

Food trends in the U.S, Europe and China



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Dr. Maryam Kebbe received her PhD in Medical Sciences from the University of Alberta's Department of Pediatrics (Edmonton, Alberta) in 2019. She completed postdoctoral training in the Medical Sciences Division at the University of Oxford (Oxford, United Kingdom) and is currently a CIHR Postdoctoral Research Fellow in the Reproductive Endocrinology & Women's Health Laboratory at the Pennington Biomedical Research Center (Baton Rouge, Louisiana). Dr. Kebbe established her roots as a nutrition and behaviour scientist and innovated solutions within clinical settings to manage obesity, from infancy through adulthood. Drawing in part on her nutrition training, Dr. Kebbe's niche targets developmental origins of obesity by studying the breastmilk and infant gut microbiomes, with a particular focus on nutritional, immunomodulatory, inflammatory, metabolic, and endocrine mechanisms. Dr. Kebbe hopes to develop and implement novel, effective, and sustainable nutrition and microbiome-based interventions to prevent obesity in infants and children.

Since the 1980s, there has been a proliferation in the availability of inexpensive and highly palatable foods, leading to a shift in the overall healthfulness of population diets. Despite decades of global efforts to align dietary behaviours with national and international recommendations, a poor diet remains one of the leading risk factors for ill-health, including dyslipidemia, cardiovascular disease, several types of cancer, and psychological illnesses.

Research endeavors have focused on characterizing dietary trends across the lifespan and globally, as well as investigating associations with disease risk.

- In the viewpoint by Riccardi *et al.* (2020), authors synthesized a body of evidence, concluding that unfavourable changes in dietary behaviours among Europeans were associated with increased cardiovascular disease risk.
- In the study by Bu *et al.* (2021), summarized by Costa, a similar shift in dietary patterns and diet-related behaviours was observed among the Chinese population, with an increased preference for consuming both carbohydrate-rich foods, such as fruits and vegetables, and energy-dense foods such as meat, snacks, and beverages.
- Both studies by Liu *et al.* (2021) and Yu *et al.* (2021), reported by Chanséaume-Bussiere, examined trends in food sources and diet quality among children and adults between 1999 and 2018 in the United States. It was determined through dietary indices, namely the American Heart Association diet score and/or the Healthy Eating Index 2015, that diet quality of foods (meals, snacks, and beverages) consumed at schools significantly improved, without population disparities. This finding contrasted with observed disparities for food consumed from grocery stores, particularly that poor diet quality decreased in only high-income (vs low-income) households.

Trends that are aligned with a Western style diet high in fat and animal-based foods have been emerging over the past few decades. Collectively, these studies underscore the importance of system level interventions to improve population adherence to dietary guidelines and recommendations and reduce health disparities, which can help to increase healthy life expectancy.

Dietary habits and their impact on cardiovascular diseases: a viewpoint on trends in Europe

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Cardiovascular diseases (CVD) are a global burden: they are the main cause of deaths in Europe with 45 % of all deaths (i.e., 4 million deaths by year) (Wilkins et al, 2017).

In 2016, more than 9.1 million premature deaths from CVD worldwide are attributable to diet-related risks (52% of all CVD deaths). In Europe, 2.1 million diet-related CVD deaths were reported in 2019. This highlights the key role of dietary patterns and food choices and the need to be optimized for health and well-being (GBD 2017, Meier 2019).

The aim of this viewpoint is to evaluate food choices of the European population and their temporal trends in relation to possible effects on the CVD risk.

Cardiovascular diseases: trends, change and progression

CVD mortality rates were highest at the beginning of the 21st century, with the greatest increases in Central and Eastern regions, and are now declining while remaining the leading cause of death in Europe. This is partly due to the prevention and treatment of the disease, but also to downward trends in certain risk factors (alcohol consumption, smoking, hypercholesterolemia, etc.). On the other hand, other risk factors, in particular overweight/obesity and diabetes, have increased by over 50% and 25% respectively during the last 10 years (Wilkins et al, 2017).

Diet: a major contributor to cardiovascular diseases

Food choices are the most important factors undermining health and well-being, for as much as almost 50% of all CVD deaths. Research on the relationship between diet and cardiovascular health shows that excessive intake of energy, saturated fat, trans fat, sugar and salt, as well as a low consumption of vegetables, fruits, nuts, and wholegrain are leading lifestyle-related cardiovascular risk factors and major reasons for concerns. Among them, food choices associated with the strongest relationship with CVD are low intakes of wholegrain, nuts and seeds, and fruit and an excessive salt consumption (cf. Table 1).

Food groups	Consumption	CVD deaths
Wholegrain	Low	20,4%
Nuts and seed		16,2%
Fruit		12,5%
Salt	High	12.0%

Table 1 : Food groups with a stronger impact on CVD burden in Europe (Meier 2019)

Trends of dietary habits in Europe

In 2000, WHO and FAO organized a Joint Expert Consultation on Diet, Nutrition and the Prevention of Chronic Diseases, to undertake more effective and sustainable policies and strategies

to deal with the increasing public health challenges related to diet and health (WHO/FAO, 2003). However, in the last decade, the trends of dietary habits in Europe are not reassuring, as only minor changes occurred, with shifts leading to unhealthy choices in some cases, thus interrupting the favorable trends observed up to the beginning of the new century (figure 1).

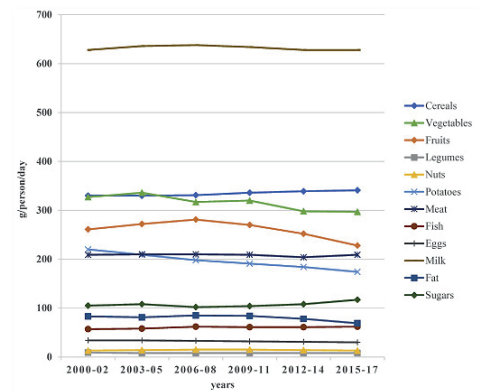
- **Fruit and vegetables:** over the past 60 years, fruit consumption has increased substantially across Europe, in parallel with that of vegetables (availability of fruit and vegetable, respectively 30% and 20%; however, a slow decline has occurred in the last decade.

- **Wholegrain:** the consumption is rather low, except for Northern countries. Despite a trend towards a greater intake in many European countries, it remains well below the recommended target of 50% of total cereal food consumption.

- **Energy and fat:** the increase has begun already in the second half of the last century; a small decline has appeared in the last decade.

- **Salt and free sugars:** the consumption still exceeds the intake recommended by WHO (5 g salt/day and 5 to 10% energy for free sugars). Manufactured foods (baked goods, breakfast cereals, sugary drinks...) brought a significant proportion of free sugars.

Figure 1: Trends of foods available for consumption in Europe since the year 2000



Dietary habits in Europe have shifted away from a healthy dietary pattern

These data clearly show that dietary habits have drifted away from a healthy dietary pattern all over Europe. Mediterranean countries are particularly facing this trend because of the "westernization" of their habitual diet following the process of globalization of food production and distribution, but also due to the increasing cost of many food items typical of the Mediterranean diet. This facilitates a shift towards less expensive, energy-dense foods with typically lower nutritional quality.

KEY MESSAGES

- A balanced diet rich in fruit, vegetables, wholegrains, nuts, and seeds, and low in salt and free sugars is a potential key lever to reduce cardiovascular risk.
- Policies to increase consumption of vegetables, fruits, and whole grains, are needed to prevent cardiovascular disease.
- There is urgent need for an appropriate strategy to improve the nutrition skills of health professionals, particularly in primary care.
- Policy options should necessarily include initiatives to facilitate production, marketing, availability, and affordability of healthy foods in each and every European country.

METHODOLOGY

- The figure 1 reports the foods available for consumption in Europe (28 countries) from the beginning of this century up to the most recent information available.
- For each food group, the average consumption was calculated for a three-year period.

Based on: Riccardi G, Vitale M, Vaccaro O. Are Europeans moving towards dietary habits more suitable for reducing cardiovascular disease risk? *Nutr Metab Cardiovasc Dis.* 2020 Oct 30;30(11):1857-1860.

References:

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- Report of a Joint WHO/FAO Expert Consultation. 2003.

China: New trends in terms of eating habits and consumption patterns

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China's economic and social development in recent years has had a considerable impact on the health and daily life of the Chinese population (Gonghuan, 2010; Broglia, 2011). In particular, its eating habits and consumption patterns experienced a major shift between 1997 and 2011, as shown in a six-wave health survey (Chinese Health and Nutrition Survey), with potential cardio-metabolic consequences (Popkin, 2006; Popkin 2012).

The present study aims to determine trends in diet-related behaviors and their interactions with cardio-metabolic diseases.

Improved living conditions

Between 1997 and 2011, several major changes occurred: the average age of the survey participants increased from 39 to 46 years, the urbanisation rate climbed by 11%, per capita income increased by 5298 yuan (€737), and the population achieved higher education levels, finishing primary school and moving on to middle school; on the other hand, there was an increase in sedentary behaviours.

Westernisation of diet...

Concerning eating habits, total food intake increased by 106 grams over the 15-year period and the successive survey waves found that the categories of foods consumed gradually became more diverse. Researchers reported significant increases in intakes of wheat (+9 g), vegetables (+13 g), fruit (+75 g), dairy products (+23 g), red meat and poultry (+24 g), fish, prawns and crab (+8 g), eggs (+9 g), snacks/fast food (+43 g), and beverages (+14 g). Intake levels surged for three categories in particular: dairy products (+1008%), snacks/fast food (+1787%) and beverages (+2959%). In parallel, intakes of traditional products such as rice and soya dropped sharply (by 91 g and 22 g respectively). In 2011, three food categories alone accounted for 65% of all foods consumed: vegetables (more than 32%), rice (23%), and wheat (10%).

...with excessive fat intakes

Over the 15-year monitoring period, there was a decrease in daily

energy intakes (-363 kcal/day) in parallel with a sharp drop in the contribution of carbohydrates (-10%) and an increase in that of fat (+8.6%) and protein (+1.8%). In 2011, the contribution of fat to the energy intakes of the Chinese population (34%) exceeded the WHO recommendations (30%).

Changing consumption patterns

Between 1997 and 2011, the number of meals eaten per day in China increased from 2.93 to 3.47. In 2011, the Chinese population was more likely to eat a snack in the morning (+10% compared with 1997), afternoon (+19%) and late at night (+20%). Meals away from home (restaurants, workplaces) also increased over the years, whereas there was a slight decrease in meals eaten at home. Lastly, preparation methods changed: the participants eschewed traditional boiled preparations in favour of fried and stir-fried food.

Health concerns among top priorities despite an increase in the prevalence of overweight, obesity, hypertension and diabetes

Despite all this, the participants' nutritional knowledge improved and a growing number of subjects said they tried to eat a balanced diet (+6%). Furthermore, they were more likely in 2011 than in 2004 to say they liked fruits and vegetables (+35% and +33%, respectively). However, the survey noted a rise in prevalence rates for overweight (+19%), obesity (+7%), hypertension (+10.8%) and diabetes (+3.4%) after the 15 years of monitoring.

The eating habits and related behaviours of the Chinese population have changed significantly over the past few decades while the prevalence of nutritional disorders has increased. Traditional diets rich in plants have gradually been replaced with a Western diet (refined cereals, meat, and ultra-processed products). While some changes (a more varied diet, choice of balanced foods) have been beneficial, others (increased consumption of snacks including late-night snacks, fast food, and sugar-sweetened beverages) could expose the population to a greater risk of developing metabolic and cardiovascular diseases.



KEY MESSAGES

- Chinese eating habits and food consumption patterns have undergone a major shift over the past few decades.
- There has been a trend towards diversification and modernisation.
- Fruit intake has increased over the years. Although intakes of vegetables have only risen slightly, these nonetheless account for more than 30% of all foods consumed.

METHODOLOGY

- Monitoring of the China Health and Nutrition Survey over a 15-year period (1997 to 2011)
- Analysis of food categories (and weights), eating frequencies, eating locations, cooking methods, meal times, nutritional knowledge, food preferences, nutrition structure over time, and interactions with cardio-metabolic risks (statistical tests)

Based on: Bu T et al. Trends in Dietary Patterns and Diet-related Behaviors in China. Am J Health Behav. 2021 Mar 1;45(2):371-383.

References:

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Evolution of the American diet quality: better and worse depending on age and food sources

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Poor diet quality is a main public health concern in developed nations, becoming the third leading cause of death and disability-adjusted life-year loss in the US (Mokdad, 2018).

Trend food through the National Health and Nutrition Examination Survey (NHANES) cohort in US

Two studies have provided an update on recent changes in the American diet quality. The first investigation conducted by Liu et al. examined the trends in the quality of diet consumed from major food sources in the United States. Trends in diet quality were investigated both overall and by population sub-group (e.g. sub-groups by age or household income). The second study by Yu et al. was started in 1999-2000 and compare trends changes between US children and adults (Table 1).

Studies	Population	Period	Measure of diet quality	Main food source
Liu et al.	20,905 children 39,757 adults	2003- 2018	HEI-2015 American Heart Association score	Grocery stores, restaurants, schools for children or worksites for adults and others such as food truck or sports facility.
Yu et al.	31,988 children 34,317 adults	1999-2000	HEI-2015	x

Improvement of diet quality occurred in schools with an increase of whole grains and fruit intake

Between 2003-2004 and 2017-2018, the estimated proportion of children with poor diet quality from schools decreased by more than half, from 55.6% to 24.4% (P < .001 for trend). Among food and nutrient components, improvement was attributable to increased consumption of whole grains and fruit, and reduced intake of saturated fat and sugar-sweetened beverages.

The improvement occurred in all subgroups, mainly after 2010 probably due to the positive impact of Healthy, Hunger-Free

Kids Act of 2010 supported by former first lady Michelle Obama. In contrast, disparities were observed in diet quality of foods from grocery stores. The proportion of children consuming low-nutrient food was stable in low-income households (from 52.7 to 49.7%) but decreased in high-income households (from 51.0 to 37.4%, P=0.003). From each food source, children had worse overall quality than adults, except from schools. In adults, modest improvements were identified in diet quality for foods consumed from grocery stores (35.8 to 38.3%) or restaurants (28.5 to 29%), and stable or worsening diet quality for foods consumed from other sources.

The findings of this study suggest that foods consumed at schools provided the best mean quality of major US sources but also suggest that the retail grocery, providing approximately two-thirds of calories, remains a key opportunity for improving diet quality.

A diet quality worse in children than in adults during 1999-2018 in the US

In accordance with the study from Liu, these results underline a worse diet quality of children than that of adults. Their findings showed that between 1999-2000 and 2017-2018, overall HEI-2015 score of children increased from 48.73 to 51.59 (P < 0.001). For adults, HEI-2015 score increased from 53.1 to 53.18 (P < 0.001) in the same period. Globally, diet quality of children was more variable than that of adults. From 1999 to 2018, whole grains and added sugars were components changing stably in children in a significant upward trend whereas total vegetables and saturated fats had a significant downward trend (P < 0.05 for annual percent change). In comparison, greens and beans, whole grains, seafood and plant proteins and fatty acids increased significantly in adults' diet whereas vegetables and sodium decreased significantly (P < 0.05 for annual percent change).

Public health action needed to improve diet quality

In conclusion, both publications emphasize the role of public health action, food industry and catering to help consumers in their choices and improve diet quality. Among numerous factors influencing the diet quality in childhood, family factor and foods environments are crucial (Scaglioni, 2018). Schools currently provide an improved diet quality, which is essential to limit the disparities that could occur for children living in different levels of income households.

KEY MESSAGES

- Diet quality of US children is worse but more variable than adults
- By 2017-2018, foods consumed at schools provided the best mean quality of major foods sources

METHODOLOGY

- Both serial cross-sectional studies included respondents from the NHANES cohort - 8/10 cycles from 1999 or 2003 to 2018 - who had valid 24h dietary recalls. Diet quality was characterized by the American Heart Association score and/or the Healthy Eating Index 2015. Yu et al. estimated trends on scores of HEI-2015 by joint-point regression model.
- The American Heart Association (AHA) diet score is composed of eight components (total fruits and vegetables; whole grains; fish and shellfish; nuts, seeds and legumes; sugar-sweetened beverages; processed meat; sodium; and saturated fat) and range from 0 to 80 with higher scores indicating healthier diets (Mozaffarian, 2015).
- The Healthy Eating Index (HEI) 2015 is based on nine adequacy components (total fruit, whole fruit, total vegetables, greens or beans, whole grains, dairy, total protein foods, seafood or plant protein and fatty acids) and four moderation components (refined grains, sodium, added sugars, and saturated fat) and range from 0 to 100 (Reedy, 2018).

Based on: Liu J et al. Trends in Food Sources and Diet Quality Among US Children and Adults, 2003-2018. JAMA Netw Open. 2021;4(4):e215262.

Yu H et al. "Difference in diet quality trends between children and adults in the United States: A serial cross-sectional study from 1999 to 2018." Asia Pacific journal of clinical nutrition 30 3 (2021): 522-536 .

References:

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- Scaglioni et al. Nutrients 2018;10:706

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Impact of Mediterranean Diet Food Choices and Physical Activity on Serum Metabolic Profile in Healthy Adolescents: Findings from the DIMENU Project



The Mediterranean diet is one of the best patterns of healthy diets. Italian researchers conducted a study to evaluate the impact of typical Mediterranean foods on the lipid and glucose profiles of 85 adolescents. Divided into six groups depending on the food tested (three "Mediterranean" foods (G1: olive oil; G2: nuts; G3: fish) and three unhealthy foods (G4: fast food; G5: sweets; G6: biscuits)), these adolescents were administered a personalised Mediterranean meal plan including the tested food group for six months. Their level of physical activity and metabolic profile were evaluated at the time of recruitment and at the end of the experiment. After six months of follow-up, a significant decrease in blood glucose and cholesterol (total and LDL) was found for all the participants. These improvements were noted in sedentary adolescents, those with moderate activity levels, and those who were active and had displayed a better metabolic profile at the start of the experiment. Therefore, combining a healthy diet such as the Mediterranean diet with physical activity increases the resulting health benefits.

Ceraudo F, et al. *Nutrients*. 2022;14(4):881. Ceraudo F, et al. *Nutrients*. 2022;14(4):881.

Lutein and Zeaxanthin and Their Roles in Age-Related Macular Degeneration-Neurodegenerative Disease



Known for their antioxidant effects, lutein and zeaxanthin belong to the class of carotenoids, which are pigments produced by plants. Found mainly in green leafy vegetables and some cruciferous vegetables, these two substances are unique in that they accumulate in the retina, specifically the macula. A recent literature review presented the current state of knowledge on the role of lutein and zeaxanthin in age-related macular degeneration (AMD) and cataracts, based in particular on human studies focusing on these substances' metabolism and bioavailability. Multiple studies have shown that regularly consuming foods containing these pigments, such as spinach, kale, and cabbage, provides significant protection against the onset of late AMD. There are also studies showing that higher dietary antioxidant intake, including with lutein and zeaxanthin, can significantly reduce early AMD associated with genetic risk variants.

Mrowicka M, et al. *Nutrients*. 2022;14(4):827.

Allium vegetables intake and the risk of gastric cancer in the Stomach cancer Pooling (StoP) Project



The allium class of vegetables and herbs includes garlic, onions, shallots, chives and leeks. All of these contain high levels of certain sulphur compounds (allicin, alliin and allyl sulphides). The Stomach cancer Pooling (StoP) Project consortium of international epidemiological studies explored the role of consuming allium vegetables in the prevention of stomach cancer. Seventeen studies including 6097 people with stomach cancer and 13,017 controls were analysed. According to this review, total allium vegetable intake was inversely associated with the risk of stomach cancer, suggesting that these foods provide protection against this disease. This association was nonetheless stronger in the studies conducted in Asia compared with the results obtained in Europe and the USA. In light of this geographical heterogeneity, the authors underline the possibility of a residual confounding factor and state that these results should be considered with caution and confirmed through further studies.

Dalmartello M, et al. *Br J Cancer*. 2022 Feb 24.

Social Media and Children's and Adolescents' Diets - A Systematic Review of the Underlying Social and Physiological Mechanisms



A systematic literature review conducted by a German team sought to evaluate the effects of social media on the dietary behaviours of children and adolescents (aged 2-18) and identify the related physiological and social mechanisms. Thirty-five articles were analysed.

Of four studies evaluating the effect of videos in terms of promoting healthy eating habits, one showed a positive effect of videos shared by peers (increased vegetable intakes). This effect was not observed for videos shared by influencers. Most of the studies also underlined that, regardless of the age of the participants, exposure to social media was associated with unhealthy dietary behaviours (skipping breakfast, consuming large quantities of unhealthy snacks and sugar-sweetened beverages, eating small quantities of fruit and vegetables). Moreover, the children and adolescents exposed to digital images of foods (healthy vs. unhealthy) showed increased brain response in reward- and attention-related regions. The authors therefore suggest that the observed effects in terms of dietary behaviour were related to physiological (appetite, increased neural response to portion size and the energy density of the foods depicted) and social (food advertising via influencers and peers) mechanisms.

Sina E, et al. *Adv Nutr*. 2022 Feb 26:nmac018.2022;375:131816.

Characterization of barriers and facilitators for adequate and healthy eating in the consumer's food environment



Brazilian researchers carried out a cross-sectional study intended to analyse barriers and facilitators for healthy and balanced eating in the food environment (municipality of Jundiá, São Paulo State). The majority of the 650 food retailers identified mainly sold ultra-processed products; 75.9% sold sugar-sweetened beverages, 37% rice and beans, and 30% fruit and vegetables. The authors conclude that access to healthy eating was facilitated by fruit and vegetable stores and neighbourhood markets, while bakeries were barriers. As for supermarkets, they had a mixed effect: they were both facilitators (greater availability of natural and minimally processed foods) and barriers (advertising, promotions for ultra-processed foods, for example).

Borges CA, et al. *Cad Saude Publica*. 2022 Feb 23;37Suppl 1(Suppl 1):e00157020.