KICLS 2025 – Track on Nutrition and Food Science:
Oral Presentations

The Associations of Genetic Variations in Taste Receptor Genes (TAS1R2 and TAS2R38) with Sugar-Sweetened Beverage Intake and Obesity Risk in Kuwaiti Adolescents: A Candidate Gene Approach

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Abstract

The global obesity epidemic is partly caused due to poor dietary habits and sedentary lifestyles. Taste-related genetic variants, especially in TAS1R2 and TAS2R38 genes, play a crucial role in shaping taste preferences, which in turn may influence dietary choices and obesity risk. This cross-sectional study explored the associations between genetic variants in taste-related genes (TAS1R2 and TAS2R38), dietary habits, and obesity risk among Kuwaiti children. Recruitment of participants included children aged 11–14 years (n=432). Questionnaires were used to collect demographic and dietary data, anthropometric measurements were determined, and blood samples were collected for DNA extraction, sequencing, and genotyping to be performed for five SNPs using TaqMan assays. Data analysis was performed with SPSS software. Significant associations were observed in TAS2R38 with obesity parameters and dietary habits; however, no associations were observed in TAS1R2. The CC carriers of rs713598 in TAS2R38 have nearly significantly higher body mass index (BMI) percentiles and z-scores compared to mutant carriers. Additionally, the T allele of rs10246939 in TAS2R38 was significantly associated with higher sugar-sweetened beverage consumption ($p = 0.018$) even after adjusting for age, sex, nationality, BMIz scores, estimated basal metabolic rate, and physical activity level, and being corrected by Benjamini-Hochberg correction. Conclusions: These results suggest that TAS2R38 variants may affect obesity risk and dietary preferences in adolescents, highlighting the impact of taste genetics on optimizing nutrition interventions to suit individual preferences and needs.

Retinol Supplementation Prevents Weight Gain and Improves Glucose Homeostasis in Mice Fed a High-Fat Diet

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Abstract

High-fat diet (HFD) induces metabolic syndrome characterized by weight gain, insulin resistance and impaired energy metabolism. Several studies have highlighted the potential role of retinol in mitochondrial bioenergetics. In this study, we investigated the effects of retinol on energy metabolism, weight gain and glucose homeostasis in mice fed an HFD. Eight weeks old C57BL/6J mice were randomly allocated to one of the four groups (10 mice in each group, 5 male and 5 female) as follows: Control (Normal-fat), Control HFD, HFD-Retinol-Short (retinol supplemented for 4 weeks), and HFD-Retinol-Long (8 weeks retinol supplementation). All groups received a daily orogastric gavage of soy oil, with the supplemented groups receiving 5 IU retinol/microliter soy oil). Body weight was monitored weekly, and energy expenditure was analysed over the last 3 days of the supplementation period. At the end of supplementation period, animals were sacrificed, blood, liver and adipose tissues were collected for various biochemical investigations. Results showed that male mice in the HFD-Retinol-Long group gained significantly less weight and had significantly improved glucose, insulin and leptin homeostasis compared to HFD control and HFD-Retinol-Short groups. Four weeks retinol supplementation did not produce any beneficial effects. In female mice, weight status was significantly improved in the HFD-Retinol-Long group, but other biochemical parameters showed mixed results. Our data suggest a clear gender and duration dependent effects of retinol supplementation on HFD-induced metabolic dysfunction. These results warrants further research on the protective effects of retinol supplementation in the prevention of obesity and metabolic syndrome in humans.

Garlic Extracts Attenuates Symptoms of Diabetes Through B-Cell Neogenesis Leading to the Activation of Insulin Signaling and Secretion Pathways

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Abstract

Impaired insulin signaling is a main hallmark of diabetes, as it is a requirement for the maintenance of glucose homeostasis and is involved in the regulation of pancreatic β-cell mass and function. Certain natural extracts have been found to enhance diabetic symptoms such as garlic extract.
In this study, the mechanism by which garlic ameliorates diabetic hyperglycemia was investigated in a diabetic animal model. STZ-induced diabetic rats were treated with garlic for 1, 4, and 8 weeks, then the total pancreatic RNA was extracted for analysis. Genes involved in β-cell insulin signaling and secretion pathways including Ins1, Ins2, Irs2, Fox3 and Snap25 were investigated using qRT-PCR. Further, serum and pancreatic insulin protein levels were measured using ELISA and western blotting respectively showed a similar pattern to gene expression. The study demonstrates that garlic extract activates insulin secretion pathway by affecting the expression of its corresponding genes, which stimulates pancreatic β-cells to eventually produce an effective insulin dose (Fig. 1) to overcome the diabetic condition.

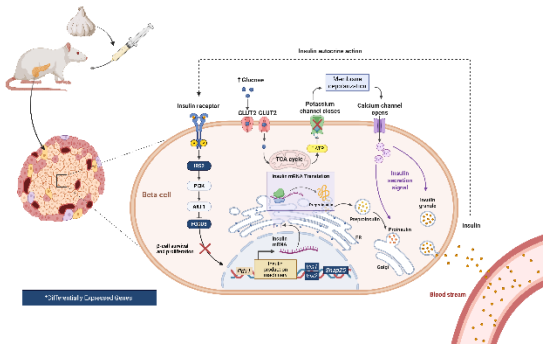

Fig. 1. A schematic representation of a pancreatic endocrine β-cell showing the effect of garlic extract on insulin signaling and release pathway. Created using Biorender.

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Nutrition Impact Symptoms as Key Indicators of Malnutrition in Kuwaiti Colorectal Cancer Patients: A Cross-Sectional Study Using the PG-SGA and PG-SGA SF

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Abstract

Malnutrition is a common but frequently overlooked complication in colorectal cancer (CRC), with global prevalence estimates ranging from 20% to over 70% depending on disease stage and assessment method. It is associated with poor treatment tolerance, longer hospital stays, and reduced survival. Nutrition Impact Symptoms (NIS) such as dry mouth, taste changes and early satiety are known to impair intake and contribute to nutritional decline. Despite international guidelines recommending early screening, data on malnutrition and NIS in colorectal cancer patients remain limited in the Middle East and have not yet been studied in Kuwait. This cross-sectional study included 65 CRC outpatients at Kuwait Cancer Control Center. Nutritional status was assessed using the full Patient-Generated Subjective Global Assessment (PG-SGA) and its Short Form (PG-SGA SF). NIS were evaluated by the symptom components of the PG-SGA/PG-SGA SF. Logistic regression was used to identify NIS associated with malnutrition. Malnutrition was identified in 61.4% of the patients. Significant NIS included anorexia, dry mouth, and nausea ($p < 0.004$), with dry mouth as an independent predictor (OR = 17.65, 95% CI: 2.02–154.19). Notably, only 23.5% of patients identified with moderate malnutrition had been referred for nutrition intervention, indicating a substantial gap in clinical practice. In conclusion, malnutrition is highly prevalent among CRC patients in Kuwait and is strongly linked to key nutrition impact symptoms, particularly anorexia, dry mouth, and nausea. These findings highlight the urgent need for routine screening with validated tools like the PG-SGA SF, followed by comprehensive nutritional assessment and timely, individualized interventions to enhance treatment tolerance, improve clinical outcomes, and support overall quality of life.

Acknowledgments: The authors gratefully acknowledge Dr. Rashad Salama and Dr. Niveen Eldreiny for their professional support and collaboration throughout the data collection process.

A Behavioral Analysis of Fruit and Vegetable Intake in Saudi Adults: Examining the Theory of Planned Behavior and Habit Strength

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Abstract

Background: Low fruit and vegetable (F&V) consumption among Saudi adults poses significant public health challenges, despite clear recommendations from the WHO and Saudi Ministry of Health. Existing studies have not extensively applied behavioral theories to understand these dietary patterns.

Objectives: (1) to validate the predictive power of the TPB constructs (attitude, subjective norms, perceived behavioral control, and intention) in relation to F&V consumption; (2) to examine the moderating role of habit strength; and (3) to identify key beliefs underlying these constructs to inform targeted interventions.

Methods: A cross-sectional study design was used with 472 Saudi adults, recruited via online questionnaires distributed through social media. Data were collected using a validated questionnaire encompassing demographics, lifestyle factors, TPB constructs, and habit strength. Structural Equation Modeling (SEM) tested the relationships among TPB constructs and behavior, while multi-group SEM assessed the moderating role of habit. Reliability analyses yielded Cronbach's alphas ranging from 0.72 to 0.92.

Results: Intention ($\beta = 0.24$, $p = 0.012$) and perceived behavioral control ($\beta = 0.42$, $p < 0.001$) significantly predicted F&V consumption, explaining 40% of the variance. Attitude, subjective norm, and perceived behavioral control significantly predicted intention, explaining 74% of the variance. Habit moderated these relationships, with the strongest PBC effect found in the low-habit group. Underlying beliefs related to health benefits and social influences were significant correlates of intention.

Conclusions: This study demonstrates that TPB constructs effectively predict F&V consumption among Saudi adults. Habit strength moderates these relationships, underscoring the need for tailored interventions that strengthen control beliefs, foster supportive social norms, and facilitate habit formation. These insights can guide policymakers and nutrition educators in designing effective, culturally appropriate strategies to enhance F&V intake in Saudi Arabia.

Evaluating the Quality of Arabic Youtube Videos on Breastfeeding Using The Discern Tool

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Abstract

Background: Breastfeeding offers substantial health benefits for infants and mothers and is recommended exclusively for the first six months of life, with continued breastfeeding for at least one to two years. However, exclusive breastfeeding rates remain suboptimal in Arabic-speaking countries. YouTube, a widely accessed platform, may offer an avenue for disseminating breastfeeding information, yet the quality and reliability of its Arabic content remain unexplored. Objective: This study aimed to evaluate the quality, reliability, and overall content of Arabic YouTube videos on breastfeeding using the DISCERN tool.

Methods: A systematic search was conducted on YouTube (Sept-Dec 2023) using the terms "Breastfeeding," "Exclusive Breastfeeding," and "Breast Milk" in Arabic. After applying inclusion/exclusion criteria and removing duplicates, 165 videos were analyzed. Three independent health education experts assessed the videos using the DISCERN instrument, which evaluates reliability, information quality, and overall video quality on a scale from 1 (low) to 5 (high). Descriptive statistics, Chi-square, Monte Carlo corrections, and Spearman correlations were conducted.

Results: Educational content (29.7%) was the most common video type. Health professionals were the primary speakers in 63.6% of videos. Most videos (92.7%) received medium ratings for reliability (mean: 3.06 ± 0.48), information quality (3.41 ± 0.69), and overall quality (3.16 ± 0.90). The Egyptian dialect was most prevalent (43.6%). Strong positive correlations were observed between DISCERN total score and reliability ($r_s = 0.816$), information quality ($r_s = 0.904$), and overall quality ($r_s = 0.821$; all $p < 0.001$).

Conclusions: Most Arabic YouTube videos on breastfeeding are of medium quality, with substantial potential for improvement. Tailored, high-quality video content from medical authorities and experts is needed to support breastfeeding promotion in Arabic-speaking communities.

Grain and Legume Consumption and Risk of Gastric Cancer: Findings from a Case–Control Study

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Abstract

Gastric cancer (GC) remains a major contributor to global cancer mortality, with dietary factors playing a critical role in modulating risk. Evidence on the dietary determinants of GC in Middle Eastern populations, particularly in Jordan, is still limited. This study examined the relationship between grain and legume consumption and GC risk in a Jordanian cohort, hypothesizing that refined grains increase risk while whole grains and legumes provide protective effects. A case–control design was employed, including 173 newly diagnosed GC patients and 314 cancer-free controls recruited from leading hospitals in Jordan. Dietary intake was assessed using a validated Arabic food frequency questionnaire adapted to Jordanian eating patterns. Multivariable analyses controlled for potential confounders to better isolate dietary effects. Findings revealed that high intake of refined grains, especially white bread, was strongly associated with GC risk (OR = 3.13, 95% CI: 1.57–6.21, p = 0.001). In contrast, moderate rice consumption was protective (OR = 0.38, 95% CI: 0.18–0.81). Legume consumption, including hummus (OR = 0.48, 95% CI: 0.26–0.97) and cooked dried beans (OR = 0.40, 95% CI: 0.20–0.81), also demonstrated protective associations. Unexpectedly, green pea consumption was linked to an elevated risk (OR = 2.19, 95% CI: 1.24–3.88, p = 0.004), possibly reflecting specific preparation methods or dietary practices. This study highlights the divergent effects of specific grains and legumes on GC risk in Jordan. While refined grains appear to elevate risk, legumes confer protective benefits. These findings emphasize the need for targeted public health strategies to promote legume consumption and reduce refined grain intake as part of GC prevention efforts in similar populations.

Circular Food Supply Chains in Kuwait: A Blockchain–AI Managerial Accounting Framework for Waste Valorization and Cost Recovery

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Abstract

Kuwait's food system faces critical challenges related to high dependency on imports and substantial post-consumption and post-distribution food waste. Traditional supply chain models and the managerial accounting systems that support them are not well-equipped to understand the value that is hidden in these waste streams. As the need for sustainability grows the ability to trace, assess, and recover value from by-products and food waste has become central to circular food system transformation. This conceptual paper introduces a novel Blockchain-AI-driven managerial accounting framework designed to enable waste valorization and cost recovery across Kuwait's circular food supply chains. The model positions waste as a traceable, monetizable asset rather than a residual burden. Blockchain provides secure, tamper-proof documentation of waste generation, ownership, and re-entry points into secondary markets, while AI supports predictive diagnostics, smart costing, and real-time valuation perspectives. Together, these technologies underpin a digital accounting system capable of mapping waste flows, allocating cost recovery potentials, and guiding operational and policy-level interventions . Following a conceptual design approach grounded in theory integration, the proposed framework empowers food system actors, including public agencies, distributors, and processors, by repositioning accounting as a strategic decision-support tool rather than a static reporting mechanism to recover both economic and environmental value from underutilized outputs. It also aligns with Kuwait's Vision 2035, strengthens food security objectives and sustainability, and operationalizes intelligent infrastructure for waste management. The paper contributes to emerging literature at the intersection of environmental managerial accounting, circular supply chains, and digital traceability and discusses a rationale for future empirical studies and region-specific pilot initiatives in food system sustainability. The framework is expected to improve waste traceability, cost recovery, and decision-making in Kuwait's food supply chains using Blockchain and AI. A key limitation is the limited digital infrastructure and data-sharing practices. Future efforts should focus on pilot testing and strengthening institutional support for circular economy adoption.

Molecular Dynamics Simulations of Homogalacturonan: Insights into Structural Behavior for Food Applications

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Abstract

Pectin is a diverse plant polysaccharide widely used in the food industry for its gelling, thickening, and stabilizing roles. Its main structural unit, homogalacturonan (HG), comprises linear chains of α-1,4-linked D-galacturonic acid with variable methylesterification patterns. These features govern HG's ability to form calcium-induced or acidic gels, which are vital for food texture and rheology. Molecular dynamics (MD) simulations have become an indispensable tool for probing how atomic-scale features influence the bulk behavior of HG. Simulations of HG chains with different charge densities and methylesterification patterns revealed complex, non-linear electrophoretic mobility behaviors arising from localized counter-ion condensation in block wise charged domains. These nuanced effects are not captured by continuum or averaged-charge models, highlighting the value of atomistic approaches. Complementary simulations across oligosaccharides of varying lengths further demonstrated that both the degree and spatial arrangement of ionizable residues significantly affect polymer conformation and mobility. These insights are particularly relevant to separation technologies and electrokinetic processing in food and pharmaceutical systems. Further understanding of HG behavior in solution has come from MD simulations integrated with small-angle X-ray scattering (SAXS), which showed that HG chains adopt semi-rigid, rod-like conformations at low concentrations, largely independent of ionic conditions. At higher concentrations, electrostatic repulsion promotes inter-chain organization, manifested as a polyelectrolyte peak, critical to gel network development. More recent simulations have revealed that multiple HG chains can spontaneously twist into super-helical bundles stabilized by electrostatic and hydration forces. This twisting mirrors fiber bundling observed in mucilage and may underpin the extensibility and cohesion of hydrated polysaccharide networks in food gels.

Valorization of Red and White Dragon Fruit Peel Powder for Development of Functional Dairy Product

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Abstract

The present study was carried out to valorize the peels of red and white dragon fruit (Hylocereus polyrhizus and H. undatus) through different pretreatments, drying methods, storage evaluation, and incorporation into dairy product. The peels were subjected to various pretreatments including steam blanching and chemicals treatments - potassium metabisulphite (KMS), sodium benzoate, citric acid (alone and in combinations). Peel slices with different pretreatments were dried using hot air cabinet, microwave-assisted, and solar drying methods; hot air cabinet drying retained the highest levels of phytochemicals and color (Bhagya Raj & Dash, 2021) . Powders were then stored in HDPE and aluminium laminated pouches at ambient temperature for 4 months. Among all pretreatments, the combined application of KMS and citric acid exhibited better retention of color (higher a* values), total phenolics, and antioxidant activity in both red and white peel powders. Aluminium laminated pouches demonstrated superior barrier properties against moisture and effectively preserved nutritional quality during storage. Red dragon fruit peel powder consistently exhibited higher betacyanin (up to 5.89 mg/g), total phenol (2.06 mg GAE/g), and DPPH radical scavenging activity (65.17 mg TE/g) compared to white peel (1.18 mg/g , 1.42 mg GAE/g , and 48.92 mg TE/g) respectively. Based on sensory scores, 1% red and white dragon peel powder incorporation in yogurt was most acceptable, and also significantly enhancing functional properties, total phenol was showing 0.45 mg/g and DPPH activity - 0.64 mg/g respectively. Fortified yogurt remained stable and microbiologically safe during 7 days at $4 \pm 1°C$, demonstrating effective peel valorization into functional dairy product.

Fig. 1.Red Dragon Peel Powder Fig. 2.White Dragon Peel Powder Fig. 3.Yogurt incorporated with dragon fruit peel powder

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Development and Characterization of Dragon Fruit Chips as A Nutritious Snack Alternative

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Abstract

Dragon fruit (*Hylocereus* spp.) chips from the red variety (*Hylocereus polyrhizus*) and white variety (*Hylocereus undatus*) were developed and characterized utilizing microwave-assisted hot air drying as a healthy and useful snack substitute (Bhagya & Dash, 2021). Chips made by drying using microwave-assisted hot air cabinet drying were found the best for making quality chips due to its ability to retain better color and higher retention of bioactive compounds and reduced drying time among other drying methods, i.e., solar drying and hot air cabinet drying (Bhagya & Dash, 2021). Red chips exhibited much higher antioxidant activity (DPPH: 72.48 mg TE/g) and total phenolic content (2.19 mg GAE/g) than the white chips DPPH: 55.30 mg TE/g and 1.65 mg GAE/g respectively. Red chips showed higher betacyanin content (6.45 mg/g) than white chips (1.21 mg/g), corresponding to a darker and more intense color value of red chips: L* (38.6), a* (25.43), and b* (10.37); whereas white chips had L* (48.75), a* (6.87), and b* (16.24). All samples exhibited an increase in moisture content throughout storage, whereas chips in aluminium laminated pouches had a smaller moisture gain (from 4.52% to 7.81%) than HDPE (up to 9.24%). Over the storage of four months, the antioxidant activity in red chips decreased by 18–22% in aluminium laminated pouch and 28–31% in HDPE. In red chips, total soluble solids (TSS) (~15.2 to 14.1 °Brix) conserved more stable than in white chips that had TSS (~14.6 to 13.0 °Brix). In aluminium laminated pouches, pH retention was better (0.21–0.32) than in HDPE (pH-0.38–0.49). Among the pretreatments, the combination of potassium metabisulfite and citric acid showed most effective and better retention of color and nutrients throughout drying and storage .Therefore, these results provide a viable method for converting dragon fruit into functional value-added product.

	
Fig. 1.White Dragon Chips	Fig. 2.Red Dragon Chips

Acknowledgement: The authors acknowledge Punjab Agricultural University for its support.

Comparison of Different Probiotics Applications Methods in Poultry Farms in Kuwait

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Abstract

The conditions created by intensive chicken farming and the extensive processing involved in poultry products are conducive to pathogen growth. The current use of antibiotics has achieved limited success in managing disease outbreaks, and their widespread application has resulted in the emergence of antibiotic-resistant bacterial strains. There is an urgent need for more cost-effective and environment-friendly alternatives to replace antibiotic use to control infectious diseases and enhance the safety of poultry products. Probiotics, such as lactic acid bacteria, are frequently found in the microbiota of birds. At KISR, an innovative probiotic product was created to benefit the poultry sector and ensure food safety in Kuwait. This formulation consists of a blend of Lactobacillus plantarum, Lactobacillus parabunchner, Lactobacillus brevis, and Pediococcus pentosaccus in a powdered form. It can be administered by adding it to water, using drops, or mixing it directly into poultry feed. The biological product functions to stabilize the intestinal microbial balance of the animals and enhancing meat production with minimal variation in application methods.

Hepatoprotective Perspective of Newly Synthesized 3-(3,5-Bis (Trifluoromethyl) Phenyl)-5-Methyl-1-((1-Methyl-1H-Pyrrol-2-Yl) Methyl)-2-Thioxoimidazolidin-4-One Against Diethyl Nitrosamine-Induced Liver Injury in Rats with Molecular Docking Investigation

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Abstract

The hepatoprotective effect of synthesized 3-(3,5-bis (trifluoromethyl) phenyl)-5-methyl-1-((1-methyl-1H-pyrrol-2-yl) methyl)-2-thioxoimidazolidin-4-one (3FL-M) was evaluated against diethyl nitrosamine induced liver injury (DEN). Wistar rats were divided into 3 groups as: placebo (received 10% tween 80%), hepatotoxic control (injected with 200 mg/kg of DEN) and treatment (injected 200 mg/kg of DEN and received 50 mg/kg oral feeding of the synthesized 3FL-M). Half the number of rats were sacrificed on the 2nd week of the experiment, whereas the other half were sacrificed after 6 weeks. Blood was collected to run liver biochemical analysis, and to evaluate pro-inflammatory cytokines tumor necrosis factor-alpha TNF-α and interleukin 6 IL-6. Liver sections were used to detect nuclear protein ki-67 and hepatocyte specific antibody HSA. 3FL-M was subjected to molecular docking calculations based on binding affinities towards TNF-α and IL-6. DEN-treated rats showed elevation in the liver serum enzymes as well as pro-inflammatory cytokines with clear destruction of the hepatic architecture, in contrast 3FL-M treated rats showed normalized liver enzymes and cytokines levels with resolution of the hepatocytes. Molecular modelling revealed that 3FL-M exhibited the significant affinities toward the binding pocket of the TNF-α and IL-6, however, further studies is recommended for developing it as a chemotherapeutic drug-like molecule.

Note: At the time of conducting this research, the author was affiliated with Hawler Medical University. The author is currently affiliated with the Department of Medical Microbiology, College of Science, Knowledge University, Erbil, Kurdistan Region, Iraq.

Pistacia lentiscus L. Seeds Aqueous Extract from Morocco: Phytochemical Composition, Safety, and Antidiabetic Potential Using In Vitro, In Vivo, and In Silico Approaches

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Abstract

Background: Pistacia lentiscus L. is an evergreen shrub from the Anacardiaceae family, mainly found in the Mediterranean.

Objective: This study investigates its antihyperglycemic effects using in vitro, in vivo, and in silico methods.

Methods: The aqueous extract was prepared using the decoction method. Polyphenol, flavonoid, and tannin contents were measured with colorimetric techniques. Bioactive compounds were identified via HPLC-DAD analysis. The safety of the extract was evaluated through acute toxicity tests, the alkaline comet assay, and the ProTox platform. The antihyperglycemic effects were examined using the oral glucose tolerance test and in silico, in vitro, and in vivo assays targeting carbohydrate-digesting enzyme inhibition. Pharmacokinetic profiling was conducted with the Swiss ADME platform.

Results: The extract showed high levels of bioactive compounds, including polyphenols (165.2 ± 1.59 mg GAE/g DE), flavonoids (18.42 ± 0.41 mg QE/g DE), and condensed tannins (63.2 ± 0.57 mg CE/g DE). Major components included 4-hydroxybenzoic acid (32.2%), quercetin (14.82%), catechin (14.8%), and caffeic acid (8.83%). Enzymatic assays indicated the extract effectively inhibited intestinal α-glucosidase (IC_{50} = 0.134 ± 0.01 mg/mL) and pancreatic α-amylase (IC_{50} = 57.9 ± 2.33 µg/mL). The aqueous extract (400 mg/kg) significantly lowered postprandial hyperglycemia after glucose (2 g/kg) administration (1.37 ± 0.13 g/L vs. control 2.25 ± 0.18 g/L, $p < 0.001$) and improved glucose tolerance in a sucrose-induced model (1.23 ± 0.11 g/L vs. 1.66 ± 0.18 g/L in controls, $p < 0.001$). Additionally, a genotoxicity study on rat leukocytes found no DNA alterations at doses of 10 to 50 µg/mL. Acute toxicity test showed no adverse effects at high doses (2 g/kg), indicating a favorable safety profile in the short term. Molecular docking studies revealed strong interactions between P. lentiscus phytochemicals and metabolic enzymes, especially naringin, which had binding affinities of -8.4 kcal/mol toward α-glucosidase and -8.6 kcal/mol toward α-amylase. Furthermore, ADME analysis suggested that several P. lentiscus phytochemicals have high bioavailability and drug-like qualities, with toxicity predictions indicating modest cytotoxicity but no significant hepatotoxicity or nephrotoxicity.

Conclusion: These results demonstrate P. lentiscus's potential as a plant-based treatment to improve glucose metabolism with no toxicity. Additional clinical studies and compound isolation are necessary to confirm its therapeutic potential.

Imputation of Feed Efficiency in Individual Chicken Housed in Groups

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Abstract

Genetic improvement for feed efficiency will enhance sustainability and profitability of poultry operation. This requires collection data of feed intake at the individual bird level. However, in practice, this can be expensive and technically challenging to collect in large number. Therefore, the objective was to present a practical method to impute individual feed intake (IFI) in chicken, using an equation as function of group feed intake and individual bodyweight. A population of 5,000 birds between age of 0 and 5 weeks old, with weekly individual data for bodyweight and IFI was simulated. The imputation of IFI was tested in two grouping structures: with 10 birds per group in total of 500 groups (G1), and 5,000 birds in a single group (G2). Feed conversion ratio (FCR), residual weekly gain (RWG), and residual feed intake (RFI), were calculated based on true and imputed IFI. The correlation between true and imputed RFI were low 0.42 and 0.28, in G1 and G2, respectively, which indicate that imputed RFI data unreliable. On the other hand, the correlation between true and imputed data is high (for G1 and G2, respectively) for IFI (0.97 and 0.96), FCR (0.89 and 0.88), RWG (0.90 and 0.86). The high correlations indicate high reliabilities. Data grouping structure in G1 is much better than G2. However, except for RFI, the accuracy for prediction in G2 did not drop substantially, making imputation still reliable in extreme grouping structure. The presented method would allow for rapid generation of such data. As a result, feed efficiency traits can be integrated into breeding programs without incurring additional cost. Therefore, imputation makes the best use for available information for genetic improvement for feed efficiency in chicken.

A rapid, Simple, and Reliable Assay to Authenticate Peruvian Kiwicha (*A. Caudatus*) for Food Applications

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Abstract

Amaranth has acquired great economic impact as functional food, with species originating from Mexico dominating global trade. In contrast, the Peruvian A. caudatus (kiwicha) has been vastly neglected, although it is endowed with very promising nutritive traits. Morphological plasticity and taxonomic ambiguities render authentication of Amaranth difficult, such that the identity of commercial samples is often unclear. To safeguard the authenticity of kiwicha and, thus, consumer safety, we characterized a germplasm collection of 84 Amaranth accessions on both, the morphological and the genetic level. We show that kiwicha can be delineated phenotypically from other species by its late flowering, taller posture, and lower grain yields. Instead, flower and seed color, often used as proxy for identity, do not qualify as taxonomic markers. Using the plastidic barcoding marker psbA-trnH igs we were able to identify a specific Single Nucleotide Polymorphism (SNP) that separated kiwicha from all other species of Amaranth. This allowed us to develop a sequencing-free authentication assay using an Amplified Refractory Mutation System (ARMS) strategy. As a result kiwicha in commercial samples can be authenticated by a single duplex-PCR yielding a diagnostic side band reporting A. caudatus against all other species of Amaranthus. This fingerprinting assay will help to develop the nutritive potential of kiwicha and to safeguard seed material for A. caudatus against adulteration by the far more prevalent species from Mexico.

One- and two-electron enzymatic oxidation mechanism of (-)-Epicatechin using glutathione trapping method

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Abstract

The natural polyphenolic phytochemicals, catechins, exist in various food sources and medicinal plants. (-)-Epicatechin (EC), which is characterized by di-hydroxyl group substitution of the B-ring and the meta-5,7-dihydroxy substitution of the A-ring, is one of the most common dietary catechins known to occur widely in green tea, cocoa, apple, wine, etc. Many pharmacological effects including antidiabetic, antibacterial, antifungal, antiviral, antioxidant, anti-inflammatory, anti-cancer, and anti-cardiovascular disease, among other activities have been attributed to the consumption of EC. These effects of EC have been ascribed not only to the direct anti-oxidative property of its phenolic hydroxyl groups but also to its "indirect" cytoprotective properties via maintaining cellular redox homeostasis. Identification of the oxidation products of this potential antioxidant may therefore provide deeper insight into the mechanism of its protective antioxidant/toxic prooxidant actions and may form the basis for new biomarkers for the detection of its antioxidant/prooxidant activities. Therefore, in this study, the horseradish eroxidase/H2O2-mediated one-electron enzymatic oxidation and tyrosinase/O2-mediated two-electron enzymatic oxidation of EC have been studied. Since the high reactivity of the intermediate metabolites is known to hamper their direct identification, these metabolites were trapped by glutathione, and the glutathione adducts that were formed were separated by HPLC and identified by LC/MS and NMR spectrometry. In both incubations five glutathionyl-metabolites have been detected by HPLC/DAD. These five metabolites were separated by HPLC and have been identified as follow: (1) 2',5'-diglutathionyl(-)-Epicatechin; (2) 2',5',6-triglutathionyl(-)-Epicatechin; (3) 2'-glutathionyl(-)-Epicatechin; (4) 6'-glutathionyl(-)-Epicatechin; (5) 5'-glutathionyl(-)-Epicatechin. It has been reported previously that enzymes preferentially oxidize the catechol B-rings of the catechins rather than the A-ring and all glutathionyl-metabolites have been reported to be formed in B-ring and the mechanism of this activity has been attributed to the formation of O-quinone/Meisenheimer complex. In the present study, in case of tyrosinase mediated two-electron oxidation of EC, the major metabolites are the mono gluathionyl conjugates formed in B-ring and the di- and tri-glutathionyl adducts were minor products. However, in case of HRP/H2O2-mediated one-electron oxidation, the major metabolites were the di- and tri-glutathionyl conjugates in addition to 5'-mono-glutathionyl conjugate. These results indicated that, especially for peroxidase catalysed oxidation of EC, the oxidation originating not only at B-ring but also at A-ring as well. This finding may explain that after the EC intake, in both in vitro and in vivo investigations, the major metabolite, which has been previously reported, was 5-(3′,4′-dihydroxy-phenyl-γ-valerolactone (3,4-diHPV) (i.e., maintaining the B-ring and fragmentation of both C- and A-rings). This 3,4- diHPV metabolite could be a result of oxidation of the A-ring, according to the present finding, followed by the A-ring cleavage and C-ring fission of the EC.

Peruvian Amaranth (Kiwicha) Accumulates Higher Levels of the Unsaturated Linoleic Acid

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Abstract

Grain amaranth (Amaranthus spp.) is an emerging crop rich in proteins and other valuable nutrients. It was domesticated twice, in Mexico and Peru. Although global trade is dominated by Mexican species of amaranth, Peruvian amaranth (A. caudatus, kiwicha) has remained neglected, although it harbours valuable traits. This study compares the accumulation of polyunsaturated fatty acids in four genotypes of A. caudatus (kiwicha) and a commercial Mexican hybrid (A. hypochondriacus × A. hybridus, variety K432) cultivated under temperate conditions in Southwest Germany. The A. caudatus genotypes flowered late, only reaching maturity in late autumn. As a result, they grew taller than the Mexican hybrid (K432) but produced fewer grains. The oil of kiwicha showed a significantly higher content of unsaturated fatty acids, especially of linoleic acid and α-linolenic acid compared to early flowering genotype K432. To gain insight into the molecular mechanisms behind these differences, we sequenced the genomes of the A. hypochondriacus × hybridus variety K432 and the Peruvian kiwicha genotype 8300 and identified the homologues for genes involved in the ω3 fatty-acid pathway and concurrent oxylipin metabolism, as well as of key factors for jasmonate signalling and cold acclimation. To explain these biochemical differences, we examined the expression of key genes in the omega-3 and cold-stress pathways across three seed developmental stages in all five genotypes. We find that transcripts for Δ6 desaturases are elevated in kiwicha, whereas in the Mexican hybrid, the concurrent lipoxygenase is more active, which is followed by the activation of jasmonate biosynthesis and signalling. The early accumulation of transcripts involved in cold-stress signalling reports that the Mexican hybrid experiences cold stress already early in autumn, whereas the kiwicha genotypes do not display indications for cold stress, except for the very final phase, when there were already freezing temperatures. We interpret the higher content of unsaturated fatty acids in the context of the different climatic conditions shaping domestication (tropical conditions in the case of Mexican amaranth, sharp cold snaps in the case of kiwicha). Our findings suggest that kiwicha oil, enriched in health-promoting unsaturated fatty acids, holds significant potential as a functional food. Future development should focus on optimizing genetic backgrounds, agricultural practices, and processing techniques to maximize its nutritional value.

Steam Blanching Effects on Physicochemical Properties, Phytochemical Content, and Color Retention of Red Okra (*Var. Punjab Lalima*) Crisps

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Abstract

This study investigated the impact of steam blanching (90°C for 5 minutes) on the physicochemical, phytochemical, and color properties of red okra (var. Punjab Lalima) crisps produced via hot air cabinet drying at 60°C. Two treatments were evaluated: untreated control samples and steam-blanched samples prior to drying. Results demonstrated that steam blanching significantly enhanced several nutritional parameters, with blanched crisps exhibiting higher ash content (7.42% vs. 6.76%), protein (3.67% vs. 3.33%), fat (2.85% vs. 2.13%), and titratable acidity (0.51% vs. 0.43% citric acid) compared to control. Phytochemically, blanching significantly increased total phenols (506.79 mg GAE/100g vs. 490.19 mg GAE/100g), total flavonoid content (214.5 mg QE/100g vs. 186.37 mg QE/100g) and total chlorophyll (108.23 mg/100g vs. 91.2 mg/100g), while no significant differences were observed for moisture, total soluble solids, sugars, antioxidants, or total carotenoids. Critically, anthocyanins responsible for the characteristic red color of red okra were not detected in either treatment, indicating complete degradation during processing regardless of blanching treatment. Color analysis revealed that steam blanching resulted in a more green product, as indicated by a lower a value (−0.75 vs. −0.13), while bulk density increased slightly and drying efficiency remained unaffected. Overall, steam blanching improved several physicochemical and phytochemical qualities and enhanced green coloration of red okra crisps, but anthocyanin retention was not achieved in either treatment.

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