



Third International Symposium on Phytochemicals in Medicine and Food

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EDITORIAL

Third International Symposium on Phytochemicals in Medicine and Food

The Third International Symposium on Phytochemicals in Medicine and Food (3-ISPMF) was held in Kunming, China on 25–30 August 2018. 3-ISPMF was organized by the Phytochemical Society of Europe (PSE), the Physiological Society of Japan, and Phytochemical Society of Asia (PSA). 3-ISPMF drew attention of more than 350 scientists on natural products and food area from 43 countries including UK, USA, Spain, Portugal, Italy, South Korea, Japan, Switzerland, Romania, Bulgaria, Czech Republic, Poland, Netherlands, Austria, Iran, and so on, gathered together to attend this meeting. 3-ISPMF was supported by several international journals, including Food Chemistry (Elsevier), Food and Chemical Toxicology (Elsevier), International Journal of Molecular Sciences (MDPI) and Critical Reviews in Food Science and Nutrition (Taylor & Francis). This supplemental issue on *Critical Reviews in Food Science and Nutrition* collected 15 articles, which supplies a stage for exchanging the latest research work on dietary phytochemicals.

Inflammation is related to various chronic diseases, which is often linked with noncommunicable chronic diseases such as cardiovascular, neurodegenerative, pulmonary, gastrointestinal and metabolic diseases, and certain types of cancer. N-acetyl-5-methoxy-tryptamine (melatonin) is a natural substance, which can be produced by plants as a secondary metabolite. Melatonin in some plant food is abundant, for example black mustard, Goji berry, tomato contains higher than 100 ng/g. In humans, melatonin participates in numerous functions including the regulation of mood, sleep, reproduction, promotion of immunomodulation, antioxidant defense and as an anti-inflammatory agent. The anti-inflammatory activity of melatonin supplement is related to COX-2, TNF- α , iNOS, PI3K/Akt, NF- κ B signal transduction. In vitro studies and in vivo studies in experimental animal model systems show that melatonin exerts anti-inflammatory activity. However, clinical trials often fail to reach positive results and are thus far inconclusive. The optimal dose to protect from long-term inflammation linked to chronic diseases may have a bright future (Nabavi et al. 2018).

Cardiovascular diseases have been the leading causes of morbidity and mortality throughout the world. Food-derived antithrombotic peptides, as potential ingredients in health-promoting functional foods targeting thrombus, have attracted increasing attention because of their high biological activities, low toxicity, and ease of metabolism in the human body. Peptides from various kinds of food materials shown antithrombotic effects (Cheng et al. 2019). Gelatin peptides from mackerel (*Scomber scombrus*) skin hydrolysates were able to significantly inhibit platelet aggregation by about 30%. The plancinin significantly inhibited prothrombin

activation by the prothrombinase complex. Sequential pepsin pancreatin system to obtain peptide fractions, which exhibited the inhibition of human platelet aggregation. Oligopeptide with an approximately 2.5 kDa molecular mass, which could potentially prolong both the thrombin time and the activated partial thromboplastin time, and specifically interact with blood coagulation factors: IX, X, and II.

Excess alcohol exposure leads to alcoholic liver disease (ALD), a predominant cause of liver-related morbidity and mortality worldwide. n-3 polyunsaturated fatty acids (n-3 PUFAs) in ALD as a possible treatment. Increasing evidence has demonstrated that n-3 PUFAs may be useful in alleviating alcoholic steatosis and alcohol-induced liver injury through multiple mechanisms, including decreased de novo lipogenesis and lipid mobilization from adipose tissue, enhanced mitochondrial fatty acid β -oxidation, reduced hepatic inflammation and oxidative stress, and promoted intestinal homeostasis, positively suggesting that n-3 PUFAs might be promising for the management of ALD. The oxidation of n-3 PUFAs ex vivo in an experimental diet was rarely considered in most n-3 PUFA-related studies, likely contributing to the inconsistent results. Thus, the role of n-3 PUFAs in ALD deserves greater research efforts and remains to be evaluated in randomized, placebo-controlled clinic trial (Wang et al. 2018a).

Some of the natural compounds has been successfully proved to be efficient on cancer therapy. All-trans retinoic acid (ATRA), an active metabolite of vitamin A, plays important roles in cell proliferation, cell differentiation, apoptosis, and embryonic development. The effects of ATRA are mediated by nuclear retinoid receptors as well as non-genomic signal pathway, such as MAPK and PKA. The great success of differentiation therapy with ATRA in acute promyelocytic leukemia (APL) not only improved the prognosis of APL but also spurred the studies of ATRA in the treatment of other tumors. Since the genetic and physiopathological simplicity of APL is not common in human malignancies, the combination of ATRA with other agents (chemotherapy, epigenetic modifiers, and arsenic trioxide, etc) had been extensively investigated in a variety of tumors. (Ni, Hu, and Cai 2018).

Microbiota is closely related to host health. The interaction of food ingredients, intestinal microbiota configurations and host system immunity is related to various kinds of pathogenic inflammations and chronic diseases. The unusual composition of the microorganism in gut is highly associated with various diseases, such as obesity, CVD, diabetes and fatty liver disease, thus the gut microbiota is also considered as a large metabolic “organ” in our body. The current knowledge about early-life nutrition and environmental factors that affect the interaction between the symbiotic microbiota

and the host immune system has demonstrated novel regulatory target for treating allergic diseases, autoimmune disorders and metabolic syndrome. Various kinds of food nutrients (such as dietary fiber, starch, polyphenols and proteins) can provide energy resources for both intestinal microbiota and the host. The indigestible food components are fermented by the indigenous gut microbiota to produce diverse metabolites, including short-chain fatty acids, bile acids and trimethylamine-N-oxide, which can regulate the host metabolized physiology, immunity homeostasis and health state. Therefore it is commonly believed early-life perturbation of the microbial community structure and the dietary nutrition interference on the child mucosal immunity contribute to the whole life susceptibility to chronic diseases (Zhou et al. 2018). Nondigestible carbohydrates (NDCs) are fermentation substrates in the colon after escaping digestion in the upper gastrointestinal tract. Among NDCs, resistant starch is not hydrolyzed by pancreatic amylases but can be degraded by enzymes produced by large intestinal bacteria, including clostridia, bacteroides, and bifidobacteria. Nonstarch polysaccharides, such as pectin, guar gum, alginate, arabinoxylan, and inulin fructans, and nondigestible oligosaccharides and their derivatives, can also be fermented by beneficial bacteria in the large intestine. Butyrate is one of the most important metabolites produced through gastrointestinal microbial fermentation and functions as a major energy source for colonocytes by directly affecting the growth and differentiation of colonocytes. Moreover, butyrate has various physiological effects, including enhancement of intestinal barrier function and mucosal immunity (Fu et al. 2018).

The emergence of bacterial resistance against conventional antibiotics. Methicillin-resistant *Staphylococcus aureus* (MRSA) is a notorious bacterial pathogen that induces high mortality and morbidity. Due to the emergence of multiple resistance, antibiotic treatments are rapidly becoming ineffective for the related infections. Growing interest in developing alternative, natural antibacterial agents have prompted the search for plant-derived antibacterial peptides in recent decades. Natural products, especially those derived from plants, have been proven to be effective agents with unique antibacterial properties through different mechanisms. Plant antimicrobials have shown remarkable antibacterial activity against MRSA, including the crude plant extracts and purified plant-derived bioactive compounds. Novel anti-MRSA modalities of plant antimicrobials such as alteration in efflux pump, inhibition of pyruvate kinase, and disturbance of quorum sensing in MRSA, may be promising alternatives to antibacterial drug development in future (Li et al. 2018). Different classes of endogenous antibacterial peptides have been identified from various plant species. Moreover, protein hydrolysates and hydrolysate-derived peptides with potent antibacterial effects have also been identified from numerous plant sources. Antibacterial peptides are often cationic and amphipathic, consisting of fewer than 100 amino acids. They are able to disrupt bacterial membrane integrity via pore formation and/or compromise bacterial metabolic processes. Promising future research directions with regards to the application of plant-derived antibacterial hydrolysates

and peptides in food preservation, farm animal disease management, and nutraceutical/functional food development will be proposed (Chai et al. 2019).

Dietary sources can be developed for the abundant phytochemicals. Onion (*Allium cepa* L.) is one of the most consumed and grown vegetable crops in the world. Onion bulb, with its characteristic flavor, is the third most essential horticultural spice with a substantial commercial value. Apart from its culinary virtues, *A. cepa* is also used traditionally for its medicinal virtues in a plethora of indigenous cultures. *A. cepa* was found to possess a panoply of bioactive compounds and numerous pharmacological properties, including antimicrobial, antioxidant, analgesic, anti-inflammatory, anti-diabetic, hypolipidemic, anti-hypertensive, and immunoprotective effects (Teshika et al. 2018). It contains different classes of phenolic compounds, such as ferulic acid, gallic acid, protocatechuic acid, quercetin, and kaempferol. Some other flavonoids were identified such as quercetin aglycon and the derivatives. Black pepper (*Piper nigrum* L.) is a widely used spice which adds flavor of its own to dishes, and also enhances the taste of other ingredients. Black pepper has also been extensively explored for its biological properties and its bioactive phyto-compounds. Antimicrobial activity of black pepper was recorded against a wide range of pathogens via inhibition of biofilm, bacterial efflux pumps, bacterial swarming, and swimming motilities. The antioxidant effects of black pepper against a series of reactive oxygen and nitrogen species. Black pepper also exhibited anticancer effect against a number of cell lines from breast, colon, cervical, and prostate through different mechanisms including cytotoxicity, apoptosis, autophagy, and interference with signaling pathways. It decreased the level of cholesterol, triglycerides, and low-density lipoprotein and increase in high-density lipoprotein. Black pepper also has anti-inflammatory, analgesic, anticonvulsant, and neuroprotective effects. The major bioactive compound identified in black pepper is piperine although other compounds are also present including piperic acid, piperlonguminine, pellitorine, piperolein B, piperamide, piperettine, and (-)-kusunokinin, which also showed biological potency (Takoore et al. 2019).

Some regional food have high potential of exploiting phytochemicals. *Hericium erinaceus*, an edible mushroom with medicinal value, has a long history of usage in China and other oriental countries. Polysaccharide is supposed to be one of the major bioactive compounds in *H. erinaceus*, which possesses immunomodulating, anti-cancer, antioxidant, gastroprotection and intestinal health promotion, neuroprotective, hepatoprotective, antihyperglycemic and hypolipidemic activities (Wang et al. 2018b). Legume trees are an important source of nutrition for West African populations, the main food products are fruit pulp and seeds, though leaves can also be used. Most relevant dietary features are high protein, vitamin, and micronutrient contents. Various therapeutic and nutritional benefits of these plants have been documented by ethnobotanical and experimental studies, stimulating an interest for their possible use as functional food or drug sources. The compounds have medicinal properties include antidiabetic and antimicrobial activities of *D. microcarpum*, cardiovascular protective and antidiabetic

activities of *P. biglobosa*, and bilharzia-preventing molluscicidal activity of *D. guineense*. Phytochemical characterizations have revealed potential sources of active drugs, such as *D. guineense* saponins and *D. microcarpum* diterpenes (Burlando, Palmero, and Cornara 2019). *Nelumbo nucifera*, or sacred lotus, has been valuable for us to use as vegetable, functional food, and herb medicine for over 2000 years. Traditionally, this plant has been used to treat chronic dyspepsia, hematuria, insomnia, nervous disorders, cardiovascular diseases, and hyperlipidemia. Now, phytochemical investigations on different parts of *N. nucifera* have indicated a wide spectrum of at least 255 constituents belonging to different chemical groups, including proteins, amino acids, polysaccharides, starch, flavonoids, alkaloids, essential oils, triterpenoids, steroids, and glycosides. Meanwhile, it has shown pharmacological activities, including anti-obesity, antioxidant, anti-inflammatory, cardiovascular, hepatoprotective, hypoglycemic, hypolipidemic, antitumor, memory-improving and antiviral activities, and already applied in health food industry and clinic uses of its single plant or herbal formulae (Chen, Zhu, and Guo 2019). *Aloe vera*, a plant species belonging to the genus *Aloe*, have been extensively studied for various therapeutic activities, including anti-bacterial, anti-viral, anti-cancer activity, as well as immunoregulative and hepatoprotective properties (Gao et al. 2018). Phytochemicals are also abundant in local herbs. *Andrographis paniculata* is a medicinal plant traditionally used as anti-inflammation and anti-bacteria herb. Andrographolide, the major active component of *A. paniculata*, exhibits diverse pharmacological activities, including anti-inflammation, anti-cancer, anti-obesity, anti-diabetes, and other activities (Dai et al. 2018).

The conference series of International Symposium on Phytochemicals in Medicine and Food have been a platform for scientists on natural products, food science and phyto-medicine to communicate and. We are organizing 4-ISPMPF at Northwest University (24–30 June 2020, Xi'an, China). 4-ISPMPF aims to explore the recent advances in the area of phytochemicals in medicine and food. We hope to bring together scientists of all ages to provide an excellent platform for exchanging ideas, discussing challenges, sharing success stories and setting up new research collaborations. We are looking forward to welcoming you to Xi'an, which is one of the oldest cities in China. It has been the capital for several most important dynasties in Chinese history, including Western Zhou, Qin, Western Han, Sui, and Tang. Xi'an is the starting point of the Silk Road and home to the Terracotta Army of Emperor Qin Shi Huang. Your active participation will certainly make 4-ISPMPF symposium a great success. Welcome to beautiful Xi'an!

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