Conference Report

Remarks and Abstracts of the 14th Asian Congress of Nutrition in Chengdu, China, 14–17 September 2023

Yuexin Yang 1,*, Junhua Han 1, Mengjie Qiu 1, Yuna He 2 and Cheng Li 3

1 Chinese Nutrition Society, Beijing 100052, China
2 National Institute for Nutrition and Health, Chinese Center for Disease Control and Prevention, Beijing 100050, China
3 Beijing Academy of Science and Technology, Beijing 100089, China
* Correspondence: yuexin_yang@sina.com

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1. Preface

The 14th Asian Congress of Nutrition, organized by the Federation of Asian Nutrition Societies (FANS) and the Chinese Nutrition Society (CNS), convened in Chengdu, Sichuan, from 14 to 17 September 2023. This landmark event, marking the 50th anniversary of FANS, underscored the pivotal role of Asia in global health through the theme “Feeding the Future by Sustainable Nutrition”. Nearly 4000 participants from across Asia and beyond gathered to engage in a discourse that emphasized the critical importance of nutrition science in our rapidly evolving world.

The opening ceremony featured inspiring speeches from esteemed leaders, including Professor Yuexin Yang, Chair of the 14th ACN, Professor Hardinsayh, FANS President 2019–2023, and Dr. Lynnette Neufeld, Director of the Food and Nutrition Division at the FAO. Their messages highlighted the conference’s role in fostering academic dialogue, promoting collaborative efforts, and encouraging interdisciplinary exchanges to tackle the nutrition-related challenges facing the globe today.

The congress was rich in academic activities, boasting over 100 scientific sessions, including plenary lectures, concurrent symposia, oral abstract presentations, and poster sessions. A staggering total of 713 speakers contributed to the symposia, exploring a myriad of topics critical to nutrition science. From the pressing global concern of obesity to the reevaluation of dietary reference intakes, the conference offered a comprehensive overview of the latest research and innovations in the field.

Highlighted sessions included thought-provoking discussions on “Sustainable Nutrition and Development”, “Healthy Diets: Advances in Definitions and Data”, “Empowering Aging Society through Sustainable Nutrition”, and “Nutrition Competence, GDP, and Food Security”. These sessions not only provided insights into current nutrition challenges but also paved the way for future research directions.

In addition to the rich academic discourse, the conference showcased the Nutrition Science and Technology Innovation Exhibition and the Academic Exchange Exhibition, with nearly 100 exhibitors displaying advancements in nutrition science and technology. The event also celebrated the achievements of young researchers through travel awards, best oral awards, and best poster awards, etc.

The 14th ACN served as a monumental platform for networking, learning, and collaboration, setting the stage for future endeavors in nutrition science and technology. Over 1600 abstracts were submitted, demonstrating the vibrant future of nutrition research. This conference report encapsulates the essence of the congress, highlighting its significant contributions to the field of nutrition and its impact on global health.
2. Remarks of the 16th China Nutrition Science Congress

On 14–17 September 2023, the 16th China Nutrition Science Congress, hosted by the Chinese Nutrition Society, was successfully held at the Tianfu International Conference Center, Chengdu, China. The event was held simultaneously with the 14th Asian Congress of Nutrition. The congress revolved around the theme of “Nutrition and Sustainable Development”, attracting nearly 3000 worldwide nutrition experts to participate.

The congress consisted of multiple parts, including the main forum, special reports, academic dialogues, posters, innovative nutrition technology exhibition, and academic tour. The content covered topics related to nutrition and sustainable development, public nutrition and health, basic nutrition research, food and nutrition, whole lifecycle nutrition, nutrition education, clinical nutrition, and precise nutrition. Scientific and technological professionals from the nutrition, health, food, agriculture, and other fields, as well as representatives from the industry, had in-depth exchanges on hot nutrition topics. The latest research advances in global nutrition, health, food, agriculture, and other fields, including those from basic research to practical applications, were shared in the congress.

The China Nutrition Science Congress is an important academic event of the Chinese Nutrition Society. The congress embodies the unremitting efforts of national nutrition research workers, promotes the high-quality development of nutrition science and technology, assists in the growth and improvement of young nutrition talents, and improves the national awareness of nutrition science.

3. Keynote Reports

3.1. Chinese Dietary Reference Intakes 2023

Yuexin Yang
Chinese Nutrition Society, Beijing, China

The ninth edition of the Chinese Dietary Reference Intakes, DRIs-2023, provides updated recommendations for energy and 35 nutrients across 20 various age groups. Additionally, it proposes PI-NCD values for sodium, potassium, and VitC, as well as SPLs or ULs for 14 additional non-nutrient food components for adults. The main content of the new version of DRI is as follows, including five aspects.

- Conceptual Framework and Modification Procedures

  The expert committee carefully studied new literature, especially regarding the definition and procedures for developing the required quantity to reduce the risk of chronic diseases. The expert committee has reorganized relevant concepts’ conceptual frameworks for EAR, RNI, and AI, and developed a unified revision and development procedure, including assessment of evidence gradation, biomarker selection, and the scientific validity, and consistency of the methodological approach for developing EAR, RNI, and AI has been added.

  The concept of PI-NCD (proposed intakes for preventing non-communicable diseases) was first introduced in DRIs-2013 and is further elaborated in the current revision, incorporating the latest research on the relationship between nutrition and chronic diseases. SPL (specific proposed level) represents suggested daily consumption amounts of other dietary components, specifically tailored for adults, to mitigate the risk of diet-related non-communicable diseases. SPL is solely pertinent to adults.

- Building on the Basic Reference Values for DRIs

  Age groups: based on changes in adolescent development and aging, the population was divided into 20 age groups, emphasizing changes in weight and nutrient requirements during specific periods.

  Representative weight and height values: created representative and reference weight and height values for 20 different age groups for both sexes to determine the weight and height of different age groups based on the survey of healthy individuals in China and the standard range of healthy BMI.
Reference values of breast milk: established reference values for energy and 36 nutrients from mature breast milk collected from Chinese mothers.

Pregnancy weight gain values: established specific weight gain values for each trimester of pregnancy for Chinese women for pregnancy requirements.

PAL: PAL values were revised to 1.40, 1.70, and 2.00 in light, moderate, and heavy physical activity levels for the 2023 version.

• New DRIs By Recent Evidence, Including Chinese Population-Based Studies

Considering the significant differences in genetic factors, physique, dietary habits, and nutritional health status between Chinese and other populations, the DRIs-2023 places more emphasis on research based on the Chinese population. It applies the basal metabolic rate (BMR) prediction formula developed for the Chinese population for energy requirements. The findings regarding the requirements for protein, calcium, iron, selenium, iodine, vitamins, water, and other dietary components used in this edition were primarily sourced from studies conducted on the Chinese population. Additionally, certain AI values utilized data from the Chinese National Nutrition Survey.

The Chinese edition of DRIs-2023 has been published by the People’s Medical Publishing House. The English edition of DRIs-2023 aims to garner essential content from the Chinese version, with the primary objective of facilitating global knowledge sharing and providing valuable insights to professionals and organizations worldwide. DRIs-2023 provides comprehensive and evidence-based insights on the prevention of malnutrition and non-communicable diseases.

3.2. Revision Process and Key Recommendations of the Fifth Edition Chinese Dietary Guidelines

Yuexin Yang
Chinese Nutrition Society, Beijing, China

Background: The Chinese Dietary Guidelines (CDGs) are a comprehensive set of dietary recommendations that were first introduced in 1989 to guide the nutritional health of the Chinese population. The CDGs have been periodically revised to reflect the latest scientific evidence and to address the changing dietary habits and health challenges faced by the nation. Subsequent editions were released in 1997, 2007, and 2016, with each edition reflecting the latest scientific evidence and addressing the changing dietary habits and health challenges faced by the nation. The 5th edition of the dietary guidelines was revised by an Expert Committee, which was prepared and organized by the Chinese Nutrition Society, under the leadership of the National Health Commission, Ministry of Agriculture and Rural Affairs, the National Food and Nutrition Advisory Committee, and other government agencies, and released in 2022.

The Objectives of the CDGs: The CDGs are based on strong scientific evidence, and the main objective is to improve the awareness rate of dietary guidelines, reduce nutrition-related chronic diseases, improve the health level of Chinese residents, and assist in the construction of a healthy China.

Revision Process: The revision process of the Chinese Dietary Guidelines involved a systematic and multi-step approach to ensure that the updated guidelines accurately addressed the nutritional and dietary needs of the Chinese population. The revision process began in 2020. After the preliminary discussions, the Revision Organizing Committee was determined, which comprised a Steering Committee, Revision Expert Committee, Secretariat Group, Scientific Evidence Group, and Graphic Design Group.

Following this initial setup, the scientific evidence work group started collecting the national data and latest versions of dietary guidelines from various countries and international organizations. Then, they identified the key nutritional and dietary issues in China through a comprehensive analysis. Subsequently, a systematic review of the current scientific evidence on food and health was conducted to inform the guideline recommendations. Based on these findings and expert consensus, the new edition of the Dietary Guidelines was developed, which included the revision of visual aids, such as...
the Chinese Food Guide Pagoda, Plate, and Abacus, and supplementary guidelines. In addition, feedback was solicited through a peer review process to ensure the validity and relevance of the proposed modifications. Once the revisions were complete, the Chinese Nutrition Society took responsibility for the publication and dissemination of the revised guidelines. To facilitate widespread public education and engagement, the 2022 CDGs were promoted through a National Nutrition Week (NNW) program. Moreover, adverts on core messages of the 2022 CDGs were placed in public places, including parks, metro stations, and neighborhood streets, and included as part of school textbook material.

Results: The 2022 CDGs have distilled the essence of a healthy diet into eight core principles, designed to guide the Chinese population toward improved health and well-being. These principles are as follows:

1. Enjoy a varied and well-balanced diet.
2. Be active to maintain a healthy body weight.
3. Consume plenty of vegetables, fruits, dairy, whole grains, and soybeans.
4. Eat moderate amounts of fish, poultry, eggs, and lean meats.
5. Limit foods high in salt, sugar, and cooking oil, and avoid alcoholic drinks.
6. Adhere to healthy eating habits and drink an adequate amount of water.
7. Learn about nutrition labeling, shop wisely, and cook smart.
8. Pay attention to hygiene, serve individual portions, and reduce food waste.

Supplementary to the core recommendations, the 2022 CDGs provided tailored guidelines for specific population groups to address their unique nutritional needs and health considerations. These supplementary guidelines were designed for:

1. Women who are trying to get pregnant and pregnant women.
2. Lactating women.
3. Infants (0–6 months).
4. Infants (7–24 months).
5. Pre-school children (2–5 years old).
7. General elderly (65–79 years old).
8. Advanced elderly (80 years old and above).

By offering this targeted advice, the guidelines aimed to ensure that all segments of the population can benefit from a nutritionally balanced diet.

3.3. Establishment of a Nutrient Profiling Model in China on Restricting the Marketing of Unhealthy Foods to Children

Junhua Han 1, Chao Gao 2, Zhu Wang 2, Yuexin Yang 1

1 Chinese Nutrition Society, Beijing, China
2 National Institute of Nutrition and Health, Chinese Center for Disease Control and Prevention, Beijing, China

Objective

Overweight and obesity rates in China have become a major public health problem, with the proportion of children aged 6–17 who are overweight tripling between 1992 and 2015, from 3.9% to 11.1%. Overweight children are more likely to exhibit metabolic and cardiovascular risk factors that were previously uncommon in children. These risks are likely to persist into adulthood, increasing their risk of cardiovascular disease, diabetes, and other diseases.

Countries around the world are taking steps to recalibrate the food environment to address the concerns of malnutrition and over-nutrition, including curbing and reducing children’s exposure to unhealthy foods and the marketing of non-alcoholic beverages. There is evidence that Chinese children are exposed to a large number of advertisements for unhealthy foods and non-alcoholic beverages. Thus, China would like to develop an
evidence-based model of nutrient profiling to limit the marketing of unhealthy foods and non-alcoholic beverages to children.

To perform this work, China established a working group for the development of the NP model, collecting NP models and related data at home and abroad, collecting information on the packaging of pre-packaged foods commonly consumed by children and pre-packaged foods marketed to children through multiple channels, and analyzing the contribution of pre-packaged foods to children’s total intake of sodium, fat, and sugar.

**Principles and Methods for Setting Thresholds**

1. **Basic principles**

   In this study, the recommended intakes of the Dietary Reference Intakes for Chinese Residents (2023) and the Dietary Guidelines for Chinese Residents (2022) were used to combine the 50th percentiles of fat, sodium, and sugar as the calculation method of the model, the current distribution of actual food ingredients was combined with the ideal nutrient target intake, and the excessive reduction of restrictive nutrient content and the ideal nutrient target intake were balanced, so that the threshold of the model was more reasonable and feasible.

2. **Calculation basis**

   Taking into account the international experience, the actual labeling situation in China, and the feasibility of the target, the working group finally decided to use 100 g as the calculation benchmark for the selection of food.

3. **Calculation method**

   (1) **Ideal value:** Based on the NP model algorithm of the WHO Western Pacific, according to the Dietary Nutrient Reference Intake for Chinese Residents (2023), the recommended daily energy intake for adults is 2000 kcal as the calculation benchmark.

   The Dietary Nutrient Reference Intakes for Chinese Residents (2023) recommends that the adult sodium intake should not exceed 2000 mg/d, and when the ratio between sodium content (mg) and energy content (kcal) per 100 g of product is equal to or higher than 1:1, the product is considered to exceed the ideal sodium value.

   The Dietary Nutrient Reference Intakes for Chinese Residents (2023) recommends that adult fat should provide 20~30% of the total energy, and when the fat (g) in the product is equal to or higher than 30% of the total energy (kcal) of the product, the product is considered to exceed the ideal value of fat.

   The Dietary Guidelines for Chinese Residents (2022) recommends that for adults, added sugars provide no more than 10% of total energy, considering that there is no mandatory labeling of added sugars on the nutrition facts list in China, so total sugars are used as a measurement standard, and when the total sugars (g) in the product are equal to or higher than 10% of the total energy (kcal) of the product, it is considered that the product exceeds the ideal value of sugar.

   (2) **Weighted value:** the average of the ideal value of sodium, fat, and sugar per 100 g of the product and the corresponding 50th percentile of the sodium, fat, and sugar content of the product per 100 g (i.e., the actual content distribution and the ideal value are combined, and the weight of each is 50%).

   (3) When the weighted values of sodium, fat, and sugar ≤ ideal, the ideal value of sodium is used as the limiting threshold.

   (4) For the threshold, fat and sugar should be revised according to 1 g, and sodium should be revised according to 50 mg.

   (5) It is recommended to adjust the appropriate thresholds of sodium, fat, and sugar based on the distribution range of sodium, fat, and sugar content levels of various types of foods, and comprehensively consider the recommended intake of sodium, fat, and sugar of Chinese residents, and the requirements of food processing technology and food consumption.
Results
This NP model is used to limit the marketing of unhealthy foods and non-alcoholic beverages to children. The food categories that are allowed to be marketed are fresh or frozen fruits and vegetables, and those that are not allowed to be marketed are confectionery and seasoned flour products, as well as the food categories that exceed the threshold (sodium, fat, or sugar), which includes 13 categories.

Conclusion
This model can provide consumers with simple and clear nutritional supplement information, help consumers make healthier food choices, and promote food producers to improve product formulations and provide healthier products, which is of great significance for the reasonable diet and chronic disease prevention and control of Chinese residents.

4. Oral Abstracts
4.1. Nutrition and Sustainable Development
Prevalence of Severe Food Insecurity in Asia and Africa: A Bayesian Comparison of the Prior and Ongoing COVID-19 Pandemic
Syed Mahfuz Al Hasan 1 and Jennifer Saulam 2,3
1 Clinical Research Support Center, Kagawa University Hospital, Kagawa, Japan
2 Department of Medical Informatics, Faculty of Medicine, Kagawa University, Kagawa, Japan
3 Department of Food Processing and Nutrition, Karnataka State Akkamahadevi Women's University, Vijayapura, Karnataka, India

Background and objectives: In 2021, an estimated 2.3 billion people worldwide could not access adequate food. Close to 40% of them had run out of food, and most of them resided in Africa and Asia. We aimed to make a Bayesian comparison of the prevalence of severe food insecurity prior to (2014–2019) and during the COVID-19 pandemic (2020–2021) in Asia and Africa, which were affected the hardest.

Methods: This Bayesian comparison analysis used FAO’s global sustainable development goals indicator dataset for the prevalence of severe food insecurity in Asia and Africa. Mean differences and the Bayes factor (BF) were reported to show the strength of difference, as opposed to a null hypothesis of no significant difference in prevalence between prior to and during the COVID-19 pandemic. We did not develop any specific expectations about the prevalence difference; hence, this was a non-informative prior-based analysis.

Results: During the COVID-19 pandemic, about 12.8% more Africans faced severe food insecurity than Asians (BF = 0.089), and this figure was 11.6% (Credible Interval: 9.8% to 13.3%) before the pandemic. Severe food insecurity increased by 4.2% in Africa during the pandemic (BF = 0.174) compared to in the years prior to the pandemic (22.9% vs. 18.7%), whereas Asia showed a 2.9% increase (BF = 0.080) during the pandemic (10.1% vs. 7.2%). In the regional analysis, Western Africa (6.9% increase) and Southern Asia (6.1% increase) were affected the most during the pandemic. However, in Eastern (0.2%) and Western Asia (0.7%), and Northern Africa (0.7%), the differences in prevalence were found marginal. About 7.1% more females in Southern Asia and 5.2% more females in Sothern Africa were severely food-insecure during the pandemic compared to males.

Conclusions: Considerably more Africans than Asians had run out of food during the pandemic, which affected more Western Africans and Southern Asians. Inequalities in achieving Zero Hunger increased, even with the growing inequalities.

4.2. Basic Nutrition and Research
4.2.1. Altered Intestinal Phenotype and Microbiota in Osteogenesis Imperfecta Mouse Models
Yuan Zhang 1,2, Josephine T. Tauer 2, Michèle Iskandar 1, Svetlana V. Komarova 1,2 and Stan Kubow 1
1 McGill University, Montréal, QC, Canada
Osteogenesis imperfecta (OI) is an inheritable bone fragility disorder characterized by age-dependent hypermetabolism. OI is mainly caused by genetic mutations in collagen-I, a dominant intestinal component sustaining intestinal structure and function. With rising attention on the gut–bone axis, it remains unclear whether OI-related collagen-I defects affect the intestinal structure and microbiota.

This project randomly assigned OI mice (Col1a1Jrt/+, Oim−/−) and their wild-type counterparts to three age groups (4, 8, and 12 weeks). Body weight and intestinal length were determined during dissection. The intestinal structure was evaluated via histomorphometry. Cecal microbial fatty acid profiling was conducted using gas chromatography. Real-time polymerase chain reaction analyzed total RNA expression in duodenal samples.

Results showed that male and female OI mice had less weight gain over 4 to 12 weeks of age. Further, Col1a1Jrt/+ and Oim−/− mice had longer relative intestinal lengths. Healthier villus-crypt units were also observed in Col1a1Jrt/+ mice at all ages. Genetically, collagen-I and III, critical for intestinal structure, were less expressed in male Col1a1Jrt/+ and Oim−/− mice, while tight-junction proteins’ expression significantly decreased in female Oim−/− mice. Noticeably, expression of CYP24A1 was significantly lower in all OI mice at 4 weeks old, suggesting better calcitriol-mediated calcium uptake in the duodenum. Lastly, cecal fatty acid profiling addressed decreased saccharolytic and proteolytic activities in 4-week-old female Col1a1Jrt/+ mice.

This study demonstrated that collagen-I mutation results in a unique intestinal phenotype in OI. Longer intestines with healthier villi and decreased CYP24A1 expression suggest potential compensating mechanisms in OI mice. Additionally, decreased microbial activities in female OI mice imply potential microbial composition alterations. In summary, this study provides valuable insights into intestinal phenotype contribution and potential microbial involvement in OI pathophysiology, which may ultimately lead to the development of novel strategies addressing the nutritional and metabolic needs of OI patients.

4.2.2. Supplementation with N3 Milk Shows a Bifidogenic Effect and Improves Health-Linked Microbial-Metabolites in Plasma: A Randomized, Double-Blind, Controlled Trial

Olga Sakwinska 1, Lea Siegwald 1, Anirban Lahiry 2, Francis Foata 2, Adrien Dardinier 1, Anna Cherta 1, Maria Giner Pilar 3, Stefan Christen 3 and Jean-Philippe Godin 3

1 Nestlé Institute of Health Sciences, Nestlé Research, Lausanne, Switzerland
2 Clinical Research Unit, Nestlé Research, Lausanne, Switzerland
3 Nestlé Institute of Analytical Sciences, Nestlé Research, Lausanne, Switzerland

Background and objectives: Supplementation with galacto-oligosaccharides (GOS) has previously been linked to several health benefits, predominantly via gut microbiome modulation. N3 milk is transformed from standard milk by one-step in situ trans-galactosylation, where 90% of lactose is converted to a GOS blend and small amounts of glucose and galactose. In a clinical study, we investigated the hypothesis that N3 milk modulates the gut microbiome and a range of health-linked biomarkers.

Methods: A randomized, double-blinded, controlled clinical trial in n = 26 healthy volunteers using crossover design (two-week intervention periods and two-week washout period) was conducted. Participants consumed 33 g of N3 milk powder once daily, dissolved in approximately 200 mL of liquid, during the intervention period and the same amount of lactose-free skimmed milk during the control period. Stool and overnight fasting blood samples were collected at the start and the end of both intervention periods. The gut microbiome was assessed using shotgun metagenomics. Plasma metabolites were analyzed with both targeted and untargeted metabolomics methods.

Results: Two weeks of supplementation with N3 milk led to a highly significant increase in the proportion of gut bifidobacteria, compared to lactose-free milk (p < 0.0001). Plasma acetate (p < 0.025), caprylic acid (p < 0.05), ketone bodies (p < 0.04), beta alanine
(p < 0.01), and vitamin B3 (p < 0.025) also increased. Untargeted plasma metabolomics revealed a shift in amino acid metabolism with N3 milk, manifesting as an increase in 3-indole propionate (p = 0.01), accompanied by a decrease in two uremic toxins, p-cresol sulphate (p = 0.02) and indoxyl-sulphate (p = 0.04).

Conclusions: N3 milk increased the relative amount of bifidobacteria present in the gut, along with microbiome-mediated plasma metabolites linked to immune and metabolic health benefits.

4.2.3. Energy Cost of Selected Physical Activities among Community-Dwelling Older Filipinos in Taguig City, Philippines

Hazel Lat, Chelcey Lauren Lim, Magnolia Velasquez, Robby Carlo Tan, David Kenneth Mendoza and Kyler Kenn Castilla
Department of Science and Technology-Food and Nutrition Research Institute, Taguig, Philippines

Background and objectives: Aside from a healthy diet, regular physical activity is essential for healthy aging. However, more older adults tend to be physically inactive. Current measures of energy costs of physical activity are based on the adult populations. Considering the different physiologic changes on older adults, this study aimed to measure and determine the energy cost of selected physical activities to gain a better understanding of their health as well as their capabilities to perform physical activities.

Methods: This was a cross-sectional study among 16 Filipinos, aged 60–79 years old, residing in Taguig City. The study used the Global Physical activity Questionnaire (GPAQ) to determine the level of physical activity among the participants. A Dual X-Ray Absorptiometry (DXA) machine was used to measure the body composition, while the indirect calorimeter (COSMED Fitmate) was utilized in measuring the resting metabolic rate (RMR) of the participants. The energy cost of the three exercise routines, including treadmill walking, self-paced walking, and an exercise routine based on the DOST-FNRI developed manual, were measured using a portable indirect calorimeter (COSMED K5). Results were presented as percentage and average.

Results: Results revealed that 29.4% of the participants were not meeting the recommended physical activity level based on their GPAQ scores. Meanwhile, 21.0% had low muscle mass based on body composition. The average RMR of the participants was 1228 ± 268.7. The average METs for walking on the treadmill at different speeds ranged from 2.3 to 2.5, from 2.1 to 3.9 METs for self-paced walking, and from 1.5 to 2.2 METs for the exercise routine based on the DOST-FNRI developed manual.

Conclusion: The measured METs of the different activities performed using an indirect calorimeter were presented in this study. The results may serve as a basis for the development of a more appropriate guideline and interventions for physical activity of older Filipinos.

4.3. Clinical Nutrition

4.3.1. Nutritional Status and Body Composition in Perioperative Patients with Head and Neck Cancer

Zhen Ding
Ningbo Medical Center Li Huili Hospital, Ningbo, China

Background: We aimed to describe the nutrition status and body composition profile in pre- and post-operative head and neck cancer (HNC) patients managed by the evidence-based whole-course nutritional support.

Methods: This work is a prospective cohort study of patients who were newly diagnosed with HNC and underwent operation. The nutrition assessment, which included Scored Nutritional Risk Screening (NRS 2002) and Patient-Generated Subjective Global Assessment (PG-SGA), and body composition assessment were conducted initially before surgery and recorded again after surgery.
Results: A total of 96 surgery patients with HNC were included. According to the preoperative SMM, all patients, of which 10 patients were missed, were divided into high SMI (N = 43) and low SMI groups (N = 42). (1) The postoperative NRS 2002 were higher than those on admission (p < 0.01), and the PG-SGA scores were higher 2 weeks after surgery than at 0 days (p < 0.01). No matter pre- or post-operatively, there were significantly higher scores in the low SMI group, both preoperatively (NRS 2002: p = 0.01) and at 0 days (NRS 2002: p = 0.008, PG-SGA: p = 0.006), and two weeks postoperatively (PG-SGA: p = 0.036). (2) There were significantly greater weight and BMI declines in the high SMI group (ΔBMI: p = 0.034, Δweight: p = 0.046). (3) Three postoperative serum nutritional indicators, including albumin, prealbumin, and PNI, were lower than those preoperatively, but the values after two weeks were raised compared to those one week after surgery (all p < 0.01). There was no statistical difference between the preoperative prealbumin and that at two weeks post-operation. (4) A negative correlation of SMM loss and prealbumin was observed (r = −0.255, p = 0.029). Preoperative BMI (p < 0.01), tumor differentiation (p = 0.003), and nutritional risk (p = 0.049) were the risk factors for weight loss.

Conclusions: For HNC perioperative patients, fat and skeletal muscle mass both declined, and the loss of adipose tissue occurred earlier than the muscle. Except for preoperative BMI, prealbumin should be taken into account as an indicator for nutritional status in clinical practice.

4.3.2. Frailty Assessment and Path Analysis of Influential Factors in Elderly Patients with Diabetes
Xiangping Li, Qian Lu and Guifang Guo
Peking University School of Nursing, Beijing, China

Objectives: To explore the incidence and effect factors of frailty and sarcopenia in elderly patients with diabetes.

Methods: A cross-sectional study design was used. Questionnaire survey, medical record review, anthropometrics, nutritional assessment, and other methods were used to investigate the general condition, diabetes treatment, disease severity, nutritional status, psychological status, sarcopenia, and frailty of 233 elderly patients aged 60 years and older. The main indicators and tools included the Appendicular Skeletal Mass Index (ASMI), Age-Adjusted Charlson Comorbidity Index (ACCI), 9-Item Patient Health Questionnaire (PHQ-9), Mini Nutrition Assessment (MNA), 24 h Dietary Review, Food Frequency Questionnaire (FFQ), International Physical Activity Short Questionnaire, and Revised Mainland China Frailty Phenotypic Assessment Tool.

Results:
1. The pre-frailty accounted for 41.20%, and the prevalence of frailty was 4.72%. The revised version and the original version of the Fried frailty phenotype had a good reliability on physiological frailty (kappa = 0.896, p < 0.001), and two criteria were used to determine the pre-frailty and frailty. There was no significant difference in the positive rate (p = 0.705), and it was also consistent with the revised version of Taiwan (kappa = 0.775, p < 0.001). The positive rate of pre-frailty and frailty determined by the Taiwan revision Fried frailty phenotype (36.91%) was lower than the revision of this study (45.92%), and the difference was statistically significant (p < 0.001).
2. The modified path analysis model of frailty and sarcopenia influence factors was well fitted. The standardized path coefficient suggested that depression (PHQ-9) had a moderate effect on the frailty, and the other variables had small effects on the frailty and muscle mass. Dietary pattern 4, characterized by high staple intake, had a positive direct effect on skeletal muscle mass (ASMI; β = 0.281), and good nutritional status (MNA) had a positive direct effect on ASMI (β = 0.192). There was a negative direct effect on debilitation (β = 0.166), and depression (PHQ-9) had a negative direct effect on MNA (β = 0.431) and a positive direct effect on debilitation (β = 0.257).

Conclusions:
1. The elderly patients with diabetes are complicated and have serious comorbidities. The incidence of chronic complications caused by diabetes was high, and the proportions of mild depression and depression were high. This is a high-risk group of frailty- and age-related sarcopenia.

2. The incidence of malnutrition risk is higher in elderly patients. The proportion of people with insufficient energy intake was high, and the energy, protein, carbohydrate, and total fat intakes were lower than the average level of the big city population.

3. The incidence of pre-frailty was higher. Among the five items evaluated by Fried’s frailty phenotype, the incidence of low grip strength and physical activity was the highest, and the incidence of low gait speed was the lowest. The revision of the grip strength threshold was highly sensitive to the assessment of frailty, especially the assessment of pre-frailty. The low gait speed was associated with severe sarcopenia and thus failed to reflect the sensitivity of patients with early frailty.

4. Dietary patterns characterized by high staple food intake and depressive symptoms had a direct impact on patients’ comprehensive nutritional assessment (MNA) and skeletal muscle mass (ASMI), with indirect protective effects on frailty. This suggested that high carbohydrate-rich staple foods’ dietary patterns have a positive effect on maintaining muscle mass and physical function, and the amount of food intake and the total amount of energy provided is important for elderly diabetic patients. Depression can have a direct impact on a patient’s frailty, and ACCI can lead to frailty by affecting dietary patterns and depression.

**Keywords:** Fried frailty phenotype; elderly diabetes mellitus; frailty; effect factors

4.4. Food and Nutrition

4.4.1. Phytochemical Screening and Antioxidant Potential of Methanol Extracts from Thai Edible Wild Mushrooms (*Amanita hemibapha* and *Termitomyces clypeatus*) in Different Cooking Methods

Kansuda Wunjuntuk 1, Kunchit Judprasong 2, Satinee Sukcheunluethai 1, Yosita Kunakornkarn 1, Sarindawadee Sudtha 1, Jerana Wattanaeabpun 1, Euaphorn Jaraspermsuk 3 and Akkarapol Chaisri 1

1 Department of Home Economics, Faculty of Agriculture, Kasetsart University, Bangkok 10900, Thailand
2 Institute of Nutrition, Mahidol University, Nakhon Pathom 73170, Thailand
3 Department of Food Management Program, Faculty of Science and Technology, Nakhon Pathom Rajabhat University, Nakhon Pathom 73000, Thailand

**Background and aims:** Wild mushroom consumption has grown extraordinarily owing to their high nutritional value, desirable taste, and aroma. In the present study, a series of experiments was performed to screen phytochemical constituents and the antioxidant capacity of two wild edible mushrooms (*Amanita hemibapha* and *Termitomyces clypeatus*) from the forest area around Srinakarin Dam in Kanchanaburi Province, Thailand.

**Methods:** Samples were prepared as raw, boiled, and stir-fried mushrooms. The methanolic extracts of freeze-dried samples were analyzed for antioxidant activity by 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging and phytochemical screening tests.

**Results:** The phytochemical screening test showed that an extract of raw *Termitomyces clypeatus* had positive results for flavonoids, saponins, coumarins, and cardiac glycosides, while boiling and stir-frying yielded positive results only for saponins. The *Amanita hemibapha* extracts showed no different screening results of phytochemical components in raw, boiled, and stir-fried samples, except there was no positive result for flavonoids in all cooking methods. The extracts of raw *Termitomyces clypeatus* and *Amanita hemibapha* had the antioxidant capacity of 19.21 ± 0.69 and 11.77 ± 0.45 μg Trolox/100 g dry weight, respectively. The boiling and stir-frying significantly reduced (*p < 0.05*) antioxidant activity by 60% and 55% for *Termitomyces clypeatus* and by 75% and 56% for *Amanita hemibapha*. 
Conclusions: These results make it possible to infer the future development of healthy recipes and food products from these two wild edible mushrooms, as well as providing scientific knowledge-based evidence and antioxidant capacities for further experiments.

4.4.2. A Network Pharmacology Approach to Identify the Molecular Targets and Mechanisms of Mori Fructus against Alzheimer’s Disease

Yue Li 1,2, Tuerxunayi Dwuti 2 and Hui Xiao 2

1 The First Affiliated Hospital of Xinjiang Medical University, Urumqi, China
2 Xinjiang Medical University, Urumqi, China

Background: There remains a lack of effective therapy for Alzheimer’s disease. Mori Fructus (MF) has diverse pharmacological activities in the fight against aging. This study aimed to identify potential anti-Alzheimer’s disease targets and mechanisms of action of MF using a network pharmacology approach.

Methods: Active compounds of MF and their putative target proteins were selected from the TCMSP Database. AD-associated targets were identified from the GeneCards, OMIM, and DisGeNET databases. Overlap between the MF and AD targets was generated using Venny 2.1. These intersection targets were used to construct the PPI network and perform GO and KEGG analyses. In addition, we obtained MF targets against tau and Aβ pathology related to AD via the AlzData database. Targets were applied to perform an analysis of GEO and receiver operating characteristics. Lastly, the reliability of the central targets was assessed using molecular docking.

Results: We identified 87 potential targets of MF active anti-AD ingredients. The neuroprotective effect of MF was related to a variety of pathways, including cancer (hsa05200), the AGE-RAGE signaling pathway in diabetic complications (hsa04933), lipid and atherosclerosis (hsa05417), etc. More importantly, 34 of the 87 targets were significantly correlated with tau pathology, Aβ pathology, or both Aβ and tau pathologies. In addition, GO analysis suggested that the primary biological processes of MF in AD treatment were in response to the inorganic (GO:0010035), positive regulation of cell migration (GO:0030335), positive regulation of cell motility (GO:2000147), etc. Bioinformatic analyses showed that the expression of ADRB2, MMP3, PRKACA, CHEK2, HMOX1, PLAU, and MMP2 significantly differed from the control group in patients with AD. Finally, molecular docking studies have suggested that these genes have excellent binding strength with MF.

Conclusions: In conclusion, these observations indicated that MF was exerting the effect of AD treatment by regulating multitargets and multichannels via the network pharmacology method.

4.4.3. Regulatory Effects of Fucoidan on Functional Dyspepsia Mice Induced by Loperamide

Tianxu Liu and Ling Wang

College of Food Science and Technology, Huazhong Agricultural University, Wuhan, China

Background and Objectives: Gastrointestinal dysmotility is a common cause of functional dyspepsia. Fucoidan possesses many physiological properties; however, its relative abilities in regulating gastrointestinal motility have not been illustrated yet. In this study, we aimed to investigate the regulatory effects of fucoidan on functional dyspepsia mice induced by loperamide.

Methods and Study Design: Here, 18–20 g BALB/c mice were used to establish the model of gastric dysmotility. We chose loperamide subcutaneous injection for seven days to induce representative symptoms of gastrointestinal hypomotility. During this period, the treatment groups were intervened with oral administration of fucoidan. Meanwhile, we employed mosapride as a positive control in our study.

Results: As a result, fucoidan could reverse this dysfunction mainly through regulating gastrointestinal hormones (motilin and ghrelin), the cholinergic pathway, total bile acid levels, c-kit protein expression, and gastric contraction-related gene expression (ANO1 and RYR3). Besides, the administration of fucoidan partially recovered the gut microbial
imbalance induced by loperamide, and it not only increased the diversity of the gut microbial profile, but also modulated the abundance of gut microorganisms, including the raised richness of Lachnospiraceae, Odoribacter, Oscillibacter, etc., and decreased the proportion of Streptococcus, etc.

Conclusion: We provided evidence to support that fucoidan might have potential abilities to regulate gastrointestinal motility and maintain the stability of gastrointestinal microecology. It is of great significance for further exploration and utilization of marine plant-derived bioactive substances.

4.4.4. Phytosterol Exhibits Antitumor Effects in Lung Cancer through Upregulation of ROS-Mediated Mitochondria Dysfunction and Akt/mTOR Signaling Inhibition

Qian Zhu 1, Jingjing Wu 2, Mengyuan Gao 1, Jianling Li 1, Han Luo 1, Hongya Liu 1, Jian Ma 1, Yongjia Li 1, ZhongWen Gong 1, Qianyao Chen 1 and Xuemei Lian 1

1 Chongqing Medical University, Chongqing, China
2 Qiannan Center for Disease Control and Prevention, China

Objective: To determine the efficacy of phytosterol on the development of chemical-induced lung tumors and the underlying mechanism.

Method: Six-week-old C57BL/6j mice were fed with either a 2% phytosterol diet or a matching control diet, respectively. Following three weeks of diet adaptation, a lung tumor was induced using multi-dose intraperitoneal injections of ethyl carbamate (urethane, 1 g/kg body weight), while control mice received saline injections. Tumors (number and diameter) and lung tissue transcriptomics were examined after a 15-week incubation period. In vitro, β-sitosterol was used to treat lung adenocarcinoma cells (A549, NCI-H1975) to explore the effect of β-sitosterol on the viability of lung adenocarcinoma cells.

Results: The 2% phytosterol diet inhibited the progression of lung tumors and increased malondialdehyde (MDA) levels in lung tissue. The oxidative phosphorylation pathway at the transcriptome level was downregulated and the expression of autophagy-related genes was raised in lung tissue. β-sitosterol inhibited cell proliferation of lung adenocarcinoma cells and significantly increased the levels of intracellular reactive oxygen species (ROS) and MDA. Furthermore, phytosterol induced phosphorylation inhibition of the Akt/mTOR signaling pathway in vivo and in vitro.

Conclusion: Phytosterols have potential antitumor effects on lung cancer, and the interactions between excess ROS, Akt/mTOR signaling inhibition, and protective autophagy may be involved.

4.4.5. Evaluation of Different Recipes and Determination of the Presence of Lactic Acid Bacteria in Sri Lankan Traditional ‘Diyabath’

Shanika Gamage 1, Tharanga Thoradeniya 1, Sharmila Jayasena 1, Carukshi Arambepola 2, Himalee DeSilva 3, Darshi Thoradeniya 4 and Pujitha Wickramasinghe 5

1 Department of Biochemistry & Molecular Biology, University of Colombo, Sri Lanka
2 Department of Community Medicine, University of Colombo, Sri Lanka
3 Faculty of Indigenous Medicine, University of Colombo, Sri Lanka
4 Department of History, University of Colombo, Sri Lanka
5 Department of Paediatrics, University of Colombo, Sri Lanka

Background and objectives: The indigenous fermented foods are gaining increasing attention as low-cost foods to improve health and sustain the food supply. ‘Diyabath’ is a breakfast meal prepared by overnight fermentation of leftover cooked rice. Though its main purpose has been to reduce food wastage in households, Sri Lankan indigenous medical practitioners (IMP) recommend ‘diyabath’ to improve health. Fermented foods with lactic acid bacteria (LAB) enhance digestive health in humans. Apart from the eight different traditional recipes of ‘diyabath’ identified in our previous survey, records on its scientific value and composition are limited. This study aimed at prioritizing the recipes identified
and assessing the LAB content to determine its potential use in an intervention-based investigation to promote health.

Methods: The eight recipes were presented to an expert panel of nutritionists, food scientists, community physicians, and IMPs for evaluation, according to the Delphi method, on the rice variety, pot material, fermentation duration, and additional ingredients used in post-fermentation. Via in-depth discussions conducted in two rounds of ranking, the panel agreed on the most acceptable recipes for a health-promoting intervention. The selected recipes were then analyzed for the presence of LAB on De Man–Rogosa–Sharpe agar—pH 5.7 (24–48 h at 30 °C).

Results: The expert panel agreed on using red-raw rice (RR), traditional Mawee rice (TMWR), and parboiled rice (PR) for preparing ‘diyabath’ and using a clay pot for fermentation for 12 h. After the fermentation, it was recommended to add coconut milk, red onion, salt, and roasted red chili to the preparation. Diyabath prepared from the three selected rice varieties showed LAB in the range of 10^6 CFU/g, which is comparable with that of other probiotic-rich fermented cereal-based foods.

Conclusion: ‘Diyabath’ prepared from cooked RR, TMWR, and PR is recommended for further investigations. Further, LAB counts suggest ‘diyabath’ as a potential food to enhance digestive health in humans.

4.5. Nutrition across Lifespan

4.5.1. Development of a Quick Screening Tool to Predict Low Muscle Mass for Sarcopenia Diagnosis in Chinese Older Adults

Wei Chen 2, Shengqi Li 1, Yueming Wang 1, Fei Li 1, Xiaohui Feng 3, Xiaodong Shi 2, Wenguang Sun 4, Aiqin Ma 3, Tingting Lv 3, Hai Li 3, Hailong Li 2, Biron Dong 5, Pranali Suryawanshi 6, Swapnil Paunikar 6, Menaka Yalawar 6, Geraldine Baggs 7 and Sheng Ge 3

1 Abbott Laboratories Trading (Shanghai) Co., Ltd., Shanghai, China
2 Peking Union Medical College Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China
3 Clinical Nutrition Department, Sixth People’s Hospital Affiliated Shanghai Jiao Tong University, Shanghai, China
4 The International Peace Maternity and Child Health Hospital, School of Medicine, Shanghai Jiao Tong University, Shanghai, China
5 The Center of Gerontology and Geriatrics, West China Hospital, Sichuan University, Chengdu, China
6 Cognizant Technology Solutions, India
7 Department of Statistical Sciences, Abbott Nutrition Research and Development, Columbus, OH, USA

Background: The feasibility of performing muscle mass measurement remains limited due to the high cost and technique limitations. Our study aims to develop a quick screening tool to predict muscle mass and sarcopenia status in Chinese older adults.

Methods: Two thousand eight hundred and twenty-three community-dwelling older adults (≥60 years old) were recruited from Beijing, Shanghai, and Chengdu in China. Appendicular muscle mass (ASMI) was assessed through bioelectrical impedance analysis (BIA) and dual-energy X-ray absorptiometry (DXA). Body mass index (BMI), upper arm circumference (UAC), calf circumference (CC), and handgrip strength were measured. Linear regression models were applied to predict the ASMI through the anthropometric parameters (BMI, UAC, and CC) and handgrip strength. The optimal cut-off in the Chinese population was used (7.05 kg/m^2 for men and 5.85 kg/m^2 for women) to define low ASMI.

Results: ASMI was positively correlated with handgrip strength, UAC, and CC in both men (r = 0.39, p < 0.001; r = 0.54, p < 0.001; r = 0.67, p < 0.001, respectively) and women (r = 0.38, p < 0.001; r = 0.57, p < 0.001; r = 0.67, p < 0.001, respectively). A final model has been identified for ASMI prediction through the combination of handgrip strength and CC in men (R^2 = 0.66, p < 0.0001) and women (R^2 = 0.66, p < 0.0001), after adjusting for age,
BMI, and living location in Chinese older adults. The area under the receiver operating characteristic curve (AUC) was 0.89 (95% confidence interval (CI): 0.88–0.91) for men and 0.90 (95% CI: 0.89–0.92) for women.

Conclusion: The model using the combination of handgrip strength and CC can be used as an alternative tool to identify low muscle mass for sarcopenia screening in community settings with high accuracy.

4.5.2. Is Quality of Life Related to Muscle Mass, Muscle Strength, and Physical Performance of Community-Dwelling Older Filipinos?

Robby Carlo Tan 1,2, Kyler Kenn Castilla 1, Michael Serafico 1, Marco Mensink 2 and Lisette de Groot 2

1 Department of Science and Technology- Food and Nutrition Research Institute, Taguig, Philippines

2 Wageningen University and Research, Wageningen, The Netherlands

Background and Objectives: In the Philippines, the older population group is projected to steadily increase in the next 10 years. The aging process is inevitable and is accompanied by physiologic changes, such as a loss of muscle mass and strength (sarcopenia), which may affect the functional status and, ultimately, the overall quality of life. This study was conducted to determine the association of muscle mass, strength, and physical performance with the quality of life of community-dwelling older Filipinos aged 60 years and older.

Methods: From November 2021 to June 2022, a total of 536 older adults coming from the cities of Tarlac, Tacloban, and Davao participated in this cross-sectional study. Muscle mass was measured using a body impedance analyzer. Handgrip strength was assessed using a hand dynamometer, while physical performance was evaluated through a short physical performance test battery and the chair stand test. Quality of life was determined using a culturally validated questionnaire. Prevalence of sarcopenia was determined using the 2019 Asian Working Group for Sarcopenia criteria, which is the presence of a loss of muscle mass, plus low muscle strength, and/or low physical performance. Binary logistic regression was used to determine the association between quality of life and sarcopenia (criteria).

Results: Nearly 25% of the respondents (n = 130) were sarcopenic. After adjusting for age, the increased odds to attain a higher overall quality of life score was associated with normal muscle mass (OR = 1.68; 95% CI: 1.12–2.51), normal muscle strength (OR = 1.50; 95% CI: 1.03–2.17), and absence of sarcopenia (OR = 1.81; 95% CI: 1.19–2.78).

Conclusion: An increased overall quality of life score among older Filipinos was associated with normal muscle mass, normal muscle strength, and absence of sarcopenia, but not with physical performance. The findings provide valuable and relevant input in crafting nutrition and lifestyle interventions for older Filipinos before the country transitions into an aging society.

4.6. Public Nutrition and Health

4.6.1. Study on Lactose Intolerance in Mongolia

Berkheedei Tuguldur

Mongolian University of Science and Technology, Ulaanbaatar, Mongolia

Background: The population of Mongolia has a high genetic predisposition for lactose intolerance. However, due to the relatively high consumption of milk and dairy products, especially fermented dairy products, the symptoms are not that severe. In recent years, the decrease in the consumption of dairy products by Mongolian citizens has been more evident in the urban population, especially in school-aged children.

Methods: In this study, a total of 421 school children under the age of 18 and 253 people over the age of 18 voluntarily participated. The participants filled out a questionnaire to evaluate their symptoms, their background, and their eating habits in terms of milk and dairy products.
Results: About 55% of the children who participated in the study did not show symptoms of lactose intolerance, while the remaining 45% already had them. On the other hand, about 95% of adults surveyed had already developed symptoms of lactose intolerance. When looking at the relationship between milk and dairy products and age, elementary school children’s daily consumption was the highest, while senior students said that they consumed it several times a week. This kind of repetition was also the case for adults, who showed that with age, the regular consumption became less stable, and the cause of symptoms reduced their use.

Conclusion: It was determined that all participants in the study lacked knowledge about lactose, and the frequency of consumption of milk and dairy products was low, and thus the effects of unpleasant symptoms on the body were directly related to this. The affected persons tended to reduce their dairy and thus calcium intake. It is concluded that in the future, these factors should be taken into careful consideration when conducting a similar study on lactose intolerance representing the population of Mongolia.

4.6.2. Review of Nutrient Profiling Systems Supporting Food Policies in Asian and Pacific Low- and Middle-Income Countries
Marie Tassy 1,2, Tsz Ning Mak 3, Alison L Eldridge 2 and Edith JM Feskens 1

1 Division of Human Nutrition and Health, Wageningen University & Research, Wageningen, The Netherlands
2 Nestlé Institute of Health Science, Nestlé Research, Société des Produits Nestlé S.A., Vers-chez-les-Blanc, 1000 Lausanne, Switzerland
3 Nestle Institute of Health Sciences Singapore Hub, R&D Singapore, 29 Quality Road, Singapore

Background and objectives: Micronutrient deficiencies, under-nutrition, and overweight/obesity are prevalent in low- and middle-income countries. Nutrient profiling systems, initially developed to help reduce diet-related chronic diseases’ prevalence in Western countries, could be one solution to promote nutrient-dense foods in Asia. Our aim is to review nutrient profiling systems supporting low- and middle-income countries’ food policies in South Asia, East Asia, and the Pacific, and their relevance considering local nutritional challenges.

Methods: Food policies implemented in low- and middle-income countries were identified from the World Cancer Research Fund’s NOURISHING database, the WHO’s GINA database, and the Global Food Research Program’s food policy maps. Prevalence of under-nutrition, overweight/obesity, and three micronutrient deficiencies, plus summary exposure to twelve dietary risk factors, were extracted from UNICEF, WHO, and World Bank datasets, NCD Risk Factor Collaboration results, and the Global Burden of Disease study.

Results: Among 48 Asian and Pacific low- and middle-income countries, 15 countries used nutrient profiling systems to support nutrition policies, either for sugar and sweetened beverages taxation purposes or front-of-pack labeling. Three schemes were implemented in South and East Asia: the Healthier Choice logo in Thailand, China, Indonesia, and Malaysia, which included thresholds for sugars, sodium, fats, dietary fibers, and at least one micronutrient, except in China, the Traffic Light labels in Sri Lanka, focusing on sugars, fats, and salt, and the Sangkap Pinoy Seal in the Philippines, highlighting products fortified with iron, vitamin A, and iodine. Of the 15 countries using nutrient profiling systems, 5 are facing a double burden of malnutrition. Dietary iron deficiencies are prevalent in most countries and vitamin A deficiencies are widespread across the Pacific islands.

Conclusions: Nutrient profiling systems encompassed both macro- and micronutrients in Indonesia, Malaysia, and Thailand, which helps promote nutrient-dense foods and tackle regional nutritional challenges.
4.6.3. Dairy Consumption at Breakfast in Children from the Southeast Asian Nutrition Surveys II (SEANUTS II): Associations with Nutrient Intake

Nadja Mikulic 1, Brenda Lee 1, Ilse Khouw 2, Bee Koon Poh 2, Rini Sekartini 3, Nipa Rojroongwasinkul 4, Nga Thuy Tran 5 and Cécile Singh-Povel 1

1 FrieslandCampina, Amersfoort, The Netherlands
2 Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia
3 Universitas Indonesia, Jakarta, Indonesia
4 Mahidol University, Nakhon Pathom, Thailand
5 National Institute of Nutrition, Hanoi, Vietnam

Background and Objectives: Children require adequate nutrient intake for their rapid biological and physical growth, and breakfast containing dairy is an important meal to provide sufficient nutrients. This study investigated the prevalence of dairy consumption at breakfast among Southeast Asian children and explored its association with nutrient intake at breakfast and throughout the day.

Methods: Using the Malaysian dataset of the Southeast Asian Nutrition Surveys II (SEANUTS II), 2438 Malay children aged 2 to 12 years were included. Questionnaires and a one-day 24 h recall were used to collect data on sociodemographic and nutrient intakes. Descriptive analysis and Wilcox’s robust tests with robust post hoc tests were used for data analysis.

Results: Only 38% of children consumed dairy at breakfast, with younger children more likely to consume dairy than older children (p < 0.001). Additionally, ~80% of children who had breakfast did not meet the recommended daily dairy intake of two servings per day, with an average intake of 0.5 servings per day. Children in all age groups consuming dairy at breakfast had a significantly higher intake of calcium and vitamin D at breakfast compared to those who did not (p < 0.001). Moreover, breakfasts with dairy were associated with a better overall quality of the daily diet, as reflected in the higher daily intakes of several important nutrients, including vitamins A, B1, B2, B12, and C, β-carotene, iron, calcium, potassium, and phosphorus (p < 0.001).

Conclusions: The findings of this study highlight the importance of promoting dairy consumption at breakfast among children in Southeast Asia to improve nutrient intake at breakfast and in the overall diet, indicating that breakfast is an important meal contribution to the overall quality of the diet. More information about children in Thailand, Indonesia, and Vietnam will be included in future analyses.

4.6.4. Contributing Factors to Nutritional Status among Thai Children Aged 7–12.9 Years—SEANUTS II Thailand

Pornpan Sukboon 1, Tippawan Pongcharoen 1, Pattanee Winichagoon 1, Nawarat Vongvimetee 1, Ilse Khouw 2 and Nipa Rojroongwasinkul 1

1 Institute of Nutrition, Mahidol University, Nakhon Pathom, Thailand
2 FrieslandCampina, Amersfoort, The Netherlands

Background and objectives: Double-burden malnutrition with increasing child overweight is a significant public health problem in low- and middle-income countries. This study identified factors associated with both extremes of malnutrition.

Methods: Data were analyzed from 1084 Thai children aged 7–12.9 years (557 boys and 527 girls) who participated in the Southeast Asian Nutrition Survey II (SEANUTS II), Thailand. Nutritional status employed the WHO BMI-for-age references and was classified into thinness, overweight, obesity, and normal weight. Multivariate-adjusted multinomial logistic regression was performed to determine factors associated with both malnutrition extremes compared to normal-weight children.

Results: Children of low birth weight were more likely to be thin (adjusted OR, AOR: 3.47, 95% CI: 1.48, 8.14), while those born to obese mothers were less likely to be thin (AOR: 0.45, 95% CI: 0.21, 0.93). Children with low energy intake or from households with low monthly incomes were less likely to be overweight (AOR: 0.48, 95% CI: 0.27, 0.86; AOR:
Maternal and paternal obesity were positively associated with being overweight (AOR: 2.12, 95% CI: 1.34, 3.36 and AOR: 2.03, 95% CI: 1.27, 3.24). Girls were less likely to be obese than boys (AOR: 0.58, 95% CI: 0.37, 0.90). Children with low energy intakes were also less likely to be obese (AOR: 0.49, 95% CI: 0.29, 0.82). Lower physical activity, longer screen time, and maternal and paternal obesity were all positively associated with obesity (AOR: 2.03, 95% CI: 1.08, 3.82; AOR: 1.89, 95% CI: 1.17, 3.04; AOR: 2.99, 95% CI: 1.95, 4.58; AOR: 1.95, 95% CI: 1.27, 3.01, respectively).

Conclusions: Child nutritional status at birth and parental nutritional status contributed to under- and over-nutrition in older children. Balances between energy intake and expenditure as well as household income are important ecological factors contributing to overweight and obesity.

4.6.5. Hygienic Assessment of School-Age Children’s Nutrition

Akmaral Baspakova
West Kazakhstan Marat Ospanov Medical University, Aktobe, Kazakhstan

Background and objectives: Nutrition is a constant factor that is important for the growth, development, and health promotion of children and adolescents. Proper nutrition is one of the factors constantly acting throughout ontogenesis, impacting the successful education of the child, their resistance to adverse environmental factors, and health conditions. The purpose of this work is a hygienic assessment of school-aged children’s nutrition in Aktobe.

Methods: Investigation design: cross-sectional study. The study involved 457 children (girls and boys) aged 10 to 14 years. Nutrition was studied using an assessment questionnaire (FFQ_KZ). The results obtained were included in the FETA program and applied to statistical processing via the SPSS 25.0 program. The study population was calculated with 95% confidence intervals (CI) and Q1, Q3, mean, and median (Me).

Results: According to the energy value, the diet of adolescents was below the norm for boys and girls. In boys and girls, the energy content of food was low, i.e., on average, in boys, 1762.7 (±395.7) kcal, and correspondingly, in girls, on average, 1712.3 (±407.2) kcal, while a normal content is 2400 kcal, p < 0.011.

The protein content in the daily diet was 70.3, and the normal indicator is 60–80 g. Fat content was 90.07, and under normal conditions is 90–100 g. Carbohydrate content was 318.6, and under normal conditions is 350–500 g. The calcium index was 908.1, the norm of which is 1200 mg, that is, it was 291.9 mg below the norm. Iron was 13.3, and is normally 15–20 mg. The sodium index was 137.2, and is normally 400 mg.

Conclusions: In the nutrition of children aged 10–14, the indicators of macro-elements and vitamins corresponded to the norm, and micronutrients revealed a deficiency: the Ca index was 908.1 [692.1; 1032.7], which was 291.9 mg lower in the study participants.

4.6.6. Association between Eating Habits and Mental Health Status of Healthcare Shift Workers

Norsham Juliana Nordin 1, Nor Amira Syahira Mohd Azmi 1, Azmani Sahar 1 and Nur Islami Mohd Fahmi Teng 2

1 Universiti Sains Islam Malaysia, Nilai, Malaysia
2 Universiti Teknologi Mara, Shah Alam, Malaysia

Background and Objectives: Working in shifts in a challenging environment of healthcare exposes healthcare shift workers to unhealthy lifestyles that may impact their mental health. This study sought to assess the association between healthcare shift workers’ eating habits and mental health status.

Methods and Study Design: The sampling frame includes healthcare shift workers around Klang Valley, Malaysia. Eating habits and mental health status of the participants were assessed using the Malay Version of the Dutch Eating Behavior Questionnaire (DEBQ) and the Depression, Anxiety, and Stress Scale-21 (DASS-21). Pearson’s χ² and simple and
multivariable binary logistic regression models were constructed following the Hosmer–Lemeshow approach to determine the potential association between the parameters.

Results: A total of 413 healthcare shift workers were recruited in this study. Overall, 40.7% of participants had one or more symptoms of depression, anxiety, or stress. The majority of the subjects obtained low scores for the emotional eating domain (86.9%), whereas 78.0% and 63.4% of the respondents obtained high scores for external eating and restrained eating, respectively. This study demonstrated that emotional and external eating habits among healthcare shift workers are associated with increased odds of having a poor mental health status (OR = 2.25; 95% CI: 1.1–4.4; OR = 2.32; 95% CI: 1.3–4.2, respectively). Further analyses found that those categorized as emotional and external eaters were associated with two times increased odds of having anxiety (OR = 2.09; 95% CI: 1.2–3.7; OR = 1.77; 95% CI: 1.1–3.0, respectively).

Conclusions: In conclusion, most of the shift workers in this study were categorized as having external and restrained eating habits. Despite only 13.9% of the shift workers being emotional eaters, their poor eating habits were associated with a poor mental health status, specifically anxiety.


Hung Nguyen Ngoc 1 and Wantanee Kriengsinyos 2

1 Doctor of Philosophy Program in Nutrition, Faculty of Medicine Ramathibodi Hospital and Institute of Nutrition, Mahidol University, Nakhon Pathom, Thailand
2 Food and Nutrition Academic and Research Cluster, Institute of Nutrition, Mahidol University, Salaya, Phutthamonthon, Nakhon Pathom 73170, Thailand

Background: Utilization of marketing strategies on ‘children’s’ food packaging has an impact on children’s decision-making, preferences, and dietary behaviors. Previous studies revealed that food products designed for children were characterized by high levels of fat, salt, sugar, and ultra-processing. This study aims to analyze newly released children’s products marketed in Thailand.

Methods: ‘Children’s’ products were products having any marketing element targeting children (i.e., having a specified age range, using characters or celebrities, and using fun or fantasy themes) on the front-of-package label. The nutrient composition of newly launched ‘children’s’ products marketed in Thailand from 2016 to 2021 was extracted. Data were retrieved from the Mintel Global New Products Database. Nutritional quality was evaluated by (1) healthfulness intensity, assessed by the proportion of eligible products bearing the Healthier Choice logo and Health Star Rating (HSR), (2) the processing degree, evaluated by the NOVA classification, and (3) adherence to the recommendation for children, based on the criteria of the WHO Nutrient Profile Model for the Southeast Asia Region (WHO SEA).

Results: A total of 290 products were included, most of which were sugary foods. Regarding healthfulness levels, one-seventh (14.5%; n = 42) were eligible to bear the Healthier Choice symbol, with most (77.2%; n = 224) scoring HSR < 3.5 stars, with the highest proportion grading in both HSR 1 and 1.5 stars (14.1%; n = 41). Besides, most (96.9%; n = 267) were ultra-processed (NOVA 4), with a high number of ingredients and additives used. All of the analyzed products incorporated marketing elements aimed at children on their packaging. However, a majority (92.1%) failed to meet the children’s marketing standards set by the WHO SEA.

Conclusions: This study’s results indicated that a considerable portion of children’s packaged foods in Thailand lack a satisfactory nutritional profile. There is a need for measures aimed at enhancing the nutritional quality and regulating marketing activities specifically targeting children on the packaging of such products.
4.6.8. Factors Associated with Nutritional Status among Adolescents in a Post-Disaster Area

Nikmah Utami Dewi ¹, Ali Khomsan ², Cesilia Meti Dwiriani ², Hadi Riyadi ², Ikeu Ekayanti ² and Diah Ayu Hartini ³

¹ University of Tadulako, Kota Palu, Indonesia
² IPB University, Bogor, Indonesia
³ Health Polytechnic of Palu, Kota Palu, Indonesia

The nutritional status of adolescents and their influencing factors in post-disaster areas is rarely carried out because it is not a priority group compared to other vulnerable groups, such as children and pregnant women. This study aimed to identify the nutritional status of adolescents and related factors so that they can be used as input for adolescent nutrition intervention strategies in post-disaster areas.

A cross-sectional study was conducted on 395 adolescents aged 15–17 years living in a post-disaster area in Palu City, Indonesia, from August to October 2021. Adolescents who attended the four schools most affected by major disasters in 2018 were randomly sampled. Nutritional status was measured anthropometrically with body mass index by age. Several other variables collected were household expenses, household size, family type, mother’s education and nutrition literacy, adolescents’ age and gender, nutritional literacy, school, body image, the influence of friends and parents, constructs that shape eating behavior, as well as physical activity and food security. Analysis was performed by logistic regression with a $p$-value of 0.05.

The percentage of severe thinness and thinness was 11.6%, while overweight and obese was 10.65%. Adolescent nutritional status was associated with gender, interactive nutrition literacy, body image, and water intake. Boys who had a lower interactive nutrition literacy score below average wanted to be fatter and had low water intake, and they tended to have a thinner nutritional status compared to the normal nutritional status. Conversely, adolescents with high interactive nutrition literacy scores wanted to be thinner and had a higher water intake and tended to be overweight and obese compared to the normal nutritional status.

Malnutrition is a public health problem, including among adolescents in post-disaster areas. An effective strategy is needed to overcome the problem of malnourishment in adolescents, especially in food-vulnerable areas, such as post-disaster areas.

5. Poster Abstracts
5.1. Nutrition and Sustainable Development
5.1.1. Food Systems for Long-Term Spaceflight: Understanding the Role of Non-Nutrient Polyphenols in Astronauts’ Health

Menglan Zhao
Shanghai Normal University Tianhua College, Shanghai, China

Background: Manned space exploration missions have developed at a rapid pace, with missions to Mars likely to be in excess of 1000 days being planned for the next 20 years. Meanwhile, until now, the formulation of space food systems has not focused on non-nutrients and has not considered issues arising from their absence during space missions or the possibility of them to solve the challenges caused by space hazards.

Aims: This study investigates, by systematic review, current space food systems and the potential for non-nutrients, such as flavonoids and polyphenols, to counteract radiation- and low-gravity-induced degeneration of bone, vision, muscle strength, immune function, and cognition.

Results and Discussion: A systematic approach found 39 related animal model studies that showed that polyphenol dietary interventions have been shown to mitigate radiation-related physiological problems and cognitive decline, as well as reduce the implications of radiotherapy. From the results of these studies, it appears that berry extracts have a significant effect on preventing cognitive problems through attenuating the expression of
NADPH-oxidoreductase-2 (NOX2) and cycloxygenase-2 (COX2) in both frontal cortex and hippocampus and immune system problems caused by radiation, similar to that experienced in space. For physiological problems, such as alteration of blood–testicular barrier permeability and oxidative stress in the kidney and liver caused by gamma rays and X-rays, various polyphenol compounds, including resveratrol and tea polyphenols, have a certain degree of protective effect, such as enhancing metabolism of the heart and decreasing DNA damage, respectively. Only one study showed no difference in the performances of a blueberry extract-fed group and a control group exposed to $^{56}$Fe irradiation after 12 months.

Conclusion: In conclusion, current animal studies have shown that polyphenols can mitigate radiation damage to some extent, but more research is needed to enable the application of a polyphenol diet to actual space flights.

5.1.2. An Attempt in Utilizing Discarded Tuna Skin by Preventing Its Oxidation
Akari Utsumi
Ochanomizu University, Tokyo, Japan

Background and Objectives: Although tuna skin is edible, 70% of it is discarded. The researcher intends to increase the demand for tuna skin by drying it and making it into processed foods. Since tuna skin is easily oxidized, this oxidation must be controlled during the processing stage. The research was conducted with the aim of finding an ingredient that exhibits high antioxidant activity against tuna skin and reducing the amount of waste by increasing the demand for tuna skin.

Methods: First, water was added to the powdered antioxidant samples of green tea, laver, parsley, almond, and coffee beans, which are high in vitamin E, vitamin C, and polyphenols, and the tuna skin was soaked in it for 30 min. The skins were then dried at 70 °C for 9 h using a dryer. Then, the peroxide value (POV) was measured using a Peroxide Value Tester Model 5 (Shibta Scientific Technology Ltd., Saitama, Japan). Second, equal masses of coffee beans and coffee grounds were sprinkled on the tuna skin and dried in the sun for a week. These were soaked in diethyl ether to extract the oil to prepare oil samples. Ethanol potassium hydroxide solutions of $8.3 \times 10^{-2}$ mol/L were also prepared. These were used to evaluate the degree of the acid value (AV).

Results: The samples soaked in coffee beans had the lowest POV of 9 meq/kg, which means coffee beans showed the highest antioxidant activity. The difference in the AV of coffee beans (1.77 meq/kg) and that of coffee grounds (1.68 meq/kg) was not significant, which means that coffee grounds had the same level of antioxidant effect as coffee.

Conclusion: Since tuna skin and coffee grounds are usually discarded without being utilized, I would like to develop a sustainable and tasty food using these discarded materials.

5.1.3. Mapping the Double Burden of Wasting and Overweight among Children under 5 Years of Age in BRICS
Yinuo Sun and Yangmu Huang
Peking University, Beijing, China

Objectives: To explore the presence and trends for the double burden of overweight and wasting prevalence among children under five years of age in Brazil, Russia, India, China, and South Africa—the countries known as BRICS—between 2000 and 2019.

Method: Prevalences of overweight and wasting under five years of age from 2000 to 2019 at the country level were derived from the Global Health Data Exchange database. The different levels and trends of childhood overweight and wasting within countries were analyzed and compared.

Results: Between 2000 and 2019, the five countries commonly witnessed decreases in the prevalence of wasting among children under five years of age, and the country with the largest prevalence of wasting reduction and the lowest prevalence was China, achieving a 10% reduction from 3.4% in 2000 to 3.0% in 2019. However, the prevalence of wasting in India (17.9%) and South Africa (5.1%) was predicted to remain above the World Health
Prevalence of overweight increased in all countries across BRICS. South Africa had the highest prevalence of overweight across BRICS (24.9% in 2019). India had the lowest prevalence of overweight in 2019 but experienced the largest increase from 2000 to 2019 by a relative change rate of 34.2% (from 5.2% in 2000 to 6.9% in 2019).

Conclusion: Despite the improvements in wasting prevalence reduction since 2000, the double challenge of under-nutrition and over-nutrition increased across BRICS, especially in India and South Africa. New public health approaches and concerted efforts toward the double burden of malnutrition are required in BRICS.

5.2. Basic Nutrition and Research

5.2.1. Screening of Antibacterial Lactic Acid Bacteria from Sichuan Pickles and Characterization of Their Antibacterial Substances

Caiyu Liao, Shouli Li, Zhuyu Duan, Lingshuang Yang, Jie Zhang, Qingchun Liu, Yu Gao, Daomei Cheng and Ke Tang
Chengdu Medical College, Chengdu, China

Objective: The study aimed to screen lactic acid bacteria (LAB) from Sichuan Pickles with antibacterial properties against foodborne pathogens and to examine their antibacterial substances.

Methods: Bacterial identification was performed through 16S rDNA gene sequencing. The bacteriostasis experiment was performed using the Oxford cup method, while a preliminary investigation of the antibacterial substance was carried out through acid excretion and protease sensitivity testing.

Results: A total of 42 LAB strains with robust growth abilities were identified. The 16S rDNA gene sequencing revealed the presence of 9 species belonging to 3 genera, including 23 strains of Lactobacillus plantarum, 10 strains of Lactobacillus casei and Lactobacillus paracasei, 2 strains each of Lactobacillus harbinensis, Pseudomesenteroides leuconostoc, and Pediococcus ethanolidurans, and 1 strain each of Lactobacillus acidipiscis, Lactobacillus buchneri, and Lactobacillus xiangfangensis. Results of the inhibition experiment indicated that the fermentation supernatant of 39 bacteria strains inhibited Vibrio parahaemolyticus, and 30 of them still maintained their antibacterial activity after the acid elimination experiment. Among all strains, the strongest inhibitory effect on Vibrio parahaemolyticus was observed in Lactobacillus plantarum LAB13, with an antibacterial circle diameter of 16.21 mm after acid elimination. Treatment with proteinase K, trypsin, and pepsin resulted in the disappearance of the antibacterial activity of Lactobacillus plantarum LAB13, leading to the preliminary conclusion that the main antibacterial substances in the fermentation supernatant were proteins. Lactobacillus plantarum LAB13 also displayed antibacterial activity against Listeria mononuclearum and Salmonella typhimurium.

Conclusion: A strain of Lactobacillus plantarum LAB13 with inhibitory properties against Vibrio parahaemolyticus was identified in Sichuan Pickles. The preliminary analysis of its antibacterial substance suggests it is protein-based. This research serves as a reference for future screening of LAB with antibacterial abilities.

5.2.2. Nutrition, Gut Microbiota, and Disease: Interaction and Influence

Shuang Zhang 1,2 and Hong Ye 1,2
1 Anhui Academy of Medical Sciences, Hefei, China
2 Anhui Medical College, Hefei, China

The relationship between different dietary methods, nutrients, gut microbiota, and diseases has become the focus of recent research.

The composition of the gut microbiota is influenced by dietary habits and food intake components. Research showed that various dietary choices, including Mediterranean diet, intermittent fasting, and low-fat vegan diet, can alter changes in the gut microbiota and contribute to reduce cardiovascular risk factors, weight loss, and improve mood. Nutrients
also have a certain impact on the gut microbiota. Natural foods, such as vegetables, nuts, Konjaku flour, cocoa powder, and some probiotic foods, effectively increase the diversity of gut microbiota, changing the composition and function. Poor dietary habits, such as high-fat diet and long-term use of protein supplements, may have a negative impact on the gut microbiota. Previous studies revealed that besides metabolic diseases, such as type 2 diabetes, chronic kidney disease, and obesity, as well as cardiovascular diseases such as hypertension and coronary heart disease, cancers such as breast cancer and colorectal cancer also have a certain relationship with the gut microbiota.

Research on brain disorders, such as Parkinson’s disease, Alzheimer’s disease, and depression has revealed that bidirectional communication between the brain and the intestine is influenced by gut microbiota and related metabolites, and interacts with the host through biochemical and functional inputs, thereby affecting the host’s homeostasis and health. Nutrients can influence physiological and psychological responses through the microbiome–gut–brain axis, subtly intervening in brain activity and the function of known regions that regulate emotions and stress responses.

The gut microbiota not only affects the host’s metabolism, but also has a certain relationship with the host’s physical and mental health, and related diseases. The pathogenesis of gut-microbiota-related diseases and how to improve gut microbiota to enhance quality of life are issues worth paying attention to in the future.

5.2.3. Ginsenoside Extract Alleviates Nonalcoholic Fatty Liver Disease by Promoting Mitochondrial Function and Activating the AMPK Pathway in Free Fatty Acid-Induced HepG2 Cells

Jinshan Wu, Huimin Liu and Jingsheng Liu
Jilin Agriculture University, Changchun, China

Nonalcoholic fatty liver disease (NAFLD) is the most common chronic liver disease and is closely associated with the development of various metabolic diseases, such as obesity. Hepatic steatosis, oxidative stress, and mitochondrial dysfunction are the main manifestations, and alleviating lipid disorders by inhibiting fatty acid synthesis (FASN) and reducing fatty acid oxidation are effective ways to hinder the process of NAFLD. Ginseng is a valuable medicinal herb rich in many bioactive components, such as ginsenosides. It has been reported that ginsenosides Rg1 and CK can reduce lipid accumulation. The moderate cost of ginsenoside extract (GE) makes it more suitable for application than monomers. However, the effect and mechanism of GE on NAFLD are less concerned. In this study, free fatty acid (FFA)-induced HepG2 cells were used as the model for NAFLD to investigate the effects and mechanisms of GE. The results suggest that GE exerts antioxidants in a FFA-induced HepG2 model. Moreover, GE treatment can significantly inhibit hepatic lipid accumulation, reduce reactive oxygen species (ROS) generation, and improve mitochondrial function. Furthermore, GE promotes AMPK phosphorylation, and downregulates the expression of sterol regulatory element-binding protein-1c (SREBP-1c), FASN, and dperoxisome proliferator-activated receptor gamma (PPARγ). The changes contribute to inhibiting fatty acid synthesis and promoting fatty acid catabolism. Our findings suggest that GE has potential for the treatment of NAFLD.

5.2.4. Ginsenoside Rg2 Alleviates Insulin Resistance by Regulating Gluconeogenesis and Glycogen Metabolism via Akt/FoxO1 Pathway in HepG2 Cells

Wei Wang, Yan Cui, and Huimin Liu
Jilin Agriculture University, Changchun, China

Background: Ginsenoside Rg2 is a key bioactive compound from Panax ginseng Meyer and shows anti-cancer, antidiabetic, anti-amnestic, and neuroprotective effects. However, the impact of Rg2 on hepatic glucose production via the Akt pathway is not addressed.

Purpose: To investigate the protective effect of Rg2 against insulin resistance via the Akt pathway.
Methods: HepG2 cells were stimulated with 1 µM of insulin for 36 h to establish a reliable insulin resistance cell model. Then, Metformin HCL, Rg2, and Akt inhibitor were added to treat the obtained cells. The glucose consumption and glycogen synthase were determined so as to evaluate hepatic glucose production. Moreover, the genes involved in gluconeogenesis, glycogenolysis, and glycogenesis were explored with RT-q-PCR and Western blot. Finally, the critical role of Rg2 in the Akt/FoxO1 pathway was further identified with an Akt inhibitor, triciribine.

Results: Our findings suggested that Rg2 decreased hepatic glucose production by activating Akt at Ser473 in HepG2 cells. Akt inactivated FoxO1 by promoting nuclear export and reducing the levels of phosphoenolpyruvate carboxykinase and glucose 6-phosphatase. Moreover, Rg2 enhanced GSK3β phosphorylation and weakened GS phosphorylation via the Akt/FoxO1 pathway, thus increasing glycogen synthase.

Conclusion: Rg2 alleviated insulin resistance by inhibiting gluconeogenesis and glycogenolysis and induced glycogenesis via the Akt/FoxO1 pathway in HepG2 cells. Our results highlighted that Rg2 might be utilized to develop healthy foods and prevent diabetes.

5.2.5. Effects of Eel Essence on Fat Oxidation and Anti-Fatigue Property in Diet-Induced Obesity Mice Model
Shanching Hsu 2 and Meichen Liao 1,2
1 Ever-Wellness International Co., Ltd., Taipei Taiwan
2 Department of Food Science, Nutrition, and Nutraceutical Biotechnology, Shih Chien University, Taipei Taiwan

Eel meat contains high-quality protein and various essential amino acids, fatty acids (EPA/DHA), special nutrients, and other chemical components. Those with a higher amino acid content are glutamine, branched-chain amino acids, alanine, lysine, and arginine. The purpose of this experiment is to evaluate the nutraceutical functions of eel essence. In this experiment, four groups of C57BL/6J mice were respectively fed diets containing either normal fat (16 kcal%, AC) or high fat (54 kcal%, HC). The AC and HC groups were fed the eel essence via oral gavage (767 mg/kg body weight, AEE and HEE) for 8 weeks, based on a 2 × 2 factorial design, to test the significance of the effect of fat quantity, the effect of eel, essence and their interaction.

Compared to the AC group, the HC group and the HEE group had significantly higher body weights, a higher fat composition percentage, higher feed efficiency, and higher energy efficiency. The HC group was a diet-induced obesity animal model. Improvement of some metabolic syndrome risk factors could be observed in the groups fed eel essence, including a higher serum HDL concentration and lower serum LDL concentration. However, abdominal fat accumulation was not improved in the HEE group. A higher strength of the whole-limbs grip measurement and longer time to exhaustion when swimming were observed in the eel essence groups.

The gene expression of hepatic acyl-CoA thioesterase 1 (ACOT1) was significantly decreased in the HEE group. ACOT1 regulates fasting hepatic fatty acid metabolism by balancing oxidative flux and capacity. It is speculated that the excessive fatty acid oxidation was reduced by the eel essence. Hence, it was concluded that eel essence has the potential to regulate fat oxidation and exert anti-fatigue effects.

5.2.6. Delphinidin Blocks TNBC Immune Escape by Reducing PD-L1 Expression
Shimiao Zong 1, Yufei Zou 1 and Xiaoping Yu 2
1 Chengdu Medical College, Chengdu, China
2 Chengdu University, Chengdu, China

Objective: To investigate the potential mechanism of Delphinidin in inhibiting the suppressed PD-L1 expression pathway on the cell membrane of triple-negative breast...
Methods: MDA-MB-231 cells were treated with different concentrations of Delphinidin (0, 20, 40, and 80 µM). The ability to detect cell proliferations and drug sensitivity by CCK-8 and the biological characteristics of Delphinidin on MDA-MB-231 cells were detected by Western blot. Ficoll density gradient centrifugation separated lymphocytes in peripheral blood, and NK and CD8+ T cells were sorted by immunomagnetic beads to construct a coculture system with MDA-MB-231 cells to simulate the immune microenvironment. Settings: A blank control group, co-culture group of NK, CD8+ T, and TNBC, and a co-culture group of the dosing co-culture + Delphinidin group were used, for a total of three groups. The apoptosis status of MDA-MB-231 cells was detected by flow cytometry Annexin-V-FITC/PI double staining and immunofluorescence multicolor staining experiments. The killing activity of T cells and NK cells was verified, and the effect of Delphinidin on the ratio of PD-L1 and CD8+ T/NK cells in each group and the mechanism of PD-L1 protein expression on the cell surface were analyzed.

Results: Compared with the control group, Delphinidin effectively inhibited the proliferation of MDA-MB-231 cells and induced apoptosis. Compared with the control group and co-culture group, the proportion of PD-L1 and CD8+ T/NK cells in the coculture + Delphinidin group decreased, the tumor killing activity of CD8+ T and NK cells was enhanced, and the expression level of PD-L1 protein in the experimental group was significantly reduced.

Conclusion: Delphinidin can effectively inhibit the proliferation of MDA-MB-231 cells, increase the killing activity of immune cells, and block immune escape by reducing the expression level of PD-L1 on the surface of TNBC cells.

5.2.7. A Cohort Study of Serum 25-Hydroxyvitamin D Levels and the Risk of Hyperlipidemia in Adults
Zhiyong Hu, Jinxiu Wang, Yang Li, Chunyang Wang, and Naibao Hu
Binzhou Medical University, Yantai, China

Objective: To investigate the association between serum 25(OH)D levels and the risk of hyperlipidemia development in an adult population by a three-year follow-up survey using a prospective cohort study design. Methods: Cox risk regression models were constructed to explore the relationship between serum 25(OH)D levels and the incidence of hyperlipidemia based on the data. The relationship between serum 25(OH)D levels and the risk of developing hyperlipidemia was obtained by stratified analysis of traditional risk factors for hyperlipidemia at baseline, providing a reliable basis for vitamin D prevention of hyperlipidemia. Results: The overall 25(OH)D level in the study population was 25.89 (21.50, 29.82) ng/mL, and the vitamin D deficiency rate was significantly higher in women than in men (22.06% vs. 10.94%). Using vitamin-D-sufficient respondents as a reference, vitamin-D-deficient hyperlipidemia prevalence was 1.612 times higher than the prevalence of hyperlipidemia in those with adequate vitamin D (95% CI: 1.228–2.116; p = 0.001). Further stratified analysis found that vitamin D deficiency increased the risk of developing hyperlipidemia in those with a positive family history of diabetes. Low education, BMI < 24, not exercising, smoking, alcohol consumption, and residence in an urban area were characteristics of the subgroup of respondents in which vitamin D insufficiency increased the risk of developing hyperlipidemia. For the critical value of the 25(OH)D level that predicts the occurrence of hyperlipidemia, a receiver operating characteristic curve (ROC) was constructed, from which an AUC value of 0.664 (95% CI: 0.631–0.697) and a 25(OH)D critical value of 31.65 ng/mL could be derived. Conclusion: The findings suggest that patients with low levels of 25(OH)D have a higher incidence of hyperlipidemia. Vitamin D insufficiency increases the risk of hyperlipidemia. It is recommended that vitamin D supplementation be administered in people with vitamin D insufficiency to reduce the occurrence of hyperlipidemia.
5.3. Clinical Nutrition
5.3.1. Assessment of Nutritional Status and Dietary Coping Strategies after COVID-19 Infection in Athletes
Qi Wei
Hubei Institute of Sport Science, Wuhan, China

Objective: COVID-19-imposed restrictions are associated with many health consequences, particularly in athletes. Adverse changes in physical activity and nutrition may affect subsequent athletic and competition performance. Studies to date have shown that athletes who are typically young, healthy, and free of comorbidities are at lower risk of serious symptoms and fatal outcomes from COVID-19 infection than the general population. However, the potential short- and long-term effects of COVID-19 infection remain largely unknown. This study was conducted to assess the impact of COVID-19 infection and pandemic restriction on the nutrition and physical activity of athletes and to compare the blood index results of athletes before and after infection.

Methods: Twenty-seven professionally trained male football players (mean age = 16.03 ± 1.14 years, height = 178.4 ± 5.8 cm, weight = 72.3 ± 5.4 kg; BMI = 24.0 ± 2.6 kg/m²) underwent pre- and post-COVID-19 surveys and completed dietary and physical activity surveys.

Results: (1) After COVID-19 infection, athletes’ physical activity gradually resumed and dietary modification strategies using high-quality vegetable proteins instead of meat and enhanced intake of different substances, such as essential fatty acids, linoleic acid, essential amino acids, and the aforementioned vitamins and minerals, improved the immune response, especially in the case of viral infections, and immunity improved and increased. (2) COVID-19 infection caused a marked deterioration in the performance of blood indicators. Following COVID-19 infection, testosterone and ferritin were reduced. Consumption of processed meat and replacement of meat with plant-based protein affected hemoglobin concentrations (p = 0.045). Changes in fat content were associated with unsaturated fatty acids (p = 0.033).

Conclusion: Nutritional status and blood markers in athletes following COVID-19 infection should be regularly followed up every three months to assess and adjust dietary strategies in a timely manner.

5.3.2. Effects of Bifidobacterium Breve 207-1 on Improving Mental Health and Sleep in Healthy Adults: A Randomized, Double-Blind, Placebo-Controlled Trial
Yapeng Li, Jincheng Zhao, Yunyi Wang, Yang Yang, Jinxing Li, Fei Chen, Ruyue Cheng, Xi Shen, and Fang He
West China School of Public Health, Sichuan University, Chengdu, China

Gut microbiota and mental health are closely related. Our study aims to explore the efficacy and safety of Bifidobacterium breve 207-1 in improving stress-related symptoms (e.g., anxiety, depression, and insomnia) in healthy adults. A total of 120 healthy adults with subclinical symptoms of high mental stress, overweight, insomnia, and constipation were retrospectively registered and were randomly assigned to receive low-dose 207-1 (LD, n = 40), high-dose 207-1 (HD, n = 40), or placebo (PL, n = 40) for 28 days. Fecal and blood samples were collected from the participants before and after the trial. Participants were also asked to take medical examinations and complete the Pittsburgh Sleep Quality Index (PSQI), the Self-Rating Depression Scale (SDS), and the Self-Rating Anxiety Scale (SAS) before and after the intervention. The results showed that 207-1 stimulated the proliferation of neurotransmitters, such as 5-HT and GABA, and inhibited HPA axis hyperactivity. The PSQI scores in the HD group decreased significantly, which represented improved sleep quality. In addition, the gut microbiota changed under the intervention of 207-1. There was a significant increase in B. breve in the LD and HD groups (p < 0.05). The relative abundance in the control group of Eggerthelia, Desulfovibrio, and Desulfobacterota were significantly higher than the probiotics groups (p < 0.05). The relative abundance of Ruminococcus in the LD group significantly decreased, while SCFAs increased, especially acetic acid and...
propionic acid ($p < 0.05$). In conclusion, B. breve 207-1 alleviates mental stress and sleep problems in healthy adults by directly affecting neurotransmitters and hormones, as well as indirectly by regulating the composition of gut microbiota and promoting SCFAs’ synthesis. Probiotics have some potential efficacy in regulating mental health and, therefore, are expected to be a new therapeutic target for mental illness.

**Keywords:** Bifidobacterium; gut microbiota; 5-HT; GABA; HPA axis; SCFAs

5.3.3. Platelet-to-Lymphocyte Ratio Differences in Newly Diagnosed Pancreatic Cancer Patients’ Weight Loss Trajectories: The Role of Inflammation

Fengyi He $^1$, Cheng Wang $^1$, Chaogang Chen $^1$ and Huilian Zhu $^2$

$^1$ Sun Yat-sen Memorial Hospital, Sun Yat-sen University, Guangzhou, China
$^2$ Sun Yat-sen University, Guangzhou, China

Background: Unintentional weight loss is a common symptom of pancreatic cancer, associating with systemic inflammation and affecting treatment, survival outcomes, and quality of life. The platelet-to-lymphocyte ratio (PLR) is a marker of systemic inflammation and was proven to be associated with poor outcomes in many cancer patients. The aim of this study is to determine the role of PLR in weight loss in patients with pancreatic cancer.

Methods: This study retrospectively collected the data from electronic medical records of an academic hospital in Guangzhou. Patients newly diagnosed with pancreatic cancer and hospitalized between 2019 and 2021 were included. Those who were bed-bound on first admission, with terminal stage of cancer, or with less than two readmissions during the following 12-month period were excluded. Demographic (age, sex, current smoking status, and regular drinking status), disease-specific variables (TMN stage and treatment parameters), as well as dietary energy intake, weight, and blood cell parameters during the 12-month follow-up period were assessed. Trajectory analyses were performed to identify distinct subgroups that share a similar course of changes in weight.

Results: A total of 136 patients with pancreatic cancer (aged $58.7 \pm 10.1$ years, 58.1% male) were included in this study. Participants had a median of 6 (3–9) monthly records across a 7 (4–12) month span. Based on records over the follow-up period, two weight trajectories were identified: stable pattern (weight loss, $3.3 (0–6.6)$%, n = 79, 58.1%) and decreasing pattern (weight loss, $14.3 (11.3–19.4)$%, n = 57, 41.9%). The patients with the decreasing weight pattern tended to be younger (aged $56.3 \pm 11.1$ vs. $60.4 \pm 9.1$ years, $p = 0.020$), with lower baseline lymphocyte counts ($1.27 (1.07–1.55)$ vs. $1.56 (1.19–1.95)$, $p = 0.007$) and higher baseline PLR ($203 (155–239)$ vs. $154 (114–238)$, $p = 0.024$).

Conclusion: An elevated PLR was associated with greater weight loss in patients with pancreatic cancer. Based on these readily available and routine biomarkers of systemic inflammation, we may identify pancreatic cancer patients at risk of excessive weight loss.

5.3.4. Vitamin D Delays the Secretion of Pro-Inflammatory Chemokines in Ectopic Endometrial Stromal Cells by Inhibiting the TGFBR2/SMAD Signaling Pathway

Hua Nie, Xiaoxia Wang, and Ying Tan

Guangdong Provincial Reproductive Science Institute (Guangdong Provincial Fertility Hospital), Guangzhou, China

Background: Endometriosis is characterized by the ectopic growth of active endometrial tissue outside the uterine cavity, such as in the ovaries or pelvic region, leading to recurrent cyclic bleeding, pain, and infertility. The incidence of endometriosis in reproductive-aged women is estimated to be around 10% to 15%. The etiology of endometriosis remains unclear, with several hypotheses proposed, including retrograde menstruation and hematogenous or lymphatic dissemination, among others. Our previous clinical cohort study found an immunological correlation between low serum vitamin D levels and the presence of endometriotic ectopia.

Objective: To investigate and compare the expression of the vitamin D derivative 1,25(OH)2D3 in the endometrium of non-endometriosis women and endometriosis patients who visited our gynecology outpatient department between September and October 2022.
We aim to study the differential effects of 1,25(OH)2D3 concentrations on the proliferation, migration, and invasion of ectopic endometrial stromal cells, as well as the related signaling pathway molecules, through RNA-sequencing technology and bioinformatics analysis. This study aims to further explore the regulatory mechanisms of vitamin D in endometriosis and provide new insights for its clinical treatment.

Methods: Preoperative serum samples were collected from non-endometriosis women and endometriosis patients, and the expression levels of 1,25(OH)2D3 and other pro-inflammatory chemokines were measured using ELISA. Additionally, endometrial samples with the greatest difference in 1,25(OH)2D3 expression between non-endometriosis women and endometriosis patients were collected, and total RNA was extracted. RNA-sequencing technology and bioinformatics analysis were used to identify signaling pathway molecules regulated by 1,25(OH)2D3 in endometrial stromal cells of endometriosis. The expression of relevant pathway genes and proteins was validated using RT-qPCR and Western blot techniques. An in vitro cell model was established, and the cells were incubated at 37 °C with increased concentrations of 1,25(OH)2D3 in the culture medium for 24 h. Changes in cell proliferation were assessed using the CCK-8 assay, while cell migration and invasion were evaluated using the Transwell assay. The activation of the downstream TGFBR2/SMAD signaling pathway was examined using Western blot. Statistical significance was set at \( p < 0.05 \).

Results: Vitamin D levels were negatively correlated with IL-6 and IL-10 concentrations and positively correlated with Treg and Th17 cells, suggesting an immunological association between low serum vitamin D levels and endometriosis. Furthermore, RNA-sequencing and bioinformatics analysis revealed that low vitamin D levels upregulated the TGFBR2/SMAD signaling pathway, promoting the secretion of pro-inflammatory chemokines by ectopic endometrial stromal cells and accelerating endometrial migration.

Conclusion: Low serum vitamin D levels are immunologically associated with the occurrence of endometriosis, while high vitamin D levels delay the secretion of pro-inflammatory chemokines by ectopic endometrial stromal cells through the inhibition of the TGFBR2/SMAD signaling pathway, thereby alleviating the progression of endometriosis.

5.3.5. Prevalence of Retinal Arteriosclerosis- and Nutritional Metabolism-Associated Risk Factors in Beijing City, China

Guanzhen Li\(^1\), Kun Li\(^2\), Shanshan Ren\(^1\) and Mingwei Zhu\(^1\)

\(^1\) Department of Clinical Nutrition, Beijing Hospital, National Geriatrics Center, Beijing, China
\(^2\) Department of Child Health, Beijing Dongcheng Maternal and Child Health and Family Planning Service Center, Beijing, China

Aims: To estimate the prevalence of retinal arteriosclerosis (RA), and to explore potential nutritional metabolism risk factors of RA in people of Beijing City, the capital of China.

Methods: We examined physical and biochemical parameters of the general population in health examination institutions in 2020, including a total of 17,130 subjects (10,613 men and 6517 women). RA was diagnosed according to the results of a funduscopic examination performed by expert ophthalmologists. Diagnosis of metabolic syndrome (MS) was based on the IDF (2016) definitions for the Chinese people standard. Type 2 diabetes mellitus (DM2) and coronary heart disease (CHD) diagnoses were obtained according to patients’ memory with exact diagnostic time in a self-administered questionnaire. Univariate and multivariate logistic regression analyses were conducted to evaluate the demographic and clinical factors associated with retinal arteriosclerosis.

Results: The prevalence of RA was 19.74% in males and 12.15% in females. Multiple logistic regression analysis showed that the multivariate-adjusted odds ratio of age was 1.111 (95% CI: 1.106–1.116), waist circumference (WC) was 1.009 (95% CI: 1.003–1.014), body mass index (BMI) was 1.046 (95% CI: 1.026–1.067), systolic blood pressure was 1.013 (95% CI: 1.010–1.015), fasting plasma glucose (FPG) was 1.066 (95% CI: 1.031–1.102), white blood
cell count (WBC) was 1.046 (95% CI: 1.014–1.079), serum uric acid (UA) was 1.002 (95% CI: 1.001–1.002), DM2 was 1.593 (95% CI: 1.372–1.851), MS was 1.203 (95% CI: 1.062–1.361), and smoking index was 1.000 (95% CI: 1.000–1.001). The areas under ROC curves showed that age, WC, FPG, and SBP had a greater ability to discriminate RA than the other factors.

Conclusion: These results indicate that RA in people of Beijing City had a higher prevalence than national averages. Age, SBP, FPG, WC, DM2, MS, WBC, BMI, and UA were all nutritional metabolism risk factors for RA.

5.3.6. Effect of Post-Discharge Oral Nutritional Supplement on BMI and Skeletal Muscle Mass through Interleukin Group in Malnourished Patients with Gastrointestinal Cancer

Yi Lin 1 and Hua Yu 2

1 University of Nottingham Ningbo China, Ningbo, China
2 Ningbo No. 2 Hospital, Ningbo, China

Background and Objectives: Gastrointestinal cancer (GI) patients often suffer from malnutrition after surgery, especially post-discharge. Most studies focused on oral nutrition supplements (ONS) for clinical outcomes in patients during the hospital stay. This study aimed to investigate the impact of tumor-specialized ONS (TSONS) on BMI and skeletal muscle mass (SMM) in post-discharge malnourished GI patients after surgery through the interleukin (IL) groups.

Methods: A retrospective study was delivered in a real-life clinical setting. GI adults at risk of malnutrition after surgery from December 2021 to October 2022 were recommended to receive hospital-prepared TSONS, containing 18% protein, 50.0% fat, and 32.0% carbohydrate per service, to reach 500 kcal per day for up to 3 weeks. Nutritional status was evaluated by the Scored Patient-Generated Subjective Global Assessment. Generalized Linear Mixed Models (GLMM) were used with subject-fixed effects to analyze the effects on BMI and SMM.

Results: In total, 42 eligible GI patients receiving three-week TSONS were included in this analysis. Three-week TSONS improved the nutritional status ($p < 0.001$). After stratifying by the status of body weight and the appendicular skeletal muscle index (ASMI), underweight or low ASMI patients gained a better nutrition status than their counterparts. Regarding IL factors, the median values were slightly increased in patients with normal weight and overweight and normal ASMI, compared to those with underweight or low ASMI, although no significance was found. GLMM showed that IL-2 and IL-10 were positively associated with SSM ($\beta = 2.1, p = 0.019$) and BMI ($\beta = 1.3, p = 0.002$), respectively, while IL-4 was negatively associated with BMI ($\beta = -1.6, p = 0.012$).

Conclusion: Three-week TSONS improved the nutritional status in malnourished GI patients after surgery. Three-week TSONS could affect the IL groups to increase BMI and SSM. In the future, RCT with a longer TSONS period is required to investigate the impacts of IL groups on BMI and SSM.

5.3.7. Study on the Improvement of Psychological Problems of Patients with Advanced Cancer by Nutritional Support

Guanghui Yu
Shifang Nanquan Health Hospital, Shifang Hospice Centre, Shifang, China

Objective: Malnutrition is one of the main factors affecting the quality of life of patients with advanced cancer. Here, malnutrition includes (1) loss of appetite. In the late stage of cancer, patients usually lose their appetite, often associated with fever, fatigue, pain, and other symptoms, which will also affect their normal eating, or in serious cases, mean they cannot eat. Meanwhile, the body will produce a lot of waste, which can lead to weight loss, immune decline, metabolic disorders, increased psychological problems, and a reduced quality of life. (2) Disease’s impact on human energy consumption. The energy consumption of cancer patients is staggering, but the intake of nutrients is far from normal. The digestive system of a tumor patient, with esophagus cancer or stomach cancer, has a digestion absorption barrier. Up to 80% of patients with advanced cancer experience...
weight loss and wasting. Weight seriously decreases in the short term, called cachexia, commonly resulting in fatigue, anemia, and tiredness. In such cases, quality of life is also severely affected, and survival is generally shorter.

Methods: In order to find out the problem, the Department of Hospice Care of our hospital carried out a series of comprehensive tests and objective evaluation on 56 patients with end-stage cancer in the recent two years. The assessment results showed that more than half of the patients had psychological problems and most of them had symptoms of malnutrition. Some of the patients who could not eat had psychological problems, such as insomnia, distress, pessimism, and negativity. The patients with obvious cancer pain even displayed serious depression, anxiety, mania, and other symptoms, which seriously affected the quality of life of the patients and increased the burden on their families.

Results: In addition, the results also showed a correlation between quality of life and mental health and poor diet in patients with advanced cancer. Diet is the main way for the body to absorb nutrients. Most patients with advanced cancer will lose their appetite and absorb less nutrients. Studies have shown that the brain is far more sensitive to biochemical disorders and nutritional deficiencies than any other organ and reacts quickly when appetite wanes and nutrients are scarce. For example, a blood sugar imbalance will stimulate the brain to produce certain food cravings and dependence, and thus trigger emotional fluctuations. Common symptoms of B vitamin deficiency are paranoia, hallucinations, mood swings, anxiety and nervousness, and auditory and visual abnormalities. Essential fatty acids are linked to the functioning of the brain, which is 60 percent fat. A lack of brain fat and conditions such as schizophrenia, mania, depression, etc., have a certain relationship.

Conclusion: Therefore, it is very important for treatment centers to make the terminal cancer patients comfortable and improve their quality of life, providing humanistic care in physical, psychological, and spiritual aspects. Measures such as improving diet and nutrition and providing mental health interventions can effectively improve psychological problems and control or postpone pain and discomfort, thus improving the quality of life and helping patients to die comfortably.

5.3.8. Evaluation of Malnutrition by Objective Nutritional Index and Association with Prognosis in Hospitalized Patients with COVID-19

Lingmei Zhou
Ningbo Medical Center Li Huili Hospital, Ningbo, China

Background and Objective: We aimed to (1) investigate the prevalence of nutrition risk, defined by NRS2002, and malnutrition, as assessed by the objective indexes (PNI and COUNT), in hospitalized patients with COVID-19, (2) observe the nutritional interventions available for them, and (3) explore predictors for discerning the critical patients and predicting the mortality of patients with COVID-19.

Methods and Study Design: The present study was a monocentric retrospective study. We included a total of 464 hospitalized patients confirmed with COVID-19 between December 2022 and January 2023 at Ningbo Medical Center Li Huili Hospital, China. Data on clinical features, complications, laboratory parameters, and nutrient requirements were analyzed retrospectively. ROC curve analysis was used to discern critical patients and mortality with COVID-19.

Results: The incidence of nutritional risk was 53.00% (246/464) among these patients. The prevalence of malnutrition was 79.09% and 88.79%, as diagnosed by the PNI and COUNT, respectively. The total in-hospital mortality was 3.02% (14/464). Univariate analysis revealed that older age, lower BMI, and comorbidities, including diabetes, hypertension, and cardiovascular disease, were significant associated with nutritional risk. Among 464 patients, only 107 (23.06%) cases received nutritional support. The cut-off values $\geq 817.54$ for SII and $\geq 5.5$ for COUNT were associated with a higher risk of critical cases in COVID-19 patients, and the cut-off values $\geq 3274.34$ for SII and $\geq 5.5$ for COUNT were associated with a higher risk of mortality in the ROC curve analysis.
Conclusions: The incidence of nutritional risk and malnutrition was high among hospitalized patients with COVID-19. The SII and COUNT scores are independent predictors of the prognosis for the disease severity and mortality in hospitalized COVID-19 patients.

5.3.9. Prevalence and Risk Factors of Malnutrition According to GLIM Criteria in Patients with Hepatocellular Carcinoma: A Single-Center Cross-Sectional Study
Shengqiang Tan 1,2 and Jie Jiang 1,2
1 Liuzhou People’s Hospital Affiliated to Guangxi Medical University, Liuzhou, China
2 Sichuan Investment Xichang Hospital affiliated to Sichuan Provincial People’s Hospital, Xichang, China

Aim: Malnutrition is highly prevalent in hepatocellular carcinoma (HCC) patients and is associated with a poor prognosis, making early identification and management crucial for improving outcomes. This study investigated malnutrition in HCC patients and evaluated the efficacy of the Nutrition Risk Screening 2002 (NRS2002) and the scored Patient-Generated Subjective Global Assessment (PG-SGA) compared to the Global Leadership Initiative on Malnutrition (GLIM) Criteria. The study also identified independent risk factors associated with malnutrition in HCC patients.

Methods: A cross-sectional study was conducted on 207 HCC patients. Nutritional screening/assessment results and blood samples were gathered within 72 h of admission. The performance of the screening tools was evaluated using Kappa (K) values. Logistic regression analyses were performed to determine if clinical parameters, such as serum albumin (ALB), hemoglobin (HGB), lymphocyte (LYM) count, ascites (ASC), portal hypertension (PHT), tumor diameter, tumor number, Child–Pugh class, Barcelona Clinic Liver Cancer Stage (BCLC), and model for albumin–bilirubin (ALBI) scores, were associated with malnutrition, as identified by the GLIM criteria.

Results: Here, 30.4% of participants were at risk of malnutrition according to NRS2002. The agreement between NRS2002 and GLIM criteria was substantial (K-value: 0.626, \( p < 0.01 \)), with low sensitivity (65.9%) and high specificity (94.3%) for NRS2002. GLIM criteria and PG-SGA diagnosed malnutrition in 41.1% and 54.6% of participants, respectively (K-value: 0.658, \( p < 0.01 \)). PG-SGA had high sensitivity (95.3%) but low specificity (73.8%) for identifying malnutrition according to the GLIM criteria. The GLIM criteria accurately detected malnutrition (75.2% accuracy) and non-malnutrition (95.7% accuracy) in the light of PG-SGA. Age, Child–Pugh score, anemia, and ASC were significantly associated with malnutrition in multivariate logistic regression (Hosmer and Lemeshow goodness of fit \( x^2 = 9.227, p = 0.324 \)).

Conclusion: GLIM criteria can be a valuable tool for diagnosing malnutrition in HCC patients, with NRS 2002 and PG-SGA as complementary options, while understanding the risk factors for malnutrition can inform timely interventions to improve patient outcomes.

5.3.10. Evidence Summary of Nutritional Management in Patients with Colorectal Cancer during the Perioperative Period
Qi Yu, Yu Fang, Ziqi Liu, Yanli Wang, and Liqing Gong
Department of Nutrition, Beijing Cancer Hospital, and Beijing Institute for Cancer Research, Beijing, China

Objective: To search and select the evidence related to perioperative nutritional management of colorectal cancer, and to summarize the best evidence.

Methods: We retrieved the British Medical Journal, Up to Date, Guidelines International Network, Medlive, National Institute for Health and Care Excellence, Scottish Intercollegiate Guidelines Network, Registered Nurses Association of Ontario, National Comprehensive Cancer Network, Centre for Perioperative Care, European Society for Clinical Nutrition and Metabolism, Chinese Society for Parenteral and Enteral Nutrition, American Society for Parenteral and Enteral Nutrition, Cochrane Library, Scopus, Taiwan Society of Colon and Rectal Surgeons, Web of Science, PubMed, CNKI, Wanfang Database, VIP, and SinoMed, and collected relevant clinical decisions, guidelines, evidence summaries,
expert consensuses, and systematic reviews. “Colorectal cancer/colorectal malignant tumor”, “perioperative period/perioperative/preoperative/postoperative/operation”, “diet/nutrition”, and “systematic review/systematic review/meta-analysis” were selected as the Chinese search terms, as well as “colorectal cancer/tumor/oncology/Neoplasm */carcinoma **”, “perioperative and preoperative and postoperative/operation/operative surgery”, “nutrition/diet”, and “systematic review/meta-analysis”. The search time limit was from January 2012 to February 2023. There were two researchers who evaluated the quality of the included literature, and extracted and summarized the evidence.

Results: A total of 18 articles were included, including 4 clinical decisions, 3 guidelines, 1 evidence summary, 5 expert consensuses, and 5 systematic reviews. Then, 29 pieces of evidence were summarized, including multidisciplinary team, nutritional risk screening and assessment, general principles of nutritional support, perioperative nutritional support, postoperative nutritional support, discharge, and follow-up. The disciplinary team (MDT) model is recommended, in which professional nutritionists, preferably experts in cancer nutrition, should be included to provide nutritional support. Once diagnosed, nutritional risk screening and nutritional status assessment should be carried out throughout the treatment of patients with colorectal cancer. For nutritional risk screening, the NRS2002 scoring tool is recommended, and those with scores ≥ 3 are considered to have nutritional risks. For those with NRS2002 scores without nutritional risk, screening once a week is recommended during hospitalization. GLIM standard is the latest international diagnostic method for malnutrition and is recommended for colorectal cancer patients. Patients with nutritional risks or malnutrition, who cannot eat for more than 5 to 7 days, with reduced oral intake or less than 50% of the recommended target amount for more than 7 days, should receive nutritional education and nutritional support treatment before surgery. Senile sarcopenia patients are a special high-risk group of malnutrition. It is more important to reach the standard of total protein/amino acid intake than total energy intake before surgery. It is recommended that protein/amino acid intake should reach 1.0–1.5 g/(kg·d). The patient’s normal volume status should be maintained and the water and electrolyte imbalance corrected as much as possible before surgery. Intraoperative hemodynamic monitoring is performed using GDFT to maximize intravascular volume and cardiac output. Special nutritional preparations rich in arginine, omega-3 fatty acids, and ribonucleotides are recommended for malnourished patients undergoing major tumor surgery during the perioperative period, or at least after surgery, and for 5 to 7 days before surgery (GPP). Perioperative nutritional management should be carried out in accordance with ERAS principles and procedures in patients with colorectal cancer regardless of radical or palliative surgery. Blood glucose management should be carried out throughout the perioperative period, and individualized blood glucose control objectives and treatment plans should be formulated according to the type of surgery and the specific conditions of patients. Nutritional management should be strengthened for patients with gastrointestinal surgery after discharge, appropriate nutritional treatment should be administered to patients with nutritional risks or malnutrition, and regular follow-up and monitoring should be conducted.

Conclusion: The best evidence in this study is scientific and systematic, providing evidence-based interventions for medical workers to implement nutritional management of perioperative colorectal cancer patients.

Keywords: colorectal neoplasms; perioperative period; perioperative nursing; malnutrition; nutritional support; evidence-based nursing

5.3.11. A Cohort Study of Nutritional Risk and Nutritional Treatment Intervention among Geriatric Patients in a Tertiary Hospital
Changhai Su
Ordos Central Hospital, Ordos, China

Objective: This study aimed to investigate the incidence of nutritional risk and malnutrition among geriatric inpatients in Erdos, Inner Mongolia, and the correlation between the
implementation of nutritional pathways and clinical outcomes. China is the country with the largest elderly population in the world, and the nutritional risk rate of elderly patients with many chronic diseases is high. The incidence of nutritional risk in hospitalized patients is 40–50%, and that in elderly patients is 40–80%. Malnutrition in the elderly leads to the decline of the body’s reserve capacity and resistance ability, which increases the body’s susceptibility to adverse outcomes, reflecting the heterogeneity of the health of the elderly. The nutritional risks and nutritional treatment of elderly inpatients in China are reported in the literature, but the nutritional risks and nutritional treatment status of elderly inpatients in Ordos region of Inner Mongolia have not been reported.

Method: The basic information of 169 hospitalized elderly patients in the geriatric department of our hospital from July to December 2022 was collected, including 75 patients in the intervention group with nutritionist participation in nutrition treatment and 94 patients in the control group without nutritionist participation in nutrition treatment. Their nutritional status was evaluated by NRS2002 (Nutritional Risk Screening 2002) and GLIM. Nutritional treatment plans were collected on discharge. The differences in biochemical indexes, hospital stays, and hospital expenses were compared between the two groups.

Results: Here, 169 patients received nutritional screening, and after data collection, 138 patients were finally included in the study, including 65 patients in the nutritionist intervention group and 73 patients in the control group, but 34 patients with incomplete screening data were excluded. The incidence of nutritional risk in the geriatric department of our hospital was 48.6% (67/138), and the rate of patients with nutritional risk receiving nutritional treatment was 74.1% (20/27), which was significantly different from that of the control group, at 55% (22/40). In terms of receiving balanced and standardized nutritional treatment, the rate of receiving nutritional treatment with nutritional risk was 50% (10/20), which was significantly different from 13.6% (3/22) in the control group. The ratio of parenteral nutrition to enteral nutrition was 2:1, and 32.2% of the patients received parenteral combined with enteral nutrition. According to the malnutrition assessment, there were 27 cases of malnutrition in the nutrition intervention group (18 cases of mild malnutrition and 9 cases of moderate and severe malnutrition), accounting for 37%. There were 28 cases of malnutrition (17 cases of mild malnutrition and 11 cases of moderate and severe malnutrition), accounting for 44.4% in the control group. Completed nutrition-related indexes of albumin, prealbumin, and hemoglobin were collected in 42 of 67 patients with nutritional risk, and there were statistical differences in all of them ($p < 0.05$). There were 20 people in the nutrition intervention group, the average hospitalization cost was 7107.64, and the average hospitalization days was 6. Among 22 people in the control group, the average hospitalization cost was 7554.06, and the average hospitalization days was 8. There was no statistical difference between the two groups ($p > 0.05$).

Conclusion: The incidence of nutritional risk and malnutrition in elderly patients in Ordos region of Inner Mongolia is high, while the rate of nutritional treatment is low, and the rate of balanced nutritional treatment was moderate for those geriatric patients in the treatment group. Through nutritional treatment paths, clinical nutritionists can standardize nutritional treatment and improve the success rate of nutritional treatment for elderly patients. There was no significant difference between hospital stay and cost in patients within the nutritional pathway.

5.3.12. Clinical Study on Adult Full Nutrition Formula for Special Medical Use
Hu Ruomei, Wang Wenqiang, and Yang Zhongping
Nutrition Department of Tianjin Hospital, Tianjin, China

Objective: Oral nutritional supplement (ONS) is an effective nutritional support method that can strengthen the nutrient content of protein, carbohydrates, fat, minerals, and vitamins in food, and provide balanced nutrients to meet the body’s demand for nutrients. More and more research has evidenced that ONS can improve nutritional status and clinical outcomes in community and hospitalized patients at high risk for malnutrition or with malnutrition. The aim of this study was to evaluate whether the special medical
all-nutrients formula improved nutritional status, exercise, short-term clinical outcomes, and quality of life, and assess its safety for the subject population.

Methods: Here, 90 middle-aged and elderly people, aged from 60 to 80 years, with malnutrition or at risk were recruited from hospital outpatient clinics and community institutions. The random number table was generated according to the statistical mechanism of the subject, and then the randomization table was obtained. The investigator provided the subject number according to the order of enrollment and randomly assigned the subjects to the research group, using Food for Special Medical Purpose (FSMP), or the control group according to the randomization table. The total nutrition group received dietary guidance and daily nutrition formula energy of 500 kcal, and the control group only received dietary guidance, and the intervention period was 12 weeks. The safety of the product was measured at baseline, and blood biochemistry, blood routine, stool status, abdominal pain, diarrhea, and abdominal distension were assessed after the intervention. The nutritional supplementation of the product was observed by the malnutrition assessment scale MNA, dietary survey, body weight, BMI, non-intentional weight loss, fat-free weight, grip strength, calf circumference, upper arm circumference, Limit of Function Questionnaire (SARS-F), Physical Activity Scale (PASE), and Quality of Life Questionnaire (EQ-5D).

Result: After 12 weeks of intervention, the MNA score of the FSMP group was significantly higher than that of the control group \((p<0.001)\). The body weight gain \((p = 0.001)\) and BMI increase \((p = 0.001)\) in the FSMP group were significantly higher than those in the control group, and the percentage of non-intentional weight loss was significantly lower than that in the control group \((p < 0.001)\). The mean increase of grip strength \((p < 0.001)\) and mean increase of calf circumference \((p < 0.001)\) in the FSMP group were significantly higher than those in the control group. The reduction of the SARC-F score in the FSMP group was significantly greater than that in the control group \((p < 0.05)\). After 12 weeks of intervention, there were no significant differences in the frequency of defecation, diarrhea, abdominal pain, and abdominal distension between the FSMP group and the control group \((p > 0.05)\).

Conclusion: FSMP can improve the nutritional status of middle-aged and elderly people and reduce the risk of malnutrition, and can increase body weight and BMI levels. It can increase body functions, such as grip strength and calf circumference, and can improve the average hemoglobin concentration of the subjects. FSMP will not cause gastrointestinal adverse reactions and liver and kidney function damage. Intestinal safety records and routine blood and blood biochemical analysis found that the subjects did not have obvious adverse reactions when eating the FSMP, and the blood test indexes remained stable.

5.3.13. Application Value of Phase Angle Measurement in Inpatients of Abdominal Surgery

Qihui Zhang 1, Jindong Ma 1 and Qiangpu Chen 2

1 Department of Clinical Nutrition, Binzhou Medical University Hospital, Binzhou, China
2 Department of Hepatobiliary Surgery, Binzhou Medical University Hospital, Binzhou, China

Objective: To study the relationship between phase angle (PA) and the nutritional status of abdominal surgery inpatients and the duration of hospitalization, to explore the relevant influencing factors, and to support nutritional interventions for hospitalized patients.

Methods: A cross-sectional study was used to include 1131 inpatients of abdominal surgery in a tertiary hospital in Shandong province from December 2019 to July 2021. General information of patients was recorded, grip strength was measured, body composition analysis examination and serological indexes were performed, and nutritional risk screening was performed using the NRS2002 scale. The diagnosis of sarcopenia in patients was performed according to the Asian Working Group on Sarcopenia (AWGS) 2019 diagnostic criteria. According to Kyle’s criteria, low PA was indicated by bioelectrical impedance < 5 kHz, <5.0° in men and <4.6° in women. The patients were divided into
groups with low and normal PA values, and the differences in relevant indicators were compared, including age, body weight, grip strength, body mass index (BMI), defatted body weight, skeletal muscle index of the limbs, muscle circumference of the left upper arm, albumin, hemoglobin, erythrocytes, sodium, potassium, presence of tumor, presence of sarcopenia, presence of alcohol consumption, NRS2002 score, and total bilirubin. Relevant factors that had an effect on PA values were screened by univariate analysis.

Results: The low PA group was statistically significant compared to the normal PA group on variables such as age, presence of tumor, presence of sarcopenia disease, NRS2002 score, and total bilirubin level ($p < 0.05$), compared to other variables. The older the patient, the higher the nutritional risk, the worse the symptoms of jaundice, and the presence of a tumor disease, the lower the PA value will be. The lower the PA value, the longer the hospital stay. The comparison between the low PA group and the normal PA group in terms of variables such as gender and whether or not they drink alcohol was not significant. There was no statistically significant difference between the low PA group and the normal PA group in terms of variables such as gender and whether or not alcohol was consumed ($p > 0.05$). The low PA group’s body weight, grip strength, body mass index, skeletal muscle mass, fat weight, limb skeletal muscle index, left upper arm muscle circumference, albumin, hemoglobin, red blood cells, sodium, and potassium were significantly lower than those in the normal PA group ($p < 0.05$), suggesting that the nutritional status of hospitalized patients in the normal PA group was better. The hospitalization time of patients in the low PA group was significantly higher than that of the normal PA group ($p < 0.05$), suggesting that patients in the low PA group required longer treatment and recovered more slowly. PA was associated with age, NRS2002 score, presence of sarcopenia, total bilirubin level, presence of tumor, and length of hospital stay. PA was negatively correlated with age, NRS2002 score, presence of sarcopenia, total bilirubin level, presence of tumor, and length of hospital stay ($p < 0.05$). Counting the percentage of patients in the low PA group and the normal PA group in the focus group, it was suggested that patients in the low PA group required a longer treatment time and slower recovery. Counting the proportion of key populations in the low PA group and normal PA group, it was found that elderly patients, patients with nutritional risk, patients with sarcopenia, patients with jaundice, and patients with hyperlipoproteinemia were negatively correlated in the low PA group ($p < 0.05$). Sarcopenia, jaundice, and tumor were significantly higher in the low PA group than in the normal PA group.

Conclusions: PA is closely related to the nutritional status and length of stay of abdominal surgery inpatients and can reflect patients’ prognosis and general condition. PA was negatively correlated with age, NRS2002 score, sarcopenia, total bilirubin level, presence of tumors, and length of hospital stay. The lower the PA value, the worse the nutritional status, and malnutrition was strongly associated with poor clinical outcomes and prognosis, with adverse clinical outcomes including functional decline, high morbidity and mortality, and prolonged hospitalization. In surgical patients, preoperative malnutrition was associated with increased postoperative complications, prolonged hospitalization, and increased mortality. The metabolic risk of malnutrition is higher in patients with abdominal tumors, especially those with tumors of the upper gastrointestinal tract and the liver, pancreas, and biliary tract. According to PA values, elderly patients, patients at nutritional risk, patients with sarcopenia, patients with jaundice, and patients with tumors need to be assigned priority attention.

5.3.14. Clinical Study on the Influence of Probiotics on Gut Microbiota in Patients with Gastrointestinal Malignant Tumors
Qiuju Huang
Department of Clinical Nutrition, Liuzhou People’s Hospital, Liuzhou, China

Objective: Malnutrition in tumor patients can increase complications after chemotherapy, reduce quality of life, and increase mortality. Imbalance of gut microbiota plays a role in the development of gastrointestinal malignant tumors. By adjusting the gut microbiota,
the nutritional status of patients can be improved, which has a clear promoting effect on anti-tumor treatment, enhancing treatment compliance, and improving treatment efficiency. Probiotics are a class of beneficial, active microorganisms for the host, which are colonized in the human intestine and reproductive system. They can produce accurate health effects to improve the host’s microecological balance and exert beneficial effects on the intestines. This article aims to explore the impact of probiotics on the gut microbiota microecology of patients with gastrointestinal malignant tumors.

Methods: A randomized controlled trial was used to recruit gastrointestinal malignant tumor chemotherapy patients hospitalized in Liuzhou People’s Hospital from January to March 2023. Here, 160 patients with nutritional risk screening table NRS2002 scores ≥ 3 (suggesting the presence of malnutrition risks) were randomly divided into a control group and an observation group, each with 80 patients. The control group received routine nutritional guidance + placebo treatment, while the observation group received routine nutritional guidance + probiotic treatment. The placebo and probiotic treatment times were 14 days, 2 g/pin, 3 pin/day, and 40 °C warm water was used for administration. The whole process was randomly double-blinded. The indicators of probiotic treatment before and after treatment were compared between the two groups: prealbumin, albumin, hemoglobin, immunoglobulin (IgG, IgA, and IgM), body mass index (BMI), and gut microbiota analysis.

Results: Before the probiotics intervention, there were no significant differences in prealbumin, albumin, hemoglobin, IgG, IgA, IgM, and BMI levels between the two groups (p > 0.05). After 14 days of the probiotics intervention, the prealbumin, albumin, hemoglobin, and IgG levels in the control group decreased significantly compared to before (p < 0.05), while there were no significant differences in IgA and IgM levels and BMI compared to before (p > 0.05). In the observation group, prealbumin, albumin, hemoglobin, IgG, IgA, and IgM levels increased significantly (all p < 0.05), while there was no significant difference in BMI compared to before (p > 0.05). After treatment, the bifidobacteria and lactobacillus counts in the observation group were more than those before treatment (p < 0.05), while the Escherichia coli, enterococcus, and staphylococcus aureus counts were less than those before treatment (p < 0.05), with a higher rod/ball ratio than before treatment (p > 0.05). After treatment, there were no significant differences in bifidobacteria and lactobacillus counts between the two groups (p > 0.05), while Escherichia coli, enterococcus, and staphylococcus aureus counts in the control group were more than those before treatment (p < 0.05), with a lower rod/ball ratio than before treatment (p > 0.05). After treatment, the bifidobacteria and lactobacillus counts in the observation group were more than those in the control group (p < 0.05), while Escherichia coli, enterococcus, and staphylococcus aureus counts were less than those in the control group (p < 0.05), with a higher rod/ball ratio than in the control group (p < 0.05). After treatment, there were no significant differences in butyrate-producing bacteria counts between the two groups (p > 0.05).

Conclusion: Probiotics can improve the nutritional status of patients with gastrointestinal malignant tumors after chemotherapy by improving nutritional and immunological indicators and regulating gut microbiota composition and quantity. This can be used as a key direction for future clinical gastrointestinal tumor prevention work for further research and is worth promoting in clinical practice.

5.3.15. Impact of Preoperative Prehabilitation on Clinical Outcomes of Patients Undergoing Colorectal Cancer Surgery
Kaisi Zhang, Jindong Ma and Qiangpu Chen
Binzhou Medical University Hospital, Binzhou, China

Objective: To investigate the effect of preoperative prehabilitation on the prognosis of patients undergoing colorectal cancer surgery and to evaluate the value of preoperative prehabilitation.

Methods: PubMed, Embase, Cochrane Library, Web of science, Zhiwang, Wipu, and Wanfang databases were searched, and the search period was from the establishment of each database to April 2022. The literature on the effect of preoperative prehabilitation
on patients undergoing surgery for colorectal cancer was collected. Two researchers independently evaluated the quality of the included literature and extracted the literature. A meta-analysis of prognostic indicators (length of stay, incidence of total postoperative complications, incidence of postoperative gastrointestinal dysfunction, and postoperative mortality) was performed using RevMan 5.3 software (Cochrane, London, UK).

Results: A total of 16 papers were included in this study, and the total sample size of the study was 4713 cases, including 1358 cases in the preoperative prehabilitation group and 3355 cases in the control group (no prehabilitation-related measures were taken before surgery). Meta-regression analysis showed that the preoperative prehabilitation group had a shorter hospital stay compared with the control group (WMD = $-0.92$, 95% CI: $-1.81$ to $-0.03$, $p < 0.05$), a lower incidence of total postoperative complications (OR = 0.54, 95% CI: 0.40–0.73, $p < 0.05$), a shorter time to first postoperative venting (WMD = $-0.38$, 95% CI: $-0.63$–$-0.13$, $p < 0.05$), and a lower incidence of postoperative gastrointestinal dysfunction (OR = 0.52, 95% CI: 0.39–0.71, $p < 0.05$), but there was no significant difference in postoperative mortality (OR = 0.2.27, 95% CI: 0.81 to 6.35, $p > 0.05$).

Conclusions: Preoperative prehabilitation reduces the incidence of postoperative complications and postoperative gastrointestinal dysfunction, and the earlier time of first postoperative venting may shorten the length of hospital stay and significantly improve the clinical prognosis of patients undergoing colorectal cancer surgery.

5.3.16. Ratio of Serum n-3 to n-6 Polyunsaturated Fatty Acids and Cardiac Fibrosis in Patients with High Risk of Cardiovascular Disease

Min Qiu $^1$, Shali Hao $^1$, Yingwen Chen $^1$, Xiong Liu $^1$, Jiandi Wu $^2$ and Yuli Huang $^1$

$^1$ Shunde Hospital, Southern Medical University, Guangzhou, China
$^2$ Affiliated Foshan Hospital, Southern Medical University, Foshan, China

Background and Objectives: Omega-3 polyunsaturated fatty acids (n-3 PUFAs), including eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), may decrease the risk of cardiovascular disease (CVD). In contrast, n-6 PUFAs, mainly arachidonic acid (AA), have a pro-inflammatory effect, which may increase the risk of CVD. This study evaluated the associations between EPA, DHA, AA, and their ratios (EPA/AA and DHA/AA) with the level of soluble suppression of tumorigenicity (sST2), a marker of cardiac fibrosis.

Methods and Study Design: Three hundred and thirty-one patients with a high risk of CVD were enrolled. The ultra-performance liquid chromatography–mass spectrometry method was used to detect the levels of serum n-3 PUFAs and n-6 PUFAs. In addition, the level of sST2 was determined by immunofluorescence assay.

Results: The median levels of EPA, DHA, and AA were 0.54, 2.91, and 7.39 $\mu$mol/L, respectively. The levels of AA were positively correlated with DHA ($r = 0.79$, $p < 0.001$) and EPA ($r = 0.53$, $p < 0.001$). In multiple linear regression models, after adjusting for age, sex, smoking, hypertension, diabetes, and history of coronary artery disease, the levels of AA and DHA, but not EPA, were positively associated with the levels of sST2. However, the ratio of EPA/AA was negatively related to the levels of sST2 (4th vs. 1st quartile: $\beta$-value = $-0.21$, 95% CI = $-0.34$ to $-0.09$; or per 10% increment: $\beta$-value = $-0.03$, 95% CI = $-0.05$ to $-0.01$). No association between the ratio of DHA/AA and sST2 was observed.

Conclusions: The levels of AA may increase the risk of cardiac fibrosis, while the ratio of EPA/AA may play a protective effect, which was not observed in DHA/AA. Further studies are needed to explore whether increased dietary intake of EPA can lower the risk of cardiac fibrosis and heart failure.

5.3.17. Research Progress of Insulin Resistance in Nutrition Management of Chronic Diseases

Jinran Yang $^1$ and Yinghua Liu $^2$

$^1$ Chinese PLA Medical School, Beijing, China
$^2$ Chinese PLA General Hospital, Beijing, China
Background and objectives: Insulin resistance (IR) is a pathological state in which target tissues fail to respond normally to insulin. At present, it is believed that IR is the common pathophysiological mechanism of metabolic syndrome. This article reviews the development process of related diseases and nutritional management caused by IR and understands the nutritional management models and characteristics of chronic diseases at home and abroad. The aim is to provide basis and guidance for better prevention and treatment of IR in the future and improve personalized and intelligent nutritional management for chronic disease patients.

Methods: Methods of document retrieval and content analysis were used to sort out and summarize the nutrition management related to IR of chronic diseases at home and abroad in this review.

Results: At present, there are many nutrition management methods for IR of chronic diseases and there are some differences in various management modes. However, the nutrition management is still not perfect. Thus, it is necessary to develop personalized nutrition management measures based on personal diet and living habits to ensure the physical and mental health of patients, which will provide a new perspective to promote the development of nutrition and health. The effective nutritional management mode of chronic diseases is an important way to realize the control of chronic diseases.

Conclusions: In conclusion, we propose that tailored nutritional approaches should represent a promising approach for both the prevention and management of metabolic syndrome. In the future, artificial intelligence technology can be used for personalized management of chronic disease patients and to improve their health levels. We need to strengthen interdisciplinary and cross-regional exchanges to enhance the depth and breadth of research in this field.

5.3.18. All-Trans Retinoic Acid Alleviates Rheumatoid Arthritis by Affecting Th1-Th2 and Th17-Treg Cell Balance and Synovial Angiogenesis

Yiqi Zhang 1, Yanhua Ning 2, Jiangchun Shi 1, Yumeng Xie 1 and Yun Li 1

1 West China School of Public Health and West China Fourth Hospital, Chengdu, China
2 School of Nursing, Ningxia Medical University, Yinchuan, China

Background and objectives: The clinical treatment effect for many rheumatoid arthritis (RA) patients is not ideal, and the toxic side effects of drugs for RA are hard to overcome. It is important to explore new effective measures against RA. The aim of this study was to evaluate whether all-trans retinoic acid (ATRA) can reverse the Th1/Th2 and Th17/Treg imbalance in collagen-induced arthritis (CIA) rats and whether ATRA exerts antiangiogenic effects by inhibiting matrix metalloproteinases (MMPs) and vascular endothelial growth factor (VEGF).

Methods: Collagen-induced arthritis (CIA) rats were treated with 0.50 mg/kg.b.w. ATRA or corn oil vehicle by gavage 3 times a week for 6 weeks. The arthritis index (AI) score was assessed once a week. The levels of serum cytokines and MMPs were tested by ELISA. The Th1, Th2, Th17, and Treg cells were detected by flow cytometry (FCM). The mRNA expressions of T-bet, GATA3, RORγt, and Foxp3 in spleens of rats were analyzed by real-time fluorescence quantitative PCR (qPCR). The qPCR and Western blot (WB) assays were used to test the mRNA expression and protein expression of MMP2, MMP9, and VEGF in the synovium of rats. The microvascular density (MVD) of synovium was tested by immunohistochemical staining (IHC).

Results: Our results showed that ATRA induced CD4+ T cell differentiation by regulating T-bet and Foxp3, restoring the balance of Th1/Th2 and Th17/Treg cells; thus, the expression of the pro-inflammatory cytokines TNF-α, IL-6, and IL-2 was inhibited, and the expression of the anti-inflammatory cytokines IL-4 and IL-10 was promoted, which further alleviated inflammation. In addition, ATRA may inhibit angiogenesis by downregulating MMP2 expression, and further reduce damage to articular cartilage and bone.
Conclusions: The present research revealed a novel mechanism by which ATRA reduces inflammation in joints, providing new evidence for the mechanism of ATRA in the treatment of RA.

5.3.19. Image-Based Meal Rating System for Nutritional Assessment and Counseling: An Exploratory Study in Vietnamese Common Foods

Hung Nguyen Ngoc 1, Anh Nguyen Minh 2, An Le Khanh 3, Linh Luu Khanh 4, Nga Phan Thi Bao 5, Cat Thi Cam Huynh 6, Dan Nguyen Duc 7 and Ngoc Thi Nhu Hoang 8

1 Mahidol University, Nakhon Pathom, Thailand
2 Institute of Preventive Medicine and Public Health, Hanoi Medical University, Hanoi, Vietnam
3 Faculty of Human Ecology, Korea University, Seoul, South Korea
4 Faculty of Public Health, Can Tho University of Medicine and Pharmacy, Can Tho, Vietnam
5 Becamex International Hospital, Binh Duong, Vietnam
6 Faculty of Applied Human Nutrition, Mount Saint Vincent University, Nova Scotia, Canada
7 Faculty of Public Health, Hue University of Medicine and Pharmacy, Thua Thien Hue, Vietnam
8 VN-UK Institute for Research and Executive Education, The University of Danang, Danang, Vietnam

Background: The Image-based Meal Rating System (IMRS) provides individuals with a convenient and intuitive way to assess the nutritional value of their meals, promote healthier eating habits, and make informed dietary choices. Our developed system, known as IMRS, utilizes visual analysis to evaluate the healthfulness of a meal and assigns it a rating on a five-colored star scale.

Methods: IMRS is based on the “Healthy Eating Plate” model and considers visual characteristics such as portion size, color, variety, and composition. It comprises seven components, prioritizing whole grains, protein, and vegetables, while discouraging excessive portions, unhealthy fats, sugar, and sodium. Each criterion has a maximum score of 1 point, and the final score is the sum of individual scores. The score is converted to a 70-point scale by multiplying it by 10, corresponding to a rating of 1 to 5 stars. Validity was assessed by comparing it to the nutrient-rich food index (NRF) score of 6.3. Data for validation were obtained from a published database of images and nutritional composition information for common Vietnamese foods.

Results: In total, 398 popular Vietnamese meals were evaluated, the mean ± standard deviation IMRS score was 33.9 ± 13.1 points, and the mean star number was 2.6 ± 0.9 stars. Salad (45.0 points; 3.6 stars), daily rice (39.2; 2.9), porridge, and soup (38.3; 2.8) were visually evaluated as the healthiest foods, whereas confection (10.0; 1.0), baked cake (17.8; 1.5), and dessert soup (19.0; 1.7) emerged as the less healthy foods. Pearson’s correlation coefficient between the NRF 6.3 and IMRS was r = 0.246 (p < 0.001).

Conclusions: The newly developed image-based meal scoring system shows promise in improving the visual and practical aspects of nutritional assessment and counseling. Further research is needed to integrate this model with artificial intelligence technologies for more effective and user-friendly systems. This advancement has the potential to greatly enhance nutrition management.

5.3.20. Intermittent Fasting as a Nutrition Approach for Weight Management and against Obesity and Metabolic Disease

Zhenlei Lyu 1 and Guotian Lin 2

1 Hainan Vocational University of Science and Technology, Haikou, China
2 University of Sanya, Sanya, China
Obesity and its related diseases pose important global public health, financial, and social issues. Intermittent fasting (IF), as a dietary regulation mode, can reduce weight, reduce oxidative stress, improve cognitive ability, and delay aging. IF has been proposed as a potential nutritional method to combat obesity and metabolic disorder.

The aim of this study is to determine the long-term effectiveness of IF in weight loss and metabolic health and compare the weight loss effects of different dietary patterns during fasting days. We recruited obese and pre-diabetes adults with a fasting lifestyle, and divided them into an obese control group, obesity fasting group, pre-diabetes fasting group, and pre-diabetes control group. There were four groups, with six people in each group. According to the hunger score, the start time and end time of fasting were scientifically set. The average fasting time was 42 h a week. The obese fasting group and the pre-diabetes fasting group were assigned a fasting intervention for six weeks. The control group maintained normal living habits. All volunteers in this study signed informed consent forms.

Research results: After 6 weeks of intervention, all fasting groups lost an average weight of 4.12 kg. The FBG or mean OGTT glucose levels in the fasting group in pre-diabetes participants were significantly lower than those in the control group (p < 0.05). TG, TCHOL, and insulin production index increased in the fasting group, while SBP/DBP decreased in the fasting group. There was no significant change in heart rate and pulse.

Conclusion: As an alternative nutrition method to fight obesity and metabolic disorder, IF has been widely studied. IF can lead to clinically significant weight loss and improve glucose and lipid metabolism. However, adhering to IF may be challenging. Preliminary data indicate that for obese patients with insulin resistance, IF can improve insulin resistance.

5.3.21. Effect of Overweight on Lipocalin and Ultrasensitive C-Reactive Protein after Adipose Meal in Young Adults and Gender Differences

Chenghong Liao 1, Zhihong Zhang 2, Guixiu Zhou 3, Cheng Chen 4, Juan Xiao 1 and Jianfeng Xu 1

1 Fuzhou Medical College, Nanchang University, Nanchang, China
2 School of Public Health, Nanchang University, Nanchang, China
3 Fuzhou Jianqiang Fifth Hospital, Fuzhou, China
4 Fuzhou Second Hospital, Fuzhou, China

Objective: To measure fasting and postprandial lipocalin (APN) and hypersensitive C-reactive protein (hs-CRP) in young people with different body mass index (BMI) values, and to analyze and assess the effects of overweight on postprandial APN and hs-CRP levels in young people, as well as gender differences.

Methods: A total of 113 cases, aged 18.8 ± 1.6 years (18–21 years), 42 males and 71 females, were included. The concentrations of APN and hs-CRP were measured 2 h after fasting and fat meals, and the association between APN and hs-CRP and BMI and gender differences were analyzed.

Results: The fasting and 2 h postprandial APN (mg/L) of 113 young people were 0.98 ± 0.39 and 1.52 ± 0.61, respectively, and the 2 h postprandial APN was higher than the fasting APN level (p < 0.05). As BMI increased, fasting and 2 h postprandial APN decreased, and plasma APN concentrations were similar in men and women in the three BMI groups. There was a negative correlation between BMI and fasting and 2 h postprandial APN (p < 0.05). Fasting and 2 h postprandial hs-CRP (mg/L) were 0.53 ± 0.36 and 0.74 ± 0.57 in the three BMI subgroups, respectively, and 2 h postprandial hs-CRP was higher than fasting hs-CRP levels (p < 0.05). Both fasting and 2 h postprandial hs-CRP concentrations were positively correlated with BMI values (p < 0.05), and both fasting and 2 h postprandial hs-CRP levels gradually increased with increasing BMI. In the subgroup with BMI ≥ 24, fasting and 2 h postprandial hs-CRP were higher in men than in women (p < 0.05). Lipocalin and hs-CRP were negatively correlated (p < 0.05).

Conclusion: A higher BMI is detrimental to postprandial lipocalin secretion, and the adipose postprandial inflammatory response is more severe in young men with overweight
BMI than in women. Overweight and gender are important factors influencing adipose postprandial lipocalin secretion and hs-CRP production in young adults.

5.4. Food and Nutrition

5.4.1. Antioxidant Properties of Ganoderma spp.
Bojie Chen, Yang Liu, Xia Li, and Hock Eng Khoo
College of Chemistry and Bioengineering, Guilin University of Technology, Guilin, China

Ganoderma is a kind of basidiomycetes that can be used as medicine and food. It is necessary to determine the antioxidant properties of different types of Ganoderma. The fruiting bodies of wild and cultivated red Ganoderma lucidum and black G. atrum were separated into canopy and stalk. The bioactive antioxidants of the defatted samples were extracted using absolute methanol for 60 min in a 60 °C water bath, twice. Total flavonoid content and antioxidant activities were determined using spectrophotometric methods. Ash content determination was also performed. The total flavonoid content of all stalk samples was significantly higher than that of the canopy samples, whereas the flavonoid content of the stalk sample of wild red Ganoderma was remarkably lower than the other stalk samples. All canopy samples of the Ganoderma had EC50 values of DPPH radical scavenging higher than the stalk samples, except for the cultivated canopy of black Ganoderma. The higher EC50 values of these Ganoderma samples reflected that they possessed a higher total flavonoid content. The high reducing power was attributed to the high flavonoid content. The reducing power of the cultivated stalk of black Ganoderma was the highest. The ash content was remarkably highest in the wild-type stalk of red Ganoderma because the polyphenolic structures had the highest carbon percentage. The lower flavonoid content of wild-type stalk of red Ganoderma among the stalk samples also showed that it contained other hydrocarbon structures, such as terpenoids, besides fatty acids and flavonoids. Wild and cultivated types of Ganoderma have their uniqueness in terms of antioxidant properties. Flavonoids are concentrated in the stalks of these Ganoderma samples, whereas their canopies could have a higher polysaccharide and saponin content. The ash content analysis revealed that the wild type of Ganoderma had a higher carbon content than cultivated samples.

5.4.2. The Influence of the Dishes Nutrient Index on Food Choice Behavior of Young Consumers
Jili Chen 1, Jinying Yang 2, Sasa Xie 2 and Min Yang 2,3
1 School of Public Health, Zhejiang University, Hangzhou, China
2 Zhejiang University School of Medicine, Hangzhou, China
3 Center of Clinical Big Data and Analytics, The Second Affiliated Hospital, Zhejiang University School of Medicine, Hangzhou, China

Backgrounds and Objective: The objective of this study was to assess the effectiveness of the Dishes Nutrition Index (DNI) as a nutrition label for catering foods in promoting healthier food choice behaviors among young consumers.

Methods: In this randomized controlled experiment, an online questionnaire with a virtual menu was used. Young consumers aged 18–44 years (N = 441) were randomly assigned to either a control group (N = 223) or an experimental group (N = 218), based on the presence or absence of DNI labels. Participants were tasked with identifying the healthiest dishes and rating their willingness to choose each dish using the Likert 11-point subscale. The dishes included three categories: vegetarian, meat, and both. Additionally, subjective influencing factors (emphasis level on nutrition, taste, name, and appearance) and demographic information (gender, age, education level, and BMI) were collected as covariates. The outcome variables encompassed participants’ ability to recognize the healthiest dishes and their willingness to choose the healthy dishes, which reflected participants’ choice behavior toward healthy food.
Results: The study revealed that the DNI label effectively facilitated correct identification of the healthiest dishes among young consumers, in both dishes (OR = 2.55, 95% CI = 1.69–3.89, \( p < 0.001 \)) and vegetarian dishes (OR = 5.26, 95% CI = 2.89–10.12, \( p < 0.001 \)). Additionally, the inclination to select healthier dishes (OR = 1.71, 95% CI = 1.07–2.36, \( p = 0.022 \)) was augmented. Notably, consumers’ priority placed on nutritional value independently influenced their intention to choose healthier dishes (OR = 1.12, 95% CI = 1.02–1.24, \( p = 0.019 \)). Furthermore, variations in the impact of healthy dish choice behavior were discerned across gender and education levels among young consumers.

Conclusion: Serving as an innovative nutrition label for catering food, the DNI label can promote healthier food choice behavior among young consumers. **Keywords:** Dishes Nutrient Index; food choice behavior; young consumers; catering food

5.4.3. Effects of Vitamin K Supplementation on Bone Mineral Density at Different Sites and Bone Metabolism in the Middle-Aged and Elderly Population: A Meta-Analysis of Randomized Controlled Trials and Systematic Review
Chenqi Xie, Haoyu Wang, Hao Zhang, Haoran Chang, and Tianlin Gao
Qingdao University, Qingdao, China

Background and aims: Vitamin K has received attention as an important nutrient with links to bone mineral density (BMD) and bone metabolism. Previous studies remain conflicting and incomplete on this link. This meta-analysis and systematic review aimed to comprehensively investigate the effects of vitamin K supplementation on BMD at different sites and bone metabolism in middle-aged and older adults.

Method: The databases of PubMed, Web of Science, and Cochrane Library were thoroughly searched for literature from the time of construction to October 2022, and RCTs that met the inclusion criteria in this meta-analysis and systematic review were extracted.

Results: This meta-analysis included 17 studies with a total of 4800 participants. The results showed that vitamin K supplementation increased the BMD of the lumbar spine. The overall effect of vitamin K supplementation showed a significant increase in carboxylated osteocalcin (cOC) and the ratio of cOC to ucOC. Accordingly, significant reductions in un-carboxylated osteocalcin (ucOC) and the ratio of ucOC to tOC were found with vitamin K supplementation. However, a pooled effect of vitamin K supplementation revealed no effect on total osteocalcin (tOC). In the subgroup analysis, vitamin K2 significantly increased lumbar spine BMD, cOC, and decreased ucOC, particularly in the subgroup of Asian and female patients. Additionally, vitamin K supplementation significantly increased lumbar spine BMD and decreased ucOC in osteoporotic patients compared to healthy participants.

Conclusion: Vitamin K, especially vitamin K2, had effects on maintaining or increasing lumbar spine BMD and reducing un-carboxylated osteocalcin (ucOC) in Asian women with osteoporosis, while vitamin K reduced the ratio of ucOC to tOC, increased the ratio of carboxylated osteocalcin (cOC) and cOC to ucOC, but had no significant effect on total osteocalcin (tOC). In conclusion, vitamin K has modulating effects on bone density and bone metabolism in middle-aged and elderly populations.

5.4.4. Haizao Yuhu Decoction Alleviates Silicosis by Reducing Inflammatory Factors and Inhibiting the TGF-β/Smad Pathway
Rui Qian, Yuqin Yao, and Xie Linshen
West China School of Public Health, Sichuan University, Chengdu, China

Background and Objectives: Silicosis is a progressive pulmonary disease caused by the deposition of exogenous silica, which induces inflammation and fibrosis. The development of modern Chinese medicine techniques has opened up the possibility of improving silicosis with traditional Chinese medicine. Haizao Yuhu Decoction (HYD), as an ancient formula with a 400-year history, can eliminate inflammation and alleviate nodules. Our study aims to investigate the therapeutic effect and mechanism of HYD on silicosis.
Methods and Study Design: In this study, we analyzed the potential therapeutic targets and involved pathways of HYD in silicosis utilizing network pharmacology. Meanwhile, these crucial molecular targets mentioned above were identified by in vivo and in vitro experiments, and our study completed molecular biology validation, including Western blot, enzyme-linked immunosorbent assay, immunocytochemistry, and so on.

Results: The network pharmacology analysis concluded that the silicosis-related target genes of HYD were enriched in inflammatory factors and fibrosis pathways. Combined with Protein–Protein Interaction (PPI) network analysis, Gene Ontology (GO), and the Kyoto Encyclopedia of Genes and Genomes (KEGG) pathway, related inflammatory factors interleukin-1β (IL-1β), interleukin-6 (IL-6), tumor necrosis factor-α (TNF-α), and transforming growth factor β (TGF-β) were detected. In the silicosis mouse models, HYD obviously improved inflammation and fibrosis in pathologically stained sections, and the concentrations of IL-1β, IL-6, and TGF-β1 were reduced by HYD in the silicosis lung tissue. Meanwhile, HYD showed an inhibitory effect on silicosis via the TGF-β/Smad pathway, manifesting the reduction of protein expression of phosphorylated Smad in both in vivo and in vitro experiments.

Conclusions: These results suggested that HYD has therapeutic potential for silicosis and the mechanism is to reduce inflammatory factor secretion and inhibit the TGF-β/Smad pathway. Our study was expected to provide new insights into the application of clinical application of HYD.

5.4.5. Visualization Analysis in Research Status of Naringin Based on CiteSpace
Mengyu Cai, Biao Gao, Zhou Qicheng, Shi Wenjing, Yicui Qu, Hongxia Li, and Hui Shen
Department of Nutrition and Food Hygiene, Faculty of Naval Medicine, Naval Medical University, Shanghai, China

Objective: To investigate the research progress and hotspots of naringin, this study utilized bibliometrics and CiteSpace software for analysis. The research data were collected from the CNKI (China National Knowledge Infrastructure, China Knowledge Network) database, WOS (Web of Science) database, and WOS core collections.

Methods: A total of 2386 documents from the years 1982 to 2022 were retrieved from the CNKI database. For the WOS database, 2781 documents from the years 1936 to 2022 were retrieved, while the WOS core collections yielded 2157 documents from 1994 to 2022. To assess the level of activity in the field of naringin research, this study created national, institutional, and author collaboration network graphs. These graphs provide insights into the collaborations between different entities involved in naringin research. Furthermore, the study analyzed the development trends of hot topics in naringin research through keyword clustering graphs, keyword time domains, and explosive words. These analyses help identify the main areas of focus and the evolution of research interests over time in the field of naringin.

By employing bibliometrics and CiteSpace software 6.2.R4, this study aims to provide a comprehensive understanding of the research progress and hotspots in naringin research, offering valuable insights for further studies and advancements in the field.

Result: The results of the study indicate that the countries with the highest number of publications on naringin are China, India, and the United States, in that order. Additionally, the countries that made the most significant contributions to the research on naringin were the United States, India, and China.

These findings highlight the active involvement of these countries in the field of naringin research, demonstrating their commitment to advancing knowledge and understanding in this area. The contributions from these countries signify their significant research output and potentially indicate their leading roles in exploring the various aspects of naringin, such as its extraction, characterization, biological activities, and potential applications.

By recognizing the contributions of these countries, it becomes evident that international collaboration and the exchange of research findings are critical for further advance-
ments in the field of naringin research. Continued collaboration and sharing of expertise can lead to a deeper understanding of naringin and its potential benefits in various industries and applications. Lin Li, Chen Dan, Su Weiwei, Ni Hui, and others are prominent leaders in naringin research in China. The journals “Chinese Herbal Medicine” in China and “Food Chemistry” worldwide have the highest number of publications on naringin.

Keyword analysis revealed that Chinese literature research primarily focuses on the extraction process and content determination of naringin. On the other hand, English literature emphasizes the mechanism research of naringin. These findings suggest that there is a divergence in research interests between Chinese and English literature.

The extraction and content determination of naringin, as well as its mechanism, remain significant areas for future research. This indicates a continued focus on understanding the extraction methods, quantification techniques, and biological mechanisms of naringin.

By aligning research efforts toward these areas, researchers can contribute to advancements in the field of naringin research, ultimately expanding our knowledge of its applications and potential benefits.

Conclusion: China still dominates the global landscape. However, the development of research in this field is showing a downward trend, which is not proportional to the contribution rate. This suggests that a significant portion of research content lacks depth and innovation, and the driving force behind the research is weak.

There is a global focus on further exploring the molecular mechanisms underlying the unique biological activity of naringin. In contrast, research on the biological mechanisms of naringin in China is relatively limited.

To address this gap, it is crucial for China to enhance its research efforts in understanding the biological mechanisms of naringin. Despite the significant presence of research institutions and authors, the lack of in-depth and innovative research indicates the need for further knowledge and understanding.

To maintain its position as a leading research country in the field of naringin, China should prioritize conducting more comprehensive studies on the molecular mechanisms that underlie the unique biological activity of naringin. By delving deeper into these mechanisms, China can contribute to the global understanding of the potential benefits and applications of naringin.

Strengthening the driving force behind research in this field is essential. This can be achieved by promoting collaboration between research institutions, encouraging interdisciplinary studies, and providing support and incentives for researchers to conduct innovative and impactful research on naringin.

By investing in further research on the biological mechanisms of naringin, China can contribute to advancements in the field and potentially uncover new therapeutic applications for this compound. This will not only enhance China’s reputation as a research powerhouse but also contribute to global scientific knowledge and potentially benefit various industries, such as pharmaceuticals, nutraceuticals, and functional foods.

5.4.6. Dendrobium Officinale Polysaccharide Prevents Bone Loss in High-Fat Diet-Induced Obese Mice

Xiangyuan Meng, Xinpeng Liu, Yujie Wang, Dan Liu, Qi Xu and Tianlin Gao

School of Public Health, Jilin University, Changchun, China
Institute of Nutrition and Health, Qingdao University, Qingdao, China
School of Public Health, Qingdao University, Qingdao, China

Background and Objective: Obesity triggers persistent inflammation throughout the body, which ultimately results in a reduction in bone mass. Phytochemicals are potential interventions to prevent the loss of bone mass caused by obesity. Our preliminary research indicates that dendrobium officinale polysaccharide (DOP), a phytochemical from *dendrobium officinale*, can reduce body weight in obese mice and ameliorate inflammation. However, it is still unclear whether DOP can mitigate bone loss in obese mice.
Methods and Study Design: Forty male C57BL/6J mice were randomly divided into four groups \((n = 10 \text{ per group})\): control group (CON), high-fat diet group (HFD), lovastatin group (LOV, 5 mg/kg/day), and DOP group (200 mg/kg/day). The experiment lasted for eight weeks, during which micro-CT was used to assess the 3D structure of the femurs and calculate the microstructural parameters, and a three-point bending test was conducted to evaluate the femurs’ biomechanical properties. The levels of biomarkers related to inflammation, bone resorption, bone formation, and bone mineralization in both serum and femurs were measured using ELISA and Western blot analysis.

Results: After establishing the obesity model, the levels of serum TNF-\(\alpha\) and IL-6 in the HFD group were significantly higher than those in the CON group, and impaired trabecula bone microstructure was observed. Mice in the DOP group had reduced serum IL-6 and TNF-\(\alpha\) levels and significantly higher femoral bone mineral density and trabecular bone volume fraction compared to the HFD group. The elasticity modulus in the DOP group was significantly higher than that in the HFD group. Moreover, the serum level of TRACP and PTH and the protein level ratio of OPG/RANKL in the femurs of the DOP group were significantly higher than those in the HFD group.

Conclusion: DOP ameliorated obesity-induced inflammation, reduced bone resorption in obese mice, significantly increased the OPG/RANKL ratio, promoted osteogenesis, and effectively prevented bone loss in high-fat diet-induced obese mice.

5.4.7. Preparation, Application, and Antibacterial Mechanism of Functionalized Antibacterial Nanomaterials Based on Traditional Chinese Medicine
Qian Li \(^1\), Liqun Wang \(^2\), Wenshan Yan \(^1\), Gulimire Aosiman \(^1\), Xiaoru Shi \(^1\) and Yuxin He \(^1\)

\(^1\) Lanzhou University, Lanzhou, China
\(^2\) Lanzhou University Second Hospital, Lanzhou, China

Microorganisms cause infectious diseases that account for nearly one-third of annual global mortalities. Chemical drugs and antimicrobial agents are the primary clinical treatment methods for bacteria diseases. However, it has been shown that many chemical drugs have specific biological toxicity and disrupt normal tissue cells, especially for children. In addition, many pathogens have evolved and resulted in the condition of antimicrobial resistance (AMR). The WHO has declared that AMR is one of the top 10 global public health threats facing humanity. Especially alarming is the rapid global spread of multi- and pan-resistant bacteria (also known as “superbugs”) that cause infections that are not treatable with existing antimicrobial medicines. New antibacterials are urgently needed.

In this work, the traditional Chinese medicine licorice and its boiled residue were used as the precursor to synthesize the extract hydrogel and the carbon dots (CDs) via a “one-step method”. After characterization, it was suggested that the licorice residue extract hydrogel showed obvious antibacterial activity for both Gram-positive and negative bacteria. Furthermore, the antibacterial activity of the N-doped and multifunctional quaternized CDs, which were produced from licorice, were investigated. The unmodified licorice and coffee residue CDs were prepared as the control group, which was also from natural sources. It showed that the quaternized licorice CDs have stronger antibacterial activity for both Gram-positive and negative bacteria, while the coffee residue CDs can only resist the Gram-positive bacteria. However, the N-doped and unmodified licorice CDs showed less antibacterial activity than the coffee residue CDs.

Further research will investigate their antibacterial activity in vitro and study the cytotoxicity and damage to organisms. It is hoped that these functional carbon dots can provide new ideas and strategies for solving antibacterial resistance and development of antibacterial drugs, so as to provide new options against AMR.

5.4.8. Screening and Analysis of Phytochemical Components in Walnut (\(Juglans regia\) L.) with Potential Prevention of Alzheimer’s Disease
Xiaoya Sun \(^{1,2,3}\), Jiawei You \(^{1,2}\), Yafeng Sun \(^{1,2}\), Bing Qi \(^4\) and Su Tian \(^{1,2}\)

\(^1\) School of Public Health, Hebei Medical University, Shijiazhuang, China
Purpose: Alzheimer’s disease (AD) is a neurological disorder that poses a serious threat to the health of the elderly population as a major cause of dementia. This study aims to screen and analyze the potential active components in different extraction phases of walnut methanol extract for their preventive activity against AD.

Methods: Edible parts of walnuts were sequentially extracted with n-hexane, dichloromethane, ethyl acetate, and n-butanol to obtain different extraction phases of walnut methanol extract. The extraction phases with stronger preventive activity against AD were screened through acetylcholinesterase inhibition, β-secretase 1 inhibition, ferric reducing antioxidant power (FRAP), oxygen radical absorbance capacity (ORAC), DPPH, and NO radical scavenging assays. Furthermore, ultra-high-performance liquid chromatography–tandem mass spectrometry (UPLC-MS/MS) was used to analyze and identify the active components in the selected extraction phases, and the content of 10 phenolic compounds in different parts of walnuts was evaluated for their preventive effect against AD.

Results: The extraction yield of walnut methanol extract was 25.5%. The yields of different extraction phases of methanol extract were as follows: n-hexane phase 78.1%, dichloromethane phase 2.3%, ethyl acetate phase 1.4%, n-butanol phase 4.9%, and water phase 5.1%. The ethyl acetate phase exhibited the strongest acetylcholinesterase inhibition activity, slightly lower β-secretase 1 inhibition activity compared to the n-butanol phase, and showed the optimum effects in FRAP, ORAC, DPPH, and NO radical scavenging assays. Further analysis of the ethyl acetate extraction phase with potential preventive activities against AD using UPLC-MS/MS revealed the presence of 54 plant chemical components, including phenolic compounds and fatty acids. Among the phenolic compounds, gallic acid, salicylic acid, ellagic acid, quercetin, catechin, epicatechin, 6-gingerol, pyrogallol, eriodictyol, and methyl ferulate were selected based on their potential preventive effects against AD, combined with the UPLC-MS/MS analysis results and previous literature reports. Activity assays showed that all phenolic compounds exhibited enzyme inhibition and antioxidant activities. Among them, ellagic acid, pyrogallol, ellagic acid, quercetin, and catechin exhibited stronger activities. Pyrogallol had the highest content in walnut seed coat, followed by ellagic acid. Walnut husk was a good source of ellagic acid, gallic acid, catechin, pyrogallol, and methyl ferulate.

Conclusion: The ethyl acetate extraction phase of walnut methanol extract has stronger potential for preventing AD, and the phenolic compounds may be the major contributing factors. Walnut husk contains relatively high levels of phenolic compounds, suggesting the possibility of developing active components for preventing AD from walnut husk and increasing the utilization efficiency of walnut by-products. The higher content of pyrogallol and ellagic acid, which exhibit stronger overall activities, in the walnut seed coat suggests that consuming both the walnut kernel and seed coat together may have better health effects.

5.4.9. The Proportion of DHA and the Ratio of n-6/n-3 PUFAs in DHA-Fortified Eggs Are More Suitable for Chinese Residents to Keep Dietary Balance

Lerong Qi, Yutong Li, and Zhen Wang
School of Public Health, Sun Yat-sen University, Shenzhen, China

Objective: Docosahexaenoic acid (DHA) belongs to n-3 long-chain polyunsaturated fatty acids (n-3 PUFAs), and it plays an important role in the development of the human nervous system and prevention of cardiovascular and cerebrovascular diseases. Eggs, as good carriers of DHA, are affordable and accessible to the general population and could be a good dietary source of DHA. In this study, we aim to measure the fatty acid
(FA) composition, including DHA, in eggs from three different breeding methods with ten brands across China, in order to guide the egg selection in the Chinese diet and provide scientific information for optimizing the dietary reference intakes (DRIs) relevant to functional FA.

Methods: Ten brands of eggs from three categories (four of conventional eggs, three of regional cage-free eggs, and three of DHA-fortified eggs) were selected for FA extraction and methyl esterification. GC-FID was used for FA quantification. Values are expressed as mean ± SD with n = 3 for each brand of eggs.

Result: (1) The proportion of DHA (w/w% of total FA) in DHA-fortified eggs (n = 9) was significantly higher than that in conventional eggs (n = 12) and regional cage-free eggs (n = 9), while the proportion of arachidonic acid (ARA) was significantly lower than the other two categories. (2) There was no significant difference in the proportion of DHA between flaxseed-fed eggs and spirulina-fed eggs, while the proportion of α-linolenic acid (ALA) of flaxseed-fed eggs were higher than spirulina-fed eggs (n = 3). (3) Among 10 brands of eggs (4 conventional eggs, 3 regional cage-free eggs, and 3 DHA-fortified eggs, n = 3 for each brand), the n-6/n-3 PUFAs ratios of DHA-fortified eggs were significantly lower than the others.

Conclusion: (1) In this study, the average n-6/n-3 ratio of three DHA-fortified eggs was 2.30 ± 0.61 (n = 9), which was significantly lower than the non-DHA-fortified eggs (p < 0.05). The recommended ratio in Chinese dietary guidelines is 4–6:1, while in the United States it is 2–3:1. Therefore, DHA-fortified eggs in China are more suitable for the general population to maintain their dietary balance. (2) DHA-fortified eggs are good dietary sources of n-3 PUFA, especially DHA, regardless of egg brands or regions.

5.4.10. Analysis of Heavy Metal Pollution in Rice and Environmental Factors in Nanning City

Jing Zhang 1 and Peng Li 2

1 Nanning Center for Disease Control and Prevention, Nanning, China
2 Guangxi University of Science and Technology, Liuzhou, China

To understand the heavy metal pollution of rice grown locally in Nanning, we analyzed its correlation with environmental factors, and we provide guidance for local food safety policies. Here, 605 rice samples were collected from 15 counties and districts of Nanning City in 2019. The heavy metal pollution in rice was detected and evaluated according to the standard method of GB2762-2017 "Limits of Contaminants in Foods", and its correlations with environmental factors (soil and water) were analyzed. The total heavy metal rate of rice grown in Nanning was 23.30%, among which cadmium was 14.71%, inorganic arsenic was 5.62%, lead was 2.64%, and total mercury was 0.66%. The highest detectable value of cadmium was 1.28 mg/kg. The comprehensive pollution index (Pc) of heavy metals, lead, cadmium, total mercury, and inorganic arsenic, in rice was 0.712, which is still clean. Except for the soil heavy metal content in Long’an, Shanglin, and Mashan, which was higher than the corresponding risk screening value, the heavy metal content in the soil and irrigation water corresponding to rice planting was lower than the corresponding agricultural land pollution risk screening value. The content of heavy metals in the soil and irrigation water and the corresponding heavy metals in rice showed a low degree of linear correlation, and the correlation coefficients were all less than 0.4. There was moderate heavy metal pollution in rice planted in Nanning, especially cadmium pollution. The overall impact of risks caused by environmental factors on the safety and quality of rice was relatively small and within a controllable risk range in Nanning. However, it is still necessary to continue to pay attention to the effect of rice on the environment, especially the accumulation of heavy metals in the soil.

5.4.11. Integrated Network Pharmacology and Cellular Assay for the Investigation of an Anti-NAFLD Effect of Zeaxanthin

Youwei Zhao, Huimin Liu, Meihong Liu, Mingzhu Zheng, and Jingsheng Liu
Jilin Agricultural University, Changchun, China

Background: NAFLD is one of the most prevalent liver diseases in the world. This study uses network pharmacology methods to predict and verify the molecular targets and pathways of ZEA’s resistance to NAFLD and explore the anti-NAFLD effect and mechanism of ZEA. Furthermore, these results were confirmed by molecular docking and cell experiments.

Results: Here, 33 core targets of zeaxanthin targeting NAFLD were identified. Through GO enrichment analysis and KEGG pathway analysis on 33 common targets, it was found that PPARs are the most relevant pathway for ZEA to improve NAFLD. Molecular docking results showed that ZEA and PPARα bind and have good affinity through hydrogen bonds. In vitro, experimental studies have demonstrated that ZEA can activate PPARα, downregulate mRNA expression of Srebp1c and Fas, reduce adipogenesis in HepG2 cells, upregulate mRNA expression of mitochondrial and peroxisome fatty acid oxidation-related factors Cpt1a and Acox1, increase fatty acid oxidation in HepG2 cells, and improve FFA-induced lipid deposition in HepG2 cells.

Conclusion: This study found the potential mechanism of zeaxanthin in improving NAFLD, confirmed the role of zeaxanthin in activating the PPARα pathway in improving NAFLD, and provided evidence for the development of zeaxanthin as a functional food resistant to NAFLD.


Yao Xiong 1, Yan Ma 1, Shuyu Lin 1, Xueneng Lai 1, Kexian Li 1, Tao Chen 1,2 and Zhao Zhang 1,2

1 Guangdong Longsee Biomedical Co., Ltd., Guangzhou, China
2 Guangdong Yi-Yuan Lanxin Biotechnology Co., Ltd., Guangzhou, China

Objective: Oplopanax elatus Nakai (OE) is a perennial woody medicinal plant, distributed only in Changbai Mountain area of Jilin Province, the Far East region of Russia, and the north mountain area of Korea. The root of OE has high medicinal value and no toxic side effects, so it is called “woody ginseng”. However, at present, its wild resources have been seriously destroyed, and the artificial cultivation system is difficult to establish, resulting in the development of its products being greatly limited. Plant tissue culture techniques were used to induce the adventitious root culture of OE, and further extract the effective substances. The extracts obtained are potential food raw materials of “medicine and food homology”, which have the health effects of anti-inflammation, liver protection, and tumor inhibition. This study aims to explore the nutrient composition of the extract of OE and evaluate its antioxidant effect.

Methods: Using an airlift bioreactor, the medium composition was set as MS medium with 3 mg/L of IBA, 50 g/L of sugar, ventilation of 0.1vvm, and the adventitious root proliferation culture was carried out in a dark environment at 25 °C. After 40 days, the adventitious root was harvested and extracted by ethanol and spray drying to obtain the extract. LC-GC/MS was used to detect the metabolites and main functional nutrients of the extracts from the advents of OE. According to the results of nutrient composition analysis, it was suggested that it has many antioxidant components. The scavenging tests of hydroxyl free radical, superoxide anion, ABTS free radical, DPPH free radical, Fe³⁺ reducing activity, and anti-lipid peroxidation were performed to evaluate the antioxidant efficacy of the extracts. The scavenging ability of ROS free radicals was further evaluated by the zebrafish model.

Results: By cultivating adventitious root in a bioreactor, the yield of adventitious root could reach 34.8 g/L. The adventitious root was further extracted by ethanol, and the yield was 40%. The metabolites were detected by LC-GC/MS. The results showed that the main nutrients of the extract of adventitious OE root (AOE) included polysaccharides (29%), flavonoids (22%), volatile oils (6%), polyphenols (2%), saponins (1.5%),
and anthraquinone (1.1%). There were 72 kinds of flavonoids, and the representative components were quercetin, kaempferin, diosmetin, felted camphin, pelargonidin, etc. The volatile oils included nine kinds, and the representative components were palmitic acid, acetic acid, 5-ethyl-5H-furan-2-ketone, etc. Saponins mainly consist of astragaloside IV. The main components of anthraquinone are aloe emodin, rhein, emodin, etc. Further antioxidant test results showed that the DPPH free radical scavenging IC\textsubscript{50} and ABTS\textsuperscript{+} free radical scavenging IC\textsubscript{50} were 29.7 µg/mL and 1.58 mg/mL, respectively. The IC\textsubscript{50} of Fe\textsuperscript{3+} reducing activity was 3.01 mg/mL, but it had no significant scavenging effect on other free radicals (hydroxyl radical, superoxide anion, and anti-lipid peroxidation). The results of the zebrafish model showed that the AOE could significantly reduce ROS in the model fish.

Conclusion: A large amount of adventitious Oplopanax elatus Nakai plant raw materials can be successfully obtained through plant tissue culture, and the nutrients of its extract mainly include polysaccharide, flavonoids, volatile oil, polyphenols, saponins, anthraquinone, etc., rich in many antioxidant components. In addition, the adventitious root of Oplopanax elatus Nakai has a strong reducing ability to DPPH, ABTS\textsuperscript{+}, and Fe\textsuperscript{3+}, which proves that it is a potential new raw material of “homologous medicine and food” with an antioxidant effect.

5.4.13. Effects of Sulforaphane on the Regulation of Calcium Oscillations in Epilepsy via GLUR2

Rui Zhang\textsuperscript{1,2}, PNan Peng\textsuperscript{1,2}, Yanan Gong\textsuperscript{1}, Xianhao Huo\textsuperscript{1,3}, Baocong Yu\textsuperscript{1,3}, Tengwei Gao\textsuperscript{1,2}, Hongzhen Zhou\textsuperscript{1}, Weihong Wang\textsuperscript{4}, Tao Sun\textsuperscript{1,3} and Jianjun Yang\textsuperscript{2}

\textsuperscript{1} Ningxia Key Laboratory of Cerebrocranial Disease, Incubation Base of National Key Laboratory, Yinchuan, China
\textsuperscript{2} School of Public Health and Management, Ningxia Medical University, Yinchuan, China
\textsuperscript{3} Department of Neurosurgery, General Hospital of Ningxia Medical University, Yinchuan, China
\textsuperscript{4} Department of Clinical Nutrition, General Hospital of Ningxia Medical University, Yinchuan, China

Objective: Epilepsy (EP) is a clinical syndrome characterized by highly synchronized discharges of neuronal populations in the brain, caused by various etiologies. Glutamate receptor 2 (GLUR2) plays a critical role in the pathological process of calcium oscillations in the early stage of epilepsy. The plant-derived chemical sulforaphane (SFN) has distinct anti-epileptic effects and potentially regulates GLUR2, but it remains unclear whether SFN exerts anti-epileptic effects by targeting GLUR2. This project aims to investigate the mechanism underlying the neuroprotective effects of SFN on calcium oscillations in the early stage of epilepsy and demonstrate the role of GLUR2.

Methods: (1) In vivo experiments: The lithium–pilocarpine model was used to establish epileptic mice. Nissl staining was used to evaluate the neuroprotective effect of SFN on hippocampal neurons. Immunofluorescence staining was used to detect the expression and synaptic content of GLUR2 in astrocytes. The expression of GLUR2 protein and mRNA in the cerebral cortex of epileptic mice at 2 h after seizure onset was detected by Western blot and RT-PCR. (2) In vitro experiments: Astrocytes were isolated and cultured. GLUR2 was knocked out (KO). The epileptic cell model was induced by glutamate and intervened with SFN. Calcium imaging was used to investigate the effect of SFN on calcium oscillations in the epileptic cell model. The effect of SFN on GLUR2 expression in the epileptic cell model was detected by Western blot, RT-PCR, and immunofluorescence. Immunofluorescence staining was used to detect the expression of GLUR2 in astrocyte colocalization of GLUR2 with PSD-95.

Results: (1) In vivo experiments: Nissl staining showed that SFN alleviated morphological changes of hippocampal CA1 and CA3 neurons induced by epilepsy. Immunofluorescence results exhibited that the SFN intervention increased the co-localization of GLUR2 with GFAP or PSD-95 in hippocampus of epileptic mice. RT-PCR and Western blot results
indicated that the SFN intervention increased the mRNA and protein expression levels of GLUR2 in epileptic mice. (2) In vitro experiments: Calcium imaging showed that SFN decreased calcium oscillation in the epileptic cell model. GLUR2 KO increased calcium levels in all groups of astrocytes, and SFN no longer decreased calcium levels in the epileptic cell model induced by glutamate. Decreased GLUR2 mRNA expression levels were observed in the epileptic cell model, with no significant difference after GLUR2 was knocked out. The SFN intervention increased GLUR2 protein levels in the epileptic cell model, with KO groups showing no pronounced disparity. Immunofluorescence outcomes highlighted that the SFN intervention enhanced the fluorescence intensity of GLUR2 relative to GFAP and PSD95 and increased the number of cells co-expressing GLUR2 with GFAP and PSD95. No statistically significant difference in relative GLUR2 intensity was observed among KO groups.

Conclusion: SFN reduced calcium concentrations in the hippocampal neurons of epileptic mice, demonstrating a neuroprotective role. Simultaneously, SFN mitigated calcium oscillations in the glutamate-induced epileptic cell model. After GLUR2 KO, the SFN intervention no longer alleviated calcium oscillations in the epileptic cell model induced by glutamate, suggesting that SFN exerts its anti-epileptic effects by modulating GLUR2 expression, altering the calcium permeability in astrocytes, and protecting neurons from excitotoxicity induced by epilepsy. This provides a novel research direction for SFN as a potential anti-epileptic drug.

Tong Peng 1, Yuan Deng 2, Shiyou Long 2, Xiaoyu Zhang 2 and Jiang Chen 2
1 Keystonecare Technology Co., Ltd., Chengdu, China
2 Sichuan Normal University, Chengdu, China

Dietary polyphenols are an integral part of many foods and are associated with some beneficial health effects. Even so, dietary polyphenols in the form of prototype compounds have limited bioavailability and hardly enter the circulatory system, which is contradictroy to its good biological activities. Phlorizin is an important component of apple polyphenol to maintain blood glucose homeostasis. Previous studies on fecal excretion kinetics of phlorizin have shown that phlorizin is extensively utilized by gut microbiota in the form of prebiotic-like effects. In this study, the in vitro anaerobic incubation was used to investigate the interaction of phlorizin with microbiota by metabolomics and microbiolomics techniques. The apparent catabolic rate and cumulative metabolic rate were used to compare the catabolic kinetic characteristics of phlorizin and its metabolites from different angles. Besides, we found that about 30% of phlorizin was metabolized and consumed by the gut microbiota, and that Lactobacillus might be involved in the process of producing phloretin by catabolism of phlorizin, Bacteroides might be involved in the process of producing phloretin (3-(4-hydroxyphenyl) propionic acid) by catabolism of phloretin, and Lachnospiraceae might be involved in the process of producing 4-hydroxyphenylacetic acid by catabolism of phloretin. In addition, seven strains belonging to Lactobacillus animalis and Limosilactobacillus reuteri were isolated by selective culture medium, both of which were confirmed to participate in the catabolic process of phlorizin to phloretin. These signatures can be used to define nutritional phenotypes with different kinetic characteristics for the bioconversion capacity for polyphenols. This approach will pave the way for personalization of nutrition based on gut microbial functionality of individuals or populations.

5.5. Nutrition across Lifespan
5.5.1. Current Status and Prevention of Iron Deficiency Anemia in Infants and Young Children
Liangli Li
Shanghai Caimaqianbao Healthcare Management Consultancy Co., Ltd., Shanghai, China
Objective: Infants aged 6~24 months are at high risk of anemia. The incidence of anemia in children aged 6~11 months in China is about 36.6%, and the incidence of anemia in children aged 12~23 months is 28%. Iron-deficiency anemia is the most common type of anemia, which directly affects children’s growth and intellectual development. It occurs due to insufficient iron intake, reduced absorption, increased demand, impaired utilization or excessive loss, etc., resulting in a decrease in hemoglobin synthesis. Paying attention to the iron intake of infants and young children and preventing the occurrence of iron deficiency and iron-deficiency anemia is essential for the health of infants and young children.

Methods: We searched relevant domestic and foreign literature and guidelines, summarizing the risk factors and preventive measures of iron deficiency in infants and young children of different ages.

Result: Children aged 0–24 months are at high risk of anemia.

1. Anemia during pregnancy is a risk factor for anemia in infants aged six months. The anemia rate of pregnant women in China may be 10~40%, and the results vary in different areas. Women should pay attention to balanced nutrition during pregnancy, add 20~50 g of red meat per day in the second and third trimester, and eat animal liver or animal blood 1–2 times a week. According to the iron nutritional status of the obstetric examination, iron supplements can be used for treatment.

2. Full-term healthy infants have sufficient iron stores in their bodies to maintain their growth for four months after birth. The average iron content in breast milk is 0.35 mg/L, which is adequate for the needs of this period.

3. The iron reserves in an infant’s body are gradually exhausted within four months after birth, and breast milk only may not be sufficient to meet the iron needs four to six months after birth. The American Academy of Pediatrics (AAP) recommends that at four months of age, infants who are partially or completely breastfeeding should be supplemented with 1 mg/kg per day of oral iron until appropriate iron-containing complementary foods (e.g., red meat or iron-fortified cereals) are introduced in their diet.

4. The recommended amount of iron per day for 6~12-month-olds is 10 mg, and the quality of complementary foods may play a decisive role in the prevention of anemia. After 4~6 months of age, complementary foods can be added. Red meat, liver, iron-fortified baby cereal, and other iron-rich pureed foods should be first introduced. There is plenty of evidence that the introduction of iron-rich complementary foods at six months of age plays an important role in preventing anemia in infants. Standard formula at six months of age can meet the baby’s iron needs. After 4~6 months, the introduction of iron-containing complementary foods can basically meet the needs of iron.

5. The recommended amount of iron per day for children aged 1~3 years old is 9 mg, and parents should pay attention to red meat, fruits, and vegetables rich in vitamin C, and promote iron absorption. Excessive intake of milk, which is low in iron and can make children feel full and decrease the amount of other iron-rich foods they eat, should be avoided. Drinking around 500 mL of milk per day is acceptable.

Conclusion: Adequate iron intake is essential for intellectual and physical development in infancy and early childhood, and multifaceted efforts are needed to ensure iron intake in infancy and prevent and reduce the incidence of iron deficiency anemia.

5.5.2. Toward Healthy and Active Aging: Physical Activity and Eating Behaviors of Community-Dwelling Older Adults in Klang Valley, Malaysia

Yi Yi Lee 1, Siaw Yuen Tey 1, Li Xinn Chua 1, Li Jia Chia 1 and Khairil Shazmin Kamarudin 2

1 International Medical University, Kuala Lumpur, Malaysia
2 Faculty of Fisheries and Food Science, Universiti Malaysia Terengganu, Kuala Terengganu, Malaysia
Background and objectives: Malaysia is rapidly becoming an aging nation. Regular physical activity is not only important for physical health but also for mental health and well-being. The present study aimed to determine the physical activity behaviors, eating behaviors, and nutritional status among community-dwelling older adults in Klang Valley, Malaysia.

Methods: This cross-sectional study was conducted among more than 200 community-dwelling older adults aged ≥60 years old residing in neighborhoods across urban Kuala Lumpur and Klang Valley (Malaysia). The older adults were recruited by purposive sampling. Weight, height, BMI, body fat percentage, and muscle mass percentage were measured using standard protocols. Self-reported physical activity was assessed using the International Physical Activity Questionnaire (short, last 7 days version), adapted for the elderly. Eating behavior traits were assessed with the Adult Eating Behavior Questionnaire (AEBQ).

Results: About 62.4% of the older adults had low muscle mass for their age. Only 12.9% of the older adults had a high physical activity level, while 23.8% were categorized in the low physical activity level category. Older adults of Chinese ethnicity showed higher physical activity levels (p < 0.05). Results showed weak, negative correlations between physical activity using total MET-mins/week and BMI (r = −0.269, p < 0.001), as well as body fat percentage (r = −0.271; p < 0.001). Muscle mass percentage had a weak, positive correlation with physical activity level (r = 0.222, p < 0.01). Several significant relationships were found between nutritional status indicators with the ‘food approach’ appetitive trait and ‘food avoidance’ appetitive traits.

Conclusions: A large proportion of older adults had low physical activity levels and low muscle mass. With the benefits of physical activity to the health and fitness of older adults being well established, regular moderate-to-vigorous-intensity physical activity and nutrition are important components of lifestyle management to promote healthy and active aging.

5.5.3. Longitudinal Changes of Human Milk Lactoferrin Concentration during the First Year Postpartum—A TAWS Cohort Study

Yang Zhou 1, Yifan Duan 1, Shan Jiang 1, Yuwen Zhang 1, Muxue Liu 2, Xuyang Gu 3, Ying Li 3, Ning Zhang 3, Rulan Jiang 4, Zhenyu Yang 1 and Jianqiang Lai 1

1 National Institute for Nutrition and Health, Chinese Center for Disease Control and Prevention, Beijing, China
2 Karolinska Institutet, Stockholm, Sweden
3 Center for Disease Control and Prevention, Wuqiang County, Hebei Province, China
4 University of California, Davis, CA, USA

Objectives: To explore longitudinal changes in human milk lactoferrin (hLF) concentrations during the first year postpartum and associated factors.

Methods: This was a prospective cohort study, in which 160 dyads of newly delivered healthy mothers and full-term newborns were recruited in Wuqiang, Hebei, China. Milk samples were collected at 0–7 days, 30 ± 3 days, 3 months ± 1 week, 6 months ± 1 week, and 12 months ± 1 week postpartum. Infant feeding practice was evaluated with World Health Organization infant and young child feeding indicators. Characteristics of mothers and infants were collected by using a structured questionnaire. Complete blood count was tested before delivery. Concentrations of hLF were measured using an enzyme-linked immunosorbent assay (ELISA). A linear mixed model was used to examine the longitudinal changes and associated factors.

Results: The concentrations of hLF were 7.17 ± 2.38 g/L, 4.02 ± 1.79 g/L, 2.95 ± 1.54 g/L, 2.19 ± 1.56 g/L, and 2.43 ± 1.65 g/L at 0–7 days, 30 days, 3 months, 6 months, and 12 months postpartum, respectively. LF concentrations decreased during the first six months postpartum (time 0 vs. 1: β = 3.17, p < 0.001; time 1 vs. 3: β = 1.11, p < 0.001; time 3 vs. 6: β = 0.70, p < 0.001). However, it increased between 6 and 12 months postpartum (time 6 vs. 12: β = −0.63, p = 0.004). The frequency of breastfeeding in the
past 24 h was negatively associated with LF concentrations ($\beta = -0.08, p = 0.031$). Prenatal mean corpuscular volume (MCV) and red blood cell volume distribution width (RDW) status may influence the longitudinal changes of human milk LF ($\text{PMCV} \times \text{time} = 0.006, \text{PRDW} \times \text{time} = 0.049$).

Conclusions: The concentrations of hLf decreased during the first 6 months and may increase from 6 to 12 months. This change may be associated with the frequency of breastfeeding in the past 24 h and prenatal MCV and RDW status.

5.5.4. Influence of Short-Term Nutrition Intervention on Physical Fitness Test Indexes of Professional Athletes

Yayi Wang, Ming Yang, and Yunfei Jiang
Sichuan Sport College, Chengdu, China

Objective: Physical fitness tests play an important role in evaluating the training level and physical quality of athletes. The periodic physical fitness test is a powerful index to examine the basic physical fitness of professional athletes and the effect of winter training. This study provides data support for a scientific diet and nutritional supplement to improve physical performance of male Wushu routine athletes through nutritional intervention.

Methods: Experimental group: wushu (15), control group: diving (15). Age: 19.67 +/- 2.91, sex: men. A 14-day experimental period was implemented, with the experimental dietary nutrition and supplement nutrition points: dietary nutrition ratio, relying on the scientific wisdom, restaurant dining, and more nutritional supplements to energy, electrolyte, glycogen reserve supplies, fitness test on that day, dynamic resistance acceleration jelly (38 g), exercise 30 min before eating 1 bag, Odyssey, and glycogen from powder (80 g), eaten before breakfast. The events tested were 30 m (explosive power), 1500 m (aerobic endurance), one-minute double-swing rope jump (flexibility and agility), and planking (core strength).

Results: One-minute double-swing rope skipping: experimental group 87.85 +/- 22.98, control group 48.87 +/- 25.84 ($p < 0.05$), and 30 m test: 4.80 +/- 0.25 in the experimental group and 5.18 +/- 0.28 in the control group ($p < 0.05$). There was no difference in the test results of the 1500 m and plank support tests between the two groups.

Conclusion: A short-term nutrition intervention had significant effect on the performance of explosive power events but had no significant effect on the performance of endurance events.

5.5.5. Infant Formula Enriched with Alpha-Lactalbumin, Osteopontin, and Gangliosides Supports Growth, Gut Health, and Immune Response

Ying Wang 1, Min Liu 2, Tinu Mary Samuel 3, Noura Darwish 4, Qiaoji Li 5, Jodi Bettler 3, Jie Dong 6, Aikaterini Themis Vylioti 4, Karine Vidal 7 and Wei Cai 1

1 Shanghai Institute of Pediatric Research, Shanghai, China
2 Shanghai Public Health Clinical Centre, Shanghai, China
3 Nestle Product Technology Center-Nutrition, Société des Produits Nestlé SA, 1800 Vevey, Switzerland
4 Clinical Research Unit, Société des Produits Nestlé SA, 1000 Lausanne, Switzerland
5 Clinical Research Unit, Société des Produits Nestlé SA, Beijing, China
6 Wyeth Nutrition, Shanghai 200040, China
7 Nestle Research, Société des Produits Nestlé SA, 1000 Lausanne 26, Switzerland

Background and objectives: Bioactive proteins and lipids found in human milk, such as osteopontin and gangliosides, have immune modulatory functions, improve gastrointestinal (GI) tolerance, and may result in functional benefits when added to infant formula. In this prospective intervention study, we tested the feeding tolerance, gut, and immune health of Chinese infants fed on an infant formula with unique whey protein concentrate enriched in $\alpha$-lactalbumin, osteopontin, and gangliosides.

Methods: Predominantly formula-fed (FF) and breastfed (BF) infants were enrolled between 3 and 28 days and assigned to the FF (N = 60) or BF group (N = 60), per their feeding
practice, for 6 weeks. The primary endpoint was the Infant GI Symptom Questionnaire (IGSQ) index score assessed using a validated IGSQ-13 questionnaire after 6 weeks of intervention, and non-inferiority of FF vs. BF was tested. Secondary endpoints included fecal markers of immune response, inflammation, and gut barrier integrity (sIgA, cytokines, calprotectin, and α-1-antitrypsin) assessed using ELISA, stool consistency assessed using a GI diary, anthropometric assessments, physician-reported adverse events (AE), and use of medications.

Results: Baseline infant characteristics (age, sex, and gestational age at birth) were not significantly different between groups. More infants were born by cesarean section in the FF vs. BF group (55% vs. 30%, \( p < 0.05 \)). The IGSQ index score demonstrated good GI tolerance in both groups at week 6 (mean (SD); FF: 19.9 (7.4); BF: 16.8 (4.2); difference of means 1.35 \([−1.312, 4.012]\)). The IGSQ domain scores (spitting up/vomiting, flatulence, crying, fussiness, and stooling), mean stool consistency, fecal marker levels, anthropometric Z-scores, and AE were not significantly different between groups at week 6. Incidence of diarrhea, respiratory tract infections, and antibiotic usage were low overall and not significantly different between groups.

Conclusions: Our data provide evidence on the safety and effectiveness of the unique infant formula in supporting growth, gut barrier integrity, and immune response.

5.5.6. Differences in Gut Microbiota and SCFAs between Allergic and Healthy Children: A Case-Control Study

Jinxing Li, Yapeng Li, Jincheng Zhao, Ruyue Cheng, and Fang He
Sichuan University, Chengdu, China

The hygiene hypothesis suggests that gut microbiota may influence the development of allergy directly or through its metabolites. The present study was conducted to compare the differences in gut microbiota and its metabolites between allergic and healthy children. Here, 95 school-aged children (6~8 years old) were included from our birth cohort. Allergy data and demographic characteristics were derived from parental self-report. Serum immunoglobulin E (IgE), blood routine, and blood biochemical parameters were detected. A total of 91 stool samples from subjects were obtained. Gut microbiota were profiled by 16s rRNA gene sequencing. Short-chain fatty acids were extracted from stool and detected by gas chromatography–mass spectrometry. Here, 36 allergic children and 59 healthy children completed the survey. At the phylum level, Firmicutes, Bacteroidota, and Actinobacteriota were the top three dominant bacteria, with no significant difference between groups. The relative abundance of Verrucomicrobiota and Cyanobacteria in the allergic children was significantly lower than that in the healthy children. At the genus level, Akkermansia in the allergic children were significantly lower than that in the healthy children, and the reverse was found for Subdoligranulum. There were no significant differences in alpha and beta diversity between groups. The content of acetic, propionic, butyric, isobutyric, valeric, and isovaleric acids, serum IgE, and blood indexes showed no significant differences between groups. We observed that the relative abundance of certain gut microbiota might be associated with allergic diseases, although the SCFAs on allergy were not found. The results also suggested that serum IgE might not be the main feature of allergy. Combined with our previous research, the gut microbiota in the early life were more important than in childhood.

5.5.7. Nutrition Issues of General Concern to Pregnancy-Related Personnel in Nutrition Clinics and Accepted Information Dissemination Methods

Xiaolu Yao ¹ and Yingzi Liu ²
¹ Shanghai United Family Hospital, Shanghai, China
² Shanghai Am-Sino Women and Children’s Hospital, Shanghai, China

Objective: Nutrition during pregnancy is a nutrition problem of common concern in society. There is ample scientific evidence that proper nutrition during pregnancy has important immediate and long-term effects on the health of both mother and child.
Nutrition in early life is closely related to the health of children throughout their lives, as well as the health and happiness of the whole family and the health quality of the entire people of the country. However, the growing demand for nutrition and health knowledge of pregnant women, the conflict with the traditional concepts of family elders, and the confusion of excessive information have brought many troubles to pregnant women. Here, we study the most concerned nutrition issues and the most acceptable information methods of pregnant-related personnel, in order to provide them with convenient and scientific nutrition and health knowledge.

Methods: We reviewed the main nutrition concerns of 96 pregnant women in the nutrition clinic from July 2022 to April 2023 and the ways to obtain such information.

Result: More than 85% of pregnant women and their families were concerned about weight gain during pregnancy, hoping to grow without unnecessary weight, but at the same time 65% of pregnant women had no cognition or wrong cognition about the reasonable weight gain range during pregnancy. Here, 48% of pregnant women did not believe that pregnancy weight gain is related to pregnancy complications and pregnancy outcomes. Further, 45% of patients visited the hospital due to complications during pregnancy, among which hyperglycemia and anemia during pregnancy were the main reasons. In this study, 87% of patients could treat hyperglycemia during pregnancy through diet control, but at the same time, most patients and their families generally had misunderstandings about food intake, and insufficient intake is greater than excessive intake, which increases a series of problems, such as ketosis and fetal growth and development restriction. The proportion of visits to the nutrition clinic due to anemia during pregnancy was 30%, among which the awareness of the source of iron in food was improved, which was inseparable from the publicity of obstetricians and mass media. Some anemia patients also had excessive weight gain or hyperglycemia, so it can be seen that more weight gain before pregnancy was not equal to adequate nutrition. In addition, the use of nutritional supplements was also a key focus of their attention. In terms of access to relevant knowledge, people had a high degree of trust in hospital medical staff, especially those they had contact with. In terms of being willing to receive nutrition information, small videos, live Q&A, and popular science articles had the highest acceptance.

Conclusion: Weight gain during pregnancy, nutritional deficiencies, pregnancy complications, and the use of nutritional supplements are common concerns for pregnant women. Excessive pregnancy weight gain is not equal to adequate nutrition, excessive weight gain during pregnancy and insufficient nutrition co-exist. The improvement in public awareness is closely related to the promotion of obstetricians and mass media. In terms of access to relevant knowledge, people have a high degree of trust in hospital medical staff, especially those they have contact with. Small videos, live Q&A, and popular science articles were the most acceptable means of information dissemination for pregnant women and their families.

5.5.8. Assessment of the Effect of Low-FODMAP Recipes Based on the Korean Diet

Yu Jin Lim 1 and Hyunjin Park 2

1 Sookmyung Women’s University, Seoul, Republic of Korea
2 Amazing Food Solution, Inc., Seoul, Republic of Korea

The diagnosis rate of irritable bowel syndrome (IBS) has been continuously increasing over the past five years in Korea. To alleviate IBS symptoms, our research team has developed 83 types of low-FODMAP recipes based on the Korean diet. The assessment of these recipes is scheduled to take place in June 2023 in Seoul, Republic of Korea. The study will recruit 40 adult Koreans with IBS, who will answer a questionnaire to determine the status of their symptoms. Based on the questionnaire, the research team will assess whether the participants meet the criteria to be considered IBS patients. Eligible participants will receive low-FODMAP meals cooked with the developed recipes twice a week. Participants will be required to consume all delivered meals and record any other food intake to track their diet. After six weeks of consuming the low-FODMAP meals, participants will again
complete the questionnaire. By comparing the questionnaire results from baseline to endpoint, the study aims to determine the effect of the newly developed low-FODMAP recipes on IBS. This study is expected to provide evidence that Korean low-FODMAP recipes can help alleviate IBS symptoms among Koreans.

5.5.9. Growth and Sensitivity Conditions of Feeding a Partially Hydrolyzed Formula in Healthy Chinese Toddlers: A Prospective Comparative Study

Lan Liu 1, Haolin Li 2, Anan Yuan 2, Ruichen Wang 1, Yantao Yang 2, Huanling Yu 3 and Haiyan Zhu 4

1 Beijing Nutritionist Association, Beijing, China
2 Nestlé (China) Ltd., Beijing, China
3 Capital Medical University School of Public Health, Beijing, China
4 Capital Medical University affiliated Fuxing Hospital, Beijing, China

Background and Objectives: “Minor sensitivity” describes a series of well-understood symptoms related to gastrointestinal comfort, skin, sleep, and respiratory conditions in children 12–36 months old. While partially hydrolyzed proteins in infant formulas have shown benefits of preventing atopic dermatitis and improving digestive comfort (Wen 2015, Huang 2021), current research lacks data in children aged 12 months onwards. This is the first study to generate growth and health effect data of a partially hydrolyzed formula (pHF) in this population.

Methods: Healthy children aged 48–72 weeks (n = 256) regardless of previous feeding type were partially randomized to receive either pHF or intact protein formula (CMF) for 4 months. The primary outcome is the change in weight-for-age z-scores (WAZ) compared between pHF and CMF groups. Anthropometrics and sensitivity symptoms were collected every four weeks using standardized techniques and questionnaires.

Results: The two groups were similar at baseline in age, birthweight, family history of allergy, and timing of complementary feeding. Compared to CMF, the pHF group had significantly more children with previously diagnosed food allergy or intolerance (6.3% vs. 20%, p = 0.0015) and food-related sensitization or discomfort (16% vs. 39%, p < 0.0001), which was expected, as previous knowledge showed that pHF can be used in the management of cow’s milk allergy and the partially randomized design allowed parents to self-elect their child to continue with pHF when enrolled in the study. Despite differences at baseline, after four months of feeding, pHF demonstrated non-inferiority (margin = −0.5 z score) in supporting age-appropriate growth comparable to CMF, and anthropometric z scores of both groups tracked closely against the WHO standards. The pHF group also showed decreasing sensitivity over the four months of feeding.

Conclusions: These preliminary results demonstrated that pHF can support healthy growth after the first year of life and may provide added benefits in improving signs of “minor sensitivity”.

5.5.10. Acute Autonomic and Cardiovascular Effects of Caffeine Intervention on Inspiratory Muscle Training in Young Men

Zhe Ren and Hao Wu
Capital University of Physical Education and Sports, Beijing, China

Objective: Caffeine is one of the most popular sports nutrition supplements. Inspiratory muscle training (IMT) can improve lung function and increase respiratory muscle strength, thereby weakening the metabolic reflex of respiratory muscles, promoting recovery from respiratory muscle fatigue. However, research on the effects of caffeine on IMT is limited. This study aims to investigate the acute effects of caffeine intervention in inspiratory muscle training on lung function and cardiovascular system in young men.

Methods: In this study, 12 healthy male college students aged 18 to 25 years with no training history were selected for two tests at a sports college in Beijing. Subjects underwent medium-intensity inspiratory muscle training (60% MIP) in both tests, and lung function parameters were measured before and after training, including spirometry, one-second rate,
and maximum inspiratory pressure, as well as cardiovascular system parameters, including heart rate variability and blood pressure. The study was reviewed and approved by the Ethics Committee of the Capital Institute of Physical Education (approval number 2022A57).

Results: There were no significant differences between the pre-training caffeine and placebo groups at baseline levels in terms of basal information, lung function, and cardiovascular system \((p > 0.05)\). Compared to the placebo group, there were significant differences in heart rate variability, heart rate, systolic blood pressure, and maximum inspiratory pressure in the caffeine group after the intervention \((p < 0.05)\), and no significant differences in spirometry, one-second rate, diastolic blood pressure, or blood flow irrigation values \((p > 0.05)\). Further studies are needed to confirm the effects and safety of caffeine on the acute effects of inspiratory muscle training.

Conclusion: The caffeine intervention enhanced the training status in inspiratory muscle training and had a positive acute effect on lung function and the cardiovascular system in healthy male university students.

5.6. Nutrition Education

5.6.1. Analysis on the Awareness Rate of Balanced Diet Knowledge among Residents in Henan Province

Shengsheng Zhou, Han Han, Bing Ye, Pengyu Fu, Shan Li, Pu Yuan, Li Yang, Feng Chao, and Shufang Zhang
Henan Center for Disease Control and Prevention, Zhengzhou, China

Background: The Healthy China Action Plan (2019–2030) clearly states that “balanced diet is the basis of health”. Four of the six core recommendations in the “Chinese Dietary Guidelines 2016” are related to a balanced diet. Objective: This study aims to assess the awareness rate of residents in Henan Province on the balanced diet knowledge based the Chinese DG 2016 and provide data support for the future education of dietary guidelines in Henan Province. Method: Adult people were surveyed with a standard questionnaire (household inquiry) at 14 survey sites in September 2021. The full score is 30 points. If the score is more than or equal to 22.5, it will be determined as “knowing”, and if the score is less than 22.5, it will be determined as “not knowing”. Result: Most of the 4735 respondents had correct understanding of the intake of eight kinds of food, namely, vegetables, fruits, lean meat of fish and poultry, eggs, processed meat products, and sugary food or beverages. However, only 23.5% and 23.8% of the respondents knew that milk and soybean food should be “eaten more”, respectively. About the salt, cooking oil, and added sugar, more than half of the respondents were not clear about the scientific intake amount. Here, 87.1% of the people knew “vegetables for every meal”, 82.9% of the people knew to “eat more dark vegetables, accounting for at least half of the total intake of vegetables”, and 66.5% of the people knew “fruits every day”. Only 25.5% of respondents knew to “eat more than 12 kinds of food every day and more than 25 kinds of food every week”. Conclusion: The overall awareness rate of balanced diet knowledge was 4.79% among Henan Province adult residents, and further research should be carried out about soybean products, dairy products, oil, salt, and added sugar.

5.6.2. Nutritional Evaluation and Effectiveness of Dietary Intervention for Female Rock Climbers

Qi Wei
Hubei Institute of Sport Science, Wuhan, China

Objective: Each sport has completely different body composition requirements, as excess fat mass, or even muscle mass, can be a burden for female rock climbers. Athletes need scientific guidance in their nutritional management and training.

This study investigated the nutritional knowledge, nutritional attitudes, dietary behaviors, dietary intake, and body composition of female rock climbers in Hubei Province before and after a nutritional intervention through the Knowledge, Attitudes, and Behavior
Questionnaire (KAP), dietary surveys, and body composition tests to evaluate the effects of the nutritional intervention.

Method: The body composition of the athletes was measured using the InBody720 body composition tester and the athletes’ blood parameters were measured. The athletes were provided a dietary nutrition intervention by means of nutrition education.

Results: (1) The mean scores on the KAP nutrition questionnaire before the intervention were as follows: general nutrition knowledge $9.13 \pm 1.63$, sports nutrition knowledge $6.13 \pm 1.38$, nutritional attitude $12.63 \pm 3.13$, nutritional behavior $26.38 \pm 3.13$, and the athletes’ total score $54.25 \pm 4.56$. (2) After the intervention, the athletes scored $13.75 \pm 0.375$ on general nutrition knowledge, sports. (3) After the intervention, the athletes scored $9.50 \pm 0.50$ on nutrition knowledge, $19.88 \pm 2.88$ on nutrition attitudes, $39.25 \pm 6.00$ on nutrition behaviors, and $82.38 \pm 8.63$ on the total KAP questionnaire. There were significant differences ($p < 0.05$) in the scores on each section of the KAP nutrition questionnaire and the total score compared to the pre-intervention period. (4) The total energy score of the athletes after the intervention was $82.38 \pm 8.63$.

Conclusion: The study concluded that the 12-week nutrition education intervention significantly improved the nutritional knowledge of rock-climbing athletes and improved their nutritional attitudes and behaviors. Regular monthly body composition testing, combined with the nutrition education intervention, optimized the body composition of the climbers, increased muscle mass, and significantly reduced body fat and body fat percentage, and the nutrition education intervention increased the athletes’ ferritin and hemoglobin levels.

5.6.3. Usability and Acceptability of a Mobile WeChat Assessment Tool to Capture Dietary Fiber Intake Patterns in Chinese Adults

Hao Huang, Zhuolun Hu, Kai Yu, Bernard Berger, Kaori Minehira Castelli, Mo Chen and Fang Huang
Société des Produits Nestlé SA.

Backgrounds and objectives: In Chinese adults, dietary fiber intakes have decreased due to changing dietary habits in past decades. A mobile application with good usability to capture dietary characteristics may help individuals to make healthier dietary decisions. This work aims to test the usability and acceptability of a mobile assessment tool based on a WeChat Mini-Program to capture dietary fiber intake patterns in China.

Methods: A WeChat Mini-Program was developed to characterize dietary fiber intake patterns. The food survey was designed based on 4.9 million self-reported food records from 1.6 million Chinese users through a dietary app from 2018 to 2019 and contained 55 food items from high-fiber-contributing food groups: grains ($n = 9$), vegetables ($n = 23$), legumes ($n = 7$), tubers ($n = 4$), fungus ($n = 3$), and fruits ($n = 7$). In June 2022, usability, measured by the System Usability Scale (SUS, scoring between 0 and 100), was tested in 1000 participants. The completion rate and time were recorded through the WeChat system function. Based on usability test results, the user interface was revised before a pilot launch. Informed consent was gained from all users.

Results: For the usability test, a total of 741 participants logged on to the WeChat Mini-Program and 571 completed the food survey (completion rate = 77%), with an average time of 199 s. The average SUS score was 60.27 ($n = 331$), close to 68, as the acceptability threshold. To enhance usability, the number of screens was reduced by re-organizing food items from food group to frequency. The updated version achieved an improved performance in the pilot launch: 712 out of 800 users opened and completed the food survey (completion rate = 89%), with an average time of 48 s.

Conclusions: Our results showed that a usability test could help enhance completion rates with a shortened completion time for a WeChat assessment tool to capture dietary fiber intake patterns in China.
5.6.4. A Study of the Effect of Telephone Follow-Up on Adherence to Oral Enteral Nutrition Preparations in Patients Undergoing Peri-Chemotherapy after Gastric Cancer Surgery

Rina Wu, Hongbin Yang, Zhongqian Jiang, Fengjiao Sun, and Yuan Zou
Cancer Hospital Affiliated to Harbin Medical University, Harbin, China

Objective: This study aimed to study the effect of a telephone follow-up on the compliance of oral enteral nutrition preparations in patients after gastric cancer surgery in the peri-chemotherapy period.

Methods: A case study was carried out from June to December 2022, and 80 patients were treated in the peri-chemotherapy period after gastric cancer surgery, including patients during intravenous administration and oral administration, and the course of treatment was started at the end of the drug during the peri-chemotherapy period. The random number method was divided into 2 groups, with 40 cases each in the control group and the observation group. The control group was patients who received routine oral enteral nutrition preparations, and the routine guidance process was as follows: patient admission–nurse for nutrition assessment–doctor-prescribed oral enteral nutrition preparation–doctor-prescribed oral enteral nutrition preparation drug–drug delivery ward–nurse checked the drug and issued it to the patient–doctor/dietitian-guided oral method–observation of the patient’s oral enteral nutrition preparation during the hospital stay–patient discharge. The control group was communicated with via WeChat every week to understand their oral condition. The observation group added a telephone follow-up on the basis of the guidance of routine oral enteral nutrition preparations. Through telephone follow-up, we came to understand the status of the oral enteral nutrition preparations of the patients, provided guidance on the method of supplementing oral enteral nutrition preparations again, and provided relevant knowledge to patients who could not supplement on time. The frequency of follow-up was once a week, for a total of three follow-ups. For each follow-up and recording, the data were sorted and analyzed, and individualized guidance was provided. We aimed to assess differences in adherence to oral enteral nutrition between the two groups.

Results: Telephone follow-up helped to grasp the patient’s oral enteral nutrition preparations and the reasons for the failure to routinely perform oral enteral nutrition supplementation. The reasons for failing to take oral enteral nutrition preparations on time included not paying attention to the supplement of oral enteral nutrition preparations, poor taste, more troublesome oral administration, inconvenient purchase, causing physical discomfort after drinking, and affecting eating. During the follow-up visit, it was also learned that patients also require nursing humanistic care in the process of oral enteral nutrition preparations. The report on patient compliance during the follow-up process was as follows: the control group patients were followed up by WeChat every week, and three patients followed the dosage requirements and frequency of oral instructions in the first week, five patients followed the dosage requirements and times orally in the second week, and five patients followed the dosage requirements and frequency of oral instructions in the third week. During the first week of follow-up in the observation group, four patients took oral enteral nutrition preparations daily according to the dosage requirements and frequency of the doctor’s instructions. At the second week of follow-up, 13 patients were able to take oral enteral nutrition preparations daily, as prescribed and as often as prescribed, including the four patients of the first week. At the third week of follow-up, 18 patients were able to take oral enteral nutrition preparations according to the prescribed dose and frequency, including 3 patients from the first week and 9 patients from the second week.

Conclusions: Telephone follow-up can help to accurately understand the reasons why patients cannot standardize oral enteral nutrition supplementation, which can effectively improve the nutrition-related knowledge in patients in the peri-chemotherapy period after gastric cancer surgery, improve the attention of patients to oral enteral nutrition supplementation, and improve the compliance of standardized oral enteral nutrition preparations.
Keywords: follow-up; oral enteral nutrition preparation adherence

5.6.5. Research on Kindergarten Nutrition Education under the Background of 24 Solar Terms
Suchen Zhang and Yating Li
Jingcheng Kindergarten, Lixia District, Jinan, China

Research background: Nutrition is closely related to children’s lives and has important value for children’s healthy growth. Through consulting relevant literature, it is found that nutrition is still in the embryonic stage in the preschool education stage, and there are few practical explorations and studies. At the same time, the 24 solar terms are excellent traditional Chinese culture, which need to be passed on through education.

Purpose of research: Combining the 24 solar terms with nutrition education will be beneficial to cultivate children’s nutrition awareness, healthy eating habits, carry forward the traditional food culture, and enhance children’s cultural confidence.

Research design: We constructed an implementation path of “systematic promotion, segmented implementation, and multiple fusion”, and innovated the 24 + 6 + N nutrition education course model.

Research method: We comprehensively used an observation method and case analysis method.

Results and conclusions: Through the series of nutrition education activities in the kindergarten, we cultivated children’s love for traditional Chinese culture and national pride. Secondly, through nutrition activities, children can understand the relevant nutritional knowledge, and this help children to change their dietary behavior, develop scientific and healthy eating habits, and internalize it into their own life attitude and healthy lifestyle.

Keywords: school nutrition; nutrition education; nutrition under the 24 solar terms

5.7. Precision Nutrition
Personalized Recommendation Method of “Carbohydrate–Protein” Supplement Based on Gradient Boosting Regression Tree and Artificial Bee Colony Algorithm
Xiangyu Wang 1, Tao Wang 2, Wenbin Li 1 and Hao Wu 1
1 Capital University of Physical Education and Sports, Beijing, China
2 Liaocheng University, Liaocheng, China

Consumption of carbohydrate–protein supplements (CPS) is a classic method used by endurance athletes to improve sports performance, increase glycogen replenishment and positive nitrogen balance, and reduce muscle damage. Existing studies provide CPS consumption recommendations based only on a person’s weight. It is important to note that various variables might impact individual nutritional demands, and one-sided index selection cannot accommodate the human body’s diversity. The goal of this work was to develop a tailored CPS intake method for endurance athletes based on individual multiple characteristics, the gradient boosting regression tree (GBRT), and the artificial bee colony (ABC) algorithm. In this study, 171 endurance sports enthusiasts were recruited, and a 1 h rowing race was used as the exercise protocol, where 46 indicators of participants were collected. We investigated previous researchers’ CPS supplementation method, which was to limit the rate of carbohydrate consumption between 0.5 and 1.2 g/kg/h while maintaining a carbohydrate to protein ratio of 4:1. GBRT was used to construct endurance sports performance regression models. After the model was fitted, we selected 23 indicators from the original 45 based on the mean decrease in impurity (MDI) and modeled them again using GBRT, and found that the model’s performance was improved. Finally, we used the ABC algorithm, combined with the effective CPS strategies derived by previous researchers and the fitted GBRT, to provide a personalized CPS intake protocol. This study’s results indicate that it is feasible to use GBRT and ABC to make personalized CPS intake recommendations. Our next studies will focus on increasing the volume of the dataset to iterate, update, and enhance the robustness of the model.
5.8. Public Nutrition and Health

5.8.1. Establishment of a School Meal Nutrition Evaluation Index

Feiyan Wu 1, Sasa Xie 1, Ruixin He 1, Zhihong Wang 2, Hongru Jiang 2 and Min Yang 1

1 School of Public Health, Zhejiang University, Hangzhou, China
2 Institute of Nutrition and Health, Chinese Center for Disease Control and Prevention, Beijing, China

Objective: To address gaps in the evaluation of existing objective standards for school meals, our objective is to formulate a school meal nutrition evaluation index (SMNEI) rooted in the “Nutrition Guidelines for School Meals”, “Dietary Guidelines for Chinese Residents (2022)”, and “Management Standards for Healthy Canteen Construction”. This index aims to assess the quality of school canteen meals within real-world contexts, thereby validating its effectiveness.

Methods: According to the “Nutrition Guidelines for School Meals”, “Dietary Guidelines for Chinese Residents (2022)”, and “Management Standards for Healthy Canteen Construction”, in conjunction with internationally recognized health and nutrition scoring systems for children and adolescents, we devised methodologies for evaluating the nutritional quality of weekly, daily, and individual school meals. After undergoing two rounds of expert consultation, the final iteration of the SMNEI system was established. This index was subsequently employed alongside other suitable dietary indexes for children and adolescents to assess the school meal quality in practical scenarios. A comparison was conducted to ascertain fitting degrees and statistical variances in scores, thereby evaluating the applicative effectiveness of the SMNEI.

Result: The daily-based SMNEI encompasses 3 categories and 17 evaluation indicators. Categories with adequate intake included whole grains and miscellaneous legumes, total vegetable quantity, proportion of dark vegetables, total fruit quantity, soybean and soy product consumption, total milk and dairy product intake, calcium, vitamin A, dietary fiber, and food variety. Categories with moderate intake included cereals and potatoes, total egg quantity, total fish and seafood quantity, and total poultry and meat intake. Categories with restricted intake comprised the proportion of red meat, total cooking oil quantity, total salt quantity, and total added sugar quantity. Additionally, the weekly SMNEI incorporates the total weekly supply of aquatic products and nuts, as well as the weekly supply frequency of bacteria and algae, animal liver, fried food, and smoked and cured meat. For breakfast, lunch, or dinner, SMNEI for each meal primarily relies on nutrient considerations, complemented by food group considerations. The breakfast evaluation involves 11 parameters, whereas lunch and dinner evaluations involve 18. By utilizing the dietary guidelines index tailored for Chinese children and adolescents aged 7 to 17, in conjunction with the SMNEI for school meals, the recipes formulated by a nutritionist and recipes formulated by a non-nutritionist were selected for scoring within actual school settings. The correlation coefficient between the scoring results was 0.69, indicating a moderate correlation, consistent with the line chart trend. Furthermore, the T-value of 0.008 indicated a statistically significant difference.

Conclusion: The outcomes drawn from utilizing the SMNEI to assess existing school meals aligned with the actual situation and could reflect the quality of school meals to a certain extent. Moreover, the scoring system of one meal, one day, and one week can more comprehensively evaluate the current school meal supply situation, providing a certain degree of practical applicability.

5.8.2. Prediction of Hidden Hunger in High School Students Based on Machine Learning

Yang Yang, Ning Zhang, and Yinan Du
Anhui Medical University, Hefei, China

Background and Objectives: Hidden hunger is the presence of multiple micronutrient deficiencies associated with various diseases, such as diabetes, cardiovascular disease, and cancer. According to statistics, more than two billion people worldwide suffer from
hidden hunger, yet there is still a lack of effective prediction methods. Machine learning is a scientific discipline that focuses on how computers learn from data, which has been widely used in the medical field and has achieved satisfactory results. In this study, we aimed to build an accurate model for predicting the risk of hidden hunger among high school students using machine learning algorithms based on the subjects’ demographic characteristics, nutritional awareness levels, and lifestyle habits.

Methods and Study Design: We used a multistage, stratified, whole-group random sampling method to select 9038 high school students in 11 cities of Anhui Province, China, for a questionnaire survey and assessed their risk level by the Hidden Hunger Assessment Scale. Then, we used Random Forest, Support Vector Machine, XGBoost, Deep Learning, and Decision Tree algorithms to build the risk prediction models. Furthermore, we validated the models’ reliability using 587 samples from Bengbu city. In addition, we presented the top ten important factors affecting hidden hunger among high school students based on the obtained prediction model.

Results: Random forests had the most powerful predictive capability among the five algorithms, with AUC = 0.758, sensitivity = 0.743, and specificity = 0.613 in the real external validation set. We found that the frequency of eating fruits, paying attention to nutritional balance in daily life, satisfaction level of the daily diet, level of nutrition awareness, mother’s literacy level, frequency of eating coarse grains, place of origin, and father’s literacy level were the ten most important factors.

Conclusions: We developed an accurate and effective model for predicting the risk of hidden hunger among high school students.

5.8.3. Serum 25-Hydroxy Vitamin D in Thai Children and Its Relation to Ultraviolet Exposure, Vitamin D Intake, and Body Mass Index

Nipa Rojroongwasinkul 1, Nawarat Vongvimetee 1, Thitisan Tepthong 1, Siriporn Tuntipopipat 1, Chawanphat Muangnoi 1, Kemika Praengam 1, Pornpan Sukboon 1 and Ilse Khouw 2

1 Institute of Nutrition, Mahidol University, Nakhon Pathom, Thailand
2 FrieslandCampina, Amersfoort, The Netherlands

Background and objectives: Adequate vitamin D levels in blood improve bone health and may reduce cardiovascular disease, hypertension, type I diabetes, cancer, and infections. Few studies, however, have reported the impact of ultraviolet (UV) exposure on serum 25-hydroxyvitamin D (25(OH)D) production in children. Consequently, this study assessed serum 25(OH)D in Thai primary school children and its relation to UV exposure, dietary vitamin D intake, and body mass index.

Methods: This cross-sectional study was based on results from the Southeast Asian Nutrition Survey II (SEANUTS II), Thailand. Data were collected from 401 children aged 6–12 years from January to December 2020. Serum 25(OH)D levels were assessed by liquid chromatography with tandem mass spectrometry. UV exposure was determined by polysulphone film badges and dietary vitamin D intakes by 24 h dietary recall. Body mass index was also assessed for all children.

Results: The children had a median (P25, P75) serum 25(OH)D level of 76.9 (63.2, 93.1) nmol/L, UV exposure of 0.7 (0.5, 0.9) SED/day, dietary vitamin D intake of 3.6 (2.0, 5.6) µg/day, and a body mass index for age Z-score of −0.0 (−1.0, 1.3). Most children (94.5%) had sufficient vitamin D levels (≥50 nmol/L). After controlling for covariates in multiple linear regression analysis, the results showed that low serum 25(OH)D levels were associated with females, older children, and low UV exposure.

Conclusions: Consistent sun exposure and regular consumption of vitamin-D-rich foods should be promoted among young children to maintain healthy vitamin D levels in the blood.
5.8.4. Demand for Nutritious Lunch and Its Influencing Factors for Medical Personnel in a Hospital in Deyang, China: A Cross-Sectional Study

Yan Zhang, Sisi Ma and Yaodong Li
Deyang People’s Hospital, Deyang, China

Background: A great number of research works have showed that the unhealthy dietary behavior of medical personnel is very prominent. There is an urgent need to provide healthy food for medical personnel to promote their health. This study aimed to investigate the demand of medical personnel in a hospital in Deyang, China, for nutritious lunch and its influencing factors, and to provide reference for the introduction of nutritious lunch.

Methods: This was a cross-sectional survey of medical personnel in a hospital in Deyang, China, using an anonymous online questionnaire via special survey website. The questionnaire consisted of demographic characteristic questions, specific questions on health-related factors, and questions about nutritious lunch requirements. A multivariate logistic regression model was constructed to determine the influencing factors of demand for nutritious lunch.

Results: A total of 458 medical personnel (58 males and 400 females) aged 20–56 years (mean ± SD: 30.84 ± 6.92 years) were included. Of the medical personnel, 14.1% were overweight or obese (BMI ≥ 24 kg/m²). A total of 336 (73.4%) medical personnel indicated they would choose a nutritious lunch if it was offered, and overweight or obese medical personnel preferred to choose a high-fiber and low-fat nutritious lunch ($p = 0.000$), were willing to pay more for a nutritious lunch ($p = 0.004$), and were more likely to refer to the nutrition label ($p = 0.003$). The multivariate logistic regression analysis showed that department, number of meals per day, lunch place, and exercise frequency were significantly associated with the demand for a nutritious lunch among medical personnel.

Conclusion: In China, the medical personnel are facing a great deal of overtime work and generally showing unhealthy dietary behaviors. In our study, medical personnel showed a strong demand for a nutritious lunch. Therefore, there is an urgent need to provide nutritious lunches for medical personnel to promote their health.

5.8.5. Infant and Young Child Feeding Practices in Thai Children Aged 6–23 Months—SEANUTS II Thailand

Nawarat Vongvimete 1, Tippawan Pongcharoen 1, Pattanee Winichagoon 1, Thitisan Thepthong 1, Ilse Khouw 2 and Nipa Rojroongwasinkul 1
1 Mahidol University, Nakhon Pathom, Thailand
2 FrieslandCampina, Amersfoort, The Netherlands

Background and objectives: Infant and young child feeding (IYCF) practices are important for the growth and nutritional status of children under two years old. This study aimed to determine percent compliance regarding IYCF practice indicators among children aged 6 to 23 months, as well as to compare percent compliance among children aged 6–8 months, 9–11 months, and 12–23 months.

Methods: The study comprised 738 Thai children (370 boys and 368 girls) aged 6 to 23 months who participated in the Southeast Asian Nutrition Survey II (SEANUTS II), Thailand. Compliance with key IYCF practice indicators (i.e., ever breastfed, minimum acceptable diet, and other indicators) were computed according to WHO-UNICEF (2021) definitions. The Kruskal–Wallis test and Pearson Chi-Squared test were used to test statistical differences among age groups.

Results: Overall, children aged 6–23 months had a low prevalence of stunting, wasting, underweight, overweight, and obesity, while 95% of children were ever breastfed (EvBF). As for complementary feeding, compliances with minimum dietary diversity (MDD), minimum acceptable diet (MAD), and egg and/or flesh food consumption (EFF) were higher in children aged 6–8 months, 9–11 months, and 12–23 months compared to among children aged 6–8 months (66.9% and 72.1% vs. 35.3%, $p < 0.001$; 61.3% and 67.1% vs. 33.6%, $p < 0.001$; 90.6% and 95.9% vs. 59.7%, $p < 0.001$, respectively). Additionally, the percentage
of vegetable or fruit consumption among children aged 9–11 months and 12–23 months was higher than among children aged 6–8 months (84.5% and 84.9% vs. 66.4%, \( p < 0.001 \)).

Conclusions: The prevalence of EvBF was high in children, while the prevalence of MDD, MAD, EFF, and vegetable or fruit consumption were higher among older children. IYCF indicators can be used as background information for improving children’s diets to optimize their growth and development.

5.8.6. Body Image Perception and Nutritional Status in 10–12-Year-Old Thai Children—Southeast Asian Nutrition Survey II (SEANUTS II) Thailand

Sasiumphai Purtiponthanan 1, Nawarat Vongvimete 1, Thitisan Thepthong 1, Atitada Boonpradeam 1, Ilse Khouw 2 and Nipa Rojroongwasinkul 1

1 Mahidol University, Nakhon Pathom, Thailand
2 FrieslandCampina, Amersfoort, The Netherlands

Background and objectives: Body image reflects a person’s perceptions and feelings about their physical appearance as well as their nutritional status, which can affect children’s health as adults. This study investigated the prevalence of body image dissatisfaction and its association with nutritional status among 10–12-year-old Thai children.

Methods: This study encompassed 540 children (278 boys and 262 girls) who participated in SEANUTS II Thailand. Body image perception was assessed using seven boys or girls figure silhouettes ranging in size from very thin to obese. Children selected the silhouette they believed was most similar to their own and the silhouette they most desired. Discrepancy between the actual figure and the ideal figure represented body image dissatisfaction. Height and weight were measured, and nutritional status was determined using WHO BMI-for-age growth references. The association between body image dissatisfaction and nutritional status was assessed using the Chi-squared test.

Results: The prevalence of body image dissatisfaction was 77.4%. A high percentage of body image dissatisfaction was found among 59.2% of girls and 51.8% of boys who wanted a thinner body figure than their own, while 22.1% of girls and 21.9% of boys wanted a larger body figure. BMI status was significantly associated with body image dissatisfaction \( (p < 0.001) \). Overweight/obese children (>90%) had greater body image dissatisfaction than children of normal weight (69.2%). Body dissatisfaction and desire for a thinner body were more frequent among boys and girls with a higher BMI.

Conclusions: The proportion of children with body image dissatisfaction was high, especially among girls, and associated with sex and nutritional status. Overweight/obese children had a higher proportion of body image dissatisfaction. Programs to promote a healthy weight and healthy eating habits should be implemented among children to prevent eating disorders and other health-related concerns.

5.8.7. Prevalence of Anemia and Iron-Deficiency Anemia in Various Hemoglobin Type Patterns among Thai Children Aged 4–12 Years

Siriporn Tuntipopipat 1, Chawanphat Muangnoi 1, Kemika Praengam 1, Pattanee Winichagoon 1, Nawarat Vongvimete 1, Khaimuk Changsri 2, Nadja Mikulic 3 and Nipa Rojroongwasinkul 1

1 Institute of Nutrition, Mahidol University, Nakhon Pathom, Thailand
2 Faculty of Allied Health Science, Thammasart University, Bangkok, Thailand
3 FrieslandCampina, Amersfoort, The Netherlands

Background and objectives: Globally, hemoglobin (Hb) disorders are common hereditary hemolytic anemias. While anemia and iron-deficiency anemia prevalence have been reported in other Thai age groups, this study provides the prevalence rates of anemia and iron-deficiency anemia (IDA) of various hemoglobin patterns among Thai children aged 4 to 12 years.

Methods: Blood samples were collected from 635 children who participated in the Southeast Asian Nutrition Survey II (SEANUTS II), Thailand. Complete blood count
and serum ferritin, soluble transferrin receptor (sTfR), C-reactive protein, and α-1-acid glycoprotein were analyzed. Hemoglobin typing was performed by electrophoresis.

Results: Participants were classified into eight groups by Hb pattern, mean corpuscular volume, mean corpuscular hemoglobin (Hb), and red cell morphology. Sixty percent of children had Hb disorders, the most common being α-thalassemia 1 trait (20.0%) and Hb E trait (19.2%). Only 2.5% and 2.0% had β-thalassemia trait or Hb E homozygous, respectively. Anemia prevalence was highest in the Hb E homozygous group (69.2%), followed by the β-thalassemia trait (37.5%), α-thalassemia 1 trait (11.8%), and Hb E trait (8.2%) groups, and lowest in the normal Hb type group (1.6%). IDA prevalence determined by ferritin and/or soluble transferrin receptor was significantly higher in the Hb E homozygous (53.8%), β-thalassemia trait (20.0%), and α-thalassemia 1 trait (5.6%) groups compared to the normal Hb type group (0.4%; p < 0.05).

Conclusions: Although homozygous Hb E and β-thalassemia traits are relatively uncommon, they require attention because of the high prevalence of IDA. IDA is not a significant problem in the general population, including normal Hb type, α-thalassemia 1 trait, and Hb E trait. These findings provide valuable insights into anemia and IDA prevalence in different Hb types among Thai children, which can provide valuable guidance for effective treatment.

5.8.8. Nutritional Status and Associated Factors of Vitamin D among Adult Ethnic Minority Groups in Yunnan Province

Nan Zhang 1,2, Qingqing Wan 2, Juanjuan Li 2, Jiang Zhao 2, Yuan Ruan 2, Zhitao Liu 2 and Qiang Zhang 2

1 Dali University, Dali, China
2 Yunnan Center for Disease Control and Prevention, Kunming, China

Objective: This study aimed to assess the nutritional status of vitamin D among adults of six ethnic minority groups native to Yunnan Province and provide evidence for policy making.

Methods: In 2016–2020, 100 adults (≥18 years of age) were randomly selected as survey subjects from 7 Yunnan Province-specific ethnic minorities (Dulong, Jinuo, Jingpo, De’ang, Achang, Brown, and Pumi) according to the age and gender composition of the Sixth National Population Census (male to female ratio 1:1, 40%, 30%, and 30% aged 18–44, 45–59, and 60 years or older, respectively). Among these minority groups, the Dulong and Pumi belong to high-altitude areas, while the Jinuo, Jingpo, De’ang, Achang, and Brown are at low altitudes. In addition, the Dulong, Pumi, and De’ang are at high latitudes, and the remaining several ethnic minorities belong to low-latitude areas. Because the Pumi were carried out in conjunction with other programs, 100 additional respondents were added proportionally, resulting in a final valid sample size of 792. Based on the sample, questionnaires were conducted, and serum 25-hydroxyvitamin D testing was performed using mass spectrometry.

Results: The overall mean level of vitamin D in the investigated population was 27.88 ± 7.59 ng/mL. The distribution of mean vitamin D levels was statistically different between gender, age, education, body mass index (BMI), season, ethnicity, altitude, and latitude (p < 0.05). The prevalence of VD sufficiency, insufficiency, and inadequate was 38.7%, 46.7%, and 14.5%, respectively. The distribution of average VD level among sex, age, season, nationality, altitude, and latitude was statistically different (p < 0.05). Among them, the insufficiency and deficiency rate of women (70.2%) was higher than that of men (52.4%). The older the age, the higher the insufficiency and deficiency rates (69.1%). The normal rate in summer (45.3%) was much higher than that in fall (27.8%), and the insufficiency and deficiency rates of the Dulong (82.0%) and the Pumi (67.1%) were relatively high. Multivariate logistic regression analysis showed that women (OR = 2.375, p < 0.001), autumn (OR = 17.905, p < 0.001), Pumi (OR = 1.049, p = 0.008), and BMI ≥ 28.0 (OR = 2.925, p = 0.021) were more likely to experience vitamin D insufficiency or deficiency.
Conclusion: Vitamin D insufficiency and deficiency are more common among adults of ethnic minorities in Yunnan, and especially women and populations such as the Dulong and Pumi, who live at high latitudes. Therefore, it is urgent to pay more attention to vitamin D nutrition monitoring. It is recommended that local communities, medical institutions, etc., promote health education and guidance to raise adults’ health awareness and guide them to pay attention to their own nutritional status. At the same time, it is also suggested that individuals could extend their outdoor exercise time according to their own conditions, use sunscreen properly, eat a balanced diet, and take compound vitamin D when it is necessary to reduce the rate of vitamin D deficiency.

5.8.9. Independent and Combined Effects of Smoking, Drinking, and Depression on Periodontal Disease

Yanqiu Huang ¹ and Hui Wang ²
¹ School of Medicine, Shanghai Jiao Tong University, Shanghai, China
² School of Public Health, Shanghai Jiao Tong University, Shanghai, China

Background: Periodontitis is a complex chronic inflammatory disease associated with health-related behaviors, such as smoking, excessive drinking, and depression.

Objectives: This research aimed to investigate the independent and combined effects of smoking, drinking, and depression on periodontal disease.

Methods: Data from the National Health and Nutrition Examination Survey (2009–2014) were analyzed in this study. Respondents included in the analysis were ≥30 years old and completed the oral health-periodontal examination, Smoking-Cigarette Use Questionnaire, Alcohol Use Questionnaire, and Patient Health Questionnaire. The logistic regression models were used to analyze the independent effects of smoking, drinking, and depression on periodontitis. The adjusted multiplicative and additive interaction models were established to examine the interaction between influencing factors.

Results: Participants with smoking behavior and depression had 58% higher risk of developing periodontitis than those without, particularly in elderly men. A dose-dependent J-shaped relationship was identified in the association between the drinking–depression interaction and periodontitis. When exposed to depression, heavy drinkers (>56 g/d) had an increased risk of periodontitis (odds ratio (OR): 1.94, 95% confidence interval (CI): 1.05 to 3.58), whereas low drinkers (<14 g/d) had a decreased risk (OR: 0.55, 95% CI: 0.30 to 0.99).

Conclusions: These results suggest that depression has an interactive effect on periodontitis occurrence between smoking and alcohol consumption behaviors. The combined effect of smoking and alcohol consumption significantly elevated the occurrence of periodontitis. Policies aimed at healthy behaviors and mental health may be beneficial for our periodontal health.

5.8.10. Vitamin D3 Enhanced Serum 25(OH)D without Physical Performance in Adolescent Swimmers

Tao Li, Fangfang Yu, Yi Hu, Danyang Yin, and Rengfei Shi
School of Health and Exercise, Shanghai University of Sport, Shanghai, China

Objective: We aimed to investigate the effect of vitamin D supplementation on serum 25(OH)D and muscle strength in adolescent swimming players. Methods: Here, 42 swimmers (n = 42, age = 12.85 ± 2.15) were randomly divided into a vitamin D3 supplementation group (VDG, n = 23) and placebo control group (CG, n = 19). The VDG took 800 IU vitamin D3 drops per day, and the CG supplemented the same dose of corn oil capsules. The experiment lasted for four weeks. Before and after the intervention, the VDG nutritional indicators (serum total 25(OH)D, parathyroid hormone, blood calcium, and blood phosphorus), physical fitness indicators (height, weight, and body composition), and muscle strength indicators (muscle mass, grip strength, back strength, vertical jump, and standing long jump) were measured. Results: (1) After 4 weeks of VD3 supplementation, the VDG serum 25(OH)D concentration was significantly higher than pre-experiment (47.86 ± 10.76 vs. 65.32 ± 14.34, p < 0.01), and the CG was also significantly higher than pre-experiment
(47.26 ± 11.70 vs. 52.20 ± 12.56, p < 0.01). The change in VDG serum 25(OH)D concentration was significantly higher than the CG (4.94 ± 4.15 vs. 17.45 ± 10.12, p < 0.01). (2) The boys and girls back strength increased significantly in both groups (p < 0.05, p < 0.01), and the fat mass of VDG boys was significantly higher than pre-experiment (p < 0.01). The muscle mass and fat mass of CG girls were significantly higher than pre-experiment (p < 0.01, p < 0.05). (3) Boys’ serum 25(OH)D concentration was significantly negatively correlated with parathyroid hormone (r = −0.530, p < 0.01), and significantly positively correlated with grip strength, back strength, and standing long jump (r = 0.333, p = 0.04; r = 0.528, p < 0.01; r = 0.499, p < 0.01). Girls’ serum 25(OH)D was significantly positively correlated with inorganic phosphorus (r = 0.452, p < 0.01), and positively correlated with muscle mass and back strength (r = 0.314, p = 0.05; r = 0.332, p = 0.05). Conclusion: Four-week VD3 supplementation (800 IU/d) can improve the nutritional level of vitamin D in young swimmers. We found that the serum 25(OH)D concentration was positively correlated with the back muscle strength of adolescent swimmers.

5.8.11. Exploration of the Implementation Mode of Population Salt Reduction Interventions—China CDC-Resolve Salt Reduction Program

Yibing Yang, Jinglei Wang and Wenhui Shi
Chinese Center for Disease Control and Prevention, Beijing, China

Background and Objectives: The cooking salt use of Chinese residents has declined, but sodium intake has increased, and salt intake is still much higher than the recommended <5 g per person per day. Salt reduction is a cost-effective chronic disease intervention but there is still a lack of salt reduction intervention modes that are in line with China’s national conditions and can be promoted.

Methods and Study Design: By summarizing the effective salt reduction interventions applicable to key places (communities, enterprises and public institution, schools, canteens/restaurants, supermarkets, etc.) and key populations in these places, based on the SHAKE strategy, the concept of healthy supportive environment construction, and the CHLA platform, the research team developed an intervention implementation mode in each place and carried out pilot application in Hunan and Zhejiang Provinces to evaluate the feasibility and replicability of these interventions.

Results: The “3.2.1 mode” for community salt reduction, “Culture-LAKE mode” for enterprise and public institution salt reduction, “CLASS mode” for school salt reduction, 4S mode for canteens/restaurants salt reduction, and “CNS mode” for supermarket salt reduction were developed. Based on the implementation mode, the salt reduction interventions of communities, enterprises and public institutions, and schools, including advocacy, distribution tools, training and lectures, on-site activity, and other activities, were successfully carried out in eight districts/counts (Wuling, Hanshou, Shigu, and Qiyang in Hunan Province, and Liandu, Yunhe, Luqiao, and Tiantai in Zhejiang Province). Canteens/restaurants and supermarkets salt reduction interventions were carried out in four of the eight districts/counts above. The national team also carried out comprehensive publicity campaigns. A series of technology plans, materials, standardized training courseware, and an association standard, “Behavior guidelines for salt reduction at home”, were developed from this study.

Conclusions: Carrying out population salt reduction measure-based implementation modes for various places was acceptable, and it can provide a basis and reference for national promotion and implementation of salt reduction activities.

5.8.12. Prevalence of Micronutrient Deficiencies, Anemia, and Nutritional Status among Thai Children Aged 4–12 Years—SEANUTS II Thailand

Kemika Praengam 1, Chawanphat Muangnoi 1, Siriporn Tuntipopipat 1, Nawarat Vongvimee 1, Pattanee Winichagoon 1, Ilse Khouw 2 and Nipa Rojroongwasinkul 1

1 Institute of Nutrition, Mahidol University, Nakhon Pathom, Thailand
Background and objectives: Micronutrient deficiencies (MNDs) and anemia can affect child growth and development, as well as other vital physiological functions, and can be present among undernourished children. This study assessed micronutrient status, prevalence of MNDs, and anemia among Thai children aged 4–12 years by their nutritional status.

Methods: Weight and height were measured, and nutritional status was determined using WHO BMI-for-age growth references. Blood samples were collected from 631 children who participated in the Southeast Asian Nutrition Survey II (SEANUTS II), Thailand. Hemoglobin (Hb), biochemical micronutrient status, namely, ferritin, soluble transferrin receptor (sTfR), C-reactive protein, α1-acid glycoprotein, vitamins A, B12, and D, and zinc were assessed.

Results: Overweight/obese children had significantly higher Hb concentrations than normal-weight children ($p < 0.05$), and significantly higher vitamin A concentrations than normal-weight and thin children ($p < 0.05$). In contrast, vitamin B12 concentrations in overweight/obese children were significantly lower than in thin and normal-weight children ($p < 0.05$). While mean ferritin and sTfR were not significantly different among groups, prevalence of all stages of iron deficiency (inclusive of those below the cut-off for ferritin and above the cut-off for sTfR) was highest among overweight/obese children, followed by thin children, and lowest among normal-weight children. However, up to one-fifth of normal weight children had iron deficiency. Deficiencies of vitamins A, D, and B12, and zinc were low, with no significant differences by nutritional status.

Conclusions: The findings suggest that overweight/obese children are at a higher risk of iron deficiency compared to normal-weight and thin children, despite having higher concentrations of Hb and vitamin A. However, the prevalence of other MNDs did not differ significantly by anthropometric status. These results highlight the importance of targeted screening interventions for iron deficiency in overweight/obese children.


Yue Wang $^1$, Lei Jun Wang $^2$ and Hua Liang Li $^1$

$^1$ Marine Biomedicine Center, Tekwon Genetic Technologies Ltd., Xiamen, China

$^2$ Xiamen Dietetic Association, Xiamen, China

Diabetic foot ulcers (DFUs) are the most striking complications of diabetes mellitus. In this case, we report a 63-year-old man who has had type 2 diabetes and liver cirrhosis for many years. The patient presented left DFUs of grade III. He has received standard wound care, including infection control and surgical debridement, from podiatric surgeons in the past three months. Nevertheless, the DFUs were not improved. The patient’s serum albumin (ALB) and prealbumin (PAB) were very low, 22.5 g/L and 110 mg/L, respectively. Total bilirubin (TBIL) was 48.76 µmol/L, indicating the occurrence of hypoalbuminemia, probably due to liver cirrhosis and inflammation. Therefore, optimizing the patient’s nutritional status is an essential part of the wound care. We used Beaulab® SCP marine fish compound peptides, a patent-pending blend of purified short peptides (Average M.W. 500 Dalton, Tekwon Ltd., Xiamen, China), for enteral nutritional support to promote the wound healing process. Results showed that after two weeks of nutritional intervention with 0.4 g/kg/d SCP, the PAB level increased significantly to 230 mg/L. The level of TBIL dropped back to 20.16 µmol/L. Granulation tissue formation was observed in the third week. At the end of the fourth week, the ulcer constriction was obvious. After two months, the patient’s DFUs was nearly completely healed. Previously, we reported that orally administered SCP notably downregulated uncontrolled inflammatory responses and conferred substantial protection from endotoxin-induced acute hepatic damage (Wang et al. J Food Biochem 2021; 45: e13618). Compared with other protein nutrients, the purified compound peptide, SCP, in addition to serving as a more efficient nitrogen source, directly participating in protein


Yue Wang $^1$, Lei Jun Wang $^2$ and Hua Liang Li $^1$

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metabolism, and correcting malnutrition in patients with liver cirrhosis, may also reduce inflammation by modulating immune responses, thereby promoting wound healing.

5.8.14. Dietary Intake Status in Chinese Infants: Findings from Interim Data Analysis in Bone and MicroBiOme Onset (BAMBOO) Study
Dantong Wang 1, Jing Wang 2, Qiangrong Zhai 3, Guohong Zhang 3,4, Qiaoji Li 5 and Yumei Zhang 6

1 Nestlé Institute of Health Sciences, Nestlé Research, Lausanne, Switzerland
2 Tianjin Women’s and Children’s Health Center, Tianjin, China
3 BGI-Shenzhen, Shenzhen, China
4 Shenzhen Engineering Laboratory for Birth Defects Screening, Shenzhen, China
5 Clinical Research Unit, Nestlé Research, Lausanne, Switzerland
6 Beijing University, Beijing, China

Background and objectives: The Bone and MicroBiOme Onset (BAMBOO) study is an ongoing observational cohort study conducted in Tianjin, China, aiming to determine age-appropriate trajectories for microbiome maturation and bone development from 0 to 3 years, and to identify the influence of dietary factors on these processes. This analysis was performed to assess dietary intakes of infants aged 0–12 m using a subset of data.

Methods: Infants who met the inclusion criteria were invited to join the study at Tianjin Women and Children’s Health Center. The participants were recruited into two groups. Subjects in groups 1 and 2 were recruited at birth and 6 months and were followed up at 12 and 36 months, respectively. The recruitment started in September 2021 and was completed in February 2023. In total, 1380 children were recruited, 690 in each group. Dietary intake information was collected through a three-day food diary starting from four months of age. Nutrient intakes were calculated using the Chinese Food Composition database, complemented by pack labels and literature reviews.

Results: Dietary intake data of the first 100 subjects recruited in each group were analyzed. We found that the prevalence of exclusive breastfeeding was 60% at 4 months and decreased to 15% at 6 months. Eighty percent of 6-month-old infants consumed complementary foods, with an average age of introduction at 5.4 months. Compared to the recommendations, the percentages of infants with excessive vitamin A intake were high, especially in infants aged 9–12 months (70%), whereas the intakes of iron and zinc were low among infants aged 6–12 months.

Conclusions: Results from interim data analysis showed an excessive intake of vitamin A and low intakes of iron and zinc compared to the recommendations, especially in children aged 6–12 months, which coincided with the introduction of complementary foods. Consistent with previous observations, these findings underscore the importance of nutritional education and guidance in the weaning process.

5.8.15. Development of a Food Logging and Nutrition Assessment Approach for a Dietary App Targeting Adults in China
Kai Yu 1, Fang Huang 1, Jian Zhang 1, Antonio De Castro 2, Ye Sun 2, Jing Yin 1, Roko Plestina 3 and Fabio Mainardi 3

1 Nestlé Research, Beijing, China
2 Nestlé Research, Singapore, Singapore
3 Nestlé Research, Lausanne, Switzerland

Backgrounds and objectives: Dietary mobile applications (apps) collect dietary information to be able to generate personalized dietary recommendations. Compared to 24 h dietary recall and food frequency questionnaires, the dietary diversity indicator (DDI) may better fit consumer usage based on its simplicity compared to other food quality indicators involving collection of complex quantitative information. This study aims to develop a DDI, fit for a consumer-grade dietary app targeting Chinese adults.
Methods: A DDI composed of 12 food groups was developed according to the dietary diversity principle in the Chinese Dietary Guideline. Dietary data from the China Health and Nutrition Survey (CHNS) 2009 and 2011 were analyzed to identify common consumed foods and explore associations between DDI with nutrient intake adequacy for 21 nutrients. A DDI considering both number of food groups and allocated weights to each food group according to nutrient contribution was subsequently developed to estimate the probability of nutrient inadequacy based on dietary diversity.

Results: A total of 70,609 dietary records from 2 waves of CHNS were included. Defined as consumed by 1% or above in the dietary recalls, 943 commonly consumed foods were identified and categorized into 12 food groups. To reach nutrient adequacy for the 21 nutrients (protein, vitamin A, thiamin, riboflavin, niacin, folate, vitamin B6, vitamin B12, biotin, choline, vitamin C, calcium, phosphorus, potassium, magnesium, iron, zinc, selenium, carbohydrates, fiber, and phytosterol), the minimal number of food groups consumed was 8 (out of 12), with the contribution of each food group specified. The Pearson’s correlation between the developed DDI score and the actual nutrient adequacy was higher than 0.5 for 16 of the 21 nutrients assessed.

Conclusions: The simplicity of the DDI approach and its reasonable correlation with the probability of nutrient adequacy render it a promising user-friendly solution for a dietary app in China.

5.8.16. Changing Food Consumption Patterns and Macronutrient Intakes in ASEAN Region
Shweta Singh 1, Marie Tassy 2, Lynda O’Neill 2 and Tsz Ning Mak 1
1 Nestle Research, Singapore
2 Department of Nutrition Sciences, Nestle Institute of Health Sciences, Nestle Research, Lausanne, Switzerland

Background and Objectives: Most ASEAN countries continue to face a double burden of malnutrition with a growing prevalence of overweight and obesity, alongside key nutrient deficiencies and inadequacies. Economic growth and urbanization have contributed to nutrition transitions across the region. The aim of this study is to review the dietary patterns among general adult populations in the ASEAN region, with a focus on macronutrient quality.

Methods and Study Design: ASEAN countries, Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam, were included in this study. Dietary intake information, including food consumption data and macronutrient intakes, were extracted from nationally representative nutrition survey reports and publications, including policy documents and journal articles, in English, from 2000 to 2021 (latest survey).

Results: Chronic energy deficiency is prevalent in Vietnam, Philippines, Indonesia, and Cambodia, with more females being energy-deficient than males. While staple foods such as rice still provide the majority of calories in the diet, there is a shift toward lower carbohydrate consumption and higher fat and protein, specifically animal protein, in Singapore, Malaysia, Brunei, Indonesia, Thailand, and Vietnam. Fish, meat, and eggs are the main sources of protein intake, while total fat consumption (vegetable oils and animal fat) has shown a steady increase across the region over time. Polyunsaturated fatty acids and omega 3 consumption fall short of the global average, except for in Singapore and Malaysia, and high intake of added sugars and salt, and low consumption of dietary fiber, are common in all countries.

Conclusions: This study highlighted key dietary shifts among ASEAN countries, from diets high in carbohydrates to increased animal proteins and fats, indicating a deviation from traditional diets. Further research is needed to explore ways to achieve balanced diets despite such shifts, taking into account factors such as socioeconomic, affordability, and dietary preferences.
5.8.17. The Effects of a Formulated High-Protein Nutritional Shake Meal Replacement on Weight Management in Overweight Women

Qisijing Liu 1,†, Yi Guo 2,†, Bo Peng 1, Dancai Fan 1, Jing Wu 1, Jin Wang 1, Ruican Wang 1, Chixuan Yao 1, Jing-Min Liu 1, Jian Wu 2, Shuo Wang 1,*, Yanrong Zhao 2,*

1 Tianjin Key Laboratory of Food Science and Health, School of Medicine, Nankai University, Tianjin, China
2 Shanghai M-Action Health Technology Co., Ltd., Shanghai, China
*
Correspondence: wangshuo@nankai.edu.cn (S.W.); zhaoyanrong@mengniu.cn (Y.Z.)
† These two authors contributed equally to this work.

Objective: With the growth of China’s economy, the nutritional issues have shifted from malnutrition to over-nutrition and unhealthy dietary structure (high energy density and insufficient intake of protein and micronutrients). Additionally, the level of physical activity in adults has significantly decreased. Consequently, the prevalence of overweight, obesity, and chronic diseases continues to rise. Interventions for overweight and obesity are urgently needed. Currently, there are a variety of methods for weight control: (1) surgical and pharmacological interventions, which are effective but come with risks of complications and side effects; (2) dieting, which can lead to nutritional deficiencies and weight regain; (3) nutritional meal planning for weight loss, which can be tedious and difficult to adhere to in modern busy lives. Therefore, this study aims to evaluate the impact of a formulated high-protein nutritional shake in conjunction with aerobic exercise for overweight female adults, providing a new, convenient, highly compliant, and effective weight loss method for those in need of weight control.

Methods: This study was conducted at the Nankai University-M-Action Joint Laboratory. A total of 40 physically inactive women with an age range of 18–40 years, a body mass index (BMI) within the range of 24–28 kg/m², or body fat percentage ≥27%, and no chronic health conditions were selected using the InBody 260 body composition analyzer. Participants were randomly divided into the meal replacement combined with aerobic exercise group (MR group) and the aerobic exercise group (control group). Both groups were told to follow a calorie-restriction diet, while participating in a 40-min aerobic workout session 3 times weekly. The MR group consumed a high-protein nutritional shake after the workout, replacing dinner, whereas the control group consumed habitual dinner. Body composition and hematological and urinary markers were measured pre/post-intervention.

Results: At baseline, there were no significant differences in body circumferences and body composition parameters between the control and MR groups. After 3 weeks of intervention, the control group showed a significant reduction of 1.3 cm in waist circumference ($p<0.05$), while the MR group had a significant reduction of 2.4 cm ($p<0.05$). In terms of weight, the control group showed a significant decrease of 0.57 kg ($p<0.05$), while the MR group had a significant decrease of 2.36 kg ($p<0.05$), and this difference between the two groups was statistically significant ($p<0.05$). Body fat mass decreased significantly in both groups, with a reduction of 0.94 kg ($p<0.05$) in the control group and 1.33 kg ($p<0.05$) in the MR group. Fat mass in various body segments significantly decreased in both the control and MR groups, but no significant differences were found between the two groups.

Conclusion: For short-term weight reduction, the method of using a formulated high-protein nutritional shake in conjunction with aerobic exercise was more effective than aerobic exercise alone. The approach of incorporating three sessions of aerobic exercise per week along with a high-protein nutritional shake for dinner is easy to implement, highly compliant, and helps overweight women to control their weight more efficiently and achieve their weight loss goals. However, further research is needed to assess the long-term effects of this intervention and its impact on weight maintenance after the intervention period.

Keywords: high protein; meal replacement; aerobic exercise; weight loss; weight management; exercise nutrition
5.8.18. Complex Prebiotic Intervention Alters Gut Microbiota and Inflammatory Status in Colorectal Adenoma Patients
Sijia Meng, Dan Wang, Jing Zhao, Yu Wang, Mei Zhi Du and Yun Zhu
Tianjin Medical University, Tianjin, China

Objective: This study aimed to assess the impact of a complex prebiotic formulation containing oligogalactose (GOS), oligofructose (FOS), and oligoisomaltose (IMO; 9:1:1 ratio) on the intestinal microbiota and inflammation levels in colorectal adenoma patients.

Methods: A randomized, double-blind, placebo-controlled trial assigned patients with adenomatous polyps to either the intervention group (N = 51) or the control group (N = 49). The intervention group received a daily dose of composite prebiotics (GOS/FOS/IMO) totaling 7.0 g for 12 weeks, while the control group received a placebo. Blood and stool samples were collected at baseline and week 12, and 16S ribosomal DNA sequencing was performed using the Illumina HiSeq platform. Mixed-effects models were used to analyze the impact of the prebiotic on gut microbiota and inflammatory markers.

Results: Over 12 weeks, the intervention group showed a slower increase in Bacteroidetes abundance compared to the control group (β = −0.056; 95% CI: −0.086 to 0.025). The intervention group exhibited increases in Bifidobacteriaceae (β = 0.022; 95% CI: 0.009 to 0.035), Unidentified_Clostridiales (β = 0.009; 95% CI: 0.004 to 0.015), Unidentified_Ruminococcaceae (β = 0.021; 95% CI: 0.010 to 0.032), and Bifidobacterium (β = 0.022; 95% CI: 0.009 to 0.035), while the control group experienced decreases. Furthermore, the intervention group demonstrated a significant reduction in interleukin 10 (IL-10) levels over the 12-week period (β = 0.752; 95% CI: 0.428 to 1.077), whereas the control group showed increasing levels (p = 0.023).

Conclusions: The comprehensive prebiotic intervention effectively increased the abundance of beneficial bacteria, such as Bifidobacteriaceae, and reduced inflammatory biomarkers in colorectal adenoma patients. If other trials were to replicate these findings, they would offer substantial support for incorporating the targeted prebiotic formulation as an adjunct therapeutic approach for colorectal adenoma patients. Further research is warranted to explore the long-term effects of prebiotic interventions on the progression of colorectal adenoma and the overall health outcomes of patients.

5.9. Other Areas
Hazard Assessment of Pyrrolizidine Alkaloids
Jinyao Chen 1, Huihui Bao 2 and Xiaomeng Li 1

1 Food Safety Monitoring and Risk Assessment Key Laboratory of Sichuan Province, West China School of Public Health/West China Fourth Hospital, Sichuan University, Chengdu, China
2 China National Center for Food Safety Risk Assessment, Beijing, China

Pyrrolizidine alkaloids (PAs) are toxins synthesized by plants and are typical secondary metabolites of plants. They mainly exist in angiosperms and have a wide variety of chemical structures. Pyrrolizidine alkaloid nitrogen oxides (PA-N-oxide, PANO) are the main forms found in plant tissues. Many PAs often appear in the form of nitrogen oxides and tertiary base PAs. At present, there are about 600 different PA structures known, which can be divided into 6 different subclasses: senecionine-type, lycopsamine-type, monocrotaline-type, triangularine-type, parsonsine-type, and phalaenopsine-type. Among them, senecionine-type is the most important and diverse category.

PAs are common in Chinese herbal medicines. In recent years, they have been frequently found in honey and bee pollen foods, and PA pollution has also been repeatedly found in retail salads and livestock feed. However, the harm of PAs to human health has not attracted widespread attention in China, and no systematic hazard assessment has been carried out in China. In this paper, the toxicokinetics, acute toxicity, repeated-dose toxicity, reproductive and developmental toxicity, carcinogenicity, and other aspects of
pyrrolizidine alkaloids were evaluated by systematic review, in order to provide reference for the next risk assessment.

In this paper, the hazard assessment was carried out from the aspects of toxicokinetics and toxicity of PAs. The search strategies were as follows: ‘PA’ and ‘pyrrolizidine alkaloids’ were used as keywords to conduct systematic search in PubMed, Embase, CNKI, and Wanfang databases. The search period was from the database collection date to October 2022. Inclusion criteria included PA toxicokinetics study, acute toxicity, repeated-dose toxicity, reproductive and developmental toxicity, genotoxicity, carcinogenicity, and other toxicity studies, as well as Chinese and English studies in vivo and in vitro. Exclusion criteria included papers with no full text and repetitive research.

The toxicokinetic study of pyrrolizidine alkaloids found that 1,2-unsaturated PAs can be rapidly absorbed by the digestive tract and then distributed throughout the body. The three main pathways revealed by PAs metabolism studies were detoxification or production of active pyrroles (DHP and corresponding esters), which are considered to be the mechanism by which 1,2-unsaturated PAs exert toxicity through their potential as protein and DNA alkylating agents. The detoxification/activation balance is considered to be the reason for the different species- and gender-specific sensitivity to 1,2-unsaturated PAs toxicity. The acute toxicity of different PAs was significantly different, and the difference in toxicity was consistent with the toxicokinetic characteristics of different PAs. The difference in toxicity between oral and intraperitoneal injection could be attributed to the process of intestinal flora-mediated N-oxide reduction to parent PA. The repeated-dose toxicity of PAs has not been systematically studied. Among the studied 1,2-unsaturated PAs’ toxicity to experimental animals, the most significant was hepatotoxicity. The developmental toxicity of PAs mainly occurs during parenteral administration, and it is difficult to confirm whether this effect is related to maternal toxicity. Many in vivo and in vitro experiments have studied the genotoxicity of PAs. It is now believed that the metabolic activation from PAs to pyrrole esters and further DNA adducts are the key reactions leading to genotoxicity. The mutagenicity of PAs has been clearly demonstrated in bacteria, fruit flies, and rodents, but the reported results suggest that the mutagenicity of PAs is not completely consistent. The main carcinogenic target of PAs in the experimental system is the liver. At present, there is no human epidemiological data on the carcinogenic effect of PA. Riddelliine and pilocarpine have the most research data, and both have been tested for carcinogenicity of NTP.

The toxic effects of PAs on experimental animals can be found whether through oral or intraperitoneal injection. In addition, PA has a variety of toxicity and mainly causes liver cancer. However, there are few epidemiological studies on the population, and the toxicity mechanism of PAs is not clear.

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