BUILDING BRIDGES BETWEEN HABIT AND HEALTH

An investigation into the nutritional value of plant-based meat and milk alternatives

Valentina Gallani & Anna-Lena Klapp

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LIST OF ABBREVIATIONS

Abbreviation	Definition
PB	Plant-based
AB	Animal-based
PBM	Plant-based milk
PBSM	Plant-based soya milk
CM	Cow's milk
EFSA	European Food Safety Authority
WHO	World Health Organization
TMAO	Trimethylamine N-oxide

ABOUT THIS DOCUMENT

This Report is a publication of **ProVeg International.** ProVeg International is a food awareness organisation working to transform the global food system. Our mission is to replace 50% of animal products, globally, with plant-based and cultivated foods by 2040.

ProVeg has received the United Nations' Momentum for Change Award and works closely with key UN food and environment agencies. We have observer status with the UNFCCC and the IPCC, special consultative status with ECOSOC, and are accredited by UNEA.

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EXECUTIVE SUMMARY

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Nutritionists and climate experts are warning of the consequences of high levels of animal-based food consumption in high- and middle-income countries.[1] As a result, a shift towards more plant-rich eating patterns is increasingly recommended. If followed consistently, such a diet can reduce the risk of many lifestyle diseases and, at the same time, help combat climate change and biodiversity loss.

In general, plant-rich diets should prioritise whole foods, including plenty of fruit and vegetables, grains, legumes, nuts, and seeds. However, transitioning from a meat-and-dairy-centred diet to a plant-centric one can be made easier by the availability of plant-based alternative products that have a similar taste and texture to their animal-based counterparts. These can include, for example, plant-based milk alternatives like soya milk or plant-based meat alternatives such as pea burgers. The convenience of these alternatives has been shown to facilitate the behaviour change process.[2]

The evidence is clear that, compared to conventional meat and milk, most plant-based alternatives have a lower carbon footprint, use less land and water, and produce less air and water pollution. However, for consumers, two of the most important questions posed by plant-based alternative products are: "Can they compete with the nutritional value of traditional animal-based products?", and, "Are they healthy?".

As a food awareness organisation, ProVeg International aims to bring more transparency and balance to the debate surrounding plant-based alternatives. To determine whether plant-based meat and milk alternatives can be a healthy choice compared to their animal-based counterparts, we conducted an international nutritional assessment of plant-based alternatives available in local supermarkets in 11 countries across four continents: Belgium, Czechia, Germany, Italy, Malaysia, the Netherlands, Poland, South Africa, Spain, the UK, and the USA Using a scoring system based on internationally recognised nutrition guidelines - the WHO Nutrients Profile model (NPM)[3], the Netherlands Nutrition Centre[4] and the EFSA nutrition claim legislation[5] - we evaluated the nutritional value of 422 plant-based meat alternatives and 251 plant-based milk alternatives and compared them with their animal counterparts.

In addition to looking at the nutritional value of products, this report takes into account the perspective of manufacturers and retailers to better understand the opportunities and challenges involved in product development, shifting consumer behaviour, and the policy environment needed to bring healthy plant-based alternatives to the market. We conclude with key recommendations for policymakers, industry leaders, consumer organisations and the scientific community to enhance the nutritional value of plant-based products. **Together we can create a food system where everyone chooses delicious and healthy food that is good for all humans, animals, and the planet.**

KEY FINDINGS

Overall, plant-based meat alternatives appeared to have a **more beneficial nutritional profile** than animal meats, but this could be further improved by reducing their salt content.

The plant-based meat alternatives contained less saturated fat and significantly more fibre than the animal counterparts, sufficient to qualify them for the claim of **"source of fibre".**

The nutritional value of plant-based meat alternatives varied according to country, highlighting the importance of **nutrition policy frameworks** and **shared industry approaches** to product development and reformulation. The Netherlands led the way, with products that are high in fibre, low in saturated fats, and fortified with key nutrients including iron and vitamin B12.

We found that, depending on the country, plant-based meat alternatives are generally fortified with iron and vitamin B12, but **fortification** still **does not appear to be a common practice**. In countries where fortification is already widespread 40-90% of products are fortified, on the contrary where fortification is not commonly used less than 20% of products are fortified.

In general, the plant-based milk alternatives contained **less total fat and less saturated fat** than cow's milk. Soya milk performed particularly well in all countries.

The countries offering the best-performing plant-based milk alternatives are the **Netherlands, Italy, Belgium,** the **UK,** and **Czechia.**


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KEY FINDINGS

In all countries, the majority of plant-based milk alternatives can be considered **low in sugar.**

Most of the plant-based milk alternatives are a **source of calcium** thanks to fortification. The most common level of calcium fortification is 120 mg per 100 ml, which is comparable to cow's milk.

Micronutrient fortification is a key element in the formulation of plant-based alternatives that aim to mimic certain animal-derived foods: however, it currently **varies widely** from country to country.

Plant-based bacon and soya milk are a good example of properly developed plant-based alternatives, that **performed better than animal-based counterparts** across all countries.

Our report shows that plant-based meat and milk alternatives can be enjoyed as part of a healthy sustainable diet. However, just like their animal-based counterparts, they have nutritional strengths and limitations. At this point, plant-based alternatives can build bridges between habit and health. By understanding responsibility for public health as a shared endeavour, we provide recommendations for the realisation of healthy, sustainable plant-based alternatives for various stakeholders. Each stakeholder can play an important role in enabling healthy and sustainable diets.

KEY RECOMMENDATIONS

FOR PRODUCERS

Formulate products that contribute to healthy and sustainable diets, limit ingredients of concern such as salt and sugar, and fortify plant-based products with specific micronutrients.

FOR RETAILERS

Ensure plant-based products are no more expensive than their animal-based equivalents and reshape the environment where food choices are made.

FOR GOVERNMENTS

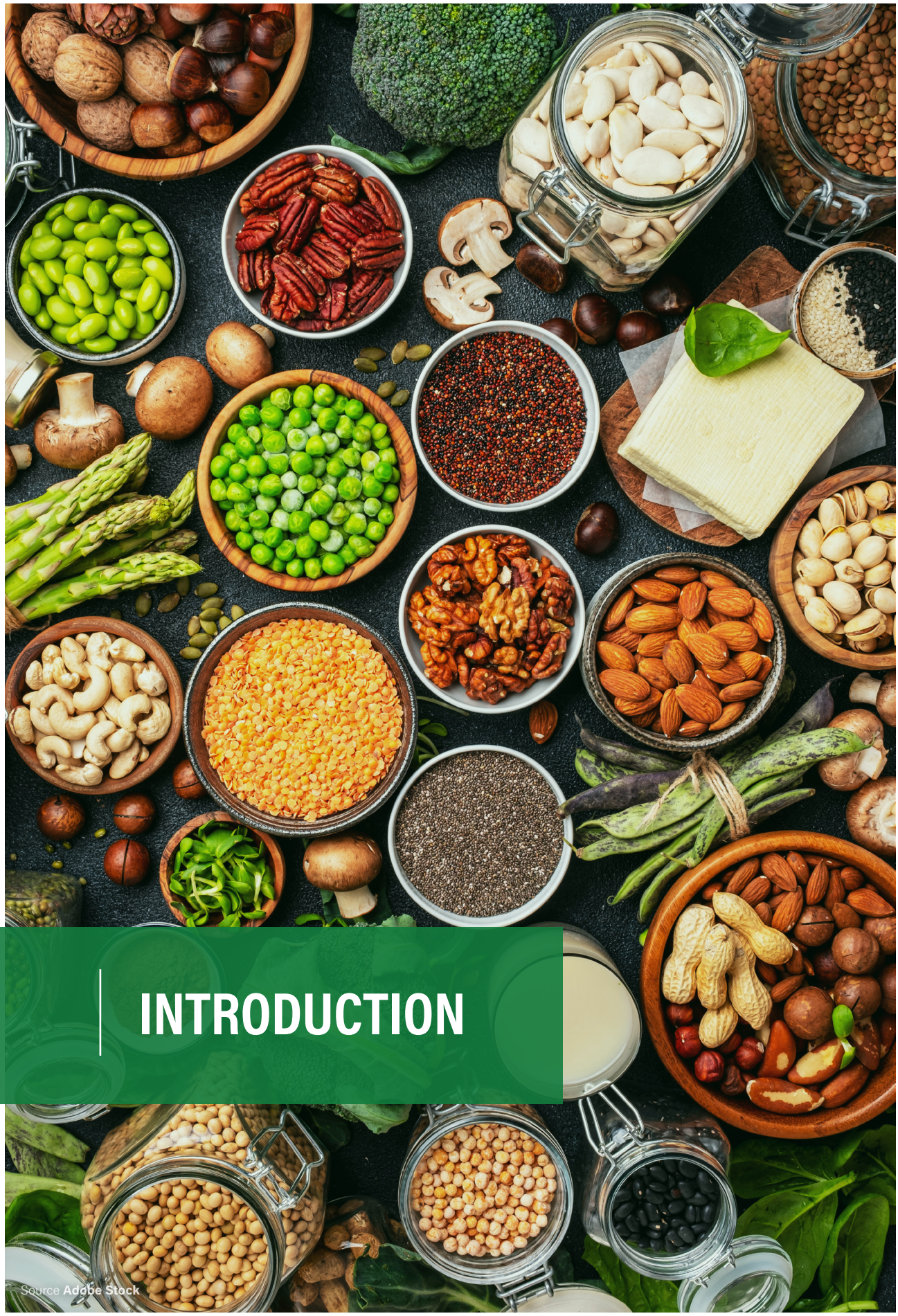
Provide national guidelines for plant-based alternatives that can help manufacturers develop healthy, sustainable products.

FOR CONSUMERS

Eat a more plant-rich diet. Plant-based alternatives can be enjoyed within a healthy, sustainable diet but recognise that these products have strengths and limitations. Choose products that are lower in added sugars, saturated fats, and salt.

FOR SCIENCE AND RESEARCH

Investigate long-term health effects of plant-based alternatives, evaluate the role of fortification, and explore salt reduction techniques while maintaining good taste.



INTRODUCTION

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The emerging scientific evidence shows that replacing animal-based foods with plant-based alternatives can reduce the environmental impact of current dietary patterns.[6 7 8] A system-wide assessment indicates that substituting 50% of animal products (pork, chicken, beef, and milk) with plant-based alternatives globally could reduce land use by 31% and cut emissions in half.[9] Another large food production analysis, which evaluated data from 38,700 companies and 1,600 processing, packaging, and retail companies in 119 countries, found that all plant milks analysed (soy, oat, almond and rice) have a significantly lower environmental impact in terms of greenhouse gas emissions, land use, and water use compared to cow's milk.[10] Moreover, based on an investigation into the impacts of 57,000 food products in major retailers in the United Kingdom and Ireland, plant-based meat and dairy alternatives were declared a win-win in terms of nutritional quality and environmental impact.[11]

Indeed, besides environmental benefits, more and more studies show that plant-based meat and dairy alternatives can have several health benefits as well. [2 13 14] Researchers attribute these benefits to the higher fibre content and typically lower saturated fat and calorie content in plant-based alternatives. Additionally, there is some evidence that plant-based meat alternatives could reduce cholesterol levels.[15 16 17] A cross-sectional study in large supermarkets in Australia – involving more than 700 products – revealed that meat alternatives generally have a better nutritional profile than animal-based equivalents.[18]

Plant-based alternatives are an important part of traditional food culture in some regions. In Spain, for example, tiger nut milk, known as horchata de chufa, is a popular national drink. Bushera is a traditional Ugandan beverage made from fermented sorghum or millet grains and water.[19] In China, soya milk has a long history, with its use first recorded about 2,000 years ago.[20] Since the majority of the world's adult population is lactose intolerant, one of the main health benefits of plant-based milk is that it is naturally free from lactose.[21 22] Compared to cow's milk, most plant-based milks contain fewer calories and less fat, and the consumption of soya and oat milk, in particular, is associated with a positive effect on cholesterol levels.[23]

Nevertheless, many consumers are concerned by the ongoing debate about processed foods. Just like their animal-based counterparts, plant-based alternatives to meat and dairy products are often categorised as 'processed' or 'ultra-processed' foods. However, the degree of processing alone cannot reliably indicate the health value of food.[24 25 26 27] For example, many everyday foods – such as porridge oats, orange juice, bread, and rice – are processed but not perceived as such.

Definition of plant-based alternatives

In this report, the term "plant-based alternatives" refers to processed plant-based products that aim to emulate the taste, texture, and functionality of meat and cow's milk. These products are designed to make it easier for consumers to reduce their consumption of animal-based foods.

These alternatives are distinct from traditional or minimally processed foods like tofu, tempeh, seitan, and legumes, due to their "new generation" ingredients such as isolated soy protein, pea protein isolate, or vegetable protein base. This new category typically includes products, such as sausages, burgers, minced meat, and chicken-style strips, as well as soya milk, almond milk, and oat milk.

It is important to note that foods that have undergone a high level of processing and are also low in essential nutrients and high in saturated fats, salt, and sugar (as well as other potentially disease-promoting substances) should be kept to a minimum in people's diets.[28] This applies to products such as beef salami with nitrites, white packaged bread with added sugar, and sugar-sweetened beverages with artificial colourants. The contribution of these ultra-processed foods to the obesity epidemic and the rising prevalence of chronic diseases such as type 2 diabetes cannot be ignored.[29] As such, it is important that these unhealthy foods are not included in the same category as healthy options such as wholemeal bread, calcium-fortified soya milk, and canned chickpeas, simply because they are all processed.

A team of researchers from the US Department of Agriculture recently published a study demonstrating that it is possible to have a healthy balanced diet even with the consumption of ultra-processed foods. They found that a healthy diet can be designed in which 91% of calories come from ultra-processed foods (as classified by the NOVA system) and while still meeting the recommendations laid out in the official Dietary Guidelines for Americans. This shows once again that the degree of processing is not always a reliable indicator of the healthiness of a product.[30] It is essential to take a more holistic approach when defining a food as healthy or unhealthy.

The evidence on the health impacts of plant-based alternatives is still limited and more research is needed. Furthermore, the nutritional content varies considerably across different types of products and brands and some products have also been criticised for their high salt and sugar content.[31] [32] Concerns have also been raised about certain micronutrients such as vitamin B12, iodine, iron, zinc, and calcium.[33] [34] In order to be comparable to animal-based products, plant-based alternatives need to be fortified accordingly. Fortification, however, is still uncommon in many countries, and plant-based alternatives may therefore lack these micronutrients. Understanding whether fortification is used and in which products, as well as the main reasons for its avoidance, would be a starting point for increasing awareness of its benefits, not only among plant-based eaters but also for the general population. Currently, there is no comprehensive international overview of the nutritional values of plant-based alternatives, which could

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provide good practice examples of products and countries that already offer balanced and nutritious products.

To this end, we conducted an international nutritional assessment of plant-based milk and meat alternatives available in local supermarkets in 11 different countries across 4 continents in order to:

1. Understand the **nutritional value** of plant-based milk and meat alternatives in comparison to conventional meat and milk products, and assess whether this varies according to country.

2. Identify areas where the nutritional value of plant-based alternatives needs **improvement**.

3. Map the state of the market in different regions of the world, showing the **availability** of plant-based products in local supermarkets.

4. Highlight the countries where **fortification** is a common practice, and explore why it is not widely used in others.

5. Identify **opportunities** and **challenges** for improving the nutritional value of plant-based products, and understand the potential for collaboration between food producers, policymakers and nutritionists/food scientists/food technologists to enhance the plant-based food offering.

METHODOLOGY

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We mobilised our staff around the world to visit local supermarkets and collect real-world data, resulting in a database of nearly 700 products from: **Belgium, Czechia, Germany, Italy, Malaysia, Netherlands, Poland, South Africa, Spain, the UK, and the USA.**

We analysed the nutritional value of 422 plant-based meat alternatives and 251 plant-based milk alternatives and compared them with their animal counterparts.

For the evaluation, a scoring system has been developed, based on a combination of three international guidelines and their health-related nutrient thresholds: the WHO European Nutrients Profile Model (NPM)[35], the Netherlands Nutrition Centre White Paper[36] and the European Food Safety Agency (EFSA) nutrition claim legislation.[37] The detailed nutritional values taken into account for the score can be found in Tables 2 and 3. We chose these guidelines because they are recognized internationally, contain the main nutrients of concern and are applied to all types of foods.

The Netherlands guideline was specifically chosen because it is the only official document from a European country designed to provide standards for plant-based alternatives, including micronutrients. To ensure the highest level of specificity and comparability, we decided to have a score for each main category, as different guidelines allow for varying quantities of nutrients in foods while still classifying them as healthy.

MEAT CATEGORY SCORE

NUTRIENTS	THRESHOLDS	POINTS
Basics*		
Total fats	≤ 17g/100g	1
Saturated fats	≤ 2.5 g/100g	1
Salt	≤ 1.1 g/100g	1
Sugars	≤ 5 g/100g	1
Nutrients category-specific**		
Iron	≥ 0.8 mg/100g	1
Vitamin B12	≥ 0.24 mcg /100g	1
Protein	≥ 20% of total calories per 100g	1
Extra category-specific point***		
Fibre	≥3 g/100g	1
POTENTIAL SUM		**8**

Table 1. Basis for the assessment of animal-based meat and plant-based meat alternatives.

* Values based on guidelines from the WHO and the Netherlands, and the EFSA legislation on nutrition claims.
**Values based on the Netherlands guidelines
***Value based on EFSA legislation on nutrition claims

MILK CATEGORY SCORE

NUTRIENTS	THRESHOLDS	POINTS
Basics*		
Total fats	≤ 3.5 g/100g	1
Saturated fats	≤ 1.1 g/100g	1
Salt	≤ 0.5 g/100g	1
Sugars	≤ 2.5 g/100g	1
Nutrients category-specific**		
Calcium	≥ 80 mg/100g	1
Vitamin B12	≥ 0.24 mcg /100g	1
Vitamin D	≥ 0.75mcg/100g	1
Vitamin B2	≥ 0.28mcg/100g	1
Extra category-specific point***		
Protein	≥1 g/100g	1
POTENTIAL SUM		**9**

Table 2. Basis for the assessment of cow's milk and plant-based milk alternatives.

* Values based on guidelines from the WHO and the Netherlands, and the EFSA legislation on nutrition claims.
**Values based on the Netherlands guidelines, and the European Commission paper on food fortification.
***No guidelines available to set the minimum protein quantity in milk and milk alternatives.

In addition to the product evaluations, we interviewed several industry professionals who provided insights into the opportunities and challenges related to product development and shifting consumer behaviour, as well as what policy support is needed to bring healthy plant-based alternatives to market. These insights are included in the results section in the form of a comment box like the one below.

Almost all of the industry experts interviewed stated that the development of plant-based alternatives is part of their broader sustainability strategy. In this context, they emphasised the lower climate impact of plant-based products, as well as their lower land use.

"In order to feed a population of 10 billion by 2050, within planetary boundaries, transitioning to more plant-based diets is inevitable. Our plant-based meat alternative products have a key role to play in helping individuals realise this transition."
Marketing Manager

A more detailed methodology description can be found at the end of the report on page 41.

NUTRITIONAL PROFILE OF PLANT-BASED MEAT ALTERNATIVES

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We found that the average nutritional quality of all plant-based meat alternatives analysed (422 products) is slightly better than that of animal-based meat products (see Figure 1). The total average score for plant-based meat alternatives is 5.32, while for animal-based meat it is 4.50. This indicates that both categories have moderate nutritional value with room for improvement. Measured by country, the average score of plant-based meat alternatives (see Figure 2) is either similar to or higher than the average score of animal-based meat. The Netherlands had the highest average score with 6.67 points out of 8, indicating that the plant-based meat alternatives available on the Dutch market have a high nutritional value. Of the 82 Dutch plant-based meat products analysed, 22 received the maximum score of 8. In contrast, animal-based meat products never exceed a score of 6.

Other countries that performed well were Belgium, Spain, the USA and the UK, with scores ranging from 5.33 to 6. The plant-based meat alternatives contained less total saturated fat and significantly more fibre than the animal counterparts, sufficient to qualify them for the "source of fibre" claim. This confirms the results of previous studies.[38] [39] [40] [41] [42] However, in some countries such as Poland, Germany and Czechia the score is similar to animal-based meat, primarily due to a lack of fortification, excessive salt content, and insufficient protein or fibre. Malaysia, in particular, received an average score of 4.12 because of the lack of fortification (especially vitamin B12), the amount of salt, and inadequate levels of protein and fibre (see Figure 2).

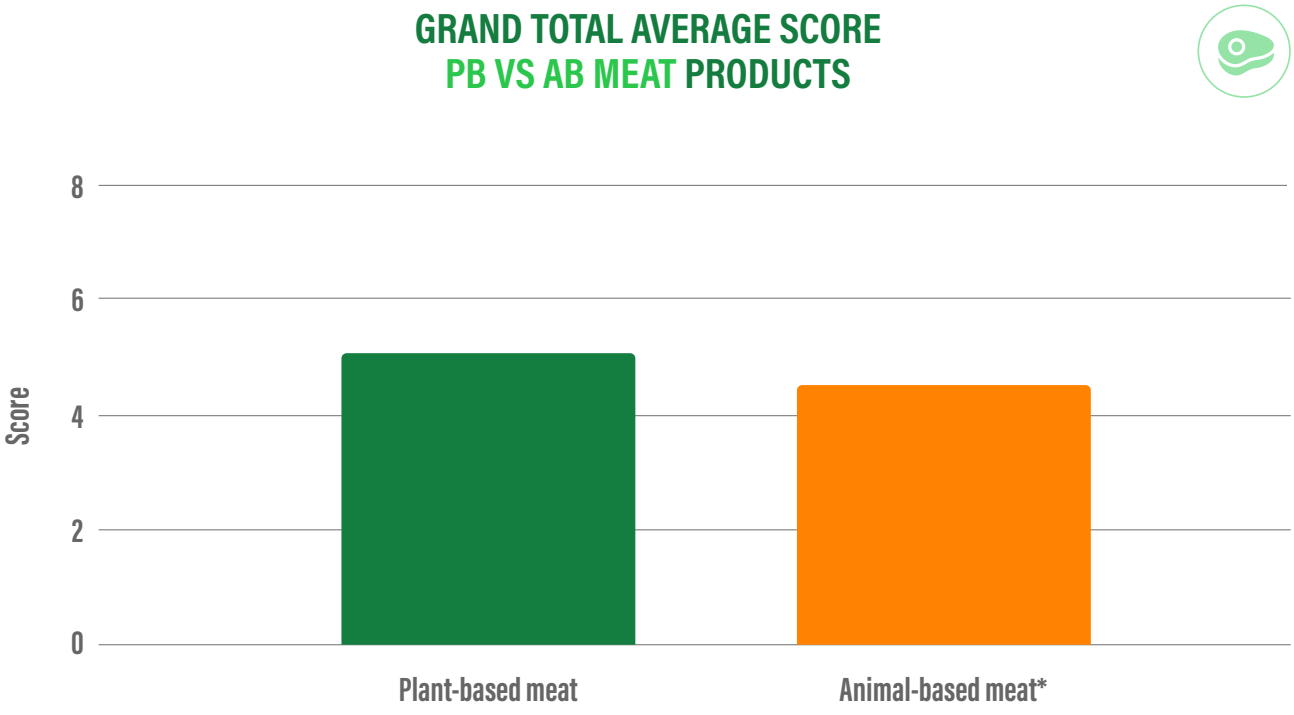


Figure 1. Grand total average score of plant-based meat alternatives vs animal-based meat products.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

GRAND TOTAL AVERAGE SCORE PB VS AB MEAT PRODUCTS

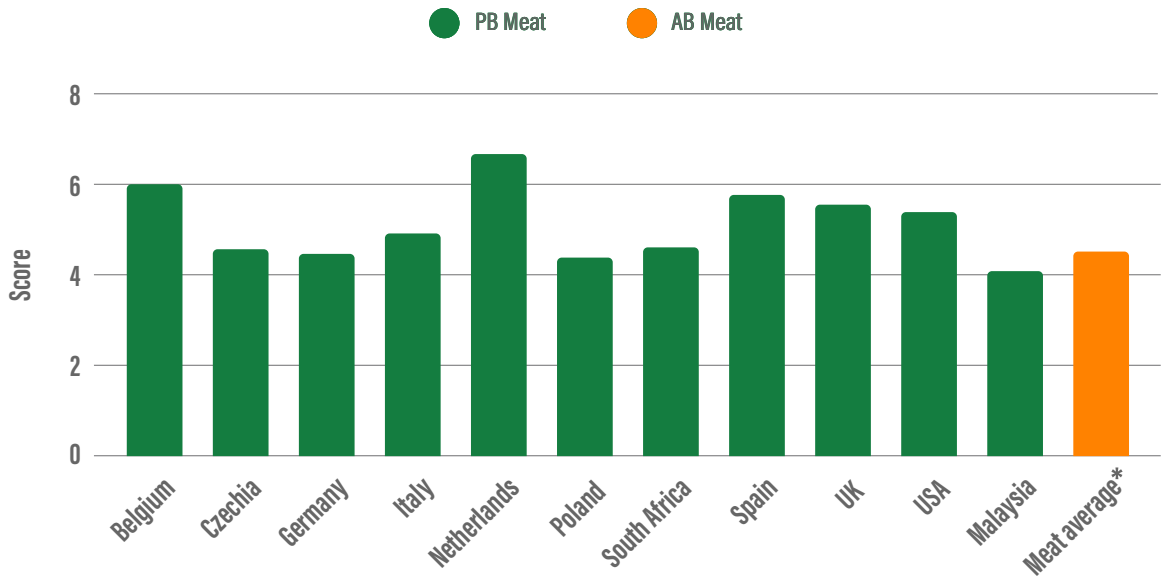
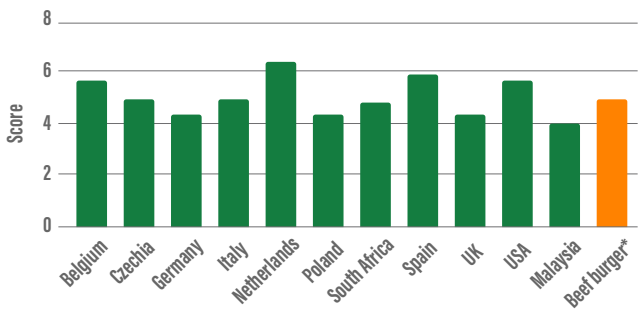


Figure 2. Total average score of plant-based meat alternatives vs animal-based meat products.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

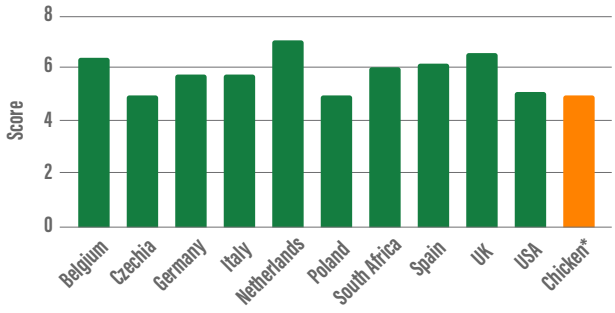
When it comes to product subcategories, plant-based burgers and chicken breast/strips scored quite similarly to their animal-based counterparts in most countries (see Figure 3 A, B). Plant-based bacon, chicken nuggets, and sausages scored particularly well in most countries in comparison to their animal-based counterparts (see Figure 3 C, D, E). However, plant-based bacon was only available in European countries and the USA, not in Malaysia or South Africa, as these countries consume significantly less pork.

AVERAGE SCORE PB VS AB SUBCATEGORIES

A) Burgers



B) Chicken breast/strips



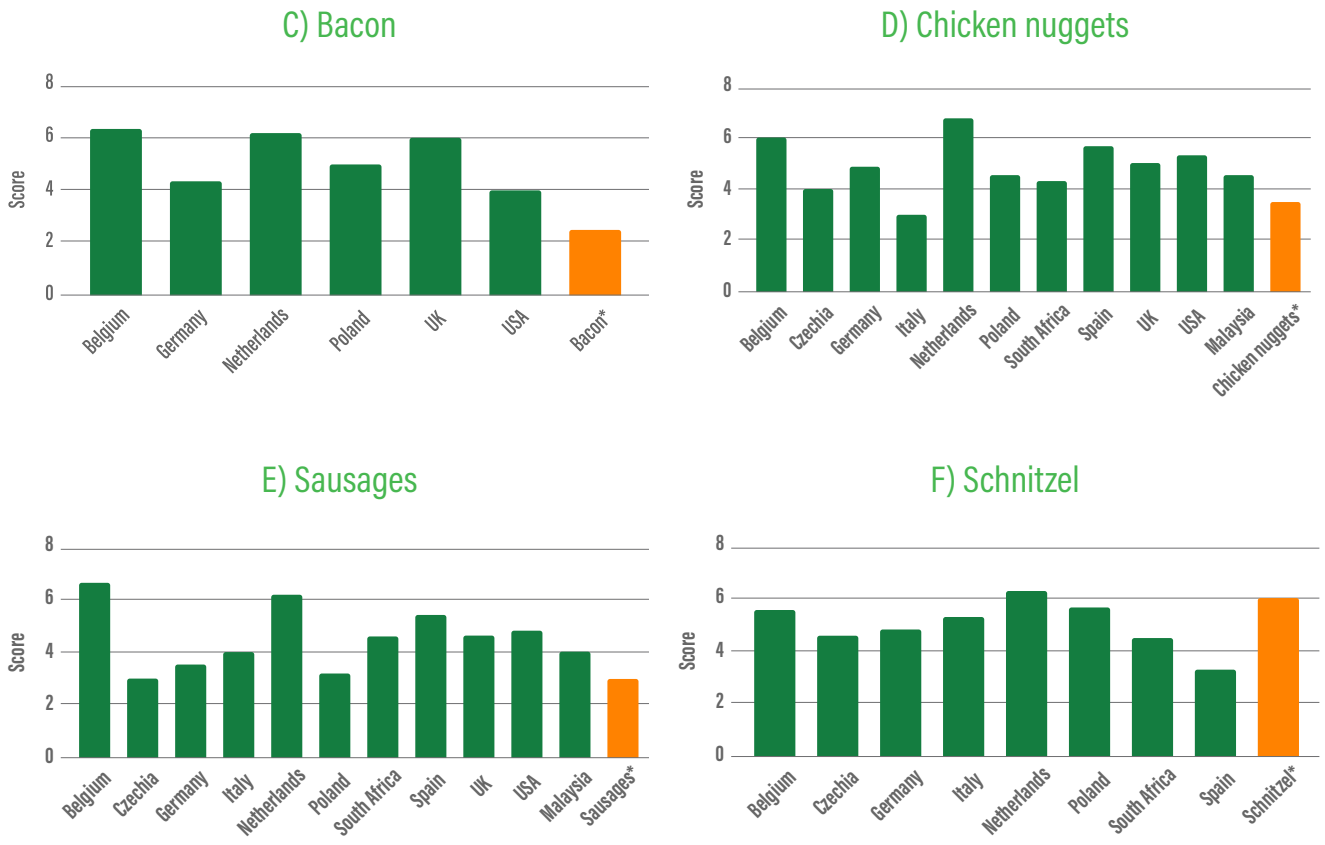


Figure 3. Average score of plant-based meat alternatives vs animal-based meat products:
A) Burgers, B) Chicken breast/strips, C) Bacon, D) Chicken nuggets, E) Sausages F) Schnitzel.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

Throughout the different subcategories, we found that only the schnitzel category performed worse in almost all countries compared to its animal-based counterpart (see Figure 3 F). The only country that showed a higher score was the Netherlands, due to a good amount of protein and fibre, as well as the inclusion of micronutrient fortification. In all other countries, the lower scores were primarily due to the lack of fortification, the amount of salt and insufficient protein. Additionally, the schnitzel category is not present in all countries because it is not a traditional and common food worldwide, similar to bacon.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Protein

When comparing plant-based meat alternatives to their animal-based counterparts, protein content is often a key factor, given the role of meat as a primary protein source. To be considered a comparable protein source, plant-based meat alternatives should provide a similar amount of protein or at least meet the threshold for being classified as a protein source, which requires at least 20% of their calories to come from protein.[43]

In this study, we found that the average protein content of plant-based meat alternatives ranges from 11.2 g to 19.6 g per 100 g of product. The average protein content of animal-based meat typically ranges from 15 g to 19.5 g per 100 g of product (see Figure 4). In all countries analysed, more than 60% of plant-based meat products fall within this range (see Figure 5). In the UK and the US, over 90% of plant-based meat alternatives are also within this range. In Spain, the Netherlands and Belgium, more than 80% do; while in the Czech Republic, Germany, Italy and Poland, the figure is between 70% and 80%, making plant-based meat alternatives a good source of protein in these countries. On the other hand, plant-based meat alternatives in Malaysia have less protein compared to other countries and contain on average only 10g of protein per 100 g of product.

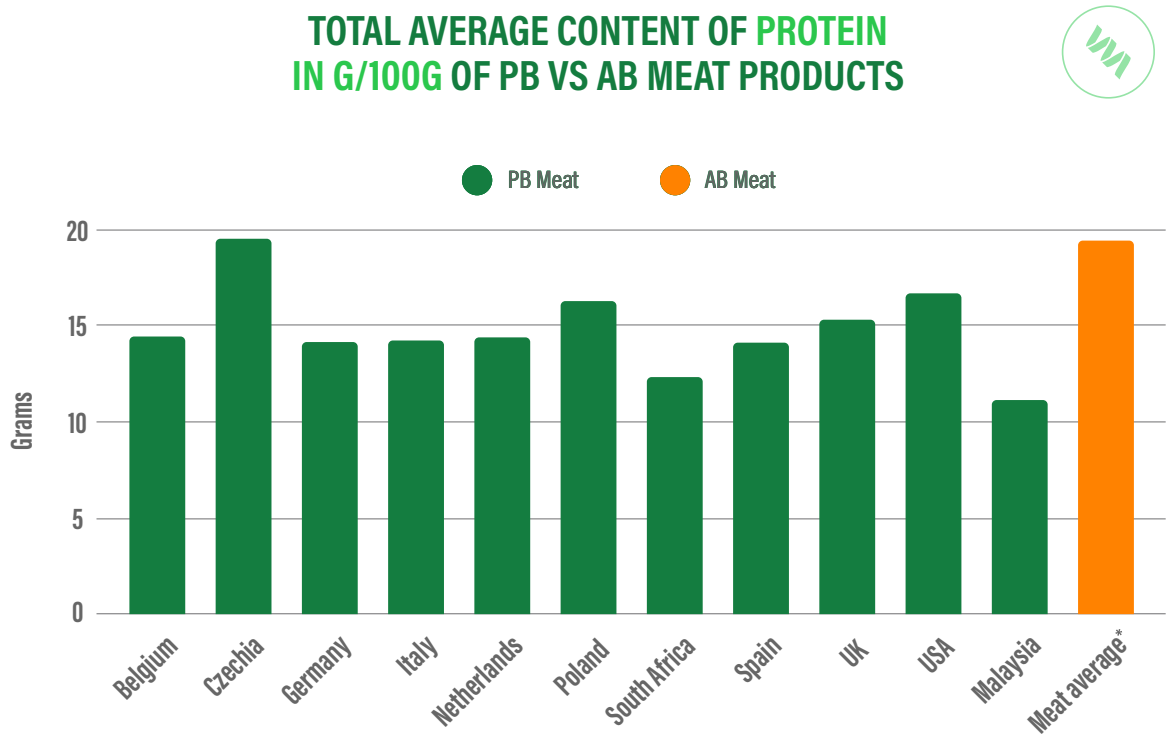


Figure 4. Total average content of protein in g/100g of plant-based meat alternatives vs animal-based meat products.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

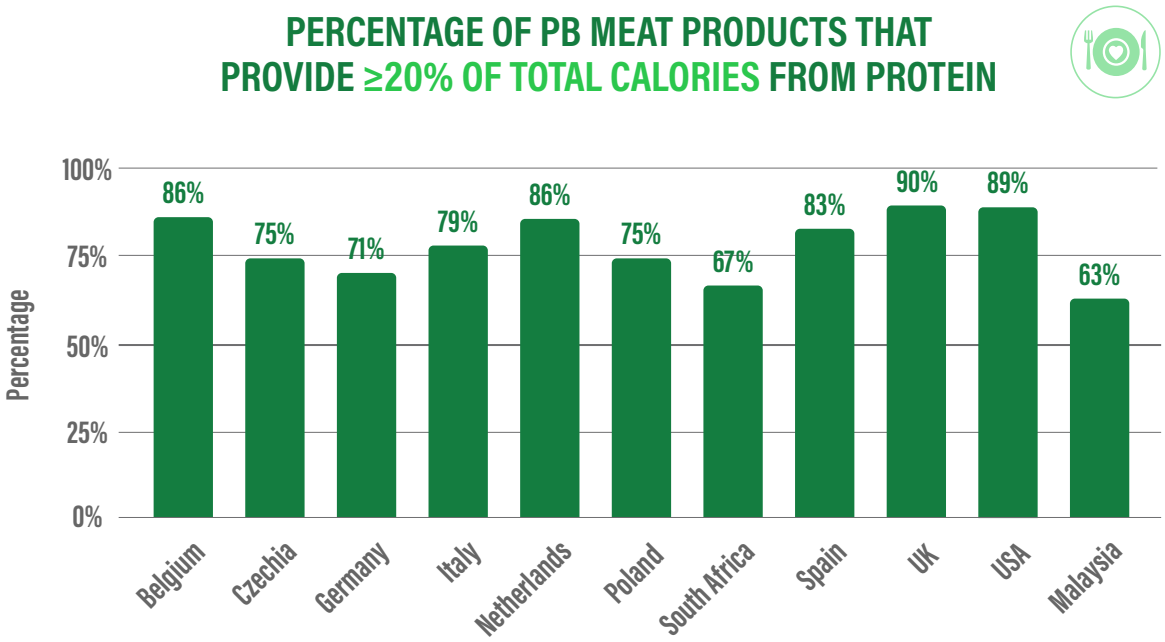


Figure 5. Percentage of plant-based meat alternatives that provide more or equal than 20% of their total calories from protein.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

In the subcategories **sausages**, **minced meat**, **bacon**, and **meatballs** the amount of protein per 100g in plant-based products is higher or similar to animal-based products (Figure 6).

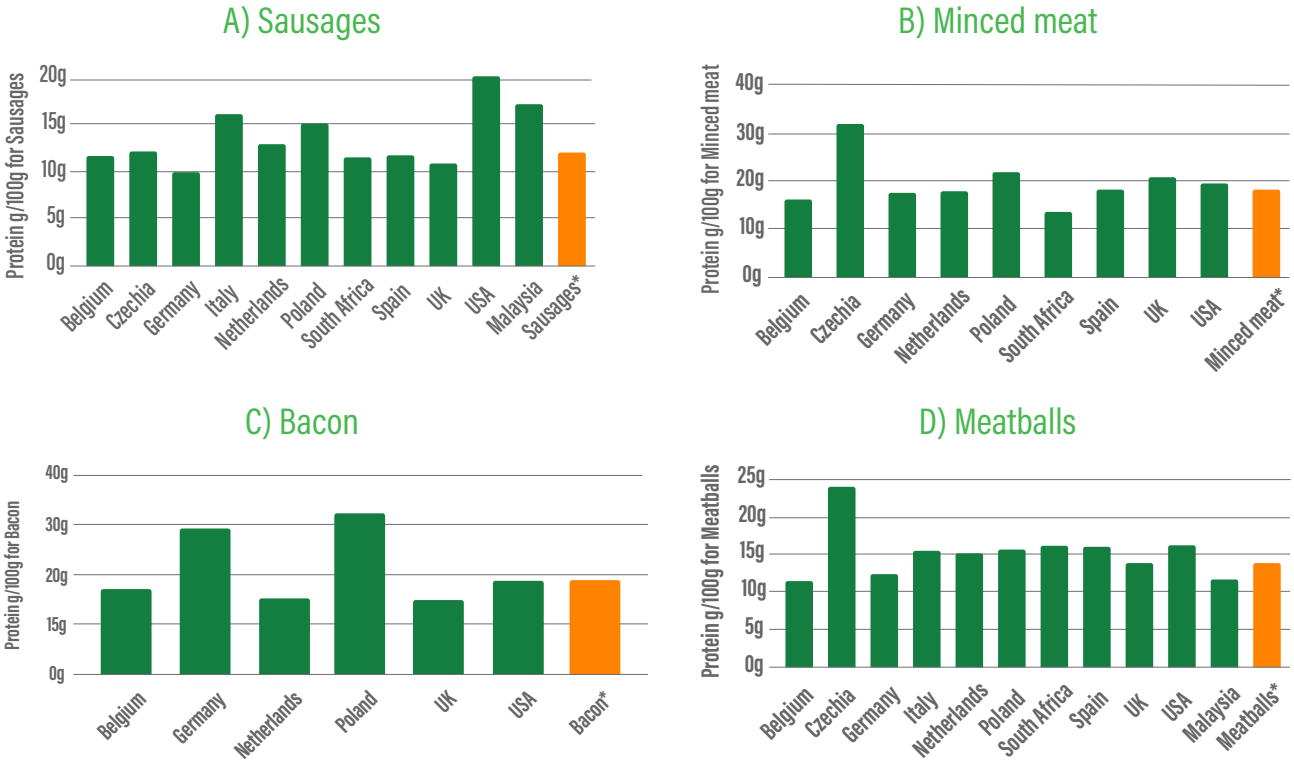


Figure 6. Average protein content in g/100g of plant-based meat alternatives vs animal-based meat products: A) Sausages, B) Minced meat, C) Bacon, D) Meatballs. *Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

Czechia is a particularly interesting case: In all subcategories, most of the products analysed contain a high amount of protein per 100g. The main ingredients found in Czechia's products contributing to the protein content are texturised or rehydrated wheat and soy protein.

It should be noted that the protein content of legume-based, plant-based meat alternatives is usually comparable to that of animal products. Nevertheless, individual plant proteins are usually low in one or more essential amino acids, which is typically not the case with conventional animal protein sources.[44] However, the biological value is increased considerably when different foods are combined, as their respective amino acids complement each other. What is important is not the profile of amino acids in a single food or meal, but rather the distribution of amino acids across the entire day. Moreover, it is well known that people are consuming more protein than recommended by national food-based dietary guidelines, especially in wealthy regions.[45] If a person consumes enough protein from a wide variety of plant-based sources – such as pulses, wholemeal cereals, nuts, and seeds – as well as sufficient calories, then protein requirements can easily be met with plant foods.

Fibre

Fibre is an important nutrient found only in plant foods and is fundamental to maintaining overall health, particularly the health of our gut microbiota.[46] Most European dietary guidelines, including those in the UK, recommend a daily intake of 25-30 g of fibre for adults.[47] In the USA, the recommended intake is 28g per 2,000 calories per day.[48]

In all countries except the USA, **more than 60% of plant-based meat alternatives** contain more than **3g of fibre per 100g** which is the required amount to be considered a **source of fibre according to EFSA nutrition claim legislation**[49] (see Figure 7). US plant-based meat alternatives contain significantly less fibre but still more than animal-based meat products, which naturally contain no fibre (see Figure 8). The small amount of fibre present in the animal-based meat category is due to the addition of plant ingredients to subcategories such as meatballs, schnitzel, and chicken nuggets, which are primarily meat-based but which include other ingredients. Various studies show the benefits of plant-based alternatives on gut microbiota due to their high content of fibre, a nutrient that is usually a concern in Western diets. [50] [51] [52]

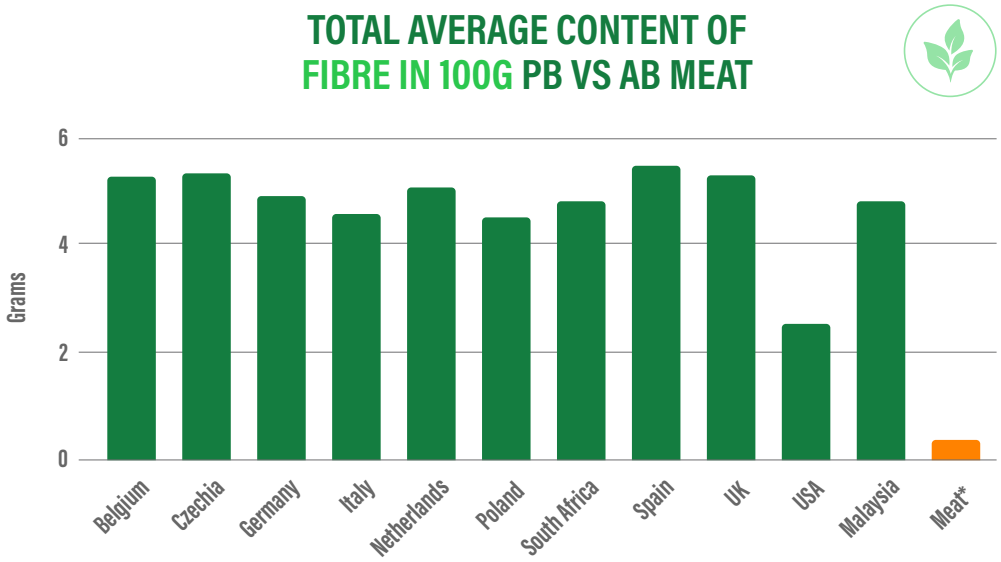


Figure 7. Total average content of fibre in g/100g of plant-based meat alternatives vs animal-based meat products.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

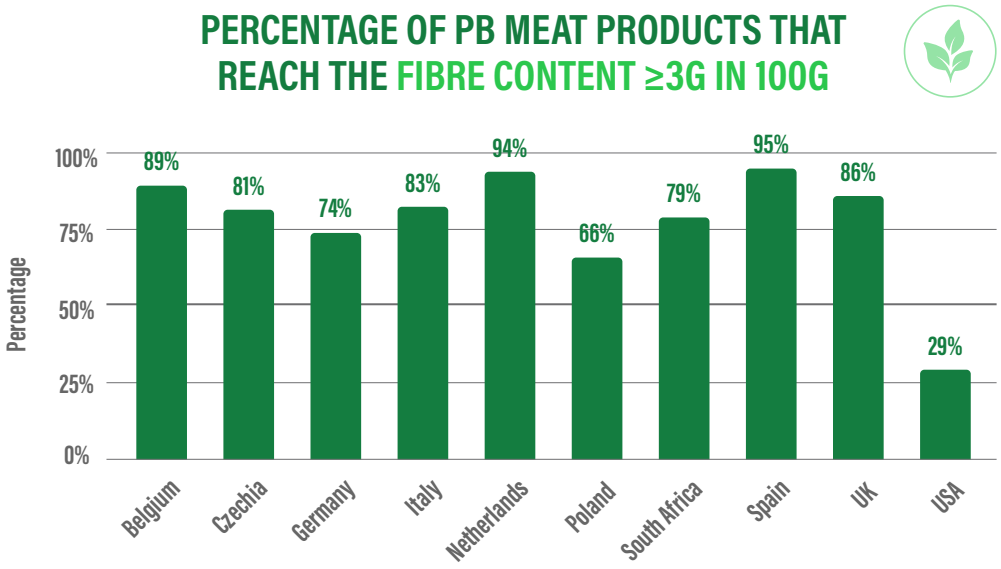


Figure 8. Percentage of plant-based meat alternatives that reach the fibre content of more or equal than 3g/100g.

The industry experts interviewed emphasised that health criteria are key considerations when developing their products, health is identified as the key issue for consumers when choosing plant-based products. Some of the interviewees stated that they based their product development on the national dietary guidelines or WHO guidelines.

"We know health is the reason consumers choose a plant-based category, however taste is the reason to stay! We are conducting extensive understanding studies to learn about consumer expectations from our products, their triggers and barriers, and use this information as an input to our product crafting process."
Marketing Manager

Saturated fatty acids

Reducing the consumption of saturated fat might lower the risk of all-cause mortality (death from any cause), particularly coronary heart disease.[53 54] The WHO recommends that saturated fats make up less than 10% of total energy intake.[55]

Previous studies have shown that plant-based meat alternatives contain significantly less saturated fat than their animal-based counterparts.[56 57 58] Our data from 11 countries confirms this. The saturated fat content in all plant-based meat alternative categories analysed was significantly lower than that of the animal-based counterpart. On average, the amount of saturated fat in plant-based meat alternatives was about 2 g per 100g of product, primarily due to the presence of coconut oil, which was the case for 87 out of 422 products. Animal-based meat, on the other hand, contains more than 6 g saturated fat per 100g of product on average (see Figure 9). In almost all countries, the majority of plant-based meat alternatives **fall below the maximum set level of 2.5g of saturated fat per 100 g** (see Figure 10). The only country in which plant-based meat alternatives contain a higher amount of saturated fats is Malaysia, primarily due to the use of coconut oil as an ingredient (see Figures 9-10).

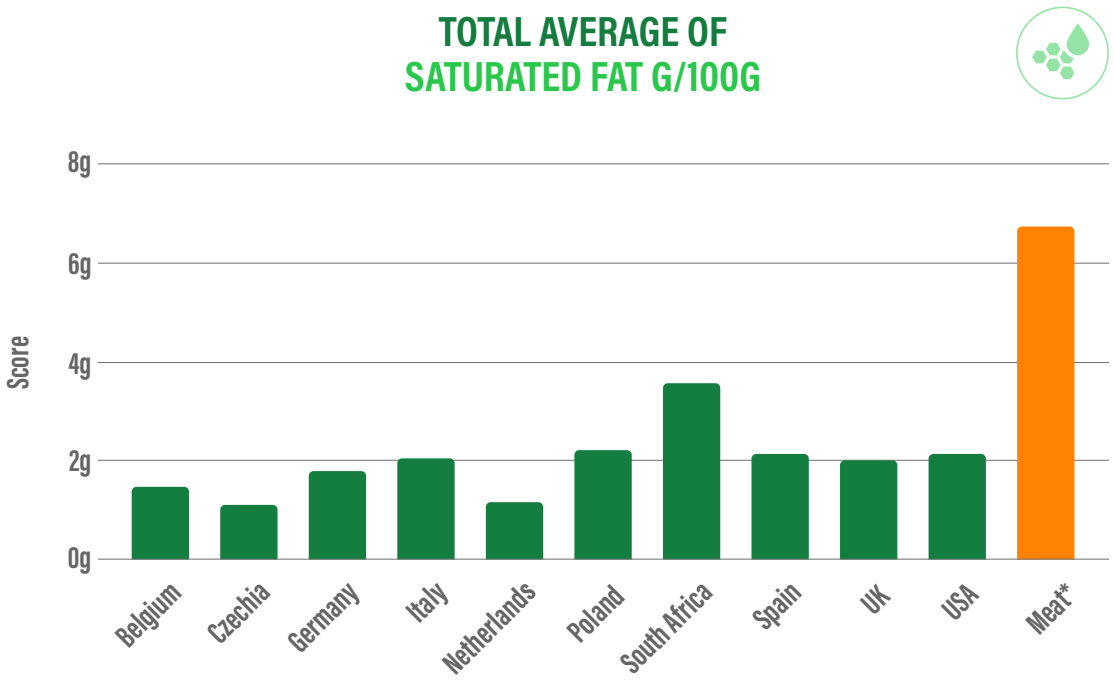


Figure 9. Total average content of saturated fat in g/100g of plant-based meat alternatives vs animal-based meat products.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

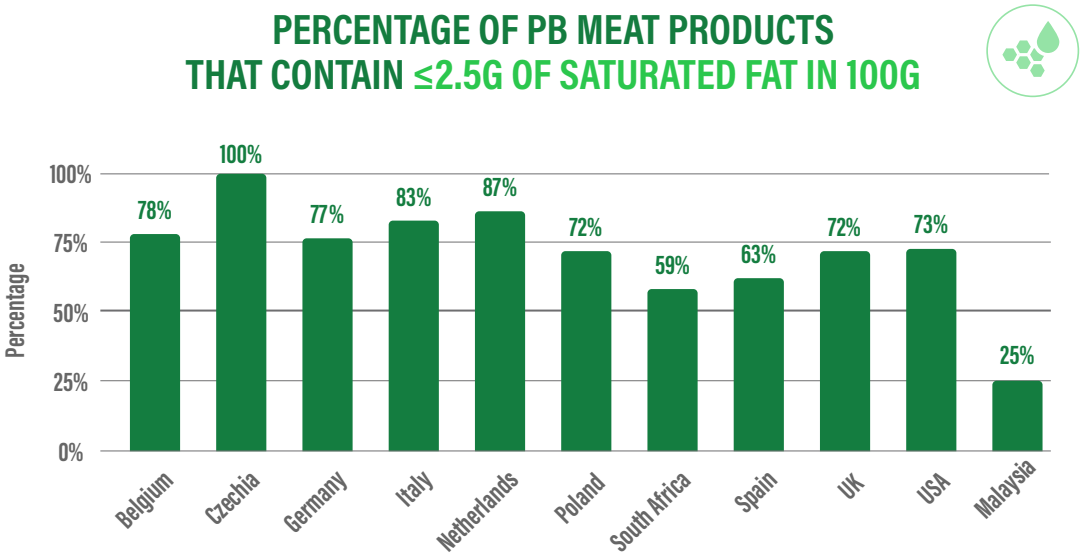


Figure 10. Percentage of plant-based meat alternatives that contain less or equal than 2.5g/100g of saturated fat.

The only subcategory where animal-based products perform similarly in terms of saturated fat is chicken breast/strips, as chicken meat generally contains less total and saturated fat compared to red meat. However, the amount of saturated fat in plant-based chicken breast/strips remains within the recommended values in all countries (see Figure 11).

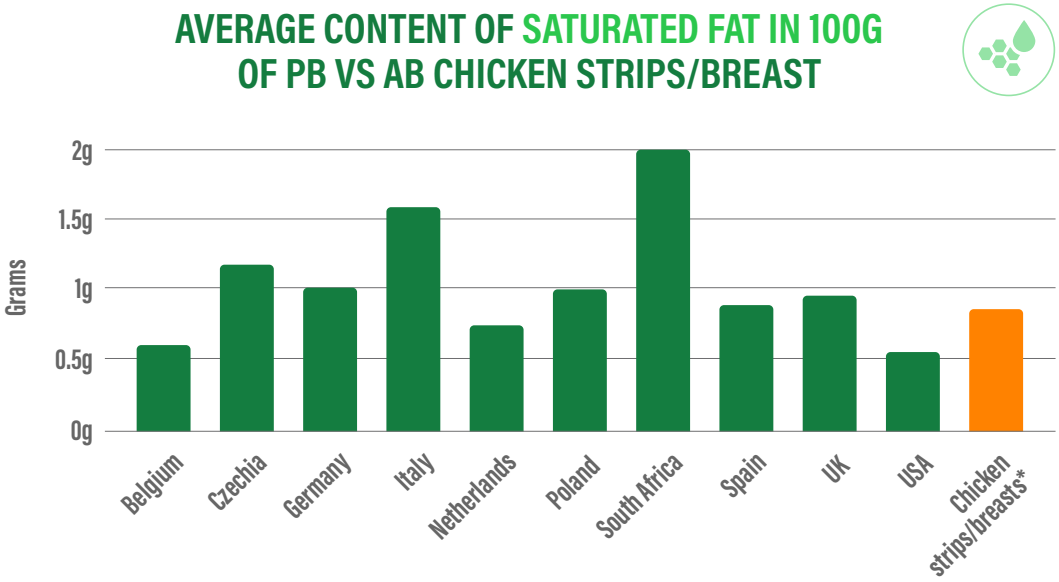


Figure 11. Average content of saturated fat in g/100g of plant-based meat alternatives vs animal-based meat products.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

It is important to note that some manufacturers currently use coconut oil, which is 90% saturated fat and only 10% unsaturated fat. To align with healthier substitutions, plant-based meat alternatives should be based on healthier raw materials to improve their fat profile. Olive oil, rapeseed oil, sunflower oil, cashews, almond paste, and peanut oil are good examples of ingredients that can maintain healthy nutritional values while maintaining the desired texture and taste.

CASE STUDY
BACON

An interesting plant-based meat subcategory that performs particularly well compared to its animal-based counterpart is bacon. In Belgium, the Netherlands and the UK, plant-based bacon scored 6 out of a maximum of 8 points, indicating high nutritional value. In contrast, animal-based bacon scored 2.5, reflecting low nutritional value, primarily due to its high content of saturated fat, total fat and salt. Plant-based bacon, on the other hand, contains much lower levels of saturated fat and total fat, along with more fibre and protein, and more iron if the product is fortified (see Figures A, B, C). However, we only found bacon alternatives in European countries and the USA, where this type of product is commonly consumed.

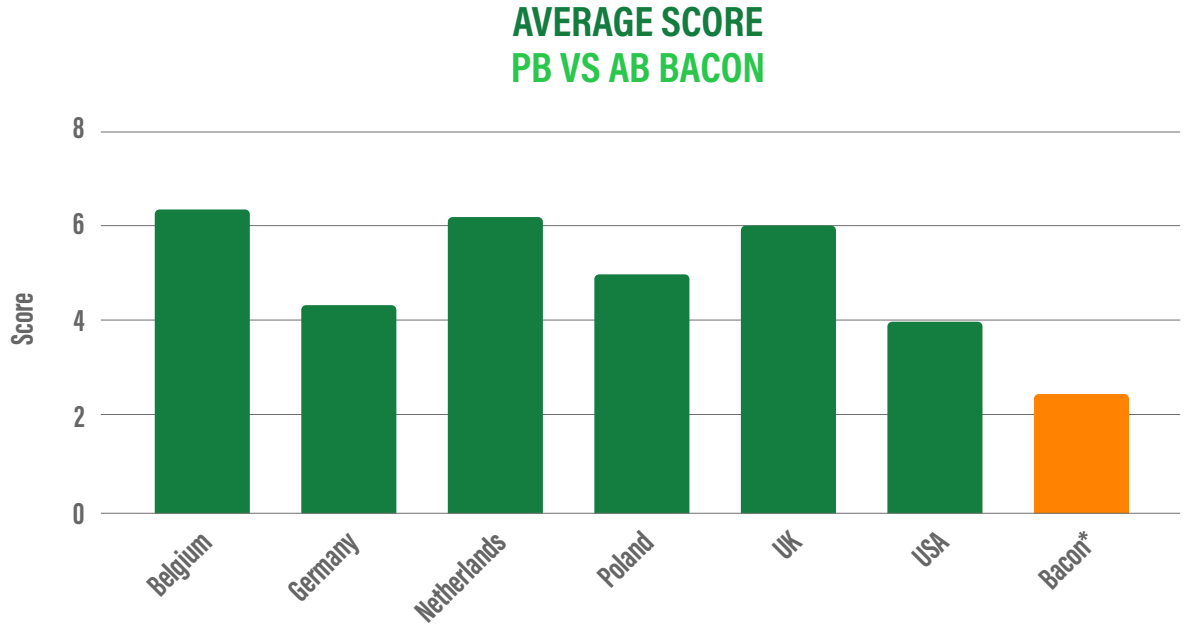
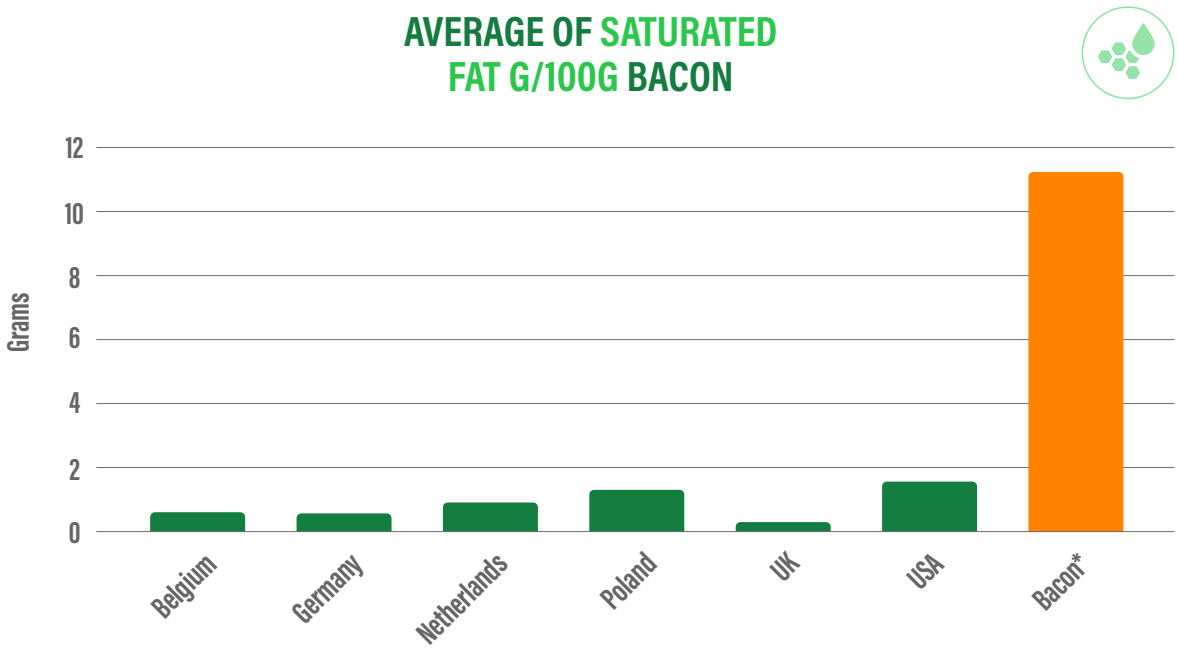


Figure 12 A). Average score of plant-based bacon vs animal-based bacon.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.



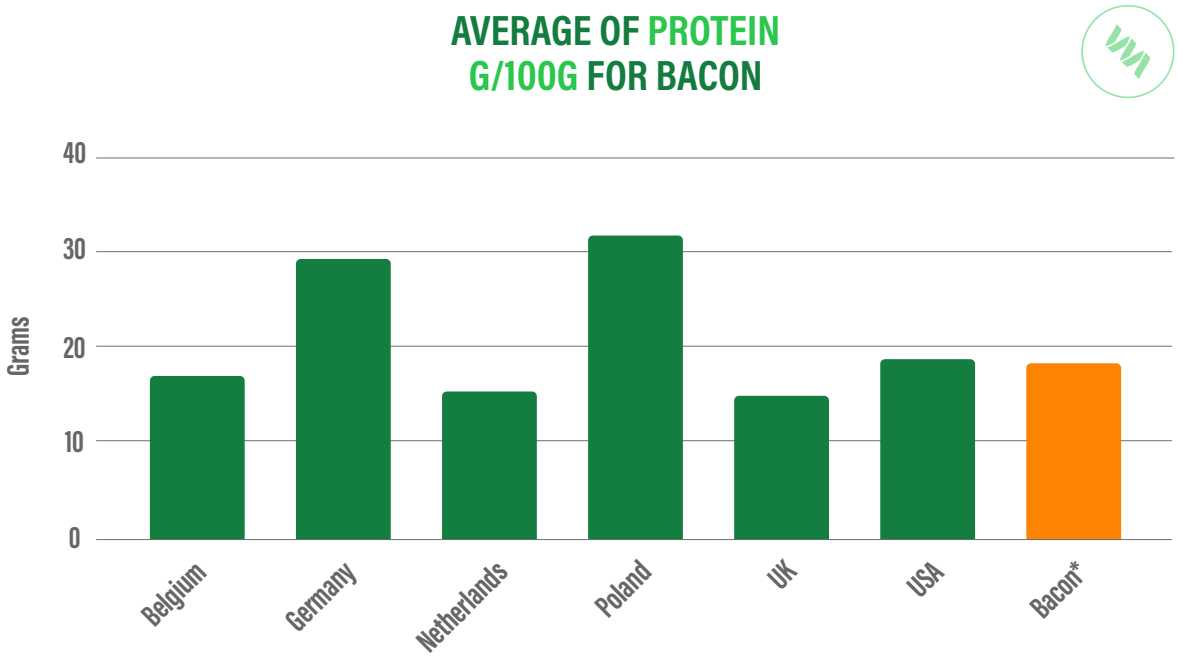


Figure 12. B) Average content of saturated fat in g/100g of plant-based bacon alternatives vs animal-based bacon. C) Average protein content of plant-based bacon vs animal-based bacon.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

Initial studies suggest that replacing red meat with plant-based meat alternatives can have positive effects on cardiovascular health. This may be due to the fact that plant-based meat alternatives contain no cholesterol and less saturated fat compared to animal-based products.[59 60 61 62]

Key micronutrients

The lack of specific micronutrients such as iron and vitamin B12 is a common concern when considering the nutritional properties of plant-based meat alternatives. We found that, depending on the country, **plant-based meat alternatives are generally fortified with iron and vitamin B12, but fortification still does not appear to be a common practice.** The countries where fortification is already widespread are the USA, the Netherlands, Belgium and Spain (see Figure 13). In the USA more than 95% of plant-based meat alternatives are fortified with iron, but only 24% are fortified with vitamin B12. In the Netherlands, more than 70% of the alternatives are fortified with both iron and vitamin B12, in Belgium about 50%, and in Spain more than 40%. In all other countries, manufacturers still do not use fortification strategically in their product development. In South Africa, there is no fortification at all, and in the Czech Republic, Italy, Germany, Malaysia and Poland, less than 20% of all products are fortified.

Our data clearly shows that there is a need to increase awareness of the benefits and opportunities of fortification. Product manufacturers can address micronutrient gaps through fortification strategies and ingredient optimisation, but they require scientific guidance and political support.

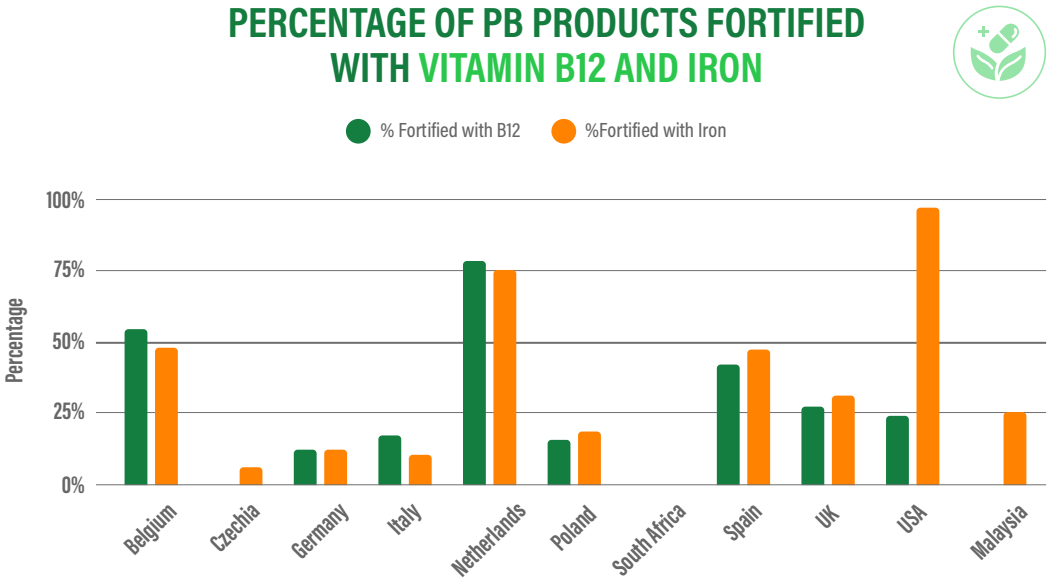


Figure 13. Percentage of plant-based meat alternatives that are fortified with vitamin B12 and iron.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

Some of the industry experts interviewed highlighted the importance of fortifying plant-based products with micronutrients such as iron and vitamin B12. However, three main barriers for plant-based manufacturers who wish to fortify their products were identified: regulatory restrictions, consumer acceptance, and technical challenges.

"Fortification plays a significant role in enhancing the nutritional profile of plant-based products. However, barriers to fortification can include regulatory restrictions, consumer acceptance of fortified foods, and the technical challenges of incorporating certain nutrients without affecting the product's taste and texture."
Commercial Manager

Salt and added sugar

Nutrients are an abstract concept for most of the population, and explaining their importance in maintaining a healthy diet increases the complexity of nutrition communication. For this reason, educating consumers on the main nutrients of concern is both difficult and fundamental for a shift towards a healthier diet. Salt and added sugar are key nutrients of concern in both plant-based and animal-based products. Reducing salt and added sugar intake is an important public health goal among the member states of the World Health Organisation.[63]

Our data show that the **sugar content of 98% of all plant-based meat alternatives analysed (422 products) was below the set maximum of 5 g per 100 g** as defined by EFSA's Nutrition Claim legislation (see Figure 14). On the other hand, animal-based meat products normally do not contain sugar, except for certain products like meatballs and sausages that can contain a small amount of sugar (not more than 2.8 g, according to USDA and UK databases) depending on the recipe. We can conclude therefore that sugar is not a nutrient of concern for either plant-based meat and animal-based meat products.

However, in most countries, the **salt content of plant-based meat alternatives exceeds the set maximum of 1.1 g per 100 g,** to be considered within the recommended healthy range (see Figure 15). Animal-based meat products have a salt content ranging from a minimum of 0.11 g to a maximum of 3.75 g per 100 g, with an average of 1.1 g. In particular, the animal-based subcategories bacon, sausages, and chicken nuggets contain between 1.33 g and 3.75 g of salt per 100 g, exceeding the maximum of 1.1 g. Plant-based meat alternatives have a salt content ranging from a minimum of 0.15 g to a maximum of 4.1 g per 100 g, with an average of 1.3 g. In only four countries – South Africa, the United Kingdom, Spain, the Netherlands and Belgium – were half of the plant-based meat alternatives within the set salt limit. In all other countries analysed plant-based meat products exceeded the set salt limit.

Manufacturers should aim to stay below this limit when producing plant-based meat alternatives. Salt can be replaced with spices, herbs, and high-quality ingredients that are tasty in their own right. Potassium salt (KCl) can also replace some of the added salt without altering the sensory characteristics of the product.

It's important to keep the **benefits of plant-based alternatives that come naturally with fibre, lower levels of saturated fat, as well as significantly lower levels of cholesterol and trans fatty acids, and make sure to not add too much salt and sugar to enhance their taste**.

Source **Shutterstock**

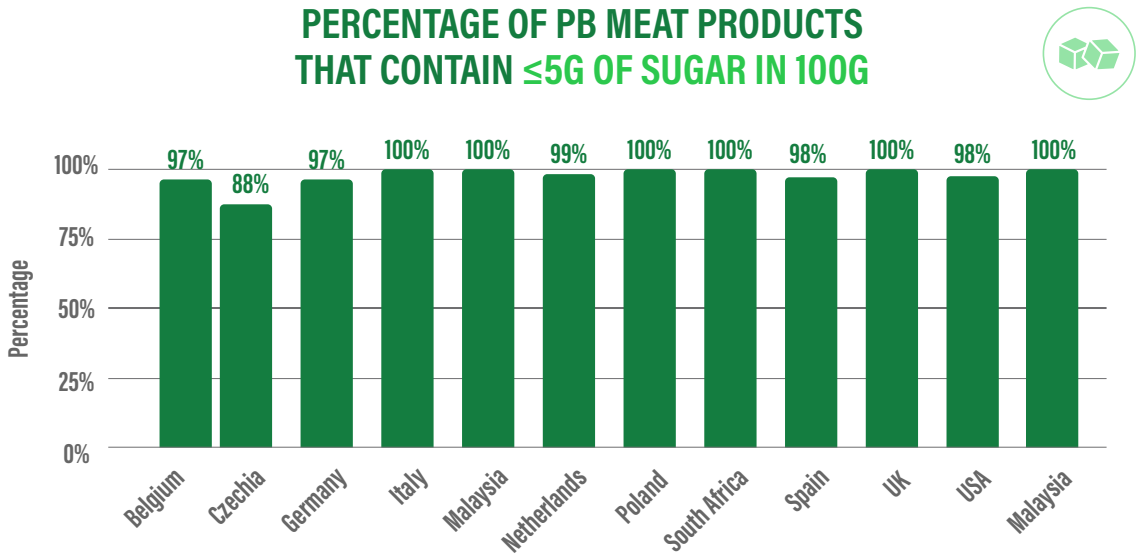


Figure 14. Percentage of plant-based meat alternatives that contain less or equal than 5g/100g of sugar.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

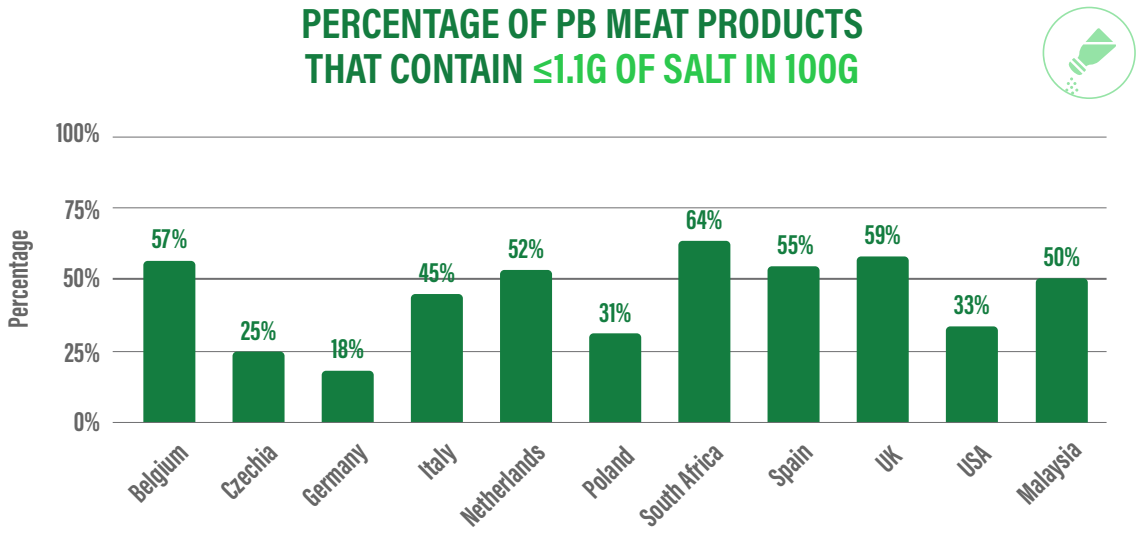


Figure 15. Percentage of plant-based meat alternatives that contain less or equal than 1.1g/100g of salt.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

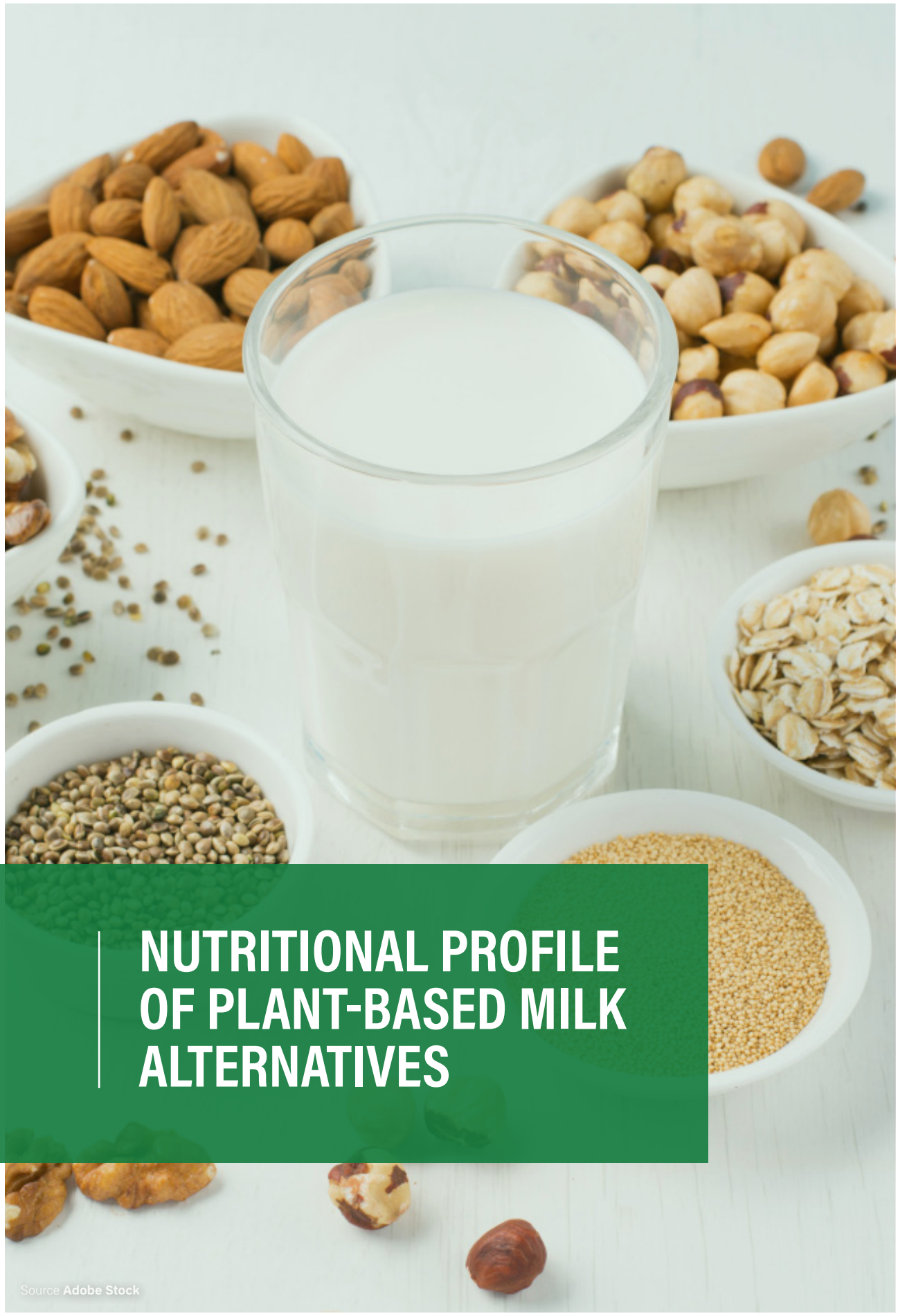
One of the biggest challenges in product development identified by the industry experts interviewed was achieving desirable sensory features such as juiciness and structure, as well as finding the right flavour without relying on the addition of too many additives. The most important opportunities for improvement were identified as technological advances in food processing, the development of new plant-based protein sources, and ongoing research into consumer preferences to better tailor products to consumer expectations. The use of fungi and precision fermentation were seen as key for the future development of sustainable low-processed, nutritious, and flavourful alternative products. However, according to the interviewees, some regulatory frameworks pose barriers, such as stringent approval processes for novel ingredients and inconsistent fortification regulations across regions. These regulations can complicate product development and distribution.

"There is an ongoing debate about processed foods. In this conversation, meat alternatives were pointed out as being heavily processed. We see it as a challenge to educate consumers about why plant-based meat is processed (e.g. to improve the nutritional profile, taste or shelf life) and how the products are made."
Marketing Manager


Source **Adobe Stock**


Source **Adobe Stock**

"Educational initiatives that address misconceptions and provide clear information about the benefits of plant-based products can significantly boost consumer acceptance and demand."
Commercial Manager



NUTRITIONAL PROFILE OF PLANT-BASED MILK ALTERNATIVES

Source **Adobe Stock**

Overall the average score of all the 251 plant-based milk alternatives analysed was slightly lower than that of cow's milk from the USA and slightly higher than that of cow's milk from the UK. Cow's milk from the USA has a higher score than UK cow's milk because of differences in fortification: in the USA, cow's milk is typically fortified with vitamin D (also vitamin A), while in the UK and most other countries, fortification is less common (see Figure 16). We also found that the average score of both cow's milk and the alternatives varied significantly by country (see Figure 17).

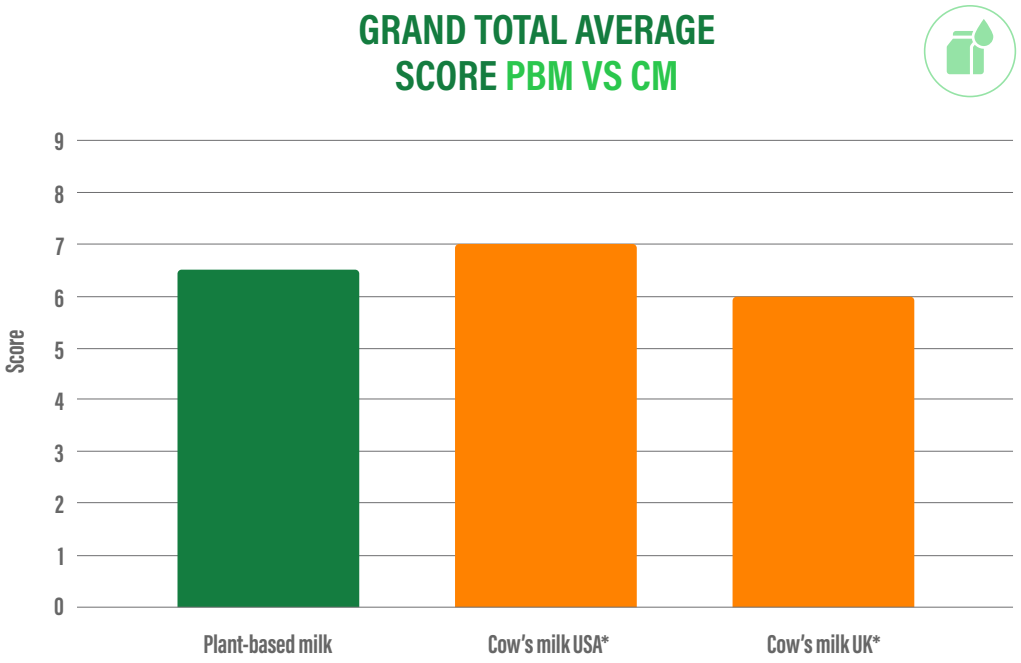


Figure 16. Grand total average score of plant-based milk alternatives vs cow's milk.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

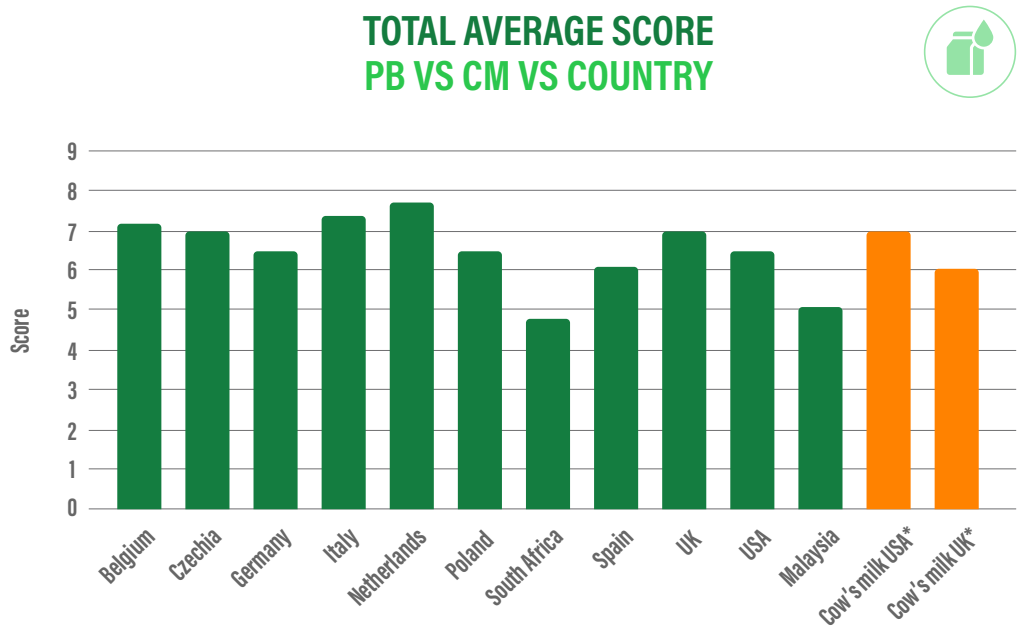


Figure 17. Total average score of plant-based milk alternatives vs cow's milk from the USA and the UK.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

We found that the **plant-based milk alternatives contained less total fat and less saturated fat**, consistent with findings from other studies.[64 65 66 67] The countries offering the best-performing plant-based milk alternatives are the Netherlands, Italy, Belgium, the UK, and Czechia, with scores between 7 and 7.7 out of 9. Spain, Germany, the USA and Poland obtained scores ranging from 6.1 to 6.5. South Africa and Malaysia obtained a score of 4.8 and 5 respectively, indicating a need to improve their plant-based milk formulations, especially regarding sugar content and fortification. If plant-based milk was at least fortified with calcium and vitamin D, those products would perform better, gaining 2 additional points. However, fortification is still not very common in most European and non-European countries.

Protein

In most dietary guidelines worldwide, milk is not categorised as part of the protein group but is primarily recommended as a source of calcium. Therefore it is not necessarily a disadvantage if some plant milks contain only small amounts of protein as long as they are fortified with calcium. However, cow's milk is often primarily regard ed as a source of protein, containing 3.5 g per 100 ml, which is significantly more than most plant-based milks. On average, the plant-based alternatives contained between 1 and 2 g of protein per 100 ml (see Figure 18). When examined individually, raw materials like oats, almonds, and coconut provide even less protein: coconut milk averages 0.2 g of protein per 100 ml, almonds 0.6 g, and oats 0.8 g.

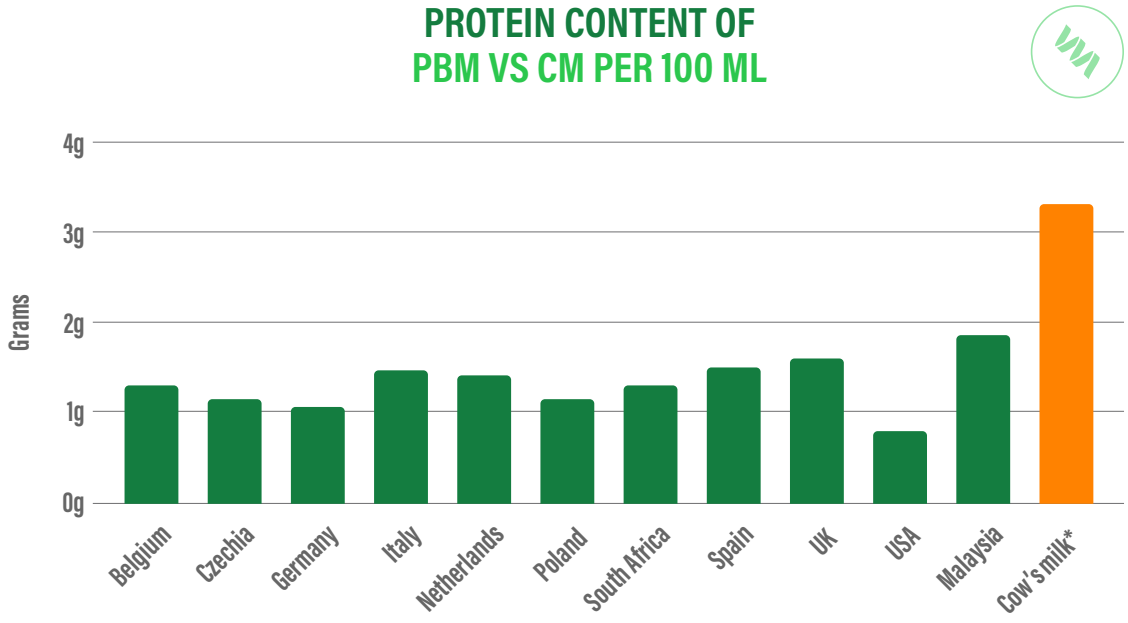


Figure 18. Average content of protein in plant-based milk alternatives (PBM) vs cow's milk (CM).
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.


Source Shutterstock

CASE STUDY
SOYA MILK

A detailed look at soya milk shows that it performs better than cow's milk in almost all countries (see Figure 19). Soya milk naturally contains a similar amount of protein (3 g on average, see Figure 20) to cow's milk and has a high protein quality comparable to animal-based proteins. When soya milk is low in sugar and fortified with vitamins B2 (riboflavin), D, B12, and calcium, it scores higher than cow's milk, thanks to its naturally high protein content and low levels of saturated fats. On average, soya milk alternatives available in Germany, the Netherlands, and Czechia achieve a score of 9, the highest possible, indicating high nutritional value. Cow's milk, on the other hand, has an average score of 6.5, mainly due to its high levels of saturated fats and lactose (milk sugar) (see Figure 19).

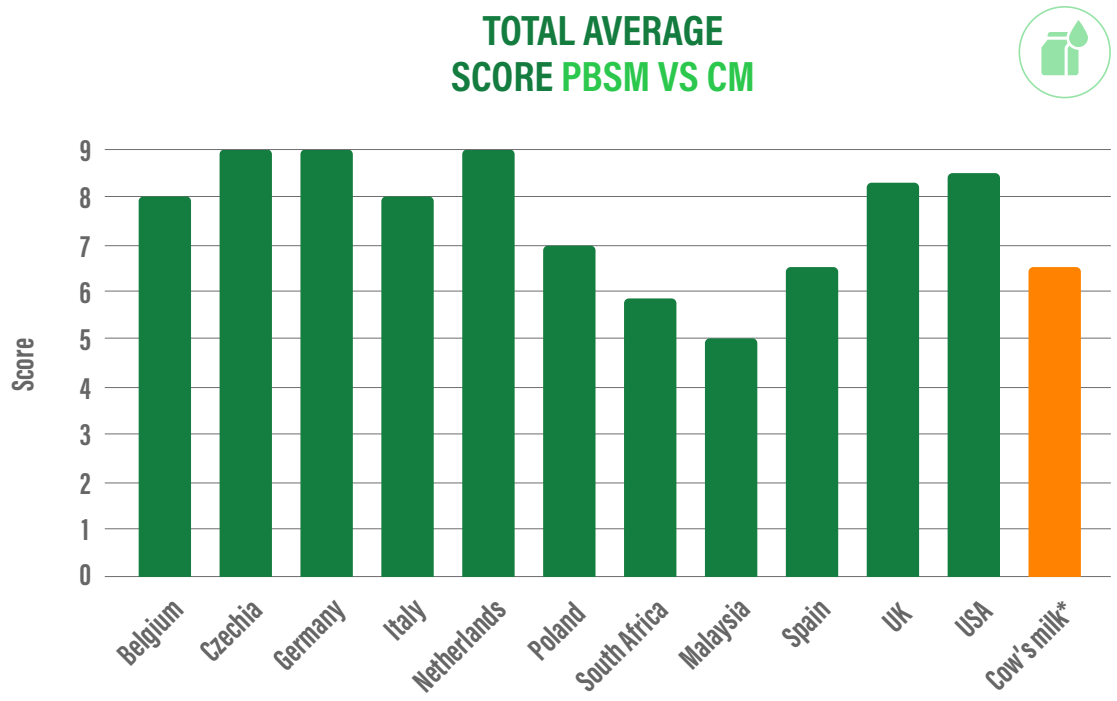


Figure 19. Total average score of plant-based soya milk vs cow's milk.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

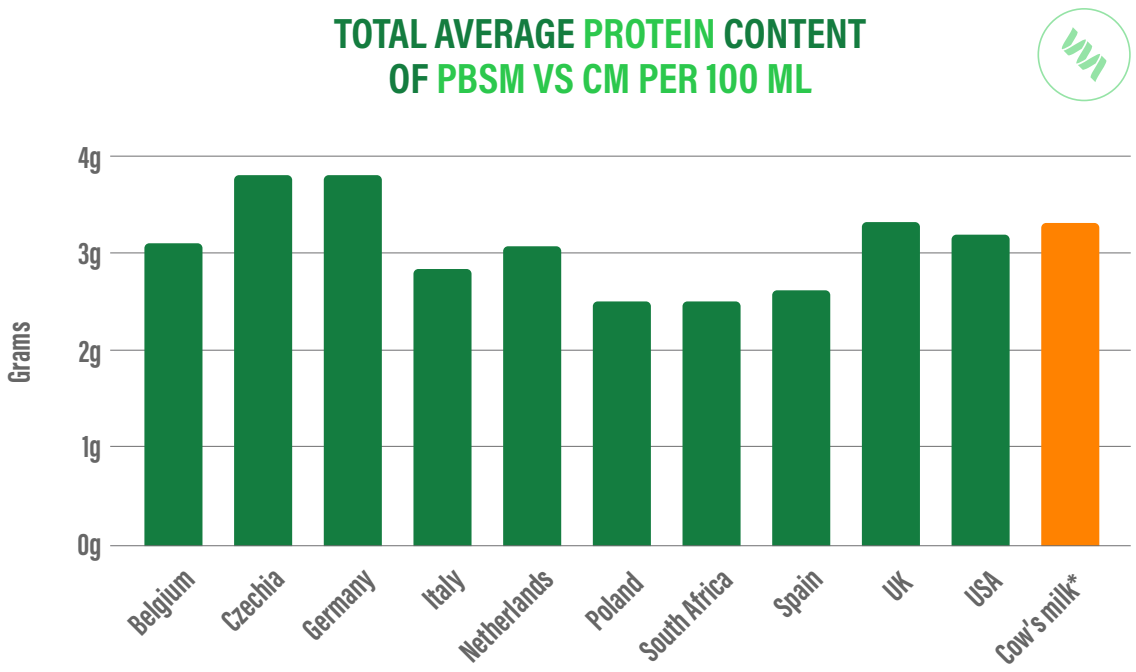


Figure 20. Average protein content in g/100ml of plant-based soya milk alternatives vs cow's milk products.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.


Source: Pexels - **Polina Tankilevitch**

Saturated fatty acids

As mentioned earlier, saturated fat needs to be limited in our diet. Cow's milk naturally contains an average of 1.5 g of saturated fat per 100 ml, which is significantly higher than the amount in plant-based milk alternatives. On average, the saturated fat content in plant-based alternatives ranges from 0.2 g to 0.8 g per 100ml of product. This is typically due to the added fat sources used to balance the formulation (usually vegetable oils such as sunflower oil) or because the milk is coconut-based (see Figure 21). In all countries, **more than 90% of the plant-based milk alternatives are below the set maximum level of saturated fat content (≤1.1 g per 100 ml)** (see Figure 22). With such low levels of saturated fats, plant-based milk alternatives can be a good option for individuals trying to balance their overall fat intake.

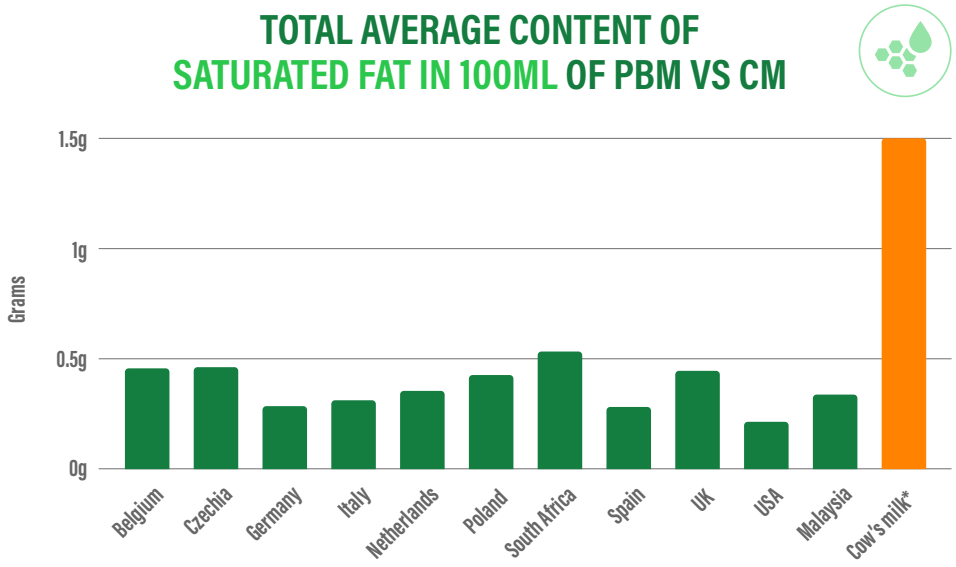


Figure 21. Total average content of saturated fat in g/100ml of plant-based milk alternatives vs cow's milk.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

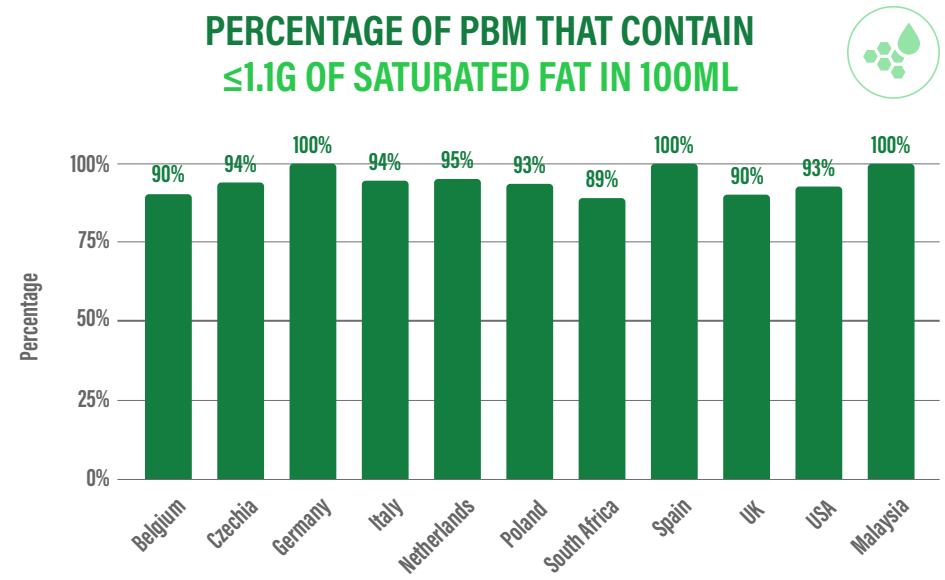


Figure 22. Percentage of plant-based milk alternatives that contain less or equal than 1.1g/100ml of saturated fat.

Key micronutrients

Similar to plant-based meat alternatives, plant-based milk alternatives can also lack specific micronutrients such as calcium, vitamin D, B12, and B2, when compared to cow's milk. **In all the countries we analysed, most of the plant-based milk alternatives are fortified with calcium. The most common level of calcium fortification is 120 mg per 100 ml, which is comparable to cow's milk** (see Figure 23). Calcium fortification should be recommended to all producers of plant-based milk alternatives and consumers should be advised to choose calcium-fortified products when using them as a milk substitute. The USA has the highest amount of fortified products, South Africa on the other hand the lowest. This is likely to be due to different regulations on ingredients added to foods or for taste and texture reasons. Most countries, except South Africa and Malaysia, fortify plant-based milk alternatives with calcium, with Belgium, the Netherlands and Italy reaching almost 100%.

It is important to note that organic products were excluded from this analysis because in Europe they are not allowed to be fortified. In the USA, organic products can be fortified, provided that the added nutrients make up no more than 5% of the formulation –allowing organic plant-based alternatives to be fortified. From a nutritional perspective, this creates a barrier for organic plant-based food producers to compete with non-organic producers and animal-based products.[68 69] However, current regulations do allow for the nutritional profile of plant-based products to be improved through the addition of micronutrient-rich ingredients. Plant-based milk producers sometimes add ingredients such as algae to boost calcium levels, and flaxseed to increase omega-3 content.

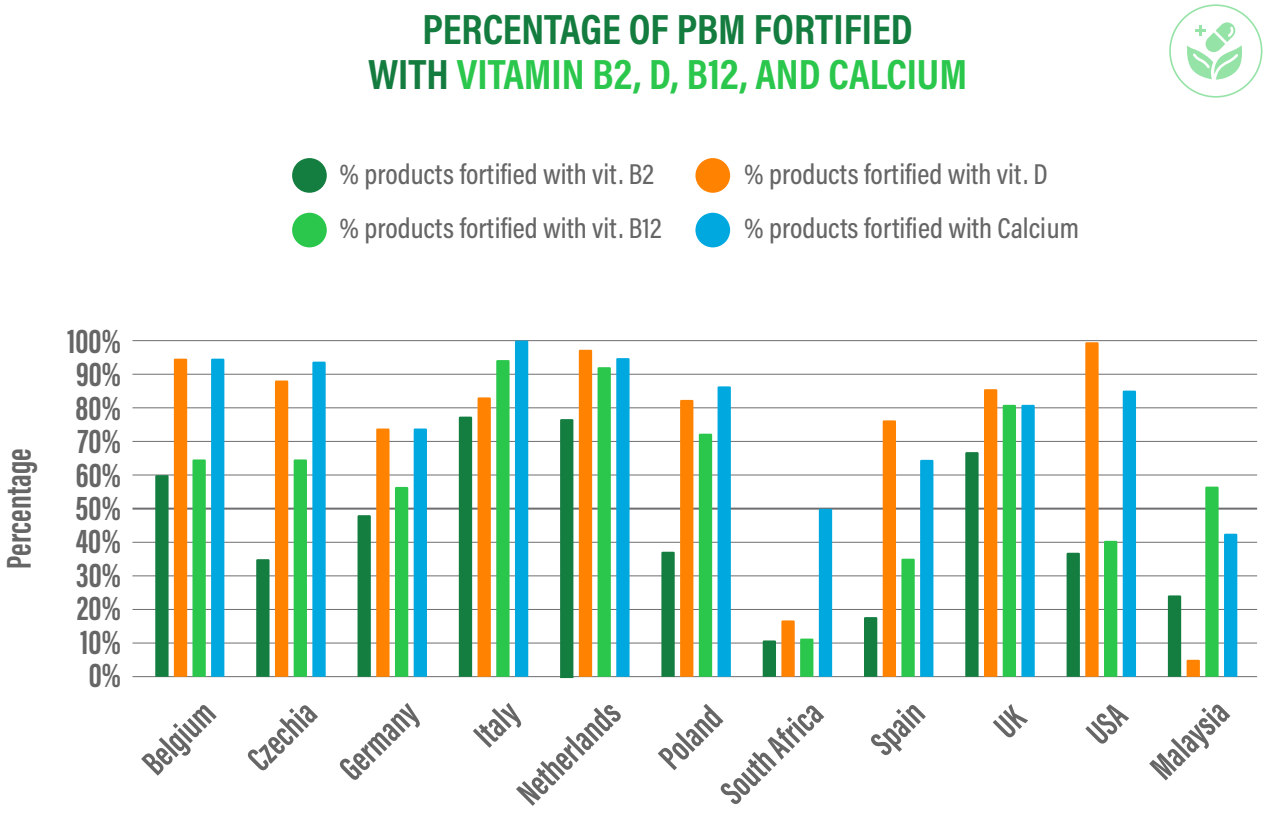


Figure 23. Percentage of plant-based milk alternatives that are fortified with vitamins B2, D, B12 and calcium.

Most countries, except for South Africa and Malaysia, have more than 70% of their plant-based milk alternatives fortified with vitamin D (see Figure 23). Regarding the specific amount of vitamin D fortification, the USA has the highest level with 1.95 mcg per 100 ml. It should be noted that vitamin D fortification is very common in the USA and even cow's milk is fortified with it. In European countries, the typical amount of vitamin D fortification is 0.8 mcg per 100 ml (see Figure 24).

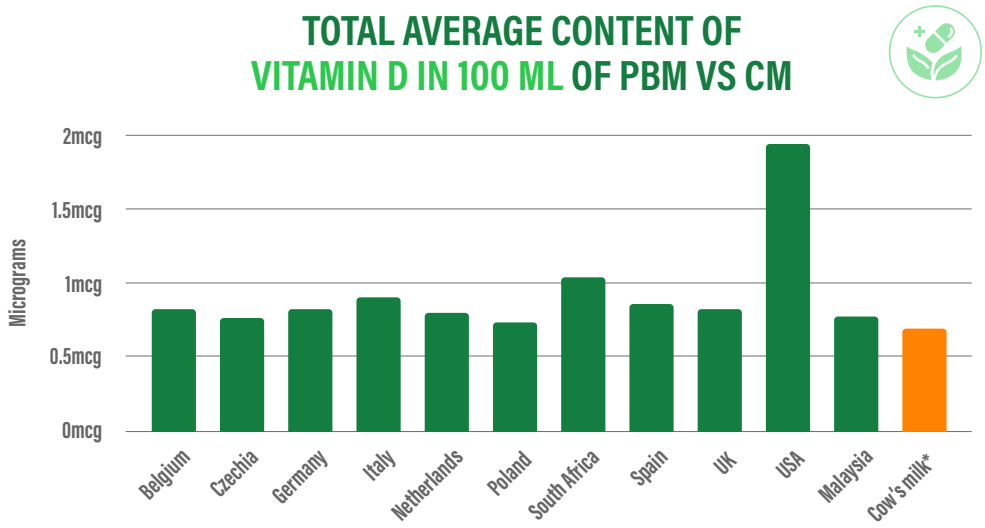


Figure 24. Total average content of vitamin D in mcg/100 ml of plant-based milk alternatives vs cow's milk.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

Vitamin B2, also known as riboflavin, is another important vitamin normally found in cow's milk that should be also present in plant-based milk alternatives. However, fortification with vitamin B2 is not yet common. **In Italy, the United Kingdom, the Netherlands, and Belgium, however, it is possible to find plant-based alternatives fortified with this vitamin.** When fortified, the riboflavin content in plant-based alternatives is generally higher than in cow's milk (see Figures 22, 25).

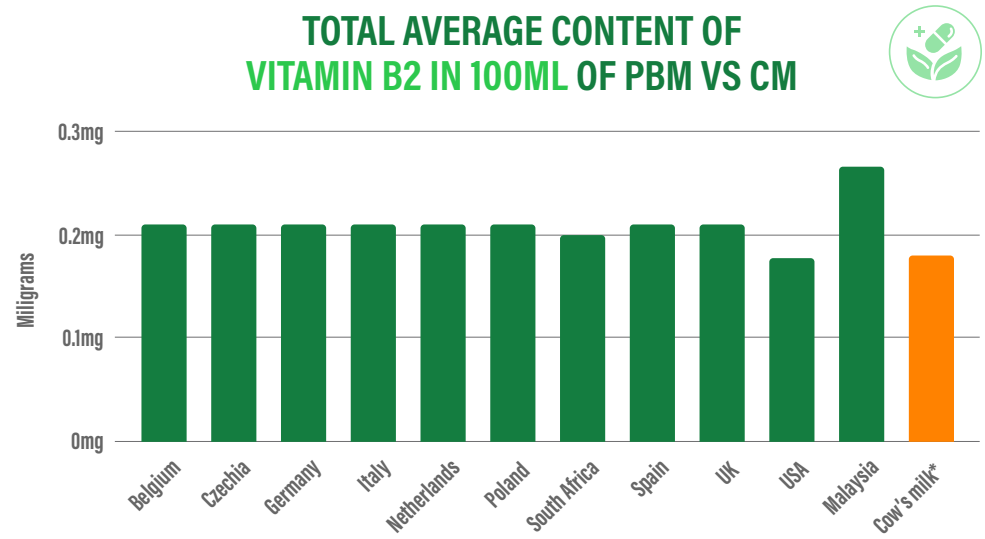


Figure 25. Total average content of vitamin B2 in mg/100 ml of plant-based milk alternatives vs cow's milk.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

Salt and added sugar

In public debates, the sugar content of plant-based milk is often criticised, and it is important to note that, for a healthy diet, it is best to minimise sugar intake, especially simple and refined sugars. However, **we found that all plant-based milks analysed in all countries contain less sugar than cow's milk**, which naturally contains lactose (see Figure 26). Lactose, or milk sugar, is a disaccharide made up of glucose and galactose. On average, cow's milk contains 4.8 g of milk sugar per 100 ml, meaning a 250ml serving contains 12 g of sugar. Even when cow's milk is "lactose-free," the sugar is still present and even more easily absorbed because the lactose has already been broken down into glucose and galactose.

Plant-based milk alternatives provide an average of 2 g of sugar per 100 ml, meaning a 250 ml serving contains 5 g of sugar. The table sugar commonly used in plant-based milk, also known as sucrose, is also a disaccharide consisting of glucose and fructose.

Different types of sugar have different effects on the body. The glycemic index (GI) of lactose is considered low compared to other sugars, therefore it's important to keep in mind both the quantity of sugars and their GI when evaluating sugar's effects on the body. More research is needed to better understand the behaviour of different added and naturally occurring sugars and their potential effects on health. On the other hand, one of the key health benefits of plant-based milk is that it provides an option for the 68% of the world's adult population who are unable to digest lactose (milk sugar).[70] Symptoms of lactose intolerance vary in severity and may include gas, bloating and abdominal cramping. Many individuals are unaware of the relationship between their symptoms and dairy consumption, often noticing an improvement only after eliminating all dairy products from their diet. Additionally, cows' milk protein allergy is the most common form of food allergy in infants and children.[71]

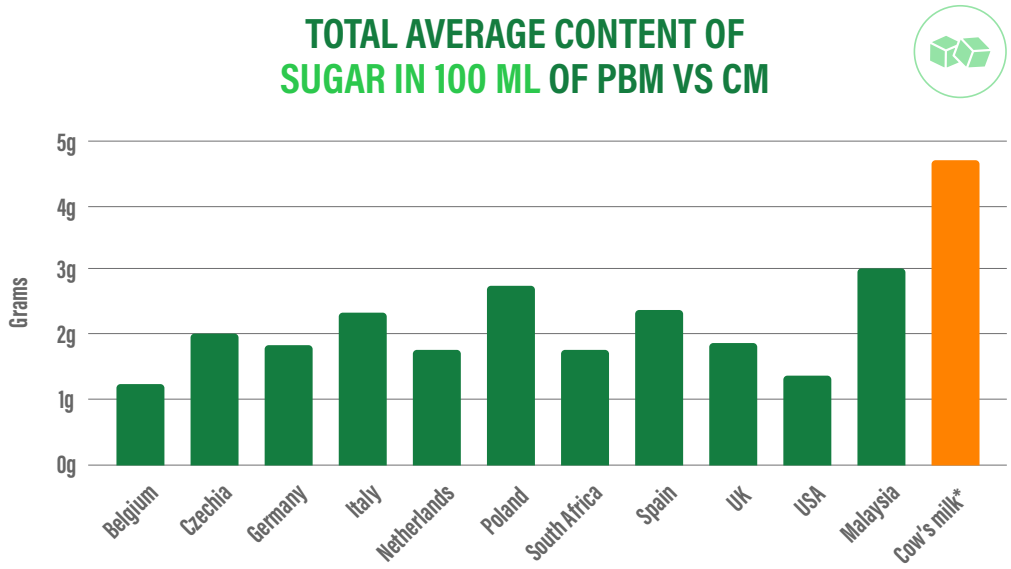


Figure 26. Total average content of sugar in g/100ml of plant-based milk alternatives vs cow's milk.
*Average nutritional value of animal-based products from USDA Food Data Central and UK Food Composition Database.

In all countries except the UK, the majority of the plant-based milk alternatives fall within the set maximum level of 2.5 g of sugar per 100 ml. **This means that most plant-based milk alternatives can be classified as "low in sugar".** In Belgium and Czechia, as much as 80% of the products are low in sugar (see Figure 27).

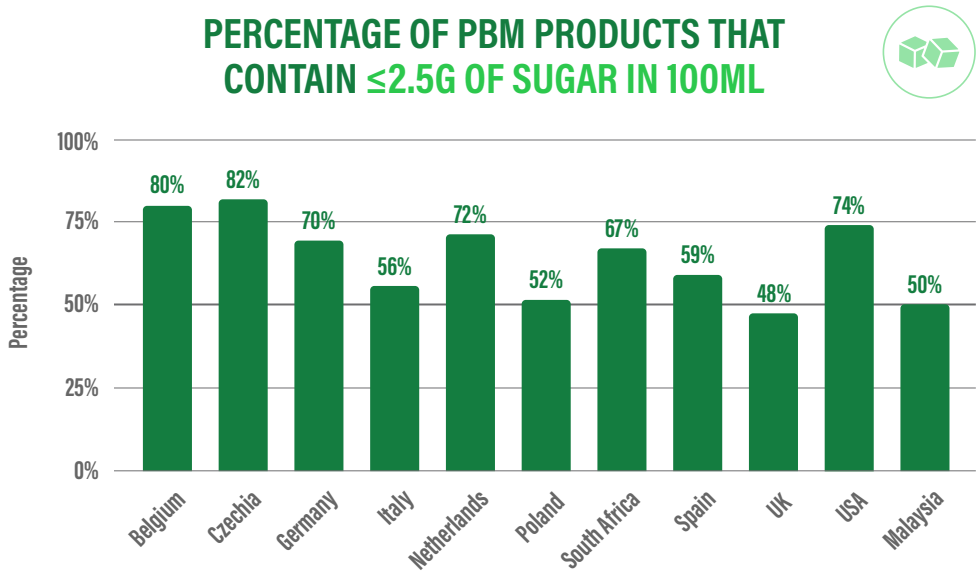


Figure 27. Percentage of plant-based milk alternatives that contain less or equal than 2.5g/100ml of sugar.

Another nutrient of concern is salt. We found that in all countries, **more than 90% of the plant-based milk alternatives fall below the set maximum level of salt content (≤0.5 g per 100 ml)** (see Figure 28). The **average salt content of plant-based milk alternatives is 0.16 g per 100 ml**, similar to cow's milk, which averages between 0.09 and 0.1 g of salt per 100 ml on average. **Therefore salt is not a nutrient of concern for the plant-based milk category.**

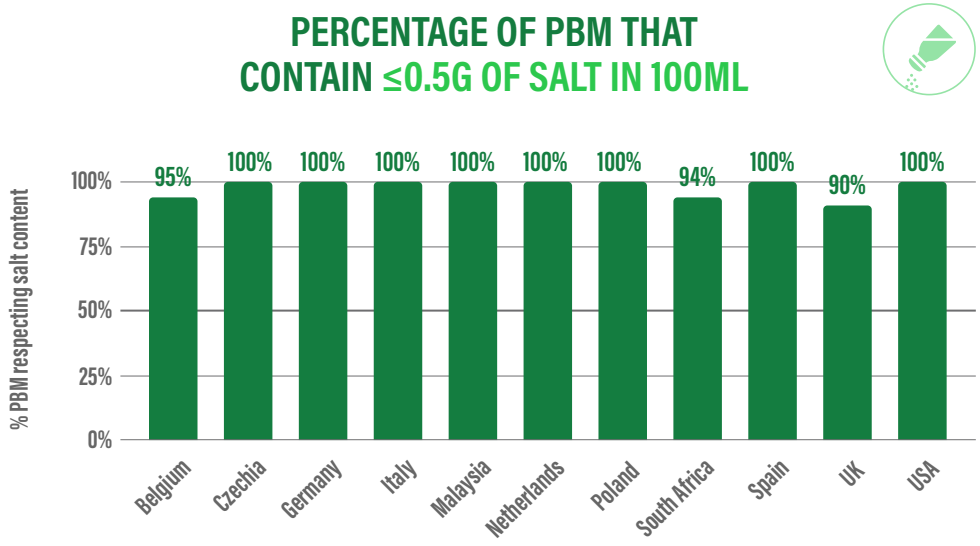


Figure 28. Percentage of plant-based milk alternatives that contain less or equal than 0.5g/100ml of salt.

Since pricing is one of the most decisive factors when it comes to purchasing behaviour, all interviewees agreed that the costs of plant-based products need to be competitive with their animal-based counterparts. To do this, further efficiency improvements in terms of ingredients and production costs are needed. At the same time, financial hurdles imposed by the government were criticised, and it was stated that these hurdles must be overcome. For example, in Italy, the VAT on animal-derived products is low (4%), whereas plant-based meat is considered a luxury good, and a higher VAT is charged. Similarly, in the Netherlands, where a 'sugar tax' was introduced on all sugary drinks which affected even unsweetened oat milk but not chocolate cow's milk.

The political consideration of banning established terms such as 'burger', 'sausage', and 'steak' for plant-based products in some countries has also been faced. The main argument behind this proposal is to prevent consumer confusion. However, to date, there is no evidence to support this argument. Terms such as 'veggie burger' and 'plant-based milk' provide important information regarding the taste and expected uses of the product. Consumers buy plant-based products precisely because they know these products offer similar taste experiences and functionalities to their animal-based counterparts.

"With our approach of hacking iconic meat products, 'meaty' product names help navigate consumers in their decision-making, in swapping animal meat for plant-based meat. Policymakers should provide more clarity. Loopholes in legislation should be closed to bring an end to the endless debate. Consumers are not confused. In fact, these 'meaty' references help in accelerating the plant-based transition and thus in achieving climate objectives."
Marketing Manager

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LESSONS FROM THE NETHERLANDS

Source **Adobe Stock**

Our analysis reveals that products from the Netherlands performed the best in the majority of all categories. This case highlights the potential and importance of government-provided guidelines in improving the nutritional value of plant-based alternatives.

The **Netherlands Nutrition Centre** (Voedingscentrum), a government-subsidised institution that provides information about food and nutrition, has published a white paper titled ***"Towards a more plant-based diet"*** (see Figure 29). This paper outlines specific criteria for plant-based products intended to replace meat and dairy in terms of nutritional value. We also used these criteria in the development of our scoring system. To our knowledge, no other country provides such precise standards to guide both producers and consumers of plant-based alternatives.

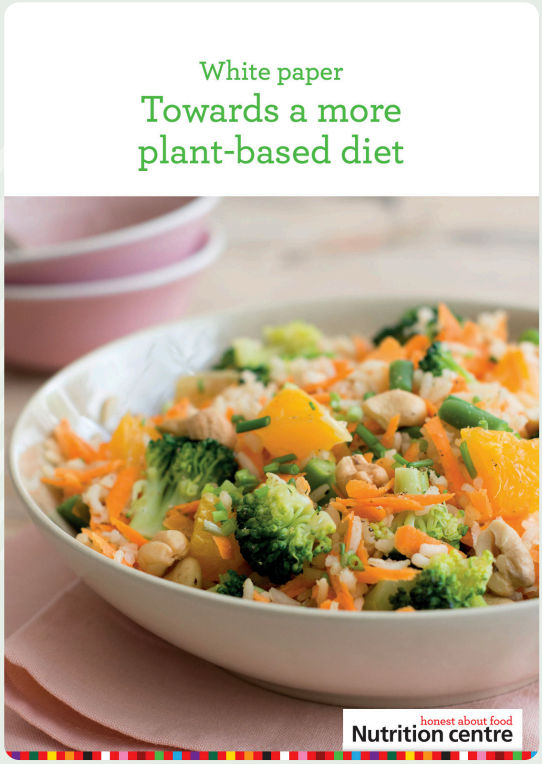

Figure 29. *Towards a more plant-based diet.* The Netherlands Nutrition Centre (Voedingscentrum).

Furthermore, the Voedingscentrum is responsible for developing the national dietary guidelines in the Netherlands, in which plant-based alternatives have also been integrated. In the protein food group, they included vegetarian burgers, pieces, or balls with "not too much salt", while excluding those with "too much salt". They also included soya milk with added vitamin B12 and calcium.

The Dutch government actively supports and shapes the development of healthy, sustainable products, and the country also takes pride in its plant-based food sector. The Netherlands Board of Tourism & Conventions, responsible for promoting the Netherlands nationally and internationally, states on its website: *"With climate change becoming more present in everyday life, many in the Netherlands are turning to vegetarian and vegan food options as a way to cut down their environmental footprint (...). This attitude has driven a growing demand for plant-based food options, not only in specialised restaurants but across the board. Whether dining at a restaurant or browsing in a supermarket, you're likely to find a wide variety of intriguing vegetarian and vegan options to try. In the east of the country alone, over 60 companies are innovating plant-based alternatives to meat and dairy products."* [72]

Last but not least, plant-based meat and dairy products are now cheaper than conventional meat and dairy products in nearly all Dutch supermarkets, according to a study conducted by research body Questionmark on behalf of **ProVeg Netherlands**. Pablo Moleman, Director of ProVeg Netherlands, said the new research was very welcome news for people trying to reduce their meat consumption, and stated: *"As consumers struggle with the cost-of-living, it will be reassuring for shoppers that they do not need to pay extra to embrace a more climate-friendly and animal-friendly lifestyle."* [73]

RECOMMENDATIONS

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Promoting public health is a shared responsibility, and each stakeholder plays an important role in enabling healthy and sustainable diets.

In the following section we provide targeted recommendations for various stakeholders to support the development and adoption of healthy sustainable plant-based alternatives.

FOR PRODUCERS

→ Formulate products that contribute to healthy and sustainable diets

International recommendations such as the Planetary Health Diet, the Netherlands Nutrition Centre White Paper, or national recommendations such as food-based dietary guidelines can help guide product development.

→ Fortify plant-based products to improve their nutritional profile (where feasible and appropriate)

Biofortification and conventional fortification, as well as a combination of both and the addition of micronutrient-rich ingredients, are effective ways to improve the nutritional value of plant-based foods. Key nutrients for fortification include those commonly found in animal-based foods, such as vitamin B12, B2, iron, vitamin D, calcium, iodine, zinc, and omega-3. It is essential to ensure rigorous quality assurance and control throughout the fortification process to maintain nutritional integrity and meet health standards.

→ Make your promotions more plant-focused

Develop a strategy to reduce sugar and salt, limit ingredients high in saturated fats (such as coconut and palm oil), and avoid highly refined ingredients such as inverted glucose syrup.

FOR PRODUCERS

→ Leverage industry expertise

Collaboration between start-ups and traditional meat and dairy companies can lead to high-quality products using alternative ingredients. Drawing on the food industry's knowledge, technology, and capacities and know-how is key to developing nutritious and tasty plant-based food.

→ Provide transparency to consumers

Whether it's dairy or meat alternatives, authentic communication is crucial in connecting with consumers and reshaping the food system. Build trust and understanding by offering transparent information to consumers about the ingredients of your products.

FOR RETAILERS

→ Reshape the food environment

Retailers play a powerful and important role in facilitating the transition towards a healthier and more sustainable food system. Uniquely positioned in the value chain as the interface between producers and consumers, they have the ability to influence consumer habits and purchasing decisions. Shoppers tend to frequent the same aisles, because of time constraints or habit, and they might not have noticed the plant-based aisle or actively sought out plant-based products before. Increase the visibility of plant-based products by positioning them on the same shelves as animal-based products, offering them as convenient options, and making them stand out more effectively.

→ Ensure price parity

Create price parity by matching the cost of plant-based products in-store with their animal-based equivalents. Many European retailers have successfully implemented this. For example, in 2023, Lidl Germany priced-matched their own-brand Vemondo range with animal-based equivalents, resulting in a 30% increase in plant-based sales.

FOR RETAILERS

→ Make your promotions more plant-focused

Implement introductory offers, discounts, and loyalty rewards for plant-based purchases to attract new customers and encourage repeat buys. Offer bulk purchase deals and bundle promotions to provide better value and further incentivise plant-based product sales.

→ Boost staff expertise and engagement

Train staff on the benefits, uses, and varieties of plant-based products. Provide ongoing education and resources to keep them informed and engaged, ensuring they remain excited and knowledgeable about your plant-based products.

→ Commit to the 'Protein Split'

We recommend that food retailers track their volume sales of plant-based and animal proteins, setting a goal aligned with the Planetary Health Diet – 60% plant-based to 40% animal-based by 2030. Establishing a standardised measurement method for this ratio will pave the way for a comprehensive understanding of the shift toward healthier, more sustainable food systems. Major retailers in Austria, Belgium, Germany, the Netherlands and the UK have already adopted methodologies to track their protein-split goals.

Policymakers and governments were unanimously viewed by interviewees as crucial in promoting the development of healthy and sustainable products. Various levers were identified to increase the normalisation, availability, and affordability of healthy, sustainable plant-based alternatives. These included the integrating plant-based alternatives into national dietary guidelines and public food programmes.

"Plant-based alternatives should become part of the food pyramid type recommendations by national institutions, such as the UK 'Eatwell guide'"
Marketing Manager

Moreover, to foster a fair and thriving food market, it is essential to reform VAT policies and subsidies to support alternative proteins equally, if not provide them with greater tax advantages and financial support, given their substantial environmental and health benefits.

"Policy and government play a vital role in supporting healthy and sustainable product development. Positive regulations include subsidies for plant-based ingredient sourcing, grants for research and development in sustainable food technologies, and labelling standards that ensure transparency for consumers."
Commercial Manager

FOR GOVERNMENTS

→ Providing national guidelines for plant-based alternatives

Clear national guidelines can help manufacturers develop healthy, sustainable products. For example, the Dutch Nutrition Centre's *"White paper towards a more plant-based diet"*, offers specific recommendations for protein content, fortification with key micronutrients and limits on saturated fat, salt and sugar.

→ Include plant-based alternatives in national dietary guidelines (FBDGs)

Nearly half (45%) of all national food-based dietary guidelines FBDGs worldwide already mention plant-based alternatives to meat or dairy. Including these products within every national FBDG could help consumers and health professionals to make healthier choices.

→ Developing regulations and strategic plans for food fortification

In many countries, mutual recognition of fortified products is still lacking. Correcting this would provide a strong policy approach to support the development of healthy fortified product formulations.

→ Set salt reformulation targets

Establishing and implementing salt reformulation targets for both animal-based meat products and plant-based alternatives to ensure a level playing field for the industry.

→ Reduce VAT for plant-based alternatives

The tax discrimination that exists in some countries (e.g. Spain, Germany, Italy, and Hungary) poses a threat to plant-based products, which are usually taxed as "luxury" items, even though they are staple foods for people with allergies and dietary preferences. The VAT on plant-based milk alternatives should be no more than that on cow's milk (e.g. Czechia, France and Belgium), or even reduced further given their lower environmental impact.

→ Stop naming restrictions on plant-based alternatives

Some countries ban established and commonly understood terms such as "milk", "sausage" and "steak" for plant-based products, unnecessarily restricting the positive environmental changes created by the plant-based market. Terms like "soya milk" and "veggie sausage" provide important information about the taste and uses consumers can expect, and consumers buy plant-based products precisely because they offer similar taste experiences and functionalities to their animal-based counterparts.

FOR CONSUMERS AND CONSUMER ORGANISATIONS

→ Prioritise fresh whole foods

In general, plant-rich diets should centre around whole foods, with plenty of fruit and vegetables, grains, legumes, nuts, and seeds. The ProVeg food plate helps individuals to plan a healthy plant-based meal whether they follow a flexitarian, vegetarian, or vegan diet.[74]

→ Reduce animal-based foods to lower environmental impact

Scientific evidence clearly shows that replacing animal-based foods with plant-based foods and alternatives can significantly reduce the environmental impact of current dietary patterns.

→ Recognise strengths and limitations of plant-based meat and dairy alternatives

A growing body of research shows that plant-based meat and dairy alternatives offer multiple benefits, as highlighted in this report. Consumer organisations should educate consumers on what constitutes a healthy, sustainable diet and guide them toward healthier choices (e.g. opting for plant-based alternatives that are low in salt).

→ Recognise processed foods as part of a healthy and sustainable diet

The degree of processing alone cannot be used to make a reliable statement about the health value of a food. Whole grain bread, typically considered a healthy food, falls into the processed/ultra-processed category, which is now usually viewed negatively.

→ Learn how to read nutrition facts labels

Pay attention to added sugars, saturated fats, and salt, which should all be minimised in the diet. Understanding nutrition labels empowers consumers to make more informed and healthier food choices.

→ Learn how to read the list of ingredients

It is the type of ingredient, not the number, that accurately predicts the healthiness of a food. Consumers are often led to believe that more ingredients always means a product is less natural and therefore unhealthy. However, the ingredients list also includes any spices or nutrients that have been added to the product and which can provide specific benefits (e.g. iodised salt) or increase shelf life (e.g. ascorbic acid, also known as vitamin C) and which are not necessarily unhealthy at all Consumer organisations should raise awareness of this.

FOR SCIENCE AND RESEARCH

→ Investigate long-term health effects

Conduct comprehensive longitudinal follow-up studies to explore the long-term health effects of consuming plant-based alternatives. These studies should focus on both potential benefits and risks over extended periods, taking into account various population demographics and dietary contexts.

→ Facilitate dietary shifts at the population level

Research effective strategies to facilitate population-wide dietary shifts towards plant-based alternatives. Successful interventions should leverage the synergy between legislation, dietary guidelines, and market dynamics.

→ Assess the bioavailability of micronutrients

Examine the bioavailability of micronutrients in plant-based alternatives compared to animal-based products. Research should focus on how processing methods and ingredient choices affect nutrient absorption and effectiveness, and identify ways to improve the nutritional profile of plant-based foods.

→ Evaluate the role of fortification

Conduct large-scale studies to assess the impact of fortifying plant-based products. Focus on evaluating the effectiveness of various fortification strategies in addressing nutritional needs and consider their implications for different population groups and dietary patterns.

→ Explore salt reduction techniques

Investigate methods to reduce salt content in plant-based products while maintaining desirable taste. Research should explore alternative flavouring strategies, the role of salt in product formulation, and consumer acceptance of lower-salt options. In this way, plant-based alternatives can outperform animal-based products while remaining tasty and nutritious.

CONCLUSIONS

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The market for the new generation of plant-based alternatives is still relatively young and very dynamic. Our report shows that plant-based meat and milk alternatives can be enjoyed as part of a healthy sustainable diet.


Source **Unsplash / Daniel L.**

The results indicate that these alternatives can contribute to daily fibre and protein intake without excessive amounts of saturated fat and sugar. We found that the nutritional value of plant-based alternatives can vary widely between countries, showing the importance of nutritional policy frameworks and common industry approaches to product development. In particular, fortification is a practice that is not yet widespread, yet can make a huge difference to the nutritional properties of plant-based alternatives.

When properly fortified, plant-based meat and dairy alternatives also provide important micronutrients, such as vitamins B12 and D, iron and calcium, making them more comparable to their animal-based counterparts. However, a salt reduction strategy for meat alternatives is needed. New technologies, such as precision fermentation, fortification, and the use of spices in place of salt, along with high-quality ingredients, are key strategies to close current gaps.

It is also important to note that the health benefits of plant-based alternatives go beyond physiological aspects. They add variety to people's plates and provide a bridge to a more plant-rich diet. A food system less dependent on animal husbandry practices also lowers the risks of antimicrobial resistance and zoonotic pandemics such as COVID-19.[75]

Mounting evidence suggests that the rise in zoonotic events is directly linked to increased human interactions with animals, particularly in terms of food sourcing. Our appetite for meat, eggs, and dairy has brought us into increasingly close contact with both domesticated and wild animals, by keeping ever more of them in increasingly confined spaces and encroaching on their habitats. Reducing the consumption of animal-based products is urgently needed for the sake of public health.[76 77]

Further evidence, including this report, indicates that plant-based products can offer advantages for both nutrition and the environment when compared to their animal-based counterparts.


Source **Unsplash**

DETAILED METHODOLOGY

Source **Adobe Stock**

This report is based on data from 11 countries: Belgium, Czechia, Germany, Italy, Malaysia, Netherlands, Spain, South Africa, Poland, the UK, and the USA. Since ProVeg has offices in most of these countries, we were able to gather data from diverse cultural backgrounds. Specifically, we mobilised our staff to visit local supermarkets and collect real-world data. Our colleagues collected the following information for each alternative product: nutrient information, the list of ingredients, and the brand name. The two main categories of the report are meat and milk products, which were further divided into subcategories (see Table 1).

For the animal-based meat and milk categories, we collected nutrient information from two national nutrition databases: the USDA FoodData Central[78] and the UK Food and Nutrition Database[79]. The databases provided mean values for the respective product subcategories.

PLANT-BASED MEAT SUBCATEGORIES	PLANT-BASED MILK SUBCATEGORIES
→ Sausages → Minced meat → Burgers → Bacon → Meatballs → Chicken breast/strips → Chicken nuggets → Schnitzel	→ Milk
ELIGIBLE	**ELIGIBLE**
→ **Alternatives containing vegetables, grains and legumes** (e.g. broccoli and quinoa burger) → **Alternatives that closely emulate their animal counterparts based on isolated proteins** (e.g. Beyond Burger) → **Alternatives with 100% plant-based ingredients** → **Fresh and frozen products**	→ **Soya** milk → **Oat** milk → **Almond** milk → **Coconut** milk
NOT ACCEPTED	**NOT ACCEPTED**
→ **Vegetarian alternatives** (e.g. burger containing egg white or milk protein) → **Other subcategories** (e.g. cordon bleu) → **Organic products**	→ **A mixture of raw materials** (e.g. Rice and coconut milk) → **Other raw materials** (e.g. Hazelnut milk) → **Flavored products** (e.g. soya chocolate milk) → **Organic products***

Table 1. Eligibility criteria of the products.

*We decided to not include organic products because in Europe their fortification is not allowed, therefore the organic alternatives won't contain some critical nutrients (e.g. vitamin B12). To be able to compare the products fairly, we have therefore decided to exclude organic products.

To include the industry perspective, we conducted interviews with product, commercial and marketing managers of different plant-based alternatives brands. We asked them to share insights on their strategies, product development, marketing, and policy practices related to the development of plant-based alternatives.

Score design for product evaluation

For the evaluation, we developed a scoring system, based on a combination of three international guidelines and their health-related nutrient thresholds: the WHO European Nutrients Profile Model (NPM)[80] , the Netherlands Nutrition Centre White Paper[81] and the European Food Safety Authority (EFSA) nutrition claim legislation.[82] The detailed nutritional values used for scoring can be found in Tables 2 and 3. We selected these guidelines because they are internationally recognised, address the key nutrients of concern, and are applicable to all types of foods. The Netherlands guideline was specifically chosen because it's the only official document from a European country that provides standards for plant-based alternatives, including micronutrients. To ensure specificity and comparability, we decided to have a score for each main category. This approach accounts for the fact that some nutrients can be present in food in different quantities while still being healthy. For example, in the Netherlands guidelines, saturated fats can be present in meat alternatives at a maximum of ≤ 2.5 g per 100 g, while for the milk alternatives the maximum is set at ≤1.1 g per 100 g. This works because the guidelines are based on the nutrient levels that make an animal-based product healthy, and on their current market availability. For example, if a beef burger with 2.5 g of saturated fats is considered healthy, a plant-based burger with the same or a lower amount can also be healthy. According to the WHO guideline, sugar content should be less than 5 g per 100 g in solid foods (including plant-based meat alternatives and animal-based meat), while the limit for liquid foods to be considered "low in sugar" is 2.5 g per 100 ml.

The **foundation of both scores is based on 4 nutrients** that are fundamental in all guidelines to describe food as healthy or not. The nutrients are those most related to the risk of lifestyle diseases, with different thresholds across the main categories.

Additionally, we included **3 category-specific nutrients** that are critical for meat and milk. For example, calcium is included in the milk score but not in the meat score, because milk is predominantly a source of calcium.

Each nutrient corresponds to 1 point. Depending on the threshold value set, the product receives 0 or 1 point per nutrient. **Products in the meat category can reach a maximum of 8 points and products in the milk category a maximum of 9 points**. An **additional category-specific point** is awarded for the presence of a **minimum fibre content for the meat category** and a **minimum protein content for the milk category**. This is because fibre is a critical nutrient associated with numerous health benefits that need to be prioritised over others.[83] Animal-based foods naturally don't contain fibre, whereas plant-based alternatives do, bringing an additional advantage to their consumption. Proteins on the other hand are not a critical nutrient for most Western-European countries, but they can be in other regions of the world, such as the Global South[84], where protein malnutrition often results from insufficient energy intake.[85] In this sense, if the milk alternatives provide a fair amount of protein, they can be compared equally to animal-based ones, especially is dairy products are used to reach recommended protein intake.

The nutrient thresholds for the meat alternatives were sourced as follows: the "basics" total fats and salt from the WHO NPM model, saturated fats and salt from the Netherlands guidelines, and sugars from EFSA Nutrition claims. The "Nutrients category-specific" thresholds were taken from the Netherlands guidelines, while; the "Extra category-specific" threshold came from EFSA Nutrition claims.

The nutrient thresholds for the milk alternatives were taken as follows. The "basics" total fats and salt from the WHO NPM model, saturated fats and salt from the Netherlands guidelines, and sugars from EFSA Nutrition claims; the "Nutrients category-specific" from the Netherlands guidelines and the European Commission paper on food fortification[86]. For the "extra category specific" we set a minimum of 1 g, as no guidelines suggest a threshold for protein in plant-based milk alternatives, and we consider protein to be a plus, not a basic nutrient for this category. We recognise that 1 g of protein doesn't make a significant difference in an overall diet, but we couldn't set it to 0 or it wouldn't qualify for an extra point. Moreover, in most food dietary guidelines worldwide, milk is primarily recommended as a source of calcium and not as a source of protein.

MEAT CATEGORY SCORE

NUTRIENTS	THRESHOLDS	POINTS
Basics*		
Total fats	≤ 17g/100g	1
Saturated fats	≤ 2.5 g/100g	1
Salt	≤ 1.1 g/100g	1
Sugars	≤ 5 g/100g	1
Nutrients category-specific**		
Iron	≥ 0.8 mg/100g	1
Vitamin B12	≥ 0.24 mcg /100g	1
Protein	≥ 20% of total calories per 100g	1
Extra category-specific point***		
Fibre	≥3 g/100g	1
POTENTIAL SUM		**8**

Table 2. Basis for the assessment of animal-based meat and plant-based meat alternatives.

* Values based on guidelines from the WHO and the Netherlands, and the EFSA legislation on nutrition claims.
**Values based on the Netherlands guidelines
***Value based on EFSA legislation on nutrition claims

MILK CATEGORY SCORE

NUTRIENTS	THRESHOLDS	POINTS
Basics*		
Total fats	≤ 3.5 g/100g	1
Saturated fats	≤ 1.1 g/100g	1
Salt	≤ 0.5 g/100g	1
Sugars	≤ 2.5 g/100g	1
Nutrients category-specific**		
Calcium	≥ 80 mg/100g	1
Vitamin B12	≥ 0.24 mcg /100g	1
Vitamin D	≥ 0.75mcg/100g	1
Vitamin B2	≥ 0.28mcg/100g	1
Extra category-specific point***		
Protein	≥1 g/100g	1
POTENTIAL SUM		**9**

Table 3. Basis for the assessment of cow's milk and plant-based milk alternatives.

* Values based on guidelines from the WHO and the Netherlands, and the EFSA legislation on nutrition claims.
**Values based on the Netherlands guidelines, and the European Commission paper on food fortification.
***No guidelines available to set the minimum protein quantity in milk and milk alternatives.

Scoring system evaluation

To better understand the scoring system and the points that a product can obtain we can refer to the following ranges:

FOR MEAT CATEGORIES

HIGH NUTRITIONAL VALUE (6-8 POINTS)
Products that score 6 to 8 points meet all nutrient thresholds across basic, category-specific criteria, and get the extra point. This means they contain levels of total fats, saturated fats, salt, and sugars that align with healthy consumption limits. Additionally for meat alternatives, achieving 8 points indicates that the product also contains beneficial amounts of fibre, as well as the micronutrients iron and vitamin B12.

MODERATE NUTRITIONAL VALUE (3-5 POINTS)
The product obtaining these values meets most of the nutrient thresholds; however, it may be missing one or two nutrients that would enhance its nutritional profile. It can still offer health benefits, but there is room for improvement.

LOW NUTRITIONAL VALUE (0-2 POINTS)
This score indicates that a product does not meet several important nutrient thresholds from the basics, and potentially contains excess fats, sugars, or salt. It also might lack critical nutrients. Such types of product should not be recommended regularly for a balanced diet.

FOR MILK CATEGORIES

HIGH NUTRITIONAL VALUE (7-9 POINTS)
Products that score 7 to 9 points meet all nutrient thresholds across basic, category-specific criteria, and get the extra point. This means they contain levels of total fats, saturated fats, salt, and sugars that align with healthy consumption limits. Additionally for milk alternatives, a 9 points score shows that the product also provides essential nutrients like calcium and vitamins B12, D, and B2, together with a discrete amount of protein.

MODERATE NUTRITIONAL VALUE (3-5 POINTS)
The product obtaining these values meets most of the nutrient thresholds; however, it may be missing one or two nutrients that would enhance its nutritional profile. It can still offer health benefits, but there is room for improvement.

LOW NUTRITIONAL VALUE (0-2 POINTS)
This score indicates that a product does not meet several important nutrient thresholds from the basics, and potentially contains excess fats, sugars, or salt. It also might lack critical nutrients. Such types of product should not be recommended regularly for a balanced diet.

Limitations of the study

While this study provides valuable insights into the nutritional profiles of plant-based meat and milk alternatives across multiple countries, it is important to recognise several limitations. These limitations may affect the generalizability of the findings and highlight areas for future research to expand or refine the analysis. By acknowledging these limitations, we aim to present a balanced view of the results and encourage further investigation into the plant-based food sector:

→ Limited Geographic Representation

Although data were collected from 11 countries across Europe, North America, Africa, and Asia, the findings are not representative of the global market. Moreover, the data were collected from only 39 supermarkets within these countries.

→ Reliance on National Nutrition Databases

Nutritional data for animal-based products were sourced from the USDA and UK Food and Nutrition databases. While these databases provide reliable information for the USA and the UK, they may not reflect nutrient variations in animal-based products available in other regions included in the study. This reliance could introduce potential inaccuracies when comparing plant-based and animal-based products outside of these regions. However, the nutritional values used are standardised and often used for scientific research purposes.

→ Exclusion of Organic Products

This study excluded organic products due to European regulations that prohibit the fortification of these products, which could result in an unfair comparison in terms of nutrient content. However, organic products represent a significant portion of the market, especially among health-conscious consumers. The exclusion of these products may limit the applicability of the findings to this particular consumer segment.


Source Unsplash / Mae Mu

→ Use of International Nutritional Guidelines

The scoring system was based on international guidelines, including those from WHO, EFSA, and the Netherlands Nutrition Centre. While these guidelines are internationally recognized, they may not fully align with national dietary guidelines or health priorities specific to the countries analysed. Consequently, the nutrient thresholds used in this study may not fully reflect regional variations in health concerns and consumption patterns.

→ Low Protein Threshold for Milk Alternatives

The protein threshold for milk alternatives was set at a minimum of 1 g, due to the absence of international guidelines for protein in plant-based milk. In most dietary guidelines worldwide, milk is recommended as a source of calcium. For this reason, protein was only considered an additional point in this report. Other authors might have made a different decision.

→ Repetition of the same products from different countries

In some cases, the same brands or products appeared across multiple countries with slight variations in their nutritional profiles. These differences may be due to local production practices, ingredient sourcing, or regulatory requirements that vary between regions. This variability highlights the complexities of evaluating plant-based alternatives on a global scale and suggests that local context plays a significant role in product formulation.

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