The Planetary Health Diet in contrast to the food-based dietary guidelines of the German Nutrition Society (DGE)

A DGE statement

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Abstract

The Planetary Health Diet was developed as a global concept for a health-promoting diet that stays within planetary boundaries. It received a great deal of attention when it was published. However, the methods used to derive the Planetary Health Diet, its statements, and its feasibility in terms of practical implementation nevertheless need to be evaluated through scientific discourse. To this end, this German Nutrition Society statement compares the recommended food quantities of the Planetary Health Diet with the German Nutrition Society's food-based dietary guidelines and with data on actual food intakes in Germany. The results show that there is broad agreement between the Planetary Health Diet and the German Nutrition Society's recommendations as they are both plant-based diets. The main differences are in the recommendations for milk and dairy products. The practical implementation of the Planetary Health Diet requires that regional conditions are taken into account as an additional step. The German Nutrition Society's recommendations already consider regional conditions. The nutritional reality in Germany sharply contrasts with both recommendations.

Keywords: Food-Based Dietary Guidelines, Planetary Health Diet, sustainability, food intake, Germany

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Introduction

The topic of "health-promoting and sustainable nutrition" has been on the agenda of various international institutions for several years now [1–5]. The *EAT-Lancet-Commission Report*, which was drawn up by international experts, is the first report to specify a universal reference diet (the Planetary Health Diet) that includes recommended food quantities for a health-promoting diet. This diet is intended to provide for a future world population of 10 billion people in 2050 whilst staying within the ecological limits of the Earth (planetary boundaries) and it is intended to prevent about 11 million premature deaths per year worldwide [6, 7]. The authors explain that current global food production is affecting the stability of the climate and the resilience of ecosystems, and that food production is threatening to exceed planetary boundaries. In addition, diet-related diseases currently constitute a major burden on society. The global recommendations of the Planetary Health Diet state that the diet should be adjusted in terms of food quantities and food choices to suit the eating cultures of individual countries. The local resources that are available, such as grazing land, water supplies and precipitation, are to be taken into account when making these adjustments [6, 7].

The Planetary Health Diet received a great deal of attention as the first report to provide concrete values for a possible global reference diet. It is used by many experts around the world as a reference diet for sustainable nutrition. However, scientists have criticized the approach that was used to determine the recommendations, as well as their nutritional

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consequences and the costs at the individual and societal level [8–15].

Criticism of the Planetary Health Diet is particularly relevant in cases where the fixed values for food quantities are arbitrarily applied as food-based dietary guidelines (FBDGs) without making adjustments for country-specific circumstances.

However, the Planetary Health Diet does not meet all characteristics of the FBDGs definitions (◆ box). For example, it was not commissioned or produced by official institutions and it does not contain any consumer-oriented messages or statements regarding further lifestyle interventions. Adapting the diet to national circumstances is not included in the recommendations – this is only intended to be done in later steps. Springmann et al. [16] refer to the Planetary Health Diet as an international FBDG. However, it was never designed as a dietary recommendation in the strict sense. Rather, it was designed as a framework to guide national FBDGs all over the world [6]. In this statement, the term dietary recommendations is used to refer to the FBDGs of the German Nutrition Society and to the Planetary Health Diet.

The official FBDG for Germany is derived by the German Nutrition Society. An initial comparison of the food quantities in the Planetary Health Diet with those in German Nutrition Society's FBDG (published as approximate values). showed that they were largely in agreement [17]. In that comparison, the Planetary Health Diet was not adapted to the specific circumstances in Germany. Even though the German Nutrition Society's FBDG was initially drawn up primarily focusing on health considerations, the fact that they are built around a mainly plant-based diet with a relatively low proportion of animal-based foods means that they meet requirements of ecological sustainability [17, 18]. However, upon closer examination, it becomes apparent that some foods have been assigned to food groups in different ways across the two dietary recommendations, which makes it difficult to compare them directly. Furthermore, the dietary recommendations have not yet been contextualized in terms of actual food intakes in Germany [17].

Food-Based Dietary Guidelines

Food-Based Dietary Guidelines (FBDGs) are defined by the international organizations *Food and Agriculture Organization of the United Nations* (FAO), *World Health Organization* (WHO) and *European Food Safety Authority* (EFSA) as:

... evidence-based dietary recommendations for foods or food groups aimed at ensuring adequate nutrient supply and preventing chronic diseases [1, 20–25],

... a basis for nutrition, health and agricultural policies and nutrition education to encourage health-promoting eating habits and lifestyles [1, 23, 25].

FBDGs:

... should be adapted to the country/region in question in terms of nutritional situation, food availability, public health priorities, and food culture [21-25],

... are often accompanied by easy-to-understand messages and illustrations that show the ratios in which different food groups contribute to the diet [1, 23, 25],

... increasingly consider more aspects such as food safety and sustainability in their derivation [1, 22, 24],

... are initiated by the government and represented by respective organizations. This is conducive for the successful implementation of FBDGs [1, 23].

Therefore, this publication aims to classify the dietary recommendations of the Planetary Health Diet in terms of their derivation, their food quantities and their practical implementation. This was done by comparing it to the German Nutrition Society's FBDG for a wholesome diet [19] on the basis of the specified food quantities and food groups as well as representative data on the nutritional situation in Germany.

Background on the derivation of the Planetary Health Diet and criticisms

The name Planetary Health Diet emphasizes the connection between health and ecological sustainability, and the synergy between these two aspects plays an important role in this diet [26]. The environmental damage caused by agricultural food production needs to be reduced to the extent that planetary boundaries are not exceeded. The following indicators were used to determine environmental impact: greenhouse gas emissions, land use, water use, phosphorus and nitrogen applications and biodiversity [6]. This global reference diet was derived from an expert assessment based on a literature review. In the reference diet, ranges and fixed

values are given for the intake levels of the food groups to facilitate flexible, global application of the diet. However, the fixed values for the specified food quantities are not always the mean values of the range. For example, the range for fish is 0–100 g/d and the fixed value is 28 g/d.

The selected food groups are intended to ensure an adequate supply of nutrients and energy. In addition, limits have been defined for saturated fatty acids and added sugars. Refined grains and highly processed foods are not included. The energy intake was set at 2,500 kcal per day, which, according to the committee, corresponds to the average energy requirements of a 70 kg, 30-year-old man or a 60 kg, 30-year-old woman whose level of physical activity is moderate to high. Actual energy intake should be adjusted in accordance with individual requirements [6]. The applied energy and nutrient requirements were calculated only for the fixed values given, but not for the ranges within which the intake may vary. There is a lack of further guidance on how to put together a diet that meets the requirements and is within the specified ranges.

The high energy content of the Planetary Health Diet has attracted criticism, especially in the context of industrialized countries that have high levels of overweight and obesity in the population [13, 14, 27]. Furthermore, another publication by members of the *EAT-Lancet-Commission* recommends limiting energy intake to 2,200–2,300 kcal/d as part of a health-promoting and sustainable diet [28]. Example calculations show that utilizing the maximum possible intake level within the range for each food group would result in an energy intake of more than 3,850 kcal/d [29]. Furthermore, despite the high energy intake, a diet according to the Planetary Health Diet does not seem to meet the nutrient requirements of some vulnerable groups [11]. This diet sharply reduces the intake of animal-based foods compared to current intakes in many countries. In this context, it should be noted that these foods can be part of a health-promoting diet, as they make it easier or make it possible to meet essential nutrient requirements, e.g., for calcium, iron or vitamin B_{12} [8, 11, 13, 30]. By contrast, the recommendations for intakes of sugar and fat – which are characterized by a high energy density and a very low nutrient density and therefore do not contribute significantly contribution to nutrient supply – are considered too high [13, 31].

The methodology used for the derivation of the diet is criticized for its lack of transparency, which does not meet current scientific standards. For example, it remains unclear how the health-relevant and ecological parameters have been combined. In addition, no detailed explanation is given about how the very specific intake levels for each food group were determined. The criteria for the selection of literature were not described in detail. In addition, no systematic literature review was conducted [9, 13, 14, 31, 32].

Other criticisms relate to practical feasibility. Some critics consider the cost of the Planetary Health Diet to be too high, especially for people on low incomes or from low-income countries [12, 15]. Furthermore, national differences in natural food production capabilities have not been taken into account. Implementing these dietary recommendations would make many countries that lack land that is suitable for agricultural production or that simply do not have enough land surface area more dependent on imports. This would be contrary to the recommendations of the FAO *(Food and Agriculture Organization of the United Nations)* and the IPCC *(Intergovernmental Panel on Climate Change)* [13, 30].

The Planetary Health Diet also makes another generalization by summarizing the values for the ecological footprints of individual food groups, which can in fact vary greatly depending on the region where they are produced [10, 33]. For example, greenhouse gas emissions per litre of milk are much lower in Europe (1.3–1.4 kg CO_2 equivalent per kg) than in other regions such as West Asia and Africa, where they range between 4.1 and 6.7 kg CO_2 equivalent per kg. This is because cows in Europe have very high milk yields [34, 35]. In addition, the role of livestock in the agricultural cycle – for example, using inedible crop residues and by-products of food production as feed and using the portion of grassland that is unsuitable for arable farming as pasture – has not been considered [13, 30]. It is also important to bear in mind that the nutrient content of food is strongly dependent on the environmental and production conditions of the countries where it is grown. For example, rice and wheat have lower protein, iron and zinc contents if they are grown in conditions with a high carbon dioxide content [10].

Background on the derivation of the German Nutrition Society Food-Based Dietary Guidelines

The German Nutrition Society's FBDG is set out in the form of the 10 guidelines for a wholesome diet by the German Nutrition Society (DGE), the DGE nutrition circle and the 3-dimensional food pyramid [36]. In addition to the D-A-CH Reference Values for Nutrient Intake, evidence-based findings on the prevention of diet-related diseases – such as cardiovascular diseases – through nutrients and foods are also taken into account in the derivation and communication of these recommendations. For example, the latter are derived from the results of the evidence-based guidelines on fat and carbohydrate intake and systematic reviews by the German Nutrition Society and other health and nutrition societies. In addition, this FBDG takes the dietary habits of the German population and aspects of ecological sustainability into account [36].

To assess the Planetary Health Diet, the approximate values of the DGE nutrition circle according to Oberritter et al. [19] are used here. The current version of the DGE nutrition circle dates from 2005 and the nutrient content was calculated based on the German Food Code and

Nutrient Database (Bundeslebensmittelschlüssel (BLS)) version II.3. The calculations were performed using weekly meal plans for adults (separate plans for men and women, separated into the age groups "25 to 51 years" and "65 years and older") at a low Physical Activity Level (PAL value: 1.4) with the aim of meeting the mean value for the nutrient intake reference values over seven days. This approach resulted in an energy intake range between 1,600 kcal and 2,400 kcal per day. From the food quantities examplary approximate values were derived. The quantities are stated as a range in each case and are based on varying energy intakes, with the lower values applying to a lower energy intake. The values refer to one day, except for the group of meat, sausage, fish and eggs, where the total quantities for one week are given to ensure greater flexibility for consumers [19]. This is one version for a wholesome diet when implementing the DGE nutrition circle and the German Nutrition Society's FBDG; other variants are possible. There is therefore room for individual adjustments [37].

Describing food intake in Germany in order to classify the dietary recommendations

In order to effectively implement dietary recommendations, it is crucial to assess the population's current food intake. Therefore, data on food intake in Germany from evaluations of the National Nutrition Survey II were used to compare the two dietary recommendations. In the German National Nutrition Survey II, data on food intake and dietary behavior in the German-speaking population were collected from 19,329 representatively selected persons aged 14 to 80 years using various dietary survey methods. However, the survey period (November 2005 to January 2007) is now some time ago [38, 39].

No more recent representative data on food intake in adults in Germany are available. The data from the German National Nutrition Monitoring (NEMONIT), a survey that followed up on the German National Nutrition Survey II with a smaller sample size (N = 2,000), were not used to compare food quantities. The NEMONIT sample exhibits significant differences to the German population in terms of gender, age and socio-economic status. According to the results of the longitudinal evaluations in NEMONIT, food and nutrient intakes remained relatively stable from 2005 to 2007 and from 2012 to 2013, and no relevant changes were observed [40]. The food intake data in the German National Nutrition Survey II were taken from the *European Food Safety Authority (EFSA) Comprehensive European Food Consumption Database* [41–43]. In this database, the data are available in a less aggregated form than in the evaluation published in the 12th German Nutrition Society Nutrition Report 2012 [38]. This meant that the foods could be summarized for the present evaluation in such a way that they corresponded as closely as possible to the food groups of the approximate values of the German Nutrition Society and the Planetary Health Diet (: online supplement ◆ Table S1). In addition, the data in this database are given as average values for women and men [38]. This facilitates comparisons because the FBDG of the German Nutrition Society and the dietary recommendations of the Planetary Health Diet are not specified separately by gender. In addition, the statements in the trend analysis of food consumption based on food balance sheets were used to assess a possible change in consumption of the food groups over the last 15 years. Every year, this analysis provides data on production in agriculture and the food industry, which means that they provide up-to-date data on food consumption. However, food balance sheets also include products that are not intended for human consumption (e.g., bones, animal feed and biofuel). If it is assumed that these shares remain stable over time, food balance sheets can provide insights into current developments in food consumption from a nutritional-epidemiological perspective [44].

Comparison of food quantities by food group

The order of the food groups in the text follows the DGE nutrition circle, in descending order of size of the segments. Vegetables and fruit are presented together because of the "five a day" recommendation in the 10 guidelines [45]. Sugar is not taken into account in the nutrition circle and so for the purpose of assessing the Planetary Health Diet, it is described separately at the end using the German Nutrition Society's quantitative recommendation on sugar intake.

Fruit and vegetables

Vegetables and legumes

The German Nutrition Society recommends at least three portions of vegetables per day (at least 400 g/d; ◆ Table 1) as a approximate value for vegetable intake. This includes all kinds of vegetables and salad leaves, as well as herbs, edible mushrooms and legumes [19, 37]. By contrast, the Planetary Health Diet makes separate recommendations for vegetables and legumes [6]. When these individual recommendations are combined, the aggregate range is 200–905 g/d. The German Nutrition Society's approximate value lies within this range.

Legumes have a high nutrient density and are nutritionally valuable. In the case of a plant-based diet, they are important sources of protein. They also provide water-soluble vitamins such as thiamine, vitamin B_6 and folates, minerals such as iron, magnesium

and zinc, as well as dietary fibre and phytochemicals [46]. The Planetary Health Diet recommends a daily intake of 0–100 g of dried beans, lentils and peas, as well as 0–75 g of peanuts and 0–50 g of foods made from soy [6]. Using a conversion factor of 1.8 to convert from dried legumes to ready-to-eat legumes [45] results in a summary recommendation for legumes of 0–305 g/d. The German Nutrition Society's approximate value for a portion of ready-to-eat legumes is 125 g/d, which is within the stated range (◆ Table 1).

The intake of vegetables, including legumes, by adults in Germany as surveyed in the National Nutrition Survey II is 134 g/d [41, 42], which is significantly lower than the values recommended by the Planetary Health Diet and the German Nutrition Society. The intake of legumes (considered separately) of 8 g/d [41, 42] is less than one tenth of the recommendation of the Planetary Health Diet, and of the approximate value of the German Nutrition Society (◆ Table 1). More recent food balance sheets data show an overall increase in consumption for the vegetable category. The consumption of legumes is stable, with a slight increase of about 50 g per person per year for food products made from legumes and 40 g per person per year for fresh legumes between 2007 and 2018 [44].

Fruit and nuts

The German Nutrition Society specifies an approximate value of at least two portions of fruit per day (at least 250 g/d) [19]. Nuts, oilseeds or dried fruit can replace one portion of fruit a day. However, the portion sizes for these foods are smaller because their energy content is higher. One portion of nuts, oilseeds or dried fruit is 25 g [45]. By contrast, the Planetary Health Diet makes separate recommendations for fruit (200 g/d) and tree nuts (25 g/d) [6]. Since the German Nutrition Society does not specify an approximate value for fruit excluding nuts, the value specified for fruit including nuts has been used for the comparison. This value is 225 g/d for the Planetary Health Diet, with a range of 125–325 g/d, which is similar to the German Nutrition Society's recommendation of a minimum of 250 g/d. The German Nutrition Society and the Planetary Health Diet have the same value for tree nuts (25 g/d) (◆ Table 1).

Average intake in Germany according to the National Nutrition Survey II for fruit including nuts is 175 g/d, which is within the range specified in the Planetary Health Diet, but below the value specified by the German Nutrition Society. For nuts, the average intake in the National Nutrition Survey II was 3 g/d, which is about 10% of the value specified by the German Nutrition Society and Planetary Health Diet, which means it is significantly lower than the recommended values (◆ Table 1). The consumption of fruit overall has been declining on average in recent years, although consumption of nuts and fruits such as berries, bananas and lemons has been increasing [44].

Cereals, cereal products and potatoes

For the food group cereals, cereal products and potatoes, the German Nutrition Society specifies approximate values of 300 g/d bread or 250 g/d bread and 60 g/d cereal flakes for an energy intake of 2,400 kcal/d, as well as a portion of cooked potatoes (250 g/d), a portion of cooked pasta (250 g/d) or a portion of cooked rice (180 g/d). In each case, opting for the wholegrain variety as often as possible is recommended [19]. The Planetary Health Diet recommends 232 g/d of wholegrains. The recommended intakes of rice and wheat contained within this are included as dry weights [6]. The water absorbed during preparation of these foods is therefore not taken into account in the quantity specification, in contrast to the approximate values of the German Nutrition Society. However, for the wholegrain food group, there is no precise indication of the proportions in to enable conversion to the equivalent in ready-to-eat foods. The proportion of wholegrains in the total energy intake is specified as a very wide range of 0–60%. In addition, a recommendation is given for potatoes and cassava (= manioc/yuca) (◆ Table 2) [6].

At first glance, the Planetary Health Diet recommendations for wholegrains and the German Nutrition Society's approximate values for bread appear to be in a similar range. However, due to the differences in the data (dry weight vs. ready-to-eat) and the enormous range in the Planetary Health Diet, these dietary recommendations can only be compared to a limited extent. In the Planetary Health Diet, pasta and noodles made from cereals belong in the wholegrain food group; in the German Nutrition Society's approximate values, these foods have their own category as starchy sides. The Planetary Health Diet therefore gives separate recommendations for intake of pasta, rice and potatoes, etc., whereas the German Nutrition Society's approximate values assume that only one starchy side will be chosen.

The average intake of cereal and starchy products in the National Nutrition Survey II is clearly below the German Nutrition Society's approximate values. However, the fact that the data in the National Nutrition Survey II do not distinguish between wholegrain and white flour products [47], meaning that it is not possible to compare the values directly, must be taken into account. Furthermore, it should be noted that it is necessary to summarize the intakes of starchy sides in the National Nutrition Survey II in order to compare them with the German Nutrition Society's approximate values. Nevertheless, even taking this into account, the total intake of 131 g/d is below the German Nutrition Society's approximate values for starchy sides of 150–250 g/d (◆ Table 2). Intake of potatoes is 61 g/d, which is above the specified

Planetary Health Diet [6]		Wholesome diet according to the German Nutrition Society [19]		National Nutrition Survey II [41, 42][b]	
Food group	Quantity (g/d) (energy intake of 2,500 kcal/d)	Food group	Approximate value (g/d) (energy intake of 1,600–2,400 kcal/d)	Food group	Average intake (g/d) (energy intake of 1,968 kcal/d)
Vegetables and legumes	440 (200–905)	**Vegetables incl. legumes**	**≥ 400**	Vegetables incl. legumes	134
Vegetables	**300 (200–600)**			Vegetables	126
Legumes, cooked[c]	140 (0–305)	Legumes, cooked	125	Legumes, cooked	8
Beans, lentils, peas; dried	**50 (0–100)**				
Beans, lentils, peas; cooked[c]	90 (0–180)			Legumes excl. peanuts, cooked	7
Soy	**25 (0–50)**				
Peanuts	**25 (0–75)**			Peanuts	1
Fruit incl. tree nuts	225 (125–325)	**Fruit incl. nuts**	**≥ 250**	Fruit incl. nuts	175
Fruit	**200 (100–300)**			Fruit	172
Tree nuts	**25**	Nuts	25	Nuts	3

Tab 1: **Comparison of food quantities for vegetables and fruit in the Planetary Health Diet with the German Nutrition Society's approximate values for a wholesome diet and actual food intake in the National Nutrition Survey II[a]**
d = day
[a] The original values from the respective publications are written in bold. Values from the Planetary Health Diet and the German Nutrition Society's approximate values that are not written in bold are values that have been summarized for comparison purposes.
[b] The summary of the values from the *European Food Safety Authority (EFSA) Comprehensive European Food Consumption Database* [41, 42] for the listed food groups are shown in ◆ Table S1 of the online supplement.
[c] This value is derived from the values for cooked beans, lentils and peas, and soy and peanuts.
[d] The calculation to convert to cooked legumes was done using a conversion factor of 1.8 [45].

Planetary Health Diet value of 50 g/d, but still within the range (0–100 g/d). Consumption of rye flour, bread, rolls and potatoes has been declining in recent years, while consumption of wheat flour and rice has increased. The consumption of maize, pasta/noodles and potato products has remained largely unchanged [44].

Milk and dairy products

The German Nutrition Society specifies an approximate values of 200–250 g/d of milk and dairy products such as yogurt, buttermilk or kefir and 50–60 g/d of cheese for an energy intake of 1,600–2,400 kcal/d. Milk and dairy products, including cheese, make a significant contribution to the supply of various nutrients, especially calcium, iodine, riboflavin and vitamin B_{12} [37]. The Planetary Health Diet recommends a maximum intake of 500 g/d of milk equivalents, which are calculated units that convert dairy products into the quantity of milk used to produce them (◆ Table 3) [6].

For the purpose of classifying the quantities of milk consumed in the Planetary Health Diet, the German Nutrition Society's approximate values were converted to milk equivalents. Because the type of dairy product (excluding cheese) is not specified, it is not possible to make a universally valid conversion. To obtain an approximate range, the ratio of milk and dairy products observed in the National Nutrition Survey II was applied to the German Nutrition Society's approximate values and a range of 596–728 g milk equivalents per day was calculated using conversion factors (Online Supplement ◆ Tables S2 and S3). This is significantly higher than the Planetary Health Diet's figure of up to 500 g of milk equivalents per day.

Planetary Health Diet [6]		Wholesome diet according to the German Nutrition Society [19]		National Nutrition Survey II [41, 42][a]	
Food group	Quantity (g/d) (energy intake of 2,500 kcal/d)	Food group	Approximate value (g/d) (energy intake of 1,600–2,400 kcal/d)	Food group	Average intake (g/d) (energy intake of 1,968 kcal/d)
Wholegrains (rice, wheat, maize, etc.)[b]	**232 (0–60% of total energy**	**Bread[c, d]**	**200–300**	Bread and bread rolls	136
Potatoes and cassava (= manioc/ yuca)	**50 (0–100)**	**Pasta/noodles, rice, potatoes[d, e]**	**150–250**	Pasta/noodles[f] Rice[f] Potatoes	35 35 61

Tab 2: **Comparison of food quantities for cereals, cereal products, and potatoes in the Planetary Health Diet with the German Nutrition Society's approximate values for a wholesome diet and actual food intake in the National Nutrition Survey II**

d = day

[a] An overview the selected values from the National Nutrition Survey II from the *European Food Safety Authority* (EFSA) *Comprehensive European Food Consumption Database* [41, 42] for the calculation of intake levels of the listed food groups is shown in ◆ Table S1 of the online supplement.

[b] Wheat and rice are included as dry weight.

[c] Alternative: 150–250 g of bread and 50–60 g of cereal flakes.

[d] The Germany Nutrition Society recommends opting for the wholegrain variety as often as possible.

[e] 1 portion (200–250 g) of potatoes (cooked) or 1 portion (200–250 g) of pasta/noodle (cooked) or 1 portion (150–180 g) of rice (cooked).

[f] The values in the National Nutrition Survey II are given as dry weights; the calculation for conversion to cooked foods is based on the following conversion factors: Pasta/noodles: 2; Rice: 3.

Planetary Health Diet [6]		Wholesome diet according to the German Nutrition Society [19]		National Nutrition Survey II [41, 42][b]	
Food group	Quantity (g/d) (energy intake of 2,500 kcal/d)	Food group	Approximate value (g/d) (energy intake of 1,600–2,400 kcal/d)	Food group	Average intake (g/d) (energy intake of 1,968 kcal/d)
Whole milk or equivalents based on whole milk	**250 (0–500)**	Milk and dairy products (MEq/d)[c]	596–728	Milk and dairy products in MEq/d[c]	464
		Milk and dairy products (g/d)	250–310	Milk and dairy products (g/d)	199
		Cheese (g/d)	**50–60**	Cheese (g/d)	38
		Milk/milk products except cheese/quark (g/d)	**200–250**	Milk/milk products except cheese/ quark (g/d)	161

Tab 3: **Comparison of food quantities for milk and dairy products in the Planetary Health Diet with the German Nutrition Society's approximate values for a wholesome diet and actual food intake in the National Nutrition Survey II[a]**

d = day; MEq = milk equivalents

[a] The original values from the respective publications are written in bold. Values from the German Nutrition Society 's approximate values that are not written in bold are values that have been summarized for comparison purposes.

[b] The summary of the values from the *European Food Safety Authority* (EFSA) *Comprehensive European Food Consumption Database* [41, 42] for the listed food groups are shown in Table S1 of the online supplement.

[c] Milk equivalents (MEq) were calculated using the following conversion factors (from dairy products to MEq): Milk, milk-based mixed drinks: 1.0; yogurt/mixed milk products: 1.4; cheese and quark with average dry matter: 7.2; exact calculation: ◆ Tables S2 and S3 in the online supplement.

The average intake of milk and dairy products in the National Nutrition Survey II is 464 g milk equivalents per day, which is well below the German Nutrition Society 's approximate values (596–728 g/d) and is above the Planetary Health Diet mean of 250 g/d, but within its specified range (0–500 g/d). Food balance sheets data show a decline in consumption of drinking milk, yogurt, buttermilk and condensed milk products, and fresh and processed cheese. The decrease in drinking milk consumption between 2007 and 2018 was around 330 g per person per year and for yogurt it was around 160 g per person per year. For cheese (hard, semi-hard and soft cheese), consumption is increasing, with an average increase of about 200 g per person per year [44].

Meat, fish and eggs

Meat and meat products

For people who eat meat, the German Nutrition Society recommends a weekly quantity of 300 g for adults with low energy needs and up to 600 g per week for adults with high energy needs for the meat and sausage food group [45]. No separate values are given for white, red or processed meat (including sausage). However, the recommendations emphasize that the distinction between red and white meat[1] and processed meat is nutritionally important [45, 49]. To facilitate the comparison, the German Nutrition Society's approximate value was converted to a daily intake, which corresponds to a maximum of 86 g/d in the case of an energy intake of 2,400 kcal/d. It should be noted that the German Nutrition Society recommends that meat and/or sausages should not be consumed every day [45]. The Planetary Health Diet specifies separate quantities for beef, lamb, pork, and poultry, all of which include processed products made from these meats (including sausage) [6]. The German Nutrition Society's approximate value for meat and meat product intakes at a high energy intake and the upper value of the range of the Planetary Health Diet recommendation are identical at 86 g/d (◆ Table 4).

The average intake of meat in the National Nutrition Survey II was 113 g/d, which is about 75% higher than the German Nutrition Society's approximate value for high energy requirements. Red meat intake was about seven times the mean specified in the Planetary Health Diet, while the average intake of white meat (16 g/d) was about half of the mean specified quantity (29 g/d). Consequently, there is a large discrepancy in terms of the ratio of red meat to white meat intakes between the Planetary Health Diet recommendation and the intakes observed in the National Nutrition Survey II. Food balance sheets data show largely unchanged consumption of meat overall, with a decrease in consumption for pork (-370 g per person per year), and increases for beef and lamb (+ 130 g per person per year), and poultry (+190 g per person per year) [44].

Fish

The German Nutrition Society has separate approximate values for intakes of non-fatty and fatty (saltwater) fish [19, 45]. Since the Planetary Health Diet only makes a recommendation for fish and seafood in general [6], the German Nutrition Society's approximate values for fish have been summarized. The aggregate value of 31 g/d is close to the Planetary Health Diet mean value of 28 g/d and is within the specified range (0–100 g/d). The average intake in the National Nutrition Survey II was significantly lower at 17 g/d (◆ Table 4). In the food balance sheets, the consumption of fish has remained relatively stable over time, although there are fluctuations of up to 1 kg per person per year from year to year [44].

Eggs

In the nutrition circle, the German Nutrition Society specifies an approximate value for the egg food group of a maximum of three eggs per week [19]. Maretzke et al. [50, 51] demonstrated in their review paper that no specific quantitative recommendation for egg intake can be derived from the available data. Nevertheless, as part of a plant-based, more sustainable diet, an unlimited quantity of eggs is not recommended [45]. The German Nutrition Society's approximate value specifies up to 26 g/d, assuming a weight of 60 g/egg [48], which is close to the upper value of the range specified in the Planetary Health Diet (25 g/d; ◆ Table 4).

In the National Nutrition Survey II, actual intake of eggs and egg products was 11 g/d. However, this value does not include the intake of processed eggs in soups, sauces, and baked goods. If these intake levels were also taken into account, the value would be higher and would therefore also be closer to the upper value of the specified ranges in which these intake levels are included [38]. In food balance sheets, there has been a slight decline in consumption of eggs recently after many years of almost continuous increases [44].

Oils and fats

The German Nutrition Society specifies approximate values in the oils and fats food group for vegetable oils such as rapeseed, walnut, and soybean oil and for margarine products made from these oils, and for butter [19]. It emphasizes that compared to butter, margarine has a higher unsaturated fatty acid content, which results in a more beneficial fatty acid composition [45]. The Planetary Health Diet specifies quantities for palm oil, oils con-

[1] Red meat was assigned to meat of mammals such as beef, pork, lamb or goat meat. White meat was assigned to poultry meat, such as chicken [49].

Planetary Health Diet [6]		Wholesome diet according to the German Nutrition Society [19]		National Nutrition Survey II [41, 42][b]	
Food group	Quantity (g/d) (energy intake of 2,500 kcal/d)	Food group	Approximate value (g/d) (energy intake of 1,600–2,400 kcal/d)[c]	Food group	Average intake (g/d) (energy intake of 1,968 kcal/d)
Meat, incl. processed meat	43 (0–86)	**Meat and sausages[d]**	43–86	Meat, incl. processed meat	113
Beef, lamb or pork	14 (0–28)			Beef, lamb or pork sausages	61 36
Beef and lamb	**7 (0–14)**				
Pork	**7 (0–14)**				
Poultry	**29 (0–58)**			Poultry	16
Fish and seafood	**28 (0–100)**	Fish and seafood	21–31	Fish and seafood	17
		(Saltwater) fish	**11–21**		
		Fatty (saltwater) fish	**10**		
Eggs	**13 (0–25)**	**Eggs[e]**	≤ 26	Eggs	11

Tab 4: **Comparison of food quantities for meat, fish and eggs in the Planetary Health Diet with the German Nutrition Society's approximate values for a wholesome diet and actual food intake in the National Nutrition Survey II[a]**
d = day
[a] The original values from the respective publications are written in bold. Values from the Planetary Health Diet and the German Nutrition Society's approximate values that are not written in bold are values that have been summarized for comparison purposes.
[b] The summary of the values from the *European Food Safety Authority (EFSA) Comprehensive European Food Consumption Database* [41, 42] for the listed food groups are shown in ◆ Table S1 of the online supplement.
[c] The German Nutrition Society's approximate values for these food groups are stated as weekly approximate values
[d] The German Nutrition Society's approximate values specify a total of 300–600 g of low-fat meat and low-fat sausage per week. [19].
[e] calculated on the basis of an egg weight of 60 g per egg (M size) [48] corresponds to ≤ 3 eggs (incl. processed eggs)

taining unsaturated fatty acids (20% for olive, soybean, canola, sunflower, and peanut oil), and lard and tallow (◆ Table 5). Milk fat is included in the recommendations for milk [6].

The German Nutrition Society's approximate values for vegetable oils is 15 g/d, which is significantly lower than the Planetary Health Diet's fixed value of 40 g/d and even below the lower value of the range, which is 20 g/d. If margarine were considered a spreadable fat, the additional German Nutrition Society range of 25–45 g/d would be comparable to the Planetary Health Diet recommendations (20–80 g/d). The German Nutrition Society does not give an approximate value for palm oil, lard or tallow – for which values are specified in the Planetary Health Diet – because they are not recommended due to their high saturated fatty acid content. Overall, the German Nutrition Society recommends a slightly lower quantity of oils and fats (25–45 g/d) than the Planetary Health Diet (20–92 g/d), however the Planetary Health Diet's range is very broad.

In the National Nutrition Survey II, the average intake of oils and fats was 21 g/d, which is far below the values of the German Nutrition Society and the Planetary Health Diet. In particular, intake of vegetable oils was very low at 3 g/d. At 18 g/d, intake of margarine and butter was within the German Nutrition Society's approximate values of 15–30 g/d (◆ Table 5). In the National Nutrition Survey II, however, this food group was for the most part included as fats used as spreads. Fats and oils used in the preparation of dishes or foods were included in the corresponding food groups [47]. For this reason, it can be assumed that the actual intake of fats and oils exceeds the values reported in the National Nutrition Survey II. According to food balance sheets, there was in fact a sharp downward trend in the consumption of vegetable fats most recently, following a rapid increase between 2012 and 2016. Butter consumption remains relatively stable, with annual fluctuations of about 5 kg/person per year [44].

Planetary Health Diet [6]		Wholesome diet according to the German Nutrition Society [19]		National Nutrition Survey II [41, 42][b]	
Food group	Quantity (g/d) (energy intake of 2,500 kcal/d)	Food group	Approximate value (g/d) (energy intake of 1,600–2,400 kcal/d)	Food group	Average intake (g/d) (energy intake of 1,968 kcal/d)
Added fats	51.8 (20–91.8)	Oils and fats	25–45	Oils and fats	21
Unsaturated fatty acids (oils)[c]	**40 (20–80)**	**Oils**	**10–15**	Vegetable oils	3
		Margarine or butter	**15–30**	Margarine and butter Margarine Butter	18 8 10
Palm oil	**6.8 (0–6.8)**				
Lard and tallow	**5 (0–5)**			Animal fats other than milk fat	< 1

Tab 5: **Comparison of food quantities for oils and fats in the Planetary Health Diet with the German Nutrition Society's approximate values for a wholesome diet and actual food intake in the National Nutrition Survey II[a]**

[a] The original values from the respective publications are written in bold. Values from the Planetary Health Diet and the German Nutrition Society's approximate values that are not written in bold are values that have been summarized for comparison purposes.

[b] The summary of the values from the *European Food Safety Authority (EFSA) Comprehensive European Food Consumption Database* [41, 42] for the listed food groups are shown in ◆ Table S1 of the online supplement.

[c] 20% for olive, soybean, canola, sunflower, and peanut oil

Sugar

High and frequent sugar intake is associated with various undesirable health effects. For this reason, the German Nutrition Society does not specify approximate values for foods that are nutritionally less recommendable, i.e., foods with a low nutrient density and/or high energy density, such as sweet and/or high-fat snacks, alcoholic and sugar-sweetened beverages, and sugar [19]. The quantitative recommendation on sugar intake from the consensus paper by the German Obesity Society (Deutsche Adipositas-Gesellschaft e. V. [DAG]), the German Diabetes Society (Deutsche Diabetes Gesellschaft e. V. [DDG]) and the German Nutrition Society were used for the comparison [52]. In this recommendation, the societies advocate for a maximum intake of free sugars of less than 10% of total energy. In the case of a total energy intake of 2,000 kcal/d, this corresponds to a maximum intake of 50 g of free sugars [52], and in the case of a total energy intake of 2,400 kcal/d (which is the upper value of the approximate values of the German Nutrition Society), it corresponds to a maximum intake of 60 g of free sugars. The Planetary Health Diet recommends an intake of added sugars of no more than 31 g/d at a total energy intake of 2,500 kcal (◆ Table 6) [6].

The Planetary Health Diet's sugar intake specification is about half of the German Nutrition Society's tolerated value. However, there are two aspects to bear in mind here. Firstly, the specifications are based on different definitions of sugar, which hampers the comparison. In contrast to added sugars, free sugars include sugars that occur naturally in foods such as fruit juices [52]. This means that the value will be higher based on this definition. Secondly, the above comparison does not take into account the fact that the German Nutrition Society classifies sugar and sugar-sweetened foods as not recommended in its FBDG used to calculate the approximate values and in the 10 guidelines for a wholesome diet. Heuer [53] states an average intake of 70 g/d of free sugars based on the National Nutrition Survey II data; based on a total energy intake of 1,968 kcal/d. This corresponds to 13 percent of total energy (E%) (◆ Table 6). Therefore, the value is above the specifications of the German health societies (< 10 E%) and more than twice that of the Planetary Health Diet. The consumption of sugar cannot be tracked in food balance sheets as reliably as the consumption of other foods due to multiple changes in calculation methods. Overall, consumption has been relatively stable, with consumption of confectionery declining recently [44].

Planetary Health Diet [6]		Consensus paper by the DAG, the DDG and the DGE [52]		National Nutrition Survey II [53]	
Food group	Quantity (energy intake of 2,500 kcal/d)	Food group	Quantitative recommendation (energy intake of 2,000 kcal/d)	Food group	Average intake (energy intake of 1,968 kcal/d)[a]
Added sugar (all sweeteners) (g/d)	**31 (0–31)**	**Free sugars (g/d)**	**≤ 50**	Free sugars (g/d)	70
Percentage of total energy (E%)	**< 5**	**Percentage of total energy (E%)**	**< 10**	Percentage of total energy (E%)	13

Tab 6: **Comparison of the food quantities for sugar in the Planetary Health Diet with the German Nutrition Society recommendations on sugar intake and actual food intake data in the National Nutrition Survey II**
d = day; DAG = German Obesity Society (Deutsche Adipositas-Gesellschaft e. V.), DDG = German Diabetes Society (Deutsche Diabetes Gesellschaft e. V.); DGE = German Nutrition Society (Deutsche Gesellschaft für Ernährung e. V.); E% = energy percentage
[a] Separate intake data are given for men and women. The values stated are the calculated mean values

Discussion

The aim of this publication is to assess the Planetary Health Diet by contrasting its food groups and quantities with the German Nutrition Society's approximate values for a wholesome diet and with actual food intake in Germany.
The results show that the Planetary Health Diet food quantities and the German Nutrition Society's approximate values are very similar across the food groups of vegetables and fruits, meat, fish and eggs, and oils. There are minor differences due to the way legumes and nuts are assigned to food groups. It is not possible to make a direct comparison in the food groups of cereals, cereal products and potatoes and sugar due to the different methodological approaches described above, e.g., the use of added or free sugars. The differences were particularly pronounced in the case of milk and dairy products.

Commonalities

In principle, the Planetary Health Diet has much in common with the FBDG of the German Nutrition Society.

> **Both recommendations emphasize a mainly plant-based diet with a small proportion of animal-based foods that limits the intake of saturated fatty acids, highly processed foods and added or free sugars.**

Both concepts also recommend using whole-grain products instead of refined grains [6, 19, 45].

> **Both the Planetary Health Diet and the FBDGs of the German Nutrition Society leave room for individual, flexible customization [6, 19, 45].**

In the Planetary Health Diet, food quantities can be arranged differently within the stated ranges according to local food diversity, farming systems, cultural conditions and individual preferences [6]. The approximate values of the German Nutrition Society are an example of a way to implement a balanced, health-promoting, culturally accepted and more sustainable diet in Germany [19, 45]. The German Nutrition Society's approximate values are based on menu calculations that include 300–600 g of meat and sausage per week, depending on energy requirements. However, if suitable alternatives are used to supply adequate nutrients, a wholesome diet can also be reached through other combinations of food groups, such as an ovo-lacto-vegetarian diet [54]. This is reflected in the 10 guidelines by the German Nutrition Society (DGE) with the phrase: "If you eat meat, you should not consume more than 300 to 600 g per week" [45].

Limitations of the comparison

However, overall, it is also clear that comparing the food quantities of the global Planetary Health Diet with the German Nutrition Society's approximate values requires a great deal of abstraction or is not very feasible in many areas due to the use of different food groups.
A good example of this is the food group cereals, cereal products and potatoes. In the German Nutrition Society's approximate values, this group includes pasta/noodles, rice and potatoes, which are commonly used as starchy side dishes in Germany, as options to make up the

recommended intake. In the Planetary Health Diet, pasta/noodles and rice are included in the wholegrains recommendation and potatoes are listed as a separate category. In the vegetable and fruit food group, the Planetary Health Diet specifies separate values for nuts and legumes; in the German Nutrition Society's approximate values, these are included in the values for fruit and vegetables, respectively. One reason for this could be differences in food cultures. For example, while peanuts tend to be eaten in small quantities as a snack in Germany, they serve as a source of protein in other regions of the world. The values may therefore need to be aggregated to enable comparison.

Another reason could be differences in the values used as a reference. Milk and dairy products are specified as milk equivalents in the Planetary Health Diet to reflect the different quantities of milk used to manufacture dairy products, which is important in terms of sustainability. In order to facilitate the classification of the Planetary Health Diet, the German Nutrition Society's approximate values were also subsequently converted into milk equivalents. However, since there are no differentiated specifications for drinking milk and fermented milk products, a mixed calculation was performed based on the data from the National Nutrition Survey II, which can only serve as a rough guide.

Conceptual differences

Another aspect that must be taken into account in the discussion are the different goals of the Planetary Health Diet and the approximate values of the German Nutrition Society and the different approaches used to derive their recommendations. The Planetary Health Diet is a global concept for feeding 10 billion people in 2050, which can or must take regional conditions into account through adaptations for practical implementation [6]. By contrast, the approximate values of the German Nutrition Society were derived with a focus on dietary habits in Germany, with the aim of providing the German population with all necessary nutrients in a way that promotes health and meets their needs [19]. The Planetary Health Diet focuses on keeping within planetary boundaries in addition to meeting energy and nutrient needs and mitigating diet-related diseases and reducing all-cause mortality. Meeting individual nutritional needs through generic approaches is generally a challenge. There are also questions about the actual nutrient supply of individual vitamins and minerals in the Planetary Health Diet despite its high energy intake (▮▮▮ section "Background") [31].

A major difference between the two diets is the age groups used for the calculations. The Planetary Health Diet includes all individuals aged 2 years and over, whereas the German Nutrition Society's approximate values were calculated for adults aged 18 years and over. This is particularly important because children and adolescents, as well as pregnant and breastfeeding women, have higher nutrient requirements. Therefore, the Planetary Health Diet does not adequately address, for example, the higher iron requirements of women of childbearing age or the higher calcium requirements of adolescents (▮▮▮ "Discussion", section on "Milk and dairy products") [11]. The authors of the Planetary Health Diet only categorize the supply of vitamin B_{12} as critical due to the low proportion of animal-based foods in this diet, which is why supplementation is recommended [6]. However, it should be noted that the ranges of the Planetary Health Diet for animal-based foods also allow for very severe restriction up to the point of following a vegan diet, which means that an adequate supply of other critical nutrients (iodine, zinc, riboflavin, etc.) may not be guaranteed [11, 54]. By contrast, meeting the D-A-CH Reference Values for Nutrient Intake formed the basis for deriving the German Nutrition Society's approximate values. One exception to this is iodine: the use of iodized table salt is recommended to help meet iodine requirements [19].

Energy intake

When the two diets are examined together, the difference in the underlying energy intake becomes apparent. The Planetary Health Diet assumes a mean energy intake of 2,500 kcal/d [6], whereas the range of the German Nutrition Society's approximate values is 1,600–2,400 kcal/d [37] and in the National Nutrition Survey II the mean energy intake is 1,968 kcal/d [38]. One widespread and well-documented problem with nutrition surveys is *undereating* or *underreporting*, i.e., participants eat less than usual on the protocol day or log a smaller quantity of food than they actually consumed. This can lead to systematic distortions. In a subsample of the National Nutrition Survey II (943 weighed dietary records), 21.7% of participants had implausibly low energy intakes. This could result in an incorrect estimation of actual food, energy, and nutrient intakes [55]. For this reason, the data in the National Nutrition Survey II are of limited reliability and can only be compared to a limited extent.

However, even when *underreporting* is taken into account, the energy intake in the National Nutrition Survey II is well below the 2,500 kcal/d reported by the Planetary Health Diet. The D-A-CH reference value for energy intake, which was revised in 2013, is between 1,700 and 2,300 kcal/d for adults with a PAL of 1.4, depending on age and sex [46]. Considering the already high proportion of individuals living with overweight or obesity in Germany (approximately 60% of men and 38% of women between 18 and 65 years of age are overweight [56]), an energy intake of 2,500 kcal/d regardless of age and sex without an increase in physical activity could exacerbate this problem as well as further increase the risk of diet-related diseases such as type 2 diabetes mellitus and could increase mortality rates [14, 28, 57].

This high energy intake is intended to facilitate meeting nutrient requirements. However, it should be noted that in reality, a higher energy intake is not necessarily associated with a better supply of vitamins and minerals. Discretionary foods, such as alcohol and confectionery, account for up to around 20% of energy intake according to the National Nutrition Survey II (◆ Table S4 in the online supplement) [38]. These foods have a high energy density, but a low or very low nutrient density. In the Planetary Health Diet, these foods are indirectly accounted for by an additional intake of energy via fats and oil (especially also via sources with a high proportion of saturated fatty acids) as well as sugar or sugary foods [6]. A reduction in the energy content of the Planetary Health Diet would result in an adjustment in the quantity of food, which would then no longer ensure a supply of all essential nutrients (▮▮▮▶ Section "Background on the derivation of the Planetary Health Diet and criticisms").

Milk and dairy products

One of the main discrepancies that becomes apparent when comparing food groups is in milk and dairy products. This can be explained mainly by differences in how the quantities are derived. The German Nutrition Society has taken the usual dietary habits in Germany and how this food group contributes to ensuring an adequate calcium intake as its starting point. The D-A-CH reference value for calcium on which the German Nutrition Society's approximate values are based is 1,000 mg/d for adults [46]. This is double the value considered adequate in the Planetary Health Diet, which is 500 mg/d of calcium for the global population [6]. Here, the authors refer to the calcium requirement specified by the WHO to reduce the risk of fractures. However, to determine the calcium required to compensate for calcium losses, the WHO, like the German Nutrition Society, uses balance studies as a basis. These result in an average requirement of calcium of 840 mg/d, taking all losses into account. To ensure adequate calcium intake for almost all healthy adults, the WHO also derives a reference value of 1,000 mg of calcium per day [58]. The specified average quantity of milk in the Planetary Health Diet is 250 g, which provides around 300 mg of calcium. Together with the additional intake from plant foods, this results in a calcium intake of approximately 700 mg/d [6], which is lower than the German Nutrition Society's approximate values and reference values for calcium intake [46] and the WHO's reference values [58], even though the energy intake is already very high at 2,500 kcal per day.

This low calcium intake is particularly critical for children and adolescents, since the dietary recommendations of the Planetary Health Diet also apply to them. This age group has a higher calcium requirement than adults because they need to build up an optimum bone density *(peak bone mass)*, which is important for the prevention of bone fractures and osteoporosis in older age; adequate calcium intake is therefore particularly important in this group. Vogel et al. [59] base an adequate calcium intake in this age group on two portions of milk and dairy products daily. For adolescents (13–19 years), the Planetary Health Diet could create a gap in calcium supply due to inadequate calcium intake.

Another aspect to consider in the comparison is that in the derivation of the Planetary Health Diet food quantities, the focus was on environmental sustainability and keeping within planetary boundaries. In the derivation of the German Nutrition Society's approximate values, the focus was on ensuring adequate nutrient supply and acceptance through closeness to existing dietary habits. In addition to the calcium content used in the derivation of the Planetary Health Diet, milk also contains other nutrients such as iodine (concentration depends on fortification of fodder), riboflavin and vitamin B_{12}, and it exerts an effect on the bioavailability of calcium and zinc through its absorption-promoting properties [46, 60–62].

Food intake in the context of health and the environment

Calculations that take into account the living conditions and environmental conditions in Germany show that the dietary recommendations of the German Nutrition Society are comparable to an ovo-lacto-vegetarian diet in terms of their impact on environmental sustainability [63, 64].

However, when this is compared with the data from the National Nutrition Survey II, it becomes apparent that the quantities of food consumed in Germany deviate considerably from the specifications of both of the dietary recommendations examined here. The intake of vegetables, fish and oil is significantly below the German Nutrition Society's approximate values and the dietary recommendations of the Planetary Health Diet. Intakes of fruit and milk and dairy products are within the specified range of the Planetary Health Diet, but below the German Nutrition Society's approximate values, according to National Nutrition Survey II data. The intake of meat, especially red meat, and sugar is significantly higher than the food quantities specified in both dietary recommendations, according to the National Nutrition Survey II data. It is difficult to compare the intake of cereals and cereal products. However, both the Planetary Health Diet and the German Nutrition Society recommend the intake of wholegrains. In the National Nutrition Survey II data, it is not possible to distinguish between whole-grain and refined grain products [47], but it can be assumed that the greater proportion of intake comes from refined grain. The comparison clearly shows that the diet of the German population, as revealed by the data in the National Nutrition Survey II, must be assessed overall as in need of significant improvement in terms of nutrition. The intake of food groups for which a high intake can be classified as health-promoting is below both the dietary recommen-

dations of the Planetary Health Diet and the approximate values of the German Nutrition Society. At the same time, intake of foods that should be consumed in limited quantities is far above what is recommended in both of the dietary recommendations. The high intake of red meat is harmful from both a health and from an environmental perspective. A dietary pattern that is high in meat and sausages is particularly likely to result in an increased risk of various diet-related diseases. As far as is currently known, there is no such association for white meat [49]. There is convincing evidence that a dietary pattern with a high proportion of processed meat, including sausages, is associated with the development of colorectal cancer [65]. Furthermore, although meat production does not always compete for resources with the production of plant-based foods, animal-based foods significantly shape the environmental footprint of the food system as a whole because they are resource-intensive foods [66].

Conclusion and future outlook

Deriving more sustainable and at the same time health-promoting dietary recommendations is of utmost relevance and complexity. It is almost impossible to derive a universally applicable global recommendation: the regional differences in food production and differences in the incidence of diet-related diseases are too great. However, the *EAT-Lancet Commission* has taken a very important step by bringing together health aspects and ecology in the form of planetary boundaries, and by designing a global reference diet. This has forced an urgently needed discussion. Nevertheless, the comparison shows – in line with criticism in the international discourse – that some conclusions of the *EAT-Lancet Commission* cannot be justified on the basis of the evidence provided in the report and that the methodology used is not sufficiently transparent. Therefore, the unquestioning and sometimes rigid application of its dietary recommendations must be considered problematic.

The dietary recommendations of the Planetary Health Diet can be assessed on the basis of a comparison with the German Nutrition Society's approximate values for a wholesome diet only to a limited extent due to differences in the methodology of derivation as well as the use of different methods of presentation. When viewed in aggregate, important aspects and statements of the dietary recommendations are lost, including intake ranges or specifications for weekly intake of animal-based foods. However, on the whole, the core messages of both dietary recommendations are compatible with each other. Both recommendations emphasize a mainly plant-based diet with a small proportion of animal-based foods that limits the intake of saturated fatty acids, highly processed foods and added or free sugars [6, 45].

> **The key challenge in implementing these two dietary recommendations is that the quantities of food consumed in Germany and thus the dietary habits of the population deviate considerably from these recommendations.**

There is therefore a clear need for improvement in the current dietary habits of the German population. In order to fully realize the great potential of a more ecologically sustainable diet that is also a health-promoting diet, structural changes in various living conditions and environmental conditions will be required. Support strategies will be needed to increase acceptance of such a nutritional transformation. The report drawn up by the Scientific Advisory Board for Agricultural Policy, Nutrition and Consumer Health Protection (WBAE) at the German Federal Ministry of Food and Agriculture (BMEL) provides clear recommendations on which measures could be used to achieve this transformation. These measures include mandatory implementation of the German Nutrition Society quality standards in communal catering settings (these standards include aspects of sustainability) [60, 67]. In its position paper on more sustainable nutrition, the German Nutrition Society also clearly commits to supporting the development and further development of instruments that serve the implementation of more sustainable nutrition [60].

> **The German Nutrition Society's FBDG support a health-promoting and more sustainable diet that is well adapted to local food production and cultural conditions.**

As part of the ongoing update of the FBDG, there will be more differentiation in food groups. Separate quantities will be derived for red meat, poultry, and processed meat, and legumes and nuts will be considered separately from vegetables and fruits. The dimension of environmental sustainability will be included in the direct derivation of the values using relevant indicators. The resulting FBDG will therefore take into account environmental factors in addition to health aspects, regional aspects and existing dietary habits. The German Nutrition Society is developing a mathematical optimization model to support the process of deriving the FBDG [68, 69]. Such models can support the complex process of weighing up the advantages and disadvantages of different foods in the different dimensions of sustainability and are increasingly used in the multidimensional derivation of FBDGs. In addition, such models allow flexible adaptation to changing food systems (up to and including individual customization) and can therefore contribute to improved acceptance and practical implementation in the population [68, 70–72].

Conflict of interests
Position papers and statements reflect the viewpoints and assessments - i.e., the interests - of the organization(s) named in the authors' byline.
The authors declare that there are no other conflicts of interest in connection with the contents of this publication.

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