This document contains the following presentations (update Dec 10)

Chair’s introduction to the session and subtheme Nutrition and Food

Senior Advisor Helli Kitinoja; Seinäjoki University of Applied Science
Research activities in the fields of Nutrition and health and Food safety

Researcher Ying Gao; Zhejiang University, Department of Sports Science
Physical activity and health in Chinese children

Assistant Professor Ying Zheng; Zhejiang A&F University, Food and Health College Research Progress of Food and Herbal Medicine in Zhejiang A&F University

Researcher Qinxue Ni; Zhejiang A&F University, Food and Health College
Intensive Processing and Industrialization Application of Gardenia jasminoides Ellis- A Traditional Chinese Medicinal Food

PHD Hongzhen Wang; Zhejiang A&F University, School of Food and Health
Secondary metabolites engineering of medicinal plant

Associate professor Kirsi Laitinen, University of Turku, Institute of Biomedicine, Faculty of Medicine; Early Nutrition and Health - research group

University teacher Marika Kalpio; University of Turku, Department of Life Technologies / Food Chemistry and Food Development
Method for analyzing chiral triacylglycerols (TAGs) in nutritionally important lipids

Professor Baoru Yang; University of Turku, Food Chemistry and Food Development Unit
Lipids in Infant Nutrition

Professor Qing Gu; Zhejiang Gongshang University, Food Microbiology
Probiotics and Human Health

Researcher Zhan Ye; Jiangnan University, School of Food Science and Technology
Dietary lipid gastrointestinal digestion and enteral health

Research fellow, Associated Professor Lina Zhang; Jiangnan University
Digestibility and allergenicity of milk proteins

Researcher Jie Zheng; Jinan University, Department of Food Science and Engineering: Interactions between amino acids and polyphenols with reactive aldehydes in foods

Project Researcher Kaile Kubota University of Turku, Department of Nursing Science
AI-driven Gamified Intervention and Intelligent Intervention Support Module to Foster the Health Equity of Children - Nutrition Project (HEAL-nutrition)

Professor Yumei Zhang; Peking University, School of Public Health; Food active ingredients, Nutrition & Health
Finland-China Food and Health Network (2021-2024)
Finland – China Food and Health Network

Long term goals:

➢ To enhance cooperation between Finnish and Chinese HEIs
➢ To build up a unique platform for multidisciplinary research and academia-industrial collaboration
➢ To generate top level science and innovation with strong impact
➢ To support business partnerships between Finland and China
➢ To enhance awareness and branding of Finland and China to enhance mobility of experts between the two countries
Finland – China Food and Health Network

- Joint research
- Sustainable food system
- Doctoral supervision
- Education cooperation & export
- Education exchange
- Nutrition, health effects of food
- Food & health technologies
- Seminars
- Industrial collaboration

UNIVERSITY OF TURKU
Participating Finnish Institutions

- University of Turku (coordinator)
- University of Helsinki
- University of Eastern Finland
- University of Oulu
- Tampere University
- University of Vaasa
- Åbo Akademi University

Universities of Applied Sciences:
- Seinäjoki
- Centria
- Laurea
- Häme
- Savonia
- Jyväskylä
- LAB
- Satakunta

- Tampere
- Lapland
- Vaasa
- Kajaani
- Karelia
Action plan for 2021 - 2022

2021
- Support from the Ministry of Education and Culture, Finland
- Establishment of the network in 2021 with Finnish institutes
- Building on active research contacts with Chinese collaborators

Kick-off Event
- Kick-off event (Nov.1, 2021) with almost 40 Chinese and Finnish researchers presenting, over 130 registered participants
- Focus on building more research co-operation in cooperation and together with Chinese partners; universities and companies

2022
- Network co-operation develops with joint actions like seminars, project planning, supervision, exchange and identifying industrial co-operators, for example.
- Creating dialogue between Chinese and Finnish researchers and companies
- Mapping educational co-operation possibilities
Contact persons
Professor Baoru Yang (academic responsible)
International Liaison Officer Kirsi Korpela (coordinator)
fcfh-coordinator@utu.fi

https://fcfh.utu.fi/
FCFH - Finland - China Food and Health network: Subgroup Nutrition, health effects and food
Kick-off 1.11.2021
Aim

• To create **multidisciplinary actions** among Finnish and Chinese Universities and Research Institutes
  • To maintain and support existing collaborations
  • To facilitate new, potential collaborations

• Main focus in research collaboration, but educational activities are supported

• Interested institutes have discussed and presented the main focus areas, but they are open for discussion
Suggested topics for the common interests

1. Child and maternal health and wellbeing
   - Infant health
   - School children nutrition
   - Interested institutes/Finland: UTU, UTA, UH, SeAMK, UO

2. Metabolic diseases
   - Diet, food and physical activity, lifestyle modifications
   - Novel bioactive molecules
   - Gut microbiota related metabolism
   - Obesity related metabolic disorders, such as fibrosis, inflammation
   - Traditional fermented foods, also from the view point of microbes used in the processing
   - Functional Materials for bioactive molecules delivery and metabolic disease related tissue engineering
   - Interested Institutes/Finland: UEF, UO, UH, UJ, ÅAU, UTU, SeAMK
Potential Institutes noted in the discussions

FINLAND:
• University of Turku
• University of Eastern Finland
• University of Oulu
• University of Helsinki
• University of Jyväskylä
• University of Tampere
• Åbo Akademi
• Seinäjoki University of Applied Sciences

CHINA
• Peking University
• Sun Yat Sen
• University of Hong Kong
• Shenzhen University
• China Medical University
• Shenyang University
• Shanghai Jiao Tong University
• Shenzhen Polytechnic
• Beijing Sport University
• Zhejiang University
Research and Educational collaboration in the fields of Nutrition, Health and Food Safety

Helli Kitinoja
Senior Advisor
Seinäjoki University of Applied Sciences

November 1, 2021
Seinäjoki University of Applied Sciences (SeAMK)

International – Entrepreneurial - Best for the Student

Faculties: Business and Culture, Food and Agriculture, Health Care and Social Work, Technology

Bachelor Degree Programmes in English:
- Agri-Food Engineering
- Automation Engineering
- International Business
- Nursing

Master Degree in International Business Management

Profile Areas: Sustainable Food Solutions, Smart and Energy Efficient Systems, Welfare and Creativity, Entrepreneurship and Growth

- 5,000 full-time students - 10 % international
- 21 Bachelor and 13 Master Programmes
- 21 Double Degree and Joint Programmes in nine countries
- 210 partner universities in 52 countries (China since 1996)
- 80 enterprises in the same Campus (triple-helix)
- South Ostrobothnia is the Food Province of Finland, (e.g. Atria plc.)

Rated as the best UAS 2020 in Finland by the graduates

www.seamk.fi
Sustainable agri-food solutions
in agriculture, food processing & hospitality management

FOOD SAFETY

CORE COMPETENCE

Sustainable agri-food systems
Business management and economics in agri-food
Nutrition

PROFILE AREA
Highlights within the Research and Education Themes “from Field to Fork”

- Quality of Nutrition in Food Services
- Education in Nutrition & Promotion of Well-being
- Responsibility in Food Services

- Processing of Meat, Dairy & Cereals
- Own-checking & Hygienic Design in Food Processing
- Legislation, Guidelines & Standards in Training Food Processing Safety & its Certification

- Agricultural Enterprise Management
- Protein-rich Plants & Organic Farming
- Healthy Soil & Carbon Sequestration
- Holistic Plant Protection & Controlled Nutrient Leaching
- Welfare of Production Animals, Environmental Impact & Biosecurity
- Gun Wirtanen: Sustainability & Food Safety – Frami Food Lab Activities. A presentation at the International week at SeAMK on February 16, 2021
Robot and material laboratory: Novel methods for automated food manufacturing

Small scale industrial food environment: Unique transforming testing platform for food safety systems

Research center: Scientific operations with university consortium of South Ostrobothnia

Chemistry and biotechnology laboratory: Basic elements for scientific research in food sector

Digitality: Data collected from industrial processes and research projects is utilized in full-scale simulating systems

Testing restaurant Prikkia: Testing environment for consumer involvement

Production kitchen of Prikkia: Testing platform for food preparation practices

Research and development kitchen of Prikkia: Testing environment for safe food preparation in HORECA sector.

Picture/Kuva: Karri Kallio & Jarmo Alarinta
RDI - Sustainable Agri-Food Solutions

- We have an experienced and **multidisciplinary group** of experts, totally 45 persons
- The **annual volume** of projects is about **1.2 M€**
- **150 publications/annually**
- The **main funding** comes from the European Agricultural Fund for Rural Development (EAFRD), European Regional Development Fund (ERDF), Interreg Europe, Horizon 2020 and Erasmus+
- More information on sustainable food chain studies and **RDI activities can be found on the website** [www.seamk.fi](http://www.seamk.fi)
Agri-Food Engineering (AFE) Bachelor Degree Programme
4 years / 240 ECTS credits, starting in September 2022

Basics in Engineering
- Basic studies common to all in SeAMK 20 ECTS
- Basic studies 57 ECTS

Agri-Food Processes
- Agricultural sciences 18 ECTS
- Food technology 10 ECTS
- Food processing and packaging 20 ECTS
- Project studies 10 ECTS

Sustainable management in agri-food business
- Industrial management 8 ECTS
- Sustainable food systems 6 ECTS
- Marketing 3 ECTS
- HR management 3 ECTS
- Production equipment 5 ECTS

Food process facilitators
- Hygienic design 10 ECTS
- Mechanical engineering 10 ECTS
- Automatisation and digitalisation 10 ECTS
- Industrial engineering and management, advanced 10 ECTS

Agri-food engineering in practice
- Research methods 5 ECTS
- Free choice studies 10 ECTS
- Final thesis 15 ECTS
- Practical training 30 ECTS

Select: 2*10 credits

Healthy Kids of Seinäjoki Platform

Strategy of the City, HKS Steering Committee

“Finnish Neuvola” Child Health Clinic Maternity Clinic

Enterprises, Shops Companies, Industry Product development

Higher Education and Research

Associations Church Third Sector

City Development and Management

Health and Wellbeing Management

Customized Guidance supporting Healthy Choices

Healthy Nutrition and Food Safety

Healthy and Wellbeing of Children and their Families

Mental Health

Physical Activity

Public Services

Business Solutions

Research

Information

Education and Services

City Development

Early Education Kindergarten

Primary School High School Vocational School

Services for Youth and Adolescents

Cultural Services Library Media

Living Environment Free time activities

Multiprofessional and Multidimensional Cooperation
Healthy Kids of Seinäjoki

Aim: Supporting overall Health and Wellbeing of Children, Adolescents and their Families
Roots on obesity and overweight prevention of children and prevention of long-term illnesses

Research interests in supporting health and wellbeing of children:

• Health and Wellbeing Management
• City and Living Environment Development and Management
• Guidance supporting Healthy Choices based on the needs of the Family
  • Healthy Nutrition, Food Safety, School Meals
  • Physical Activity and Exercise supporting Health
  • Multiprofessional and Multidimensional Cooperation
    • Child Obesity and overweight prevention
• New Product Innovations with the companies and industry
  • Effectiveness of the interventions and methods
Kallio, Karri; Kyntäjä, Merja; Ventelä, Sarita; Ojala, Markus; Wirtanen, Gun (2020). New food premises for training and research purposes. https://urn.fi/URN:NBN:fi-fe202101081366

Healthy Kids of Seinäjoki.
http://www.healthykidsofseinajoki.fi/en/

(Analysing the current situation of the promotion of health and wellbeing of children in the City of Seinäjoki. Publication of Seinäjoki University of Applied Sciences, Researches.)

(Healthy Kids of Seinäjoki model as a Development Platform. Action Plan for the research and development.)

(Proposal for the indicators to be used in measuring the effectiveness of the HKS interventions.)
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Physical activity and health in Chinese children

Ying Gao
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1.11.2021
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It was predicted in the official report that there will be **MORE THAN 49 MILLION** overweight/obese children in China in 2030.

(Zhang L, et al., 2021)
Diet and PA Related to Obesity

• Overall, about 55.2% of the adolescents consumed fast food at least 1 d/w, and 10.3% did so 4–7 d/w. BMI, physical activity and sedentary behavior were correlated with fast food consumption (Li et al., 2020)

• Time spent in MVPA was positively associated with achieving the healthy zones for BMI, upper body strength and flexibility (Marques et al., 2015)

• Being sedentary and inactive would increase the risk of overweight/obesity (Crowe et al., 2020)
A declining PA and increasing SB trend among Chinese children was observed from 2004 to 2015 (Yang et al., 2021).

The proportion of 13–15-year-olds doing more than 60 min of MVPA per day is 19.7% (Hallen et al., 2012), while only 8.9% Chinese children reached the goal (李培红等, 2016).

Sedentary behavior and physical activity in school-aged children: objectively measured sedentary time and associations with muscle inactivity and activity level (2021-2023)
Research Progress of Food and Herbal Medicine in Zhejiang A&F University

Ying ZHENG (zhengying@zafu.edu.cn)
College of Food and Health, ZAFU
Nov. 1, 2021
The College of Food and Health originated from the subject of Food Science and Engineering established in 2001. And the Traditional Chinese Medicine (TCM) was created in 2003, which was the only professional subject with traditional Chinese medicine resources in Zhejiang Province.
Faculty and Students

The college consists of a diverse group of individuals, including 63 faculty and staff, more than 1120 undergraduate students and 163 graduate students.
Traditional Chinese Medicine major was officially approved.

Zhejiang A&F University school-level key construction major.

Approved as a first-class professional construction point in Zhejiang Province.

Approved as master of Chinese medicine, trinity enrollment.

Developing History

- 2003: Traditional Chinese Medicine major was officially approved.
- 2009: Zhejiang A&F University school-level key construction major.
- 2014: Approved as an emerging characteristic specialty construction point in Zhejiang Province.
- 2018: Approved as master of Chinese medicine, trinity enrollment.
- 2019: Approved as a first-class professional construction point in Zhejiang Province.
Research Interests of TCM

3 main fields

Protection and Sustainable Utilization of TCM

Functional Screening and Evaluation of TCM

Bioengineering of TCM and Developing New Health Supplements

Dendrobium catenatum
Anoectochilus roxburghii
Ganoderma lucidum
Crocus sativus
Tetrastigma hemsleyanum
Bletilla striata
Polygonatum sibiricum

Polygonatum sibiricum
Bletilla striata
Ganoderma lucidum
Crocus sativus
Tetrastigma hemsleyanum
Anoectochilus roxburghii
Main contents

◆ Germplasm investigation and preservation of TCM
◆ Reproductive ecology and evolution
◆ Introduction, domestication, and breeding of TCM

Objective

➢ **Disentangle** Temporal and spatial distribution and evolution pattern of genetic variation of TCM
➢ **Reveal** Evolution and adaptive mechanism of TCM
➢ **Formulate** Strategy for TCM protection
By using patch clamp, protein coupled affinity chromatography and other technologies, an efficient screening platform to identify functional ingredients of TCM was constructed, and compounds in active components were also fished by cell models containing related target molecules.
The fermentation culture system was constructed by the in vitro culture of medicinal fungi, endophytes, and tissue cells on purpose to introduce functional ingredients into yeast and other microbes. As a result, it enriches and generates large-scale products of functional ingredients by microbial fermentation.
Graduate Quality

- High employment competitiveness and enrollment rate
- High recognition of employment and better follow-up development
- High evaluation from employers and long-term cooperation
- Supporting the development of ethnic medicine
Thank you!

College of Food and Health, ZAFU
Early Nutrition and Health -research group

Kirsi Laitinen, Associate Professor

Institute of Biomedicine, Research Centre for Integrative Physiology and Pharmacology
Faculty of Medicine
Our vision is to uncover interactions between diet, metabolism and microbiome, as well as behavioral factors, and their contribution to maternal and child health.

→ means for advancing better health in these susceptible populations.
Dietary intake of fat and fibre according to reference values relates to higher gut microbiota richness in overweight pregnant women

Henna Röytiö¹, Kati Mikkala¹, Tero Vahlberg² and Kirsi Laitinen¹*

Metagenomics analysis of gut microbiota in response to diet intervention and gestational diabetes in overweight and obese women: a randomised, double-blind, placebo-controlled clinical trial

Kati Mikkala¹, Niklas Paulin², Noora Houttu¹, Ella Koivuniemi¹, Outi Pellonperä³, Sofia Khan², Sami Pietilä², Kristiina Tertti³, Laura L. Elo², Kirsi Laitinen¹

Review
Interactions of dietary fat with the gut microbiota: Evaluation of mechanisms and metabolic consequences
Kati Mikkala¹, Noora Houttu¹, Tuğçe Canv², Kirsi Laitinen¹
Distinct Metabolic Profile in Early Pregnancy of Overweight and Obese Women Developing Gestational Diabetes

Kati Mokkala, Tero Vahlberg, Outi Pellonperä, Noora Houttu, Ella Koivuniemi, and Kirsi Laitinen

Original Article
CLINICAL TRIALS AND INVESTIGATIONS

Distinct Metabolomic Profile Because of Gestational Diabetes and its Treatment Mode in Women with Overweight and Obesity

Kati Mokkala, Tero Vahlberg, Noora Houttu, Ella Koivuniemi, and Kirsi Laitinen

Impact of combined consumption of fish oil and probiotics on the serum metabolome in pregnant women with overweight or obesity

Kati Mokkala, Tero Vahlberg, Noora Houttu, Ella Koivuniemi, Leo Lahti, and Kirsi Laitinen

Original article
Overweight and obesity status in pregnant women are related to intestinal microbiota and serum metabolic and inflammatory profiles

Noora Houttu, Kati Mokkala, Kirsi Laitinen
Development and evaluation of a stand-alone index for the assessment of small children’s diet quality

Henna Röyttö, Johanna Jaakkola, Ulla Hoppu, Tuija Poussa and Kirsi Laitinen

Development of a stand-alone index for the assessment of diet quality in elementary school-aged children

Ella Koivuniemi, Outi Nuutinen, Markus Riskumäki, Tero Vahlberg and Kirsi Laitinen

Parental and Child Factors Associated With 2- to 6-Year-Old Children’s Diet Quality in Finland

Ella Koivuniemi, MSc; Johanna Gustafsson, PhD; Irene Mäkelä, MD; Viivi J. Koivisto, MD; Tero Vahlberg, MSc; Ursula Schwab, PhD, RD; Harri Niinikoski, MD, PhD; Kirsi Laitinen, PhD, RD

Overall Dietary Quality Relates to Gut Microbiota Diversity and Abundance

Kirs Laitinen and Kati Mikkala
THANK YOU!

https://sites.utu.fi/nutritionresearch/en/

kirs.laitinen@utu.fi
Method for analyzing chiral triacylglycerols (TAGs) in nutritionally important lipids

Marika Kalpio
PhD, University Teacher
Food Chemistry and Food Development
Department of Life Technologies

AIM
To understand
- the role of chirality in fats and oils
- the impact of the TAG regioisomers and enantiomers on metabolism, bioavailability, digestion, absorption, transport, and common health as well as on physicochemical properties
Chiral chromatography connected with sample recycling system and MS detection

Lipid extraction, TAG fractionation, FA composition, ECN distribution, Semipreparative RP-HPLC

Chiral chromatography + sample recycling

Kalpio et al. 2015

Kalpio et al. 2015

Kalpio et al. 2020

Kalpio et al. 2021

Chemoenzymatic synthesis, University of Iceland

21 synthesized, 17 enantio-separated

MS detection (HPLC-ESI/APCI-MS, direct inlet MS)

70.5 / 29.5


Chemoenzymatic synthesis, University of Iceland
Method for analyzing chiral TAGs in nutritionally important lipids
Lipids in Infant Nutrition

Baoru Yang
Food Chemistry and Food Development
Department of Life Technologies
University of Turku
November 1st, 2021
Lipids in Infant Nutrition

Large variety of fatty acids

Specific positional distribution of fatty acids in fat molecules

Diversified lipid classes in fat droplet and membranes

Complexity of large number of molecular species

Influenced by multiple factors, e.g. maternal diet and lactating stage

Human milk fat: The Best choice for infant nutrition
Our interest and approach

**Triacylglycerols**
- Analysis of regio- and stereoisomers (MS/MS)

**Glycerophospholipids**
- Regioisomeric analysis using MS/MS

- Human milk, infant formula, other natural fats and oils
- Understanding the significance of regio/stereoisomeric structure for fat digestion and nutrition in infants
Direct infusion and ultra-high-performance liquid chromatography/electrospray ionization tandem mass spectrometry analysis of phospholipid regiosomers

Mikael Fabritius | Baoru Yang

Rationale: Phospholipids are important components of cell membranes that are linked to several beneficial health effects such as increasing plasma HDL cholesterol levels, improving cognitive abilities and inhibiting growth of colon cancer. The role of phospholipid (PL) regiosomers in all these health effects is, however, largely not studied due to lack of analytical methods.

Methods: Electrospray ionization mass spectrometry in negative mode produces structurally informative fragment ions resulting from differential dissociation of fatty acids (FA) from the sn-1 and sn-2 positions, primarily high abundance [RCOO]− ions. The fragment ion ratios obtained with different ratios of regioisomeric phospholipid reference compounds were used to construct calibration curves, which allow determination of regioisomeric ratios of an unknown sample. The method was developed using both direct infusion mass spectrometry (MS) and ultra-high-performance liquid chromatography and hydrophilic interaction liquid chromatography mass spectrometry (UHPLC-HILIC-MS).

Results: The produced calibration curves have high coefficients of determination (R² >0.98) and the fragment ion ratios in replicate analyses were very consistent. A test mixture containing 60/40% ratios of all available regioisomer pairs was analyzed to test and validate the functionality of the calibration curves. The results were accurate and reproducible. However, regioisomeric quantification of certain chromatographically overlapping compounds is restricted by the relatively wide window in precursor ion selection of the MS instrument used.

Conclusions: This method establishes a framework for analysis of phospholipid regiosomers. Specific regioisomers can be quantified using the existing data, and method development will continue with improving chromatographic separation and exploring the fragmentation patterns and efficiencies of different PL classes and FA combinations, ultimately to refine this method for routine analysis of natural fats and oils.

Figure 3 Fragmentation of PL test samples showing the m/z ratio of each major fragment ion and tentative structures. (a) DPPC from soybean (most abundant peak, PI 34:2) and (b) SM extract from egg (most abundant peak, SM 16:0-d18:1).

Figure 4 Calibration curves of the regiospecific PL reference standard pairs using [RCOO]− fragment ion ratios and the [M+HCOO−]− ion in the middle of the mass range.

The results show that the method is reproducible and accurate. The calibration curves have high coefficients of determination (R² >0.98) and the fragment ion ratios in replicate analyses were very consistent. A test mixture containing 60/40% ratios of all available regioisomer pairs was analyzed to test and validate the functionality of the calibration curves. The results were accurate and reproducible. However, regioisomeric quantification of certain chromatographically overlapping compounds is restricted by the relatively wide window in precursor ion selection of the MS instrument used.

Conclusions: This method establishes a framework for analysis of phospholipid regiosomers. Specific regioisomers can be quantified using the existing data, and method development will continue with improving chromatographic separation and exploring the fragmentation patterns and efficiencies of different PL classes and FA combinations, ultimately to refine this method for routine analysis of natural fats and oils.
Regiospecific Analysis of Triacylglycerols by Ultrahigh-Performance-Liquid Chromatography–Electrospray Ionization–Tandem Mass Spectrometry

Marko Tarvainen, Heikki Kallio, and Baoru Yang

Food Chemistry and Food Development, Department of Biochemistry, Faculty of Science and Engineering, University of Turku yliopisto FI-20014 Finland

Supporting Information

ABSTRACT: An ultrahigh-performance-liquid chromatography–electrospray ionization–tandem mass spectrometry (UHPLC–ESI–MS/MS) method was developed for the analysis of AAB and ABC type triacylglycerol (TG) regiosomers. Excellent linear regressions were established between the ratio of [RR]" product ions and the proportion of regiosomers of TGs. The method was further optimized by analysis of 18 regiospecific pairs of AAB type TGs and five triplets of regiosomers of ABC type TGs with acyl carbon number (ACN) ranging from 36 to 54 and the number of double bonds (DB) from 0 to 7. Reverse linear relationships were recognized between the slope of the calibration curve and the number of double bonds of the sn-2 fatty acids. Negative linear regressions were found between the intercepts of the calibration curves and the sum of ACN + DB of sn-2 fatty acids. The method was highly repeatable as shown by the low deviation and high stability of the calibration curves at different concentrations and between different periods of analysis. This is the first time that calibration curves for the ABC type TGs are reported. The results provide crucial and novel information for reliable and quantitative determination of regioisomeric TGs in natural fats and oils.
Probiotics and Human Health

Prof. Dr. Qing Gu

01/11/2021
Probiotics

Definition of probiotics from WHO & FAO
“live microorganisms which when administered in adequate amounts confer a health benefit to the host”

Types of Probiotics
1. Bacteria
   - Lactobacillus
   - Bifidobacterium
2. Yeast
   - Saccharomyces boulardii

Different sources of probiotics

- Yogurt
- Cheese
- Fermented milk
- Fortified milk

- Pickles
- Kimchi
- Kombucha
- Chocolate
- Granola bars

- Poi Juices
- Powders
- Microalgae
- Probiotic supplements

- Sauerkraut
- Miso soup
- Tempeh
- Sourdough bread
- Ginger beer
Beneficial Effects of Probiotics

**Mode of Action**

- **Modification of microbial population**
  - Modifications of the structure and function of intestinal epithelium

- **Competition for nutrients**
- **Aggregation with pathogenic bacteria**
- **Competitive adhesion to epithelial receptors**

- **Production of specific substances** (Organic acids, bacteriocins, dipicolinic acid)

**Digestive Health**
- Imbalance
- Gut Barrier function
- Gut inflammation
- Adverse Symptoms (Diarrhea, constipation, bloating, pain/discomfort)
- Irritable and inflammatory bowel
- Antibiotic associated diarrhea
- Antibiotic associated C. Difficile infection or relapse
- Improve lactose digestion/tolerance
- Infant
  - Relieve colic
  - Reduce incidence and severity of NEC

**Cardiovascular**
- Manage moderate/elevated cholesterol levels

**Mental Health**
- Anxiety and stress

**Immune Health**
- Supports immune function

**Respiratory**
- Imbalance

**Skin Health**
- Reduce risk of Atopic Dermatitis

**Vaginal Health**
- Imbalance
Main Research Interests

Probiotics and gut health
Probiotic genome and function; key technologies for preparation and industrialization of probiotics
Main Research Interests

Nutritional functions of probiotics derived compounds

Research on the regulation mechanism of intestinal microecology by functional active substance released by lactic acid bacteria, including **bacteriocins**, polyphenols, vitamins, exopolysaccharides
Main Research Interests

**Flavor and microbial metabolism regulation of microflora in natural fermented foods**

Collection of new microbial resources in different fermented products, such as fruit wines, cheese, milk, pickle, fermented fish product; flavor and metabolic regulation of these fermented food products
Academic Achievements

- National funding: >20
- Peer-reviewed papers: >120
- Patent: > 20
- National research awards: = 4
Team introduction

Prof. Qing Gu
Dean of the School of Food and Biological Engineering, Zhejiang Gongshang University
guqing2002@hotmail.com

Prof. Ping Li

Associate prof. Dafeng Song

Lecturers

Shiying Wu
Jiarun Han

Shuxun Liu
Cheng Qian

Researchers & Doctor candidates

Qingqing Zhou
Xiaodan Zhao

Jianxing Yu
Guoqiang Li
Tingting Yan

Ziqi Chen
Chenlan Xia
Thank you for your attention!
Dietary lipid gastrointestinal digestion and absorption, and the enteral health

Zhan Ye  Post Doc.

School of Food Science and Technology
Jiangnan University
Email: yezhan@Jiangnan.edu.cn

OUTLINE

1. Backgrounds
2. Main work
3. Future efforts
1. Backgrounds

- Dietary lipid composition affects their gastrointestinal digestion and absorption fates;
- Long-term unbalanced dietary lipid intake may affect the human health by influencing the gut homeostasis and the nutrients absorption.
2. Main work

1. Digestion rate: PO > RO > LINO
2. Bile salt affinity: PO > RO ≈ LINO
3. Dietary oil rich in short chain fatty acids showed higher digestion efficiency.

Dietary oils

- PO
- LO
- RO

TGs with different chain length and degree of unsaturation

- Tripalmitin (C16:0)
- Tristearin (C18:0)
- Triolein (C18:1)

Dietary oils digestion and absorption

- Systematic circulation
- Serum lipid profiles
- Serum fatty acid composition

Postprandial Serum lipid analysis

Dietary oils oral gavage administration

- Every 0.5h

Correlation analysis

- Fatty acids of the serum samples
- TG of the serum samples

Correlations

In postprandial (0 ~ 240 min)
2. Main work

Dietary oils

Oral gavage

For 6 weeks

Tissue samples

Dietary oils and fats

Modification

Gut microbiota

Cross-talk

Intestinal inflammation

Dietary oils and fats

Modification

Gut microbiota

Cross-talk

Intestinal inflammation

Dietary oils and fats

Modification

Gut microbiota

Cross-talk

Intestinal inflammation

Dietary oils and fats

Modification

Gut microbiota

Cross-talk

Intestinal inflammation

Dietary oils and fats

Modification

Gut microbiota

Cross-talk

Intestinal inflammation

Dietary oils and fats

Modification

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Intestinal inflammation

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Cross-talk

Intestinal inflammation

Dietary oils and fats

Modification

Gut microbiota

Cross-talk

Intestinal inflammation

Dietary oils and fats

Modification

Gut microbiota

Cross-talk

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Representative publications:


3. Future efforts

1. The individual fatty acid within the TAGs molecules on the dietary lipid intestinal absorption should be illustrated.
2. The molecular nutrition of different fatty acids with regard to the gut microbiota homeostasis are deserve to be explored.
3. Underlying mechanisms of the individual fatty acids on the gut health and human nutrition still need to be uncovered.
Thank you!

Zhan Ye  Post Doc.

School of Food Science and Technology
Jiangnan University
Email: yezhan@Jiangnan.edu.cn
Finland – China Food and Health Network kick-off Meeting

Lina Zhang
Jiangnan University
Background

2011.09-2015.9
PhD. Wageningen University
- Dynamics of milk proteome in human and animal milk

2015.11-2017.9
Post-doc, Biomedical Research Center, University of North Carolina at Greensboro
- Glycated proteins in T1D human plasma with high glucose and low glucose level
- Proteome study of human islets

2017.9-Now
Associate Professor, School of Food Science and Technology, Jiangnan University
- Proteomics and glycomics study in human and dairy farm animals
Human and animal milk (bovine, caprine, sheep, and camel) composition analysis

- Comparison in milk proteome related to species, geography and healthy status
- Post-translational modification analysis of milk proteins: glycosylation and phosphorylation
- Qualitative and quantitative analysis of oligosaccharides
Research area

- Human and animal milk protein digestibility
  - Milk digestibility analysis: species and processing
  - Milk protein absorption: cell and animal model
  - Influence of post-translational modification on the protein digestibility
Milk allergenicity and its influence on neurodevelopment

- Animal model compare the sensitization of αs1-casein between bovine and caprine milk and the mechanism
- Influence of allergy on neurodevelopment
Milk protein functionality

- The effect of milk protein on regulation of blood glucose of T2D
- The effect of milk protein on anti-inflammation effect

Research area

Db/db
Diabetes mellitus
Normal

Gavage milk proteins
Five weeks

Blood serum
Tissue

Pathway
WB
Mechanism
Thanks for your attention!

THE SCHOOL OF FOOD SCIENCE AND TECHNOLOGY
JIANGNAN UNIVERSITY
Interaction between Reactive Carbonyl Compounds and Amino Acids/Phenolic compounds and their safety evaluation

Jie Zheng, PhD, Associate Professor

Department of Food Science and Engineering
Reactive carbonyl compounds
Reactive carbonyl compounds are generated in thermally processed foods.
## Reactive carbonyl compounds in foods

<table>
<thead>
<tr>
<th>Food</th>
<th>GO</th>
<th>MGO</th>
<th>2,3-BD</th>
<th>3-DG</th>
<th>1-DG</th>
<th>3-DGal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honey</td>
<td>0.2–7.0</td>
<td>nd-761</td>
<td>0–4.3</td>
<td>79–1641</td>
<td>143–1099$^a$</td>
<td>14–46</td>
</tr>
<tr>
<td>Candies</td>
<td>nd-1.1</td>
<td>141–1011</td>
<td>nd-36</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bread</td>
<td>nd-28</td>
<td>13–619</td>
<td>nd-47</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheese</td>
<td>nd</td>
<td>nd</td>
<td>nd-tr</td>
<td>nd-tr</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alkali-treated pretzel</td>
<td>2.5–16</td>
<td>4.5–34</td>
<td>tr-6.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cookies</td>
<td>4.8–26.0</td>
<td>1.8–81.4</td>
<td>8.5–385</td>
<td>tr-88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pasta (cooked)</td>
<td>nd</td>
<td>nd</td>
<td>nd-8.8</td>
<td>nd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potatoes (cooked/fried)</td>
<td>nd-tr</td>
<td>nd-18</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oils (raw)</td>
<td>&lt;1.2</td>
<td>nd-0.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oils (cooked)</td>
<td>0.8–4.0</td>
<td>0.2–1.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Precursors of AGEs
Precursors of Acrylamide

Precursors of heterocyclic amines

Ref: J. Agric. Food Chem. 54(26), 10253-10261.
Reactive carbonyl compounds in thermally processed foods
Control of reactive carbonyl compounds (RCs) with natural ingredients
Residual concentration of carbonyl compounds after incubation of 5 mM carbonyl compounds with 50 mM cysteine, glycine, lysine, glutamine, asparagine and glutamate, respectively, at 37 °C for 2 h

Adducts we identified forming between amino acids and toxic aldehydes

6-(1,2-propanedione)-8-(1-acetol)-rutin

6-(1-acetol)-8-(1,2-propanedione)-rutin

6-(1,2-propanedione)-8-(1,2-propanedione)-rutin
<table>
<thead>
<tr>
<th>Commercial product</th>
<th>Adduct content (mg/kg)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adduct A</td>
<td>Adduct B</td>
</tr>
<tr>
<td>No. 1</td>
<td>1.43 ± 0.43&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.94 ± 0.20&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>No. 2</td>
<td>1.36 ± 0.23&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.43 ± 0.30&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>No. 3</td>
<td>0.41 ± 0.07&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.85 ± 0.17&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>No. 4</td>
<td>0.15 ± 0.05&lt;sup&gt;b&lt;/sup&gt;</td>
<td>--</td>
</tr>
<tr>
<td>No. 5</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>No. 6</td>
<td>0.39 ± 0.07&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.54 ± 0.04&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>No. 7</td>
<td>0.33 ± 0.04&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.41 ± 0.03&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>No. 8</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>No. 9</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>No. 10</td>
<td>0.25 ± 0.02&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.30 ± 0.04&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>No. 11</td>
<td>0.20 ± 0.03&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.17 ± 0.01&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>No. 12</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>No. 13</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

~ 17950 mg/kg ~ 38 mg/kg ~ 4.7 mg/kg ~ 36 mg/kg
Postprandial variation of plasma levels in rats

Rutin

Oral administration
100 mg/kg BW

Adduct A

Adduct B

Adduct C
Cytotoxicity commonly reduced by formation of adducts between RCs and amino acids

Cell viability

Apoptosis

Apoptotic markers

Inflammation

DNA damage
Hesperitin–monogalactoside (Que-mono-MGO)

Hesperitin–digalactoside (Que-di-MGO)

Adduct formation

- PI3K-AKT pathway
- Nrf2-ARE pathway

\( \Delta \Psi_m \)

Oxidative stress

LDH release

Apoptosis

IC\(_{50}\)

- 0.91 mM
- 0.59 mM
- 0.15 mM
Serum concentration

<table>
<thead>
<tr>
<th>HMF administration</th>
<th>Heart</th>
<th>Liver</th>
<th>Kidney</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMF content</td>
<td>0.4±0.2</td>
<td>0.1</td>
<td>1.2±0.3</td>
</tr>
<tr>
<td>DCH content</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>DCH administration</td>
<td>HMF content</td>
<td>0.2±0</td>
<td>1.0±0.4</td>
</tr>
<tr>
<td>DCH content</td>
<td>5.0±1.3</td>
<td>3.4±1.8</td>
<td>36.5±4.8</td>
</tr>
</tbody>
</table>

MDA in Plasma (nmol/L)

- CK
- DCH20
- DCH100
- HMF20
- HMF100

MDA in Heart, Liver and Kidney (nmol/mg protein)
Recent Publications

Research Team

Research Leader
Shiyi Ou Ph.D.
Professor

Caihuan Huang
Associate Prof.

Jie Zheng
Associate Prof.

Fu Liu
Associate Prof.

Juanying Ou
Lecturer
Thank you for your attention!

Jie Zheng
Jinan University
Tel. 18148962369
Email: zhengjie@jnu.edu.cn
Guanghua Zhao
College of Food Science and Nutritional Engineering, China Agricultural University
gzhao@cau.edu.cn

- Protein nanocage design and applications in encapsulation of nutraceuticals
- Mineral elements transport and regulation
- Natural compounds and chronic diseases
- Cereal production and nutrition
Encapsulation and delivery of nutraceuticals

High selectivity for cancer cells which overexpress two kinds of receptors: SCARA5 for L-ferritin and TfR1 for H-ferritin.

Protein cage redesign and applications

Nature Communications, 2019, 10, 778.

ACS Nano, 2020, 14, 12, 17080.
Protein cage redesign and assembly

ACS Nano, 2018, 12, 11323-11332

Chem Soc Rev

Redesign of protein nanocages: the way from 0D, 1D, 2D to 3D assembly
Chenyang Lv, Xiaorong Zhang, Yu Liu, Tuo Zhang, Hai Chen, Jiachen Zang, Bowen Zheng and Guanghua Zhao

Compartmentalization is a hallmark of living systems. Through compartmentalization, ubiquitous protein nanocages such as viral capsids, ferritin, small heat shock proteins, and DNA-binding proteins from...
ZIP4 is a zinc transmembrane transporter which is responsible for the absorption of zinc from diet in small intestine.
Mineral elements transport and regulation——CaSR, Lar
Natural compounds and chronic diseases

- Effects of environmental factors on inflammation-related chronic diseases and cancer.
- Prevention of chronic diseases by natural compounds from foodstuff.

**Sci. Transl. Med.** 2018, 30; 10 (443)

**Gut Microbes** 2020, 12, 1

Natural compounds and chronic diseases

- Effects of environmental factors on inflammation-related chronic diseases and cancer.
- Prevention of chronic diseases by natural compounds from foodstuff.

*Trends Food Sci. Tech.* 2021, 111
*J. Ag. Food Chem.* 2021, 69, 8428
*J. Funct. Foods* 2020, 71, 104014
*J. Nutr. Biochem.* 2019, 68, 1
*Food Chem.* 2018, 264: 411
*Food Microbio.* 2018, 76: 346
# Cereal production and nutrition

## Material
- Cereal grain raw materials
  - Maize
  - Black Wheat
  - Rice

- By-products of grain processing
  - Maize germ meal
  - Wheat bran
  - Rice bran

## Processing
- Physical treatment
  - Superfine grinding
  - Vacuum freeze drying

- Biochemical technology
  - Soaking
  - Fermentation
  - Enzymolysis

## Improved quality
- Micronutrients bioavailability
- Low energy density products

---

**Diagram of two-tier Caco-2 cell culture model**
Our team

Guanghua Zhao  Jianfen Liang  Haixia Yang

Thank You!

Tuo Zhang  Jiachen Zang  Chenyan Lv
Principal Investigator: Anni Pakarinen PhD, MHSc, RN
Development Manager, Senior Researcher
Department of Nursing Science
University of Turku
Finland

Presented by: Kaile Kubota MHSc, RN
Project Researcher
Anni Pakarinen (PhD, MHSc, RN)
Development Manager, Senior Researcher
Department of Nursing Science
University of Turku, Finland

Research Expertise:
• Children's Digital Health Promotion
• Gamification and Serious Games
• Design Thinking in Health Technology Innovations

Kaile Kubota (MHSc, RN)
Project Researcher
Double Master’s Degree in Future Health & Technology
Fudan University and University of Turku

Research Focus:
• Digital Health Promotion
• Gamification and Serious Games
• Application of Artificial Intelligence in Healthcare
AI-driven Gamified Intervention and Intelligent Intervention Support Module to Foster the Health Equity for the Life of Children HEAL
All children should have the right to a healthy life and future.

However, they are prone to health inequalities encompassing their physical, psychosocial and food health.
Health interventions around the world has been developed aiming to promote the health of children. And yet, we continuously strive to effectively alleviate their health disparities.
21% of school-aged children consume vegetables less than once a day; 34% eat fruit less than once a day; 42% drink sodas daily; and 46% consume fast food at least weekly¹.
In Finland, a recent study showed that 27% of 2- to 16-year-old boys and 17% girls are at high risk of obesity²
Food and nutrition play a vital role in everyone’s health. It fuels the cognitive development of a child as well as their physical and psychosocial growth.

However, children and adolescents today are failing their healthy food consumptions and this phenomenon deprive them of having long, productive and healthy lives.
Global progress towards health equity and its determinants has been slow and largely due to lack of awareness and investment\(^3\).
Therefore, we should extend our noble efforts forward in making a change and helping the children achieve health equity.
• To foster the health equity of children in middle childhood (6-13 years old)

• To develop a novel and child-centred intervention with the combination of gamification and AI techniques

• To alleviate their subjective nutrition, physical and psychosocial health disparities

• To examine the validity of the approach while considering the ethical issues of digital health promotion and processing of data for use in support for timely research, decision-making and action plans.
Pakarinen 2021
Scope of Intervention

- Health Recommendations
- Health Literacy
- Health Behaviour
- Physical Activity
- Food & Nutrition
- Psychosocial Health
Effective & Sustainable

(Image credit: European Commission 2021)

Pakarinen 2021
Collaborations

- Collaboration with the University of Tartu, Estonia
- Collaboration with the University of Lleida, Spain
- Collaboration with Chinese Higher Education Institutions for food and nutrition research and development of HEAL intervention
Thank you! Kiitos! 谢谢!

For research collaboration, please contact us!

Anni Pakarinen PhD, MHSc, RN
e-mail: anni.pakarinen@utu.fi

Kaile Kubota MHSc, RN
e-mail: kakubo@utu.fi
References


Food Active Ingredients, Nutrition & Health

Prof. ZHANG, YUMEI (张玉梅)
School of Public Health, Peking University, Health Science Center
zhangyumeisphn@pku.edu.cn
Our team—a happy family!

"Dounai group" (豆奶一族：dou means soybean, nai means milk)

2 Professors, both Ph.D supervisor;
Dr. Peiyu Wang, Dr. Yumei Zhang

1 Associate Professor;
Dr. Jianghua

1 (Tsinghua) Assistant Professor; Dr. Ai Zhao

1 Biostatistics: Dr. Yingdong Zheng

1 Postdoc, Dr. Linwei Tao

5 Ph.D Students,

4 Graduate Students for MS
Here comes the Team

- **Projects Undertaking:**
  - **11** NSFC (National Natural Science Foundation of China) projects, I am PI **5** of them;
  - **1** National Scientific key projects of 13th five year plan
  - **2** Beijing Major Science and Technology Project; **1** Hebei Major Science and Technology Project; **1** Key Project of NSFBJ
  - Cooperate Universities: University of TURKU, UC DAVIS, University of Iceland;
  - Cooperate with diary companies: Nestle, Arla, Fonterra, BASF, DSM, Chinese local companies such Yili, Mengniu, Sanyuan, Junlebao etc.
  - Cooperated with 10 plus Chinese universities, 15 maternal and children's hospitals, 20 plus community hospitals

In past 5 years we undertake projects over RMB 350 M
Plant active Ingredients

✓ Soy Isoflavones and soy active ingredients on Cardiovascular disease & mechanism;
✓ Sea buck thorn fruits juice on hyperlipidemia & prediabetes—cooperated with University of Turku);(2 RCT)
✓ Phytosterols esters added to bovine milk & hypercholestromia
✓ β-conglycinin of soybean; (1 RCT)
✓ Lactobacillus casei N1115; (2 RCT)
✓ Prebiotics(inulin) on lactose deficiency (1 RCT)
✓ Anthocyanins from purple potato, blue berries
✓ DHA at different position of triglycerides

RCT: randomized clinical trials
16 years of experience: from rural Hebei to national and international multi-center breast milk research

<table>
<thead>
<tr>
<th>Year</th>
<th>Location/Project</th>
<th>Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>Hebei rural areas</td>
<td>50 samples</td>
</tr>
<tr>
<td>2011</td>
<td>Maternal Infant Nutrition &amp; Growth</td>
<td>580 samples</td>
</tr>
<tr>
<td>2016</td>
<td>80 samples</td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>Chinese North &amp; South Cohort</td>
<td>Multicenter: China, Finland, Spain, South Africa</td>
</tr>
<tr>
<td>2018</td>
<td>MING Study Beijing, Suzhou, Guangzhou</td>
<td>Over 5000 samples</td>
</tr>
</tbody>
</table>

*13th Key projects*
Milk active Ingredients

---Nutrients or active ingredients of foods

✓ Chinese breast milk fatty acids, milk microbiota, mycobiome & NMR metabolomics are different from Finland, Spain, South Africa; ---multicenter study

✓ The trend of bioactive protein such as α-lactoalbumin osteopontin, gangliosides, fatty acids, human milk oligosaccharides in human milk whey and casein );---longitudinal study

✓ Probiotics on children and adult health:
  ✓ Lactobacillus casei N1115 from Tibet traditional yogurt on Hyperlipidemia; the safety and improve immune function on infants and toddlers (2 RCT)
  ✓ A strain of Bifidobacterium animalis subsp. lactis on infants, safety and immune;(1RCT)
  ✓ A strain Bifidobacterium infantis on children health(1RCT)
Before and After in our Cooperation

Teaching & Training Programs between China- Finland 

Research Cooperation :


Yong Xue, Qing Miao, Ai Zhao, Yingdong Zheng, Yumei Zhang*, Peiyu Wang, Heikki Kallio, Baoru Yang*. Effects (Hippophae rhamnoides) juice and L-quebrachitol on type 2 diabetes mellitus in db/db mice. Journal of Functional Food. 2015, 16:223-233 (IF3.859)

Thanks!

Wonderful future cooperation!