O₂, and 4°C. As a control, the Reefer container was set at 4°C. After simulated transportation for 7 days, the container was opened, and low–temperature distribution was performed at 10°C. 50% colored strawberries showed no difference in the weight loss rate according to Reefer and CA containers, but in the case of 80% colored strawberries, the weight loss rate increased when using the Reefer container. On the other hand, even 80% colored strawberries treated with CA containers showed little difference in weight loss compared to 50% colored strawberries. The hardness of the strawberries transported in the CA container was similar, with no difference between 50% and 80% coloration, and the hardness of the control group tended to be the lowest. The rate of decay incidence increased significantly in the Reefer container, and the increase in the rate of decay incidence differed depending on the degree of coloration in the control group. In contrast, the decay incidence rate in the CA container was similar regardless of the degree of coloration. As a result of VOCs analysis, candidate components that are indicators of strawberry freshness are D–Limonene, butyl acetate, and methyl 2–methyl butyrate, and components that cause off–flavor are methyl butanoate, methyl hexanoate, and ethyl butanoate. In particular, butyl acetate, a candidate for freshness, increases as the storage period elapses. At the same time, CA container treatment shows a low value, which is expected to be a good indicator of freshness. As a result, it was confirmed that the use of CA containers during ship transportation is effective in maintaining the freshness of strawberries, and even when exporting 80% colored strawberries with much maturity, the quality is similar to

that of exporting 50% colored strawberries. (This work was carried out with the support of "Cooperative Research Program for Agriculture Science and Technology Development (Project No. PJ016682)" Rural Development Administration, Republic of Korea.)

P1-03

침엽수 추출물 처리에 따른 무화과 선도 유지 특성 연구

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아열대 작물 중 하나인 무화과 생과의 경우 수확 후 상온에서 2~3일 정도로 유통기간이 짧아 수송력, 저장성이 매우 약한 과실 중 하나로 맛과 선도 유지를 늘려 소비자에게 공급함으로써 무화과의 소비를 촉진시켜 무화과 재배 농가의 소득을 증진시킴으로써 지역경제 활성화와 더불어 해외수출을 통해 경쟁력을 확보하고자한다. 본 연구는 국내 재배 승정도우핀 품종의 무화과를 가지고 유통 중 저장 품질 개선 효과를 확인하기 위하여 서방성이 높고 천연 방부 성분을 가진 잣나무 추출물을 무기담체에 담지하여 분말상의 마이크로캡슐화를 하여 실험하였다. 저장성을 확인하기 위해 중량변화, 경도, 당도, 산도(pH), 부패율, 색도변화로 평가한다. 실험은 상온(29±1℃)에서 7일, 저온(1±1℃)에서 25일 동안 침엽수 추출물이 동봉된 부직포 주머니를 1팩에 1개씩 넣어 실험한 결과, 대조군보다 실험군에서 2일차에 부패 저해율이 62%로 낮았고, 저온에서는 18일차에 부패저해율이 82% 낮게 발생하였으나, 나머지 평가에서는 유의미한 변화를 확인하여 대조군 대비 부패율이 저감됨을 확인하여, 과실에 대한 유통기한이 연장됨에 따라 유통은 물론 소비자들이 과채류를 장기적으로 이용할 수 있게 된다.

P1-04

국내산 농산물의 선도유지용 침엽수 추출물 함유 생분해성 고분자 필름 개발

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생활양식 및 문화 수준이 상승으로 인해 높아진 소비자 구매 성향에 따라 농산물의 유통 및 보관을 위한 기술이 많이 발전하였으며, 최근 소비자들은 환경에 대한 높은 관심과 환경 호르몬 등 유해화학물질에 대한 거부감 등으로 제품 구매에 있어서 식품의 외관 상태, 보관 및 유통을 위한 포장의 안정성과 합리성에 대해서도 관심이 높아졌다. 이에 국내 소비자 트렌드 및 유통 현황을 감안하여 천연 방부제로 알려진 침엽수 중 하나인 잣나무 추출물을 함유한 생분해성 고분자 필름을 적용한 농산물의 선도유지 효과를



검토하여, 국내 농산물의 선도 유지를 위한 기본적인 자료를 얻고자 수행하였다. 농산물 처리 시 무처리 군과 잣나무 추출물이 들어가지 않은 코팅제 그리고 항균력이 있는 잣나무 추출물이 함유된 코팅제로 구성하여 각각 실온(25±1℃)에서 7일 동안 실험했다. 7일 동안 실험한 결과, 딸기의 경우 잣나무 추출물이 들어간 것은 4일차까지 곰팡이와 무름현상이 없었으나 5일차부터 곰팡이 및 무름 현상이 같이 발생하여 부패율이 11% 발생하였고, 석류의 경우, 20일차부터 표면의 변화로 인해 대조군과 잣나무 추출물이 들어가지 않은 코팅제에 비해 79.5% 부패 저해율이 낮은 것을 확인할 수 있었다. 이를 토대로 농산물의 생분해성 필름을 처리하는 것을 통해 선도유지가 가능하다는 것을 확인하였고, 나아가 과실뿐만 아니라 농축산물, 해산물, 가공식품, 식품, 화훼 등 다양한 제품군을 활용할 경우 시장 경제 활성화는 물론 수출에 대한 경쟁력을 확보할 수 있다.

P1-05

파프리카 ‘시로코’ 저장온도 별 PP필름 포장 따른 수확후 특성

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파프리카 포장은 수확후 다양한 환경에서 선도 유지 효과에 대해 구명하고자 하였다. 수경재배한 파프리카 ‘시로코’를 이용하여, 저장 시 온도 조건별(10℃와 20℃)의 PP필름으로 개별적 포장 여부가 수확후 생체중량 감소, 외관, 경도 등의 특성을 조사하였다. 파프리카 생체중량 감소 정도에서 포장 여부에 따른 차이가 커서, PP필름 개별 포장한 것이 무포장에 비해 중량감소 정도가 적었다. 무포장은 온도에 따른 차이를 보여 저장온도 10℃가 저장 20℃보다 변화폭이 적은 것으로 나타났다. 가용성 고형물(SSC) 변화는 온도와 포장 여부에 따른 변화 패턴이 다르고 처리 효과에 따른 차이도 저장 후반부에 나타났다. 가용성 고형물 함량은 저장온도 10℃의 필름 포장은 다소 증가하는데 비해, 저장 20℃의 무포장은 감소하였다. 파프리카 경도 차이는 저장 후기에 영향을 받는 것으로 나타나, 저장온도 20℃의 무포장이 다른 처리에 비해 차이를 보일 정도로 낮았다. 그러나 같은 저장온도 20℃라도 필름 포장에 의해 경도 감소 정도 폭을 줄여주는 효과가 있었다. Hue angle은 파프리카 ‘시로코’는 저장 중 감소하지만, 저장온도나 포장여부가 영향을 미치는 것으로는 보이지 않았다. 외관에 따른 상품성은 저장온도 10℃에서 PP 필름포장을 통해서 외관에 따른 상품성이 다른 저장온도나 포장 한 것보다 변화폭이 적고, 상품성 보존에 매우 효과적인 것으로 나타났다. 파프리카 외관 변화에서 선도를 보전하기 위해서 적절한 온도 처리와 포장을 병행해야 수확후 상품성에 보다 효율적으로 유지할 수 있는 것으로 나타났다. 본 연구를 통한 파프리카 ‘시로코’의 저장온도와 포장여부에 따른 연구 결과, 적절한 저장온도인 10℃에서 포장을 통해 무포장보다 외관적 선도에 더욱 품질을 유지할 수 있었다. 국내 유통환경은 파프리카의 상품성을 보다 유지할 수 있는 선도를 보전하기 위해 포장이 필요하며, 앞으로 효과적인 포장방법에 대한 연구가 지속적으로 필요할 것으로 보인다.

P1-06

플라즈마 에틸렌 제거 기술을 적용한 사과 품질 변화

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에틸렌은 발아, 과실의 성숙, 노화 등의 특정 발육단계나 상처, 스트레스 등의 특정 조건에서 다량으로 생성되며, 식물 생장 조절에 중요하게 관여한다고 알려져 있다[1]. 에틸렌은 식물의 노화를 촉진시키는 호르몬으로 과실의 성숙, 낙엽, 낙과, 신장성장의 억제와 촉진 등 다양한 식물의 생리현상에 영향을 미친다[2] 이에 본 연구에서는 에틸렌 제거용 원통형 DBD 플라즈마 모듈을 사용하여 사과 저장 시 발생하는 에틸렌을 제거하고 이에 따른 사과의 품질 변화에 대해서 알아보하고자 한다. 사과 품질 변화에 대한 평가는 실험군과 대조군 비교 실험으로 외관, 무게감소, 경도, 색도 변화량 항목으로 평가한다. 실험은 2°C로 유지되는 저온저장고에 원통형 DBD 플라즈마 모듈을 설치하고 플라즈마 모듈에 저온저장고 내부공기를 순환시킨다. 에틸렌을 105분 흡착 시킨 후 플라즈마 모듈 8분 운전 7분 휴식으로 24시간 작동시켜 저온저장고 내부 에틸렌 가스를 지속적으로 제거했다. 약 4개월 동안 플라즈마 처리를 한 결과 대조군 사과에 비해 중량 감소가 3% 적었고, 경도, 색도 변화량도 대조군에 비해 변화가 적었다. 따라서 실험군의 저장성이 대조군에 비해 좋음을 확인했다.

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P1-07

스마트 APC 도입의사가 디지털 역량 수준에 미치는 영향에 관한 연구

이소진*

지역농업네트워크 협동조합

급변하는 유통환경에서 농산물 유통 디지털화의 중요성이 강조되는 가운데 APC의 선별 포장 기계화, 1차 가공시설, 정보화 시스템 구축의 필요성이 증대하고 있다. 농식품부의 “스마트 APC 추진 보고”에서는 스마트 APC를 데이터를 기반으로 자동화시설을 이용해 운영효율성 및 농산물 상품성 제고를 도모하는 APC로 정의하고 디지털전환을 위해 적극적인 확산 정책을 추진하고 있다. APC의 디지털화를 위해서는 산지유통주체의 도입의사가 무엇인지 파악하고, 현재의 디지털 역량 수준을 측정할 필요가 있다. 본 연구는 스마트 APC 도입의사인 생산성, 이미지 제고, 마케팅, 비용절감을 세부 독립변수로 하고, 디지털 역량 수준은 임원의 스마트 APC 이해도, APC 디지털화 계획수립 여부, ICT 교육 시간, 데이터 업무 활



용 정도를 세부 종속변수로 설정한 연구모형을 채택하였다. 스마트 APC 도입의사가 디지털 역량에 미치는 영향을 알아보기 위하여 설문조사를 실시하고 회귀분석을 실시했다. 자료수집은 2022년 12월 15일부터 3월 26일까지 전국 산지유통시설 운영주체 200명을 대상으로 하였다. 총 178명의 응답이 수집되었으나 설문이 끝까지 완료되지 않았거나, 불성실한 16부를 제외하고 최종적으로 162부의 유효설문지를 통계분석 자료로 이용하였다. 수집된 자료는 코딩 과정을 거쳐 IBM SPSS statistics version 25.0 for windows를 이용하여 분석하였다. 연구가설 검증은 통한 결과는 다음과 같다. 첫째, 스마트 APC 도입의사는 탐색적 요인분석과 확인적 요인분석을 통해 생산성, 이미지 제고, 마케팅, 비용절감 등 4개 영역에서 각 3개 변수씩 총 12개 세부 도입의사 변수를 구성하였다. 둘째, 스마트 APC 도입의사 중 생산성 영역 변수가 디지털 역량 수준에 영향을 미칠 것이라는 가설을 분석한 결과, 불량률 감소, 취급량 증가, 적정 재고 유지는 모두 영향을 미쳤다. 셋째, 스마트 APC 도입의사 중 이미지 제고 영역 변수가 디지털 역량 수준에 영향을 미칠 것이라는 가설을 분석한 결과, 새로운 영업 기회, 산업의 선도 이미지는 영향을 미쳤고, 제품 만족도 증가 의사는 도입 수준에 유의한 영향을 미치지 않았다. 넷째, 스마트 APC 도입의사 중 마케팅 영역 변수가 디지털 역량 수준에 영향을 미칠 것이라는 가설을 분석한 결과, 새로운 영업 기회, 새로운 트렌드 창출은 영향을 미쳤고 충성고객 증대는 도입 수준에 유의한 영향을 미치지 않았다. 다섯째, 스마트 APC 도입의사 중 비용절감 영역 변수가 디지털 역량 수준에 영향을 미칠 것이라는 가설을 분석한 결과, 작업인력 인건비 절약, 비현장 인력 인건비 절약, 재고비용 절약은 모두 모두 영향을 미쳤다. 따라서 본 연구결과로 볼 때 각 변수 요인들에 영향을 미치는 핵심 가치의 정도는 다를 수 있으며 스마트 APC 도입 의사결정 과정에서 산지유통조직의 도입의사와 디지털 역량에 맞는 전략적 실행방안을 개발하고 혁신을 위한 인식변화가 필요하다.

1) 본 결과물은 농림축산식품부의 재원으로 농림식품기술기획평가원(스마트 농산물 유통저장 기술개발 사업)의 지원을 받아 연구되었음(No. 1545027893)

P1-08

두부 소비기한 연장을 위한 원료 및 공정별 미생물 오염도 분석

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본 연구에서는 두부 제조 공정 중 미생물 오염도를 분석하고 제조 공정을 개선하여 두부의 소비기한 연장에 기여 하고자 하였다. 본 실험에서 사용된 재료는 전라남도 소재 A 업체에서 사용하는 두부 원·부재료 및 용수, 생산공정 단계별로 제조된 두부, 작업장 환경 등을 대상으로 하였다. 실험 결과 일반세균수는 생콩, 불린 콩, 콩물, 두유액, 응고제, 사용 용수, 두부, 성형 틀, 여과기, 가열 용기, 포장기계, 살균기, 두유 용기, 칼에서 $2.3 \pm 0.1 \log \text{CFU}/100 \text{ cm}^2$, $6.8 \pm 0.0 \log \text{CFU}/100 \text{ cm}^2$, $7.2 \pm 0.0 \log \text{CFU}/100 \text{ cm}^2$, $1.8 \pm 0.1 \log \text{CFU}/100 \text{ cm}^2$, $1.3 \pm 0.0 \log \text{CFU}/100 \text{ cm}^2$, $2.3 \pm 0.1 \log \text{CFU}/100 \text{ cm}^2$, $1.1 \pm 0.0 \log$

CFU/100 cm², 4.5±0.0 log CFU/100 cm², 2.7±0.0 log CFU/100 cm², 5.7±0.0 log CFU/100 cm², 4.2±0.0 log CFU/100 cm², 1.6±0.2 log CFU/100 cm², 2.0±0.0 log CFU/100 cm², 5.1±0.0 log CFU/100 cm²로 검출되었다. 대장균군은 불린 콩, 콩물, 가열 용기, 칼에서 2.9±0.0 log CFU/100 cm², 4.8±0.0 log CFU/100 cm², 2.6±0.0 log CFU/100 cm², 2.9±0.0 log CFU/100 cm²로 검출되었다. 식중독 세균 실험 결과 생콩에서 *Bacillus cereus*가 검출되었다. 이러한 결과를 종합해 볼 때 식중독 세균인 *Bacillus cereus*를 제어하기 위해 원료 콩의 세척 공정 강화가 필요하고 기구 용기에 대한 위생관리가 필요한 것으로 판단되었다.

P1-09

Study on temperature distribution in cold storage of Korean garlic in wire mesh pallet container using CFD analysis

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Garlic (*Allium sativum*) is a major crop in most Asian countries, and its consumption in Asia-Pacific countries exceeds 90% of the global consumption. It contains beneficial ingredients and numerous essential nutrients, such as manganese, vitamin B6, and vitamin B1. Garlic demand is rising not only in Asian countries but also around the world. Particularly, garlic demand has been steadily increasing in European countries, such as Spain, France, Italy, and the American continent. In South Korea, 331,671 tons and 387,671 tons of garlic was produced in 2018 and 2019, respectively, making the country the fifth ranking garlic producer in the world, and the production has been increasing every year. In this study, the study on temperature distribution in cold storage of Korean garlic in wire mesh pallet container using CFD (Computational Fluid Dynamics) analysis was performed and Computations were based a commercial simulation software (ANSYS 19.0). Considering the respiration heat of garlic, the decreasing rate of temperature in the area in contact with the cold air was fast due to the inflow of cold air inside, while the decreasing rate of temperature in the center of the pallet was very low. In order to maintain a uniform temperature distribution inside the agricultural products storage pallet in the low-temperature storage, it was evaluated that creating a certain pore to facilitate the inflow of cold air into the interior is good for low-temperature storage of agricultural products.



Keywords : Garlic, Cold storage, Wire mesh pallet container, CFD

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P1-10

Measurement and analysis of physical environmental load during handling and distribution of domestic fruits - focused on Seongju melon

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The proportion of agricultural products handled through the Agricultural Products Processing Center (APC) is also steadily increasing every year, and in the case of Seongju Korean melon, a total of 10 APCs of Nonghyup and farming association corporations are in operation, and the distribution ratio is about 60% based on total production. In this study, measurement and analysis of physical environmental loads during the production handling and distribution of domestic agricultural products made through APC were conducted, focusing on Seongju Korean melons. It was found that the vibration intensity (frequency band: 1 to 250 Hz) during transport in the production area depends more on vehicle speed than road conditions (asphalt, concrete farm-road, unpaved farm-road). The vertical vibration intensity measured by the electric forklift body during handling at the APC site was about three times greater than in other directions, but the vibration intensity measured by the fork was similar to the vertical direction of the body in all directions. The vibration intensity in the vertical direction measured by the 5-ton truck between Seongju ~ Seoul and Seongju ~ Jeju was about three times larger than in other directions, and in particular, the difference between directions was more pronounced in the low frequency band of 10 Hz or less. The vibration intensity measured in the ferry (200 tons) between Yeosu-port and Jeju-port was significantly smaller than that of overland transport by truck in all directions.

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P1-11

포장조건과 신선도유지제 처리에 따른 저장 단감의 품질 변화

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단감의 신선도 유지 방법 중 하나인 신선도유지제 1-MCP (1-Methylcyclopropene)처리와 비닐포장 방식을 조합하여 유통 중 발생할 수 있는 품질저하를 방지하고자 저장 및 포장조건에 따른 유통조사를 실시하였다. 조사에 사용된 시료는 경상남도 김해에서 수확 및 저장한 '부유'단감을 이용하였다. 저장고 내에서 팔레트 위에 컨테이너를 3*3개 적재 후 종 모양으로 만든 비닐로 팔레트 전체를 덮어 저온저장 후 기간별 품질변화를 관찰하였다. 저장 중 비닐처리와 무처리군 간에 차이를 비교하고자 신선도유지제(이하 1-MCP)를 1, 4ppm 처리 후 날개, 3과, 5과 포장 후 포장지에 주사바늘로 구멍을 뚫어 실온에 방치 후 0, 4, 7일 간격으로 당도, 경도, 색도 등 품질인자를 조사하였다. 조사결과, 비닐로 덮어 저장한 단감의 품질은 저장 6주차부터 시료의 색도와 유리당 중 하나인 Scurose가 감소하였다. 1-MCP 처리 농도 및 포장 조건별 유통조사 결과, 비닐덮개 및 1-MCP를 1, 4ppm 처리한 시료군은 무처리군 보다 경도는 5N이상, Hunter 값 중 L, a값이 약 3 이상 차이났다. 1-MCP 1ppm 처리 후 포장하여 유통조사한 결과, 조사기간이 길어질수록 연화, 갈변 등 장애과의 발생이 증가하였으나, 1-MCP 처리군이 무처리군에 비해 장애과 발생량이 절반 수준이었다. 조사를 통하여 단기저장 중 단감을 비닐로 덮는 것이 수분 및 경도를 유지하는데 도움을 줄 수 있으며, 1-MCP 처리 및 비닐포장으로 유통 중 발생할 수 있는 상품성 저하를 방지할 수 있었다.

P1-12

Seasonal variation of metabolites in Kimchi cabbage: utilizing metabolomics-based machine learning for cultivation season discriminationWooChul Ju^{1*}, Sung Jin Park², Min Jung Lee², Sung Hee Park²
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Seasonal variation is crucial for ensuring consistent kimchi production. However, there has been limited research focused on investigating metabolic changes due to seasonal differences in kimchi cabbage. In this study, we examined the seasonal variations in key ingredients of kimchi cabbage, including glucosinolates, hydrolysis contents, water-soluble contents, sugars, organic acids, amino acids, and lipid-soluble contents (fatty acids and sterols), across four different seasons. Kimchi cabbage samples were collected at an average interval of two weeks. Our findings revealed that spring and summer kimchi cabbage exhibited similar

patterns, while autumn and winter kimchi cabbage showed comparable characteristics. Notably, winter kimchi cabbage displayed distinct features compared to other seasons. For instance, the average aliphatic glucosinolate (GS) content in winter kimchi cabbage was 3.31 μ mole/g, significantly different from the average of 6.55 μ mole/g observed in summer kimchi cabbage ($P < 0.01$). These results underscore the influence of environmental factors, such as temperature and precipitation, on glucosinolate profiles. Furthermore, we assessed the impact of different metabolic compound compositions on consumer preferences. Additionally, we developed a predictive model utilizing hydroxyglucobrassicin, myo-Inositol, palmitic acid, 1-monopalmitin, fructos as indicator substances. Remarkably, the model achieved an accuracy of 94.1% in differentiating between summer kimchi cabbage and winter kimchi cabbage. After eliminating GS, which was anticipated to have a significant association with cultivar specific traits, classification was conducted using the top 5 AUC scores. Once again, the accuracy remained at 94.1%, identical to the previous results (we used the algorithm of biomarker based model evaluation in MetaboAnalyst). We performed machine learning using Linear SVM, PLS-DA, Random Forest, and Logistic Regression, and found that Random Forest achieved the highest accuracy. These findings contribute to bridging the knowledge gap concerning seasonal differences in cabbage vegetables and offer valuable insights for establishing standardized approaches to ensure consistent quality of seasonal kimchi cabbage.

P1-13

Effects of controlled atmosphere container storage on browning of oriental melon and metabolomic profiling

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Oriental melon (*Cucumis melo* var. *makuwa*) is a valuable crop unique in Korea, renowned for its taste and nutritional benefits. However, post-harvest browning limits its marketability during long-distance shipping or exporting. To overcome this issue, this study examined effect of controlled atmosphere (CA) container storage on quality of oriental melon. The melons were stored at a constant temperature of 4°C. The atmospheric composition in the reefer container was maintained similar to ambient conditions, while the CA container maintained an oxygen level of 4% and carbon dioxide level of 12%. After a 14-day period, melons stored in CA containers (1.84 ± 0.19) exhibited a significant reduction (46.8%) in browning compared to the traditional reefer container group (3.46 ± 0.17). Average weight loss of oriental melon

was significantly high at CA container storage ($1.76 \pm 0.48\text{g}$) compared to reefer storage ($1.14 \pm 0.31\text{g}$). There was no difference in total soluble solids content between two different storage condition throughout the storage time. This study also investigated volatile organic compounds using thermal desorption tubes and gas chromatography mass spectrometry (GC-MS) analysis, along with assessing the various metabolites for pathway analysis: detail data will be displayed and discussed. These findings provide valuable insights into the effects of different storage methods on the quality of oriental melons, offering a scientific perspective for optimizing exporting practices on it.

P1-14

Changes in quality characteristics of dried apples by various packaging films and methods during storage

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This study was conducted to obtain optimum packaging materials for dried apples. The dried apples were packaged using various packaging films (double-layer laminated film: oriented polypropylene (OPP)/polyethylene (PE) and nylon (NY)/PE, triple-layer laminated film: polyethylene terephthalate (PET)/aluminum (AL)/PE, PET-aluminium oxide (Alox)/NY/PE) and methods (passive, N₂ gas exchange and degassing). After, the packaged dried apples were stored in the incubator irradiated with LED light at 40°C for 50 days, and the moisture content, hardness, browning degree, color, polyphenol oxidase (PPO), and total phenolic content (TPC) were analyzed. The moisture content was higher in the following order: NY/PE, OPP/PE, PET-Alox/NY/PE, control, and PET/AL/PE film. The moisture content of the passive package was higher than the N₂ gas exchange and degassing package. However, the hardness of the sample showed the opposite result. The browning of dried apples increased with the storage period. The browning degree, a value, and b value were higher in the double-layer laminated film groups with the passive package than in the triple-layer laminate film groups with N₂ gas exchange and degassing package. On the other hand, the L value and PPO of the samples showed the opposite result. TPC was not significantly different among the packaging films and methods. Based on the changes in the quality, it is concluded that triple-layer laminated films with N₂ gas exchange and degassing package were the most desirable for dried apple packaging.



P1-15

Management system for sound preservation and transportation of convergence health functional food

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This study aims to develop a management system for Convergence Health Functional Food (CHFF). CHFF refers to a product that enhances consumer accessibility and convenience by combining food with health functional food. Currently, there are no management standards for CHFF, and temporary manufacturing, preserving, and sales are permitted through the use of "Regulatory Sandboxes." This study examined the preservation laws of conventional health functional foods and related laws in the United States and the EU to identify the need for CHFF preservation standards. Firstly, as a preliminary step in the manufacture of CHFF, it is necessary to establish standards for the subdivision, packaging, and storage of health functional foods. Secondly, it is necessary to develop transportation standards for food or health functional foods used in CHFF. Thirdly, storage standards need to be established, such as storing completed CHFF separately from other health functional foods. Finally, it is necessary to establish a standard for use-by dates, taking into consideration the characteristics of CHFF, which combines food and health functional foods.

P1-16

Plant-based alternative foods labeling standards for international harmonization

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Establishing labeling standards for plant-based alternative foods (PBAs) is imminent. Although the market for PBAs has experienced significant growth, there is a lack of established standards for labeling these products. This absence of standards poses a risk of complications in import-export processes due to labeling disparities among countries and risks consumers' confusion. To address this issue, we conducted a quantitative study to analyze the labeling practices of various PBAs both domestically and internationally to formulate appropriate labeling measures. By examining the labeling and regulatory status of PBAs in Korea and

other countries, we have developed accurate labeling standards and guidelines. In addition to the definition of PBAs, standards were set for displaying product names and the content of raw materials on the main display surface of PBAs. In addition, nutrition ingredients were emphasized on the main display of the product, and guidelines were derived using pictures to deliver more accurate information. By leading not only domestic but also international standards through the labeling guidelines derived from this study, it will be possible to facilitate cross-border distribution and foster the growth of PBA markets.

P1-17

Changes in bioactive compounds of Shiitake mushrooms (*Lentinula edodes*) by storage temperature

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Shiitake mushroom (*Lentinula edodes*) is a nutritionally rich food ingredient that contains a large amount of bioactive compounds such as eritadenine and ergothioneine. However, research on changes in bioactive ingredients during storage of shiitake mushroom is insufficient. In this study, we examined changes in the level of antioxidants, eritadenine, and ergothioneine between three temperatures (1, 3, and 5°C) for 4 weeks in order to investigate an efficient storage condition for maintaining those bioactive compounds in shiitake mushrooms. Total flavonoid content in the cap did not notably vary between storage temperatures for 4 weeks, whereas total phenol content gradually increased, with shiitake mushrooms stored at 5°C showing the highest level of total phenolics at 2 weeks. The eritadenine content of the caps increased and then decreased slightly for up to 2 weeks after storage, regardless of temperature. On the other hand, ergothioneine content in the cap significantly declined 1 week after beginning storage, and the highest level of ergothioneine was observed at 1°C. These results suggest that the amount of each bioactive compounds is affected by the storage temperature.



P1-18

Quality characteristics according to ethylene treatment and MA of domestic banana

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This study was conducted to establish a post-ripening technology system to improve the quality of domestic bananas. Due to climate warming, banana has recently increased interest as a new income crop in Jeju Island and some farms in the southern coast of Korea, and the cultivation area is increasing. It is necessary to develop and disseminate post-harvest management technology for high-quality distribution and sales of domestic bananas. After harvesting the cavendish bananas of this experimental material, post-ripening was carried out through treatment with 100ppm ethylene for 24 hours at a temperature of 18°C in the storage room. Quality characteristics such as hardness, color, sugar content, and starch content were compared according to the presence or absence of MA packaging including imported products. The hardness showed a tendency to decrease in all treatment groups after 1 day of ethylene treatment, and there was a difference of 15.7N between domestic bananas treated with film and those without film treatment from the 1st day of post-ripening. Chromaticity and yellowness (Hunter b value) increased in all treatment groups, and in particular, the MA film treatment group showed a difference of more than 10 from the MA film treatment from the first day of ethylene treatment, and the difference between the treatment groups was less than 5 from the 6th day. value was indicated. The post-ripening process seemed to have started earlier with the MA film treatment, but after the 9th, the post-ripening process was rapid, with brown spots appearing on the imported products. As post-ripening proceeded, the sugar content increased, and the MA film treatment group maintained a higher sugar content than the other treatments, and the difference was less than 3Brix after the 7th day. In the case of starch content, it can be seen that the starch was converted to sugar around the inside after 4 days of MA film treatment, and it progressed rapidly from the 7th day. In conclusion, humidity is important during ethylene treatment for banana post-ripening, and uniform quality can be exhibited through MA film treatment.

P1-19

Changes in the quality of functionally labelled black soybean Sunsik product during storageJi-Hyun Im^{1*}, Kang-Pyo Lee², Ye-Won In², Ok-Hwan Lee¹, Boo-Yong Lee³¹Department of Food Biotechnology and Environmental Science, Kangwon National University
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This study investigated changes in dietary fiber and calcium content during storage of black soybean Sunsik product with functional labeling system. As a result of dietary fiber analysis, both black soybean sunsik (BS) and black soybean sunsik with nondigestible maltodextrin and calcium lactate (BSN) showed a tendency to increase compared to the initial content at 12 months of storage. Conversely, the calcium contents of BS and BSN decreased with the storage period. This is a result of the release of cations due to the breakdown of phytate during storage, and the released cations form new cross-links with pectic acid in the middle lamella, leading to an increase in dietary fiber content. Based on the mathematically calculated distribution day by annual temperature, the shelf-life was predicted to be 17.89 months for BS and 30.68 months for BSN.

P1-20

적색종 용과("Da Hong", 대홍) 저장온도에 따른 품질특성 조사

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아열대과수인 용과는 1999년 제주도에 도입되어 현재 16농가 4.9ha 재배되고 있고, 그 중 적색종 용과는 정예소득작목단지를 조성하여 10농가 3.9ha 재배되고 있다. 대만에서 육성한 적색종 용과 (*Hylocereus polyrhizus*) '대홍'은 백색종 용과보다 당도가 높고, 식감이 부드러운 것이 특징이다. 용과는 수분 함량이 많은 과일로 수확 후 저장 기간 동안 수분 손실로 과중 및 경도 감소, 부패 등 품질 변화가 발생한다. 적색종 용과의 품질 변화 억제를 위해 다양한 수확 후 처리 기술이 연구되어 왔으나 현장에서 활용할 수 있는 효과적 수확 후 관리 기술이 부족한 실정이다. 따라서 본 연구는 적색종 용과의 수확 후 저장온도 설정 및 품질향상을 위한 수확 후 관리 방법을 개발하기 위해 수행되었다. 제주 시 조천읍 농가에서 12월에 수확한 적색종 용과를 실험에 사용하였고, 수확 직후 적색종 용과를 플라스틱 선반에 담고 종이로 포장 한 후에 상온, 8℃, 12℃로 나누어 4주간 실험을 수행하여 부패, 감량, 과실품질 변화를 확인하였다. 그 결과, 부패는 상온에서 저장한 경우 7일에, 8℃와 12℃에서는 21일에 처음 발생하였다. 부패율은 8℃보다 12℃에 저장한 경우가 더 높게 나타났다. 저장 조건에 따른 과중 감량 변화로는 상온이 다른 조건에 비하여 크게 감소하였으며, 8℃와 12℃에서는 차이가 없는 것으



로 조사되었다. 당도, 경도에서는 저장조건 8℃>12℃>상온 순으로 각각 변화가 적었다. 따라서 적색 종 용과(“Da Hong”, 대홍)의 저장을 위한 저장온도는 부패 및 품질특성 등을 고려시 8℃가 적합한 것으로 사료되며, 농가 현장에 적용 될 경우 출하시기를 분산 할 수 있는 기초자료가 될 수 있을 것으로 판단된다.

P1-21

Application of hyperspectral imaging to predict a total volatile basic nitrogen of yellow croaker during storage

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Total volatile basic nitrogen (TVB-N) is an objective indicator used to evaluate changes in the quality of aquatic products: the higher the TVB-N value, the closer the fish is to spoilage. However, traditional destructive methods for measuring TVB-N content are time-consuming and not suitable for assessing freshness in large quantities of samples simultaneously. On the other hand, hyperspectral imaging offers a non-destructive approach with rapid analysis time and simultaneous analysis capability, allowing real-time monitoring of sample conditions. Additionally, it provides the advantage of visualizing changes in sample quality, thereby offering intuitive information. Therefore, in this study, we propose a method using hyperspectral imaging to determine the freshness, predict the TVB-N content (which serves as an indicator of freshness), and visualize it to provide spatial information on the freshness of yellow croaker. The yellow croaker was stored at 0 °C for 60 hours with 12 hours interval for measurement of the TVB-N and hyperspectral signal. Partial least square regression (PLS-R) model was developed to predict the TVB-N by HSI and the coefficient of determination between hyperspectral imaging and TVB-N was 0.9028. This result indicates that hyperspectral imaging has the potential to predict the freshness of yellow croaker as a non-destructive method.

P1-22

**pH를 조절한 탄산수로 수세한 피조개(*Scapharca broughtonii*), 가리비(*Argopecten irradians*),
바지락(*Ruditapes philippinarum*)의 선도변화**

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피조개, 가리비, 바지락은 식재료로 사용되는 주요 양식패류로서 다양한 형태로 유통 및 소비되고 있다. 하지만 가공 및 유통중 주위환경의 위생상태, 저장온도 상승 등의 요인으로 미생물 증식이 발생하여 식중독의 원인이 되기도 한다. 따라서 pH를 조절한 탄산수의 세척과정이 패류의 유통중 안전성에 영향을 미치는지 확인하기 위하여 식품첨가용 구연산과 탄산나트륨을 혼합하여 pH를 3의 세척수를 제조하고, 피조개, 가리비, 바지락의 패각을 제거한 육을 세척하였을 때 저장기간별 휘발성염기질소(Volatile basic Nitrogen, VBN)과 일반세균수의 변화를 측정하였다. 세척처리한 패류시료는 15일간 4℃에서 보관하였으며, 대조구는 수돗물로 세척한 후 저장 및 실험을 수행하였다. 탄산수 세척처리한 시료는 모두 VBN 함량증가가 대조군에 대비하여 감소하였으며, 5일까지 약 10mg/100g까지 증가하였으나 이후 증가폭이 감소하여 15일후 피조개는 15mg/100g, 가리비 20.85mg/g, 바지락 9.74mg/g의 함량을 나타내었다. 미생물수의 증가폭도 탄산수 세척처리함에 따라 감소하는 결과를 나타내었다. 탄산수 세척 피조개는 11일차에 3.3 log CFU/g로 나타났으며(대조구: 6.0 log CFU/g), 바지락역시 11일차에 2.7 log CFU/g(대조구: 6.5 log CFU/g)를 나타내어 효과적으로 미생물의 증식을 억제시켰다.

P1-23

봄재배 감자 저장 후 상온 보관 기간에 따른 품질변화

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이미연¹, 박기진¹, 홍세진²¹강원특별자치도농업기술원 감자연구소, ²강릉원주대학교 식물생명과학과

강원특별자치도 감자재배면적은 5,147ha('22년)로 전국 16,112ha 중 31%, 생산량은 171,303톤('22년)로 전국 427,695톤 중 40%를 점유하고 있는 주력 작목이다. 이 중 봄재배 감자는 6월~7월 수확하여 바로 출하가 되기도 하지만 저장을 통해 출하시기를 조절하여 유통·판매할수 있다. 하지만 봄재배 감자는 저장 중 발생 하는 멍아가 상품성에 영향을 주어 농가 소득감소에 원인이 되고 있다. 본 연구는 품종에 따른 저장조건별 저장 후 상온보관 시 감자의 내·외부 품질변화 구명에 목적을 두고 진행되었다. 품종(추백, 수미, 대서) 및 저장조건(저온, 반지하, 상온) 저장 후 상온보관 기간에 따른 품질변화 조사 결과 추백, 수미, 대서 품종의 저온, 반지하, 상온저장 후(3개월) 상온보관 기간에 따라 감모율과 멍아율은 증가하였고 상온보관 20일까지 건물률과 비중은 품종별로 차이는 있었지만 보관기간에 따른 차이는 없



었다. 맹아의 발생은 저온저장 후 상온보관 10일에서 대서(18.2%), 수미(28.7%) 품종이 낮았다. 따라서, 대서, 수미 품종은 저온저장 후 상온보관 시 10일 이내에 유통하는 것이 좋을 것으로 판단되며, 향후 상온보관 중 맹아의 발생을 억제하는 기술 개발이 필요할 것으로 판단된다.

P1-24

Effects of storage temperature on the quality characteristic of texturized vegetable protein (TVP)

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This study analyzed the quality characteristics of Texturized Vegetable Protein (TVP) according to storage temperature. In the Extruded process, the screw speed was fixed at 250 rpm, the temperature of the barral was 190°C, and the moisture was fixed at 9 rpm. The materials used for Extruded process were used by mixing 80°C Defatted Daewon soybean flour, gluten, and corn starch at a ratio of 5:3:2. The extruded TVP was vacuum-packed in a PE pack at -20°C, 0°C, and 4°C and stored for 9 days to confirm the changing quality characteristics. During the storage days, the change in texture profile was the lowest at -20°C, and the change was the largest when stored at 0°C. In terms of water absorption and turbidity, the quality change was the least in 4°C storage, and the quality decreased after 3 days of storage period. In conclusion, the possibility of refrigerated storage and distribution of plant tissue protein (TVP), which was distributed only in a frozen and dry state, was confirmed.

P1-25

Evaluation of quality attributes and antioxidant activity of paprika

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This study was carried out to find new quality attributes for paprika commercialization and APC upgrade. Physicochemical quality characteristics such as hardness and SSC, as well as vitamin C and antioxidant activity, were analyzed using common paprika and a new variety of Tribelli paprika. As a result, the hardness of common paprika was slightly higher than that of Tribelli, and Tribelli paprika was analyzed to have a high level of CO₂ in the pulp. The SSC

of Tribelli was higher than that of regular paprika, and the fructose content was the highest and the sucrose content was the lowest in free sugar analysis. Red Tribelli paprika had the highest vitamin C content, and minerals such as Fe, Zn, and Mn were found to be somewhat higher than other ingredients. In addition, as a result of analyzing total polyphenol, DPPH and ABTS radical scavenging ability, and antioxidant activities such as FRAP, it was found that the total polyphenol content of red Tribelli and yellow common paprika was high. These results suggest that the marketability of paprika can be improved through APC through more delicate and scientific quality control by considering consumers' tastes along with various varieties in the existing method of selecting only by size, and adding health-related information. In the future, it is judged that it is necessary to research the correlation between the objective quality characteristics results and the variety, color, taste, etc. desired by consumers, and research for the commercialization process of maintaining freshness customized for each paprika variety.

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P1-26

Temperature and humidity change during paprika transportation and quality monitoring by APC process

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Paprika is likely to lose its marketability due to increased respiration rate and microbial proliferation during transportation due to high product temperature after harvest. In this study, temperature, humidity and quality characteristics were monitored during transportation of paprika in the summer season, and MA small packaging films effective in maintaining freshness were selected. After harvesting, the temperature of the paprika was 31.5°C, and although it was transported by refrigeration to APC, the temperature of the paprika didn't low. In July, the harvest of paprika in the Jeonnam region is almost over, so there are many cases where APC returns to room temperature by delivery service, so there are concerns about quality deterioration due to the increase in product temperature again. In addition, shrinkage occurs in the packaging due to increased respiration and condensation. In the case of using the MPP film, a microperforated film with a thickness of 30um in a single small package, which is an improved packaging form in this study, the quality of paprika is reduced by suppressing weight loss and condensation compared to conventional methods. Paprika in the summer season is the last harvest season of the winter cropping season, and overall skin texture is low, so there is a high possibility of microbial penetration. Therefore, rapid precooling immediately



after harvest lowers the temperature of the product to lower the respiration rate, transportation at a low temperature, and treatment that can control microbial growth within the APC Technology and temperature management are considered essential.

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P1-27

Study on the change of respiration characteristics of Korean melon using anti-condensation PE film during transportation

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Fruits and vegetables are subjected to a variety of vibration stress during the transportation from a production area to markets. Vibration inputs are transmitted from the transporting vehicle through the packaged fruit. And the steady state vibration input may cause serious internal damage of agricultural products. Product quality of fruits declines by various factors while they are stored right after harvesting and among the substance in charge of post ripening action, ethylene (C₂H₄) biosynthesis increases fruits' respiration process after harvesting and decreases storage expectancy and the ratio of oxygen (O₂) and carbon dioxide (CO₂) in the headspace of gas-collecting container. Ethylene production of oriental melons rapidly increases while storage duration becomes longer. This tendency is much clearer for the fruits with vibration stress at input acceleration level. This study was conducted to investigate the respiratory characteristics according to the application of the anti-condensation PE film of Korean melon during transportation. Compared to the respiratory change characteristics of Korean melons that did not previously apply film packaging materials, it was judged that the application of anti-condensation packaging materials would play a role in reducing quality changes during the transportation of Korean melons.

Key words: Respiration, Korean melon, Anti-condensation, PE film, Transportation

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P1-28

CA 컨테이너를 활용한 멜론의 모의 수출 후 선도유지 효과

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수출 멜론은 주로 대만, 홍콩, 일본 등 동남아시아 국가를 대상으로 저온 컨테이너를 이용하여 수출되고 있다. 저온 컨테이너는 외부 환경 요인 중 온도 요인만 조절할 수 있는 컨테이너로 수출 농산물의 신선도 유지에 한계가 있다. CA(controlled atmosphere) 컨테이너는 대기환경 조절을 통한 선도 유지 기술을 탑재한 컨테이너로 수출 농산물의 신선도 유지에 가장 고도화된 기술이다. CA 기술은 주로 사과 등 장기 저장이 필요한 농산물에 활용되어 왔지만 농산물 수출 시에도 수송 컨테이너에 적용, 활용 가능성이 높은 기술이다. 따라서 본 연구에서는 CA 컨테이너를 활용하여 멜론을 모의 수출하였을 때 수송 기간 및 수출대상국 현지에서의 유통기간까지 고려하여 멜론의 품질을 분석하여 CA 컨테이너의 효과를 구명하고자 수행하였다. 연구에 사용된 멜론은 전남 영암에서 재배된 멜론을 이용하였으며 경종 개요로는 3월 10일 정식, 4월 10일 수정, 5월 10일 적과, 6월 5일에 수확된 멜론을 4과 크기로 선별하여 6월 9일에 국립원예특작과학원 저장유통과 전처리동으로 운반하였다. CA 컨테이너는 온도 4℃, 산소 5%, 이산화탄소 12% 조건으로 설정하였으며 대조구로 사용된 저온 컨테이너는 온도 4℃로 설정하였다. 모의 수송 전 멜론의 초기 품질 중 경도는 9.03N이었고, 가용성 고형물 함량은 10.6 ° brix 수준이었다. 2주간의 모의 수송 후에는 현지에서의 판매장 조건에 맞춰 10℃ 저장고에 보관하면서 3일 간격으로 품질을 분석하였다. 현지에 도착한 날로 가정한 모의 수송 2주후 0일차의 경도를 분석한 결과, CA 컨테이너로 수송한 멜론의 경도는 7.24N 로 저온 컨테이너로 수송한 멜론(5.18N)보다 모의 수송 기간 중 경도 유지 효과가 뛰어난 것으로 조사되었다. 또한 현지에서의 판매 기간을 고려한 10일차까지의 경도도 저온 컨테이너 처리구(3.48N)보다 CA 컨테이너 처리구(4.84N)가 더 높게 유지되는 것으로 분석되었다. 당도는 모의 수송 2주후 0일차 분석 결과, 저온 컨테이너 처리구가 10.9 ° brix로 CA 컨테이너 처리구 10.2 ° brix보다 다소 증가한 것으로 조사되었는데 이러한 결과는 멜론은 후숙과로 저온 컨테이너 수송 기간 중 후숙이 진행되는 반면 CA 컨테이너 수송 기간 중에는 대기환경조절의 영향으로 후숙이 지연된 것으로 판단된다. 판매 기간 중 당도변화에서도 3일차까지는 저온 컨테이너 처리구의 당도가 더 높은 것으로 분석되었지만 판매기간중 지속적으로 감소하여 6, 10일차에는 CA 컨테이너 처리구의 멜론보다 낮은 당도를 나타내었다. 이러한 결과로 보았을 때 멜론 수출시 CA 컨테이너를 활용할 경우 수송 기간 중 후숙 방지, 판매기간 중 선도 유지 효과가 매우 뛰어나 향후 멜론 수출시 CA 컨테이너의 활용도가 매우 뛰어날 것으로 판단된다.

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P1-29

양파의 품질등급규격 설정을 위한 소비자선호도 및 품질인자 분석

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양파의 등급은 현재 국립농산물품질관리원에서 정하는 등급규격을 따르고 있으나, 최근 코로나-19 이후 급증한 양파의 소비패턴을 반영하고 있지 않다. 본 연구는 소비자를 위한 양파의 품질속성을 분석하여 양파의 등급을 결정하는 품질인자를 선정하는데 활용하고자 하였다. 공시재료는 조생종(마루시노)와 중만생종(카타마루)을 대상으로 양파의 인편을 각각 분류하여 소비자가 양파를 구매하는데 가장 중요하게 생각하는 기준과 대표되는 품질속성이 무엇인지 발굴하는 방식으로 진행하였다. 소비자 테스트는 조생종을 A로, 중만생종을 B로 구분하여 순서 효과와 이월 효과가 없도록 설계된 평가를 요청하였다. 종합적으로 소비자가 양파의 품질을 판단하는 데 있어 가장 중요하게 생각하는 요인은 신선도가 1순위, 조직감이 2순위, 맵이가 3순위, 당도가 4순위, 크기가 5순위로 나타났다. 관능평가 결과, 조생종 양파와 중만생종 양파 사이에는 단맛($p=0.008$), 매운맛($p=0.002$), 전체적인 기호도($p=0.03$)에서 유의한 차이가 있었다. 상관관계 분석 결과, 전체적인 기호도는 단맛($r=0.59$), 외관(겉질)($r=0.57$), 향기($r=0.52$), 내부(인편)($r=0.51$), 조직감($r=0.49$)과 관련이 있음을 보여주었다. 품질평가는 소비자 테스트에 활용된 시료를 대상으로 내부 및 외부 품질인자 10가지를 분석하였으며, 조생종 양파와 중만생종 양파 사이에 당도($p=0.008$)와 수분함량($p=0.003$)에서 유의한 차이가 나타났다. 종합해보면 양파 품질의 실측값과 관능평가간의 상관분석을 통해 수요자를 위한 양파 등급설정에 필요한 품질인자는 외관(겉질), 내부(인편), 조직감, 당도와 수분함량이었다. (본 성과물은 농촌진흥청 연구사업(과제번호: PJ017154)의 지원을 받아 수행되었음.)

P1-30

매생이의 동결건조공정의 확립을 위한 동결 특성 측정

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해조류 중에서 향압, 항산화, 항균 및 항바이러스 활성이 있으며, 심근경색, 동맥경화 및 고혈압 예방 효과도 있는 것으로 보고되고 있는 매생이는 다양화 효과로 그 수요량이 늘어나고 있으나, 가공 주요 공정 중에서 동결 및 건조 공정의 최적조건의 확립이 미비하여 매생이 동결건조 제품의 생산단가의 상승, 품질의 고도화 등의 어려움을 극복하기 위하여 먼저 동결공정의 최적 조건의 확립이 중요하다. 매생이의 동결공정의 과냉각 해석, 에너지 절감형 동결장치 제작을 위한 동결잠열(kcal/kg), 최적의 품질 유지를 위한 최적동결속도($^{\circ}\text{C}/\text{min}$) 및 동결완료온도($^{\circ}\text{C}$) 등의 동결 특성이 품질에 영향을 주므로 동결공정의 지표 확립을 위한 기초 연구로서 DSC를 이용하여 상용의 Cooling rate인 $1.0 \sim 2.0^{\circ}\text{C}/\text{min}$ 에서 매생이의

동결 특성을 측정하였다. 상용 Cooling rate 0.1°C/min 냉각에서는 미동결 상태로 발열반응 최대 온도 -6.35°C를 통과하여 순간적으로 -2.91°C로 온도가 상승하였으며, 0.2°C/min Cooling rate에서는 발열반응이 최대인 온도 -7.10°C를 거쳐 -10.36°C까지 강하한 후 순간적인 -4.73°C로의 온도 상승으로 동결이 진행되었다. 생매생이의 동결반응개시온도(On Set Point)는 각각 -2.914°C, -4.73°C였으며, 발열반응 최대온도 -6.35°C에서의 최대 Heat flux는 28.86 W/g, -7.10°C에서 22.07 W/g의 값을 나타내었다. 생매생이의 동결잠열은 동결속도 각각 0.1 및 0.2 °C/min에서 239.7 J/g, 230.5 J/g 로서 거의 일정하였으며, Super cooling 현상의 소멸시간은 6.7sec로 빠른 속도로 상변화로 전환되었다.

P1-31

Metabolomics approach analysis of *Larimichthys polyactis* using NMR spectroscopy.

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Small yellow croaker (*Larimichthys polyactis*) is a popular edible fish in East Asia, especially Korea and China. Given the perishable nature of fish, maintaining freshness is essential for ensuring quality and safety for customers. Fish freshness is intrinsically associated with metabolic perturbations that occur during distribution. In order to investigate the metabolome associated with the freshness changes during a shelf life of 60 hours at a low temperature (10°C), we applied an NMR-based metabolomics approach to the small yellow croaker. Significant metabolic perturbations were observed. In particular, acetate, mid-chain fatty acids, trimethylamine (TMA), choline, cytosine, formate, xanthine, and hypoxanthine accumulated, while the levels of trimethylamine-N-oxide (TMAO) and inosine monophosphate (IMP) decreased. The present study revealed the intricate relationship between freshness and metabolic alterations in the small yellow croaker during distribution at low temperatures, highlighting potential biochemical markers for evaluating the freshness of the small yellow croaker in detail.



P1-32

차(茶)류 49종의 형태적 특성 평가를 위한 SAM 분석

김은아*

(주)클린힐

차는 전 세계 사람들이 물 다음으로 가장 많이 음용하는 음료로 차나무의 종류, 차나무 재배방법, 제다 방법, 발효 정도 등에 따라 차류 상품이 다양하게 생산되고 있다. 본 연구는 SAM 분석을 통해 다양한 차류 상품의 형태적 특성을 분석하고자 하였다. 국내와 해외 5개국(중국, 일본, 인도, 스리랑카, 베트남)의 대표적인 차류 상품 49종의 형태적 특성을 평가하기 위하여 발효정도에 따라 녹차, 홍차, 반발효차 그룹으로 나누어 전계 방사형 주사전자현미경(Field Emission Scanning Electron Microscope, FE-SEM) 분석을 실시하였다. 녹차 그룹은 4개국(한국, 중국, 일본, 베트남) 18종, 홍차 그룹은 5개국(한국, 중국, 베트남, 인도, 스리랑카) 16종, 반발효차는 2개국(한국, 중국) 15종으로 분류하였다. SAM 분석 결과 녹차에서는 물결모양, 둥근원형, 넓은 판모양을 나타내었는데, 물결모양은 한국의 하동 우전, 제주 덕음녹차, 중국의 신양모첩, 황산모봉, 서호용정, 일본의 호우지차, 베트남 Thai Nguyen Tan Cuong이었으며, 둥근원형은 한국의 보성 우전, 중국의 벽라춘, 은사옥록, 일본의 심증전차, 번차에서 나타났다. 넓은 판모양은 한국의 하동 세작, 보성 세작, 제주 증제녹차, 중국의 태평후괴, 일본의 옥로차에서 나타났다. 홍차에서 SAM 분석결과는 물결모양, 원형, 물결판모양이었다. 홍차에서 물결모양은 한국의 하동발효차, 제주 홍차에서 나타났으며, 중국의 운남전홍, 기문홍차, 인도의 아쌈 벨세리, 다즐링, 날기리, 스리랑카의 덤블라에서 나타났다. 홍차에서 둥근원형은 한국의 보성홍차, 중국의 금준미, 인도의 아쌈 망갈람, 스리랑카의 우바, 캔디, 루후나, 누와라엘리아에서 나타났다. 홍차에서 넓은 판 모양은 베트남의 Ha Giang에서만 보였다. 반발효차에서 물결모양은 하동 청차, 하동 백차, 제주 서귀황차, 중국 백차 백모단, 공미, 중국 황차 군산은침, 광산황대차에서 나타났으며, 원형은 중국 청차 문산포종, 북항모침에서 보였으며, 판모양은 중국 청차 대홍포, 철관음, 봉황단충, 동정오롱, 중국백차 백모단, 수미에서 보였다. 차류 상품 49종의 SAM분석 결과 제다방법, 발효정도 등에서 공통점은 보이지 않았다.

P1-33

A measurement and analysis of distribution environment of urban areas in Korea

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Korea Conformity Laboratories

차는 전 세계 사람들이 물 다음으로 가장 많이 음용하는 음료로 차나무의 종류, 차나무 재배방법, 제다 방법, 발효 정도 등에 따라 차류 상품이 다양하게 생산되고 있다. 본 연구는 SAM 분석을 통해 다양한 차류 상품의 형태적 특성을 분석하고자 하였다. 국내와 해외 5개국(중국, 일본, 인도, 스리랑카, 베트남)의

대표적인 차류 상품 49종의 형태적 특성을 평가하기 위하여 발효정도에 따라 녹차, 홍차, 반발효차 그룹으로 나누어 전계 방사형 주사전자현미경(Field Emission Scanning Electron Microscope, FE-SEM) 분석을 실시하였다. 녹차 그룹은 4개국(한국, 중국, 일본, 베트남) 18종, 홍차 그룹은 5개국(한국, 중국, 베트남, 인도, 스리랑카) 16종, 반발효차는 2개국(한국, 중국) 15종으로 분류하였다. SAM 분석 결과 녹차에서는 물결모양, 둥근원형, 넓은 판모양을 나타내었는데, 물결모양은 한국의 하동 우전, 제주 덕음녹차, 중국의 신양모침, 황산모봉, 서호용정, 일본의 호우지차, 베트남 Thai Nguyen Tan Cuong이었으며, 둥근원형은 한국의 보성 우전, 중국의 벽라춘, 은사옥록, 일본의 심증전차, 번차에서 나타났다. 넓은 판모양은 한국의 하동 세작, 보성 세작, 제주 증제녹차, 중국의 태평후괴, 일본의 옥로차에서 나타났다. 홍차에서 SAM 분석결과는 물결모양, 원형, 물결판모양이었다. 홍차에서 물결모양은 한국의 하동발효차, 제주 홍차에서 나타났으며, 중국의 운남전홍, 기문홍차, 인도의 아쌈 벨세리, 다즐링, 날기리, 스리랑카의 딤블라에서 나타났다. 홍차에서 둥근원형은 한국의 보성홍차, 중국의 금준미, 인도의 아쌈 망갈람, 스리랑카의 우바, 캔디, 루후나, 누와라엘리아에서 나타났다. 홍차에서 넓은 판 모양은 베트남의 Ha Giang에서만 보였다. 반발효차에서 물결모양은 하동 청차, 하동 백차, 제주 서귀황차, 중국 백차 백모단, 공미, 중국 황차 군산은침, 광산황대차에서 나타났으며, 원형은 중국 청차 문산포중, 북항모침에서 보였으며, 판모양은 중국 청차 대홍포, 철관음, 봉황단총, 동정오룡, 중국백차 백모단, 수미에서 보였다. 차류 상품 49종의 SAM분석 결과 제다방법, 발효정도 등에서 공통점은 보이지 않았다.



PART II

가공/품질

P2-01

Pasting properties of black rice flour fermented with probiotics

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The purpose of this study was to compare and analyze the pasting characteristics of freeze-dried black rice flour after fermentation with probiotics to use as basic data for diversification of related materials and products. WAI was the highest in YM-1.0, and the lowest in CH-0.5 and YM-0.5. WSI was also the highest in YM-1.0, and the lowest in CH-1.0. As a result of particle size measurement, the control was the highest, CH-1.0 was the lowest in Dv (10), and YM-1.0 was the lowest in Dv (50) and Dv (90). As a result of SEM measurement, it was confirmed that the black rice flour samples fermented with probiotics had smaller particles than control and many small particles were distributed around them. As a result of X-ray diffraction analysis, the diffraction angles of all samples showed a crystal structure similar to the A curve with a strong peak around 15, 18, and 23°. As a result of the amylogram measurement, for the maximum viscosity and breakdown, CH-1.0 was the highest and YF-0.5 was the lowest. In Setback, the control group was the highest and YM-1.0 was the lowest. As a result of DSC analysis, the control was the lowest in all measurement results, and CH-0.5 was the highest at 9.91 cal/g in pasting enthalpy.

P2-02

붉은대게 자숙 살의 냉장 저장 중 향기성분 및 세균 군집 변화

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우리나라 동해안에 서식하는 붉은 대게의 살은 특유의 맛과 연한 조직감으로 선호도가 높아 산업적으로 많이 활용된다. 가공학적 측면에서 계살은 외부 껍질 및 내부 연골과 붙어있어 단백질 변성 없이는 살을 온전하게 분리하기 어렵다. 때문에 자숙·냉각 처리 후 채육하며, 이 과정에서 살에 존재하는 내생 효소 활성 및 미생물 수가 현저히 감소된다. 그러나 자숙 계살의 냉장 유통안정성은 약 10일 이내로 낮아 시중에서는 냉동 유통되고 있다. 본 연구에서는 자숙 계살의 냉장 유통안정성 확보를 위한 연구의 일환으로 품질 저하 연관 인자 발굴을 위해 세균 수 및 세균 군집 변화를 살펴보고, 향기성분 변화를 분석하여 자숙 계살의 향기성분 프로파일링 및 품질 저하 시 나타나는 이취 성분을 동정하고자 하였다. 그 결과, 자숙

계살을 4°C에서 8일간 저장하였을 때, 일반세균은 7.5 log CFU/g까지 증가되었으며, 주요 미생물은 호냉성과 호염성의 특징을 가지는 세균종으로 나타났다. 자숙 계살의 휘발성 향기성분으로 총 17종이 검출되었으며, 저장기간이 증가함에 따라 trimethylamine의 함량이 가장 증가되었다. 이취성분의 증가와 미생물의 증가는 연관성을 보이는 것으로 나타나 자숙 계살의 미생물을 억제하여 유통한다면 이취를 방지하며 냉장 유통안정성을 확보할 수 있을 것으로 예상된다.

이 연구는 2023년도 해양수산부 재원으로 해양수산과학기술진흥원의 지원을 받아 수행된 연구임 (20220131, 계살제품의 품질향상을 위한 공정개발 및 상품화)

P2-03

수박 전처리 방법에 따른 착즙액의 유효성분 함량 변화

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시트룰린(citrulline)은 체내에서 소화되면서 특정 효소에 의해 아르기닌(arginine)으로 변환되어 산화 질소를 증가시켜 혈관을 이완시키는 기능을 가지는 것으로 최근 보고됨에 따라, 시트룰린을 이용한 음료, 건강보조식품 등의 상품화도 진행되고 있다. 시트룰린은 농산물 중에는 박과채소류에 있으며 특히, 수박 과피에 함량이 높다. 본 연구에서는 다양한 가공품에 적용하기 쉽고, 시트룰린 함량을 높여 기능성 소재화를 위한 농축액 제조 조건을 설정하고자 하였다. 첫 번째 단계로 착즙액 제조 전 시트룰린 함량을 증대시킬수 있는 전처리 방법을 구명하기 위해 수박을 과피, 과육, 통수박(과육7+과피3)으로 나누어 대조, 냉동(-20 °C, 24H) 초저온냉동(-80°C, 24H), 고압(121°C, 1.2kg/cm², 20min), 열수(60, 80, 100°C), 초음파처리(1H)와 같이 전처리 방법을 달리한 후 착즙하여 폴리페놀, 라이코펜, 아르기닌, 시트룰린 함량 변화를 조사하였다. 시트룰린 함량은 과육의 경우 대조 3,760.1 µg/g F.W., 냉동 3,508.7 µg/g F.W. 초저온냉동 3,405.4 µg/g F.W. 순 이었으며, 과피에서는 냉동 처리가 39,836.3 µg/g F.W. 으로 높았다. 통수박에서도 과피에서와 같이 냉동 처리가 효과적이었다. 아르기닌, 라이코펜 함량 역시 냉동처리가 높아 수박 착즙액 전처리 방법으로는 냉동처리가 효과적이라고 생각되며, 이후 연구에서는 적정 농축브릭스 등의 조건을 설정하여 천연 유래 시트룰린 제품개발 예정이다.



P2-04

수박 착즙액 첨가량별 젤리의 성분 함량 변화

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헬시플레저(Healthy+Pleasure)를 추구하는 사람들이 증가하면서 젤리형 건기식의 제품개발과 판매가 동반 상승하고 있다. 수박은 대부분 생과일로 이용되며 일부 가공 공정 중에도 껍질은 부산물로 버려지고 있다. 과육 및 과피 모두 시트룰린이라는 특수 아미노산이 다량 함유되어있으며 최근에 시트룰린의 이뇨, 고혈압, 당뇨, 혈관 확장의 효과가 지속적으로 보고되고 있다. 시트룰린 함유 기능성 젤리 개발을 위한 전 단계로, 수박 착즙 부위와(과육, 과피, 통수박) 착즙액의 첨가량을 달리하여 젤리를 제조하고 성분함량 변화를 분석하였다. 수박 착즙액(과육, 과피, 통수박), 첨가량(0, 25, 50, 100%)을 달리하여 제조한 젤리의 폴리페놀 함량은 과육 100% 에서 0.37 mg/g, 통수박 100% 에서 0.35 mg/g, 과피 100%에서는 0.31 mg/g, 대조에서는 0.17 mg/g이었으며, 착즙액 첨가량이 증가할수록 함량이 높았다. 라이코펜 함량은 과육 100% 젤리에서 10.73 µg/g, 통수박 100% 젤리에서는 7.35 µg/g이었다. 조단백질 함량은 통수박 100% 젤리에서 4.61 %로 가장 높았고, 아르기닌 함량은 과육 100% 젤리에서 802.85 µg/g, 통수박 100% 에서 682.58 µg/g, 과피(0, 25, 50, 100)와 대조에서는 검출되지 않았다. 시트룰린 함량은 과피 100% 젤리에서 25,314 µg/g으로 처리 중에 가장 높은 함량을 보였다. 관능평가 결과에서는 수박 착즙액 첨가량이 증가하면서 맛, 향, 색, 씹힘성, 기호도가 높아졌으며 특히 과육 100%, 통수박 100%에서 좋았다.

P2-05

채육 가공 방법에 따른 붉은대게살의 수용성 정미성분 비교평가

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기존 붉은대게 가공산업에서는 생물원료로부터 게살을 분리하기 위해 압착채육 전 필수불가결하게 자숙·냉각공정을 사용하고 있다. 하지만 이 과정에서 원료 내 맛과 영양성분들이 공정수로 다량 유실되어 품질이 하락되는 문제점이 있다. 본 연구팀은 이러한 문제점 해결을 위해 물 사용을 최소화 할 수 있는 냉·해동 채육 방법을 개발한 바 있고, 관련 기술 적용을 위한 가공설비 개발과 제품의 유통안정성 확보를 위한 연구를 진행하고 있다. 본 연구에서는 새롭게 개발된 채육 기술의 제품 품질 측면에서의 우수성 입증을 위한 일환으로 시판 자숙 게살제품과의 정미성분에 대한 비교평가를 진행하였다. 생물원료 게살을 대조구(R)로, 가공 방법에 따라 냉·해동 채육 게살을 FT구, 냉·해동 채육 게살을 microwave 처리하여 익힌 것을 FT+M구, 시판 자숙 게살제품을 B구로 정하였고, 수용성 정미성분인 5'-nucleoside monophosphate와 유리아미노산 함량 등을 분석하여 비교하였다. 그 결과, 두 지표 모두에서 B구는 생

물원료인 R구에 비해 현저하게 낮아 저숙·냉각 과정 중 정미성분이 크게 유실되는 것으로 나타난 반면, FT구와 FT+M구는 R구와 유사한 수준으로 나타나 채육과정 중 정미성분 유실이 거의 일어나지 않았다. 즉, 냉·해동 채육 방법으로 가공 시 붉은대개의 정미성분을 잘 보존할 수 있고, 이는 다양한 응용제품 개발 시 품질적인 측면에서 장점이 될 수 있다.

이 연구는 2023년도 해양수산부 재원으로 해양수산과학기술진흥원의 지원을 받아 수행된 연구임 (20220131, 계살제품의 품질향상을 위한 공정개발 및 상품화)

P2-06

Characterization of pectin from dragon fruit peel by using different extraction methods

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The purpose of this research was analyzed potential usage of hybrid citrus fruit peels as a sustainable supply of pectin film packaging. This study has uncovered the practicality of using these by-product peels and developed strategies to improve the attributes of pectin films, including as their water and oxygen barrier qualities, as well as mechanical strength, through the study. Pectin was extracted from hybrid Setoka(ST) peels at a rate of 24.12%, while Kanpei(KP) and Shiranui(SH) yielded 21.20% and 18.15%, respectively. The pectins' monosaccharide composition included Rha, GalA, Glc, Gal, and Ara. KP films had the highest tensile strength (28.29 MPa), followed by SH films (20.30 MPa), which were both significantly different ($p < 0.05$) from ST films (11.74 MPa) and commercial citrus pectin film (4.56 MPa). Furthermore, all hybrid citrus films also have better barrier properties than commercial citrus pectin film. By leveraging the unique properties of hybrid citrus fruit peels, this finding help in contributing to the advancement of sustainable packaging solutions, utilizing citrus peel waste and offering improved film characteristics.



P2-7

Enzyme-extracted pectin as a clean label emulsifier for improved stability of oil-in-water emulsions

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This study aimed to evaluate the potential of enzymatically extracted okra pectin as a clean-label emulsifier for enhancing the stability of oil-in-water emulsions. The emulsifying functionality of okra pectin has been attributed to specific structures, and this study sought to obtain diverse structures of okra pectin using five commercial hydrolytic enzymes. The emulsion stability and droplet morphology of oil-in-water emulsions stabilized with pectins obtained from the different enzymes were compared, and the corresponding structural and macromolecular properties were correlated with their emulsifying characteristics to establish structure-function relationships. The results revealed that the emulsifying characteristics of okra pectin were mainly influenced by its structural configuration, particularly side-chain compositions, and degree of esterification, rather than molecular weight. Furthermore, optimal conditions for enzymatic extraction of okra pectin with improved emulsifying properties and yield were established. At 1% pectin concentration, okra pectin completely stabilized oil-in-water emulsion (ϕ 1.5), as determined by accelerated emulsion tests and emulsion rheological characteristics. This study emphasizes the potential of enzymatically extracted okra pectin as a clean-label emulsifier for improving the stability of oil-in-water emulsions in food products. Additionally, the structure-function relationships established in this study can serve as a theoretical foundation for designing and modifying pectins for specific emulsion applications.

P2-08

Mogroside V content and antioxidant properties of monk fruit extract using natural deep eutectic solvents

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Siraitia grosvenorii, monk fruit, is popularly used as a natural sweetener. Mogroside V, a glycoside, responsible for its intense sweetness, is also a potent antioxidant compound.

This study aimed to investigate the effects of natural deep eutectic solvents (NADES) on the extraction efficiency of mogroside V from monk fruit. Acidic (CCLA)-, alkaline (KCG)-, and neutral (CCEG)- based NADES, which have different pHs, were used in this experiment. The mogroside V content was determined using the HPLC method and the antioxidant activities of the extracts were measured using DPPH and ABTS radical scavenging assays. The results showed variations in mogroside V extraction efficiency according to NADES, with CCEG, neutral NADES having significantly higher mogroside V content and higher antioxidant activities compared to other solvents. In addition, higher extract yield was achieved by CCEG. This study suggests that neutral-based NADES are suitable green solvent alternatives for extracting mogroside V from Monk fruit.

P2-09

Characterization of pectin from dragon fruit peel by using different extraction methods

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Hylocereus undatus's peel, a pectin-rich fruit waste, has the potential to become a substantial source of commercial pectin in the future. Pectin was extracted from the peel using different approaches, including cold water (CE), hot water (WB), ultrasound (US), and enzyme-assisted extraction (EZC, EZX). Under these different extraction methods, the yield and characteristics of the extracted pectin were compared. The results showed that the yield of pectin was significantly higher in enzyme-assisted extraction (EZC 20.38%, EZX 19.40%) than in US (14.81%), WB (14.57%), and CE (11.17%) extraction procedures. Pectin extracted using CE, WB, and US, on the other hand, had higher viscosity and emulsification abilities as well higher protein content than enzyme-assisted extraction. As a result, viscosity, protein content, and high molecular weight are related to the emulsification ability of pectin. This study emphasized and explained different extraction methods of pectin from the dragon fruit peel and their correlation with pectin's properties. The obtained results formed a basis for understanding its functional usage as an ingredient in food systems while also tackling the environmental issue by exploiting the waste into something useful.



P2-10

Quality characteristics of different flavor vegan protein bar comprised of sweet potato and rice protein isolate

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Currently, the growing demand in developing vegan product is gaining high attention from researcher in order to tackle the concern on animal-based product especially on the carbon emission problem and animal-right protection. Thus, this study aims to develop a vegan-based protein bar which consist of sweet potato and rice isolate protein with different kind of flavors (nuts (NP), orange peel (OP), chocolate (CP), hemp seeds (HSP) and red ginseng (RGP), respectively. Different types of protein bars were analyzed for physical (texture, color, moisture content, pH, and brix), nutritional (protein and carbohydrate content) and functional(antioxidant activity) properties. The analysis on physical characterization showed that NP exhibited the highest hardness with value of 22275.95 (g/cm²) compared to other RSP ranging between 17456.89–20463.13 (unit), respectively. On the other hand, higher Brix value and antioxidant activity were observed in CP sample compared to other protein bars. Particularly, no big difference were noted in all samples in term of moisture content (64.02–67.24%), protein content (16.05–18.53%), and carbohydrate content (27.81–29.84%) on dry basis, respectively. Hence, based on all the results, this study provide the insight on development of sweet potato and rice protein isolates as high potential materials in manufacturing vegan nutritional protein bar.

P2-11

Quality characteristics of sauces with different additions of fermented jujube and lemon extracts

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This study investigated the quality characteristics of sauces with different additions of fermented jujube(FJ) and lemon extracts(LE). The FJ was prepared by fermenting *Lactiplantibacillus plantarum* in jujube extract. The sauce with 40% FJ +40% LE as the

control was the lowest pH and highest total acidity, whereas sauce with 70% FJ+10% LE showed opposite results. The sauce with 70% FJ+10% LE of the polyphenol contents, DPPH and ABTS radical scavenging activities, were markedly higher than those of the control and other samples. Reducing sugar of sauces showed a tendency to increase as the FJ increased. In addition, with an increased amount of FJ, the lightness(L) significantly decreased, while redness(a) and yellowness(b) gradually increased. In the results of the sensory evaluation, overall preference of 50~60% FJ was high among the samples. As the above results, it is considered that both functionality and taste can be added the 50~60% FJ for sauce.

P2-12

Quality characteristics of sauces with different additions of fermented jujube and several nuts

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This study investigated the quality characteristics of sauces with different additions of fermented jujube(FJ) and several nuts(walnut, peanut, cashew nut and almond). The FJ was prepared by fermenting *Weissella confusa* in jujube extract. Also, to make the sauce, 35% FJ and 15% nut powder were added. The pH, total acidity and reducing sugar of the sauce did not change with the kind of nuts. The sauce with walnut of the polyphenol contents, DPPH and ABTS radical scavenging activities were markedly higher than those of other samples. Also, the sauce with peanut of lightness(L), redness(a) and yellowness(b) were higher than those of other samples. The results of the sensory evaluation showed that the sauce added with 15% walnut had the highest sour, sweet, bitter and overall-acceptability scores. As the above results, it is considered that both functionality and taste can be added the 15% walnut and 35% FJ for sauce.



P2-13

Quality characteristics of jeungpyeon prepared with lactic acid bacteria fermented solution using jujube

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In this study, we attempted to compare the the quality characteristics of Jeungpyeon prepared with the addition of different quantities of lactic acid bacteria fermented solution using jujube. The pH of fermented wines ranged from 5.10 to 5.32 and the total acidity of samples ranged from 0.052~0.057%. The b-value, hardness, and reducing sugar contents increased with the addition of increasing quantities of fermented solution using jujube, whereas moisture contents and cohesiveness decreased. Total polyphenol and total flavonoid contents had the highest values(148.50 and 32.90 mg/100 mL, respectively) in the D treatment which is the jeungpyeon of 7% fermented solution using jujube. The ABTS and DPPH radical scavenging activity of the samples were 32.38~50.07% and 40.59~59.61% respectively. These results indicate that jeungpyeon prepared with lactic acid bacteria fermented solution using jujube can be developed as useful tool for use in the industrial applications.

P2-14

Inhibitory effect of DU-145 prostate cancer cell proliferation of colored wheat 'Arriheuk' extract

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In this study, it was conducted to investigate the effect of hydrothermal and ethanol extraction concentration of colored wheat 'Arriheuk' on the inhibition of proliferation of DU-145 prostate cancer cells. As a result, cell proliferation decreased as the concentration of the Arriheuk extract increased, and the Arriheuk extract showed a concentration-dependent inhibitory effect on cell proliferation in DU-145 cells. It showed a low cell survival rate at the concentration of 500 µg/mL of Arriheuk hydrothermal extract, and a low cell survival rate depending on the concentration even at 75% and 50% of ethanol. The expression of Bcl-2, which is known to delay or inhibit apoptosis, decreased proportionally as the concentration of Arriheuk extract increased. In contrast, it was confirmed that the expression level of Bax,

which induces the release of cytochrome c and apoptosis, was significantly increased. In addition, it was confirmed that the hydrothermal and ethanol extracts of Arriheuk had higher apoptosis inducing effects than the control. Therefore, it was confirmed that the Arriheuk extract had an inhibitory effect on cancer cell proliferation by blocking the PI3K/Akt and MAPK/ERK pathways in DU-145 cells. It can be used as a basis for inhibition of prostate cancer cell proliferation for future food applications.

P2-15

Processability study for the development of colored wheat 'Arriheuk' waffle with enhanced protein content

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In this study, for the development of protein-enhanced waffles using colored wheat 'Arriheuk', waffles were prepared using Arriheuk, soft flour, soybean and tofu powder and their quality was compared and analyzed. 100% soft flour was set as the control group, and soybean and tofu powder were added as treatment groups to prepare protein-enhanced waffles according to the ratio of 100%, 50%, and 30% of Arriheuk. As for the analysis items, crude protein and free amino acid of waffle and color and viscosity of waffle dough were measured. As a result, the brightness of the waffle dough with soybean and tofu powder was lower than that of the control group, and there was no significant difference in brightness according to the amount of Arriheuk added. The crude protein content was 8.42% in the control group, but it was 11.75% when tofu powder was added to 100% of Arriheuk and 10.93% when soybean powder was added, showing a significant difference from the control group. In addition, tryptophan and lysine, which are free amino acids, showed values of 3.03 mg/100g and 1.80 mg/100g in the control, respectively, and showed significantly high values of 1.99 to 8.33 mg/100g in the treatment group, confirming that the protein content was enhanced. Accordingly, it is intended to be used as basic data for future confectionery and bakery development.



P2-16

병풀 활용성 증진을 위한 외식상품 메뉴 개발 및 적용

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병풀은 미나리과의 포복성 다년생 초본식물로 “병을 고친다” 하여 병풀이라고 하며 호랑이가 상처를 입으면 병풀 위를 뒹굴며 치료한다고 해서 호랑이풀로도 불린다. 병풀의 주요성분은 아시아티코사이드(asiaticoside), 마데카소사이드(madecassoside), 아시아틱산(asiatic acid), 마데카식산(madecassic acid)으로 다양한 기능성과 생리활성을 나타내는 것으로 알려져 있어 의약품 및 화장품 소재로 많이 이용되고 있으나 식품으로서 활용은 미비하다. 따라서 병풀을 식품으로서가치 증진을 위해 외식상품 메뉴를 개발하고 활용성 증대를 위한 교육과 외식 상품화를 추진하고자 하였다. 병풀을 우리나라 궁중·반가의 숨어있는 음식에 적용하여 10종의 메뉴(병풀영양밥, 병풀토장면, 병풀연계찜, 병풀두부무침, 병풀느르미, 병풀굴림만두, 병풀구름떡, 병풀명월전병, 병풀물김치, 병풀서여향방)를 개발하였다. 뿐만 아니라 올바른 영양정보 제공을 통한 소비자의 음식 선택의 폭을 넓히기 위해 영양표시성분 9종을 분석하였다. 또한 식품소재로 병풀의 가치 확산과 소비확대를 위한 병풀 레시피 보급 교육을 충주시농업기술센터와 협력하여 5회(64명)에 걸쳐 실시하였다. 그 결과, 교육을 통해 병풀을 처음 접한 경우가 많았고 병풀로 만든 음식도 교육을 통해 처음 먹어 본 경우가 대다수로 병풀음식 인식 제고를 위한 홍보, 교육기회 확대 등의 노력이 필요할 것으로 사료된다. 한편, 충주 수안보상록호텔의 메뉴화를 위한 대량급식 적합성 검토와 기호도 조사를 통해 병풀영양밥의 메뉴 적용 가능성을 확인하였고 레시피 보완 등을 통해 정식 메뉴화에 성공하였다.

P2-17

pH-shifting 처리에 따른 병아리콩 아쿠아파바 마요네즈의 품질 특성

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최근 건강, 비용, 환경 등의 문제로 달걀을 식물성 성분으로 대체하여 마요네즈를 만드는 추세가 증가하고 있다. 본 연구에서는 유화제로써 병아리콩 아쿠아파바(AQ)의 기능성을 향상시키기 위해 pH-shifting 처리가 AQ와 식물성 마요네즈의 품질 특성에 미치는 영향을 조사하였다. AQ를 pH 2, 4, 10, 12에서 전개한 다음, pH 7에서 재접힘 처리하였다. 처리한 AQ(AQ2, AQ4, AQ10, AQ12)를 이용하여 식물성 마요네즈(M2, M4, M10, M12)를 제조하고 무처리 AQ(AQ0)를 이용한 마요네즈(M0)를 대조구로 실험하였다. AQ의 수분함량은 AQ2에서 가장 낮게 나타났으며, 대조구에서 가장 높게 나타났다. 단백질 용해도는 염기성 조건으로 갈수록 증가하였으며, 산성 조건에서 처리한 AQ는 대조구보다 낮게 나타났다. 마요네즈의 응집력은 가장 높은 M12를 제외하고 유의한 차이를 보이지 않았으며, 점착성은 M0, M12에서 가장

높고 M2, M4에서 가장 낮았다. 점도와 열 안정성은 염기성 조건으로 갈수록 증가하였고 M12에서 가장 높았다. 점도가 증가함에 따라 유화 안정성도 높은 경향을 보였다. 이러한 결과는 pH12-shifting 처리가 유화 특성이 개선된 식물성 마요네즈 생산에 효과적일 것으로 판단된다. 본 연구를 통해 동물성 유화제를 대체함으로써 식물성 마요네즈에 대한 기초 연구 자료로 활용할 수 있을 것으로 기대된다.

P2-18

다수확 품종 중 가공용 쌀로 제조한 발효주의 이화학적 특성 비교

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최근 전통주 시장의 트렌드에 맞춰 소비자들이 발효주의 원료 품종과 품질에 관심을 기울이고 있어, 양조용 원료에 관심이 커지는 상황이다. 따라서 본 연구의 목적은 다수확 품종 중 가공용 쌀로 제조한 발효주의 이화학적 품질 특성을 분석하여, 양조에 적합한 쌀 품종을 선별하는 기초 자료를 제공하는 것이다. 다수확 품종 중 가공용 쌀 품종인 금강1호, 한아름4호, 미르찰, 이루미를 국립식량과학원에서 제공을 받아 실험을 진행하였다. 4가지 쌀의 일반성분(조단백질, 조지방, 탄수화물)은 각각 6.35~7.34%, 0.89~1.04%, 79.44~80.94%이었다. 동일한 발효제(누룩, 입국(*A. luchuensis*), 효모(Y263))를 사용한 발효주를 제조하고 이화학적 특성을 분석하였다. 알코올 16~17.3%, 가용성고형분 15.1~16.6°Brix, pH 4.13~4.19, 총산도 0.35~0.41%, 환원당 7.44~8.12% 이었다. 양조에 적합한 쌀의 특성은 단백질과 지방 함량이 낮고 탄수화물이 높은 것인데, 쌀 품종 중 금강1호가 각각 6.35, 0.89, 80.94g/100g으로 나타나 가장 양조에 적합한 쌀로 나타났다. 그리고 제조한 발효주의 소비자 기호도 조사(9점 척도, 20명)를 진행한 결과, 전반적인 기호도 점수는 5.35~7.25점이었으며 이 중 금강1호가 가장 높은 점수인 7.25점을 받았다.

본 연구 결과를 바탕으로 다수확 품종 중 금강1호가 발효주에 적합한 품종으로 가능성을 확인하였다.

P2-19

Bromelain 농도에 따른 식용곤충 단백질 가수분해물의 가공 특성 평가

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본 연구에서는 국내 식용곤충인 흰점박이꽃무지 유충(*Protaetia brevitarsis*)과 풀무치(*Locusta migratoria*)의 활용 가능성을 높이기 위해 단백질 가수분해물을 제조하여 가공 특성을 평가하였다. 열풍 건조된 곤충 분말을 탈지 후 증류수와 1:3(w/v)의 비율로 혼합한 뒤 단백질 분해 효소 bromelain



의 농도를 0%, 1%, 2%, 3%, 4%로 달리하여 첨가 후 단백질 가수분해물을 제조하였다. 단백질 가수분해물의 물리화학적 특성을 알아보기 위해 탁도, 단백질 용해도, 가수분해도, 유리 설프히드릴기 함량을 분석하였다. 그 결과, 효소 농도가 증가할수록 탁도와 단백질 용해도가 증가하였다. 가수분해도는 효소 농도가 3%까지 증가하다 이후 감소하는 경향을 보였다. 표면 및 총 유리 설프히드릴기는 가수분해 후 효소 농도에 비례해 증가하였다. 단백질 가수분해물의 기능성을 알아보기 위해 수분 및 오일 결합력, 거품 형성능 및 안정성, 유화 용량 및 안정성, 겔보기 점도를 분석하였다. 수분 결합력은 가수분해 후 감소하였고 오일 결합력은 증가하였다. 가수분해 후 거품 형성능과 유화 용량이 증가하고 안정성이 높아졌다. 겔보기 점도는 전단 속도에 따라 감소하였고 효소 농도가 증가할수록 전체적으로 점도가 낮게 나타났다. 최종적으로 식용곤충 단백질 가수분해물은 효소 농도 증가 시 물리화학적 특성이 개선되고 거품 및 유화 기능성이 향상되었으며, 본 연구 결과는 대체 단백질 식품 분야의 발전을 위한 기초자료로 활용될 수 있을 것으로 생각된다.

P2-20

수확시기에 따른 딸기의 품질특성 비교

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딸기의 수확시기에 따라 1화방에서 5화방까지 분류(S1, S2, S3, S4, S5)하여 설향 품종 딸기의 품질특성을 비교 측정하였다. 모든 딸기의 수분함량은 89.60~92.62%였으며, 딸기 표면 및 내부의 색도는 수확시기에 따른 일정한 경향을 나타내지 않았다. 모든 딸기의 pH는 3.53~3.75 범위였으며, 당도는 8.73~11.23 °Brix로 5화방 딸기의 당도가 8.73 °Brix로 가장 낮았다. 모든 딸기의 산도는 0.68~0.81%였으며, 1화방에서 3화방으로 갈수록 산도가 감소하는 경향을 나타내었다. 수확시기에 따른 딸기의 관능특성 결과, 강도에서 단맛은 5화방을 제외한 모든 딸기가 5점(보통) 이상으로 평가되었으며, 2화방 딸기가 7.10으로 가장 높았다. 신맛의 강도는 2화방 딸기가 4.40으로 가장 낮았으며, 4화방, 5화방 딸기의 경우 각각 6.10, 6.30으로 신맛이 높은 것으로 평가되었다. 기호도에서 맛은 5화방을 제외한 모든 딸기가 6.40~7.60으로 우수하게 평가되었으며, 전반적기호도는 2화방 딸기가 7.70, 1화방 딸기가 6.70 순으로 높았다. 이에 따라, 수확시기에 따른 딸기의 품질 및 관능특성의 차이를 확인할 수 있었으며, 보완연구를 통해 딸기 가공 연구의 기초 자료로 사용하고자 한다.

P2-21

Comparison of physicochemical characteristics of raw rice and mash prepared for selection of rice varieties suitable for distilled spirits

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The purpose of this study was to provide basic data for selecting varieties suitable for brewing by analyzing the physicochemical characteristics of each rice variety. The rice varieties used for the analysis of brewing were Geumgang-1, Hanareum-4, Chohong, Saemimyeon, Mirchal, Irumi, and Migam which were high-yield varieties distributed by the National Institute of Crop Science. In particular, it was judged that raw rice of Geumgang-1 and Hanareum-4 would be suitable for brewing as it had low crude protein and crude fat, and high carbohydrates. For fermenting, koji, N9 yeast, and purified enzyme were used for making the base liquor. As a result, the alcohol content, soluble solid content, pH, total acidity, reducing sugar, and total organic acid values of the base liquors made by each rice variety were 16.57~19.37%, 9.5~12.7 °Brix, 4.34~4.76, 0.18~0.23%, 0.24~0.98%, and 79.42~235.49mg/100mL, respectively. The base liquor made with Geumgang-1 and Hanareum-4 showed high alcohol content(19.13 and 18.83%) and soluble solid content(12.43 and 12.5 °Brix), and lower pH(4.59 and 4.54). The organic acid content suitable for producing distilled spirit is high in total organic acid and lactic acid content, and low in acetic acid. Overall, Geumgang-1 showed the quality characteristics of suitable for making distilled spirits.

P2-22

쌍별귀뚜라미 분말 비율을 달리하여 제조한 수삼 첨가 머핀의 이취 저감 및 품질 특성

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식용 곤충은 고단백 대체 식품 자원으로 주목받고 있으나, 곤충의 외관과 이취는 구매자들이 소비를 꺼리는 큰 문제점이다. 따라서 본 연구에서는 수삼 분말을 활용해서 이취를 감소시키고 쌍별귀뚜라미(GB) 분말 첨가량을 0%, 10%, 20%, 40%로 달리한 고단백 머핀의 물리화학적 및 관능적 특성을 조사하고자 하였다. 머핀의 비중, 비용적과 높이와 수분은 GB 분말의 함량이 증가할수록 감소하였다. 색도의 경우 머핀 간의 유의적 차이를 확인할 수 있었다. 머핀의 조단백질과 DPPH 라디칼 소거능은 GB 분말 첨가량이 증가할수록 증가하였다. 조직감 특성인 경도, 탄력성, 응집성, 깨짐성은 GB 분말 첨가량이 증가할수록 감소하였다. HS-SPME/GC-MS 분석 결과 GB 분말 40%를 첨가한 머핀에서 0% 첨가 머핀에 나타나지 않은 향



미 화합물이 가장 많았다. 또한 관능 평가 결과, 전반적인 항목에서 GB 분말 첨가량의 증가가 낮은 선호도를 보였다. 따라서 머핀에 GB 분말을 20% 첨가할 경우, 이취를 저감하고 품질 변화가 최소화된 고단백 머핀을 제조할 수 있을 것으로 판단된다. 이러한 연구를 통하여 쌍별귀뚜라미의 식용 곤충으로서 활용 가능성을 높이고, 다양한 식용 곤충 기반 제품 개발을 위한 기초자료로 활용될 수 있을 것으로 생각된다.

P2-23

초음파 처리한 식물성 완두 단백질 휘핑크림의 품질 특성 비교

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식물성 휘핑크림은 최근 몇 년 동안 광범위하게 연구되고 있다. 휘핑크림은 지방 함량이 약 30-40% 이며, 단백질은 거품 안정화에 사용된다. 식물성 단백질 중 완두 단백질 콩 단백질보다 우수한 유화제와 발포제이지만 휘핑크림에 적합한 연구는 부족한 실정이다. 따라서 초음파 처리한 식물성 완두 단백질 휘핑크림의 품질 특성 연구를 진행했다. 대조군으로 사용된 동물성 휘핑크림(CON)은 시중 판매되고 있는 제품을 사용했다. 식물성 휘핑크림은 완두 단백질 용액과 코코아 버터, 카놀라유를 사용하여 초음파 처리하지 않은 완두 단백질 휘핑크림(PP)과 완두 단백질 용액을 360 W에서 6분 초음파 처리한 완두 단백질 휘핑크림(UPP)으로 실험을 진행했다. UPP는 다른 샘플보다 휘핑 시간과 거품 배수율이 감소했고, 오버런과 경도는 증가했다. 광학 현미경의 결과 UPP는 PP보다 지방 구 입자와 기포 크기가 작아졌으며, PP와 CON보다 기포가 더 균일하게 분포되었다. 이는 UPP의 높은 오버런 값과 연관 있다. 지방 불안정화는 UPP에서 가장 높은 결과를 보였으며, 이는 가장 낮은 거품 배수율과 연관 있다. 최종적으로 초음파 처리로 UPP가 휘핑크림에서 중요한 품질 특성인 오버런, 거품 배수율, 경도가 대조군과 유사하거나 더 좋은 결과를 얻었다. 따라서 초음파 처리한 식물성 완두 단백질 휘핑크림이 동물성 휘핑크림의 대안이 될 수 있을 것으로 생각된다.

P2-24

Development of plant-based complex polysaccharides of κ-carrageenan/konjac glucomannan/rice flour for 3D-printable meat analogs

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Development of materials and processing technology is necessary to improve texture of plant-based meat analogs. 3D food printing is a technology that can mimic muscle structure of meat, but it requires preparation of printable materials. Important properties of printable

materials for meat analogs are thermal stability and texture after cooking. κ -carrageenan/konjac glucomannan (KC/KGM) gel has excellent toughness but poor heat stability and strength. In this work, we studied thermal stability and texture properties by KC:KGM:rice flour (RF) ratios in order to develop 3D-printable materials for improving texture of meat analogs. KC/KGM gel found optimal ratio at a fixed 8% solid content, and then composite gels with different ratios of KC/KGM dispersion and RF were investigated physical properties and prepared as printable materials. Gel with significantly higher cohesiveness and lower brittleness were obtained at 6:4 (w/w) for KC:KGM. After waterbath cooking (90°C, 30 min) and cooling (20°C, 10 min), form of KC/KGM gel was deformed, and RF addition improved thermal stability of composite gels by starch gelatinization. As a result of texture properties after cooking, RF addition enhanced strength of KC/KGM gel, and composite gels with a relatively tough and hard texture were obtained at 4:1, 5:1, and 6:1 (w/w) for KC/KGM:RF. Desired texture can be prepared only by combinations of polysaccharides with unique characteristics. 3D-printable KC/KGM/RF composite gels with suitable ratios can be expected to produce meat analogs with improved texture.

P2-25

Quality characteristics of Korean traditional wheat-based Nuruk according to grinding ratio and inoculated strain

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The purpose of this study is measuring changes in quality characteristics and enzyme activity of nuruk during fermentation period with grinding ratios and inoculated strains. A total of two grinding ratios were set using milling ratio with 50% milled wheat for the experiment: Coarsely milling (W1), Finely milling (W3). As the inoculated strains, *Aspergillus luchuensis* 34-1 (M1) and 74-5 (M2) were used, a non-inoculated untreated group (M0) were set as control groups. As for quality characteristics, temperature of fermenting material, pH, titratable acidity, amino acidity, organic acids, and free sugars were measured. Enzyme activities were analyzed for α -amylase, saccharifying power, α -glucosidase, acidic protease, and lipase. Microorganisms according to the fermentation day were confirmed by measuring aerobic bacteria, lactic acid bacteria, yeast and mold. The temperature of nuruk maintained a high value of about 35°C at the beginning of fermentation and then decreased from 5 to 7 days, and this difference was larger in the untreated group. pH, titratable acidity, and amino acidity



were less reproducible in W3 than W1, it considered to be because W3 did not cause proper fragmentation and did not have uniformity in quality characteristics. In the case organic acids and free sugars, they had a higher content on the 5 to 10 days than at the beginning of fermentation. As for the enzyme acidity, M0 showed irregular values for each sample, and in the W1 and W2, W1 showed a continuously high value,k but W3 showed a maximum on the 10th day of fermentation. Finding from this study suggests the most useful when inoculated with *Aspergillus luchuensis* 34-1 after being coarsely milling as nuruk.

P2-26

전처리 방법에 따른 양배추 분말의 품질특성 변화

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양배추는 대부분 원물로 섭취하며, 가공제품의 종류가 한정되어있으므로 이용도를 높이기 위해 분말을 제조하기도 하는데, 양배추 특유의 아린맛, 풋내 등이 발생하여 기호성이 많이 떨어진다. 본 연구에서는 양배추의 아린맛과 풋내를 줄이기 위하여 전처리 방법으로 데치기(2분), 찌기(3분) 공정을 추가하였고, 이후 50℃에서 열풍건조하고 분쇄하여 양배추 분말을 제조하였으며, 이화학적 및 관능적 특성을 조사하였다. 분말의 수율은 무처리 9.8%, 데치기 5.7%, 찌기 9.4%로 데쳤을 때 가장 낮은 값을 보였다. 수분흡수지수는 데쳤을 때 가장 높았고, 찜 그리고 무처리 순이었다. 반면에 수분용해지수는 무처리, 찜, 데치기 순으로 높아 데치는 과정 중 가용성고형분이 용출된 것으로 생각되었다. 색도는 전처리한 분말이 무처리구보다 명도는 감소하고, 황색도는 증가했다. 한편, 관능평가 결과 전처리했을 때 아린맛, 풋내 등 이취가 상대적으로 낮았고, 전체적기호도는 찜 후 제조한 양배추 분말이 가장 높았다. 따라서 양배추 분말 제조 시 찌는 것이 이취를 줄이면서 기호도를 높이는 방법이었다.

P2-27

데치기 시간에 따른 유채, 미역취, 곤드레의 품질특성 변화

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데치기는 품질 저하에 관련되는 효소들을 불활성화시키고, 기호성·기능성을 보존 또는 높일 수 있으므로 다양한 채소나 과일에 활용한다. 그러나 데치는 과정 중 색, 질감, 맛의 변화 및 수용성 영양성분의 손실이 일어나므로 데치는 시간이 무엇보다 중요하다. 본 연구에서는 나물의 특성에 따라 유채(1~3분), 미

역취(1~5분), 곤드레(5~10분)를 데친 후 이화학 및 관능적 특성을 조사하였다. 수분함량은 유채, 미역취, 곤드레 모두 데치는 시간에 따른 차이가 없었다. 그러나 엽록소 함량은 유채와 곤드레에서 시간이 길어질수록 증가하는 경향을 보였고, 미역취에서는 3분까지 증가하다가 5분 이후 감소하였다. 한편, 항산화 활성, 총페놀화합물, 플라보노이드 함량은 데치기 시간이 늘어날수록 감소하는 경향을 보였다. 관능검사 결과 조직감과 전체적인 기호도는 유채와 미역취, 곤드레를 각각 2분, 3분, 7분 데쳤을 때 가장 높았다. 결론적으로 유채는 2분, 미역취는 3분, 곤드레는 7분 데치는 것이 기호성과 기능성을 살리면서 섭취하기에도 적합할 것으로 생각된다.

P2-28

과즙 종류에 따른 강황 젤리 품질 및 curcuminoids 함량

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전남 진도에서 전국 생산량의 60%를 재배하고 있는 강황(*Curcuma longa*, L.)의 소비층 확대를 위해 강황 분말 첨가 젤리 제조조건을 확립하였다. 강황의 쓴맛을 완화시킬 수 있는 부재료를 검토하고 강황 분말을 0~2% 첨가하여 총페놀성화합물 및 키쿠민류 함량과 품질특성을 분석하였다. 부재료 중 신맛이 강한 레몬즙, 유자즙 첨가시 강황의 쓴맛을 크게 완화시켜 관능평가에서 높은 기호도를 나타내었다. 유자즙 첨가구(75 g ~ 116 g) 보다 레몬즙 처리구(121 g ~ 138 g)에서 더 높은 경도(hardness)와 점착성(adhesiveness)을 나타내었으며 강황 첨가량이 증가할수록 총페놀화합물 및 총플라보노이드 함량이 유의적으로 증가하였다. 강황 2%를 첨가한 유자즙 젤리의 bisdemethoxycurcumin, demethoxycurcumin, curcumin 함량은 각각 0.46 mg/100 g, 1.01 mg/100 g, 4.77 mg/100 g 으로 레몬즙 젤리 0.32 mg/100 g, 0.70 mg/100 g, 3.35 mg/100 g 보다 유의적으로 더 높은 함량을 나타내었다. 관능평가 결과 유자즙과 레몬즙 젤리의 강황 분말 최대 첨가량은 각각 0.7%, 0.5% 이며 이때 전체적 기호도 5점 이상으로 상품화가 가능 할 것으로 사료된다.

P2-29

다양한 과채류를 첨가한 큐브형 여주 스낵의 품질특성

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노인인구의 증가로 인해 당뇨병 환자가 증가하고 있으며 이를 예방할 수 있는 기능성식품에 대한 관심 및 수요가 증가하고 있다. 따라서 항당뇨 효능이 우수한 것으로 알려진 여주를 쉽게 섭취할 수 있도록 큐브형 스낵을 제조하였으며 배합비에 따른 품질특성 및 기능성 효능을 검토하였다. 부재료 선정을



위해 야채즙(양배추, 돼지감자)과 분말(케일, 시금치)을 첨가하여 동결건조 스낵을 제조하였을 때 양배추즙과 케일분말을 첨가한 처리구에서 품질이 우수하고 관능평가시 전체적인 기호도가 가장 높았다. 즉, 양배추즙과 케일분말 처리구의 GABA 함량은 143 mg/100 g, 항산화 효능은 198 mg/100 g 이며 총페놀성화합물 함량은 166 mg/100 g으로 돼지감자즙 처리구보다 GABA 함량은 172%, 항산화 효능은 148%, 총페놀성화합물 함량 152% 높은 함량을 나타내었다. 선발된 부재료와 여주분말을 배합하여 큐브형 스낵을 제조하였으며 이때 수율, 경도 및 틀 분리 용이성을 위해 가용성고형분 함량을 20~23 °Brix로 조정하였다.

P2-30

오일 조건 및 유통형태에 따른 양파 캐러멜소스의 품질특성 비교

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양파(*Allium cepa* L.)는 주요 양념 채소이나 조리 시 불편함 등으로 양파 조미제품에 대한 소비자들의 관심이 높아지고 있다. 본 연구에서는 양파를 이용한 캐러멜소스 제품 개발 시 오일 조건 및 유통형태별 처리조건에 따른 소스의 품질특성을 비교하였다. 오일 조건별 산가는 식용오일 중 해바라기씨유에서 유의적으로($p < 0.05$) 낮았고 CDA(conjugated dienoic acid)는 유의적으로($p < 0.05$) 높아 산패율이 낮았고, 함황화합물 향기 성분의 종류가 다양하였다. 또한, 해바라기씨유를 3% 첨가 시 양파 향과 맛, 풍미가 좋아 관능적인 측면에서 가장 우수하였다. 유통형태를 결정하기 위한 시험에서는 살균 후 냉장 처리구에서 갈색 색소 형성이 높았고, 저장 시 산가 증가율이 유의적으로($p < 0.05$) 낮았다. 따라서 양파 캐러멜소스 제조 시 3% 해바라기씨유를 이용해 캐러멜화 후 살균처리하여 냉장 유통하는 것이 적합할 것으로 판단되었다.

P2-31

가루쌀 '바로미2'의 이화학적 및 호화특성

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최근 정부에서는 쌀가공산업 활성화를 위해 건식제분 전용품종 '바로미2'를 개발하였고 '26년까지 전문 생산단지를 42.1천ha로 확대할 계획을 발표하였다. 이에 대응하여 가루쌀을 활용한 다양한 가공제품 개발을 위해 가공공정에 중요한 인자인 이화학적 특성 및 호화특성을 비교분석하였다. 가루쌀의 경도는 2.6 kg으로 일반쌀(7.8kg)의 33% 경도를 나타내었으며 전분을 분리하여 제조한 gel의 경도는 각각 497 g, 267 g으로 더 높은 경도를 나타내었다. 이러한 낮은 경도로 인해 물결합력과 용해도가 일반쌀 보다 다

소 높은 것으로 분석되었다. 신속점도계(RVA)를 이용하여 호화특성을 검토하였고 가루쌀과 일반쌀의 최대점도는 각각 83 RVU, 107 RVU였으며 노화지수(setback)은 28 RVU, 44 RVU로 가루쌀의 점성이 낮고 노화가 다소 빠른 것으로 나타났다. 일반쌀 대비 가루쌀의 총당 함량은 1.6배, 환원당 함량은 3배가 더 높았으며 특히 sucrose와 maltose 함량은 866 mg/100 g, 315 mg/100 g으로 일반쌀 대비 84 배, 8배 높아 가루쌀을 이용한 가공시 점도가 감소하고 다소 노화가 촉진되지만 당 첨가량을 감소시킬 수 있을 것으로 기대된다.

P2-32

토란 전처리에 따른 아린 맛 성분 변화

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토란(*Colocasia esculenta*)은 필수아미노산, 무기질이 풍부하고 갈락탄, 뮤신, 멜라토닌 성분을 함유하여 혈압조절, 소화촉진, 면역증진 등에 효능이 있다. 하지만 아린맛이 강하여 모든 연령대가 소비하기에 한계가 있다. 본 연구에서는 침지수 및 다양한 열처리에 따른 토란의 아린맛을 내는 옥살산칼슘 성분을 비교하였다. 모든 침지수는 기존에 이용하던 쌀뜨물(3.5 mg/100g) 보다 옥살산칼슘 함량이 2.5~3.0 mg/100g으로 감소하였고 침지 시간이 길어질수록 식초수를 제외하고 모두 감소하였으며, 옥살산 함량은 다시마추출물 및 소금물 6시간 침지와 식초물 3시간 침지구에서 가장 낮은 값을 보였다. 또한 다양한 열처리 중 토란을 찐 후 숙성(20℃), 3분 및 5분 데친 후 열풍건조 처리구에서 옥살산칼슘 및 옥살산 함량이 가장 낮은 값을 보였고, 기존의 삶기 처리 대비 1.4~1.5배, 1.9~3.3배 감소하였다.

P2-33

오일 조건에 따른 고추 페이스트소스의 품질특성 비교

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고추(*Capsicum annuum* L.)는 주요 양념 채소이지만 해마다 기상에 따른 수급 불안정으로 농가 소득 및 소비자 물가에 영향을 주고 있다. 본 연구는 고추의 수급 조절에 도움이 될 수 있는 고부가가치 페이스트 소스를 개발할 때 오일 조건별 품질특성을 조사하였다. 고추에 첨가한 식용오일 종류별 관능평가 결과, 감칠맛이 높고 쓴맛이 적은 해바라기유가 전반적인 기호도가 가장 높았는데, 3%에서 초록색이 진하고 개운한 맛과 매운맛이 5%보다 높았다. 산가는 오일 종류별로 유의적인 차이는 없었는데, 0일차 대비 4주차는 평균 1.3배 증가하였으나 산가 기준값(0.6 mg KOH/g) 보다 낮은 경향이였다. 색도 중 명도(L*)는 해바라기유, 녹색도(-a*)는 포도씨유에서 유의적으로 가장 높았고(p<0.0001), 카놀라유에서 가장 낮



았다. 물성 중 점조성과 응집성은 대두유에서 가장 높았고, 해바라기유에서 낮았는데, 함량이 높을수록 낮은 값을 나타냈다. 캡사이시노이드 함량은 포도씨유가 유의적으로($p < 0.0001$) 가장 높았고, 스코빌지수(SHU)는 포도씨유를 제외한 3종에서 3%가 5%보다 높았는데, 그 값이 평균 4681로 청양고추(4천~7천) 수준이었다. 최종적으로 고추 페이스트소스에 오일 종류는 색도, 물성, 캡사이시노이드 함량 및 관능에 영향을 미치는 것을 알 수 있었다.

P2-34

발효 지역에 따른 한식된장의 품질특성 비교

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한식된장 발효 시 온도가 미치는 영향을 구명하기 위해 동일하게 제조한 된장을 제조한 지역과 온도가 다른 지역에서 발효 후 품질특성을 조사하였다. 조사 결과, J지역(JS, JD) 된장을 G지역(강원)에서 발효 시 J지역(전남)에서 발효한 것보다 젖산과 아미노태질소가 낮았고, 프로테아제 활성이 높은 경향을 보였다. G지역(GP, GC) 된장 역시 J지역에서 발효 시 젖산과 바이오제닉아민, 알코올 함량이 더 높았고, 프로테아제 활성이 낮은 경향이였다. 따라서, 지역에 따른 온도 차는 된장의 발효 시 특히 젖산 생성과 프로테아제 활성에 영향을 미치는 것으로 판단되었다. 한편, 향기 성분은 PCA 분석 결과 PC1(99.547%)은 JS 지역과 JD, GP, GC 지역의 차이를 나타냈고, 맛 성분은 J지역 된장은 단맛과 쓴맛, G지역 된장은 짠맛이 우세하였고, 발효 지역을 변경한 J지역 된장은 감칠맛과 쓴맛, 짠맛, G지역 된장은 짠맛이 우세하였다. 따라서, 향기 성분과 맛 성분은 지역별 온도 차이보다 된장을 만든 방식에 따라 영향을 받는 것으로 사료되었다.

P2-35

Characteristics of accelerated aging brandy by adding each type of oak chips

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Brandies were made with 30 Brix^o wines and it was distilled to first distillation and secondary distillation methods, and aging was stored for 0, 2, and 4 weeks in light, medium, and dark oak chips. Their physicochemical characteristics were investigated. Regardless of the type of oak chips applied, the PH, total acid concentration, and soluble solid content were all similar. As aging progressed, volatile acid content increased, and formic acid was detected after oak chips were added. For the

chromaticity, the lightness decreased and the a^* and b^* values increased according to the baking and aging period of the oak chips. In the sensory evaluation, the brandy that was first distilled from 30 Brix° wine and then aged for four weeks with dark oak chips showed the highest overall preference. This result provides information about the usage of oak chips for accelerated brandy aging, and it suggests that brandy produced with 30 Brix° wine, first distillation, 4-week aging, and dark oak chips will be advantageous in terms of preference.

P2-36

Effect of high hydrostatic pressure (HHP) treatment of soaked rice grain on quality characteristics of garaeduk

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High hydrostatic processing(HPP) was applied to treat rice as a mean for aseptic processing of garaeduk at low range of pressure in order to avoid structural change of starch. The soaked rice grains were vacuum-packed and subjected to 50, 100, 150 and 200 MPa for 10 min. Garaeduk was manufactured with a mechanical extruder, and sealed in a polyethylene pouch at 25°C for 4 days. The numbers of indigenous bacteria in rice was effectively reduced by 0.4, 2.0, 2.6 to 3.3 log CFU/g after HHP treatment at 50, 100, 150, and 200 MPa, respectively. The number of heat-stable bacteria in HPP treated rice was decreased at 50 MPa to 0.3 log CFU/g, and at 200 MPa to 1.8 log CFU/g. The degree of retrogradation after 4 days at 25°C by α -amylase iodine method was 45.5, 39.6, 36.6, 28.5, and 23.5 % for control and HPP treatment group at 50, 100, 150, and 200 MPa, respectively. Hardness of garaeduk showed decreasing tendency during storage up to 4 days at 25°C compared to garaeduk prepared by untreated rice.



P2-37

Quality characteristics of fruit wine according to Daehong peach pretreatment

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The physicochemical properties of wine according to the pretreatment of Daehong peaches were studied. The alcohol content of wines prepared by shredding or juicing peaches ranged from 10.90 to 10.97% and pH 3.81 to 3.98. The volatile acid content of the juicy peach wine was 137.93 mg/L, which was about 145.5% higher than that of the shredded peach wine, and the L value (brightness), which indicates the brightness of the chromaticity, was 28.48, which was 117.35% higher than that of the shredded peach. In terms of color, the appearance of juicy peach wine somewhat brighter is considered to be the difference in the flesh(fiber) quality present in the fermented liquor. Considering the quality characteristics of alcohol, acidity, and reducing sugar content, as well as the labor and equipment cost incurred during the juicing process, it is judged that it is suitable to crush the raw materials in the production of Daehong peach wine.

P2-38

Characteristics of beer produced from Gunsan malt with the addition of Korean wheat (Hwanggeumal, Saegumgang, Baeggang)

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The physicochemical characteristics of Korean varieties of wheat; Hwanggeumal, Saegumgang, Baeggang grinding (HG, SG, BG), and powder (HP, SP, BP) beer were studied. Total acid and volatile acid were significantly higher in HG and SG. The soluble solid in all wheat samples were higher at 8.03 to 8.97 Brix° compared to the control at 7.97 Brix° (Gunsan Malt 100%). In contrast, the chromaticity values were lower when wheat was added compared to the control group. The organic acids were higher in grinding samples than in powder except malic acid and succinic acid. The sensory evaluation results were investigated on a 7-point scale, HP was the highest overall, BG was higher in color and flavor than other samples, and BP was higher in taste. The PCA results of the e-nose showed similarities between control, HP, and BP. In conclusion, sensory values were higher when Korean wheat was added in powder form than Gunsan malt 100%, Hwanggeumal and Baeggang wheat can be suitable for making Korean craft beer.

P2-39

Effects of storage temperature and duration of Daehong peach wine on physicochemical properties

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The characteristics of Daehong peach wine according to the storage temperature and storage period were investigated. Alcohol content ranged from 10.3 to 11.3% in all samples, and soluble solids were all within 6.3 and 6.6 Brix°. When the storage temperature rose, the value of reducing sugar increased. The main organic acid of Daehong peach wine was found as malic acid, and the main free sugar was glycerol. Samples stored at -15°C for two weeks (94 mg/L) and at 5 °C for ten weeks (89.53 mg/L) had the lowest volatile acid concentrations. At 2 and 6 weeks of storage at -15°C, the highest values of lightness were obtained at 89.92 and 90.33, respectively. Consequently, it can be an effective storage method when kept at -15°C for two weeks because the volatile acid is low and the degree of clarity is high.

P2-40

블렌칭 조건별 산마늘 분말의 품질특성 비교

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산채는 고유의 독특한 맛과 향기를 지니고 있으며, 건강식품으로 가치가 높다. 또한 섬유소가 많은 저열량 식품으로 칼슘, 인, 철 등의 무기물과 각종 비타민이 많다. 그러나 대부분의 산채는 한 계절에만 생산되므로 식품소재로 응용분야 확대가 요구된다. 현재 산채 가공상품은 건조나물, 장아찌 위주여서 부가가치 높은 상품 개발이 필요하다. '21년 전국 산채 생산량은 38,035톤이며, 이중 강원도는 11,888톤으로 31.3%, 를 차지하고 있다. 산마늘(*Allium victorialis*)은 명이나물로 불리며, 마늘처럼 알리신 성분이 풍부하게 들어 있는 부추속에 속한 채소이다. 산마늘 분말을 활용한 즉석국 개발을 위하여 블렌칭 조건별 품질특성을 조사하였다. 평창에서 재배된 산마늘을 수확하여, 블렌칭 처리조건은 95°C, 30초, 1분, 2분, 3분 처리하였다. 블렌칭 처리후 열풍건조기(60°C)에 넣어 건조하면서 수분함량 10% 이하일 때 종료하였다. 각 처리별 수분함량은 4.69~4.89%였다. 블렌칭 후 산마늘의 물성(Hardness)은 무처리 370.7g, 30초~2분 블렌칭처리 463.7~466.0g, 3분 블렌칭처리는 324.0g으로 물러지는 경향을 보였다. 산마늘 분말의 수분흡수지수는 무처리 9.08g/g, 블렌칭 처리구는 10.14~11.64g/g였다. 산마늘 분말의 수분용해지수는 무처리 34.42%, 블렌칭처리구는 28.26~33.48%였다. 산마늘 분말의 폴리페놀함량은 무처리 1,320mg/100g, 블렌칭 처리구는 877.18~1,010.44mg/100g, 플라보노이드함량은 무



처리 1,550.24mg/100g, 블렌칭 처리구는 387.36~562.74mg/100g이었다. 항산화활성 DPPH함량은 10mg/ml에서 무처리 45.17, 블렌칭처리구는 33.51~39.14였다. 산마늘분말을 제조하기 위한 블렌칭 처리는 무처리에 비해 수분흡수지수는 증가, 폴리페놀, 플라보노이드, 항산화 활성은 낮았다.

P2-41

염 농도를 달리한 블렌칭 처리와 건조 방법에 따른 울릉도산 명이나물, 눈개승마, 참고비의 색상 변화

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나물류는 제한된 수확시기와 짧은 저장기간으로 인해 연중 지속적인 공급에 어려움이 많다. 이러한 문제를 해결하고자 상당수의 나물은 데친 후 건조나물의 형태로 판매가 이루어진다. 건조 전 나물을 데치는 것은 품질 저하의 원인이 되는 효소의 불활성화, 조직 연화의 최소화, 기호성과 기능성의 보존, 저장기간 중 색상의 변화 방지 때문이다. 특히 건조나물의 경우 제품의 색상이 소비자의 기호도와 제품 선정에 직접적인 영향을 미치므로 나물의 색상 보존이 경제적 측면에서 매우 중요하다. 본 연구에서는 울릉도 산나물인 명이나물, 눈개승마, 참고비를 이용한 건조나물 제조 시 색상 유지를 위해 다양한 농도의 가염 블렌칭 처리를 수행한 후 건조 방법을 달리하여 최적 건조 조건을 탐색하였다. 이를 위해 색도 색차계를 이용하여 건조나물의 색상 변화를 비교하였고 대류형 건조기를 이용한 건조 전후의 무게 차이를 통해 수분함량을 측정하였다. 결과적으로 명이나물은 전처리나 건조 방법에 따른 색상의 유의적인 차이를 보이지 않았으나 눈개승마는 블렌칭 처리 유무에 따라 녹색 색상에 유의한 차이가 나타났다. 참고비의 경우 건조나물의 녹색 색상은 전처리보다는 건조 방법에 크게 영향을 받는 것으로 확인되었다. 이러한 결과들은 더욱 우수한 품질을 지니는 울릉도산 건조나물 제작에 필요한 정보로 활용될 수 있을 것이다.

P2-42

설탕대체제 및 난소화성말토덱스트린을 첨가한 닭강정 소스의 개발과 품질특성에 관한 연구

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설탕대체제와 기능성원료를 첨가한 닭강정 소스의 제조는 선행 연구를 통해 여러차례 예비실험을 거쳐 최종 배합비를 선정하였다. 설탕대체제인 스테비아는 설탕 함유량 대비 0%(SC1), 20%(S20), 40%(S40), 60%(S60), 80%(S80), 100%(S100)로 결정하였고, 난소화성말토덱스트린은 대조구(SC)와 비교하여 닭강정 소스 총 함량 대비 1%로 맞추어 함량을 결정하였다. 닭강정 소스의 수분함량을 측정한 결과 닭강정 소스의 대조구인 SC의 수분함량이 가장 낮았으며, 설탕 함유량은 적고, 스테비아 함량은 늘어날수록

소스의 수분함량은 증가하였다. pH 측정 결과에서는 대조구 및 스테비아와 말토덱스트린을 첨가한 닭강정 소스에서 4.48~4.56사이로 큰 차이를 보이지 않았다. 당도 측정 결과에서는 대조구인 SC에서 7.33 brix 으로 당도가 가장 높았으며, SC1에서 7.03, S20에서 6.57, S40에서 5.87, S60에서 5.49, S80에서 4.57, S100에서 3.40 brix으로 설탕 함유량은 적고, 스테비아 함량은 늘어날수록 닭강정 소스의 당도는 감소함을 보였다. 당류 함량을 분석한 결과, 닭강정 소스의 당류는 fructose, glucose, sucrose, maltose가 검출되었다. SC, SC1, S20, S40, S60에서는 sucrose가 함량이 높았고, S80, S100에서 fructose의 함량이 높았다. 색도를 측정한 결과에서 명도(L)값은 대조구인 SC에서 28.87, 스테비아의 첨가량이 증가할수록 명도 값은 증가함을 보였으며, 적색도(a)값과 황색도(b)값은 대조구에 비해 스테비아의 첨가량이 증가할수록 증가하였다. 닭강정 소스의 색, 향, 맛, 점도, 전체적인 기호도를 7점으로 관능평가를 실시한 결과, 색의 경우 SC, SC1, S20, S40 소스에서 점수가 높았고, 향은 S20, S40에서 점수가 높았으며, 맛은 S40, 점도는 S20과 S40에서 점수가 가장 높았고, 전체적인 기호도는 S40에서 점수가 가장 높았다. 따라서 설탕대체제 및 기능성 원료를 이용하여 제조한 소스류의 개발은 최근 소비자들이 추구하는 식품의 건강 및 질병 예방과 관련하여 건강기능식품 산업의 발전뿐만 아니라 국내 기능성 소스류의 제품개발 및 기술개발에도 큰 도움이 될 것이다.

P2-43

설탕대체제 및 난소화성말토덱스트린을 첨가한 닭강정 소스의 영양성분과 기능성 연구

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최근 식품은 환경 및 건강을 고려한 제품의 수요가 증가하고 있고, 과다 섭취시 각종 성인병의 원인이 될 수 있는 설탕 대신에 대체 감미료를 사용한 식품개발 연구가 증가하고 있다. 본 연구에서는 설탕 첨가량을 줄이고, 설탕의 단맛을 대체할 감미료(스테비아)와 천연 전분으로부터 유래된 난소화성말토덱스트린을 첨가하여 제조한 기능성 닭강정 소스의 제품개발을 위해 연구를 진행하였다. 예비실험을 통해 스테비아는 설탕 함유량 대비 20%(S20), 40%(S40)로 결정하였고, 난소화성말토덱스트린은 대조구(SC)와 비교하여 닭강정 소스 총 함량 대비 1%로 맞추어 함량을 결정하였다. 닭강정 소스의 영양성분 함량을 측정 한 결과, 열량은 대조구인 SC에서 308.45 Kcal/100g으로 가장 높았고, S20에서 286.29 Kcal/100g, S40은 265.94 Kcal/100g이었다. 나트륨 함량은 대조구인 SC에서 721.64 mg/100g으로 가장 많았고, S40은 719.22 mg/100g, S20에서 649.95 mg/100g이었다. 트랜스지방과 포화지방, 콜레스테롤은 SC, S20, S40에서 모두 함유되어 있지 않았다. 닭강정 소스의 무기질 함량을 측정 한 결과에서는 Ca, K, Fe, Mg, P, Zn, Mn, Cu가 함유되어 있었고, 그 중 K의 함량이 가장 높았다. K의 함량은 SC에서 161.51 mg/100g, S20에서 137.67 mg/100g, S40에서 159.90 mg/100g이었다. 다음으로 P의 함량이 많았으며, S40에서 38.95 mg/100g, SC에서 36.63 mg/100g, S20에서 34.74 mg/100g이었다. Mg의 함량



은 S40에서 19.96 mg/100g, Ca의 함량은 S40에서 9.04 mg/100g으로 다른 소스에 비해 높았다. K, P, Mg, Ca은 닭강정 소스의 주요 무기영양성분이었으며, S40에서 P, Mg, Ca의 함량이 다른 소스에 비해 다소 함유량이 높았다. 닭강정 소스의 총 폴리페놀 함량을 측정한 결과 대조구인 SC는 0.23 g/100g, S20은 0.31 g/100g, S40은 0.41 g/100g으로 S40에서 함량이 높았다. 전자공여능 측정 결과 대조구인 SC는 64.03%, S20은 68.14%, S40은 72.68%으로 대조구인 SC에 비해 스테비아를 첨가한 S20과 S40의 닭강정 소스에서 전자공여능은 높았으며, S40에서 가장 높은 전자공여능을 보였다.

P2-44

Investigating the impact of different starch types on meat analogues produced through low moisture extrusion

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Plant-based meat analogues are one of the many solutions to address environmental problems, animal welfare issues, and the future food needs because of a growing population. The raw materials for extruded plant-based meat analogues include vegetable proteins, starch, lipids, and gums. Among them, starch acts as a binding agent and bulking agent and is an important factor for texture, especially in the field of alternative meats. Although starch itself is well studied, there have been few studies on the effects of changing starch type on extruded meat substitutes. In this study, different starch types, corn, pea, tapioca, sweet potato, and potato, were added to isolate soy protein at 20% each to investigate the effect of changing the starch type on meat substitutes. A low moisture extrusion process was performed to produce the meat analogues. Water holding capacity, swelling rate, nitrogen soluble index (NSI), integrity index, texture profile analysis (TPA), and cutting strength, degree of texturization were measured on the extruded products. With the exception of the Tapioca starch, the other starches showed an increase in water holding capacity. The addition of sweet potato starch decreased springiness and cohesiveness. Addition of corn starch and pea starch reduced chewiness. Corn starch, pea starch, and sweet potato starch reduced the cutting strength in the transverse direction. All five types of starch decreased the cutting strength of the longitudinal direction. Additionally, the degree of texturization increased with the addition of tapioca starch and potato starch.

P2-45

Exploring the influence of garlic on off-flavors in soy protein-based meat analog

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According to the UN, the global population will reach 10.9 billion by the year 2100. Additionally, greenhouse gases produced by livestock contribute to 14.5% of total anthropogenic emissions. Due to these problems, there is growing need for alternative food sources, which has led to increased attention towards future foods. Future foods include cultured meat, meat analogue, and edible insects. Among them, extruded meat analogue from plant protein sources is gaining popularity as a mass-production process due to its efficiency. Plant-based meat analogue is mainly produced by soy proteins. However, soy-based raw materials have an off-flavor problem, which adversely impact consumer perception. For this reason, the purpose of the study was to enhance the flavor profile of plant-based extruded meat analogue by utilizing garlic. Garlic powder, possessing relatively high inhibition of lipoxigenase enzyme, was added to the mixture before putting into extrusion processing for meat analogue production. The extrusion parameters were moisture content of 35%, barrel temperature of 150°C, 150°C, 160°C and screw speed of 250 rpm. The raw material for the plant-based extruded meat analogue included isolated soybean protein with varying proportions of freeze-dried garlic powder (0%, 5%, and 10%). As the garlic content increased, the values of SME (specific mechanical energy), integrity index, and pH decreased. An increase in NSI (nitrogen solubility index) corresponded to a decrease in the integrity index. As a result of principal component analysis of the electronic nose, raw materials with 5% and 10% garlic content were located in the negative direction, and raw materials with 0% garlic content were located in the positive direction. This indicates a distinction in the fragrance pattern of volatile components within the garlic-infused raw material. The findings of this study can be helpful for addressing the off-flavor issue in plant-based meat analogues.



P2-46

Changes in quality characteristics of pickled purple radish during storage

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Radish (*Raphanus sativus* L.), a family of Brassicaceae, is widely consumed as salades, pickles, and fermented foods in Korea. Purple radish contains a large amount of anthocyanins such as cyanidin and pelargonidin that have various health beneficial effects. However, studies on quality characteristics of pickled purple radish during storage is limited. This study investigated to change in quality characteristics and antioxidant activity of pickled purple radish during storage. Hunter L and a values did not change significantly, but Hunter b value increased significantly during the storage. The hardness decreased significantly at 15 days of storage and then did not change. Metabolites, including sugars, organic acids, and amino acids, were mainly found in the pickled purple radishes during storage using GC-MS analysis. PLS-DA results indicated that glucose and fructose were high variable important factors. Sucrose content gradually decreased, but glucose and fructose contents increased during the storage. Un-targeted metabolites in the pickled purple radishes during storage by LC-ESI-QTOF-MS analysis are in progress. ABTS+ radical-scavenging activity and FRAP of pickled purple radish were 69.86 ± 1.58 and FRAP 64.15 ± 1.31 μg ascorbic acid equivalent/g, respectively, but slightly decreased during storage.

P2-47

남해 '섬애썩' 첨가 썩맥주 품질특성

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썩은 대표적인 천연 항노화 식품 소재로 예로부터 널리 활용됐으나 일부 품종에서 독성이 나타나 일반 식품으로 사용하는 데 제한이 있었다. 이런 문제가 개선된 '섬애썩'은 항산화 활성 및 유타틸린, 자세오 시딘 등 유효성분을 가진 식품 소재지만, 소비 촉진을 위한 가공품 개발이 필요한 실정이다. 본 연구는 수제맥주 시장의 변화 흐름에 발맞추어 지역 농산물을 활용한 로컬 맥주를 개발하고자 하였다. 썩맥주는 맥아와 쌀을 담금 후 여과, 끓임, 냉각 후 '섬애썩' 농축액을 첨가하여 발효, 숙성 과정을 거쳐 제조하였다. 최종 완성된 레시피로 제조한 썩맥주는 알코올 함량, 색도, pH, 총산, 쓴맛, 관능 평가 등 품질특성을 분석하였다. 최종 완성된 썩맥주의 pH, 총산은 대조구와 비교해 크게 차이가 나지 않았다. 알

코올 함량은 대조구가 3.8%, 쑥맥주 4.0% 였으며, 맥주의 쓴맛 정도를 나타내는 BU 값 또한 크게 차이가 나지 않았다. 색도를 살펴본 결과, 대조구에 비해 쑥맥주의 적색도, 황청도 값이 컸다. 관능평가 결과, 대조구 대비 쑥맥주의 경우 쑥의 향과 맛이 자연스러우면서 첨가량이 적당하였다. 전자혀 분석 결과, 신맛은 크게 차이가 없었으나 쑥맥주에서 쓴맛(8)이 대조구(4)에 비해 2배 정도 높았고, 짠맛(4.3)은 대조구(7.7)에 비해 낮았다. 전자코 분석결과, 대조구는 111개, 쑥맥주는 110개의 peak를 확인하였으며, 대조구와 쑥맥주 간에 차이가 나는 peak는 4개였다. 처리 간 차이가 나는 peak의 주요 compounds 상위 5개는 2-methyl-3-Furanthiol, m-Xylene, 1,4-dimethylbenzene, ethylbenzene, Chlorobenzene이였으며, 주로 Aromatic, Floral, Fresh, Sweet한 향을 내는 성분들이었다. 이상 결과들을 종합하여 볼 때, 쑥맥주는 수제맥주 소비층 확대뿐만 아니라 지역 농산물, 수제맥주 소비 촉진에도 기여할 수 있을 것으로 판단된다.

P2-48

Effect of hydrostatic high pressure treatment of dry-milled rice ("Baromi2") flour

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This study was conducted to investigate the characteristics of dry-milled rice flour with hydrostatic high-pressure treatment (HHP). Rice flour ("Baromi2") was prepared by pulverizing it with an air-classifier mill. A twenty percent aqueous solution of rice flour (w/w) was treated with a pressure of 450 mPa for 30 to 120 minutes. The samples were lyophilized for 48 hours, and their dispersion stability in aqueous dispersion, water absorption index, swelling power, solubility, and pasting properties were compared with untreated rice flour (RF). The HHP-treated sample descended more slowly than RF. The HHP-treated sample exhibited approximately twice the water absorption index compared to RF, but there was no significant difference in swelling power and solubility. In terms of pasting properties, the breakdown was reduced, and the setback increased in the HHP-treated sample compared to RF. This study is expected to provide the basic data about the non-thermal physical treatment of rice flour.



P2-49

증자시간에 따른 천마의 품질 변화

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천마는 난초과 식물이지만 독립적으로 광합성을 하지 못하고 뽕나무버섯균에 기생하는 식물이다. 한방에서는 뇌졸중, 두통, 고혈압, 증풍에 사용하는 것으로 알려져 있고 주요성분은 gastrodin, 4-hydroxybenzylalcohol, vanillyl alcohol 등으로 보고되어 있다. 약용작물은 저장기간 연장이나 약효 증진을 위하여 포제를 실시하여 왔으며 천마는 증자를 통하여 가공제품이나 한약재로 사용하여 왔다. 이러한 이유로 효율적인 천마 증자 시간을 구명하고자 증자시간에 따른 성분 등 품질변화에 대한 연구를 수행하였다. 증자시간은 5, 10, 20, 30, 60, 120분으로 설정하였다. 그 결과 증자시간에 따른 천마의 건조수율은 20.2~22.9%을 나타내었고 열에 의한 수용성 성분의 용출로 인해 증자 120분에서 건조수율이 가장 낮은 경향을 나타내었다. 또한 증자시간에 따른 천마의 경도 역시 120분에서 감소하였으며 이는 천마 전분의 호화에 따라 감소한 것으로 생각된다. 이와 더불어 증자시간에 따른 총당 함량을 분석한 결과 증가시간이 길어짐에 따라 총당 함량은 증가하여 120분 증자시 5분 증자 대비 4배 증가하였다. 천마의 주요성분은 증자시간이 길어짐에 따라 gastrodin 분해효소가 열에 의해 불활성화 되어 gastrodin 함량은 유의적으로 증가하였고, 4-hydroxybenzylalcohol 함량은 감소하는 경향을 나타내었다.

P2-50

천마 가공향상을 위한 전처리방법별 품질변화

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천마는 전북 생산량이 전국의 68.6%(농축산식품부, 2020)를 차지하고 있는 특화작목으로 신경보호, 항치매, 항당뇨효과가 보고되어 있다. 천마는 2000년 식품원료로 등록되어 가공제품 개발에 사용되고 있으나 고유의 독특한 이취로 인하여 가공식품 개발시 제약요인으로 작용되어 이취를 감소시킬 수 있는 가공 전처리방법을 개발하고자 시험을 실시하였다. 전처리방법으로는 슬라이스 절단(5mm)하여 증자 후 건조처리, 180℃ 온도에서의 볶음과 굽기 처리를 실시하였다. 그 결과 천마 이취의 주 성분 p-cresol 함량은 무처리에 비해 전처리를 하였을 때 유의적으로 감소하였으며 증자 후 건조하였을 때 무처리 대비 97%, 볶음과 굽기 처리하였을 때 88%이상이 감소되는 효과를 나타내었다. 천마의 주요성분인 gastrodin 함량은 전처리를 실시하였을 때 무처리보다 높았으며 굽기, 증자후 건조, 볶음처리 순으로 높았다. 또한 4-hydroxybenzylalcohol 함량은 무처리에서 가장 높았고 전처리 방법은 볶음처리에서 높았다. 항산화활성을 나타내는 성분인 총 폴리페놀함량과 DPPH 라디칼소거 활성은 굽기 처리에서 가장 높았다. 또한 가공 전처리별 천마의 관능평가 결과 증자 후 건조처리에서 냄새, 색 및 외관에 대한 평가가 높아 종합적인 품질평가가 우수하였다.

P2-51

Antioxidant activity evaluation of *Platycodon grandiflorum* roots juice

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In this study, to develop a *Platycodon grandiflorum* roots juice with optimal taste and functionality, we compared and analyzed the characteristics and functionality of *Platycodon grandiflorum* roots juice according to different manufacturing methods (fermented syrup mixed juice and extracts). First, *Platycodon grandiflorum* roots syrup was produced by fermenting a mixture of 6-year-old *Platycodon grandiflorum* roots cultivated in Icheon and sugar in a ratio of 6:4. The sweetness and acidity of the *Platycodon grandiflorum* roots syrup were measured as 54.77 ± 0.02 brix and $1.04 \pm 0.01\%$, respectively. The polyphenol content was 1602.48 ± 13.80 ppm, and the antioxidant activities, measured by the DPPH radical scavenging(%) and ABTs radical scavenging(%), were found to be $33.53 \pm 1.96\%$ and $53.22 \pm 0.22\%$, respectively. To produce *Platycodon grandiflorum* roots syrup mixed juice, we adjusted the sweetness and acidity by mixing *Platycodon grandiflorum* roots syrup and citric acid and water in various ratios and based on the taste evaluation, finally we set the optimal ratio to be 14 brix for sweetness and 0.3% for acidity. Next, the *Platycodon grandiflorum* roots extract used in this experiment was prepared by heating and extracting 6-year-old *Platycodon grandiflorum* roots for long-term. It had a sweetness of 8.10 ± 0.01 brix and acidity of $0.67 \pm 0.01\%$. The functionality analysis of syrup mixed juice and extract the following results : the polyphenol content was 749.42 ± 24.96 ppm and 2028.6 ± 17.20 ppm respectively, and the DPPH radical scavenging activity was found to be similar while the ABTs radical scavenging activity was higher in the extract. In order to improve the functionality of *Platycodon grandiflorum* roots juice, it is appropriate to extract it for a long-term but the extract had a bitter taste. Therefore, in our future research, we planning to create *Platycodon grandiflorum* roots extract and blend it with *Platycodon grandiflorum* roots syrup, and we will develop *Platycodon grandiflorum* roots juice that satisfy both functionality and taste.



P2-52

Effect of anaerobic fermentation conditions to skate (*Raja kenogei*) muscles on enzyme activity and myoglobin redox forms

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Skate (*Raja kenogei*) is popular in S. Korea, especially in the Southwest area as a fermented fish product. Even though the color of fermented skate muscle is considered as the one of indicators for better product quality, no study has been conducted on the color change of skate muscle depending on fermentation conditions. The skate wings were fermented for 15 days at 10 °C. The muscle of fermented skate wings under anaerobic conditions with vacuum (AC-S) was conducted the proteomic analysis including 1-DE and 2-DE followed by protein identification with LC-MS/MS, colorimetric measurements, and myoglobin redox form analysis by spectrophotometric determination. Myoglobin redox form and color values measurements showed that AC-S with increasing fermentation period increased a* value and reduction of met-myoglobin to oxy-myoglobin. For proteomic analysis, The skate muscles were analyzed for protein patterns by SDS-PAGE, and proteins with molecular weights of 10-250 kDa were observed. Sixteen specific protein spots were isolated in the 2-DE analysis and some of them were identified as myosin, keratin, actin, albumin, serine/arginine matrix, trypsin, and parvalbumin, respectively. Additionally, the intensity of the spots identified as enzymes including creatine kinase M-type, B-type, glyceraldehyde-3-phosphate dehydrogenase, and NADP-specific glutamate dehydrogenase-like was changed depending on the atmosphere conditions during fermentation. Peak intensities of glyceraldehyde-3 phosphate dehydrogenase and creatine kinase, reported to reduce met-myoglobin, were expressed higher in the skate muscle fermented under anaerobic conditions than in the fermented under aerobic conditions. This is the first study to approach color change in fermented skate from an enzymatic perspective, as well as colorimetric and redox changes in myoglobin. Further research is required to investigate the correlation between color and the related enzymes in the future.

P2-53

Change of physicochemical characteristics and functional components in the mugwort (*Artemisia dubia* Wall.) by different drying methods**Ah-Hyun Kim^{1*}, Ju-Yeon Jeong¹, Ji-Eon Jeong², Seo-Hee Yang²,
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Among the natural antioxidants, Mugwort (*Artemisia dubia* Wall.) commonly known as mugwort, is one of the medicinal plants, mainly cultivated in Hampyeong-gun, Jeollanam-do, Korea. In this study, the physicochemical characteristics and functional components of mugwort pellets with different drying methods were compared to establish appropriate drying conditions for the preparation of rice cake made with mugwort. Mugwort pellets were freeze-dried and hot-air dried, respectively, and hot-air drying was performed at 55°C and 65°C. All samples were dried to constant weight and then evaluated for analysis. The results of the proximate composition analysis showed that hot-air dried mugwort pellets (HMP) had lower content of moisture, crude protein, crude fat, and crude ash, except carbohydrate, than freeze-dried mugwort pellets (FMP), which decreased with increasing temperature of hot-air drying. For color values, the a^* value was higher in HMP due to the non-enzymatic browning reaction caused by heating treatment, while the L^* and b^* values were higher in FMP, suggesting that the green color can be maintained during freeze-drying. For pH, the pH increased during hot-air drying, which was attributed to the decrease in total organic acid content, and also tended to be proportional to temperature. For functional components, total phenolic contents (TPC) and total flavonoid contents (TFC) were measured, and both showed significantly higher in FMP. In HMP, the content increased significantly at lower temperatures. As a result, freeze-drying is considered to be a drying method that can minimize the deterioration of physicochemical characteristics and functional components of mugwort compared to hot-air drying, and further research is needed on the optimal drying temperature to preserve the functional components during hot-air drying.



P2-54

블랜칭 조건별 더덕, 도라지, 땅두릅순의 품질특성 비교

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더덕(*Codonopsis lanceolata*), 도라지(*Platycodon grandiflorus*), 땅두릅(*Aralia cordata*) 등의 숙근성 약용작물의 새순은 대부분 산채로 이용하고 있다. 약용인 뿌리에 비해 기능성 채소로 이용할 수 있어 소비가 용이하며, 특히 다양한 가공식품화가 가능하여 최근 소비가 확대되고 있다. 더덕, 도라지는 2~3년간 재배하여야 품질향상 및 수량이 증수되어 타작물에 비해 수확 소요기간이 길어 자본회수가 늦다. 특히 최근 소비트렌드(간편식)의 변화로 소비량이 감소하고 있고, 이상기후로 안정생산이 어려워 소비 확대 및 부산물 활용이 요구된다. 따라서 더덕순, 도라지순, 땅두릅순을 활용한 건나물 제조를 위한 블랜칭 조건을 설정하고자 본 연구를 수행하였다. 평창에서 재배된 더덕순, 도라지순 및 화천에서 재배된 땅두릅순을 수확하여 사용하였다. 더덕순의 블랜칭 조건은 100℃, 30초, 60초, 90초, 120초 처리하였다. 도라지 순의 블랜칭 조건은 100℃ 1, 2, 3, 4, 5분 처리하였다. 땅두릅 순의 블랜칭 조건은 100℃, 3, 5분 처리하였다. 더덕순, 도라지순, 땅두릅순의 건나물 제조공정은 블랜칭 처리 후 반건조(60℃, 1시간)하여 유념(비비기 공정)을 10분 처리하였다. 유념처리 후 열풍건조(60℃)하여 최종 시료로 하였다. 더덕순의 블랜칭 조건별 녹색도인 a값은 -12.1~-10.3이었고, 경도는 블랜칭 시간이 길어질수록 경도가 낮아졌다. 수분함량은 60.7~88.2%였다. 열풍 건조 후 녹색도인 a값은 -3.81~-2.90로 건조에 의해 녹색도가 낮아졌다. 건나물의 재수화율은 333.0~382.2%였다. 더덕순을 100℃, 30초 블랜칭한 처리구가 다른 처리구에 비해 녹색도와 재수화율이 높았다. 도라지순의 블랜칭 조건별 녹색도인 a값은 -12.5~-1.5였고, 경도는 블랜칭 시간이 길어질수록 경도가 낮아졌다. 수분함량은 79.4~90.0%였다. 열풍 건조 후 녹색도인 a값은 -5.2~-2.7로 건조에 의해서 녹색도가 낮아졌다. 건나물의 재수화율은 327.1~360.2%였다. 도라지순을 100℃, 1분 블랜칭한 처리구는 다른 처리구에 비해 녹색도와 재수화율은 높았으나, 경도가 높았다. 땅두릅순의 블랜칭 조건별 녹색도인 a값은 -11.4~-9.9였고, 경도는 블랜칭 시간이 길어질수록 경도가 낮아졌다. 수분함량은 56.2~87.6%였다. 열풍 건조 후 녹색도인 a값은 -2.24~0.24로 건조에 의해서 녹색도가 낮아졌다. 건나물의 재수화율은 177.4~263.8%였다.

P2-55

Changes on the physicochemical properties of sweet potato stem by blanching in alkali or calcium solution

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This study conducted to investigate changes in the physicochemical properties of sweet potato stem by blanching in alkali or calcium solution. Samples were blanched with two different methods; (i) Blanched at 100°C for 1, 2, 3, 4, and 5 min in 0.3% NaHCO₃ solution, (ii) Blanched at 50, 60, 70°C for 1, 5, 10, 20, 30, 60 min in 0.5% CaCl₂ solution. The pH of alkali-blanching sample (0.3% NaHCO₃) was increased with longer blanching time. The hardness of blanched samples were lower than non-treatment sample with decreasing by blanching time. Chlorophyll content of alkali-blanching samples were lower than non-treatment sample with the highest content observed in the sample treated for 4 min. The pH of samples blanched at 60°C and 70°C in calcium chloride solution (0.5% CaCl₂) decreased with increasing blanching time. The hardness of samples blanched at 50°C and 60°C decreased with longer blanching time, while the 70°C blanched sample was maintained at increasing of blanching time. The chlorophyll contents decreased with higher blanching temperature and 20 min blanched samples were the highest. These results suggest that blanching treatments with alkali and calcium chloride solution affected various changes on physicochemical properties of sweet potato stem.

P2-56

돼지 적내장의 이화학적 및 단백질 가수분해 특성

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최근 돼지 부산물은 생리 활성 펩타이드 생산을 위한 유용 소재로 주목받고 있다. 돼지 적내장은 심장, 간, 비장, 폐 및 신장 등의 흉강 장기를 포함하며, 단백질 함량이 평균 13.4% 수준이다. 본 연구에서는 돼지 적내장 5종의 이화학적 및 단백질 가수분해 특성을 평가하였다. 돼지 적내장은 도축 당일 수거하여 세척, 동결건조 및 분말화하였다. 돼지 적내장 분말은 5%(w/v) 농도로 증류수에 현탁 후 alcalase와 trypsin으로 최적 활성 조건(E:S=1:100(w/w), pH 8.0, 50°C 및 37°C, 2시간)에서 가수분해하였고, 단백질 함량과 용해성, 가수분해도 및 단백질 전기영동을 실시하였다. 단백질 함량은 15.90-20.30 g/100 g으로 간과 비장이 가장 높았고(p<0.05), 단백질 용해성은 심장, 신장, 비장, 간 및 폐 순으로 높았다(p<0.05). 모든 부위의 가수분해도는 유사한 수준이었으며(p>0.05), alcalase를 처리한 경우 trypsin보다 유의적으로 높았다. 주요 단백질은 50~75 kDa 사이에서 관찰되었고, 대부분이 가수분해로 저분자화 되



었다. 따라서, 돼지 적내장의 부위별 단백질 함량 및 용해성의 차이가 있으나, 부위에 따른 차이보다는 적용 효소가 단백질 가수분해 효율에 더 큰 영향을 미친다고 사료된다.

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P2-57

Protein recovery from soybeans using extrusion and enzyme treatment

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Enzyme-assisted aqueous extraction processing (EAEP) is considered as environmentally friendly technology that can be simultaneously recover the edible oil and protein. Furthermore, EAEP produces a significant amount of protein-rich aqueous effluent. In the present study, we evaluated the effect of commercial endo-proteases (Protex 6L and 7L) and cellulose on the protein extract from extruded-soybean flour produced by EAEP. The extrusion process enhanced protease hydrolysis, and effectiveness of protein extract was significantly increased 7.5% by aqueous extrusion process compared to non-extrusion control process. In addition, Protex 6L was more effective for extracting protein than Protex 7L. The amount of extraction protein was higher produced by alkaline protease Protex 6L than bacterial neutral protease Protex 7L. Meanwhile, cellulose was not effective in facilitating protein extractability. However, the maximum protein extraction yield of 91% was obtained using Protex 6L in combination with sequentially adding cellulose, and the highest extract ability rate of 93.5% was achieved at 50 °C and after 4 h treatment. Taken together, our finding suggested that cellulase-protease enzyme combination have the synergistic effect on the protein extraction.

P2-58

박류 부산물의 이화학적 및 단백질 가수분해 특성

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박류는 식품 가공 과정에서 발생하는 가공부산물로 단백질 함량이 높아 산업적 활용도가 우수하다. 최근 생리활성 펩타이드의 식품 소재화에 대한 관심도가 높아지고 있으나, 대두박 이외의 박류 단백질의 가수분해 특성에 관한 연구는 미비한 실정이다. 본 연구는 박류(대두박, 들깨박, 주정박, 맥주박 및 밀 글루

텐)의 이화학적 특성 및 단백질 가수분해 특성을 평가하였다. 박류는 4%(w/v) 농도로 증류수에 균질화하였다. 단백질 가수분해는 적용 효소(alcalase 및 trypsin)의 최적 반응 조건(E:S=1:100(w/w), pH 8.0, 50℃ 및 37℃)에서 2시간 진행하였고, 불활성화 이후 가수분해도 측정 및 단백질 전기영동을 실시하였다. 밀 글루텐은 가장 높은 단백질 함량 및 용해성을 나타내었다($p < 0.05$). 단백질 전기영동에서 가수분해 이후 박류의 주요 단백질은 저분자화 되어 분해됨을 확인하였다. 단백질 가수분해도는 원료 및 적용 효소에 의한 교호작용이 나타났($p < 0.05$). Alcalase 처리 밀 글루텐의 가수분해도가 가장 높았지만, trypsin 처리 밀 글루텐은 가장 낮은 수치를 나타내었다($p < 0.05$). 이는 trypsin 처리가 박류 단백질의 가수분해에 적합하다는 이전의 보고와 상이하여 박류 부산물의 발생 과정에서 열처리에 의한 trypsin 억제제의 불활성 정도가 단백질 가수분해 효율에 영향을 미친 것으로 판단된다.

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P2-59

느타리버섯과 표고버섯 유래 단백질의 가수분해 특성

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최근 버섯 단백질 유래 유리 아미노산과 펩타이드의 품미 증진 및 생리활성 향상에 관한 연구가 활발히 진행되고 있다. 본 연구는 단백질 소재로의 활용이 제한적인 느타리버섯과 표고버섯의 단백질 가수분해물의 특성을 비교하였다. 시판 느타리 및 표고버섯의 자실체 분말은 2%(w/v) 농도로 증류수에 균질하였다. 단백질 가수분해는 alcalase 및 trypsin의 최적 반응 조건(E:S 1:100(w/w), pH 8.0, 50℃ 및 37℃, 2시간)에서 진행하였다. 실험항목은 원료 분말의 단백질 함량, 용해성, 가수분해도 및 단백질 전기영동을 실시하였다. 느타리버섯과 표고버섯의 단백질 함량은 각각 15.7% 및 4%였고, 표고버섯의 단백질 용해성이 유의적으로 높았다. 가수분해도에서 버섯 종류 및 적용 효소 간의 유의적인 교호작용이 나타났고, alcalase 처리 느타리버섯 가수분해물에서 가장 높은 가수분해도가 관찰되었다($p < 0.05$). 단백질 전기영동 결과 대부분의 주요 단백질이 가수분해됨을 확인하였다. 따라서, 버섯 유래 단백질의 가수분해 효율을 향상하기 위해서는 원료에 적합한 단백질 가수분해효소의 적용이 필요하다고 판단된다.

본 연구는 농촌진흥청 반려동물전주기고도화기술개발사업(G24002314461)의 지원을 통해 연구되었습니다.



P2-60

Physicochemical characteristics of hamburger patty added with different flour as binding agents

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This study investigated the changes in physicochemical characteristics of hamburger patty added with different flour as binding agents to expand the consumption of rice flour. The Hamburger patty with rice flour (RW) showed a significantly lower moisture content than wheat flour (Control) addition. And, the content started to decrease when more rice flour was added. For water-holding capacity (WHC), RW showed lower than Control. The WHC decreased when more rice flour was added. In color value, the L* value was not revealed as insignificantly different from the control when rice flour was added, a* and b* values decreased when more rice flour was added. For texture properties, hardness increased when more rice flour was added due to more dense structure. Besides, chewiness and gumminess showed higher values in RW compared to the control. And, no change in elasticity due to the addition of rice flour as a binder. As a result, rice flour was added to the hamburger patty as a binding agent, and texture properties were improved. But hardness and WHC, which affect tenderness were decreased. So, more research is required to overcome the adverse effects. Also, Further research is required to investigate the cooking characteristics of the patties.

P2-61

Changes of useful components in *Polygonum multiflorum thunberg* root by different dry methods

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As an aging society progresses, interest in anti-aging and maintaining health is increasing, and research on biological active substances from natural materials is extensively. *Polygonum multiflorum* root (PMR) is a perennial herb of the Polygonaceae family, and in oriental

medicine, the tuber of PMR is called Hasuo and is mainly used for medicinal purposes. However, research on the biochemical components and physiological activity for food development is insufficient. This study was performed to analysis of chemical constituent in PMR by different dry methods (hot-air dry, shade dry, and freeze dry). The major free sugar were detected fructose, glucose, and sucrose in dried PMR based on various dry methods. The highest content of free sugars was found in freeze dried PMR. The four organic acids were detected in dried PMR by HPLC analysis. The content of oxalic acid in shade dried PMR was higher than the dried PMR by different dry methods. The content of total amino acid and essential amino acids were high in the orders of freeze drying > shade drying > hot-air drying. The potassium and magnesium levels of freeze dried PMR was significantly higher than the other drying method of PMR. Whereas the calcium and sodium levels were higher in hot-air dried PMR. The major fatty acid was determined the linoleic acid in all PMR dried samples. As a result, the drying method with the least loss of useful ingredients PMR is found in freeze drying method. But the useful component amount differences were shows not high according to the drying methods. So, we need to considered cost-effective drying methods for industrialization.

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P2-62

Comparisons of the nutrient components from fermented mycelia and fruiting bodies of *Tuber borchii*

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Recently, so much consumers are interested in edible mushroom fruiting bodies and mycelia as functional foods because they are less harzard and contain useful bioactive compounds. The shape of a typical fruiting body differs visibly from mycelia, which was consisted the cell cultures on agar plates, the cell clusters produced in a flask or stirred thank fermenter. The fruit body production using solid culture required a long period of time, otherwise mycelia fermentation can be produced in a compact space and in a shorter period of time with minimum chances of contamination. Truffles are below-ground-growing fungi, and the species



belonging to the genus *Tuber* are highly estimated their nutritional value, health benefits, and unique sensory properties. Truffle species contained the minerals, fatty acids, proteins, amino acids etc., and their special aroma and flavor are the main factors for their appreciation as an exclusive food ingredient. Existing research on truffles has focused on identifying volatile compounds and nutritional components in fruiting bodies. This study was aim to compare and analyze the nutrient components of both the fruiting body and mycelia of *Tuber borchii*. As a result, the contents of β -glucan, vitamin D₂, amino acids of *T. borchii* mycelia was slightly lower than *T. borchii* fruiting body. The major amino acids of *T. borchii* mycelia and fruiting body were the glutamic acid. *T. borchii* mycelia was their potential as a food material has been demonstrated due to the advantages of production time and costs.

P2-63

Charcteristics of brown rice for manufacturing rice Gangjung according to process conditions

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This study was conducted to analyze the characteristics according to the processing method of roasted brown rice for the manufacture of rice Gangjung. The variety of brown rice used in the experiment is Alchanmi, and processing method was prepared under a total of 24 conditions (2*3*4) by setting an steeping time, pre-gelatinization, and roasting method. The physical properties (hardness) and density of roasted brown rice were analyzed to soften the texture of rice Ganjung. The hardness showed the lowest value when steeped for 16 hours, boiled for 20 minutes, and roasting at 280 degrees for 1 minute and 45 seconds, and the density was also the lowest. Due to the long-term steeping and pre-gelatinization of brown rice, it is thought that the porous shape of the roasted brown rice was maximized during the high-temperature roasting treatment. In conclusion, the processing conditions of roasted brown rice for the manufacture of rice Ganjung with good texture were selected, and future research will be conducted to manufacture rice Ganjung with roasted brown rice and analyze its characteristics.

P2-64

Development of 3D printed hybrid chicken with improved structural characteristics using plant-based proteins and transglutaminase

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The development of hybrid meat is required as an alternative to reducing the amount of animal meat, and the current demand for a meat alternative, which has a high similarity to real meat, encourages the replacement of plant-based ingredients. However, hybrid meat is manufactured by blending animal meat and alternative proteins into a ground processed meat form, which makes it challenging to mimic the fiber structure and textural characteristics of real meat. We aimed to develop a hybrid chicken product with improved structural characteristics by utilizing a layer-by-layer manufacturing technique called 3D printing to mimic animal-based muscle fiber bundles. Additionally, we varied the ratios of isolated soy protein (ISP), isolated pea protein (IPP), and transglutaminase (TG) to achieve this goal. We substituted ISP and IPP for 20% of the weight of the chicken breast to manufacture hybrid chicken ink. We analyzed the characteristics of the chicken ink before cooking, as well as its properties after 3D printing and steam cooking, considering the effects of TG addition. The samples with the addition of ISP and TG exhibited higher emulsion stability, extrudability, gel strength, pseudoplastic behavior and viscoelasticity in the chicken ink before cooking, indicating improved stability and texture properties as well as suitability for 3D printing. After cooking, the presence of TG led to higher levels of chemical cross-linking, elasticity, and shear strength. This allowed for the production of a hybrid chicken with a fibrous texture. Therefore, we confirmed the feasibility of manufacturing hybrid chicken that mimics muscle fiber bundles through the application of plant-based proteins and TG, and it is anticipated that these research findings can be utilized as valuable data for sustainable food research.

P2-65

Quality characteristics of Makgeolli using Seolgitteok from Icheon rice

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We reviewed to use seolgitteok as a starch raw material in a makgeolli manufacturing kit. Our study compared the quality characteristics of makgeolli using hard-boiled rice, which is the most traditional method for making Korean liquor, and makgeolli using rice flour,



dried seolgitteok, and seolgitteok. Seolgitteok was prepared without adding salt and sugar. The mixing ratio of ingredients for fermentation of makgeolli was 25 °C, 7 days of alcoholic fermentation by adding 10% of nuruk, 1% of improved nuruk, 0.2% of yeast, and 1.4 times of water compared to starch raw materials. The amount of makgeolli filtered after fermentation was highest in seolgitteok and hard-boiled rice, followed by rice flour and finally dried seolgitteok. The alcohol content was 14.9% in seolgitteok, 14.5% in hard-boiled rice, 13.0% in dried seolgitteok, and 11.8% in rice flour. The dried seolgitteok makgeolli showed the highest sugar content and reducing sugar content, and seolgitteok makgeolli showed the lowest. It was investigated that seolgitteok makgeolli showed a similar tendency to hard-boiled rice makgeolli. It is thought that there is a great possibility for the use of seolgitteok in the experience kit.

P2-66

Investigation of quality characteristics of commercial rice flour premix

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We investigated the quality characteristics of commercial rice flour premixes (6 types of frying powder and 7 types of Korean-style pancake powder). For the rice flour premix, gluten-free products consisting of rice flour (three types of frying powder, five types of Korean-style pancake powder) and mixed products of rice flour and wheat flour (three types of tempura powder and two types of bucham flour) were used. The quality characteristics of the rice flour premix were investigated such as moisture content, ash content, crude fat, crude protein, color, amylose content, water absorption index, and water solubility index. The gelatinization properties of the rice flour premix were analyzed by Rapid Viscosity Analysis (RVA). As a result of the investigation, the pasting temperature was higher in samples mixed with rice flour and wheat flour. Peak viscosity was generally high in gluten-free samples, and trough viscosity tended to be low in samples mixed with rice flour and wheat flour. Setback, which shows the tendency of aging, did not show a certain trend. This is thought to be due to differences in the protein and starch contained in the variety. In the future, the sugar content, salinity, pick-up rate, and spreadability of the dough will be investigated and used as data for the development of Icheon Rice Flour Premix.

P2-67

Investigation of the characteristics of powder by rice variety produced by jet millDongho Kim^{1*}, Eunkyeong Lee¹, Yoonhee Jo¹, Jeongbeen Park¹, Jungjin Lee²¹*Icheon-Si Agricultural Technology Center, Division of Research and Development*²*Gyeonggi-Do Agricultural Research&Extension Services, Division of Crop Research*

Our study was to investigate the characteristics of rice flour by variety for the development of rice flour premix. Rice flour was manufactured with a jet mill, and 3 variety were used. (Alchanmi, a representative variety of Icheon rice, Charm Dream, one of the representative varieties of Gyeonggi-mi, and Baromi 2, a rice variety for dry milling) For the quality characteristics of rice flour, crude protein, crude fat, crude ash, and moisture content were analyzed as general components, and amylose content, color, and Rapid Viscosity Analysis (RVA) were additionally investigated. Baromi 2 had the highest levels of crude protein, crude fat, and ash, while Alchanmi and Chamdream showed similar values. There was no significant difference in color, and Baromi 2 showed the lowest amylose content. As a result of RVA investigation, Baromi 2 had the highest pasting temperature at around 72°C, and Alchanmi had the highest peak viscosity and breakdown, and Chamdream had the highest final viscosity. As for the setback related to aging, Baromi 2 was investigated with the lowest value and the highest value.

P2-68

Effect of different pretreatment methods on physico-chemical characteristics of dried and air-fried apple chips coated with superfine rice powdersYoon-Han Kang¹, Dieudonne Iradukunda^{2*}, Dong-Jin Kwon¹¹*Department of Marine Bio Food Science*²*Department of Food Processing and Distribution, Gangneung-Wonju National University*

This study examined the effects of steaming and coating sliced apples with superfine glutinous (GR) and non-glutinous rice (NGR) powders at different ratios before drying and air-frying them. Eight different dried and air-fried apple chip samples were prepared. Some samples were steamed and coated with 100:0 and 80:20 (GR:NGR), while others were steamed without any coating before drying and air-frying. Coating apple slices with superfine GR and NGR powders considerably increased their water absorption and swelling capacities while reducing viscosity, water solubility index, total polyphenol and flavonoid contents, and DPPH radical scavenging activity. It also improved the color and



structural characteristics of apple chips. Thus, the results suggest that coating apple slices by substituting GR superfine powder with 20% of NGR superfine powder produces good-quality dried and air-fried apple chips.

P2-69

Carbon dioxide treatment alleviates chilling injury by influencing membrane-related process in paprika

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Paprika (*Capsicum annuum* L.) is prone to chilling injury (CI) during low-temperature storage. In this study, the effect of CO₂ treatment on CI in paprika stored at 4 °C for 14 days (cold storage) followed by 2 days at 20°C (retailer conditions) was investigated. The results showed that CO₂ treatment effectively maintained paprika quality with reduced surface pitting, a common symptom of CI. Transcriptomic and metabolomic analyses revealed that genes and metabolites associated with membrane-related processes and stress response were induced in CO₂-treated fruits. Furthermore, the CO₂-treated paprika exhibited higher tocopherol content and enhanced activity of ABTS and DPPH, indicating CO₂ treatment increased the antioxidant capacity of the paprika. Overall, these findings suggest that CO₂ treatment helped to mitigate the adverse effects of low-temperature storage on the paprika by activating protective mechanisms. These findings have implications for improving the storage and shelf life of paprika, thereby benefiting the paprika industry and consumers. This work was carried out with the support of “Cooperative Research Program for Agriculture Science and Technology Development (Project No. PJ01601102)” and 2023 the RDA Fellowship Program of the National Institute of Horticultural and Herbal Science, Rural Development Administration, Republic of Korea.

P2-70

Changes in physical properties of protein sources by adding vegetable protein sources and seaweed and treating with transglutaminase (TGase)

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Transglutaminase (TGase) treatment of vegetable protein sources with the addition of seaweed was investigated for changes in physical properties such as pH change and water retention capacity. The pH was 6.3–6.57 in the group treated with soybean isolate and gluten and 0.1% TGase, and in the group added with 0.1% TGase and 5% Na-alginate, showing no significant difference, but the water holding capacity was 0.1% TGase. In the case of treatment, it rises to 82.4–87.3%, which seems to be an enzyme-induced tissue formation effect. In the chromaticity, it was shown that the L value decreased significantly in the TGase-treated group, and the a value was significantly low at 9.8–11.6, and the b value was high. On the other hand, in terms of texture, Hardness, Cohesiveness, and Springiness were all maintained significantly higher when treated with TGase.

P2-71

Isolation of proteins from Cricket (*Gryllus bimaculatus*) using enzymes and microorganisms and investigation of the characteristics of the isolated proteins

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Enzymes, lactic acid bacteria, and fungi were used to isolate protein sources from cricket (*Gryllus bimaculatus*) approved for human consumption, and the degree of hydrolysis, essential amino acid content of the extracted protein source, reduction of off-flavor, and preference of the energy bar added to the isolated protein source were investigated. The protein content obtained by defatting increased to 77.57~78.43%, which was sufficient to be used as a protein source. As a result of confirming the degree of degradation by SDS-PAGE, protein bands were faint in all enzymes, lactic acid bacteria and *A. oryzae*. In addition, all of *A. oryzae* showed better decomposition ability than lactic acid bacteria, and the *A. oryzae* fermented group showed better free amino acid content in



the content of 8 essential amino acids. After the roasting process of twin crickets, it was expected that off-flavor reduction was achieved as the fragrance components were further reduced in the group treated with lactic acid bacteria and *A. oryzae* bacteria. On the other hand, energy bars containing 5% of cricket powder were prepared and the preference was measured. As a result, the preference was worse than that of the non-added group, but no significant difference was observed. Therefore, the possibility of developing paired crickets as a protein source is evaluated as sufficient.

P2-72

반응표면분석법에 의한 하수오발효 식물 추출복합물 열수추출 조건의 최적화

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인구 고령화에 따라 노화로 인한 다양한 질병 예방에 대한 관심이 증대되고 있으며, 대표적인 노화로 인한 손상이 심한 간과 신장을 보호해주는 효과가 있는 하수오(전남 순천)를 버섯균사로 발효하고, 지역 특산자원인 산수유, 표고, 황칠을 배합하여 중장년층의 남성갱년기 건강에 도움이 되는 소재의 개발을 탐구하고자 본 연구를 수행하였다. 표고균사 집목 하수오 및 주원료(산수유, 황칠) 혼합물의 추출특성 분석과 추출조건의 최적화를 위하여 반응표면분석법(response surface methodology, RSM)을 이용하였다. 추출조건에 대한 실험 디자인은 중심합성계획(central composite desing)을 실시하였으며, 추출공정에서 중요한 독립변수로서 추출온도, 추출시간 및 시료에 대한 용매비를 설정하고, 종속변수로는 총 추출수율, 당도, 총플라보노이드함량(TPC) 및 총폴라보노이드함량(TFC)로 하였다. 페놀성 화합물은 식물에서 흔히 볼 수 있는 2차 대사산물 중의 하나로 천연물에서 생리활성에 연관이 큰 물질로 알려져 있으며, 이 중에서 플라보노이드는 천연물에 존재하는 폴리페놀 중에 높은 함량을 보이는 물질로 다양한 생리활성 기능을 가진다고 알려져 있다. 본 연구 결과에서 폴리페놀의 함량은 시료 12(100℃, 6 hrs, 20 ml/g solvent), 5(85℃, 4 hrs, 15 ml/g solvent), 7(85℃, 8 hrs, 15 ml/g solvent) 순으로 각각 36.60±1.30, 35.72±1.10, 34.02±0.65 mg GAE/g으로 측정되었으며, 총플라보노이드의 함량은 시료 3(55℃, 8 hrs, 15 ml/g solvent), 시료 15(70℃, 6 hrs, 10 ml/g solvent), 시료 5(85℃, 4 hrs, 15 ml/g solvent) 순으로 각각 7.81±0.07, 7.16±0.02, 7.13±0.15 mg QE/g으로 측정되었다. 따라서 본 연구결과 플라보노이드 함량이 높은 것으로 나타난 시료 3, 시료 5 및 시료 15는 남성갱년기 개선을 위한 식품과 의약품 적용에 효과적인 조합으로 판단된다.

사사

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PART III

화학/분석

P3-01

한국에서 유통되는 화학식품의 잔류농약 함량 분석

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경기도보건환경연구원

본 연구에서는 국내 유통되는 벌화분 제품의 잔류농약 함량을 조사하기 위해 61건의 벌화분 제품을 수거하여 339종의 잔류농약 분석을 진행하였다. 분석결과 벌화분 검체의 34%(LOQ)에서 잔류농약이 검출되었다. 국내산 및 수입산 검체에서 잔류농약 검출률은 각각 31%, 44%로 수입산 검체에서 잔류농약 검출률이 높은 것으로 확인되었다. 오프라인 및 온라인으로 수거한 벌화분 검체의 경우 잔류농약 검출률은 각각 27%, 60%로 온라인 수거 검체의 잔류농약 검출률이 높게 나타났다. 총 15종의 잔류농약이 검출되었고, Pendimethalin(7건), Chlorfenvinphos(6건), Chlorpyrifos(3건), Fluazinam(2건) 순으로 많이 검출되었다. 검출된 농약 중 Chlorfenvinphos는 미국, 유럽, 국내에서 식용작물에 사용 금지된 농약임에도 불구하고 벌화분에서는 검출되는 것을 확인하였다. 따라서 지속적인 벌화분 잔류농약 모니터링을 통한 안전성 조사 및 허용 기준 검토가 필요할 것으로 보인다.

P3-02

대파 조리 과정 중 boscalid의 잔류량 변화

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본 연구는 대파를 볶기, 삶기 및 굽기 조리 과정 중 boscalid의 잔류량 변화를 비교하기 위해 수행하였다. 대파는 boscalid 농약(49.3%, WG)을 1.971 kg a.i./ha 비율로 수확 14일 전 3회 살포하여 수확하였다. 수확한 대파는 뿌리 및 겉껍질을 제거하여 세척한 뒤 가공하였다. 볶기의 경우 파를 8 mm로 절단하여 30초, 1, 3 및 5분간 가열하였다. 삶기의 경우 대파 길이를 8 mm와 5 cm로 달리하여 절단한 뒤, 8 mm 절단 대파는 1, 3, 5, 7 및 10분간 가열하였고 5 cm 절단 대파는 5, 10, 15 및 20분간 삶아주었다. 굽기의 경우 5 cm로 절단한 대파를 오븐 온도 180℃로 5, 10, 15 및 20분으로 구워주었다. 시료 중 boscalid의 잔류량은 LC-MS/MS를 이용하여 분석하였다. 대파 및 조리 가공품 중 boscalid의 정량한계는 0.01 mg/kg이었으며, 정량한계, 정량한계 10배 및 정량한계 50배 농도 수준으로 회수율 시험한 결과, 대파 95.0—99.1% 볶은 대파 97.9—104.6%, 삶은 대파 94.5—99.9%, 구운 대파 100.3—104.7%로 나타났다. 대파 중 boscalid의 초기 잔류량은 2.60 mg/kg이었으며, 볶은 대파 중 농약의 잔류량은 1.81—2.29 mg/kg이었다. 삶기의 경우 8 mm 절단 대파는 가공 후 잔류량이 0.49—0.88 mg/kg이었으며, 5 cm로 절단 대파는 가공 후 0.23—0.58 mg/kg의 잔류량을 나타내었다.



구운 대과 중 농약의 잔류량은 각각 3.14—3.64 mg/kg이었다. 볶기와 굽기의 경우 가열 시간이 증가할수록 잔류량이 높아지는 경향을 나타냈으며, 이는 가열에 의해 대과의 수분함량이 감소하여 잔류량이 증가한 것으로 판단된다. 삶기의 경우 가열 시간이 증가할수록 잔류량이 감소되었으며, 삶는 과정에서 열에 의해 분해되어 감소된 것으로 판단된다.

P3-03

유통 중인 디카페인 음료류의 카페인 함량 조사 연구

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경기도에서 유통되고 있는 디카페인 음료류 총 113건을 수거하여 카페인 함량을 조사하였다. 카페인은 HPLC-PDA(High performance liquid chromatography-photodiode array detector)를 이용하여 분석하였다. 카페에서 판매하는 커피음료는 평균 18,590 mg/L 농도를 나타내었으며, 354 mL 한 잔을 기준으로 약 6.20 mg 카페인이 함유되어 있었다. 원두, 드립백, 캡슐 제품을 포함한 볶은 커피는 평균 0.439 mg/g 카페인이 검출되었고, 인스턴트 커피와 조제커피는 각각 평균 1.481 mg/g, 0.114 mg/g 카페인이 검출되었다. 액상커피의 평균 농도는 46.739 mg/L였고, 고카페인 표시가 없는 콜드브루 커피 1건에서 고카페인 표시기준인 0.15 mg/mL를 초과하여 검출되었다. 침출차와 고행차는 각각 평균 0.941 mg/g, 0.083 mg/g 카페인이 검출되었고, 액상차와 혼합음료는 각각 평균 3,773 mg/L, 2,222 mg/L 농도를 보였으며 탄산음료는 카페인이 검출되지 않았다. 2건을 제외하고 모든 디카페인 음료에서 카페인이 검출되었으나, 일반 음료류에 비해 약 90% 이상 낮은 함량 수준을 보였다.

P3-04

식용곤충과 현미를 이용한 동충하초(*Cordyceps militaris*)의 이화학적 특성 비교

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동충하초(*Cordyceps militaris*)는 자낭균류 맥각균목 동충하초과로 곤충에 기생하여 기주의 영양분을 이용하여 자실체를 형성하는 버섯의 한 종류로 *Cordyceps* 속은 300여 종으로 국내에는 약 80여종이 분포되어있다. 동충하초의 효능으로는 면역증강활성, 항암활성, 항바이러스효과 및 항염증 효과 등 다양한 생리활성이 보고됨에 따라 그 이용 가능성이 증대되고 있다. 본 연구에서는 신규 식품 소재로서 식용 곤충의 다양한 영양원 및 기능성 등의 사실에 주목하고 동충하초의 배양조건을 탐색하기 위하여 현미와 식용곤충 8종(슈퍼밀웜, 밀웜, 누에, 메뚜기, 쌍별귀뚜라미, 누에번데기, 흰점박이꽃무지 유충, 장수풍뎅이 유충)을 각각 혼합한 배지를 사용해 동충하초를 배양하여 이화학적 특성 및 항산화 활성을 비

교하였다. 조단백질 함량은 대조구(*Cordyceps militaris* using brown rice) 대비 CB_BM(*Bombyx mori*, 누에)에서 약 12% 높은 함량을 보였다. 또한 유기산 함량은 CB_GB(*Gryllus bimaculatus*, 쌍별귀뚜라미)에서 succinic acid가 6.29 mg/100 g으로 높은 함량을 보였다. Total polyphenol 함량은 CB_ZM(*Zophobas morio*, 슈퍼밀웜)에서 8.57 mg/g, Total flavonoid 함량은 CB_GB에서 0.88 mg/g으로 시료구 중 높은 함량을 나타내었다. 또한 DPPH free radical scavenging activity, ABTS radical cation scavenging ctivity 및 Superoxide dismutase-like activity은 CB_BP(*Bombyx mori* pupa, 누에 번데기)에서 각각 71.81%, 52.86% 및 51.44%로 나타났다.

P3-05

Analytical method development and monitoring in instant noodles of ethylene oxide and its metabolite 2-Chloroethanol by the QuOil or the QuEChERS method and GC-MS/MS

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oxide is one of the most widely produced chemicals worldwide. It is mainly used as a chemical intermediate in the manufacture of numerous important chemicals such as mono-, di-, tri- and polyethylene glycols as well as various ethanol-amines and glycol-ethers. Two methods, one based on QuEChERS and one on QuOil, are presented allowing the simultaneous analysis of ethylene oxide (EO) and its reaction product 2-chloroethanol (2-CE) in instant noodles. Following a standard dSPE cleanup the samples are measured by GC-MS/MS. Direct GC-analysis of the QuEChERS or QuOil extracts, can be problematic due to the large expansion volume of acetonitrile and the negative impact of acetonitrile and the residual water contained in extracts to the column and the filaments. A way out is split-injection and in the case of PTV-injectors, the evaporation of the solvent in the liner by a gentle nitrogen stream. Results of recovery experiments using QuOil or QuEChERS ranged from 92.4 to 101.8 % and the relative standard deviations ranged 3.3 % ~ 5.4 %. Limit of detections (LODs) ranged 1.55 ~ 6.33 µg/kg and limit of quantifications (LOQs) ranged 4.93 ~ 20.14 µg/kg for EO and 2-CE. The development method turned out to be suitable for legal regulation. Also, as a result of monitoring, EO(SUM) was not detected in 329 samples (Instant noodles).



P3-06

Variations on phytochemical component and antioxidant activities by season and plant parts in *Daphne jejudensis*

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Daphne species have been used as folk medicines as anti-rheumatism, wound healing, anti-inflammatory, anti-cancer, anti-carcinogenic, anti-diabetic, and anti-aging effects. On our exploration towards developing useful plant sources in Jeju island, we found anti-inflammatory potential in the leaf of *Daphne jejudensis*. In this study, we compared the antioxidant efficacy of each plant part and seasonal differences on the ingredients in *D. jejudensis*. The antioxidant effects were the highest in flowers, followed by flower buds, roots, leaves, and in branches. In the comparison on the collection time, the leaf in May (spring season) showed the highest amount of daphnin ($636.88 \pm 2.33 \mu\text{g/g}$ Dried weight) followed by summer, fall and winter. With these findings, we can figure out the responsible metabolites for the biological effects in *D. jejudensis*, and new pharmaceutical interventions can be designed in the future regarding this material.

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P3-07

유전자 종판별 기술을 이용한 식품접객업소조리식품의 수산물 원재료 진위판별 모니터링

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식품접객업소에서 판매하는 참치회 32개, 참치초밥 25개, 곁들임 튀김류 4개, 회덮밥 9개 시료를 대상으로 DNA 바코드(barcode) 종판별 분석을 실시하였다. 종판별을 위한 마커 유전자는 미토콘드리아의 16S ribosomal RNA 및 cytochrome c oxidase subunit I 를 선택하였다. 모니터링 결과, 참치회 총 32개 중 참다랑어류로 확인된 시료는 11개였으며, 다랑어류는 13개로 확인되었다. 새치류로 분류된 제품은 8개로 전체 참치회 중 25%를 차지하였다. 참치초밥 25개 중 참다랑어류로 확인된 시료는 12개였으며, 다랑어류는 6개로 확인되었다. 새치류로 분류된 제품은 7개로 전체 참치초밥 중 새치류는 28%였다. 곁들임 튀김류는 참치튀김, 왕새우튀김, 새우튀김, 왕게다리튀김 등 4개를 대상으로 하였다.

이중 왕게다리 튀김에서만 원재료가 아닌 아메리카 대왕오징어(*Dosidicus gigas*)가 확인되어, 유일하게 제품명과 원재료명이 불일치하였다. 회덮밥의 경우 9개 시료의 분석결과 총 8종의 각 기 다른 어종이 확인되었다.

P3-08

개정향플 추출물의 생리활성

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경기도산림환경연구소

개정향플은 용담목 협죽도과의 여러해살이풀로 한국에는 약 10곳의 자생지가 알려져 있는 희귀식물이다. 개정향플의 기능성화장품 원료로서의 가능성 및 적합한 추출 용매를 확인하기 위하여 열수와 70% 에탄올로 추출한 후 항산화 및 tyrosinase, elastase 저해 활성을 측정하였다. 총폴리페놀 함량 측정 결과 개정향플 열수 추출물과 에탄올 추출물은 각각 51.12 mg/g GAE, 93.38 mg/g GAE의 폴리페놀 함량을 나타내었다. 항산화 활성 측정 결과 개정향플 추출물은 농도가 증가함에 따라 항산화 활성 또한 증가하였으며, 에탄올 추출물은 vitamin C와 비슷한 활성을 나타낸 반면 열수 추출물은 그보다 낮은 활성을 나타내었다. Tyrosinase 저해활성 측정 결과 개정향플 에탄올 추출물은 대조구의 절반, 열수 추출물은 1/3 정도의 저해활성을 나타내었으며, elastase 저해활성 측정 결과 에탄올 추출물은 약 30%의 활성을 나타낸 반면 열수 추출물은 활성이 거의 없었다. 이를 종합하였을 때 기능성 화장품 원료로서 사용 하기에는 에탄올 추출물이 더 적합한 것으로 판단된다.

P3-09

Androgen receptor-mediated endocrine disrupting potential of environmental phenolic compounds in food and house products

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We are exposed to various harmful chemicals daily, some designated endocrine disruptors by the United Nations and some through household products and food. In-vitro methods for testing endocrine disruptors recommended by the OECD have limitations that do not reflect metabolism in the body. Therefore, we aimed to measure the endocrine-disrupting activity of the substances through the androgen receptor transcriptional activity test by co-applying S9 liver fraction extract, which can mimic the metabolic process. The three phenolic compounds (4-(1,1,3,3-tetramethylbutyl)phenol, 4-Heptylphenol, p-(1,1-



dimethylpropyl) phenol) of the metabolites for androgenic activities showed that all test substances did not differ in agonistic activities from Phase I and Phase I+II metabolism. Whereas, all test substances decreased FI (fold induction) in AR antagonistic activities from Phase I and Phase I+II metabolism. Based on this study, it is expected that it can be used as basic data for establishing an activity prediction system for the safety management of the endocrine system of food, drug, and cosmetic ingredients and for drafting in vitro OECD test guideline added metabolizing system through sharing the results with OECD. This research was supported by a grant (21162MFDS078 and 21153MFDS605) from Ministry of Food and Drug Safety in 2023.

P3-10

송이토마토의 과피색에 따른 품질 특성 비교

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송이토마토의 과피색(레드, 핑크, 브라운, 옐로우 그리고 오렌지)에 따른 품질 특성 비교를 위하여 동일한 재배조건에서 생육된 5가지 품종을 적숙기에 수확하여 CIE L*a*b*, 유리당, 유기산, lycopene 그리고 β -crotene을 측정하였다. CIE a* 측정결과 레드 품종이 가장 높게 나타났고, 옐로우 품종이 가장 낮게 나타났다. 반면 CIE b*값은 옐로우 품종이 가장 높게 나타났고 핑크 품종이 가장 낮게 나타났다. 유리당 분석 결과 브라운과 옐로우 품종이 다른 품종에 비하여 fructose는 약 11%, glucose는 약 8% 높게 나타났다. 유기산 분석에서는 citric acid, lactic acid, malic acid, 그리고 oxalic acid가 측정되었으며, 토마토의 주요 유기산인 citric acid는 모든 품종에서 약 20-23 mg/g DM으로 품종에 따른 차이는 보이지 않았다. Lycopene 분석 결과 오렌지와 옐로우 품종에서는 lycopene이 검출되지 않았으며, 레드 품종에서 54.12 ± 2.49 mg/g DM로 다른 품종에 비하여 약 1.68배 높게 측정되었다. 브라운과 핑크 품종의 lycopene 함량은 각각 31.91 ± 5.32 mg/g DM와 33.95 ± 2.27 mg/g DM로 유사하게 나타났다. β -crotene 분석 결과 모든 품종에서 측정되었으며, 브라운 품종이 25.94 ± 3.12 mg/g DM로 가장 높았으며, 핑크과 레드 품종이 약 22-23 mg/g DM을 나타냈다. 반면 오렌지와 옐로우 품종의 β -crotene 함량은 각각 6.09 ± 0.86 mg/g DM과 9.36 ± 0.49 mg/g DM로 붉은색을 띠는 다른 품종에 비하여 약 2-3배가량 낮게 나타났다. 본 실험의 결과 송이토마토의 과피색에 따른 유기산과 유리당의 차이는 크지 않으나, carotenoid 계열인 lycopene과 β -crotene은 붉은 계열인 레드, 브라운, 그리고 핑크 품종의 송이토마토가 황색 계열인 옐로우와 오렌지 품종의 송이토마토보다 높은 것을 확인할 수 있었다.

P3-11

재배방법에 따른 병풀의 기능성분 및 대사체 변화

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병풀은 상처치료와 피부질환 개선, 뇌신경 기능 향상, 항당뇨, 심혈관 질환 및 위점막 개선 등 생리활성 효과가 뛰어나 의약품과 화장품 소재로 활용되는 기능성 작물이나 대부분 수입에 의존하고 있다. 최근에 충주 지역을 중심으로 국내 병풀 재배가 이루어지고 있으나 재배면적은 미비한 실정이다. 병풀 재배 환경적 요인인 온도, 습도, 통풍, 일조량 조절과 안정적 원료 공급을 위해서는 시설재배가 필수이다. 이에 국립농업과학원에서는 국산 병풀의 생산 효율성을 높이고 시설재배 환경 개선을 위한 스마트팜 환경제어 시스템을 구축하였다. 본 연구에서는 기존 토경 재배와 개발한 수경재배 시스템에서 생산한 병풀의 기능성분과 대사체 변화를 구명하여 아직 활용도가 낮은 식품소재화를 위한 기초자료를 삼고자 하였다. 토경재배와 수경재배 병풀의 대사물질을 UPLC-Q-TOF MS(ESI-negative mode)로 분석한 그 결과, 12개 대사산물을 확인하였고 PLS-DA score 플롯에서 병풀은 재배방법(토경, 수경)별로 클러스터를 형성하였으며, 이는 재배환경이 대사물질의 변화에 영향을 준 것으로 판단된다. 병풀의 기능성분으로 알려진 madecassoside, asiaticoside, madecassic acid, asiatic acid의 정량 분석 결과, madecassoside는 토경과 수경재배에 따른 유의적 차이가 없었으나 asiaticoside는 토경재배 병풀이 수경재배 병풀 보다 높은 함량을 보인 반면에 madecassic acid는 반대의 경향을 보였다. 병풀의 의약품과 의약외품 분류는 madecassoside 함량(1% 이상, 미만)으로 하고 있어 연중 생산이 가능하고 수확후 전처리 공정 생략 등 생산성 향상 측면을 고려한다면 수경재배 병풀의 가치는 충분하다고 판단된다.

P3-12

홍삼 부위별 초분광영상을 이용한 등급 판별

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홍삼의 등급은 육안검사로 내외부 품질을 확인하여 1등급(천삼), 2등급(지삼), 3등급(양삼), 등외로 판별하며, 육안검사는 검사관의 숙련도 차이로 인한 등급 판별의 오차가 발생할 수 있다. 초분광영상 기술은 비파괴 분석 방법으로 물체의 외부뿐만 아닌 내부 품질도 시각화하여 분석할 수 있다. 그러나 홍삼은 몸통, 다리 등의 부위별 내부 정보가 달라 초분광영상을 활용한 등급 판별에 높은 정확도를 얻는 것에 어려움이 따른다. 본 연구는 홍삼 부위별 초분광영상을 통하여 홍삼 등급 판별에 최적의 부위를 확인하고자 하였다. 인삼산업법에 따라 분류된 천삼 50개, 지삼 34개, 양삼 40개, 등외 70개의 초분광영상 데이터에 region of interest(ROI)를 구하여 전체, 몸통, 다리로 구분하였고 파장 평균 데이터(Raw)를 획득하였다. Raw에 전처리 방법인 multiplicative scatter correction(MSC), standard normal variate(SNV), 2차



미분, min-max normalize(MMN)를 적용한 데이터들과 전처리하지 않은 Raw의 등급 판별 정확도를 측정하였다. 모든 전처리 방법에서 몸통의 정확도가 가장 높았으며 전체, 다리 순으로 높은 정확도를 나타냈다. 몸통 기준 Raw, 2차 미분, MMN, MSC, SNV 순으로 높은 정확도를 보였다. Raw의 정확도는 몸통 81.57%, 전체 76.31%, 다리 68.42%를 보였으며, 가장 낮은 정확도를 보인 SNV는 몸통 76.31%, 전체 68.42%, 다리 63.15%이었다. 전처리한 파장 평균 데이터의 낮은 정확도는 전처리 전 ROI를 통하여 한 점의 파장만이 아닌 관심 영역 파장의 평균값을 도출하였기 때문에 잡음 처리를 위한 전처리는 정확도에 악영향을 미치는 것으로 판단된다. 결론적으로 초분광영상 기술로 홍삼의 등급을 판별할 때 몸통의 파장 평균 데이터를 사용하면 높은 정확도를 도출할 것으로 사료된다.

P3-13

Chemical and biological profiles of dendrobium in two different species on LC-QToF MS and cytotoxicity analysis

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The Dendrobium species (Orchidaceae) has been cultivated as an ornamental plant as well as used in traditional medicines. In this study, the chemical profiles of Dendrobii Herba, used as herbal medicine, Dendrobium in two different species, their hybrid, and the gamma-irradiated mutant lines of the hybrid, were systematically investigated via ultra-performance liquid chromatography coupled with quadrupole time-of-flight mass spectrometry (UPLC-QToF MS). Among the numerous peaks detected, 17 peaks were unambiguously identified. Gigantol (1), (1R,2R)-1,7-hydroxy-2,8-methoxy-2,3-dihydrophenanthrene-4(1H)-one (2), tristin (3), (-)-syringaresinol (4), lusianthridin (5), 2,7-dihydroxyphenanthrene-1,4-dione (6), densiflorol B (7), denthyrsinin (8), moscatilin (9), lusianthridin dimer (10), batatasin III (11), ephemeranhol A (12), thunalbene (13), dehydroorchinol (14), dendrobine (15), shihunine (16), and 1,5,7-trimethoxy-2-phenanthrenol (17), were detected in Dendrobii Herba, while 1, 2, and 16 were detected in *D. candidum*, 1, 11, and 16 in *D. nobile*, and 1, 2, and 16 in the hybrid, *D. nobile* × *candidum*. The methanol extract taken of them was also examined for cytotoxicity against FaDu human hypopharynx squamous carcinoma cells, where Dendrobii Herba showed the greatest cytotoxicity. In the untargeted metabolite analysis of 436 mutant lines of the hybrid, using UPLC-QToF MS and cytotoxicity measurements combined with multivariate analysis, two tentative flavonoids (M1 and M2) were evaluated as key markers among the analyzed metabolites, contributing to the distinction between active and inactive mutant lines.

P3-14

Structural determination of cyanidin 3-O-(2-O-xylosyl)galactoside in fruits of *Eleutherococcus sessiliflorus*

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Eleutherococcus sessiliflorus is widely distributed in Korea, China and Japan and the Russia and consumed as vegetables, herbs, and foods. This plant contains valuable bioactive compounds such as eleutherosides, phenolic acids, flavonoids, anthocyanins, and triterpenoids. *E. sessiliflorus* has been reported to exert several biological effects, including antioxidant, lipid absorption decreasing, immunomodulatory, anti-rheumatic and anti-inflammatory activities. In our preliminary experiments, main anthocyanins (cyanidin glycosides and delphinidin glycosides) were found in fruits of *E. sessiliflorus* by LC-ESI-QTOF-MS analyses. However, studies on accurate structure of anthocyanins in the fruits are required. In this study, we isolated and identified anthocyanins from the fruits of *E. sessiliflorus*. The 70% methanol extracts of the fruits were solvent-fractionated to obtain water-saturated n-butanol (BuOH) fraction containing anthocyanins. LC-MS results indicated that cyanidin xylosylgalactoside was found to be main compound in the BuOH fraction. The BuOH fraction were fractionated by column chromatographies of ODS and silica gel to obtain one anthocyanin and two chlorogenic acid derivatives. The isolated anthocyanin was elucidated as cyanidin-3-O-(2-O-xylosyl)galactoside based on MS and 1D- and 2D- NMR experiments.

P3-15

Development of an analytical method for the determination of benzotriazole UV stabilizers in food

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Benzotriazole ultraviolet stabilizers (BUVS) are chemical substances that are widely used as defense against the damaging effects of radiations coming from the sun. These absorbers, despite their significance, are categorized as emerging pollutants



since they have been demonstrated to be mutagenic, toxic, pseudo-persistent, bio-accumulative, and to have strong estrogenic effects. Due to their continued use in personal care products, they nevertheless continue to enter the environment. Several food samples, particularly those derived from aquatic sources, have also demonstrated their presence. In addition, the degree of exposure to these pollutants in foods should be examined because there are certain risks associated with human consumption. This study therefore focuses on the development of a new, straightforward and affordable analytical approach to extract them from different food matrices, clean them using EZPOP cartridge and determine the BUVS using gas chromatography coupled with mass spectrometry. The method was validated in different kinds of food and performance parameters such as LOD, LOQ, accuracy, precision and linearity were determined.

P3-16

Development and validation of analytical method for determination of polycyclic aromatic hydrocarbons in livestock products

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Polycyclic aromatic hydrocarbons(PAHs) are organic compounds in which two or more benzene rings are linearly angled or densely formed. Fused benzene rings arranged in various configurations. PAHs are well known as carcinogens, mutagens, and teratogens and therefore pose a serious threat to the health and the well-being of humans. As a result, PAHs may be present in food, air, soil, water, and may be contaminated with the human body through food cooking and processing processes. This study was analyzed using GC-MS, and the analysis method validation was conducted using livestock products as matrix. Fresh cream, chicken breast, duck, yogurt were used as representative food matrix. Method validation is performed by obtaining LOD, LOQ, Accuracy, Precision, Linearity. LOD/LOQ values of the sample were 0.01 to 0.84, the accuracy was ranged from 90.6 to 105.4%, and the precision was less than 4%

P3-17

Development of analytical method for the determination of trichlorobenzenes (TCBs) in foodHye-Gyeong Lee*, Jun-Hyeong Park, Jung-a Lee, Hong-Jo Park,
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Trichlorobenzenes(TCBs) are isomeric organic compounds in which three chlorine substituents are bonded to one benzene ring. These compounds can be produced unintentionally by combustion of organic materials in the presence of chlorine and can be released into the environment through their production and use as solvents, dyes and chemical intermediates. As the use of chemical substances continues to increase, environmental emissions also increase, which can lead to the aggregation of TCBs in organisms by their transfer through foods. Since TCBs are known to be toxic when exposed to humans, food safety management is very important. In this study, performance parameters were obtained to develop an analytical method using GC-MS for the measurement of TCBs in food. Representative foods include apple, boiled egg and clam. Samples have LOD/LOQ values ranging from 0.07 to 0.43 ppb, accuracy ranging from 83.5 to 114.9%, and precision less than 11.5%.

P3-18

Development of analysis method for pentachlorothiophenol (PCTP) in food using GC-MSJun-Hyeong Park*, Hye-Gyeong Lee, Jung-a Lee, Hong-Jo Park,
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Pentachlorothiophenol(PCTP) is an organic compound in which five chlorine substituents and one thiol group are bonded to a benzene ring. It is mainly used as a plasticizer for rubber products, and can be unintentionally produced by incineration. Its use has been discontinued in industries because its degradation products are teratogenic. It is categorized as PBT and vPvB in Europe, and research on it has only recently started, therefore there aren't many findings yet. Consequently, research and safety management on PCTP are currently required. In this study, an analytical method was developed using ultrasonic extraction, SPE cartridge for clean-up and GC-MS for the determination of PCTP. Method validation was carried out using three representative foods including apple, egg, and clam, and the performance parameters were obtained. The accuracy ranged from 94.0 to 115.7%, while the precision value was less than 15.2%. The LOD and LOQ values were between 2.28 and 2.66.



P3-19

마른김 아임계추출물의 LC-MS 기반 대사체 분석 및 항산화 활성

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김 (*Pyropia* spp.)은 홍조류에 속하는 대표적인 해조류로, 다당류, 단백질, 무기질, 비타민, mycosporine-like amino acid류(MAA), 그리고 고도불포화지방산 등의 유용성분을 함유하고 있다. MAA류에 속하는 porphyra-334는 고온에서 가열에 의해 dehydrated porphyra-334로 전환되고, 이 화합물은 porphyra-334에 비해 강한 항산화 활성을 발휘한다고 보고된 바 있다. 그래서, 본 연구에서는 마른김을 아임계추출 시 다양한 MAA류가 dehydrated MAA류로 전환 여부를 대사체 분석을 통해 확인하고 항산화 활성을 평가하였다. 두 마른김 품종(방사무늬김과 잇바디돌김)의 아임계추출물과 열수추출물을 대상으로 UPLC-ESI-QTOF-MS를 이용하여 대사체 분석을 실시하였다. 그 결과, 마른김 아임계추출물에서는 6종의 MAA류와 5종의 dehydrated MAA류를 포함한 총 37종의 화합물이 검출되었다. 마른김 품종뿐만 아니라 아임계추출물과 열수추출물 간에 확연하게 구별됨을 PCA 분석을 통해 확인되었다. 특히 마른김 열수추출물에는 MAA류가, 그리고 아임계추출물에는 dehydrated MAA류가 높은 함량이었다. 또한, 아임계추출물이 열수추출물에 비해 높은 ABTS+ radical-scavenging 활성과 철환원력을 나타냈으나 두 품종 간 항산화 활성은 확연한 차이를 나타내지 않았다. 아임계추출물에 존재하고 있는 대부분의 dehydrated MAA류는 항산화 활성과 높은 Pearson 상관관계(>0.9)를 나타내었다.

P3-20

Image analysis of Kimchi cabbage penetrated with brine and seasoning using a serial block face scanning electron microscope and energy dispersive X-ray spectroscopy

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Changes in the shape and composition of Kimchi cabbage cells by brine and seasoning penetration were observed using Serial Block Face(SBF) SEM imaging and Energy Dispersive X-ray Spectroscopy(EDS). Raw kimchi cabbage(RKC), salted kimchi cabbage(SKC), unfermented kimchi(UKC), and fermented kimchi(FKC) were prepared as samples. Due to the osmotic pressure caused by salt, the cell size of SKC and FKC was reduced compared to that of RKC and transformed into a thin and elongated rectangular shape. In addition, the volume rendering protocol of SBF-SEM equipped with an ultramicrotome successfully provided a 3D representation of kimchi cabbage tissue shape. As a result of EDS analysis,

SKC contained the most Na, Mg, S, Cl, K, and Ca, which are the mineral components of salt, and low concentrations of C element and high concentrations of Na and Cl were found in the cell walls of FKC. The decrease in the concentration of element O was due to the leakage of water and air into the brine as the cells were exposed to brine and seasoning with high salt concentration. It seems that the C element was reduced as pectin present in the cell wall was leaked out due to tissue softening that occurred during the fermentation. This study contributed to acquiring basic data on the internal changes and material transfer in kimchi cabbage during the kimchi manufacturing process by expanding the application of SBF-SEM and EDS to agricultural products.

P3-21

A comparative study of cell wall soluble polysaccharide between Brewer's spent yeast and yeast strains on sugar composition and antioxidant enzyme activities

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Yeast, which plays an important role in beer production, would be promising by-product resources that recovered as brewer's spent yeast with physiologically beneficial effects. In this study, we compared the water-soluble polysaccharide composite properties, and antioxidant enzyme activity of brewer's spent yeast and the widely used yeast strains (*Saccharomyces cerevisiae* and *S. boulardii*). The alkali-extracted water-soluble polysaccharide content from the cell walls was 553.52, 591.56, and 641.90 $\mu\text{g}/\text{mg}$, in the order of *S. cerevisiae*, *S. boulardii*, and brewer's spent yeast. In the case of cell wall soluble polysaccharide of brewer's spent yeast through alkali extraction, it was found to have a more soluble glucose form than *S. cerevisiae* and *S. boulardii* with 49.3% mannan and 20.1% β -glucan. Also, GPC, $^1\text{H-NMR}$, and FT-IR were analyzed to confirm molecular weight distribution, intermolecular bonding format. Antioxidant enzyme activity was measured using antioxidant enzymes such as superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPX). It was found that brewer's spent yeast is rich in all antioxidants, suppresses oxidative stress, and can be used as a bioactive substance to prevent and suppress aging in the future. Therefore, based on the results of this study, it is expected that the water-soluble polysaccharide extracted from the cell wall of spent yeast, a by-product of the beer production process, can be used as an excellent functional raw material.



P3-22

황해쑥(Artemisia argyi)의 추출 조건에 따른 항산화활성 및 대사체 분석

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지역특화작목인 황해쑥(Artemisia argyi) 2품종(ACS, ACP)에 대한 다양한 추출조건별 항산화 활성 및 대사체 분석을 실시하였다. 총 폴리페놀 함량은 50% 주정, 70℃의 추출조건에서 가장 높은 함량을 나타내었으며, 품종별로 비교시 ACP가 45.7 mg/g로 ACS 31.3 mg/g보다 높았다. DPPH 및 ABTS 라디칼 소거활성 역시 50% 주정, 70℃ 추출물에서 높은 활성을 나타내었다. UPLC-Q-TOF MS positive mode를 이용하여 황해쑥 품종별, 추출조건별 대사물질을 PLS-DA score plots을 시각화한 결과, 모든 추출 조건에서 그룹별 차이가 있는 것으로 확인되었다. 17개의 주요 대사물질을 동정하였으며 이들 물질들의 상대적 함량을 비교한 결과 chlorogenic acid, chlorogenic acid dimer, apiin인 경우 추출 온도와 시간의 증가에 따라 감소되는 반면 나머지 물질들은 증가하는 경향을 보였다. 그러나 주정농도 90%, 90℃의 조건에서는 다른 온도나 농도에 비해 대체적으로 감소되는 경향을 보여 낮은 추출효율을 나타내었다. 50℃와 70℃인 경우 매우 유사한 경향을 보였지만 일부 대사물질에서 다소 높은 추출효율을 보여 최적 추출온도는 70℃인 것으로 확인하였다. 주정 농도의 경우 총 폴리페놀 및 항산화활성은 50% 조건에서 높았지만 주요 대사물질은 일부 70% 조건에서 높은 함량을 보여 50~70% 농도에서 용도에 맞는 조건 설정이 필요할 것으로 보였다. 본 연구의 결과는 황해쑥 기능성 소재 개발의 기초자료로 활용될 수 있을 것으로 판단된다.

P3-23

초분광 영상을 이용한 비파괴적 젤라틴 젤 농도 분류

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젤라틴은 젤리 등의 제조에 널리 사용되는 단백질계 겔화제이다. 일반적인 젤라틴 농도 측정 시험법은 가열 및 용해 과정이 필요하여 비파괴적 측정이 제한적이다. 초분광 영상은 시료의 정보를 얻기 위해 스펙트럼과 이미지를 조합한 기술로 최근 비파괴적 식품 판별 및 분석기술 개발에 활용되고 있다. 본 연구의 목적은 초분광 영상을 기반으로 젤라틴 농도 분류 가능성을 평가하는 것이다. 시판 돈피 젤라틴을 12%(w/v), 18%, 24% 및 30% 농도로 60℃에서 완전히 용해하고, 4℃에서 24시간 보관하여 젤라틴 겔을 형성하였다. 초분광 영상은 VNIR카메라(470-900nm, 해상도 2048×2048)에 조리개가 F2.0 렌즈(초점거리 24mm)를 부착하여 측정하였다. 분광 데이터는 HSI Studio와 ENVI(Essential Visual Information) 소프트웨어로 분석하였다. 470nm 파장에서 가장 낮은 흡광도와 700nm에서 가장 높은 흡

광도가 관찰되었고, 소프트웨어의 파장대별 흡광도는 유사하였다. SAM(Spectral Angle Mapper) 기법으로 픽셀을 분류한 결과는 일부 불균일성을 나타내었으나, 추후 초분광 영상 측정 조건 개선 및 정밀한 알고리즘 개발을 통한 젤라틴 젤의 비파괴적 농도 분류가 가능함을 확인하였다.

이 성과는 정부(과학기술정보통신부)의 재원으로 한국연구재단의 지원을 받아 수행된 연구임(No. RS-2023-00253726).

P3-24

Development and validation of an analytical method for determining per- and polyfluoroalkyl substances in agricultural products using LC-MS/MS

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Per- and Polyfluoroalkyl substances (PFAS) is the generic term for a vast group of fluorinated compounds, including oligomers and polymers. PFAS are an contaminant group with food safety concerns because of persistence and long-range transport in the environment, and the potential for accumulation in humans and long-term adverse health effects. Dietary intake through migration or uptake into foods is expected to be a significant contributor to exposure to PFAS. Accordingly, we tried to establish a method for the simultaneous analysis of as many types of PFAS as possible. In this study, we developed pretreatment methods and instrumental analysis conditions for 24 PFAS in agricultural products by applying LC-MS/MS and isotope dilution. Extraction and purification were performed according to QuEChERS method and d-SPE method, respectively. The developed method was validated in accordance with CODEX procedural manual. The calibration curves of all analytes were linear with correlation coefficients higher than 0.997 in the range level 0.25 – 100 ng/mL. Rice and apples were selected as representative matrix of agricultural products, and the limits of detection (LOD) and limits of quantification (LOQ) were obtained, respectively. The accuracy and precision of each representative matrix satisfied the CODEX guidelines.



P3-25

Development and validation of per- and polyfluoroalkyl substances (PFASs) analytical method in aquatic products

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Per- and polyfluoroalkyl substances (PFASs) are collectively referred to as a broad group of fluorinated substances, including oligomers and polymers. PFASs are also bioaccumulative and having toxic effect to human health. Therefore, it is necessary to measure the exact contents of PFASs through the diet of food for food safety management. In this study, an analytical method for measuring 24 PFASs species in aquatic products was developed and optimized using liquid chromatography/tandem mass spectrometry (LC-MS/MS). As methods, the QuEChERS system for extraction, dSPE and wax cartridge method for purification, and LC-MS/MS for instrumental analysis were adopted. According to the guideline of CODEX, the validation of developed method of PFASs in aquatic products was carried out. As a result, the limit of detection (LOD) and limit of quantification (LOQ) were obtained from mackerel, a representative matrix of fish, and squid, a representative matrix of invertebrates, according to classification by type in aquatic products. The observed deterministic coefficient (R^2) of 0.999 in the range of 0.25–100 ng/mL for 24 PFASs confirmed the linearity of the technique. The accuracy and precision of each representative matrix satisfied the CODEX guideline standards. In addition, it participated in the FAPAS Food Chemistry Proficiency Test, an international comparative proficiency, and showed the Z -score value in compliance with the results of four perfluorinated substances, PFOA, PFNA, PFHxS, and PFOS. This method is considered fit-for-purpose in the measurement of PFASs in food matrices such as aquatic products.

P3-26

Pre-gelatinized rice improves rheological properties and 3D printability of mealworm powder

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Edible insect present a sustainable protein source, but acceptance barriers exist due to their appearance. Food 3D printing, also known as additive manufacturing, enables the creation

of customized edible structure using specially prepared ink. However, incorporating unconventional ingredients like Mealworm (MW) into these inks poses challenges due to their unique texture and rheological properties. The objective of this study was to improve rheological properties and 3D printability of MW using pre-gelatinized rice (PR). Through the examination of rheological properties, texture profile measurement and 3D printing using various proportion of MW and PR mixtures, it was found that increasing of PR concentration results in increased yield and flow stress, while Tan delta decreases. These findings suggest that the inclusion of PR significantly improves the rheological properties and printability of MW powder. Notably the optimal formulation, comprising 20% MW, 20% PR and 60% water, demonstrate excellent 3D printability. This research underscore the potential of PR in modifying rheological properties and enhancing the 3D printability of MW powder.

P3-27

Development of multi-analytical method for alkenylbenzenes in food using GC-MS/MS

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It is increasing the possibility of exposure to alkenylbenzene, a plant toxin, due to climate change. In addition, alkenylbenzene-related research has been conducted such as European Union, but the research in Korea has rarely been done. Alkenylbenzene is a volatile substance having a benzene ring and is a secondary metabolite produced by external stress, which is not an essential element in plants. Several alkenylbenzenes, such as estragole and methyl eugenol, are known to be toxic, and the most relevant toxicological endpoints include genotoxicity and carcinogenicity. The European Commission prohibited the addition of pure estragole and methyl eugenol as a flavoring substance to food and established maximum levels for these substances when naturally present in corresponding ingredients in certain foodstuffs, such as dairy products, fish products, sauces, or non-alcoholic beverages. Accordingly, we developed a simultaneous analysis method using GC-MS/MS by optimizing pretreatment and instrumental analysis conditions for three alkenylbenzenes (myristicin, estragole, methyl eugenol) in food, and validation was carried out in accordance with CODEX procedural manual.



P3-28

꾸지뽕 열매의 단백질 가수분해 활성

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뽕나무과 나무뿌리의 식육 연화 효과는 규합총서 및 음식디미방에 기록되어 있고, 선행 연구에서 뽕나무과 열매 유래 단백질 가수분해효소(macluralisin)를 동정한 바 있다. 그러나 뽕나무과에 속하는 꾸지뽕 열매 유래 단백질 가수분해효소의 동정 및 활성에 관한 연구는 제한적이다. 따라서, 본 연구의 목적은 꾸지뽕 열매의 수용성 분획을 에탄올 처리한 단백질 침전물의 카제인 분해 활성을 평가하는 것이다. 꾸지뽕 (*Cudrania tricuspidata*) 열매는 2021년 11월 산청 지역에서 수확하여 동결건조하였다. 동결건조 분말은 0.1 M phosphate buffer(pH 6.6, 5mM EDTA)에 용해하였고, 수용성 분획 대비 에탄올(99%, v/v)을 각각 1:1, 1:2, 1:4, 1:6(v/v) 비율로 처리하였다. 원심분리하여 단백질 침전물을 분리한 뒤 단백질 정량, 전기영동 및 카제인 분해 활성을 측정하였다. 모든 처리구에서 유사한 단백질 분자량의 분포가 관찰되었고, 65kDa 부근 단백질 밴드는 macluralisin(63-65kDa)으로 추정되었다. 단백질 함량은 1:1 에탄올 처리구에서 가장 높았다($p < 0.05$). 반면 카제인 분해 활성 측정은 1:4 에탄올 처리구가 335.2 Ucas/mg으로 가장 높았고($p < 0.05$), 이는 상용 단백질 가수분해효소인 alcalase의 37% 수준이었다. 추후 식육 연화제로 활용하기 위한 효소 분리, 정제 및 동정이 필요하다고 판단된다.

본 과제(결과물)는 교육부와 한국연구재단의 재원으로 지원을 받아 수행된 3단계 산학연협력 선도대학 육성사업(LINC 3.0)의 연구결과입니다.

P3-29

Identification of taste-activity value (TAV) on the taste-active compounds in commercial Makgeolli

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This study derived the taste activity value (TAV) by reflecting the threshold value of the taste-active compounds in commercial Makgeolli. TAV is the ratio of the concentration of the taste-active compounds in commercial Makgeolli to its corresponding taste detection threshold. In order to calculate the TAV, the content of taste-active compounds was analyzed using liquid chromatography. Detection threshold values were measured following a three-alternative forced choice (3-AFC) in ASTM E679-91. The best estimate thresholds (BET) of glucose,

sucrose, aspartame, citric acid, lactic acid, and glutamic acid in the Makgeolli-based system were 12374.92, 6796.85, 28.07, 113.11, 27.71, and 419.72 mg/L, respectively. The TAV ranges of taste active compounds for 46 commercial Makgeolli were glucose 0.00–7.87, sucrose 0.00–3.63, aspartame 0.00–11.19, citric acid 0.00–1.16, lactic acid 0.30–17.93, and glutamic acid 0.43–19.42. Consequently, it indicates that glutamic acid, glucose, and lactic acid contributed significantly to the taste of commercial Makgeolli. The results from this study can be used to better understand the role of taste-active compounds in commercial Makgeolli.

P3–30

Qualitative and quantitative analysis of phospholipids in domestic citrus fruits and vegetables

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The phospholipids of citrus fruits(9 types), vegetables(4 types), and mushrooms(2 types) at fresh and/or processed(blanching, boiling, or baking) were qualified and qualified to establish a cognitive phospholipid database for domestic agricultural food resources. The n-acyl-phosphatidylethanolamine(NAPE), phosphatidylethanolamine(PE), phosphatidylcholine(PC), sphingomyelin(SM), phosphatidylserine(PS), phosphatidylinositol(PI), lyso-phosphatidylcholine(LPC) were qualified and the linearities were $R^2 > 0.99$. The major phospholipids of citrus fruits were PE(123~226mg/100g of freeze-dried) and PC(96~143mg/100g of freeze-dried), and PI(9~26mg/100g of freeze-dried) was detected only in cheonhyehyang, kumquat, lime, and lemon. The total phospholipids content was the highest in cheonhyehyang(388mg/100g of freeze-dried) and the lowest in kumquat(234mg/100g of freeze-dried)($p < 0.05$). The major phospholipids of vegetables(bracken, soybean sprouts, doraji, deodeok) were PE, PC, and PI, and bracken contained additional SM and NAPE. The total phospholipid content was high in the order of bracken>soybean sprouts>doraji>deodeok. Phospholipid contents of vegetables increased during processing, with NAPE by 0.64~1.28 times, PE by 1.50~3.95 times, PC by 1.45~4.35 times, and PI by 1.03~1.48 times($p < 0.05$). The major phospholipids of mushrooms were PE, PC, PS, PI, and LPC. The content of PE, PC, PS, PI, and LPC of King oyster mushroom were significantly higher than those of Oak mushroom by 2.29, 1.42, 0.90, 2.08, and 2.79 times, respectively($p < 0.05$). During processing, the phospholipid content of King oyster mushroom increased while that of Oak mushroom decreased. This study confirmed that PE and PC were the major phospholipids in citrus fruits, vegetables and mushrooms. PI was found in both vegetables and mushrooms, and NAPE and PS were detected only in vegetables and mushrooms, respectively.



P3-31

Analysis of total aflatoxin in soy sauces and pastes for school meals in Chungcheongnam-do using LC-MS/MS

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Due to climate warming, the frequency and level of contamination of mycotoxins, especially aflatoxin, are increasing in the production, processing and distribution stages of food. In addition, fermented soybean paste is fermenting the microbiota present in the surrounding environment naturally inoculate the paste and participate in its fermentation. However, simultaneously, this process is vulnerable to contamination by mycotoxigenic fungi that produce aflatoxins, such as *Aspergillus flavus*. For this reason, we investigated the occurrence of aflatoxin in soy sauce and paste supplied as ingredients for school meals in Chungcheongnam-do in 2023. We collected 22 samples produced and supplied in Chungcheongnam-do as food ingredients, and analyzed aflatoxin according to the method of the Ministry of Food and Drug Safety. Aflatoxin (B1, B2, G1, G2), ochratoxinA, zearalenone, fumonisin (B1, B2) were analyzed by simultaneous analysis method using LC-MS/MS. Fortunately, aflatoxin was not detected in all 22 samples. We will continue to monitor aflatoxin in traditional sauces supplied to students in Chungcheongnam-do to contribute to the improvement of students' health.

P3-32

Potential of FT-NIR spectroscopy for detection of chilling injury in Kimchi cabbage

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Kimchi cabbage(KC) exposed to chilling injury(CI) at low temperatures during storage, which would result in quality degradation of kimchi products. This study performed non-destructive analysis of KC with differing severity of CI depending on the storage temperature(0℃, -3℃, -5, and -15℃) by means of Fourier-Transform Near Infrared(FT-NIR) spectroscopy and chemometrics. The average spectra of chilling-induced damage in leaf and stem part exhibit different absorbance compared to fresh samples. The score plot of the principal component analysis for the first two latent vectors showed separation of CI-affected and non CI-affected KC group. A discriminating model using partial least squares-discriminant analysis (PLS-

DA) were developed four-class (“sound”, “trace”, “moderate”, and “severe”) classifications. The results showed PLS-DA model had the high classification rates for the prediction set, with accuracies of 95.83%, and 86.36% for stem and leaf, respectively. The dominant wavenumbers that were useful in classifying the severity of CI in leaf part were approximately 5168, 5330, 7231, and 8655 cm^{-1} . For the stem part, discriminative wavenumbers obtained from beta coefficients were 5905, 6525, 7193, and 9360 cm^{-1} . These wavenumber regions associated OH bonds in polysaccharides, CH₃ bonds in cellulose and ArOH bonds in aromatic compounds. This is because CI causes damage of polysaccharides and cellulose present in the cell wall of cabbage tissue, and changes the aroma composition. This study reports that there is potential to use FT-NIR spectroscopy for detecting Kimchi cabbage with chilling injury symptoms.

P3-33

경기도 내 카페에서 판매되는 음료별 당류 함량 조사

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경기도 내 프랜차이즈 커피 전문점 18개를 대상으로 제조음료 346건을 수거하여 당 함량을 분석하였다. 분석기기로는 RI detector가 부착된 HPLC로 식품공전 (2.1.4.1.4 기기분석법에 의한 당류의 정량)에 따라 전처리하였다. 제조음료를 14개 그룹(커피류, 우유 함유 음료(커피 제외), 프라푸치노, 쉐이크, 요거트, 주스, 차, 에이드, 아이스티, 블렌딩, 곡물차, 한방차, 허브차, 클렌즈 주스)으로 나눠 분석한 결과, 커피류의 아메리카노와 허브차에서는 당이 포함되어 있지 않았다. 우유 함유 음료(커피 제외), 차, 쉐이크, 요거트, 아이스티, 한방차, 곡물차 그룹은 10 g 이상의 당함량을 가지고 있는데 특히 유자차가 20.268 g의 함량으로, 조사한 제조음료 중에서 가장 높은 당 함량을 가지고 있었다. 조사한 프랜차이즈의 영양성분표시는 10개의 업체에서 표시를 하고 있었고, 표시된 음료 188개에서 77개가 측정값이 영양성분 표시량의 120% 이상의 값으로 분석되었다. 제조음료별 1회 제공량을 tall size로 할 경우 WHO 당 권고기준 50 g과 비교하면 유자차가 143.9%, 기타 한방차 135.6%, 대추차 127.5%, 생강차 122.3%, 레몬차 116.0%, 딸기 쉐이크 112.2%, 딸기 요거트 107.0%, 초코 쉐이크 106.4%, 블루베리 요거트 101.0%, 플레인 요거트 100.2% 순으로 초과하여 음용 시 주의해야 한다.



PART IV

미생물/발효/안전성

P4-01

양조용 포도 품종별 포도주의 페놀화합물 비교 연구

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페놀화합물 (phenolic compounds)은 다양한 형태로 식품에 존재하며 이들이 가지고 있는 항산화 작용에 의한 질병 위험 감소의 역할로 많은 각광을 받고 있다. 이중 포도의 껍질, 종자, 송이줄기에 많이 존재하는 페놀화합물은 적포도주 제조 시 파쇄, 착즙, 발효 과정 중에 나와 포도주에 쓴맛과 떼은맛, 색에 관여하고 있다. 포도주는 전 세계적으로 널리 음용하고 있는 알코올음료 중 하나로 최근 건강에 대한 관심이 높아짐에 따라 기능성 성분인 페놀화합물을 다량 함유하고 있는 포도주 소비가 늘어나는 추세이다. 특히, 포도주에서의 페놀화합물 함량은 포도품종, 양조기술, 발효온도, 착즙정도, 숙성조건 등에 영향을 받는 것으로 알려졌다. 이에 본 연구에서는 국내에서 재배한 양조용 포도 품종인 메를로(Merlot), 피노누아(Pinot Noir), 말벡(Malbec), 및 카베르네 소비뇽(Cabernet Sauvignon) 4종으로 포도주를 제조한 후 품종에 따른 포도주의 페놀화합물 함량 (총 페놀화합물, 탄닌 중합체, 프로안토시아닌 및 총 안토시아닌)과 색도를 비교하였다. 그 결과 메를로 품종에서 총 페놀화합물 함량은 956.23 ± 16.66 mg/L, 탄닌 중합체 함량 147.94 ± 2.95 mg/L, 프로안토시아닌 함량이 591.79 ± 14.02 mg/L으로 유의적으로 높은 반면, 총 안토시아닌 함량은 카베르네 소비뇽 품종에서 153.93 ± 60.19 mg/L으로 유의적으로 높게 나타났다. 색도(color intensity)의 경우 총 안토시아닌 함량이 가장 높은 카베르네 소비뇽 품종에서 가장 높은 수치를 보였다. 본 연구는 농촌진흥청 기관고유사업(세부과제: PJ01668502) 및 2023년도 농촌진흥청 국립원예특작과학원 전문연구원 과정 지원사업에 의해 이루어진 것임.

P4-02

국내산 검정콩 저분자 발효물의 함황아미노산 및 품질특성 비교

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우리나라 주요 식량 작물인 내산 (Glycine max L.)은 식물성 단백질(40%)이 다량 함유되어 있으며 영양적으로 우수한 식품 원료 중 하나이다. 특히, 경상북도는 국내 콩 생산량이 17.5% (2022년 기준 22,737톤)로 전국 2위로 많이 생산되고 있다. 검정콩은 전통적으로 모발건강에 도움이 되는 소재로 전해지고 안토시아닌 색소와 함황아미노산을 함유하고 있어 다양한 건강 기능성 소재로 개발이 기대되고 있다. 본 연구에서는 검정콩 함황아미노산 함량을 증가시키기 위해 저분자 발효 방법으로 검정콩 원물

(C) 및 검정콩 저분자화 발효물(F)의 함황아미노산 함량, β -글루칸 함량, 페놀성 화합물 함량, 이소플라본 함량 및 항산화 효과 등 품질을 비교하였다. 그 결과, 검정콩을 이용한 저분자 발효물의 함황아미노산(시스테인 및 메티오닌)함량은 (C)구간 0.06 mg/100 g에서 발효 후의 (F)구간이 0.65 mg/100 g로 약 10배 정도 높은 함량을 나타내었다. β -글루칸 함량은 (F)구간에서 92.87 mg/g 으로 (C)구간 보다 4.3배 정도 증가하였다. 이소플라본 함량은 (C)구간 (261.27 μ g/g) 보다 (F)구간 (770.44 μ g/g) 로 2.9배 정도 높게 나타났다. 또한 항산화 활성을 나타내는 페놀성 화합물 함량도 (C)구간 (888.04 μ g/g) 보다 (F)구간 (3599.34 μ g/g)로 4배 정도 증가하였으며, ABTs 라디칼 소거능은 (C)구간 (31.43%) 보다 (F)구간 (48.76%)를 나타내었다. 이상의 결과에서 경북 검정콩의 저분자화 발효 과정에서 모발과 피부의 생성 함황아미노산의 함량 및 다양한 기능성 성분이 증가 되어 고령자의 단백질 보충, 모발 건강의 다양한 소재로 산업적 활용이 기대된다.

P4-03

Hot pepper (*Capsicum annuum* L.) powder as a noble and economic fermentation enhancer for yeast and alcoholic beverage

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Capsicum annuum L., commonly known as hot pepper, is an annual herb belonging to the Solanaceae family. Its fruits and leaves are used for consumption, and in traditional medicine to treat frostbite, neuralgia, and dog bites. Hot peppers are not only a popular spice for their spicy flavor, but also known for their excellent nutritional value, high in vitamin C and carotenoids, which are beneficial for immune enhancement, stamina, and obesity control. In this study, the effects of adding hot pepper powder from 5 traditional Korean native varieties (Yuwol-cho, Subi-cho, Sumi-heang, Goun-bit, Chilsung-cho) and 5 improved varieties (Dabok, Cheong-yang, Chung-seong, Olbokhap, Shin-honggildong) on yeast growth, fermentation rate, and final fermentation efficiency were evaluated. The results showed that addition of 0.5% pepper powder (especially from Korean native varieties) significantly increased yeast growth by more than two-fold, accelerated fermentation rate, and improved final fermentation efficiency by 10-15%. Furthermore, the fermented hot pepper broth with added pepper powder showed superior antioxidant activity, taste, aroma, and overall preference compared to the non-additive control. These findings suggest that hot pepper powder can be used as a yeast growth and fermentation promoter.



P4-04

표면반응분석법을 활용한 가바 생물전환 균주의 최적 배양조건 확립

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(주)창역

현대 식품산업의 핵심 키워드로 웰빙 전통식품이 크게 부각되고 있다. 웰빙 전통식품이란 기존의 전통식품의 개념을 뛰어 넘는 고부가, 고기능성 유용물질을 생산하는 제품을 의미한다. (주)창역에서는 전통식품인 떡류를 생산 가공하여 전국적인 유통망을 운영하는 기업으로 전통식품 중에서 핵심 키워드인 발효식품으로 증편을 생산 가공하여 유통하고 있다. (주)창역에서는 자체 기술개발을 통해 고유의 발효종을 생산하여 증편을 생산하고 있으며 여기에 들어가는 유산균으로 *Lactobacillus brevis* YDS01(KCCM11870P)균주를 활용하는 것을 특징으로한다. 기존 생산공정에서 가바(GABA, gamma-Aminobutyric acid) 생물전환 균주를 포함하며 생육과정에서 가바의 증가는 확인되었으나 그 양이 미미하여 추가적인 유산균의 가바 생물전환 최적 조건을 탐색하기위해 표면반응 분석법을 활용하여 분석하였다. 고농도 GABA 생성을 위한 유산균 배양조건을 확립하기 위해 배지 종류 및 기질 종류 별 GABA 생성 조건을 확인하고, 식용 배지와 다시마 추출물을 활용한 고농도의 GABA 생성을 위한 조건을 확립하기 위하여 반응표면 분석법 (RSM)으로 분석하여 최적 배양조건을 탐색하였으며 추 후 다음 배양조건을 활용한 기존 공정에 활용하여 고농도의 GABA를 함유하는 기능성 증편 생산의 기초를 확보하였다.

P4-05

Reduction of odor components in distilled Soju produced using domestic hops

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With a rise in the domestic consumption of distilled soju, differentiation from other products is a means to increase consumer choice. The purpose of this study was to selectively remove odor while maintaining the floral scent. We achieved this by culturing brewer's bacteria in domestic hops that is used to produce distilled spirits. After immersing domestic hops in water to absorb moisture, brewing bacteria were inoculated with 1% of dry hop weight and incubated at 38 °C for 8 days. Subsequently, distilled soju was manufactured using the cultured hops. Among the hop odor components, the most significant effect was the decrease of myrcene by about 36%, compared to that before cultivation. In addition, cis-3-hexenal components were reduced by 31.6% in

Aspergillus oryzae and 42.4% in *Aspergillus luchuensis*, compared to before cultivation, thereby reducing the odor-causing components in hops. On the other hand, β -ionone and 2-phenylethyl isovalate, which are types of flower fragrance, increased slightly during cultivation. Our study suggests that it is possible to manufacture distilled soju with reduced odor while maintaining the floral scent by using domestic hops and brewing bacteria.

P4-06

A comparative analysis of the physicochemical properties of enzyme-treated raw rice fermentation liquor

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The NTS does not recognize the koji used in the production of distilled soju as an additive, and local specialty liquor manufacturers are burdened with high logistics and forestry costs. Since amino acids are a nutrient source for yeast, our approach was to check if the use of proteolytic enzymes would help alcohol fermentation. In this study, raw rice fermentation liquor was manufactured using starch-degrading, proteolytic, and lipolytic enzymes, without using koji, and the physicochemical characteristics were analyzed across treatments. Regardless of the treatment with proteolytic and lipolytic enzymes, the sample treated with Nurukzyme R400(16.20–16.53; $p < 0.05$) exhibited high fermentation levels, and the alcohol content (%) was significantly higher than that obtained using Chungmu-enzyme(6.71–7.86; $p < 0.05$). Further analysis indicated a pH of 3.47–3.66, total acid levels (% acetic acid) of 0.09–0.13 %, and amino acid content (% glycine) of 0.02–0.04 %. Further analysis indicated a pH of 3.47–3.66, total acid levels (% acetic acid) of 0.09–0.13 %, and amino acid content (% glycine) of 0.02–0.04 %. The use of proteolytic and lipolytic enzymes did not increase the amino acid content and alcohol productivity, although amino acids are a nutrient source of yeast. Our findings suggest that efficient production of alcohol in raw rice fermentation liquor is possible by using the starch-degrading enzymes alone, without koji.



P4-07

양파간장 분말을 이용한 시즈닝 품질특성 평가

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국산 양파를 이용한 양파 간장의 사용 편리성을 높이고 보존성을 높이기 위하여 분말로 가공하였으며, 본 연구에서는 양파간장 분말 시즈닝의 전체 중량 대비 10, 15, 20, 25, 30% 양파간장 분말을 첨가하여 제조하여 복합 조미식품인 시즈닝의 품질특성을 평가하였다. 양파간장 분말의 첨가량이 많아질수록 수분, 조회분, 조단백 및 조섬유 값은 증가하였고, 조지방은 유의적인 차이가 없었다. 또한 양파간장 분말 함량이 증가할수록 pH는 6.30~5.88로 감소하였으며, 적정산도는 0.37~0.92%로 증가하였다. 염도는 양파간장 분말 30% 첨가 시료구가 5.40%으로 높은 값을 나타냈으며 당도는 7.00 ° Brix으로 일정한 값을 보였다. 색도는 양파간장 분말 함량이 증가할수록 L값은 감소하고 a, b값은 증가하는 경향을 보였다. 환원당 함량은 양파간장 분말 함량이 증가할수록 감소하는 경향을 보였다. 흡습성은 무첨가 시료구에서 1.28~6.24%로 가장 낮은 흡습력을 보였고, 주요 유기산은 citric acid로 나타났으며, 양파간장 분말 첨가 30% 시료구에서 1,462.92 mg/100 g로 가장 높은 함량을 보였다. 또한 유리당은 양파간장 분말 첨가량이 많아질수록 fructose, glucose, maltose는 증가하는 경향을 보였으며, 관능평가 결과 전체적인 기호도는 양파간장 분말의 첨가량 20% 시료구가 우수한 기호도를 나타냈다.

P4-08

Development of seasoning products using fermented onion Korean soy sauce powder

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Onion (*Allium cepa* L.), a crop that is widely consumed worldwide, is a spice vegetable that is essential to our diet. In an effort to promote the consumption of domestic onions and enhance the quality and functionality of Korean soy sauce, onion juice was used instead of water in the manufacture of Korean soy sauce. Onion soy sauce was processed into powder form and developed as a high-value seasoning in order to enhance the convenience and extend the shelf life. Korean onion soy sauce powder seasoning was produced by addition of 10, 15, 20, 25, and 30% onion soy sauce powder relative to the total weight. A significant increase in the quercetin content in Korean onion soy sauce

seasoning was observed with addition of increasing amounts of Korean onion soy sauce powder. The DPPH free radical scavenging activity, ABTS radical cation scavenging activity, total polyphenol, and flavonoid contents increased as demonstrated by the increasing trend with addition of increasing amounts of Korean onion soy sauce powder. These findings indicate that the content of active ingredients and antioxidant potency was enhanced by inclusion of onion soy sauce powder in the seasoning.

P4-09

Evaluation and quality characteristics of excellent yeast (*Saccharomyces cerevisiae* SFT-70) for complex fermented tea production

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Kombucha, a fermented tea containing probiotics, is produced by addition of microorganisms and sugar to tea. Yeast causes fermentation of sugar to produce alcohol, while it is oxidized by acetic acid bacteria to form acids. Production of kombucha requires yeast for symbiotic fermentation for production and oxidization of alcohol into acetic acid. Yeast obtained from institutions and yeast separated and stored from fermented foods were utilized as the subject matter in this study. The research involved measurement of pH, titratable acidity, acid resistance, ethanol production and tolerance, cellulase decomposition, CO₂ production, and bacterial count. Among the 20 strains tested, five strains were selected for their superior cellulase activity and capacity for production of ethanol and CO₂. Among the five strains, the highest amounts of ethanol and CO₂ were produced by *Saccharomyces cerevisiae* SFT-70, at 6.75% and 10.0 CO₂ cm/40h, respectively. Cellulase degradation activity of 3.30 mm, at pH 5.28, with a titratable acidity of 0.28%, and a yeast count of 9.59 log CFU/mL was also detected. Based on these characteristics, it is considered suitable for use in production of kombucha.



P4-10

다양한 식품군에서 분리, 동정된 발효 성능이 우수한 젖산균(*Leuconostoc mesenteroides* SFT-45)의 특성확인

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젖산균(lactic acid bacteria)은 탄수화물을 분해하여 젖산을 생성하는 미생물로 세균에 속한다. 프로바이오틱스라 불리는 젖산균은 음료 뿐만 아니라 치즈, 버터, 김치 등 다양하게 이용되고 있다. 그러나 현재 발효음료 제조시 젖산균주만 접종한 제품이 대부분이며 복합발효를 통한 음료개발은 미미한 실정이다. 따라서 본 연구는 국내 발효식품과 농산물에서의 젖산균을 분리, 동정하고 발효특성 확인을 통해 복합발효차로 알려진 콤부차 제조에 적합한 젖산균을 선발하고자 하였다. 수집된 시료에서 CaCO₃를 포함하는 MRS agar 배지와 BCP agar배지를 이용해 총 35개의 집락(colony)을 순수분리 하였다. 이를 대상으로 젖산균의 형태학적 및 생물학적 특징을 나타내는 균주를 선별하여 동정한 결과 *Lacticaseibacillus* 속 4종, *Leuconostoc* 6종 그리고 *Bacillus* 속인 *B. coagulans* 5종으로 나타났다. 다음으로 분리동정된 균주 15종과 분양균주 7종의 내산성과 ethanol 내성 등의 발효특성을 확인하여 5종을 선별하였다. 선별된 5종을 대상으로 발효온도 및 시간에 따른 발효 특성을 확인 한 결과 모든 균주가 30℃에서 가장 높은 활성을 나타냈으며, 발효기간에 따른 pH, 적정산도 및 생균수는 *Leuconostoc mesenteroides* SFT-45 균주가 각각 4.24, 1.67% 및 9.52 logCFU/mL로 나타나 복합발효에 적합한 것으로 확인되었다.

P4-11

Quality characteristics of kombucha Fermented with commercial SCOBY during fermentation

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In this study, Kombucha was manufactured by applying commercial SCOBY (Symbiotic Culture of Bacteria and Yeasts) to obtain and compare basic data on fermented beverage. The prepared Kombucha was fermented using SCOBY (company A, B) for 9 days and analyzed the quality characteristics (pH, total acidity, sugar content), total phenol, total flavonoid, DPPH free radical scavenging, reducing sugars and organic acids. The initial fermentation pH was similar to A (3.39) and B (3.40). After the end of the fermentation, A (2.51) decreased faster than B (3.02). Total acidity was 2.13% for A on 9 days, which is higher than B (0.15%), and sugar content of A(8.4%) on 9 days was lower than B (11.6%) as fermentation progressed. DPPH radical scavenging of A (78.30%)

was higher than B(59.89%) on the final fermentation date. Total phenol decreased from 33.09 mg/100ml at the beginning to 24.65 mg/100ml in company A, and company B decreased from 18.84 mg/100ml to 9.52 mg/100ml at 9 days. Total flavonoid decreased from 44.68 mg/100ml to 24.65 mg/100ml in company A, and company B decreased from 31.11 mg/100ml to 25.88 mg/100ml at 9 days. Reducing sugar was 1.83 mg/ml of company A and 0.44 mg/ml of company B on day 6, showing high reducing sugar of company A. Organic acids were investigated for acetic acid and lactic acid, and on the 9 days of fermentation, the content of acetic acid was high at 7.00 mg/ml in Kombucha using company A, and lactic acid (1.6mg/ml) was higher than company B. In addition, DSL (D-saccharic acid-1,4-lactone) and glucuronic acid were also 452.20ng/ul and 29.05ng/ul, respectively, on the 9 days of the end of fermentation. Therefore, This results suggested that the production of Kombucha using the A treatment can produce high quality product with excellent acidity, antioxidant activity, total phenol, total flavonoid, reducing sugar, and organic acid production when comparing the A and B treatment.

P4-12

Quality characteristics of rice Makgeolli fermented by the processing forms of *Crepidiastrumson sonchifolium*

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The quality characteristics change of the fermented rice makgeolli prepared from *Crepidiastrumson sonchifolium* (CS) were investigated. Makgeolli were prepared by adding CS using 3% CS original material(CSM), CS extract(CSE), hot-air dried CS powder(CSP), CS sugar leaching(CSS). The pH value is 4.1-4.2, which indicates a normal fermentation process. The total acidity has a value of 0.36-0.39. The color of the makgeolli was measured according to the type of material processing. The scores of the L (brightness) value in CSS were higher than the other samples, and the a (redness) and b (yellowness) values were lower. Alcohol fermentation values were 13.5-16.3%. Alcoholic fermentation of makgeolli using CSS was the lowest values. The total phenol contents were 60-78mg%. DPPH radical scavenging were 44.2-56.4%. ABTS radical scavenging were 63.5-64.6%. The total organic acid were 3849.6-4895.9 ng/ul. The addition of auxiliary components in 3 days leads to the highest organic acid content. Makgeolli with CSS showed the highest



antioxidant activity. Results of the preference test showed that appearance, flavor, taste, odor removal, overall acceptability of CSS scored higher than another sample. This results suggested that makgeolli added with CSS could be commercially developed due to its superior properties, including high antioxidant activities. Considering that CS is currently not widely used as a food ingredient, it is considered that this study proposed alternatives in the use of CS.

P4-13

Quality characteristics of fermented rice Makgeolli by Nuruk

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As a local specialty liquor using locally produced rice and agricultural products, it was carried out to develop rice makgeolli products as a toast to the 2023 Suncheon International Garden Fair. In the first step, in order to select a fermentation saccharification agent, rice makgeolli is fermented with differently for each of the five types of commercial Nuruk (SH, JJ, AD, SS, and BK) and the other ingredients are the same, aerobic saccharification at 25°C for three days, followed by anaerobic alcohol fermentation, and for a total of seven days. By analyzing the pH, soluble solid, total acidity, alcohol, organic acid, reducing sugar, ABTS radical scavenging, and sensory evaluation of rice makgeolli, we tried to select the Nuruk with the best fermentation characteristics. The pH was from 3.1 to 4.0, and soluble solids was from 5.0 to 13.7, the lowest in SS, and the highest in AD. The total acidity was the same for SH, SS, and JJ at 0.6%, and AD was the highest at 1.1%. The alcohol content differed greatly by Nuruk from 8.2 to 15.7% when fermenting for 7 days, and BK was the highest at 15.7%. As for the total organic acid content, BK was the lowest at 144.3 ppm, AD was the highest at 1176.5 ppm, and by Nuruk, it was contained in the order of lactic acid, acetic acid, succinic acid, citric acid, and malic acid. The reducing sugar was from 7% to 37%, the highest in SH, and the ABTS radical scavenging ability was 80.5% in JJ, followed by SS 72.4, BK 71.7, and SH 59.8. The sensory evaluation was the taste and overall preference were the highest in BK when evaluating the color, aroma, taste, and overall preference, but SH was the highest in taste and overall preference after 1 day of aging after adding sweeteners (0.02%).

P4-14

A microbial response to oxidative stress via transcription factorsSungmin Hwang*, Jung Up Park, Bohyun Yun, Ji-won Park, Go Kyoung Na,
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Oxidation is a common process that occurs in foods, human body and natural environments. Oxidative stress, however, that takes place when the levels of reactive species overwhelm the antioxidant capacity, causes lipid peroxidation and protein denaturation. High levels of the reactive species are generated in hypersaline habitats through cycles of desiccation–rehydration under intense UV radiation. Thus, foods and living organisms from the salt fields are necessary to be kept safe from the oxidative stress. Here, we expand annotation of a large group of transcription factor harboring a single winged–helix DNA binding domain from microorganisms to function as thiol–based transcriptional regulators of oxidative stress response by genome–wide gene expression analysis, global protein–binding determination assay, quantitative transcriptome analysis, computational protein modelling, and microbial genetics approaches. Using a model organism of hypersaline environments, we reveal that a novel transcription factor functions during hypochlorite stress as a transcriptional activator and repressor of an extensive gene coexpression network associated with thiol relay and other related activities. Overall, this study supports an emerging principle that a transcription factor which is widespread in most salt–loving prokaryotes plays a pivotal role against oxidative stress.

P4-15

Fermentation characteristics of Cheonggukjang prepared with non-germinated Pungsannamul-soybeanEun Ah Sim*, Eun-Gyung Mun, Hyeonbin Kim, Ui-Lim Choi,
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In this study, Cheonggukjang was manufactured using non–germinated Pungsannamul–soybeans, which are discarded because they could not germinate. The Pungsannamul–soybeans are representative variety used for bean sprout production in Jeonju, and it is a small–grained variety of 7~14g compared to Daewon–soybeans, which 25g per 100 grains. The Choenggukjang of Daewon–soybeans (DS) and non–germinated Pungsannamul–soybeans (NPS) were prepared by inoculating the pre–culture solution of KCTC3135, a standard strain of



Bacillus subtilis, fermenting for 0, 24, 48, 72 hours. After 72 hours, amino nitrogen, which is used as an indicator of fermented soybean, of NPS was 1.75 times higher than DS. The protease activity of NPS to generate amino acids in Cheonggukjang was 1.2 times higher than DS. In addition, total phenolic contents (TPC) and total flavonoids contents (TFC) of NPS showed 121.89 ± 4.74 , 64.26 ± 7.41 $\mu\text{g/g}$ respectively, which was significantly higher than 111.97 ± 5.24 , 32.64 ± 7.12 $\mu\text{g/g}$ of DS. DPPH radical scavenging activity of NPS was higher at $106.24 \pm 4.69\%$ than $91.80 \pm 4.24\%$ of DS. Isoflavone in the form of glycosides was decomposed into aglycones with high absorption rate in the body. Total aglycone content of NPS was 285.85 $\mu\text{g/g}$, higher than that of 244.14 $\mu\text{g/g}$ of DS. The contents of glutamic acid, aspartic acid, alanine, and glycine, which affect taste, in fermented soybean were 1.6, 3.9, 1.23, and 1.49 times higher in NPS than in DS. These results provide useful information that fermentation characteristics of NPS has better than those of DS. This suggests that non-germinated Pungsannamul-soybeans with low industrial value can be utilized in the direction of high added value.

P4-16

전통발효식품 유래 유용균주 발굴 및 이를 활용한 천연물 발효 추출물 제조

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식품에 대한 소비자의 안정성 요구 증가 및 건강수명에 대한 관심이 고조되고 있으며, 국내 건강 기능성 식품 원료 시장은 2022년 기준 약 4조 원 규모로 특히, 글로벌 미생물 발효 기술 시장은 2021년 약 21억 5,180만 달러에서 2028년까지 약 30억 1,790만 달러로 예측 기간 동안 약 5.8%의 성장 추세이다. 기존 건강 기능성식품의 원료가 되는 천연물의 유용 성분 추출방법으로 유기용매 활용 소재추출법, 열수추출법 등이 적용되어 추출법에 대한 우려 및 기능성 지표 성분 저하, 대량생산 한계 등이 문제점으로 발견된다. 이에 발효 기반 효소 추출법 개발 등 기존 추출법을 대체하기 위한 발효가공·추출법 개발 연구가 필요한 실정이다. 전남에서 주로 재배되는 황칠은 국내 최대 생물자원 중 하나로 질병 치료 및 예방에 유용한 성분을 다양한 기능성 연구 결과 및 소재 보유 공급량도 충분하지만 제품화가 미흡한 실정에서 산업화확대 및 관련 연구가 필요하다. 또한 국내산 약용작물 전호잎은 ‘관절건강’ 개별인정형 기능성 원료를 인정받았으며 항염증, 관절 개선, 비만 억제 효능 연구도 추진중이다. 본 연구는 전통발효식품 유래 유용균주 발굴 및 이를 활용하여 천연물(황칠, 전호) 유래 발효 추출물을 제조하고 기능성 지표성분을 분석하여 추출 효율을 높이는 발효 추출공법 개발을 목표로 한다. 멀티오믹스 기반 전통발효식품 유래 토종 균주 발굴 및 이를 활용한 천연물 발효 추출물 제조공정 개발을 토대로 발효 추출공법 공정 표준화 기준을 설정하여 한국을 대표하는 천연물 발효 추출 공정기술 개발 및 기능성 소재화 연구에 기여하고자 한다.

P4-17

커피체리 펄프를 활용한 막걸리 제조기술 개발 및 그 특성주진규^{1*}, 김권채¹, 김재민¹, 최민재¹, 차상화², 손동모², 백지환¹¹광주대학교 식품영양학과, ²마이크로맥스 영농조합법인

국내 커피 시장은 14조 원으로 지속적인 성장 추세이며, 국산 커피 재배가 증가함에 따라 커피를 제조하는 과정에서 발생하는 부산물도 증가하고 있다. 그러나 커피 생산 시 과육 부분인 커피체리 펄프의 활용방법은 크게 고려되지 않고 있다. 따라서 커피 매니아층과 일부 소비자를 중심으로 커피가 첨가된 가공식품에 대한 니즈와 함께 국내산 커피체리의 부가가치를 충족시키는 가공식품 개발이 필요하다. 본 연구에서는 부산물을 활용하여 꾸준히 증가하고 있는 막걸리 시장을 겨냥해 커피체리 펄프 막걸리를 제조함으로써 커피체리의 부가가치 창출을 통한 소비 증대를 목표로 한다. 이에 커피체리 펄프를 활용한 막걸리를 제조, 주부재료의 적정 배합 비율 및 중균을 발굴하여 커피 산업의 지속가능성을 유지하고자 한다. 선행 연구에서 복합 중균 개발을 위해 발효식품에서 유용 균주를 발굴하였고 이를 활용하여 커피체리 펄프와 백미, 현미, 잡곡에 접종하여 막걸리를 제조하였다. 발효 온도를 다양하게 하여 일정 기간 유지하였다. 발효가 끝난 후 여과한 뒤 병입 하여 알코올 도수, pH, 당도, 색도, 관능평가를 진행하였다. 본 연구를 통해 커피체리 펄프 막걸리 제조 과정에서 발효과정 중 일어나는 일반성분 및 미생물 특성에 대한 전반적인 정보 수집과 DB화가 가능하다. 향후 커피 매니아층과 소비자 니즈에 부합하는 커피 가공식품의 하나로 커피체리 펄프 막걸리를 개발하여 연구를 통해 커피 가공식품의 기반구축 및 소비확대가 가능할 것으로 판단된다. 지역특화작목으로 자리매김한 커피를 이용하여 막걸리 등 새로운 가공제품 개발과 상품화로 고부가가치 창출 및 지역 경제 활성화 연구에 기여하고자 한다.

P4-18

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손동모², 백지환¹¹광주대학교 식품영양학과, ²마이크로맥스영농조합법인

국내 커피 소비가 증가하면서 전라남도 화순 등 국내 커피 재배도 2019년 기준 6.9ha(42농가)에서 2022년 8.6ha(44농가)로 1.8배 증가하였다. 커피 체리는 수확하여 주로 그린빈만을 생두로 사용하기에 커피 부산물인 커피 체리 펄프(카스카라)의 양도 증가할 것으로 예상되어 커피 체리 펄프의 활용 방안을 찾고자 한다. 국내 와인 시장의 규모는 2021년 기준 1조 5,000억 원으로 2020년 대비 50% 성장하는 추세이다. 이에 커피 체리 펄프를 활용한 와인을 제조하여 커피 체리 펄프의 활용성을 높이고자 한다. 커피 체리 펄프 와인의 제조기술 개발을 위하여 원재료 및 발효 온도에 따른 와인의 특성을 비교한다. 원재료는 커피 체리 펄프, 오디, 복분자를 단독 또는 혼합 사용하며, 발효 온도를 달리하여 와인의 특성(Brix,



pH, 알코올 도수)을 비교 분석한다. 전처리 공정 표준화를 위해 원재료는 세척 후 착즙하여 착즙액과 고형분을 혼합한 뒤 발효 온도에 맞춰 일정 기간 발효한다. 와인의 발효 미생물은 전통 발효식품 유래 맞춤형 발효 종균을 발굴하고 이를 활용하여 제조한 와인의 분석 결과 커피 체리 펄프 와인에서 Brix, pH가 가장 높게 나타났으며, 알코올 도수는 두 번째로 높았다. 발효 온도에 따른 특성 분석 결과 온도별 와인의 특성이 다름을 확인하였다. 본 연구를 통해 커피 체리 펄프를 활용한 와인의 제조가 가능할 것으로 판단되었으며, 최적 발효 온도 조건을 확립하였다. 추가적으로 더 다양한 온도 조건에서 커피 체리 펄프 와인 제조를 진행할 예정이며, Brix, 알코올 도수 및 pH를 측정, 최종 관능평가를 통해 커피 체리 펄프를 활용한 와인의 제조공정 표준화 기술을 확립한다.

P4-19

멸균 지표미생물의 D, Z-value 비교

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본 연구는 현재 식품의 멸균지표 미생물인 *Clostridium botulinum* 포자와 강한 내열성을 가지는 포자형성균인 *Bacillus sp.*의 열 저항성을 비교, 분석하여 레토르트 식품의 신속한 멸균 여부 검사법 적용 가능성을 제시하고자 하였다. 실험 균주는 *Bacillus subtilis*(KCTC 3135, 1027, 2213), *Geobacillus stearothermophilus*(KCTC 1752, 2107, 1830), *Bacillus atrophaeus*(KCTC 3701, 1022)를 생물자원센터(KCTC, Korea Collection for Type Cultures)에서 분양받아 사용하였다. 살균 특성 분석 결과 *B. subtilis*의 살균 온도에 따른 D-value와 Z-value는 111℃와 116℃, 121℃에서 D-value는 각각 5.0 ± 0.1 분, 4.4 ± 0.1 분, 2.9 ± 0.1 분이었으며, Z-value는 43.0 ± 1.4 로 나타났다. *G. stearothermophilus*의 포자는 111℃와 116℃, 121℃에서 D-value는 각각 10.8 ± 0.5 분, 6.6 ± 0.1 분, 4.3 ± 0.1 분이었으며, Z-value는 25.0 ± 1.6 로 나타났다. *B. atrophaeus* 포자의 111℃와 116℃, 121℃에서 D-value는 각각 7.1 ± 0.2 분, 5.2 ± 0.1 분, 3.7 ± 0.1 분이었으며, Z-value는 35.8 ± 1.4 로 나타났다. *C. botulinum* 포자의 121.1℃에서 D-value는 0.21분, Z-value는 10℃로 보고되고 있다. 따라서, 포자의 생존 여부를 확인하는 시험법을 레토르트 식품의 신속한 멸균 여부 검사법에 적용 가능성이 있을 것으로 판단된다.

P4-20

유통 샐러드의 미생물학적 오염도 분석

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본 연구에서는 판매장소와 재료에 따른 유통 샐러드의 식품위생 지표 미생물과 식중독 세균의 오염도를 평가하여 유통 샐러드의 안전성을 확보하고자 하였다. 샐러드는 개인이 운영하는 일반 음식점, 온라인 매장, 편의점, 프랜차이즈 업소 등에서 71건을 구매하여 실험에 사용하였다. 재료별 샐러드 종류는 가금류 샐러드, 돈육과 우육 샐러드, 채소 샐러드, 치즈 샐러드, 해산물 샐러드 등으로 구분되었다. 판매처에 따른 일반세균 오염도는 온라인 매장이 $6.4 \pm 1.0 \text{ Log CFU/g}$ 으로 가장 높았고, 편의점과 프랜차이즈 업소가 각각 $5.7 \pm 1.1 \text{ Log CFU/g}$, $5.7 \pm 0.5 \text{ Log CFU/g}$ 으로 가장 낮게 나타났다. 판매처에 따른 대장균군 오염도는 온라인 매장이 $4.9 \pm 0.8 \text{ Log CFU/g}$ 으로 가장 높았고, 편의점이 $4.0 \pm 1.5 \text{ Log CFU/g}$ 으로 가장 낮았다. 재료에 따른 일반세균 오염도는 가금육 샐러드가 $6.1 \pm 1.0 \text{ Log CFU/g}$ 으로 가장 높았고, 돈육과 우육 샐러드가 $5.5 \pm 0.5 \text{ Log CFU/g}$ 으로 가장 낮게 나타났다. 재료에 따른 대장균군 오염도는 가금육 샐러드가 $4.8 \pm 1.1 \text{ Log CFU/g}$ 으로 가장 높았고, 돈육과 우육 샐러드가 $3.9 \pm 0.9 \text{ Log CFU/g}$ 으로 가장 낮았다. 식중독 세균 실험 결과 프랜차이즈 업소에서 구매한 가금류 샐러드, 인터넷에서 구매한 치즈 샐러드에서 *Bacillus cereus* 총 2건이 검출되었다. 이러한 결과를 종합하여 볼 때 온라인에서 판매하는 샐러드의 미생물 오염도가 가장 높게 나타나 각별한 주의가 필요하며 배송 시 철저한 온도관리가 필요한 것으로 판단되었다. 또한 편의점 및 프랜차이즈 업소에서 판매되는 샐러드에 비하여 개인이 운영하는 일반 음식점에서 판매되는 샐러드의 미생물적 오염도가 높게 나타나 개인업소에 대한 지속적인 안전관리 및 교육이 필요할 것으로 판단되었다.

P4-21

Occurrence of fungi in dried ginseng by storage environment

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Dried ginseng such as white ginseng and red ginseng is processed through drying or additional steaming and then stored until processing or distribution. To investigate the occurrence of fungi in dried ginseng during storage, white ginseng and red ginseng were purchased from Jeonbuk and Chungnam province in Korea and stored at different temperatures and humidity for 14 weeks. In storage environments with two humidity settings [60% and 95% relative humidity (RH)] at 15°C, total fungi increased rapidly in both ginsengs only at 95% RH. Under the same condition, *Aspergillus* and *Penicillium*



spp. increased rapidly in both ginsengs after 10 weeks and 4 weeks of storage at 95% RH, respectively. In storage environments with no humidity control (RH fluctuation from 22% to 48%), total fungi increased but slightly in both ginsengs (5°C and 15°C). At 25°C, however, the fungi tended to decrease in white ginseng. Linear regression analysis showed that fungal increase would be steeper at 95% RH than at 60% RH in both ginsengs when stored at 15°C. It also showed that fungal occurrence would not be affected by the temperatures tested in white ginseng, while it would increase proportionally with storage period in red ginseng. These results indicate that both temperature and humidity are likely to affect fungal occurrence in dried ginseng during storage.

P4-22

A BRET-based rapid detection of PAHs by fusion protein expression system

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PAHs, which are known for their role as endocrine disruptors and carcinogens, have a prolonged presence in the human body and pose significant toxicity. Hence, it is crucial to effectively manage and regulate PAHs through risk assessment. Existing regulations rely on separate analytical methods and individual assays to evaluate the risks associated with different PAH mixtures, making comprehensive detection challenging. AhR specifically binds to harmful PAHs, forming a dimer with the ARNT protein in vivo. The concentration of combined PAHs can be determined by assessing the protein-protein binding between the dimerized AhR and ARNT. In the BRET system, the sensitivity of the BRET signal relies on the spatial distance between Nluc (the energy donor) and HaloTag (the energy acceptor), achieved through AhR ligand-mediated heterodimerization of AhR-ARNT and the location of AhR/ARNT terminus. Plasmids containing AhR and ARNT sequences were cloned, and Nluc and HaloTag gene fusion vectors were constructed, serving as NanoBRET donors and acceptors at the N-terminus or C-terminus of AhR and ARNT. The optimal combination was determined by introducing the fusion vector into human embryonic kidney cells (HEK-293) and measuring the BRET-based binding reaction between AhR and ARNT.

P4-23

A survey on a status of pesticide residues in seafood during the distribution and production stages

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Pesticide residues in seafood are known to be introduced into seafood through feed, water, soil, and the atmosphere at aquaculture sites, or to contaminate seafood through aquaculture facilities, storage spaces, or distribution processes. In South Korea, pesticide residue test methods for seafood are provided according to the Food Code, but in practice, these methods are applied to livestock products and not yet to seafood. While the risk management of pesticide residues for agricultural and livestock products is continuously being carried out, the situation regarding seafood is inadequate in terms of standards and risk management, despite its high consumption. Therefore, there is a need to improve the risk management system for seafood. In this study, we aim to develop and validate a multi-component simultaneous analysis method for seafood that is not currently specified in the Food Code. Through this method, we intend to conduct a survey on the actual state of pesticide residues in seafood at the distribution and production stages, thereby obtaining monitoring data for exposure assessment and ensure the risk assessment and management of seafood.

P4-24

광주지역 유통 가금육에서 분리된 캄필로박터균의 항생제 내성 조사

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본 조사는 광주광역시에서 유통 판매되고 있는 가금육을 대상으로 식중독 발생 비율이 높은 캄필로박터균을 시험하고 분리하여 항생제 내성을 조사하였다. 전체 307건의 가금육중 111건에서 캄필로박터균이 검출되었고, 116균주를 분리하였다. 분리한 균주는 *Campylobacter jejuni* 102균주, *Campylobacter coli* 14균주였다. 분리된 균주에 대한 Ciprofloxacin 등 8종의 항생제 내성 시험결과 99균주에서 1가지 이상의 항생제 내성이 있었다. 내성을 나타낸 항생제는 Ciprofloxacin, Nalidixic acid로 각각 98균주(84,5%), 96균주(82,8%)에서 내성을 보여 높은 내성비율을 나타내



었다. 이 외에도 Tetracycline(44.0%), Gentamicin(2.6%)에도 내성을 보였으나, Azithromycin, Clindamycin, Erythromycin 그리고 Florfenicol에서는 내성을 나타내지 않았다. 조사결과 가금육에서 캄필로박터균 검출률은 36.2%로 높게 조사되었으므로 유통 및 가공과정에서 교차오염을 예방하기 위한 위생적인 관리가 필요하고, 식중독 예방을 위해 조리 시 가금육의 심부까지 충분한 온도로 조리될 수 있도록 해야 한다.

P4-25

남해안 서식 패류의 미생물학적 안전성 분석

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본 연구는 남해안 서식 패류의 종류별, 월별 미생물 오염도를 평가하고자 피조개 8개, 굴 16개, 바지락 10개, 전복 6개, 새고막 8개 등 총 48개의 패류를 실험하였다. 2020년 월별 채취되어 냉도 보관 중인 패류에 대해 일반세균, 대장균군 정성 및 정량 실험과 식중독 세균 분리 동정실험을 진행하였다. 월별 패류의 일반세균 및 대장균군 오염도는 4월 1.5 ± 0.2 CFU/g 및 불검출, 6월 1.6 ± 0.2 CFU/g 및 불검출, 7월 3.1 ± 0.1 CFU/g 및 0.4 ± 0.0 CFU/g, 8월 2.4 ± 0.1 CFU/g 및 0.9 ± 0.3 CFU/g, 9월 2.4 ± 0.1 CFU/g 및 0.9 ± 0.1 CFU/g, 10월 1.8 ± 0.2 CFU/g 및 0.1 ± 0.0 CFU/g, 11월 2.1 ± 0.1 CFU/g 및 불검출로 나타나 수온이 비교적 높은 7월, 8월, 9월에 일반세균 및 대장균군 수가 높게 나타났다. 패류 종류별 일반세균 및 대장균군 실험결과는 피조개 1.9 ± 0.2 CFU/g 및 0.1 ± 0.0 CFU/g, 굴 2.1 ± 0.2 CFU/g 및 0.1 ± 0.0 CFU/g, 바지락 2.0 ± 0.1 CFU/g 및 1.0 ± 0.1 CFU/g, 전복 2.4 ± 0.1 CFU/g 및 1.2 ± 0.1 CFU/g, 새고막 2.5 ± 0.1 CFU/g 및 2.5 ± 0.1 CFU/g으로 나타났으며, 전복에서 일반세균 및 대장균군 모두 높게 나타났다. 대장균군 및 대장균, 식중독 세균의 패류별 검출현황을 살펴보면, 굴에서 *Enterobacter cloacae* 1건, 바지락에서 *Bacillus cereus*, *Enterobacter cloacae*, *Serratia marcescens*, *Klebsiella pneumoniae* 각각 1건씩 검출되었으며, 전복에서 *Enterobacter cloacae* 3건, 새고막에서 *Escherichia coli* 1건이 검출되어 바지락과 전복이 가장 높은 검출률을 나타내었다. 이러한 결과는 바지락 시료 10개 중 6개가 7-9월에 채취된 시료이며, 전복 시료 6개 모두 7-9월에 채취된 시료이기 때문인 것으로 판단된다. 이러한 결과를 종합해 볼 때 수온이 상승하는 여름철에 패류 섭취에 각별한 주의가 필요한 것으로 판단된다.

P4-26

세척 공정에 의한 생미역의 미생물 안전성 및 품질에 미치는 영향

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본 연구에서는 생미역의 세척에 사용된 다양한 세척제의 초기 미생물 제어 효과를 향상시키기 위해 중탄산나트륨(베이킹소다, NaHCO_3), 구연산(citric acid), 차아염소산나트륨(NaOCl)의 단독 및 병합 처리 조건을 설정하였으며 냉장 저장 중 생미역의 미생물 수 및 품질 특성 변화를 분석하였다. 세척제의 단독 처리 방법으로는 2%, 5% 탄산수소나트륨수, 0.5%, 1% 구연산수와 100 ppm 차아염소산수를 적용하였고, 살균 효과를 비교하기 위해 무처리구, 수돗물 처리구를 사용하였다. 병합 처리 방법으로는 0.5% 구연산수 처리 후 100 ppm 차아염소산수로 처리하는 단계적 병합 처리구를 이용하였다. 탄산수소나트륨수는 무처리구에 비해 일반 세균수 0.40~0.48 log CFU/mL를 감소시켰고, 수돗물 처리구(0.44 log CFU/mL)와 유사한 감균 효과를 나타내어 미생물 제어 효과는 크지 않았다. 또한 탄산수소나트륨수 처리구는 선택의 변화는 거의 없었으나 조직이 쉽게 붕괴되는 변화가 발생하여 품질 유지에도 바람직하지 않았다. 차아염소산수는 1.00 log CFU/mL의 일반 세균수를 감소시켰고, 구연산수는 일반 세균수 2.00~2.18 log CFU/mL를 감소시켜 단독 처리구로는 구연산수가 가장 우수한 살균 효과를 나타내었다. 반면에 구연산수 처리구는 조직의 변화는 없었으나 선택의 변화가 가장 크게 나타나 품질 유지에는 바람직하지 않았다. 단계적 병합 처리구는 일반 세균수 2.25 log CFU/mL의 감균 효과를 나타내어 구연산수 단독 처리구에 비해 미생물 제어 효과가 더 크게 나타났다. 또한 병합 처리구는 조직 변화도 없었으며 구연산수 단독 처리구에 비해 선택 변화가 더 적게 나타나 미생물 제어 및 품질 유지 효과에도 가장 우수한 것으로 나타났다. 생미역을 냉장에서 14일 동안 저장한 후 미생물 수를 조사한 결과, 무처리구는 일반 세균수 2.22 log CFU/mL가 증가하였으나, 단계적 병합 처리구는 미생물 수의 변화가 없었으며, 외관 및 선택에도 변화가 없었다. 따라서 0.5% 구연산수와 100 ppm 차아염소산수의 단계적 병합 처리는 생미역 세척 시 초기 미생물 제어와 품질 유지에 있어 효과적인 살균 처리 방법으로 냉장 보관 중 미생물 안전성 및 품질을 유지할 수 있는 바람직한 세척 방법으로 판단된다.

P4-27

Fecal microbiota profiling of dairy cattles, holstein and jersey, in South Korea : a comparative study

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In light of the complex interactions between the host animal and its resident gut microbiomes, studies of these microbial communities as a means to improve cattle production are important. This study was conducted to analyze the intestinal microorganisms of Holstein



(HT) and Jersey (JS), raised in Korea and to clarify the differences in microbial structures according to cattle species through next-generation sequencing. The alpha-diversity analysis revealed that most species richness and diversity indices were significantly higher in JS than in HT whereas phylogenetic diversity, which is the sum of taxonomic distances, is not significant. Microbial composition analysis showed that the intestinal microbial community structure of the two groups differed. In the both groups, a significant correlation was observed among the distribution of several microbes at the family level. In particular, a highly significant correlation ($p < 0.0001$) among a variety of microbial distributions was found in JS. Beta-diversity analysis was performed to statistically verify whether a difference exists in the intestinal microbial community structure of the two groups. Principal coordinate analysis and unweighted pair group method with arithmetic mean (UPGMA) clustering analysis showed separation between the HT and JS clusters. Meanwhile, permutational multivariate analysis of variance (PERMANOVA) revealed that their microbial structures are significantly different ($p < 0.0001$). LEfSe biomarker analysis was performed to discover the difference microbial features between the two groups. We found that several microbes, such as Firmicutes, Bacilli, Moraxellaceae and Pseudomonadales account for most of the difference in intestinal microbial community structure between the two groups. [This work was supported by a grant from the Establishment of Integrated Biobank for Agriculture, Food and Livestock Microbiome Project funded by the Ministry of Agriculture, Food and Rural Affairs (MAFRA)]

P4-28

Metagenomic biomarker discovery and comparative microbial community in Cheonggukjang supplied *Bacillus subtilis* SRCM102059, using next generation sequencing

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To compare the microbial compositions of Cheonggukjang before and after application of the *Bacillus subtilis* SRCM102059 as a starter strain, we analyzed V3-V4 region of 16S rRNA of four different Cheonggukjang by using next generation sequencing. Linear discriminant (LDA) effect size (LEfSe) analysis was performed to reveal the significant ranking of abundant taxa in different fermented foods. A size-effect threshold of 2.0 on the logarithmic LDA score was used for discriminative functional biomarkers. After application of the *B. subtilis* SRCM102059, on the genus level, the genus *Bacillus* composition is reduced but on the species level *Bacillus*

subtilis composition is increased and *Bacillus licheniformis*, *Kosakonta sp.* composition are reduced. This results showed that GRAS bacterial such as *B. subtilis*, community composition increased whereas non-GRAS bacterial such as *B. licheniformis*, *Kosakonta sp.*, reduced in Cheonggukjang after application of the *B. subtilis* SRCM102059. Permutational multivariate analysis of variance (PERMANOVA) showed that statistical difference in microbial clusters between two groups was significant at confidence level ($p=0.001$). This research could be used as basic research to identify the correlation between the biochemical characteristics of Korean fermented foods and distribution of microbial communities. [This work was supported by the “functional research of fermented soybean food (safety monitoring)” under the Ministry of Agriculture, Food, and Rural Affairs]

P4-29

Complete genome sequence of *Acetobacter senegalensis* Gb7 isolated from kombucha

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Acetobacter segalensis Gb7 was selected by isolating and identifying microorganisms from Kombucha and the acid production capability and alcohol tolerance of the strain. As a result of analyzing the genome of the selected strain, the genome size is 10,647,024,698 bp with a G + C content of 55.65%, 3,875 total genes, 57 tRNA genes, and 15 rRNA genes. The genome of strain contains acid resistance genes (ASN_RS06710, ASN_RS13455, *acnA*, and *groL*) and alcohol tolerance genes (ASN_RS05760, ASN_RS05930, and ASN_RS06525). In this study, *Acetobacter segalensis* Gb7 can be used as a material for acetic acid fermentation based on strain characteristics.

P4-30

Physiological activities and functional characteristics of radish vinegars using *Acetobacter pasteurianus* SRCM102411

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Radish fermented with *Acetobacter pasteurianus* SRCM102411 was prepared, and physiological activity and functional characteristics analysis were measured. As the



fermentation period increased, viable cell counts increased, the pH decreased, and the total acidity increased from 2.52% to 8.34%. As a result of measuring α -glucosidase inhibitory activity and pancreatic lipase inhibitory activity for physiological activity evaluation, the activities significantly increased by fermentation. Radish vinegar(RV) showed significant inhibitory activity ($p < 0.05$) on adipocyte differentiation in the 3T3-L1 preadipocytes without affecting cell viability as assessed by measuring fat accumulation using Oil Red O staining. These in vitro biological effects were higher in RV than in commercial vinegar. Our findings suggest that RV can be used for the prevention of lifestyle diseases such as obesity and diabetes.

P4-31

Aroma patterns and their potential biomarker of different fermentation stages by farm-produced vinegars

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The present study investigated the volatile flavor profiling of farm-produced vinegar collected from three different regions of Korea. The collected vinegars were barley vinegar of Seongnam City, Gyeonggi-do Province (SB), five-grain vinegar of Yecheon Gun, Gyeongbuk-do Province (YO), rice vinegar of Gimje City, Jeonbuk-do Province (JR). The volatile aroma components of 12 kinds of different fermentation steps (alcohol, acetic acid early, middle and late stage) were analyzed using gas chromatography-mass spectrometry with headspace solid-phase microextraction (HS-SPME/GC-MS). The aroma constituents varied at each fermentation step. Principle component analysis (PCA) was employed to distinguish the specific aroma compounds. At the alcoholization step (AS), alcohols were mainly ethanol (50-80%). The high contents of ethanol, 3-methyl-1-butanol could be the potential aroma biomarker for the AS. At the acetic acid fermentation step (AFS), ethanol was largely consumed, as well as butanol and propanol. The most dominant volatile acids of AFS was acetic acid (>90%). Acetic acid and 3-hydroxy-2-butanone were representative compounds for AFS and could be the potential biomarkers. PCA results indicated that the specification of aroma biomarkers for each type of vinegar was practical, serving as the indicators or predictors for the AFS identification, offering a potential for vinegar identification and quality improvement.

P4-32

Inverse association of daily fermented soybean past("Jang") intake with metabolic syndrome risk, especially body fat and hypertension, in men of a large hospital-based cohort

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Jang is a fermented soybean paste containing salt and is traditionally used as a substitute for salt to enhance the flavor of foods in Korea. It has been speculated that regular consumption of Jang may lower the risk of metabolic syndrome (MetS). We hypothesized that Jang intake was associated with the risk of MetS and its components after adjusting for potential confounders, including sodium intake. The participants in the low-Jang and high-Jang groups consumed an average of 0.63 g and 4.63 g Jang daily; their total sodium intake was about 1.91 and 2.58 g/day, respectively. After adjusting for covariates, the participants with the highest sodium intake (≥ 3.31 g/day) were positively associated with MetS risk in the quintiles of men and women. Among the MetS components, waist circumference, fat mass, and hypo-high-density lipoprotein (HDL)-cholesterolemia were positively associated with sodium intake in all participants and women. Unlike the association seen with sodium intake, Jang intake (≥ 1.9 g/day) was inversely associated with MetS components, including waist circumference, fat mass, serum glucose concentrations, and hypo-HDL-cholesterolemia in all participants and men, after adjusting for covariates including sodium intake. This work was supported by the "functional research of fermented soybean food (safety monitoring)" under the Ministry of Agriculture, Food, and Rural Affairs.

P4-33

Optimization of ethanol production by *Saccharomyces cerevisiae* SRCM 500093 through response surface methodology

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This study aims at optimizing the fermentable process variables in the production of bioethanol by *Saccharomyces cerevisiae* SRCM 500093 using Response surface methodology (RSM). Plackett-Burman design (PBD) was applied to evaluate the effect of various carbon, nitrogen and mineral sources on ethanol production, 3 variables, sucrose, tryptone, and



MgSO₄ · 7H₂O were subsequently screened as promising components for further optimization study, and RSM involving Central composite design (CCD) was established to optimize their optimal concentrations. The maximum ethanol production (33.13%) by *S. cerevisiae* SRCM 500093 was under sucrose 186.83 g/L, tryptone 31.23 g/L, and MgSO₄ · 7H₂O 0.0529 g/L within 20 hr respectively. Upon statistical analysis, coefficient of determination (R²) was 0.9615 and Our established model was confirmed through additional validation study. These results confirmed that the model was adequate and reliable to optimize bioethanol production from the commercial materials. This work was supported by a grant from the Establishment of Integrated Biobank for Agriculture, Food and Livestock Microbiome Project funded by the Ministry of Agriculture, Food and Rural Affairs (MAFRA)

P4-34

Microbial community of fermentants prepared with composite strains

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This study was conducted to confirm the microbial community of the fermentation product (Nuruk) prepared by combining the selective fungal strains. Various types of fermentation product were prepared using three types of fungi (*Aspergillus oryzae* SU_Y, *Lichtheimia ramosa* KJ_WF, *Aspergillus niger* JA_B) isolated from traditional Nuruk. In order to investigate the activity of the strains according to the inoculation ratio of the composite strains, the ratio of each strain [6(0:1:1), 10(1:1:2), 16(0:1:2)] was selected as a manufacturing condition based on previous studies. The microbial community was analyzed by metagenome sequencing, and the microbial abundance and diversity indices were confirmed using the ASV (Amplicon Sequence Variant) index and the rarefaction curve. As a result, the dominance of strains selected at inoculation ratios 6 and 16 was clear. In addition, the relative distribution of the microbial community was confirmed with a bar type graph to confirm the high occupancy of *L. ramosa* > *A. niger* at the species level. Since the simplification of the distributed microorganisms due to the use of selective strains was confirmed in most samples, the possibility of manufacturing selective strain fermentation products is expected through the dominance of the microorganisms inoculated with the composite strains.

P4-35

Changes in the ginsenoside content during the fermentation process using *Lactobacillus plantarum* KCCM 42962

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Ginsenosides, which are bioactive components in ginseng, can be converted to smaller compounds for improvement of their pharmacological activities. The conversion methods include heating; acid, alkali, and enzymatic treatment; and microbial conversion. The aim of this study was to determine the bioconversion of ginsenosides in fermented red ginseng extract (FRGE). Red ginseng extract (RGE) was fermented using *Lactobacillus plantarum* KCCM 42962. The changes in the ginsenoside composition of FRGE were evaluated using HPLC, and the 12 ginsenosides were analyzed. Additionally, we investigated changes of the reducing sugar and polyphenol contents during fermentation process. FRGE had a high total content of ginsenosides (5.54 mg/mL) as compared to the control (2.18 mg/mL). In particular, the ginsenoside metabolites Rg3, F2, Rh1, and Rg2 showed a high level in the FRGE (4.05 mg/mL) compared to the control (0.68 mg/mL). During fermentation for 4 days, total sugar content decreased from 1.15 mg/mL to 0.35 mg/mL, uronic acid content increased from 0.15 μ g/mL to 3.25 μ g/mL, and total ginsenoside content increased to 6.89 mg/g at 3 days. In addition, ginsenoside metabolites increased from 0.68mg/g to 4.85mg/g at 3days of fermentation. FRGE had a high content of polyphenol (5.95 mg/mL) as compared to the control (3.25 mg/mL). These results confirm that fermentation with *L. plantarum* KCCM 42962 is very useful for preparing minor ginsenoside metabolites while being safe for foods.

P4-36

Microbial consortium of Jeju traditional fermented foods and their cosmetic ingredient potentials

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In this study, we analyzed the microbial community of traditional fermented foods in Jeju Island to identify the distribution of useful microorganisms and confirm their anti-inflammatory effects to determine their potential use as cosmetic ingredients. Firstly,



we examined the microbial communities of *Branchiostegus japonicus* Sweet Rice Punch, *Trichiurus lepturus* intestines Jeotgal, *Spratelloides gracilis* Jeotgal, *Omphalius rusticus* Jeotgal, *Turbo cornutus* Jeotgal, *Chromis notata* Jeotgal, Jeju Soy Sauce, and Jeju Soybean Paste. We found that *Lactobacillus sakei* (53.7%), *Tetragenococcus halophilus* (71.3%), *Lentibacillus* sp. (42.9%), *T. halophilus* (37.7%), *L. sakei* (87.2%), *Bacillus subtilis* (23.4%), *T. halophilus* (96.8%), *Enterococcus durans* (14.6%), and *E. durans* (32.8%) were the dominant species. Secondly, to study the relationship between the eight Jeju fermented foods and their anti-inflammatory effects, we applied RAW264.7 cells, a classic cell model for inflammation studies. We first prepared ethyl acetate extracts of the eight Jeju fermented foods and found that they all inhibited nitric oxide (NO) production in a concentration-dependent manner. Thirdly, to test the applicability of the eight Jeju fermented foods to human skin, we used the MTT assay to assess the cytotoxic effects of the eight types of Jeju fermented foods on human keratinocyte HaCaT cells. Finally, the topical applicability of the eight Jeju fermented foods was tested through primary skin irritation, and it was found that they did not cause any adverse effects. Therefore, extracts from the eight Jeju fermented foods have potential applications as ingredients in anti-inflammatory products and can be used in the cosmetic industry

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P4-37

Analysis of the fermentation properties of Godulbaegi Kimchi

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Godulbaegi is astringent and bitter. Therefore, the young leaves or roots are usually blanched and eaten as a pickle or kimchi. In this study, we measured the changes in the hardness with the soaking time (12, 24, 48 hours) and the salt content (3%, 5%) of the kimchi grown in Gochang. The fermentation characteristics of kimchi were analyzed by measurement of changes in sugar content, pH, acidity, and total lactic acid bacteria count during 21 days of storage. The results showed that as the soaking time and salt content increased, the hardness of godulbaegi decreased significantly. When godulbaegi was soaked for 12, 24, and 48 hours at 3% salinity, the hardness decreased to 24%, 46%, and 50%, and at 5% salinity, the hardness decreased to 67%, 71%, and 72% with the increase of soaking

time. During 21 days of storage, the sugar content and pH of the kimchi decreased sharply on day 12 and tended to change minimally thereafter. The total number of lactic acid bacteria gradually increased, reaching the highest value on day 12. It tended to decrease after day 12. Acidity also gradually increased until day 12. After that, there was no change. Taken together, the results of this study suggest that the hardness of godulbaegi decreases with increasing soaking time and salinity, and the total growth of lactic acid bacteria is highest at 12 days of storage, which is the maturation period of godulbaegi kimchi.

P4-38

Manufacturing Takju by raw material using complex starter and investigation of quality characteristics

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Fermentation characteristics were examined through physicochemical analysis of makgeolli prepared according to raw materials, temperature, water content, and lactic acid addition amount using two types of Nuruk with different inoculation ratios using complex starter. Nuruk was prepared according to the inoculation rate of the mold used (A(A. oryzae 1 : L. ramosa 1 : A. niger 1), B(A. oryzae 0 : L. ramosa 1 : A. niger 2), and the enzyme activity and quality were compared. Glucoamylase was the highest in Nuruk A (1:1:1) at 579.34 U/g, and α -amylase and acidic protease were highest at Nuruk B (0:1:2) at 78.8 and 4,415.0 U/g, respectively. Inoculation of A. oryzae was confirmed to be a strain that affects the increase of saccharification ability of Nuruk. Physicochemical characteristics of takju fermented for 7 days at temperature (20°C, 25°C), amount of water (160%, 180%), amount of lactic acid (0.2%, 0.5%) treatments depending on Nuruk and raw materials (black barley, rice) was analyzed. In black barley Takju, the alcohol concentration was the highest at 15.1% when using Nuruk A, 25 °C, 180% water content, and 0.5% lactic acid treatment. In rice Takju, A and B Nuruk were the highest at 15.13% and 15.16%, respectively, at 25 °C, 160% water content, and 0.5% lactic acid treatment. It is expected that this result can be used as information for starter companies that manufacture Nuruk and small breweries that produce Makgeolli.



P4-39

시판 84개 한식메주를 이용한 간장의 품질특성

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한식 메주를 이용하여 제조되는 간장의 경우에는 메주를 소금물에 담그고 2~3개월 후 된장과 간장의 분리작업을 한 다음 숙성시켜 판매하는 경우가 보편적이다. 따라서 초기 메주의 제조방법이나 발효정도, 침지하는 소금물의 염도나 발효기간 및 조건 등에 따라 그 품질에 차이를 보인다. 본 연구에서는 지역별로 9~10개소, 전국 84개의 한식 메주를 이용한 장류 제조업체의 시판 간장에 대하여 품질을 분석하였다. 간장의 품질지표에 가장 큰 영향을 미치는 요소인 염도는 전국 평균 22.2%이며, 최대 28.5%, 최소 14.2%로 2배 이상의 차이를 보였으며, 제주도가 다른 도에 비해 낮은 양상이었다. 수분은 평균 69.6%, 최대 78.6%, 최소 57.3%였으며, 지역별 차이보다는 업체별 차이가 컸다. pH는 평균 5.1, 최대 8.1, 최소 4.3였으나, 대부분의 업체에서 5내외의 수치를 보여 변이폭이 낮았다. 산도는 평균 0.9%로 최대 2.7%, 최소 0.0%로 pH 값에서 특이적으로 높은 간장의 경우 산도가 매우 낮은 양상이었다. 환원당은 평균 1.1%였으나 특이적으로 높은 1개 제품을 제외하고는 최대 3% 이하의 함량을 보였다. 발효도를 나타내는 아미노산성 질소는 평균 567.9mg%, 최대 1641.3mg%, 최소 166.6mg%였으며 경기도지역의 간장이 타 지역에서 비해 다소 낮은 경향이였다. 총 유리아미노산 함량은 평균 $7.1\text{mg} \cdot \text{mL}^{-1}$, 최대 $16.9\text{mg} \cdot \text{mL}^{-1}$, 최소 $1.8\text{mg} \cdot \text{mL}^{-1}$ 의 큰 편차를 보였다. 유리 아미노산중 단맛, 구수한맛, 쓴맛에 관여하는 아미노산의 비율을 분석한 결과 각각 평균 32%, 12%, 18% 정도의 비율로 구성되어 있었으며, 이중 구수한맛 아미노산의 제품별 편차가 큰 것으로 조사되었다. 제시된 각 품질지표의 분포를 이용하여 제품의 품질수준을 판단하는 지표로 활용될 수 있을것으로 생각된다.

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P4-40

Comparison of microbial communities, quality characteristics, and sensory characteristics of commercial Makgeolli

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Makgeolli is well-known as a traditional rice alcoholic beverage, which is made with nuruk ingredient containing many microbes of fungi, yeast, and lactic acid bacteria (LAB)

etc. The aims of this study were to investigate the microbial communities in 16 kinds of commercial makgeolli using next generation sequencing (NGS) analysis and to determine their role of dominant strains has contributed to the fermentation in makgeolli. As a result, the mean physicochemical properties of pH, total acidity, sugar, and alcohol contents were 4.13 ± 0.31 , $0.4 \pm 0.16\%$ (w/v), 7.48 ± 3.48 °Brix, and $8.27 \pm 2.85\%$, respectively. *Saccharomyces* other and *Lactobacillus paracasei* (*Lc. paracasei*) were the most predominant species showing the taxonomy abundance of 92.32% and 82.25%, respectively. By electronic-nose analysis, we found four volatile components of 2-methyl-1-butanol, trans-1,3-dichloropropene, S(-)methyl-1-butanol, and 3-methyl-1-butanol in at least three makgeolli samples. In the further study, we will investigate how it affects the production of metabolites in makgeolli by analyzing the genetic information in the dominant strains.

P4-41

Selection of superior yeast strains for high alcohol production and fruit aroma generation in solid-state fermentation

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In order to discover indigenous fermenting strains and apply them in the field, it is necessary to develop solid-state fermentation (SSF) methods that are easy to propagate and maintain activity during distribution. Therefore, we aimed to select strains with excellent alcohol production and fruity aroma among 95 yeast strains for the production of SSF. The alcohol production ability of each yeast strain was quantitatively measured by determining the alcohol content (%) and simultaneously confirming CO₂ production in the form of trapped gas in a Durham tube. In addition, to select yeast strains with superior fruit aroma production, a sniffing test was conducted for qualitative screening, followed by quantitative analysis through E-nose testing. As a result, among the 95 yeast strains, we identified 51 strains with relatively superior alcohol production abilities. Through the sniffing test, yeast strains capable of generating fruit aroma were qualitatively identified, and 26 strains that overlapped with yeast strains showing excellent alcohol production were selected in the first round of screening. Based on the fragrance patterns investigated



by E-nose, 13 yeast strains were selected in the second round of screening, confirmed by PCA and SIMCA plot analysis as similar groups. Subsequently, based on the volatile aroma compounds such as trimethylamine, methyl formate, and propan-2-one detected in the selected 13 yeast strains, which represent fruit aroma generation, a final selection of 5 yeast strains (*S. cerevisiae* YM34, 40, 45, 50, NR-09) was made. Therefore, based on the results of this study, we anticipate that the selected yeast strains with superior alcohol and fruit aroma production can be utilized as suitable strains for SSF in the production of high-quality fermented products.

P4-42

Antimicrobial and potential probiotic activity of JSRB 8 *Bacillus velezensis* isolated from traditionally fermented soybean products

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Bacillus velezensis was approved as a food ingredient due to non-toxicogenic and non-pathogenic properties by Ministry of Food and Drug Safety (MFDS, South Korea). In this study, we isolated *Bacillus*-like bacteria from traditional Gochujang and Deonjang, and confirmed a probiotic properties including safety evaluation and antimicrobial activity against pathogens. Isolated strains showed broad-spectrum antibacterial activity against food-borne pathogenic bacteria. Furthermore, adherence to HT-29 cells and survive rate (acidic, bile, and heat conditions) of isolates were investigated. Among the isolates, JSRB 8 strain showed remarkable probiotic activities and it was selected for further experiments. The 16S rRNA sequence and phylogenetic analysis results showed that the JSRB 8 was *B. velezensis* which was labeled as *B. velezensis* JSRB 8. Additionally, we manufactured the Cheonggukjang with the *B. velezensis* JSRB 8, and than amino nitrogen, poly- γ -glutamic acid (γ -PGA) and exo-enzyme contents in Cheonggukjang were estimated. [This work was supported by the “functional research of fermented soybean food (safety monitoring)” under the Ministry of Agriculture, Food, and Rural Affairs.]

P4-43

Comparison of fermentation and functional characteristics of useful fungi isolated from traditional Nuruk

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The comprehensive characteristics of 16 fungal strains isolated from traditional wheat malt collected from four regions were analyzed. 18S rRNA or ITS sequences were identified for the isolated fungi, and 5 strains that did not produce aflatoxin were finally selected, focusing on strains (54,9–56,7 units/mL) with excellent glucoamylase activity (glycosylation ability) among the 16 identified fungi. NR-W showed optimum growth at 45°C, and AD-WF showed optimum growth at 15°C and had low temperature resistance. As a safety test, MIC test was performed through antagonism and antibiotic resistance through E-test. As a result, there was no antagonism against two standard strains, and some strains were susceptible to Gentamicin and Tetramycin. Two out of three aflatoxin-generating genes (aflR, ver1, omtA) were detected, but the total aflatoxin through ELISA quantitative analysis produced 3.9–5.1 ppb, which was judged to be a safe strain. Functional tests evaluated antibacterial activity, antidiabetic activity, and hypertension through thrombolysis, and inhibited the growth of *Staphylococcus aureus* by 100%, showing excellent antibacterial activity. Specifically, in the case of *Aspergillus oryzae* AD-Y, the thrombolytic activity was 2.53 times superior to that of the positive control. Based on these comprehensive characteristics, it is expected that it will be highly useful as a safe fermenting microorganism with excellent characteristics.

P4-44

Lactobacillus strains isolated from *Perilla frutescens* leaf are candidates for probiotics and may improve blood cholesterol levels

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Probiotics have received a lot of attention for their various health benefits, so it is important to find a new probiotic strain that promotes human health. In this study, three strains isolated from *Perilla frutescens* leaf were evaluated for their potential to improve cholesterol levels. In acid tolerance test, *Lactiplantibacillus pentosus* YPS55 showed a significantly higher survival rate at



104.16 % ($p=0.039$) than the control (*Lacticaseibacillus rhamnosus*GG), and in the bile resistance test, *L. pentosus*YPS61-2 showed a significantly higher survival rate at 105.74 % ($p=0.009$) than the control. The Auto-aggregation rate of the 3 strains was significantly higher than the control, ranging from 70.58 ± 4.27 to $78.06 \pm 0.33\%$. *L. pentosus* YPS55, which showed high acid tolerance and auto-aggregation, was selected to evaluate its impact on blood cholesterol in vivo. After inducing hypercholesterolemia by feeding high-fat diet (41 kcal% fat) to 7-week old female BALB/c mice, 9.4×10^8 CFU of *L. pentosus* YPS55 was orally administered to the experimental group every day for 8 weeks. Finally, cholesterol levels were checked with blood collected from the cardiac puncture after sacrifice. When compared to the controls, oral administrations of this strain reduced significantly increased the high-density lipoprotein (HDL) cholesterol level from 73.98 to 95.75 mg/dL ($p=0.007$), and significantly decreased the low-density lipoprotein (LDL) cholesterol level from 24.58 to 14.21 mg/dL ($p=0.0009$), indicating that this strain may have the beneficial effect on improving cholesterol in the body. Therefore, it indicates that this strain may have a beneficial effect on improving cholesterol in the body.

P4-45

Comparison of *Saccharomyces boulardii* cell surface display system for endo-inulinase expression

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Saccharomyces boulardii, the probiotic yeast strain, has a high potential for use in biotherapeutic agent for preventing various gastrointestinal diseases. Employing the synergistic effect of *S. boulardii* and endo-inulinase, a digestive enzyme capable of breaking down inulin into functional oligosaccharides, has potential for the advanced probiotic yeast. In order to express endo-inulinase, the present study utilized a cell surface display system known for its superior pH and temperature stability compared to the free enzyme. To construct the cell surface display, a comparative analysis was conducted among six proteins, namely AGA2, CWP1, CWP2, SED1, PIR1 and TIR1, which are essential proteins for facilitating attachment to the cell surface. As a result, SED1 exhibited the highest fluorescence intensity and was therefore identified as the most effective anchor protein for eGFP. Utilizing the endo-inulinase cell surface display system, all six anchor proteins with endo-inulinase can consume inulin almost in 48 H. AGA2 and SED1 were found to be highly effective anchor proteins for the display of endo-inulinase by fermentation

in a complex broth containing inulin. In conclusion, this study provides evidence of *S. boulardii*'s cell surface display system and suggest the advanced probiotic yeast for managing dyspepsia. Furthermore, this study opens up new possibilities for the application of *S. boulardii*'s cell surface display system to other digestive enzymes for probiotics.

P4-46

Effects on nutrients composition of *Tenebrio molitor* according to fermentation by *Cordyceps militaris* Mycelia

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Recently, there are many natural resources research for reduction of irritation and enhancement of function using mushroom mycelia fermentation. *Cordyceps militaris* is one of the entomogenous fungi that traditionally used as an herbal medicine in Korea and China. In this study, two different drying conditions of *Tenebrio molitor* larvae (shade drying, 30 min boiling after hot air drying) were fermented by *C. militaris* mycelia, respectively. And we analyzed proximate compositions, the content of β -glucan, cordycepin, and adenosine of fermented *T. molitor* larvae by *C. militaris* mycelia. As a result, the ash content of each dried *T. molitor* larvae did not show a significant difference by *C. militaris* mycelia fermentation. However, the contents of crude protein, crude fiber, and β -glucan were increased by *C. militaris* mycelia fermentation. Moreover, fermented shade dried *T. molitor* larvae by *C. militaris* mycelia was produced the highest content of cordycepin (13.75 mg/g). In short, ferment process using macro fungi can be increase their nutrients composition and provide resource developing new functional food or medicine product.

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P4-47

Synthesis of dextran like exopolysaccharide from rice flour hydrolysate by *Gluconobacter oxydans* ATCC 11894 bioconversion

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Dextran is a beneficial exopolysaccharide(EPS) with many functions such as indigestibility, its synthesized from dextrin by dextran dextrinase (DDase). The DDase (EC 2.4.1.2), a transglucosidase derived from acetic acid bacteria *Gluconobacter oxydans* (ATCC 11894, G.oxydans) and catalyzes formation of the polysaccharide dextran from maltodextrin. In this study, we investigate synthesis of dextran from rice flour hydrolysate to replace maltodextrin. HPAEC results showed that, rice flour hydrolysate by commercial enzyme Termamyl, Promozyme had similar saccharide composition with maltodextrin. Optical density of cell cultivated 72 hour using rice flour hydrolysate was higher than maltodextrin. Both rice flour hydrolysate, maltodextrin had higher viscosity than 10% dextran solution that values of 3mPa · s and 25 mPa · s respectively. H-NMR data suggested that formation of α-1,6 glycosidic bond in the dextrin substrate, the ratio ranging from 1:0.14 ~ 1:4.4. Gel permeation chromatography analysis showed various appearance of peak including dextran and polymer. RIAP analysis results showed a digestibility of 45% in 72 hours culture sample which was similar to positive control as dextran. These results suggest that rice flour hydrolysate have the potential to substitute maltodextrin.

P4-48

Optimal culture conditions and anti-inflammatory compositions hot water extract from fermented *Coix lacryma-jobi* L. var. *mayuen* Stapf. by *Hericium erinaceum* mycelials

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Fermentation is a process that decomposes organic matter and produces useful substances. During fermentation, molecules such as isoflavones, saponins, phytosterols, and phenols can undergo modifications, leading to increased pharmacological effects. Recently, researches conducted on the effects of fermentation on increased absorption and utilization in the body, as

well as reducing side effects such as gastrointestinal intolerance. In this study, the composition of fermented *C. lachryma-jobi* (FCL) were investigated. We performed to establish the optimal fermentation conditions of FCL, five species of mushroom mycelium were tested at different amount of *C. lachryma-jobi* extract and temperatures to measure mycelial growth density. The results showed that the *Hericium erinaceus* mycelium had the best growth and mycelial density, with an optimal fermentation temperature were ranged from 24°C to 26°C. Furthermore, the content of ergosterol and β -glucan from FCL were increase. Based on these results, mushroom fermentation enhances the pharmacological effects of the substrate, suggesting its potential value as a process for the development of functional foods in the future.

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P4-49

The research trends of eumycetes genomics

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Although microorganisms had a genetic diversity, their genomes are, smaller in size and have less variants compared to higher level organisms. The technological advances of sequencing enable the new approach to microbial genomics. Eumycetes include fungi, yeasts, and mushrooms, with 72,000 species reported worldwide. The genetic material responsible for the growth and development of eumycetes, has been the subject of extensive research. Eumycetes genes have been harnessed in diverse fields such as exhibit various functions, including antioxidant capacity, antimicrobial activity, and anticancer effects. Recent studies have provided important information into the genetic diversity and functional aspects of eumycetes. Genetic diversity research investigates genetic variations, gene expression regulation, and gene networks in various eumycetes species. The advancement of genomic sequencing technologies has studies of eumycetes genomes, enabling the identification of functional genes. It contributes to enhancing our understanding of the genetic diversity and functionality of eumycetes, fostering applied research and technological advancements. In this study, we introduced current research trends in eumycetes genomics for provided research directions for the future.



P4-50

Strategy of *Lentinula edodes* log cultivation smart farm system establishment

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Lentinula edodes is divided into log cultivation and sawdust cultivation according to the production method. Sawdust cultivation *L. edodes* is growing rapidly through optimal production facilities, while the log cultivation *L. edodes* is declining due to seed fungus inoculation problem with the aging of the farmers. According to the analysis results of the Rural Development Administration, *L. edodes* is one of the major forest mushrooms that ranks first in production (KRW 191.1 billion) and fourth in production (26,889 tons) among cultivated mushrooms in Korea. However, the cultivation area of domestic agricultural mushrooms is decreasing. Therefore, we tried to promote production efficacy using smart farm system. Current studies are underway to investigate culture characteristics, environmental data, and establish a culture room environmental control system for year-round cultivation of *L. edodes* for log cultivation. Therefore, establishment of *L. edodes* smart farm through log cultivation is expected to productivity of high-quality *L. edodes*, improve working environment, and strengthen agricultural competitiveness

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P4-51

Development and application of phage cocktail treatment to control *Pectobacterium carotovorum* subsp. *carotovorum* in lettuce

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Pectobacterium carotovorum subsp. *carotovorum* (PCC) causes pre- and post-harvest losses of lettuce production globally by causing soft rot disease. Although agricultural antibiotics and copper-based pesticides have been commercially used to control PCC, the

emergence and spread of bacterial resistance emphasized the necessity of safer and more effective alternatives. Thus, this study characterized five PCC phages as biocontrol agents to develop the phage cocktail and applied the most effective cocktail treatment consisting of two PCC phages (PCC1 and PCC5) against PCC in lettuce. Five PCC phages were previously isolated and purified from agricultural soils in Korea. Their host spectrums were assessed against 13 PCC strains and 21 non-PCC strains using dot assay. Additionally, *in vitro* bactericidal activity of each phage was determined at various MOIs of 0.01 to 10 using plate count method. Afterward, the efficacy of each cocktail treatment candidate was evaluated using time-killing assay. Finally, the biocontrol efficacy of phage cocktail (PCC1 and PCC5) was evaluated against PCC in lettuce at an MOI of 0.1. Among the five PCC phages, PCC1, PCC4, and PCC5 were determined to be cocktail candidates based on the non-overlapping host spectrum and pattern of bactericidal activity. In addition, cocktail treatment of PCC1 and PCC5 most significantly inhibited PCC growth for 30 h. Its pretreatment also reduced disease incidence of ~40% and disease severity of ~0.7 in lettuce. These results proposed that the developed phage cocktail consisting of PCC1 and PCC5 can be used as a biocontrol agent to control PCC in fresh produce.

P4-52

Synergistic effect of vB_EcoS_EC phage and pleurocidin peptide against antibiotic-resistant *Escherichia coli*

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The emergence of antibiotic-resistant (AR) *Escherichia coli* has become a global threat to public health. The purpose of this study was to evaluate the synergistic effect of a novel AR *E. coli*-specific phage (vB_EcoS_EC) and pleurocidin (Ple) peptide against AR *E. coli*. Bactericidal effect of vB_EcoS_EC was assessed by incubating various MOIs (0.001-10) of vB_EcoS_EC with AR *E. coli*. Ple, derived from winter flounder, has been identified as a 25-amino acid antimicrobial peptide. Minimum inhibitory concentration (MIC) of Ple were determined using a broth microdilution method. Subsequently, AR *E. coli* were exposed to various concentrations of Ple ($1/4 \times$ - $4 \times$ MIC) to evaluate the bactericidal effect of Ple and monitor changes in the membrane integrity of AR *E. coli* induced by Ple. Finally, AR *E. coli* was treated with vB_EcoS_EC and Ple combination to evaluate their synergistic effect. vB_EcoS_EC significantly inhibited *E. coli* with the greatest reduction (~4.5 log CFU/mL) for 12 h at the lowest MOI of 0.001 ($p < 0.05$). MIC of Ple was determined as 2.8 μ M and



Ple significantly inhibited AR *E. coli* growth even at $1/2 \times$ MIC ($p < 0.05$). The decreased membrane integrity of AR *E. coli* was confirmed starting from at $1 \times$ MIC of Ple. From both bactericidal results, the final concentrations of vB_EcoS_EC and Ple were determined to be an MOI of 0.001 and $1 \times$ MIC, respectively. The combined treatment of vB_EcoS_EC and Ple exhibited a significantly greater reduction (~ 6.2 log CFU/mL) and prolonged inhibition time (over 14 h) than those of each treatment ($p < 0.05$). This study demonstrated that vB_EcoS_EC and Ple could be novel and effective control agents against AR *E. coli*.

P4-53

Optimization of a novel and efficient polyvalent phage infecting *Escherichia coli* and *Salmonella* spp. for scale-up production

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The purpose of this study was to optimize the concentration and incubation time of *Escherichia coli*-specific phage (vB_EcoM_KFSEC10) for scale-up production. vB_EcoM_KFSEC10 was isolated and purified from slaughterhouse sewage. The specificity was investigated against eight strains of *E. coli*, eleven strains of *Salmonella* spp. and other fifteen strains of major foodborne pathogens using dot assay. Temperatures and pHs stabilities of vB_EcoM_KFSEC10 were assessed by exposing to various temperatures (-80 – 80°C) and pHs (1–12) for 1 h. Prior to scale-up, vB_EcoM_KFSEC10 was determined the optimal MOI (0.01, 0.1, and 1.0) and incubation time at a flask level. While vB_EcoM_KFSEC10 was mixed with *E. coli* at optimized MOI for 12 h at 37°C in a fermenter, a viable bacterial number and vB_EcoM_KFSEC10 titer were measured using plate count method and plaque assay, respectively. vB_EcoM_KFSEC10 exhibited a broad specificity against six strains of *E. coli* and eight strains of *Salmonella* spp. vB_EcoM_KFSEC10 was stable under ranges of pHs (2–11) and temperatures (-20 – 50°C). The optimized condition of vB_EcoM_KFSEC10 was determined as an MOI of 0.1 and for 2 h based on the highest production efficiency. Moreover, vB_EcoM_KFSEC10 concentration was significantly increased up to 4 h [(10.0 ± 0.1) log PFU/mL] in optimized condition ($p < 0.05$). Bacterial concentrations were maintained at 8 h. This study demonstrated the stabilities of vB_EcoM_KFSEC10 and optimized conditions for scale-up production.

P4-54

Metagenomic analysis of bacterial community and functional capacity in Cheongsan Island Local Kimchi

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Kimchi is a traditional Korean dish that is made by fermenting vegetables with seasonings such as chili powder, garlic, ginger, and fish sauce. There are also many other types of kimchi that use ingredients like scallions, carrots, and even fish. The addition of fish to kimchi is optional and not used in all types of kimchi. However, it is a traditional ingredient that can add depth of flavor and nutritional value to the dish. In the fermentation process of kimchi, the microbial community goes through a series of changes as different types of lactic acid bacteria (LAB) dominate at different stages of fermentation. Although this microbial succession is well-documented in baechu-kimchi, there is still much to learn about the microbial communities of other regional varieties of kimchi. In these studies, we assumed that the microbial structure of Cheongsan Island local kimchi with broth made from Spanish mackerel might be distinct from that of the representative baechu-kimchi. Moreover, we are unaware of studies designed to identify the predominant species in Spanish mackerel-baechu kimchi (MK). Therefore, we investigated the bacterial community of Spanish mackerel-baechu kimchi using culture-independent and -dependent analyses. Additionally, starter candidates were selected from among the isolated strains following safety and functional assessments.

P4-55

Isolation, identification, and fermentation characteristics of acetic acid bacteria (*Acetobacter pasteurianus* SFT-18 and *Gluconobacter oxydans* SFT-27) for Kombucha manufacturing

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Kombucha is a fermented tea drink made with sugar and a symbiotic culture of bacteria and yeast (SCOBY). The SCOBY contains acetic acid bacteria, lactic acid bacteria, and yeast. Kombucha quality and functionality depend on microbes and manufacturing. Research is



limited in this area. Domestic kombucha production requires imported powder or SCOBY. Acetic acid bacteria were identified from various fermented foods and agricultural products for application in kombucha production. 35 species of *Acetobacter* and 2 species of *Gluconobacter* were identified as acetic acid bacteria based on their characteristics. Seven acid and alcohol-resistant strains were selected and their fermentation characteristics were confirmed based on temperature and period. Fermentation was optimal at 30–35°C. *Acetobacter pasteurianus* SFT-18 had a titratable acidity of 1.68% and 9.52 log CFU/mL an acetic acid count. The *Gluconobacter oxydans* SFT-27 had 10.32 mg/mL of glucuronic acid and 25.49 mg/mL of gluconate. Two strains were selected for making kombucha.

P4-56

Development of lingonberry wines co-fermented with mulberry, apple and pear

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Lingonberry (*Vaccinium vitis-idaea* L.) is a small red berry of the Ericaceae family and grows wild in the forests of Northern countries (including Sweden, Finland, and Norway), Central Europe, Russia, and Canada. The lingonberry is closely related to a cranberry, but it is less known and popular than the cranberry. Lingonberry contains plentiful phenolic compounds such as gallic acid, flavonols, anthocyanin, and proanthocyanidin, which have excellent antioxidant and anti-inflammatory properties. Lingonberry is typically consumed as food in many different forms, such as jam, juice, syrup and wine. Despite its high functionality, lingonberry is not well known in Korea. In this study, we aimed to develop lingonberry wine for novel product in Korea. However, yeast hardly ferments lingonberry since it contains high amount of benzoic acid, so blending with lingonberry and other fruits was necessary to dilute benzoic acid. Thus, we mixed the lingonberry with commonly used domestic fruits (mulberry, apple and pear) to increase fermentability. We expect that fermenting with lingonberry and domestic fruits can improve the functionality and organoleptic quality of lingonberry wine. This research might contribute to the domestic wine industry by suggesting the utilization of new ingredients and providing useful information about the lingonberry product.

P4-57

Anti-stress (Relaxation) and gut microbiota mediated mechanism of psychobiotic *Limosilactobacillus reuteri* fermented brown rice

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Stress has been shown to disrupt the balance of human intestinal microbiota, resulting in mental health issues such as anxiety, depression and memory loss. Synbiotics have been displayed to reduce the adverse effects of stress on gut microbiota composition and behavior. This study used a chronic mild stress model with ICR mice to conduct metagenomics & metabolomic investigation of anxiety and probiotic *Limosilactobacillus reuteri* fermented brown rice (Synbiotics) treatment. Body weight measurement and behavior tests such as EPM, NOR, and FST were used to validate the anxiety model. A four-week Synbiotics regimen was able to reverse the behavioral despair brought on by anxiety. Serum and fecal samples were collected from all four groups (Control, Stressed, Drug, and Synbiotics) for metagenomic(16S rRNA gene) and UHPLC-MS metabolomic profiling. The metabolites that had been differentially expressed among four groups demonstrated that Synbiotics and drug treatment commonly perturb amino acid metabolism, energy metabolism, SCFAs and neurotransmitters. Additionally, significantly more species were identified in the fecal metagenomes of the Synbiotics group. Our findings supported the gut-brain axis involved in reducing the symptoms of stress by suggesting a potential connection between Synbiotics-induced gut microbiota modulation and the reduction of stress/anxiety in stressed mice



PART V

생리활성 / 영양 / 기능성

P5-01

Safety and inhibition of hypersensitivity from sprout ginseng-derived postbiotics using smart agriculture

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Smart agriculture is an agricultural form developed from smart farms. Smart agriculture is a combination of information and communication technology (ICT), biotechnology (BT), genetic engineering technology (GT), and environmental engineering technology (ET). An optimal growth environment can be created based on crop growth data and environmental information. The quality of agricultural products can be improved with less labor, energy, and nutrients than before. In this study, ginseng sprouts were harvested using smart agriculture and lactic acid bacteria were isolated from them. Lactic acid bacteria were killed as postbiotics and their safety and inhibition of hypersensitivity were confirmed. As a result of measuring genetic toxicity by the ames test, it was measured that postbiotics did not induce back mutation. It was confirmed that the expression level of various pro-inflammatory cytokines decreased in a postbiotics dose-dependent manner in LPS-stimulated RAW264.7 cells. In addition, the expression levels of H1R and COX-2 related to hypersensitivity decreased in a postbiotics dose-dependent manner in compound 48/80-induced HMC-1 cells. Therefore, it is suggested that the postbiotics derived from ginseng sprouts can be used as a material for improving hypersensitivity.

P5-02

Quantification of triterpenes in *Centella asiatica* cultivated in a smart farm, and their activation in keratinocytes

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This study aimed to compare the bioactive compounds in *Centella asiatica* (*C. asiatica*) cultivated in a smart farm and a field and their effects on human keratinocyte cells. *C. asiatica* was collected in Jeju-do, Korea, and cultured in a smart farm and a field. The main bioactive compounds in the two differentially cultured *C. asiatica* were identified, and their activation in

keratinocytes were assessed. Amplification and sequencing of the internal transcribed spacer (ITS) DNA in the nucleus and psbA–H DNA in the chloroplast were performed for species analysis. A comparison of DNA of plants reported in the NCBI GenBank was performed. The ITS DNA and psbA–H DNA sequences of *C. asiatica* cultivated in a smart farm and a field were consistent with No. MH768338.1 and No. JQ425422.1, respectively. Analysis of the triterpenes was performed using high performance liquid chromatography (HPLC) and as a result, *C. asiatica* cultured in a smart farm had more triterpenes than those cultured in a field. The effects of *C. asiatica* grown in a smart farm on cell proliferation and scratch recovery in HaCaT cells were greater than those grown in a field. These results suggest that *C. asiatica* cultivated in a smart farm can be effectively utilized as a health functional food.

P5-03

**Anti-inflammatory and anti-obesity effect of the new cultivar
Salvia miltiorrhiza 'Hongdan'**

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Salvia miltiorrhiza (Redroot Sage) Bunge is a perennial herb that belongs to family Lamiaceae. It is a commonly used medicinal plant for improving body function such as promoting circulation and improving blood flow in Korea, China and Japan. In this study, the bioactive potentials (e.g., antioxidant, anti-inflammatory, and anti-obesity properties) of samples were examined in the development of new cultivar new cultivar *Salvia miltiorrhiza* 'Hongdan' The ethanolic extracts of Redroot Sage were used for bioactivity evaluation and compare the effects of new cultivar *Salvia miltiorrhiza* 'Hondan' with other cultivars. As a results, anti-inflammatory and anti-obesity effect of *Salvia miltiorrhiza* 'Hongdan' were excellent. The inhibitory effect of *Salvia miltiorrhiza* 'Hongdan' on lipopolysaccharide-induced inflammatory responses such as inducible nitric oxide synthase-derived nitric oxide production in RAW 264.7 macrophages was greater than those of other cultivars. Futhermore, *Salvia miltiorrhiza* 'Hongdan' showed a significantly higher anti-obesity activity than other samples. The effect of *Salvia miltiorrhiza* 'Hongdan' on the inhibition of lipid accumulation was achieved by reducing the expression of the major adipogenic transcription factors (PPAR γ and C/EBP α).



Salvia miltiorrhiza 'Hongdan' supplementation in high fat diet-induced obese mice ameliorated body-weight gain, body fat deposition, the formation of white lipid droplets in hepatocytes, as well as the levels of serum TG and LDL-Cholesterol without liver damage. The present study suggests that the new cultivar *Salvia miltiorrhiza* 'Hongdan' may be useful as a functional material for functional food and pharmaceuticals.

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P5-04

Comparison of nutritional and physicochemical characteristics between Korean native pepper variety and improved variety

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Capsicum annuum L., commonly known as hot pepper, has been widely used as a spicy seasoning, as well as for food and medicinal purposes. In this study, comparison of the chemical and nutritional characteristics was conducted on five traditional varieties (Yuwocho, Subicho, Sumihyang, Goeunbit, Chilseongcho) and five improved varieties (Dabok, Cheongyang, Chungseong, Olbokhap, Sinhonggildong) of hot peppers available in Korea. Firstly, color analysis showed that redness was higher in Subicho, Sumihyang, Dabok, and Olbokhap, while yellowness was relatively higher in Yuwocho and Olbokhap, but significantly lower in Sinhonggildong. Therefore, except for Yuwocho, Olbokhap, and Sinhonggildong, the remaining seven varieties exhibited color differences ranging from 69.5 to 71.9. Ethanol extracts of all ten hot pepper varieties showed maximum absorbance at 250 nm and secondary absorbance at 470 nm, indicating the presence of capsaicinoids and carotenoids, respectively. DSC analysis divided the varieties into three groups, with Sumihyang, Goeunbit, and Dabok showing very similar exothermic reactions. Furthermore, nutritional analysis revealed almost similar contents of moisture, protein, lipid, and carbohydrate among the varieties, with Sumihyang having a relatively higher protein content. Fatty acid analysis showed that the major saturated fatty acids were palmitic acid and stearic acid, while the unsaturated fatty acids were oleic

acid (w9), linoleic acid (w6), and linolenic acid (w3), with linoleic acid accounting for 60–67% of total fatty acids. The w6/w3 fatty acid ratio varied from 6.3 (Dabok) to 30.0 (Chungseong), with an average of 14.1 ± 3.4 for traditional varieties and 18.6 ± 9.9 for improved varieties. Mineral content analysis showed the order of $K > Mg > Ca > Na > Fe > Zn > Mn$, with higher Zn in traditional varieties and relatively higher Mn in improved varieties. These findings can be utilized in the development of functional food and cosmetic ingredients using various hot pepper varieties in the future.

P5-05

Anti-oxidant, anti-diabetes, and anti-thrombosis activities of Gounbit, a Korean native hot pepper variety

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The Goeunbit is a domestic hot pepper variety (HG09004) that was registered as a protected variety under the number 6612 in 2017. It was developed by crossing a high-pigment strain (YP001131) collected from Hungary with a traditional variety with the characteristics of Subicho (YP3041-9-3). Goeunbit is suitable for rain-shelter cultivation and is characterized by its high pigment content and the traits of Subicho, a traditional variety. When used for drying peppers, Goeunbit has a mild spiciness but high sugar content. In this study, the useful bio-activities of Goeunbit were evaluated by preparing ethanol extracts and sequentially partitioning them into organic solvents. The antioxidant, antidiabetic, and anticoagulant activities were assessed. The results showed that the ethylacetate (EA) fraction of Goeunbit extract exhibited a high polyphenol content and excellent antioxidant activity. Particularly, it demonstrated significant inhibitory activity against α -glycosidase, β -glycosidase, acid phosphatase, alkaline phosphatase, β -glucuronidase, and α -mannosidase. Furthermore, the EA fraction of Goeunbit extract displayed a potent anticoagulant activity, as evidenced by more than 15-fold prolongation of thrombin time, prothrombin time, and activated partial thromboplastin time at a concentration of 5mg/ml, surpassing the activity of aspirin. The hemolytic activity assessment as part of acute toxicity evaluation revealed hemolytic activity only in the hexane fraction of Goeunbit extract. These findings suggest the potential development of functional materials with antioxidant, antidiabetic, and anticoagulant activities using the EA fraction of Goeunbit extract.



P5-06

Anti-oxidant, anti-diabetes, and anti-thrombosis activities of Sumihyang, a Korean native hot pepper variety

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The sumihyang is a traditional Korean hot pepper variety that was selected from excellent individuals obtained from Ogicho hot peppers collected in Subi-myeon, Yeongyang-gun, Gyeongsangbuk-do, South Korea, and established through adaptation tests until 2013. Sumihyang has large fruit size and thick pericarp, making it a high-yielding variety. It is a vigorous, annual plant with a slightly spicy taste, good gloss, and high sugar content, making it suitable for dried chili production due to its excellent quality. In this study, ethanol extract of Sumihyang and its sequential organic solvent fractions were prepared to evaluate their antioxidant, antidiabetic, and anticoagulant activities for the value-added utilization of Sumihyang. The ethyl acetate (EA) and butanol (BuOH) fractions of Sumihyang extract exhibited very high polyphenol content and excellent antioxidant activity. In particular, the EA fraction showed strong inhibitory activity against α -glycosidase, β -glycosidase, acid phosphatase, alkaline phosphatase, β -glucuronidase, and α -mannosidase. In the evaluation of anticoagulant activity, the BuOH fraction of Sumihyang extract showed more than 15-fold prolonged thrombin time and activated partial thromboplastin time at a concentration of 5 mg/mL, and a 7.8-fold prolonged prothrombin time, indicating stronger anticoagulant activity compared to aspirin. As part of the acute toxicity evaluation, strong hemolytic activity was observed only in the hexane fraction of Sumihyang extract. These findings suggest the potential of active fractions from Sumihyang in the development of functional ingredients with antioxidant, antidiabetic, and anticoagulant activities.

P5-07

Anti-thrombosis, anti-oxidant and anti-tyrosinase activities of the aerial part of *Apocynum lancifolium*

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Apocynum lancifolium is a perennial plant of the Apocynaceae family that grows in mountains and fields in Korea and China. Its fruit is about 12cm long and has a characteristic head of

hair-like fibers. It was designated as an endangered species by the Korea Forest Service, but recently a habitat was discovered in the seashore, Gyeonggi Province. It is commonly used for ornamental purposes, but the roots, also known as "napoma," are used for medicinal purposes such as diuresis, lowering blood pressure, treating heart disease, hypertension, neurasthenia, hepatitis, and edema. With recent studies showing its potential to improve hyperlipidemia, hypertension, liver protection, depression, and antioxidant and anti-inflammatory activities, there is growing interest in its potential as a new source of natural medicine. In this study, the total polyphenol and flavonoid contents of 70% ethanol and water extracts of *A. lancifolium* were measured, and their antioxidant activities (DPPH radical scavenging activity, ABTS cation radical scavenging activity, nitrite scavenging activity), anticoagulant activity (thrombin time, prothrombin time, APTT), tyrosinase and elastase inhibition activities were evaluated. The ethanol and water extracts of *A. lancifolium* contained high levels of total polyphenols (93.4 and 51.1 mg/g, respectively) and showed excellent radical scavenging activity. In addition, the 70% ethanol and water extracts exhibited strong anticoagulant activity through inhibition of blood coagulation enzymes and coagulation factors, and did not show hemolytic activity. These results suggest that *A. lancifolium* extracts may be a new source of natural ingredients for functional foods and cosmetics with anticoagulant and antioxidant activities.

P5-08

Anti-thrombosis, anti-oxidant and anti-tyrosinase activities of the leaves of *Rhododendron fortunei*

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Rhododendron fortunei, commonly known as "manbyeongcho" in Korea, is an evergreen plant belonging to the family Ericaceae. It is found only in high altitude areas of Korea and Japan. There are several types of manbyeongcho, including *R. brachycarpum* var. *roseum* found in North Korea, *R. aureum* found in Baekdu Mountain, and *R. fortunei* found in China. In traditional medicine, *R. fortunei* has been used to treat various ailments such as diabetes, liver cirrhosis, menstrual irregularities, infertility, and hypertension. Recent studies have also shown that *R. fortunei* has antioxidant, anti-wrinkle, moisturizing, antibacterial, and anti-inflammatory properties, making it a valuable source for developing new functional food and cosmetic ingredients. In this study, 70% ethanol and hot water



extracts of *R. fortunei* leaves were prepared and their total polyphenol and flavonoid contents were measured. Their antioxidant activities (DPPH radical scavenging activity, ABTS cation radical scavenging activity, nitrite scavenging activity), anticoagulant activities (thrombin time, prothrombin time, APTT), and enzyme inhibitory activities (tyrosinase and elastase) were evaluated. The results showed that *R. fortunei* leaves extract contained high levels of total polyphenols, with 208.1 and 200.0 mg/g in the ethanol and hot water extracts, respectively. They also exhibited excellent antioxidant activities. In addition, the *R. fortunei* leaves extracts showed stronger anticoagulant activities than aspirin through inhibition of coagulation factors, without hemolytic activity. These findings suggest that *R. fortunei* leaves could be a valuable resource for developing functional food and cosmetic ingredients with anticoagulant and antioxidant activities.

P5-09

Anti-thrombosis, anti-oxidant and anti-tyrosinase Activities of of *Abies nephrolepis*

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Abies nephrolepis is an evergreen coniferous tree belonging to the pine family and is found in cold mountainous areas in Korea, northeastern China, and eastern Siberia. In Korea, it grows along the Taebaek Mountain Range, particularly in the high-altitude areas of Seoraksan and Taebaeksan, and also in the southern region's Jirisan. The tree can grow up to 25 meters tall and has thin, straight branches. Usually, *A. nephrolepis* is used for pulp due to its light weight and soft material, and its beautiful leaf texture and shape make it suitable for ornamental trees or Christmas decorations. Recently, *A. nephrolepis* has gained attention for its potential as a new source for functional medicine due to its anti-cancer cell growth, NO synthesis inhibition, anti-inflammatory activity, and gap junction inhibition activity. In this study, a 70% ethanol extract of *A. nephrolepis* leaves and branches was prepared, and their total polyphenol and total flavonoid content was measured. Their antioxidant activity (DPPH radical scavenging activity, ABTS cationic scavenging activity, nitrite scavenging activity), anticoagulation activity (TT, PT, APTT), and tyrosinase and elastase inhibition activity were evaluated. As a result, *A. nephrolepis* leaf and branch extracts contained very high total polyphenol content of 120.8 and 101.1 mg/g, respectively, and exhibited excellent radical scavenging activity. Furthermore, the

leaf and branch extracts showed strong anticoagulation activity through the inhibition of blood coagulation enzymes and coagulation factors, but the leaf extract showed hemolytic activity. These results suggest that *A. nephrolepis* branch extract can be used as a new resource for the functional food and cosmetic industry for anticoagulant and antioxidant activity.

P5-10

A study on the functional ingredients of Jeollanam-do Kimchi

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This study analyzed the functional ingredients of Kimchi produced in Jeollanam-do. We have collected 12 samples, each of the 4 kinds of Kimchi (Chinese cabbage Kimchi, Chonggak Kimchi, Green onion Kimchi, Mustard leaf Kimchi) is made in three regions (Yeosu, Suncheon, Haenam). The total polyphenolic compounds in the Kimchi extracted with hot water were 46.99–95.07 mg GAE/g and the total flavonoid contents were 25.75–81.53 mg QE/g. Haenam mustard leaf Kimchi and green onion Kimchi extracts were the highest compared to the other samples. DPPH radical scavenging activity was 13.85–37.93%. Haenam mustard leaf Kimchi and green onion Kimchi extracts had the highest scavenging activity. Yeosu green onion Kimchi and mustard leaf Kimchi extracts reduced the number of lipid droplets in MDI-treated 3T3-L1 cells. As a result of measuring cell viability by treating 3T3-L1 cells with the extracts, there was no cytotoxicity at all concentrations. The mRNA expression levels of PPAR γ , C/EBP α , SREBP-1c, LPL, ACC, aP2, leptin and FAS in Yeosu green onion Kimchi and mustard leaf Kimchi extracts were decreased compared to the MDI-treated cell group. These results of study are expected to be used as scientific basic data in the field of functional ingredients of Jeollanam-do Kimchi.



P5-11

Anti-coagulation and platelet aggregation inhibitory Activities of the edible root of *Dioscorea alata* L.

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Dioscorea alata L, commonly known as "tropical yam" or "water yam," is the most widely consumed yam species among the 650 yam species belonging to the Dioscoreacea family. It is extensively cultivated in tropical and subtropical regions. It is a major food source in Africa and India and is also used for medicinal purposes, particularly in China and Taiwan, for its anti-inflammatory properties. In comparison to other yam varieties such as *Dioscorea batatas*, the tropical yam has gained popularity in domestic cultivation in Korea due to its higher yield per unit area, approximately twice that of ordinary yams and *Dioscorea batatas*. In this study, the nutritional characteristics and anti-thrombosis activity of the root of tropical yam were compared to those of domestic yam variety, *D. batatas*. The results showed that the root of tropical yam exhibited superior nutritional characteristics and potent anticoagulant activity compared to those of domestic yam varieties. Particularly, it demonstrated excellent activities in inhibiting thrombin, prothrombin, and blood coagulation factors, comparable to aspirin. The water residue obtained after sequential organic solvent fractionation of the root extract showed the strongest anticoagulant activity. Furthermore, the water residue exhibited strong platelet aggregation inhibition at 0.25mg/ml and showed no hemolytic activity up to a concentration of 1mg/ml. These findings suggest the potential development of high-value anticoagulant agents utilizing the edible root of tropical yam.

P5-12

Analysis of minerals and functional ingredients in domestic and foreign laver (*Pyropia spp.*)

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The main components of laver were carbohydrate and protein. The lipid content was 0.2 %, showing no significant difference. The minerals of laver were Ca, Mg, Na, and K,

of which the content of K was the highest. The content of Ca was the highest in Korean laver(657 mg/100g). The total polyphenol content was shown to the lowest in Chinese laver(4.74 mg/g). And the laver of Korean(7.25 mg/g) and Japanese(6.87 mg/g) were no significant difference. The ABTS+ radical-scavenging activity and the ferric ion reducing anti-oxidant power(FRAP) was the highest in the Korean laver. The porphyrin-334 content was no significant difference in each laver. But the Korean laver has the highest content of shinorine(825.4 ± 84.8 mg/100g) compared to the laver of Chinese and Japanese. In this study, the minerals and functional ingredients of laver from other countries were analyzed to provide basic data.

P5-13

Antioxidant activity and anti-obesity effect of Sunchang kombucha vinegar

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This study was conducted to analyze antioxidant activity (DPPH, ABTS, SOD and ORAC) and anti-obesity activity (pancreatic lipase inhibition, inhibition of adipogenesis in 3T3-L1 pre-adipocytes) of Sunchang kombucha vinegar (SKV). Antioxidant activity was expressed as 50% inhibitory activity (IC50) based on dilution factor, and IC50 of DPPH, ABTS, SOD, and ORAC were confirmed to be 170.97, 142.47, 1,357.40, and 1,691.43, respectively of SKV. Lipase inhibitory activity was 258.49 when IC50 was calculated based on the dilution factor. When treated with SKV at dilutions of 1/1000 and 1/500, the rate of lipid accumulation decreased by 30.35% and 30.69%, respectively, compared to the group treated only with differentiation inducer (MDI). In addition, leptin secretion levels were 1,915 pg/mL and 1,754 pg/mL in the groups treated with SKV at dilutions of 1/1000 and 1/500, respectively, which was significantly lower than the level in the group treated only with MDI (3,487 pg/mL). These results indicate that SKV have the potential to be applied as functional beverage for antioxidant and anti-obesity.



P5-14

Effect of beneficial bacteria and harmful components in traditional soybean paste on the anti-obesity

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This study analyzed the anti-obesity activity of 8 types of Korean traditional soybean pastes selected based on the content of beneficial bacteria and harmful substances. The 8 types of traditional soybean pastes (TSP) were freeze-dried and subjected to ethanol extraction. After removing the extraction solvent, the freeze-dried powder was evaluated for anti-obesity activity (lipase inhibitory activity, 3T3-L1 cell adipocyte differentiation inhibitory activity). Pancreatic lipase inhibitory activity of TSP extract increased in concentration-dependently, showed an activity of 33.34~64.49% at the highest concentration 10 mg/mL of treated groups. The cell viability maintained over 80% as treated of the soybean pastes extract until 0.3 mg/mL on the 3T3-L1 cell line. The inhibition of lipid accumulation of TSP extract showed 6.59~40.57%, compared to the group treated only with differentiation inducer (MDI). The amount of leptin was analyzed to be 280~5,862 pg/mL to the group treated at the highest concentration of 0.3 mg/mL. These results indicate that the beneficial bacteria and harmful substances did not significantly affect for anti-obesity of soybean pastes extract.

P5-15

Anti-hyperlipidemia and hepatocellular protective effect of ethanol extract from *Lithospermum erythrorhizon*

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This study evaluated the angiotensin-converting enzyme 1 (ACE 1) inhibitory activity and the ability to recover non-alcoholic liver cell damage on HepG2 cell line effects of ethanol extract from *Lithospermum erythrorhizon* (LE). ACE I inhibitory activity increased in a concentration-dependent manner, showing 36.95% activity at the highest concentration of 10 mg/mL. When HepG2 cell line was treated with 100 μ M of tert-butyl hydroperoxide (t-BHP), the cell viability decreased by 38.92% compared to the untreated

group. Cell viability in the LE ethanol extract treatment group (0.1 mg/mL) was 75.47%, which was 13.39% higher than that in the t-BHP alone treatment group. The AST and ALT production decreased from 9,320 pg/mL to 6,670 pg/mL and from 496 pg/mL to 372 pg/mL, respectively, as the LE ethanol extract (0.1 mg/mL) was treated. These results indicate that LE ethanol extract have the potential to be applied as functional materials for anti-hyperlipidemia and hepatocellular protection.

P5-16

Nrf2-mediated protective effect of protein hydrolysates from *Protaetia brevitarsis* larvae against H₂O₂-induced cytotoxicity in AML12 hepatocytes

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In the present study, we hypothesized that protein hydrolysates of *Protaetia brevitarsis* larvae (PBL) which is known to exert significant scavenging activity toward reactive oxygen species (ROS) might protect liver cells against ROS-induced cytotoxicity. Therefore, hepatoprotective effects of protein hydrolysates of PBL and their underlying mechanisms were investigated in AML12 mouse liver cells. Pretreatment with the PBL flavourzyme hydrolysate (PFH) showed the highest protective effect against H₂O₂-induced cytotoxicity in AML12 cells among three PBL hydrolysates produced by different proteases (alcalase, flavourzyme, and neutrase). Further mechanistic studies demonstrated that PFH reduces intracellular ROS levels through increasing NF-E2-related factor 2-mediated expression of catalase and heme oxygenase-1. These results suggest that PFH represents potential sources of natural hepatoprotective agents.

P5-17

Nrf2/HO-1-mediated protective effect of protein hydrolysates from silkworm (*Bombyx mori*) Pupae against H₂O₂-induced cytotoxicity in AML12 mouse hepatocytes

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In the present study, we hypothesized that protein hydrolysates of silkworm (*Bombyx mori*) pupae (SP), which have been previously reported to exhibit scavenging activity toward reactive oxygen species, might protect liver cells against oxidative stress-induced cytotoxicity. Therefore, the hepatoprotective effect of protein hydrolysates of SP was investigated in H₂O₂-



treated AML12 mouse hepatocytes. Among three SP hydrolysates produced by different proteases (alcalase, flavourzyme, and neutrase), the SP flavourzyme hydrolysate (SPF) showed the highest protective effect against H₂O₂-induced cytotoxicity in AML12 cells. Further mechanistic studies showed that pretreatment with SPF reduces cellular ROS levels through increasing NF- κ B-related factor 2-mediated expression of heme oxygenase-1. These findings suggest that SPF represents a potential source of nutraceuticals that supports liver functions.

P5-18

Dual targeting of KRAS and β -catenin by Isoalantolactone, an NR4A1 inactivator, inhibits colon cancer cell growth

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Colorectal cancer (CRC) is one of the most commonly diagnosed cancers and a major cause of cancer-related deaths worldwide. Many CRCs exhibit mutations in adenomatous polyposis coli (APC) and KRAS, resulting in abnormal activation of the β -catenin and Kras signaling pathways. Meanwhile, the orphan nuclear receptor NR4A1 is overexpressed in numerous human tumors and cancer cell lines, including CRC, and it plays essential roles in cancer cell growth and survival through multiple signaling pathways. NR4A1 has recently been shown to regulate the growth of CRC cells harboring APC and KRAS mutations, and our preliminary study also showed that NR4A1 regulates both β -catenin and Kras signaling pathways in CRC cells. Therefore, the present study defined a novel role of NR4A1 regulating β -catenin and Kras pathways and provided evidence for isoalantolactone, an NR4A1 inactivator, to inhibit colon cell growth.

P5-19

Anti-tumor effect of Ganjang (Korean soy sauce) on AOM/DSS-induced colitis-associated colorectal mouse model

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Fermented foods contain biogenic amines that have been known to cause side effects such as headaches, rashes, and increased blood pressure. Although Korean traditional fermented

soy sauce contains biogenic amines, it is known to have similar to or better antioxidant and physiological activities than commercially mass-produced soy sauce. The results of whether traditional soy sauce, which has good bioactivity, is harmful to health due to the presence of biogenic amines, have not been elucidated. In this study, we compared and evaluated the biogenic amine level of traditional and commercial soy sauce and its anti-tumor effect on colorectal cancer. Colorectal cancer is the third most common type of cancer and is caused by chronic inflammation, which is known to cause inflammatory bowel disease (IBD). Therefore, we investigated the anti-tumor effect of ganjang using an azoxymethane/dextran sodium sulfate (AOM/DSS)-induced colitis-associated colorectal cancer (CAC) mouse model. Ganjang alleviated AOM/DSS-induced pathological symptoms such as colonic shortening, increased spleen weight, and tumor formation. The traditional soy sauce showed no behavioral and biochemical abnormalities in mice and showed efficacy similar to that of commercially available soy sauce. These results suggested that ganjang exerts anti-tumor effects on AOM/DSS-induced CAC mice model.

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P5-20

Effects of Cheonggukjang (fermented soybean) the development of colitis-associated colorectal cancer in mice

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Colorectal cancer (CRC) is the third most common type of cancer and is caused by multiple factors. Chronic inflammation, known to cause inflammatory bowel disease (IBD), is closely associated with CRC. Cheonggukjang (CJ), a traditional Korean fermented soybean, is a functional food with anti-inflammatory effects in the intestines, but its anti-cancer effects have not yet been explored. In this study, we investigated the cancer-protective effects of cheonggukjang in an azoxymethane/dextran sodium sulfate (AOM/DSS)-induced colitis-associated colorectal cancer (CAC) mouse model. The CJ alleviated AOM/DSS-induced pathological symptoms such as colonic shortening, increased spleen weight,

tumor formation, and histological changes. It also modulated pro-inflammatory and anti-inflammatory cytokine levels via the suppression of NF- κ B and inflammatory mediator signaling pathways. Furthermore, the CJ improved intestinal integrity by regulating mucin-associated and tight junction proteins. In addition, it suppressed tumor growth by regulating apoptosis and proliferation. These results highlight the anti-tumor effects of CJ in an AOM/DSS-induced CAC mouse model.

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P5-21

Anti-proliferative effect of *Euonymus alatus* (Thunb.) Siebold leaf extract by apoptosis in human breast cancer cells

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Euonymus alatus (Thunb.) Siebold (*E. alatus*) is a deciduous shrub belonging to the Celastraceae family that is distributed in Asian countries, including Korea, China, and Japan. *E. alatus* contains bioactive substances, such as flavonoids, lignans, steroids, alkaloids, and terpenoids. Furthermore, *E. alatus* leaves have efficacy in diabetes, asthma, and hypertension. On the other hand, studies on the anticancer effect of *E. alatus* leaves are insufficient. In this study, the antiproliferative activity of *E. alatus* leaf extract was confirmed in various cancer cells. When *E. alatus* leaf extract was treated with A549 (lung cancer cells), SW480 (colon cancer cells), PC3 (prostate cancer cells), and MDA-MB-231 (breast cancer cell), the highest cell proliferation inhibitory activity was observed in MDA-MB-231 cells. In addition, treatment with the *E. alatus* leaf extract increased the apoptosis of breast cancer cells in a concentration-dependent manner and induced DNA fragmentation and nuclear condensation. Therefore, the *E. alatus* leaf extract can be a functional food and pharmaceutical material with anticancer activity.

P5-22

A tool to screen for identify potential anti-aging effects of probiotics bacteria using *Caenorhabditis elegans* animal model

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The growing interest in the effects of probiotics on longevity has led to the need for practical in vivo models to understand the mechanisms of probiotic activity, and in recent years, the *C. elegans* nematode has emerged as a powerful animal model for studying host-probiotic interactions. Despite being evolutionarily distant from humans, *C. elegans* shares many conserved cellular pathways with humans. Notably, this nematode has been found to possess several well-defined MAPK signaling cassettes, which are crucial for the innate immune defense and are commonly found in both arthropods and mammals. Here, we used *C. elegans* to screen probiotics with potential anti-aging effects. The purpose of this study was to evaluate the probiotic and anti-aging effects of lactic acid bacteria (LAB) isolated from kimchi; *Lactobacillus rhamnosus* GG (LGG), a previously reported probiotic strain, were used for comparative analysis. We isolated a total of 255 strains of LAB from kimchi, and 53 strains of LAB with resistance to artificial gastric juice (pH 2.5; 250 units / mg pepsin) and bile salts (0.5% oxgall) and a high binding capacity for intestinal epithelial cells were selected. Next, we evaluated the function of 53 strains isolated using the smart animal model *C. elegans*. Similar to LGG, we identified five strains of LAB that enhance the expression of PMK-1 in *C. elegans*, of which one strains showed higher expression of PMK-1 than LGG. In conclusion, animal models using *C. elegans* are simple, fast, and efficient, and through this system, we expect to discover more potential probiotic strains for functional food.

P5-23

Immunopotentiating activity of *Platycodon grandiflorum* extracts in immunosuppressed rats

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Platycodon grandiflorum (PG) has been used as a food and a traditional oriental medicine to treat diseases such as asthma, bronchitis and pulmonary tuberculosis. Recently, several studies have demonstrated that platycodin D, which is abundant in PG roots, is one of the major active



saponins and reduces inflammation, tumors, and obesity. This study was performed to examine the immune enhancing effect of water-extracted or enzyme-treated PG for the effective production of platycodin D. The immunopotentiating activity of the PG water extract (PGW) and the PG enzyme extract (PGE) were compared by measuring cytokine levels in Sprague Dawley rats immunosuppressed by cyclophosphamide (CP) treatment. As a result of body weight measurement, body weight decreased in the CP-treated groups except for the control group, which is considered to be due to the induction of immunosuppression. After 14 days of oral administration, the white blood cell and lymphocyte levels increased in PGW and PGE group compared to the CP-treated group, and the neutrophil levels significantly decreased in PGW and PGE group. Cytokine (IL-6 and COX-2) expression levels in spleen tissues were also significantly decreased in both groups. This study suggests that supplementation with PG extracts may enhance immune function by regulating cytokine production.

P5-24

The protective effect of fermented soybean snacks against loperamide-induced constipation in rats

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Cheonggukjang is one of the most popular fermented soybean paste consumed in Korea. Fermented soybean products, including cheonggukjang, are well-known healthcare food for inflammation, cardiovascular diseases, obesity, and constipation. However, it is not clear whether fermented soybean-based products can alleviate constipation. This study was conducted to find out the constipation-relieving effect of fermented soybean snacks (FSS) based on cheonggukjang. The Sprague Dawley (SD) rats were randomly divided into four groups, eight in each group: normal control, loperamid (LP)-induced constipation group, FSS 300mg/kg + LP-induced constipation group, FSS 600mg/kg + LP-induced constipation group. SD rats were administered with FSS for 3 weeks followed by LP-induced constipation for the final 1 week. We measured total weight, fecal water content, defecation weight, gastrointestinal transit rate, and TNF- α in blood. The results showed that FSS alleviated constipation symptoms by improving the fecal water content, defecation weight, and gastrointestinal transit rate. Based on these results, we believe that regular FSS can effectively alleviate constipation.

P5-25

Effect of fermented blackberry extracts on 3T3-L1 differentiationJae Young Park^{1*}, Seung-Hyeon Lee^{1*}, Ha-Rim Kim¹, Eun-Mi Noh¹,
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Blackberry (*Rubus fruticosus*), which are known to contain a variety of bioactive compounds, has been extensively studied for their antioxidant properties. Blackberry possesses multiple health beneficial effects, including anti-inflammation, anti-atherosclerosis, anti-tumor and immunomodulatory activity. However, the potential biological effects and precise molecular mechanisms of the fermented extracts remain largely unexplored. In this study, we aimed to investigate the efficacy of blackberry fermented with lactic acid bacteria for addressing metabolic disease. Two types of fermented blackberry extracts were investigated for the differentiation of 3T3L1 cells. Fermented blackberry extracts at concentrations of 50, 100, 200 and 500 µg/ml were evaluated for cell viability and inhibition of differentiation of 3T3-L1 cells. Fermented blackberry extract had no cytotoxicity up to a concentration of 500 µg/ml. Subsequently, the inhibitory effect of the fermented blackberry extract on 3T3-L1 differentiation was investigated. Fermented blackberry extracts were treated at concentrations of 100, 200, and 500 µg/ml, and cell differentiation was induced with a mixture of methyl isobutylxanthine, dexamethasone, and insulin, followed by Oil Red O staining. As a result, the fermented blackberry extract inhibited 3T3L1 cell differentiation in a concentration-dependent manner. Although further studies are needed to elucidate the mechanism for the effect, our results showed that fermented blackberry extract has potential as a functional material for metabolic diseases.



P5-26

Anti-inflammatory effect and signaling mechanism of glycine max hydrolyzed with enzymes from *Bacillus velezensis* KMU01 in a dextran sulfate sodium-induced colitis mouse model

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The purpose of this study was to investigate the anti-inflammatory effect that Glycine max hydrolyzed with enzymes from *Bacillus velezensis* KMU01 on dextran sulfate sodium (DSS)-induced colitis in mice. Hydrolysis improves functional health through the bioconversion of raw materials and increase in intestinal absorption rate and antioxidants. Therefore, G. max was hydrolyzed in this study using a food-derived microorganism, and its anti-inflammatory effect observed. Enzymatically hydrolyzed G. max (EHG) was orally administered once daily for four weeks before DSS treatment. Colitis was induced in mice through consumption of 5% (w/v) DSS in drinking water for eight days. Results showed that EHG treatment significantly alleviated DSS-induced body weight loss and decreased the disease activity index and colon length. In addition, EHG markedly reduced tumor necrosis factor- α , interleukin (IL)-1 β , and IL-6 production, and increased that of IL-10. EHG improved DSS-induced histological changes and intestinal epithelial barrier integrity in mice. Moreover, we found that the abundance of 15 microorganisms changed significantly; that of Proteobacteria and *Escherichia coli*, which are upregulated in patients with Crohn's disease and ulcerative colitis, decreased after EHG treatment. These results suggest that EHG has a protective effect against DSS-induced colitis and is a potential candidate for colitis treatment.

P5-27

영지버섯에 의한 꾸지뽕나무 잔가지의 고체발효 및 생물변환 생성물들의 xanthine oxidase 및 angiotensin converting enzyme 저해활성

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미생물에 의한 발효법은 농산물이나 식품 부산물(plant-based products)의 기능성과 생리활성을 증대시키는 방법의 하나로서 널리 활용되고 있다. 꾸지뽕나무(*Maclura tricuspidata* (Carr.) Bureau ex

Lavallee)는 전통적으로 전 부위(열매, 잎, 가지, 줄기, 껍질 및 뿌리 등)를 약용으로 이용되어 왔고, 그 중 잎, 열매 및 어린가지(twig)는 식품으로 사용될 수 있도록 식약처에서 허용하고 있다. 특히 꾸지뽕나무 가지는 동절기 가치지기 과정에서 산출되는 부산물로서 다양한 생리활성 성분들을 함유하고 있어 약용 또는 건강기능성 식품소재로서 유용하게 활용할 수 있는 잠재력을 지니고 있다. 따라서 본 연구에서는 꾸지뽕나무 가지를 영지버섯균으로 5일 동안 고체발효(solid-state fermentation)시키면서 xanthine oxidase(XOD)와 angiotensin converting enzyme (ACE) 저해활성 변화를 조사하고, 발효과정에서 생성된 생물변환 생성물들의 XOD 및 ACE 저해활성을 조사하였다. 발효동안 XOD와 ACE 저해활성은 점진적으로 증가하는 경향을 보였으며, 특히 발효개시 후 2일 이후부터 증가 폭이 큰 편이었다. 또한 발효시료에서 주요 생물변환 생성물들을 분리한 다음 기기분석 분석을 통하여 화학구조가 동정된 8종과 UPLC-QTOF-MS분석에 의해 잠정적으로 동정된 성분들로서 flavonoid화합물 17종, 4-hydroxybenzyl alcohol(4-HBA) 유도체 5종 및 coumarin 유도체 4종을 포함하여 26개 성분을 대상으로 측정된 결과 quercetin, luteolin, morin, umbelliferone, esculetin 및 epitaxifolin은 5,000ppm농도에서 70% 이상의 강한 XOD 저해활성을 나타내었다. 화합물 그룹별로는 4-HBA 유도체나 coumarin 유도체들보다는 flavonoid화합물들의 XOD 저해활성이 강하였으며 배당체형(glycoside form)보다는 유리형(free form) 화합물들의 저해활성이 강한 편이었다. ACE 저해활성도 역시 4-HBA 유도체나 coumarin 유도체들보다 flavonoid화합물이 강한 편이었다. 결론적으로 영지버섯균으로 꾸지뽕나무 가지를 발효시키면 발효과정에서 영지버섯 균사체가 분비하는 β -glycosidase에 의해 잔가지에 함유된 배당체들(glycosidic forms)이 유리형(free forms)으로 가수분해됨으로서 XOD 및 ACE 저해활성이 증가하는 것으로 판단된다.

P5-28

임산 자원의 발효과정 중 대사체학적 변화

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산채류는 비타민과 무기물이 풍부하고 특유의 향기 성분, 이화학적 특성 및 다양한 생리활성으로 인하여 주요한 식재료 및 간식으로 이용되어왔다. 약리효능으로는 항산화, 항비만, 항균 효과 등이 보고되어 있으며 약리작용과 건강 기능성이 탁월하여 인간의 삶과 질을 향상시켜 건강한 삶을 유지할 수 있도록 도와줄 수 있는 산채류는 건강기능식품, 건강식품 등의 소재로 사용 가능할 것이다. 산채 기능성 물질을 추출하여 메디케어 관련 제품화를 위한 원료로 사용하거나 기능성을 보존하여 소비자들에게 제공할 가공방법을 개발하여 고콜레스테롤증, 동맥경화증, 비만, 당뇨병 등 대사성 질환이나 혈전증, 심장병, 고혈압 등 순환기성질환 억제에 도움을 줄 수 있을 것으로 생각한다. 본 연구에서는 코지와 효소제 및 유산균을 사용하여 산채를 발효하고, 발효 기간별 배양된 발효액 특성, 항산화적 특성, 페놀산 함량 등을 조사하여 발효조건을 최적화하고 대사체 분석을 통한 대사물질 규명 및 검증하여 산채류를 활용한 차별화 발효 및 효소식품을 개발하고자 한다.



P5-29

Changes and characteristics of cultured lactic acid bacteria depending on fermentation time of red ginseng rice malts

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We tried to establish the optimal lactic acid fermentation conditions for rice malts made using red ginseng, a vegetable material with excellent physiological activity, and rice koji fermented with *Aspergillus oryzae*. Koji is an enzyme (or fermenting agent) inoculated with useful microorganisms such as rice and soybeans, which can hydrolyze starch or protein. Since Koji contains amylase and protease produced by the fungus, it plays a role in converting starch and protein in the raw material into fermentable sugar and amino acid. In a previous study, it was confirmed that koji with ginseng increased enzyme activity. In this study, using lactic acid fermented red ginseng rice malts, the fermentation conditions were optimized by investigating the total number of lactic acid bacteria cultured for each fermentation time, the characteristics of the fermentation broth, the antioxidant properties, and the content of organic acids. Based on these results, it is thought that the lactic acid fermented red ginseng rice malts will have various useful values not only for general food intake, but also for health functional food and application products related to beneficial physiological activity.

P5-30

발효 홍삼의 진세노사이드 및 벤조피렌 분석

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(재)진안홍삼연구소

현재 국내 건강기능식품 시장은 건강에 대한 관심이 높아지면서 포화 상태이며, 그 중 홍삼은 대기업 브랜드 제품이 시장을 꽉 잡고 있는 실정이다. 홍삼특구인 진안군 홍삼의 위상을 제고하고자 새로운 유형의 홍삼을 개발하여 시장을 공략할 필요가 있다. 본 연구는 진안군에서 재배한 수삼을 홍삼으로 제조하는 공정 중 증삼 전 단계에서 황국균 및 백국균을 이용하여 발효하고, 발효 수삼을 증삼하여 홍삼으로 제조하였을 때 진세노사이드 조성 변화 및 벤조피렌의 함량을 확인하고자하였다. 수삼 원물은 균의 활성화를 높이기 위해 편칭을 하였으며 황국균, 백국균 및 혼합균(황국균+백국균)을 각각 처리하고 1~3개월 동안 발효하였다. 국균으로 발효한 수삼을 꺼내 증삼 과정을 거쳐 홍삼으로 제조한 후 분쇄하여 시료로 사용하였으며, 진세노사이드와 벤조피렌을 분석하였다. 진세노사이드 조성 변화 확인 결과 대조군인 일반 홍삼과 비교하였을 때 모든 처리군에서 Rk1 > Rg5 > Rg3 등 순으로 진세노사이드 함량이 높았다. 특히 백국균 처리군에서 진세노사이드 Rk1 $8.96 \pm 1.2\%$, Rg5 $35.8 \pm 6.2\%$, Rg3 $23.7 \pm 3.7\%$ 로 높은 전환율을

나타났다. 벤조피렌 함량 분석 결과 백국균과 혼합균 처리군에서 식품공전상 기준치($2 \mu\text{g}/\text{kg}$) 보다 1/10 배 낮은 $0.2 \mu\text{g}/\text{kg}$ 수치로 검출되었으며, 이를 제외한 모든 처리군에서 벤조피렌이 불검출 되었다. 따라서 시료 중 백국균 발효 홍삼에서 진세노사이드 Rk1, Rg5, Rg3의 함량이 크게 증가한 것을 확인할 수 있었으며, 벤조피렌 안전성도 입증하였다. 이와 같은 연구결과는 식약처에서 인정한 수삼, 홍삼의 주요성분과 인삼산업법상의 흑삼의 주요성분을 모두 함유하고 있는 새로운 유형의 발효 홍삼으로서 건강기능식품 시장의 신규후보에 대한 새로운 시장 창출을 기대해본다.

P5-31

Metabolomic changes during aging of fermented black ginseng vinegar

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Korean ginseng is a medicinal crop with a history of cultivation dating back 1,500 years. Among them, black ginseng is one of the processed ginsengs manufactured by repeating the steaming process three or more times. Discussion on the low molecular weight of ginseng saponin by acetic acid fermentation during fermented vinegar production has been mentioned in several papers, but the mechanism for this is lacking. During the steaming process, hydrolysis causes the malonyl group of polar ginsenoside to escape or the glycosyl residue at the C-20 position to escape. However, the same phenomenon occurs due to acid hydrolysis by acid during acetic acid fermentation, and a pattern different from that of thermal hydrolysis appears. In this study, a metabolomic approach was taken to change the composition of black ginseng by acid hydrolysis during vinegar aging.

P5-32

Anti-obesity effects of *Cirsium pendulum* Fisch and *Polygonum multiflorum* Thunberg in a high-fat diet-induced obese C57BL/6J mouse model

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The World Obesity Atlas report predicts that the world's obese population will reach 1 billion by 2030. Diabetes, high blood pressure, and several cancers are known to be brought on by obesity. But synthetic drugs have side effects like abdominal pain and indigestion.



Thus, natural products or extracts, which used to be traditional medicine, are needed in place of drugs. This study examined the synergistic effects of extracts of *Cirsium pendulum* Fisch(CP) and *Polygonum multiflorum* Thunberg(PT) against obesity. Male C57BL/6J mice that were four weeks old were assigned to one of five groups. Treatment with CP, PT and CP+PT decreased the weight of the lipids and liver as compared to a mouse model caused by a HD. Additionally, the mixture significantly reduced serum total cholesterol, LDL cholesterol, HDL cholesterol, and serum glycerol, by 25%, 36%, 16%, and 9%, respectively, compared to the HD group. Also, mixture reduced by 80%, 32%, 50%, 40%, and 75%, respectively, the expression of genes associated with lipid anabolism, including SREBPs, PPAR γ , CEBP α , FABP4, and CD36. These regulatory factors synthesize and accumulate fat. On the other hand, when comparing the HD group, the treatment with the mixture increased the mRNA expression of PPAR α , CPT1, and ACOX which are responsible for increasing fat oxidation. And, the mixture significantly increased the protein expression of p-AMK and p-ACC. Therefore, these results suggest that a mixture of CP and PT extracts has synergistic effects against high diet-induced obesity.

P5-33

산림약용자원의 항염증 효능평가를 통한 호흡기 및 면역질환 개선용 식소재화 가능성 연구

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우리나라에서 자생하는 산림약용자원의 경우 척박한 토양과 기후에 적응하여 살아왔기 때문에 맛과 향이 강하고 기능성 물질의 함유도 높은 것으로 평가되고 있다. 이와같이 좋은 자원을 현재는 생채, 건조, 분말 등의 단순 가공공정을 통해 판매되는 것이 대부분이다. 본 연구는 단순히 사용되는 산림약용자원에서 항염증 효능평가를 실시하고, 효능이 탁월한 소재를 활용하여 호흡기 및 면역질환 개선용 제품에 소재로 개발하고, 농가의 신규 소득원 및 고부가가치화를 이루고자 한다. 실험소재의 경우 전라지역에서 자생하는 꾸지뽕, 오미자, 약모밀, 천마, 울금을 사용하였으며, total phenolic compound, DPPH, ABTs activity 및 NO생성억제 활성으로 소재 스크리닝을 진행하였다. 사용 소재 중 울금 주정 추출물은 49.73 ± 1.36 mg/g으로 total phenolic compound 함량과 35.55 ± 1.43%로 DPPH activity가 가장 높게 확인되었다. 항염증 효능 지표인 NO생성억제의 경우에도 최대 86% NO생성억제하는것으로 확인되었다. 울금의 항염증 효능성분을 확인하기 위해 울금에 대표성분인 curcumin를 이용하여 NO생성억제 활성을 확인하였으며, 그 결과 추출물에 비해 25배 낮은 농도에서 생성억제 효능이 있는 것으로 보아 curcumin이 활성물질임을 구명하였다. 이와 같은 연구결과를 통해 산림약용자원인 고부가가치를 위해 추후 울금에 유용미생물(유산균, 국균, 담자균 등)을 활용한 bioconversion을 실시할 예정이며, 중간 발효대사물 및

최종 발효대사물의 대사체 분석을 통해 발효 후 활성물질인 curcumin의 함량변화를 확인하고, 이를 소재 화학 예정이며, 추가로 저이용 임신자원인 산더덕껍질, 산도라지껍질 발효물과 시너지 효과를 확인하여 호흡기 및 면역질환 개선용 제품의 원료로 상품개발하고 산림경제 경쟁력을 강화하고자 한다.

P5-34

인삼의 Minor ginsenoside성분이 함유되어 있는 콤부차의 품질특성

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(재)진안홍삼연구소

콤부차는 차 추출물과 설탕을 주원료로 하여 초산균, 유산균, 효모 등이 복합적으로 공생하는 스코비(SCOBY)로 만들어진 발효 차음료이다. 생리활성으로는 항산화, 항균성, 항암성 간 기능 개선 등이 알려져 있으며 다이어트의 관심도가 높아지며 탄산음료와 알코올성 음료의 대체식품 수요가 증가하고 있다. 그러나 국내에서는 주로 단발효 공정이 알려져 있으며, 생리활성이 높은 인삼을 활용한 발효음료의 개발이 부족한 실정이다. 인삼은 간기능보호, 뇌기능개선, 항당뇨, 면역조절, 항산화, 항비만, 항알레르기, 항염증, 신경세포보호, 정자운동 증진 등이 보고되었으며 최근에는 항암작용과 근력을 개선시킨다는 보고되고 있다. 본 연구는 인삼청을 활용한 복발효 기법을 추가하여 인삼의 주요생리활성 성분 ginsenoside를 함유하고 있는 발효 차음료를 개발하였다. 발효 차음료는 5일 단발효와 직접제조한 인삼청을 넣어 5일동안 2차 발효로 진행되었다. 발효 9일차때 pH는 2.98, 총산도는 1.97, Brix는14.1로 적절하였으며, fructose와 glucose 함량은 증가하였고 sucrose 함량은 감소하였다. Total phenol과 Total flavonoid 함량은 9일차가 가장 높았으며, 항산화 시험 ABTS radical scavenging, DPPH radical scavenging, FRAP activity 또한 같은 패턴을 보여주었다. 인삼의 중요성분인 ginsenoside는 스코비에 공생하는 산 생성 균들에 의해 가수분해되어 major ginsenoside에서 흡수율이 높고 약효와 뛰어난 minor ginsenoside로 변환되는 것을 확인하였으며 9일차에 증가된 Rk1과 Rg3, Rg5는 항암작용이 있는것으로 밝혀졌다. 이에 따라 최근 관심도가 높은 발효 차음료를 활용하여 인삼의 맛과 향 그리고 기능성 증가된 산업화를 위한 연구를 수행하여 활용도를 높이는 고부가가치 제고 연구가 기대된다.

P5-35

In vitro evaluation of natural estrogenic compounds from citrus peel through BRET-Based ER dimerization and transactivation assays

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Citrus fruits have been extensively examined for their antioxidant, antimicrobial, and anti-cancer properties. However, the potential estrogenic effects of citrus fruits



as functional food ingredients and the cellular mechanisms of their signaling pathways have not been thoroughly investigated. The study evaluated the dimerization and transactivation activities of compounds and extracts from citrus peel using BRET-based ER α and ER β dimerization assays, as well as ER transactivation assays, which are non-animal experiments. The results demonstrated that compounds in citrus peel and citrus peel extracts possess estrogenic properties and act as agonists. Moreover, naringenin, hesperetin, and hesperidin were identified as antagonists for ER. This study not only sheds light on the cellular estrogen signaling pathways associated with citrus peel but also suggests the potential use of citrus peel extracts as functional food ingredients to alleviate or prevent estrogenic symptoms.

P5-36

Efficacy and safety evaluation of fermented soybean (Doenjang powder) intake on intestinal microbiome and metabolic disease in pre-diabetic subjects

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This study investigated the effects of Korean fermented soybean, Doenjang, on the gut microbiota and metabolic diseases in pre-diabetic individuals. Forty-five participants with fasting glucose levels between 100–125 mg/dL or glycated hemoglobin (HbA1c) levels of 5.7–6.4% were enrolled. Participants were randomly assigned in a 1:1:1 ratio to receive either traditional Doenjang with low (TSMM 29) or high (TSMM 32) beneficial microbial content, or a commercial Doenjang (CDH). After four weeks, a significant increase was observed in the population of beneficial bacteria in the TSMM 32 group compared to the CDH group ($p=0.0094$). Additionally, the TSMM 29 group demonstrated a significant improvement in the score and frequency of loose stools compared to the CDH group ($p=0.0147$, $p=0.0103$). However, no clinically significant changes were noted in blood glucose indices. In conclusion, Doenjang, particularly the variant with high beneficial bacterial content, exerts a positive influence on the intestinal microbiome in pre-diabetic individuals. However, commercially produced Doenjang also exhibits benefits. Despite these findings, we did not observe significant changes in blood glucose indices,

a crucial factor in evaluating diabetes progression, or significant changes in safety evaluation markers such as blood pressure, biochemical, and diagnostic test indices, across all types of Doenjang.

P5-37

Contents of major components and antioxidant effects of green *Coffea arabica* 'Geisha' beans cultivated in Korea

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Coffee trees are mainly cultivated in countries located in the coffee belt under tropical and subtropical climates (25 degrees south~25 degrees north). However, due to global warming, the climate of the Korean Peninsula has been gradually changing to a subtropical climate, leading to the expansion of coffee cultivation, particularly in the southern regions. In this study, the main components and antioxidant effects of *Coffea arabica* cv. 'Geisha' cultivated in the greenhouse facilities of Research Institute of Climate Change and Agriculture located in Jeju city (KOR) were evaluated and compared with those of Geisha green beans from Peru (PER) and Ethiopia (ETH). Among them, KOR green beans had the lowest contents of caffeine, chlorogenic acid, polyphenol, and flavonoid, which were 70-72%, 72-87%, 88-93%, and 86-93% of each component contained in PER and ETH green beans. In addition, DPPH and ABTS radical scavenging activities were also lowest in KOR green beans. These findings not only provide information on the quality of domestically cultivated Geisha coffee beans but also serve as fundamental data for enhancing the quality of domestic coffee. [This research was supported by the research program of National Institute of Horticultural and Herbal Science(PJ01186204), Rural Development Administration.]

P5-38

Comparison and analysis of antioxidant activity according to a garlic cultivar produced in Jeju

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Garlic is a bulbous plant that is part of the *Allium* genus of vegetables, which includes onions, shallots, chives, and leeks. Garlic is comprised of 65% water, carbohydrates



organo-sulfur compounds, protein, free amino acids, and fiber. Garlic (*Allium sativum* L.) has a reputation as a therapeutic agent for many different diseases such as microbial infections, hypertension, hypercholesterolaemia, diabetes, atherosclerosis, medicinal resource, and spice. Garlic is a very important ingredient in food in the Republic of Korea. Also, Garlic production was 350 kilotons in Korea, 2020. Additionally, the health benefits of garlic can depend on its content of biologically-active compounds, which differs between various cultivars and geographical regions. However, we tried to identify the biochemical activity according to the cultivars. Therefore, it was to evaluate and compare the biological activity of aqueous extracts from three garlic cultivars (Namdo, Daeseo, and Hongsan) in Jeju. These results can be applied to the development of improve foods and potential natural materials for anti-oxidative activity.

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Key word: Allium, garlic, antioxidants

P5-39

Antioxidant activity and anti-obesity effects of mixture of *Brassica juncea* and black rice bran

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Recently, obesity has been attracting attention as a dangerous disease worldwide. In order to treat such obesity, antioxidant ability for ROS scavenging as well as anti-obesity should be evaluated. This study was conducted to provide basic data on the antioxidant activity, inhibition of adipocyte differentiation and generation of reactive oxygen species (ROS) of a mixture of *Brassica juncea* extract (BJE) and black rice bran fraction (BRF). Total phenolic and flavonoid contents were investigated and various antioxidant assays were performed,

including DPPH and ABTS radical scavenging activities, FRAP, reducing power and ORAC values. We further evaluated the effect of the mixture on lipid accumulation and ROS generation in 3T3-L1 cells. The total phenol content of the mixture was 8.51 ± 0.05 mg GAE/g to 10.03 ± 0.07 mg GAE/g, and the total flavonoid content was 4.45 ± 0.19 mg QE/g to 6.25 ± 0.12 mg QE/g. The antioxidant activity of the mixture is higher than 0.025 mg/mL of ascorbic acid. All mixtures have inhibitory effects on lipid accumulation and ROS production. These results suggest that it is worth conducting further experiments to develop an anti-obesity functional food using a mixture of BJE and BPF.

P5-40

Inhibition effect against 20 bacteria and 4 cell lines of methanol and water extracts from pawpaw (*Asimina triloba* [L.] Dunal) cultivated in Korea

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Antibacterial activities of six pawpaw extracts derived using methanol and water solvents on roots, twigs, and leaves were investigated using an agar diffusion assay to determine the minimum inhibitory concentrations (MICs) and minimum bactericidal concentrations (MBCs) against 20 bacterial strains. Most of the extracts produced an inhibition zone at 50 mg/disc against all tested microorganisms, with the exception of *Vibrio parahaemolyticus*. In particular, pawpaw twig and root methanolic extracts (PTM and PRM, respectively) showed potent antibacterial effects superior to those of other samples. The anticancer activity of the six extracts was investigated using a cytotoxicity assay against four cancer lines (HT-1080, HeLa, HepG2, and AGS). PTM showed the strongest inhibition activity against HT-1080 (IC₅₀=64.57 µg/mL), HepG2 (IC₅₀=68.99 µg/mL), and AGS (IC₅₀=70.48 µg/mL) cells. Meanwhile, PRM exhibited the highest antiproliferative activity for HeLa cells, with an IC₅₀ value of 126.17 µg/mL. These findings suggest that the pawpaw twig and root extracts, particularly those derived using methanol solvent, have medicinal value and can be further investigated as biomaterials in various fields.



P5-41

Inhibition of melanogenesis by Piper betle leaf essential oil via an activation of MAPK signaling and the antioxidant pathway

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In this study, the anti-melanogenic effects and anti-oxidant activity of Piper betle leaf essential oil (PBEO) and the mechanisms through which it inhibits melanogenesis in MNT-1 cells and enhances antioxidant activity in HaCaT cells were investigated. Mushroom tyrosinase (TYR) activity and melanin content were measured in the cells. An in vitro investigation showed that PBLE suppressed tyrosinase (Tyr), tyrosinase-related protein-1 and -2 (Trp-1 and Trp-2), and microphthalmia-associated transcription factors (MITF), decreasing the formation of melanin in contrast to the untreated control. PBLE reduced the cyclic adenosine monophosphate (cAMP) response to an element-binding protein (CREB) phosphorylation by preventing the synthesis of cAMP. PBEO was also subjected to evaluate its inhibitory effect against the generation of reactive oxygen species (ROS) in HaCaT cells. The protein expression levels of superoxide dismutase (SOD), glutathione peroxidase (GPx), and catalase (CAT) were markedly higher in the sample-treated group. PBEO treatment also increased the activities of NF-E2-related factor-2 (Nrf-2) and heme oxygenase-1 (HO-1). Additionally, it activates extracellular signal-regulated kinase (ERK) and p38 mitogen-activated protein kinases (p38), destroying Tyr and MITF and avoiding melanin production. Overall, these results suggest that PBEO can stimulate p38, ERK, JNK phosphorylation and subsequent suppression of melanin, leading to the inhibition of melanogenic enzymes and melanin production, possibly owing to the presence of polyphenolic compounds.

P5-42

Attenuation of UVB-induced photoaging by oleanolic acid and ursolic acid: structure-activity relationship, molecular docking and elucidation of molecular mechanism

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Oleanolic acid (OA) and ursolic acid (UA) are pentacyclic triterpenes well known for their pharmacological activities. OA and UA are widely distributed in foods and medicinal plants like ginseng, olive, basil, apple, blueberry, clove, and coffee. Ultraviolet B (UVB) is a major cause of photoaging. Short-term exposure can cause sunburn and erythema to the skin, and long-term exposure can cause photoaging, photoimmunosuppression, and photocarcinogenesis. Therefore, this study aimed to investigate the inhibitory activity of OA and UA in UVB-induced photoaging and compare their activity based on structure differences. OA and UA showed no cytotoxicity at 5 μ M and significantly inhibited reactive oxygen species (ROS) generation in UVB-exposed HaCaT cells. In silico studies, OA and UA have shown higher binding affinity with human neutrophil elastase compared to epigallocatechin gallate (EGCG). OA and UA treatment inhibited extracellular matrix degradation, as proved by the stimulation of Colla1, elastin, and Has2, and the inhibition of MMP-1. Furthermore, OA and UA upregulated the expression of SIRT-1 and downregulated the expression of ERK, JNK, and p38 protein activated by UVB exposure. These results show the potential activity of OA and UA to attenuate UVB-induced photoaging through the downregulation of the MAPK, AP-1, and MMP-1 signaling pathways.

P5-43

***Dillenia indica* L. Bark extract: A natural antidiabetic food remedy with antioxidant properties in insulin-resistant cells and diabetic mice**

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Glucose homeostasis provides energy and manages chronic diseases. Higher glucose levels in the blood indicate diabetes. Diabetes has been treated with *Dillenia indica* L.



for centuries, but its mechanism is unknown. Thus, we investigated the effects of TRDI (Terpenoid-Rich *Dillenia indica* L. bark extract) on glucose homeostasis in vitro and in vivo. TRDI inhibited α -glucosidase activity in a concentration-dependent manner with an IC₅₀ of $3.03 \pm 1.01 \mu\text{g/mL}$, which was 92-fold more potent than the positive control acarbose (IC₅₀ = $279.49 \pm 3.29 \mu\text{g/mL}$). TRDI stimulated IRS-1 and Akt, which increased GLUT4 translocation across the plasma membrane. Furthermore TRDI decreased palmitic acid (PA; $250 \mu\text{M}$)-induced reactive oxygen species (ROS) in C2C12 cells and increased the antioxidant enzyme protein levels of SOD1, CAT, GPx-1, and TrxR. TRDI also increased HO-1 expression and nuclear translocation of Nrf2 in insulin-resistant C2C12 cells produced by PA- and STZ-induced diabetic mice. TRDI was unable to surmount the Nrf2 inhibition caused by insulin resistance. Collectively, these findings advocated that TRDI had a fascinating potential to modulate glucose homeostasis and was considered a good food supplement/ingredient to shorten the early stage of anti-diabetic functional food development.

P5-44

Whitening, wrinkle inhibitory, and anti-obesity activities of sword bean (*Canavalia ensiformis*) fermentation liquid fermented by *Lactobacillus* sp.

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This study was performed in order to confirm the possible use of sword bean fermentation liquid as a cosmetic and anti-obesity functional foods material. To this end, we estimated that the whitening, wrinkle inhibitory, and anti-obesity activities of sword bean (*Canavalia ensiformis*) fermentation liquid fermented by *Lactobacillus plantarum* (L. *plantarum*) and *Lactobacillus brevis* (L. *brevis*). The whitening effect was evaluated by determining the melanin contents, cell proliferation against melanoma cell line (B16F10), and the levels of tyrosinase-related protein-1 (TRP-1). The wrinkle inhibitory effect was evaluated by measuring the proliferation of mouse embryo fibroblasts cell line (NIH-3T3) and human dermal fibroblast cell line (CCD-986sk). The anti-obesity activity was verified by measuring the Oil Red staining in 3T3-L1 mouse preadipocytes. Consequently, the melanin content of sword bean was decreased after fermentation. The levels of TRP-1 also decreased after fermentation, however, there was no effect on TRP-1 inhibition of sword bean fermentation liquid fermented by L. *brevis*. Sword bean fermentation liquid has no proliferation against NIH-3T3 cell, meanwhile, the proliferation against CCD-986sk cell effect was strong as contrasted with control. The staining

results remarked that compared to control, exposure to sword bean reduced lipid accumulation in cells. These results are thought to be useful as basic data in the cosmetics industry and anti-obesity functional foods fields.

P5-45

Functional properties of enzymatic hydrolysates of sesame seed meals

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Sesame seed meals, the residue from the seed oil extraction process, has bioactive compound such as polyphenol and unsaturated fatty acid as well as protein, they can be used as functional food materials, technology to utilize it should be developed. In order to establish the optimal hydrolysis condition of Sesame seed meal protein, degree of hydrolysis of protein hydrolysates were measured according to type of enzyme. As a result, protein content of hydrolysate by using Alcalase showed the highest with 726.46 mg/g, followed by 548.00, 533.38, 399.54 mg/g for Neutrased, Protamex and Flavourzyme, respectively. Degree of hydrolysis of hydrolysate by using Neutrased showed the highest with 43.61%. The total polyphenol contents were 18.93–24.42 mg/g and the total flavonoid contents were 8.02–19.18 mg/g. DPPH and ABTS radical scavenging activities indicating antioxidative capacity were significantly increased in concentration. In the study, Enzymatic Hydrolysates of Sesame seed meals by Alcalase showed higher the total polyphenol contents and ABTS radical scavenging activities than other enzyme extracts. Therefore, through this study, it was confirmed that sesame seed meal can be developed and used industrially.

P5-46

The inquiry into the osteogenic potential and physicochemical properties of chickpea protein extracts from three different enzyme hydrolysis

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The production of vegan food needed the employment of three distinct commercial proteases in order to remove the protein from chickpea flour, which contained a considerable amount of



vegetable protein. It was discovered in the course of the ongoing research into the osteogenic potential of various chickpea protein extraction methods that the bone-healing capabilities of chickpeas are not usually acknowledged within the medical community. This research was conducted to evaluate the usefulness of chickpea protein and to propose that it may be used as a novel source of protein as well as a high-quality natural plant-based protein in the production of vegan cuisine. The purpose of this study is to explore the influence of chickpea protein, chickpea protein F, chickpea protein P, chickpea protein C, and chickpea protein A on the differentiation and mineralization of mouse preosteoblast cell line MC3T3-E1. According to the results of experiments measuring growth, viability, and proliferation, modest concentrations of extract protein (between 0 and 1000 mg/ml) were not harmful. The differentiation and mineralization of MC3T3-E1 showed that chickpea protein F and chickpea protein P slowed MC3T3-E1 mineralization at concentrations of chickpea protein C and chickpea protein A that were nontoxic. This was discovered at concentrations of chickpea protein C and chickpea protein A.

P5-47

***Cirsium japonicum* var. *maackii* attenuates weight gain, reduces thrombus formation, and prevents atherosclerosis in high-fat diet-induced C57BL/6 mice**

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Cirsium japonicum var. *maackii* is a herbal plant native to Korea, Japan, and China, and has been widely used in traditional medicine for various conditions. In this study, we investigated the effects of *C. japonicum* var. *maackii* extract (CJE) on weight gain, blood coagulation factors, expression of vascular adhesion molecules, and atherosclerosis in high-fat diet (HFD) mice. Mice receiving CJE treatment showed a decrease in weight gain compared to the HFD group, without any changes in food intake. CJE also suppressed the activity of blood coagulation factors by reducing the concentrations of PAI-1, fibrinogen, and prothrombin fragment F1+2. Additionally, CJE inhibited the expression of vascular adhesion molecules, VCAM-1 and ICAM-1, in abdominal aortic tissues. Particularly, CJE treatment alleviated atherosclerosis. These findings highlight the potential of CJE as a therapeutic agent for weight management and prevention of cardiovascular complications associated with high-fat diets.

P5-48

음나무(*Kalopanax septemlobus*)의 가시, 잎, 가지 열수 추출물에 항산화 활성 연구신승렬^{1*}, 홍주연², 박지혜³, 한신규³¹대구한의대학교 식품영양학과, ²대구한의대학교 호텔외식조리베이커리학과, ³대구한의대학교 대학원 한방식품학과

본 연구는 속껍질이나 뿌리를 이용하여 술을 담그거나 약재료로 사용하고 있는 음나무에 관한 연구가 현재 미비하고, 가시가 있는 원 개체와 관리를 목적으로 가시가 적은 개체를 선발하여 수를 늘린 가시가 없는 개체의 생리활성 및 기능성 차이에 관한 연구가 전대미문 하여 음나무의 자원산업화를 위해 항산화 활성에 관한 연구를 하였다. 음나무는 같은 곳에서 자생하는 두 개체를 잎자루를 기준으로 잎과 가지, 가지로 구분하여 열수 추출한 후 추출물의 항산화 활성을 측정하였다. 음나무의 수분 함량은 가지 62.73%, 가시가 있는 나무의 잎 63.90%, 가시가 없는 나무의 잎 57.34%, 가시가 있는 나무의 가지 75.30%, 가시가 없는 나무의 가지 73.33%로 가시가 있는 나무의 수분 함량이 가시가 없는 나무의 수분 함량보다 더 많았다. 폴리페놀 함량을 측정한 결과 가시가 있는 나무의 가시는 217.79 ± 0.81 mg/100g, 가시가 있는 나무의 잎은 198.10 ± 0.27 mg/100g, 가시가 없는 나무의 잎은 186.15 ± 0.81 mg/100g으로 가시의 폴리페놀 함량이 가장 높았다. 플라보노이드 함량을 측정한 결과 가시가 있는 나무의 가시는 80.28 ± 0.33 mg/100g, 가시가 있는 나무의 잎은 97.83 ± 0.50 mg/100g, 가시가 없는 나무의 잎은 93.88 ± 0.50 mg/100g으로 잎의 플라보노이드 함량이 높고, 가시가 있는 나무보다 가시가 없는 나무의 플라보노이드 함량보다 더 높았다. ABTS 라디칼 소거활성 측정 결과 추출물 농도 250~1,000 μ g/mL에서 가시는 87.14~98.34%, 가시가 있는 나무의 잎은 82.22~97.73%, 가시가 없는 나무의 잎은 75.79~98.03%, 가시가 있는 나무의 가지는 39.86~95.54%, 가시가 없는 나무의 가지는 18.08~53.48%으로 추출물의 농도가 증가할수록 ABTS 라디칼 소거활성은 증가하였으며, 가지 열수 추출물에서 가장 높은 활성을 보였다.

P5-49

Comparative study on the physicochemical properties and antioxidative activity of various berry vinegars

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In this study, we compared the physicochemical properties and antioxidant activity of black raspberry vinegar, aronia berry vinegar, blueberry vinegar and mulberry vinegar. The results showed that the pH values of the different samples of berry vinegars varied within the range of 2.87 to 3.14. In addition, the total acidity content varied within the range of 4.08% to 6.46%, with the black currant vinegar having the highest total acidity content of 6.46%. Total



polyphenol content of berry vinegars was highest in black raspberry vinegar with 52.32 ± 0.51 TAE mg/mL. The total flavonoid content was also the highest in the black raspberry vinegar with 24.86 ± 0.00 RUE mg/mL. Black raspberry vinegar showed the highest ABTS+ radical scavenging activity and DPPH radical scavenging activity. The ABTS+ radical scavenging activity of black raspberry vinegar was measured at 97.28 ± 0.46 IC₅₀ uL/mL and the DPPH radical scavenging activity was measured at 78.30 ± 0.50 IC₅₀ uL/mL. Acetic acid was measured to be the highest in all four berry vinegars. The highest acetic acid (61,495.36 mg/L) was measured in the black currant vinegar, which had the highest total acidity. The black raspberry vinegar had the highest total amino acid content, with ornithine being the highest at 6.68 mg/L. Black raspberry vinegar had higher levels of polyphenols, flavonoids, antioxidant activity, and amino acids than other berry vinegars when physicochemical properties and antioxidant activity of vinegars made from different berries were compared. These results suggest that black raspberry vinegar has the potential to provide health benefits due to its higher antioxidant activity than that of other berry vinegars.

P5-50

Ant-inflammation effects of *Elsholtzia ciliata* in poly I:C stimulated RAW264.7 cells

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Elsholtzia ciliata, an annual herb used in traditional medicine, possesses various medicinal properties, including antibacterial, antipyretic, antiviral, astringent, carminative, diaphoretic, and diuretic effects. In this study, we aimed to explore the anti-inflammatory effects of an *E. ciliata* extract (ECE) using RAW264.7 cells stimulated with Poly I:C. Our findings reveal that ECE effectively inhibits the production of nitric oxide and key inflammatory factors such as inducible nitric oxide synthase (iNOS) and cyclooxygenase-2 (COX-2) and increased heme oxygenase 1 (HO-1). Furthermore, ECE down-regulates the expression of pro-inflammatory cytokines including prostaglandin E2 (PGE2), interleukin-1 β (IL-1 β), tumor necrosis factor- α (TNF- α), and interleukin-6 (IL-6). More so, ECE inhibited the phosphorylation of MAPK and STAT-1. These compelling results highlight the potential of *E. ciliata* as a promising candidate for mitigating viral-induced inflammation. The presented findings provide valuable insights into the use of this medicinal herb for the development of novel anti-inflammatory therapeutics.

P5-51

Antioxidant activities and ACE inhibitory effects of fermented green tea by *Lactobacillus* species

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Green tea, one of the most popular tea in the world, contains amounts of human beneficial compounds including catechins, polyphenols, flavonoids, and amino acid etc. Green tea is used in various foods with beneficial effects. In this study, we investigated the fermentation characteristics of green tea by *Lactobacillus* species. The antioxidant activities were investigated through total polyphenol content (TPC), total flavonoid content (TFC), DPPH radical scavenging activity, SOD-like activity, and reducing power. Also, it was investigated the angiotensin converting enzyme (ACE) inhibitory activity by fermented green tea extracts. Taken together, we identified that fermentation of green tea by *Lactobacillus* species plays an important role in regulating antioxidant activities and ACE inhibitory effects.

P5-52

Effect of six herbal medicine water extracts and their mixed extract on antioxidation and preadipocyte differentiation

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In this study, we investigated that the antioxidation and preadipocyte differentiation activity of six herbal medicine water extracts (*Cornus officinalis* [CO], *Kalopanax pictus* [KP], *Astragalus membranaceus* [AM], *Phellinus linteus* [PL], *Glycyrrhiza uralensis* [GU], *Levisticum officinale* [LO]) and their mixed extract. Total polyphenol contents (TPC) and total flavonoid contents (TFC) were measured, and the antioxidant activities such as total antioxidant capacity (TAC), DPPH radical scavenging activity, and SOD-like activity were estimated. Among the samples, CO extracts have the highest TPC and TFC, all antioxidant activities also were the highest in the CO extract. Mixed extracts and LO extract were ranked second and third respectively for all antioxidant effects. As a result of measuring fat accumulation using Oil Red O staining, mixed extract showed the highest inhibitory effect on preadipocyte differentiation in 3T3-L1. Moreover, there was no cell cytotoxicity in all samples during preadipocyte differentiation. These results suggest that six herbal medicine and their mixed extract can be useful as materials for developing health functional food.



P5-53

Skin-lightening, anti-wrinkle, and anti-obesity effects of sword bean (*Canavalia ensiformis*) pod fermentation liquid

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In this study, the skin-lightening, anti-wrinkle, and anti-obesity effects of fermentation liquid from sword bean (*Canavalia ensiformis*) pod. Sword bean pod was fermented by *Lactobacillus plantarum* (L. plantarum) and *Lactobacillus brevis* (L. brevis). The skin-lightening effects was evaluated by in vitro melanoma cell line (B16F10) assay and the expression level of tyrosinase-related protein-1 (TRP-1). The anti-wrinkle effects were studied by fibroblasts cell line (NIH-3T3, CCD-986sk) assay, and the anti-obesity effects was confirmed by Oil Red staining in 3T3-L1 preadipocytes. These results, regardless of whether it was fermented or not, the melanin content decreased, and the expression level of TRP-1 was decreased after fermentation. In particular, sword bean pod fermentation liquid by L. plantarum showed the higher skin-lightening effect than fermentation liquid by L. brevis. Sword bean pod has no proliferation against NIH-3T3 cell, however, the proliferation against CCD-986sk cell effect was strong compared to control. In addition, sword bean pod reduced lipid accumulation in 3T3-L1 cell regardless whether it was fermented or not. Consequentially, this study suggest that fermentation does not have a significant impact, but sword bean pod possess skin-lightening, anti-wrinkle, and anti-obesity effects. As a result, we believe that sword bean pod considerable value as a cosmetic and anti-obesity functional foods materials.

P5-54

Physiological activity of fermented *Coix lacryma-jobi* L. var. *ma-yuen* by mushroom mycelial

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Recently, interest in skin care increase and efforts are vigorous do development natural products with anti-oxidant, skin whitening, anti-inflammatory. So research performed sustainly about natural products fermentation using mushroom mycelium. *Coix lacryma-jobi* L. var. *ma-yuen* has been reported effects anti-fat, immune-enhancing

pharmacologically and reported effects skin whitening by tyrosinase inhibitory activity. *Hericium erinaceum* have been known contained physiological active substances proteins, lectins, terpenoids.

In this study, we tested cytotoxicity, inhibitory activity on melanogenesis, inhibitory activity on tyrosinase used fermented *C. lacryma-jobi* extract by *H. erinaceum* mycelium for the purpose anti-irritation and physiologically active increase. As a result, we determined the higher cell viability, tyrosinase and melanin production inhibition in fermented *C. lacryma-jobi* hot water extract by *H. erinaceum* mycelial than *C. lacryma-jobi* hot water extract. Therefore, we suggest that fermented *C. lacryma-jobi* hot water extract *H. erinaceum* mycelial can be used in functional food raw materials, food additives, and cosmetics industries.

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P5-55

Comparison between perilla and sesame seed meal extracts on oxidative stress and inflammation in LPS-treated RAW 264.7 cells

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Perilla seed meal (PSM) and sesame seed meal (SSM) are by-products of oil products inevitably mass-produced and discarded every year. Valorization of these agricultural by-product is one of the effective strategies for sustainable food supply. This study aimed to investigate the proximate composition and biological activities of PSM and SSM. PSM and SSM were extracted in water at 121°C under 0.12 Mpa. The color characteristics of PSM and SSM extracts were determined by the browning index and Hunter's color values. The results showed that the browning index and b-value were higher in SSM than in PSM. Antioxidant capacity of PSM was higher than that of SSM, as demonstrated by the 2,2-diphenyl-1-picrylhydrazyl radical scavenging activities, 2,2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) radical scavenging activities, total polyphenol and flavonoids contents. In addition, the antioxidant and anti-inflammatory activities of those extracts were tested in lipopolysaccharide-treated RAW 264.7 cells. Under the non-toxic concentration, PSM and SSM extracts reduced LPS-caused oxidative stress as shown by DCF-DA assay. Similarly, PSM and SSM extracts inhibited LPS-



elevated nitric oxide production in a dose-dependent manner. Consistent with these results, LPS treatment suppressed the gene expression of antioxidant enzymes such as glutathione peroxidase-1, superoxide dismutase-1, and catalase while PSM and SSM extracts reversed LPS-lowered levels of these genes. These results suggest the inhibitory effect of PSM and SSM extracts on LPS-induced oxidative stress in RAW 264.7 cells, implying a potential use of PSM and SSM for functional materials.

P5-56

Fucoidan of *saccharina japonica* improves the inflammatory responses and skin barrier deterioration in fine dust (FD)-stimulated HaCaT keratinocytes

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The present study investigated the effect of fucoidan (SJF) isolated from an edible brown alga, *Saccharina japonica* on fine dust (FD)-stimulated inflammation and skin barrier deterioration in HaCaT keratinocytes. The results showed that SJF dose-dependently increased cell viability while decreasing intracellular ROS production in FD-stimulated HaCaT keratinocytes. SJF downregulated the expression of inflammatory cytokines, IL-1 β , -5, -6, -8, TNF- α , and chemokines, eotaxin, MDC, and TARC, by modulating the MAPK and NF- κ B signaling, while inducing the Nrf2/HO-1 signaling pathway. Furthermore, SJF preserved the skin moisturization and the tight junction stability in FD-stimulated HaCaT keratinocytes by increasing the expression of skin hydration proteins, such as involucrin, filaggrin, LEKTI, as well as tight junction proteins, including occludin, ZO-1, claudin-1, claudin-4, claudin-7, and claudin-23. Collectively, SJF effectively suppressed inflammatory responses and deterioration of the skin barrier. This work was supported by the Korea Institute of Maritime Science and Technology Promotion (KIMST) funded by the Ministry of Oceans and Fisheries (Grant No. G22202201282301).

P5-57

Anti-allergic effect of *Curcuma longa* L. leaf hot water extract in IgE/BSA-stimulated mast cells and a passive cutaneous anaphylaxis (PCA) mouse model

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The present study investigated the effect of *Curcuma longa* L. leaf hot water extract (CLHW) on IgE/BSA-stimulated allergic reactions in mouse bone marrow-derived cultured mast cells (BMCMCs) and a passive cutaneous anaphylaxis (PCA) mouse model. The results showed that CLHW effectively suppressed the degranulation of IgE/BSA-stimulated BMCMCs by inhibiting the release of β -hexosaminidase and histamine in a dose-dependent manner. Also, CLHW decreased the Fc ϵ RI expression on the surface of BMCMCs and its IgE binding. In addition, CLHW dose-dependently downregulated the expression of cytokines, interleukin (IL)-1 β , IL-3, IL-4, IL-5, IL-6, and IL-13, tumor necrosis factor (TNF)- α , and interferon (IFN)- γ , and a chemokine, thymus and activation-regulated chemokine (TARC) by suppressing the activation of nuclear factor- κ B (NF- κ B) and Src-family signaling in IgE/BSA-stimulated BMCMCs. Furthermore, CLHW effectively attenuated the IgE/BSA-induced PCA reaction in the ears of BALB/c mice. These results revealed the therapeutic potential of CLHW as a naturally available treatment against allergic reactions. This work was supported by the Korea Institute of Planning and Evaluation for Technology in Food, Agriculture, and Forestry (IPET) (Grants No. 122052031HD03041782064880000).

P5-58

Exploring the potential of *Sargassum horneri* ultrasonic ethanol extract in inhibiting melanogenesis: mechanisms and efficacy

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Melanogenesis, regulated by genetic, hormonal, and environmental factors, occurs in melanocytes in the basal layer of the epidermis. Dysregulation of this process can lead to various skin disorders, such as hyperpigmentation and hypopigmentation. This



study revealed the potential of *Sargassum horneri* ultrasonic ethanol extract (UKSHE) against melanogenesis in α -MSH-stimulated B16F10 cells. The result showed UKSHE reduced the melanin content and the intracellular tyrosinase activity in α -MSH-stimulated B16F10 cells. Additionally, UKSHE inhibited the phosphorylation of cyclic adenosine monophosphate-response element-binding protein (CERB) and upregulated the phosphorylation of extracellular signal-regulated kinase (ERK) and Akt in α -MSH-stimulated B16F10 cells. Moreover, the expression levels of microphthalmia-associated transcription factor (MITF), tyrosinase, tyrosinase-related protein-1 (TRP1), and tyrosinase-related protein-2 (TRP2) protein were significantly downregulated by UKSHE treatment in α -MSH-stimulated B16F10 cells. Moreover, the experiments conducted using the ERK inhibitor (PD98059) revealed that the activity of UKSHE depends on the ERK signaling cascade. These results suggest UKSHE has an anti-melanogenic effect and can be used as a material to make whitening and lightening-related cosmetics. The study was supported by the technology development program funded by the Ministry of SMEs and Startups (G21S326608602).

P5-59

Extraction of food intake from the Korean population for risk assessment of persistent organic pollutants (POPs): data from the Korea national health and nutrition examination survey 2016-2021

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For the safety management of food-derived pollutants in Korea, a risk assessment should be conducted by checking how much persistent organic pollutants (POPs) consumed by food in Korean population. In this study, the 7-8th (2016-2021) data from the Korea National Health and Nutrition Examination Survey (KNHANES) were used. The R program and R studio was used for our statistical analysis to extract the food intake of Korean population. We changed the food code, which is set differently for each year surveyed, to the content of the latest year (2021). Some new tertiary food codes were created and used by combining the primary food code according to the samples that were monitored for pollution level in the items categorized by the Ministry of Food and Drug Safety. In addition, we used complex sampling method considering the cluster, strata and weight. The food intake extracted by the

subjects who actually consumed the food was converted into the total subjects intake. Some items that cannot be determined by the National Health and Nutrition Examination Survey data were calculated based on production weight and imported weight from National Food Safety Information Service. The 37,955 subjects in the 7–8th (2016–2021) data from the Korea National Health and Nutrition Examination Survey were analyzed. Therefore, the food intake of mean and 95th percentiles were extracted by 9 groups (total subjects, ≤ 2 years, 3–6 years, 7–12 years, 13–19 years, 20–64 years, ≥ 65 years, male, female). Finally, we expect to evaluate the exposure amount and risk percentage of persistent organic pollutants (POPs) in the Korean population by the food intake extracted from this study.