Journal of Zhejiang University-SCIENCE B (Biomedicine & Biotechnology)
ISSN 1673-1581 (Print); ISSN 1862-1783 (Online)
www.zju.edu.cn/jzus; www.springerlink.com
E-mail: jzus@zju.edu.cn

Report:

Dietary Guidelines for Chinese Residents (2016): comments and comparisons

Shan-shan WANG[1], Sovichea LAY[1], Hai-ning YU[2], Sheng-rong SHEN[†‡1]

([1]*Department of Food Science and Nutrition, College of Biosystems Engineering and Food Science, Zhejiang University, Hangzhou 310029, China*)

([2]*College of Pharmaceutical Sciences, Zhejiang University of Technology, Hangzhou 310032, China*)

[†]E-mail: shrshen@zju.edu.cn

Received July 26, 2016; Revision accepted Aug. 1, 2016; Crosschecked Aug. 8, 2016

Abstract: A high quality diet is believed to play a functional role in promoting the healthy growth of mankind and preventing many kinds of chronic degenerative diseases, including cancer, cardiovascular disease, diabetes, and obesity. Adherence to a high quality diet has been strongly associated with a lower risk of mortality. To help promote healthy lifestyles and physical strength, the Chinese government has produced a new revised version of the Dietary Guidelines for Chinese Residents (2016) and the Chinese Food Pagoda, as guidance for dietary intake among its population. Similarly, the Japanese government has produced the Japanese Food Guide Spinning Top Model, and the US government has recently published revised dietary recommendations in its 2015–2020 eighth edition of Dietary Guidelines for Americans. The evidence from all respective cohort studies involved in producing these guidelines shows a reduced risk of many chronic diseases and mortality if the guidelines are followed. All scientific findings support encouraging the general population to consume a broad variety of food on the basis of nutrient and food intakes in order to prevent deficiency diseases and a surplus of energy and nutrients, and recommend daily physical activity for health promotion.

Key words: Dietary guidelines, Chinese Food Pagoda, Japanese Food Guide Spinning Top, Dietary Guidelines for Americans

http://dx.doi.org/10.1631/jzus.B1600341 **CLC number:** TS201.4

1 Dietary Guidelines for Chinese Residents (2016)

In response to stronger demands for healthy growth of Chinese people, the Chinese government has produced a new version of the Dietary Guidelines for Chinese Residents in the form of the Chinese Food Pagoda (Fig. 1) (The Chinese Nutrition Society, 2016). The new 2016 dietary pagoda is a revision of the 2007 Food Pagoda. Compared with the 2007 version, the number of guidelines is reduced from ten to six, and recipes as well as visual graphics and charts are enhanced to make them easy for people to read, understand, accept, and use. The current guidelines consist of three parts: the dietary guidelines for general population, the dietary guidelines for specific population, and the practice of balanced diet of Chinese residents. The dietary guidelines for the general population form the core of the guidelines. The six guidelines proposed for healthy people over 2 years of age in the general population are as follows.

1.1 Eat a variety of foods, with cereals as the staple

The daily diet should include cereals, vegetables and fruits, livestock and poultry, fish, milk, soy, nuts, and other foods. On average, more than twelve kinds of food should be consumed daily, and at least

‡ Corresponding author
ORCID: Sheng-rong SHEN, http://orcid.org/0000-0003-4096-1693
© Zhejiang University and Springer-Verlag Berlin Heidelberg 2016

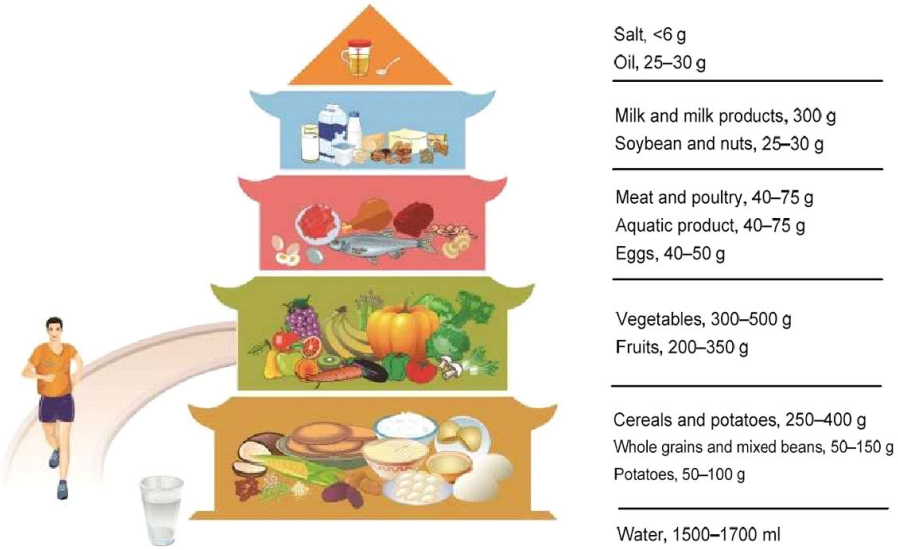


Fig. 1 Food Guide Pagoda for Chinese Residents (Chinese Nutrition Society, 2016)

twenty-five per week. The daily amount of cereals and potatoes consumed for body energy production should be 250–400 g, including 50–150 g of whole grains and mixed beans and 50–100 g of potatoes. The major characteristic of a balance diet pattern is to eat a variety of foods with cereals as the staple.

1.2 Balance eating and exercise to maintain a healthy body weight

People of all ages should know how to select foods for healthy eating and should exercise every day to maintain energy balance and a healthy weight. People should engage in daily physical activities of moderate intensity at least five days per week, corresponding to a weekly total of at least 150 min. Regular physical activity should amount to at least 6000 steps each day. Avoiding ingesting excessive food and physical inactivity is the best way to maintain energy balance.

1.3 Consume plenty of vegetables, milk, and soybeans

Vegetables and fruits are important components of a balanced diet; milk and soybean are rich in calcium and protein, respectively. The daily vegetable intake should be in the range of 300–500 g. Dark vegetables, including spinach, tomato, purple cabbage, pak choy, broccoli, and eggplant, should account for half this amount and should appear in every meal. Fruits should be consumed every day. The daily intake of fresh fruits, excluding fruit juice, should be between 200 and 350 g. A variety of dairy products, equivalent to 300 g of liquid milk, should be consumed per day. Bean products and nuts should be frequently eaten in an appropriate amount for energy and essential oils.

1.4 Consume an appropriate amount of fish, poultry, eggs, and lean meat

The consumption of fish, poultry, eggs, and meat should be in moderation. The appropriate weekly intake is set at 280–525 g of fish, 280–525 g of poultry, and 280–350 g of eggs with an accumulated daily intake of 120–200 g on average. Fish and poultry should be chosen preferentially. The yolk should not be discarded when consuming eggs, and less fat and fewer smoked and cured meat products should be eaten.

1.5 Reduce salt and oil, and limit sugar and alcohol

Choose to consume less salt and fewer fried foods. The daily recommended intake for adults should be no more than 6 g of salt and 25–30 g of cooking oil. For sugar, the daily intake should be properly controlled, and should be less than 50 g, or preferably less than 25 g. For trans fatty acids, the daily intake should be less than 2 g. To keep the body well-hydrated, enough water, corresponding to 7–8 cups (1500–1700 ml) for adults, should be consumed every day. The drinking of plain boiled water

or tea should be promoted and sugar-sweetened beverages discouraged. Children and pregnant or lactating women are not encouraged to drink alcohol. For adults, the amount of alcohol consumed per day should not exceed 25 g for men and 15 g for women.

1.6 Eliminate waste and develop a new ethos of diet civilization

Treasure and prepare foods according to the need for consumption. Promote separate meals for individuals to eliminate waste. Food should be fresh and hygienic, and properly handled for cooking. Raw and cooked food should be prepared separately. Cooked food should be reheated adequately before serving. Learn to read food labels before purchasing. Regularly going home and enjoying sharing time with family for dinner are the inherent practices of an excellent culture of diet civilization.

To help consumers put the guidelines into practice, the commission proposed a program of daily food recommendations and presented these in the form of a Food Guide Pagoda (Fig. 1). The pagoda illustrates the concept of food classification and the recommended daily intake of each of five food groups (The Chinese Nutrition Society, 2000). The Food Guide Pagoda was designed on the basis of the Dietary Guidelines for Chinese Residents. However, the specific recommendations are not shown in the pagoda. In practical application, the recommendations must be adjusted to individual variables, such as weight, height, age, sex, and physical activity.

2 Importance of dietary guidelines

Nowadays, diet is believed to play a crucial role in promoting healthy growth and preventing chronic degenerative diseases such as cancer, diabetes, heart disease, obesity, hypertension, hyperglycemia, arteriosclerosis, arthritis, and osteoporosis. Rates of these diet-related chronic diseases continue to rise and they come not only with increased health risks, but also at a high cost. For example, around half of all American adults, about 117 million individuals, are reported to have one or more preventable chronic diseases, including cardiovascular disease (CVD), hypertension, type 2 diabetes, some cancers, and poor bone health, many of which are related to poor quality eating patterns (poor nutrition, tobacco use, and excessive alcohol consumption) and physical inactivity. Over two-thirds of adults and nearly one-third of children and youth are overweight or obese. In an attempt to promote healthy foods to their populations, governments and health authorities in many countries have developed and promulgated dietary guidelines (Truswell, 1987). The key objective of these guidelines is to "provide advice to the general population about healthy food choices; therefore, their regular diet contributes to a healthy lifestyle and is consistent with minimal risk for the development of diet-related disease" (National Health and Medical Research Council, 1992). Part of the guidelines encourage the public to purchase, prepare, and consume food which is high in non-digestible dietary fiber, and either fat-free or comparatively low in fat, salt, sugar, and cholesterol (Turrell, 1997). Increasing evidence from prospective cohort studies on diet quality and mortality has demonstrated that higher diet quality scores are strongly associated with a lower risk of mortality (Kurotani *et al.*, 2016). To promote reasonable nutrition and healthy lifestyles, the dietary guidelines were compiled on the basis of the principles of nutrition combined with knowledge of the actual national or local situation. This approach can help people to make wise and appropriate food choices and adjust their diet to reduce diet-related chronic diseases and keep healthy. Dietary guidelines have important guiding significance. Our aim of this article is to discuss the recent scientific evidence and development of the Chinese, Japanese, and American dietary guidelines related to diet quality and mortality.

3 Comparison of the dietary guidelines for Chinese, Japanese, and American populations (2015–2020)

All foods and numerous beverages contain calories, and the total number of calories that we use for energy in the body differs according to the components (proteins, carbohydrates, and fats) in a food. The total number of calories that a person needs each day varies depending on a number of factors, including a person's age, sex, height, weight, and level of physical activity (US Department of Agriculture, 2015). According to the Chinese Food Pagoda, the

dietary guidelines encourage the general public to consume plenty of cereals, tubers, whole grains, legumes, vegetables and fruits, meat and poultry, aquatic foods, eggs, and dairy products, as well as soybean and nuts in moderation, but limited amounts of salt and oil. Also, water and physical activity are represented coming around the Pagoda. When compared with the previous version of the 2007 Food Pagoda, there have been no significant changes in dietary recommendations. The recommended amounts of fruits, eggs, and meat and poultry have slightly decreased, while the amount of aquatic products, soybean and nuts has slightly increased. Recommendations for the level of physical activity and the consumption of other foods are largely unchanged. However, there is a moderate increase in recommended water consumption from 1200 ml to between 1500 and 1700 ml per day. This implies that the new version encourages the public to drink more water for a healthy body. A well-studied report of adherence to dietary guidelines and mortality of 133 000 Chinese adults in urban Shanghai, conducted by Yu *et al.* (2014), provided significant evidence for the effects of the Chinese Food Pagoda (CHFP) on diet quality-related health and mortality. The authors examined adherence to the 2007 CHFP in association with total and cause-specific mortality by comparison with the US dietary guidelines: Dietary Approaches to Stop Hypertension (DASH) and the Alternative Healthy Eating Index (AHEI). The standard energy dietary intake was adjusted to 2000 kcal/d (1 kcal= 4.1868 kJ) and the 2007 CHFP score was designed on the basis of the following 5 food groups: (1) grains; (2) vegetables and fruits; (3) dairy products, beans, and bean products; (4) meat and poultry, fish and shrimps, and eggs; and (5) fats and oils and salt. This is the first study to assess the mortality risk associated with the 2007 Chinese Dietary Guidelines and compare the results with those based on two well-known US dietary guidelines (Yu *et al.*, 2014). From the results, they demonstrated that a higher score of adherence to CHFP was associated with reduced morbidity and lower total mortality from major chronic diseases, especially CVD, in both men and women during mean follow-ups of 6.5 and 12 years. They observed decreased risks associated with diet-related chronic diseases including CVD and cancer, and reduced diabetes mortality, particularly in men. The reason for the significantly lower total mortality could be that participants strictly adhered to the specific recommendations for the consumption of vegetables and fruits, legumes, fish, and eggs, even though they may not have complied fully with the recommendations for grains, dairy, meat, fat, and salt. Similarly, a higher score based on DASH and AHEI dietary guidelines also predicted lower morbidity and mortality from all causes, CVD, and diabetes, but not cancer. The authors concluded that a higher compliance with Chinese or US dietary guidelines is linked to lower total mortality in Chinese adults. Positive associations are more evident in men than in women and are more consistent for CVD and diabetes than for cancer mortality.

Recent articles about another prospective study on the relationship between the quality of diet and mortality based on the Japanese Food Guide Spinning Top has provided concrete evidence in support of the health benefits from the Japanese Food Dietary Guidelines (Oba, 2009; Kurotani *et al.*, 2016). Japanese foods have drawn considerable interest in Western countries due to the low rate of coronary heart disease and long life expectancy in Japan (Oba, 2009). Life expectancy of the Japanese people has gradually increased over the last few decades and is currently among the longest in the world, particularly among Japanese women who, in 2012, had the longest life expectancy of 87 years (Kurotani *et al.*, 2016). Kurotani *et al.* (2016) examined the association between adherence to the Japanese Food Guide Spinning Top and total and cause-specific mortality. The participants were consisted of 36 624 men and 42 970 women in the age group from 45 to 75 years who had no history of cancer, stroke, ischaemic heart disease, or chronic liver disease. The 2005 Japanese Food Guide Spinning Top was jointly developed by the Japanese Ministry of Health, Labor and Welfare and the Ministry of Agriculture, Forestry and Fisheries, based on the Dietary Guidelines for Japanese. This was used as a guide to help the general public choose the type and amount of foods they should eat each day to promote health. The food guide comprises five categories of dishes: grain dishes (rice, bread, and noodles), vegetable dishes (vegetables, mushrooms, potatoes, and seaweed), fish and meat dishes (meat, fish, egg, and soybeans), milk (milk and milk by-products), and fruits (fruit and 100% fruit juice)

(Fig. 2). The recommended number of servings of each dish and the recommended total energy intake are arranged in relation to sex, age, and level of physical activity. The recommended energy intake from snacks and alcohol is less than 200 kcal each day. From these results, Kurotani *et al.* (2016) observed that a dietary pattern of a high intake of vegetables and fruits and adequate intake of fish and meat promoted a significant reduction in the risk of mortality from CVD, particularly cerebrovascular disease. According to the data, the Japanese population prefers fish to beef and pork unlike Western populations which have a balanced nutrient consumption of white and red meat. However, the authors indicated a less clear association between scores on the Japanese Food Guide Spinning Top and cancer deaths in the study population. They also highlighted that vegetables and/or fruits are most likely to protect against cancers of the lung, stomach, oesophagus, mouth, pharynx, and larynx, whereas milk probably protects against colorectal cancer. In contrast, there is convincing evidence that red meat and processed meat increase the risk of colorectal cancer. Finally, the authors stated that a higher intake of fish and *n*-3 polyunsaturated fatty acids is associated with a lower risk of myocardial infarction. To sum up, the authors concluded that the balance of energy intake of grains, vegetables, fruits, meat, fish, eggs, soy products, dairy, confectioneries, and alcohol can contribute to longevity by reducing the risk of death, mainly from CVD, in the Japanese population.

The 2015–2020 eighth edition of the Dietary Guidelines for Americans, jointly developed by US Department of Health and Human Services (HHS) and the US Department of Agriculture (USDA), is very interesting in providing key recommendations for selecting healthy food choices. It centers on preventing diet-related chronic diseases that afflict people (US Department of Agriculture, 2015). The guidelines aim to support individuals to improve and maintain overall health and to decrease their risk of chronic disease through adopting healthier eating patterns and making healthy choices in their daily lives. The focus is on disease prevention, not treatment. At the present time, there is growing concern about chronic diseases, including those associated with excess weight and obesity, CVD, diabetes, cancers, and bone disease, which are becoming more and more serious among the American population. For example, 65% of adult females and 73% of adult males were found to be overweight or obese in 2009–2012. In 2010, about 85 million men and women aged 20 years or more (35% of the population) suffered from CVD. In 2012, the prevalence of diabetes (type 1 plus type 2) was 14% for men and 11% for women aged 20 years or more. Around 10 million

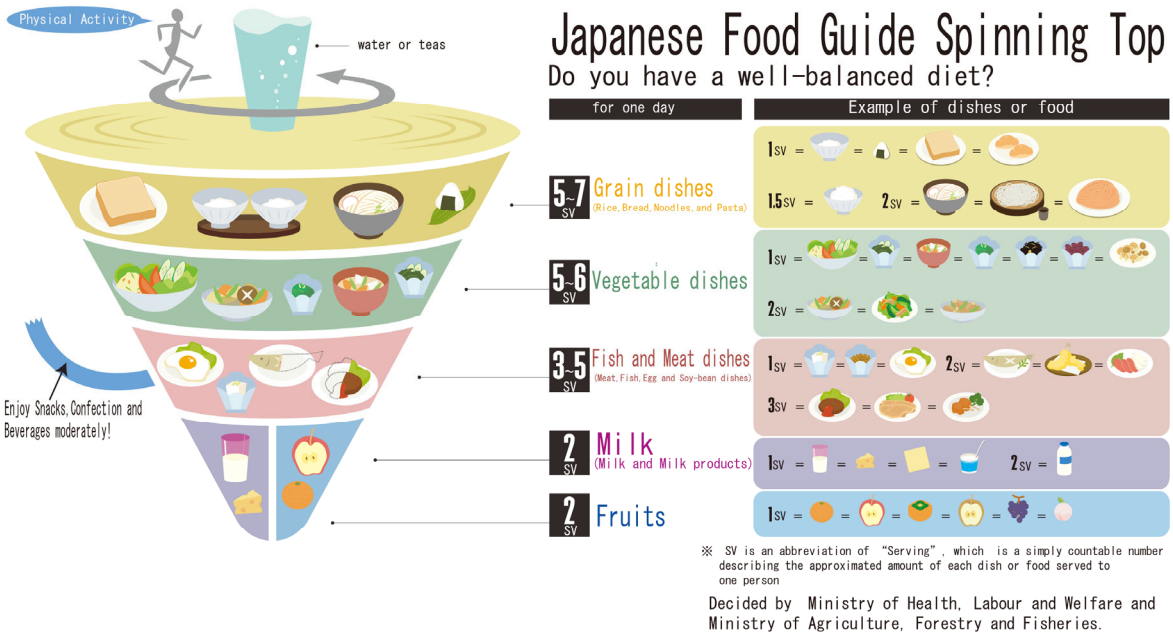


Fig. 2 Japanese Food Guide Spinning Top (Ministry of Health, Labour and Welfare and the Ministry of Agriculture, Forestry and Fisheries of Japan, 2005)

(10%) adults aged 50 years or more had osteoporosis and 43 million (44%) had low bone mass. Therefore, to promote a healthy diet to help people avoid the diseases of civilization (cancer, diabetes, heart disease, and obesity), the US government has characterized five dietary guidelines plus two important key recommendations (a healthy eating pattern and physical activity) in the eighth edition of the Dietary Guidelines for Americans, 2015–2020 (Fig. 3) (US Department of Agriculture, 2015).



Fig. 3 The eighth edition of Dietary Guidelines for Americans, 2015–2020 (US Department of Agriculture, 2015)

The two key recommendations for healthy patterns of eating and physical activity in the newly-edited American guidelines are briefly described as follows (US Department of Agriculture, 2015):

1. Key recommendations for a healthy eating pattern. All foods and beverages consumed should be within a suitable calorie level. A healthy diet generally comprises a wide range of different vegetables from all of the vegetable subgroups such as dark green, red and orange, legumes (bean and peas), and starchy. Fruits should be consumed either in whole form or in 100% fruit juices. Grains should contain whole grains (whole kernel) and the consumption of refined grains and products processed with refined grains should be limited, particularly the consumption of processed foods that are high in trans fatty acids, added sugars, and/or salt, including cookies, cakes, and various snack foods. Recommended dairy products include fat-free or low-fat milk, yoghurt, cheese, and/or enriched soy beverages (soymilk). A diversity of protein-rich foods is recommended including seafood, lean meats and poultry, eggs, legumes (bean and peas, and soy), nuts, and seeds. Finally, oils should come chiefly from monounsaturated and polyunsaturated fatty acids. These are usually liquid at room temperature and are obtained from a plant source. We need to obtain these oils from the diet because our body cannot produce them. They are believed to provide health benefits because they are the primary source of essential fatty acids and vitamin E. However, we should limit the intake of saturated fats (trans fats), added sugars, and salt (sodium). Saturated fats and added sugars should each comprise less than 10% of daily calories and daily salt consumption should be lower than 2300 mg. Alcoholic beverages, if consumed, should be limited to an appropriate volume: a maximum of one drink per day for women and two drinks per day for men, and restricted to only adults of legal drinking age. Coupled with these recommendations, Americans of all ages should comply with the Physical Activity Guidelines for Americans (US Department of Agriculture, 2015) to promote physical fitness for achieving and maintaining a healthy body weight, and simultaneously avoiding the risk of chronic disease. The connection between diet and physical activity helps balance calorie intake and body weight. Therefore, a key recommendation of the dietary guidelines includes Physical Activity Guidelines for Americans.

2. Key recommendations to meet the physical activity patterns for Americans. Apart from dietary consumption, individuals are encouraged to regularly exercise for health promotion, according to the principles of the Physical Activity Guidelines for Americans developed by the US Department of Health and Human Services. Adults need at least two and a half hours of moderate physical activity and should practice muscle-building exercises at least two days per week. Youths between 6 and 17 years of age need at least one hour of physical activity every day such as aerobic, muscle-strengthening, and bone-strengthening

activities. Numerous studies have shown that adhering to the physical activity guidelines can bring many health benefits like maintaining a healthy weight, and can help achieve weight loss when combined with a low calorie diet. Other studies have indicated that the risks of premature death, coronary heart disease, stroke, hypertension, hyperlipidaemia, type 2 diabetes, breast and colon cancer, and metabolic syndrome are reduced by regular physical activity. Physical activity, moreover, can help reduce depression and prevent falls. People can choose different types of regular physical activity that they like throughout the day for a healthy lifestyle (US Department of Agriculture, 2015).

There has been no change in MyPlate, a Federal Government symbol serving as a reminder for establishing healthy eating patterns and healthy choices across the food groups (Fig. 4).

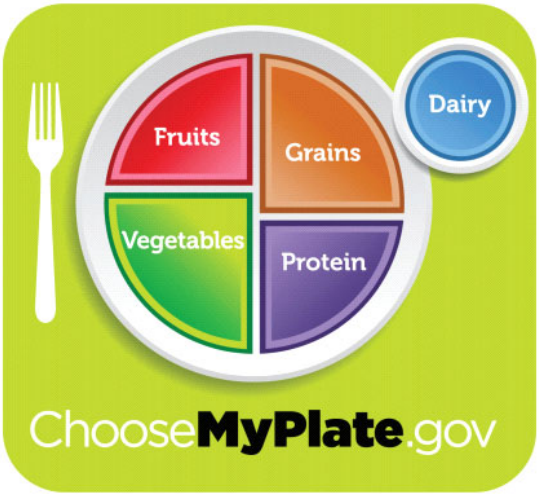


Fig. 4 Implementation of the dietary guidelines through MyPlate (US Department of Agriculture, 2015)

The US dietary guidelines can be defined at the molecular level, and related to specific behavior orientation, unlike the Dietary Guidelines for Chinese citizens. Western food can be more precisely defined because it is easier to quantify and its processing can more easily be standardized. The accuracy of dietary guidelines and people's understanding of them are often contradictory, which is why the advice and recommendations in the dietary guidelines for most countries in the world are at the food species level rather than based on nutrition. A more macro "cuisine" concept launched in the form of the Japanese Food Guide Spinning Top, may better suit Chinese citizens who have the same eating habits and cooking methods as the Japanese.

4 Conclusions

We found that all the dietary guidelines examined have been consistently associated with a lower risk of many chronic diseases. Scientific findings encourage the general population to consume a broad variety of different food sources on the basis of nutrient and food intake to prevent deficiency diseases and a surplus of energy and nutrients. Daily physical activity is also encouraged for healthy growth and physical strength. For instance, the Chinese Food Pagoda suggests people do at least 6000 steps a day. Strong evidence demonstrates that higher intakes of vegetables and fruits provide a lot of health benefits. Whole grains may also contribute, though with slightly less consistency. However, there is growing scientific evidence that added sugar, trans fatty acids (saturated fats), and table salt provide serious threats to our health and therefore should be minimally consumed. Many health organizations agree that saturated fat and sugar should constitute less than 10% of total calories and salt consumption should be no more than 2300 mg per day. From a personal point of view, we also strongly encourage people to drink more water and keep bottled water nearby because where there is water, there will be life!

Compliance with ethics guidelines

Shan-shan WANG, Sovichea LAY, Hai-ning YU, and Sheng-rong SHEN declare that they have no conflict of interest.

This article does not contain any studies with human or animal subjects performed by any of the authors.

References

The Chinese Nutrition Society, 2000. Dietary Guidelines and the Food Guide Pagoda. *J. Am. Diet. Assoc.*, **100**(8): 886-887. http://dx.doi.org/10.1016/S0002-8223(00)00257-1

The Chinese Nutrition Society, 2016. The Food Guide Pagoda for Chinese Residents. Available from http://dg.cnsoc.org/upload/images/source/20160519163856103.jpg [Accessed on June 20, 2016] (in Chinese).

Kurotani, K., Akter, S., Kashino, I., *et al.*, 2016. Quality of diet and mortality among Japanese men and women: Japan Public Health Center based prospective study. *BMJ*, **352**: i1209.

http://dx.doi.org/10.1136/bmj.i1209

Ministry of Health, Labour and Welfare and the Ministry of Agriculture, Forestry and Fisheries of Japan, 2005. Japanese Food Guide Spinning Top. Available from http://www.maff.go.jp/j/balance_guide/b_use/pdf/eng_reiari.pdf [Accessed on June 30, 2016].

National Health and Medical Research Council, 1992. Dietary Guidelines for Australians. Australian Government Publishing, Canberra.

Oba, S., Nagata, C., Nakamura, K., *et al.*, 2009. Diet based on the Japanese Food Guide Spinning Top and subsequent mortality among men and women in a general Japanese population. *J. Am. Diet Assoc.*, **109**(9):1540-1547. http://dx.doi.org/10.1016/j.jada.2009.06.367

Truswell, A.S., 1987. Evolution of the dietary recommendations, goals and guidelines. *Am. J. Clin. Nutr.*, **45**(Suppl. 5): 1060-1072.

Turrell, G., 1997. Determinants of gender differences in dietary behavior. *Nutr. Res.*, **17**(7):1105-1120. http://dx.doi.org/10.1016/S0271-5317(97)00082-1

US Department of Agriculture, 2015. Dietary Guidelines for Americans 2015–2020, 8th Edition. Available from http://health.gov/dietaryguidelines/2015/guidelines [Accessed on June 20, 2016].

Yu, D.X., Zhang, X.L., Xiang, Y.B., *et al.*, 2014. Adherence to dietary guidelines and mortality: a report from prospective cohort studies of 134,000 Chinese adults in urban Shanghai. *Am. J. Clin. Nutr.*, **100**(2):693-700. http://dx.doi.org/10.3945/ajcn.113.079194

中文概要

题　目：中国居民膳食指南（2016）：评价和比较

概　要：高质量的膳食在促进人类健康成长和防治包括癌症、心血管疾病、糖尿病和肥胖在内的多种慢性疾病中起着重要的作用。坚持高质量的膳食能有效地降低死亡率。为了帮助形成健康的生活方式，增强体质，中国政府发布了新的中国居民膳食指南（2016）和膳食宝塔，用来指导居民膳食的摄入。同样，日本政府早期发布了日本膳食指南陀螺模型，美国政府最近也出版了修订后的第八版美国居民膳食指南（2015–2020）。与指南相关的同期证据表明，遵循指南进行膳食指导，许多慢性疾病的发病率和死亡率都会降低。所有的科学发现支持鼓励居民在保证营养和食物摄入的基础上消耗各种各样的食物以防止营养缺乏疾病以及能量和营养过剩，并且建议进行日常活动来保持身体健康。

关键词：膳食指南；中国膳食宝塔；日本膳食指南陀螺模型；美国居民膳食指南