



Alternative Proteins: Market Research on Consumer Trends and Emerging Landscape

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Abstract: Meat and poultry consumption is set for global growth with increased demand. However, today's market trends demonstrate that new consumers are interested in alternative proteins (i.e., non-animal-derived/plant proteins). In the past few years, this interest has been growing and has resulted in the revamp of "alternative protein" segments and new product launches that can compete with or complement traditional meat products. The market trends also strongly support a continued demand for meat and poultry consumption as the alternative protein segment possesses less than 4% of the total global protein share. At the same time, the accelerated growth (with Compound Annual Growth Rate 2–3 times greater than that for meat and poultry, globally) and market penetration of alternative proteins, coupled with consumer interests fueled by the "flexitarians," present an opportunity to review the current situation, global trends, and consumer research and to evaluate the potential and gaps for the meat and poultry industry. Furthermore, the technological aspects of utilizing alternative proteins (non-animal-derived) also presents an opportunity to create new experiences for a customer familiar with meat/meat product consumption. The present International Congress of Meat Science and Technology proceedings paper, therefore, offers a short glance into the market landscape of alternative proteins, as we stride to a common goal of feeding 2 billion more people by 2050.

Key words: alternative proteins, market trends, flexitarians, consumer research
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Introduction

Food production as an essential factor for sustained human life is actively discussed and debated among global communities, with thought processes aligning with the goal of feeding 9 billion+ people by 2050 (Gerland et al., 2014). Nutritious food consumption is vital for a cross-section of the population to continue to maintain healthy living. Therefore, both quantity and quality of food produced becomes a focal point in strategic discussions, policies, and initiatives (West et al., 2014; Ranganathan et al., 2016). Global meat consumption has shown an increasing trend in the past 3 decades (Henchion et al., 2014;

FAOSTAT, 2018) and could be attributed to the increase in the purchasing ability of people (especially for those above median income) in developing economies (Bryant et al., 2019). On the other hand, various trends and consumer preference patterns are emerging in the diets of developed or Western nations; especially notable is the increase in flexitarian consumers as documented in studies in the United States (FMI, 2020). These consumers prefer alternative protein sources (i.e. plant-based), sometimes alone and sometimes with traditional meat products. "Alternative protein" is the collective term we have used in this manuscript for the purpose of describing non-animal-derived proteins and non-animal-cell-derived proteins. The objective of this proceedings paper is to examine alternative protein developments

in global economies, summarize those against consumer trends, and review published research to present a snapshot of future possible opportunities for new product developments.

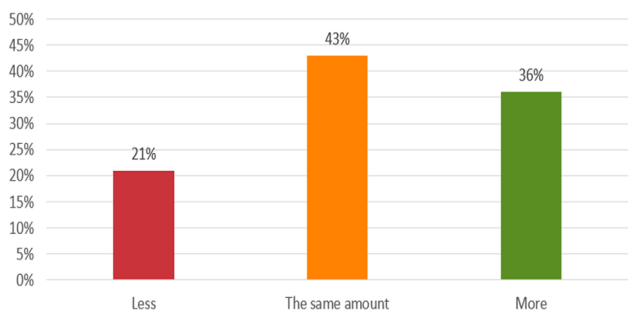
Consumption Trends

Consumers are considering consuming alternative protein products. Global market research with 6,000 consumers in 12 countries (4 each in the Americas, Europe, and Asia-Pacific regions; Figure 1) indicated that alternative protein use may rise as 36% of consumers intend to use more alternative proteins in the next year compared with 21% intending to use fewer (Kalsec, unpublished data, 2019). Indeed, consumption

trends already demonstrate increased use of alternative proteins. In the last 2 y, overall alternative protein dollar sales increased 38%, largely influenced by a 555% increase in dollar sales of plant-based burgers alone (GFI, 2019). This increase cannot be attributed to a rise in vegetarianism or veganism; it is due to meat-eating consumers considering including alternative proteins into their diet, with around 12% of consumers self-identifying as flexitarians in the US (Askew, 2020; FMI, 2020). A meat-eating consumer base may contribute to the popularity of hybrid proteins including both conventional and alternative proteins as cited in the Power of Meat survey covering retail outlook and landscape for meat and poultry categories, specifically in the US (FMI, 2020).

Increased use of alternative proteins is correlated with trends in consumption of traditional meat, as consumers are reporting intention to decrease beef and pork consumption and increase poultry and fish consumption, as seen in Figure 2 (Kalsec, unpublished data, 2019). It should be noted, however, that meat remains strong because about 50% of those surveyed do not intend to change their current meat intake (Kalsec, unpublished data, 2019). Research conducted by the Food Marketing Institute similarly concluded that, while 32% of those studied intend to reduce traditional protein intake, 82% and 79% of that segment would avoid beef and pork, respectively (FMI, 2020). Other reports agree with such findings (Zeng et al., 2019). However, not all evaluations concur with that conclusion of reduction in meat consumption, as

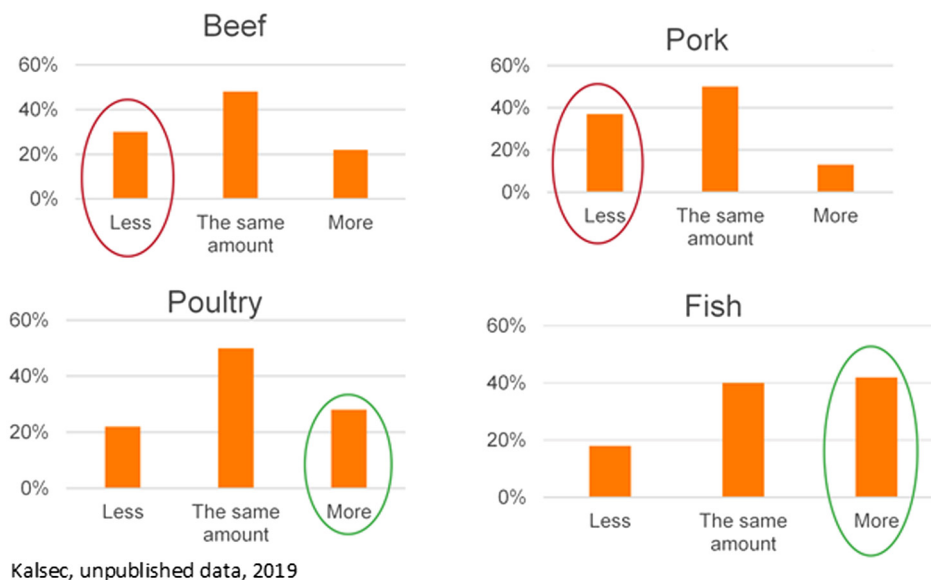
Intention to use alternative proteins in 2020



Source: Kalsec, unpublished data, 2019

Figure 1. Customer ($n = 6,000$) survey results on intention to use alternative proteins in 2020.

Intention to use conventional proteins in 2020



Kalsec, unpublished data, 2019

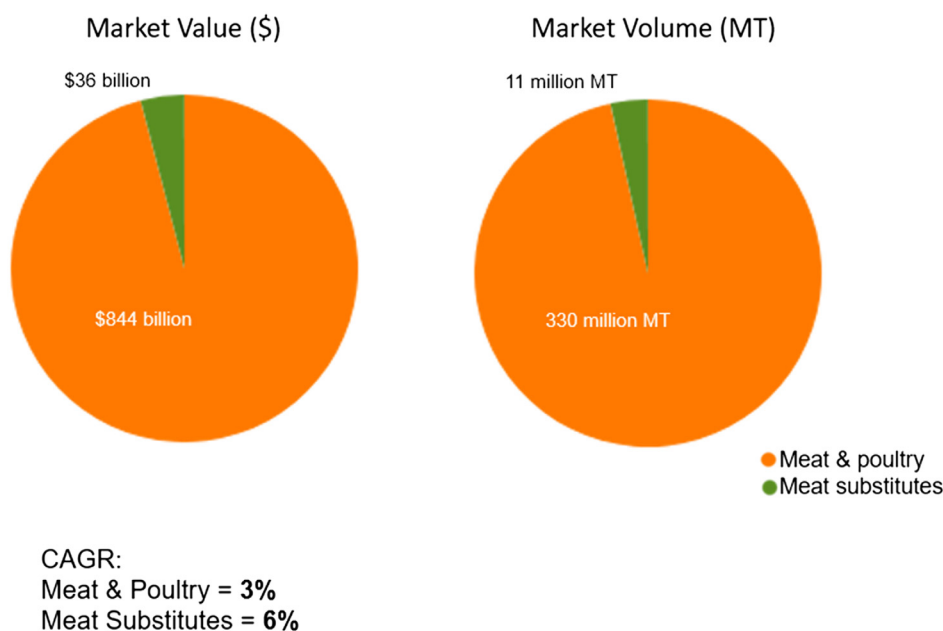
Figure 2. Customer ($n = 6,000$) survey results on intention to use conventional (meat) proteins in 2020.

some marketing firms indicate that beef and pork consumption continue to rise (Acosta, 2018; FMI, 2020).

Consumers cite many reasons for reducing conventional meat consumption and including alternative proteins in their diet. Health concerns are generally a top motivator as alternative proteins are perceived as healthier than conventional counterparts (Datassential Trendspotting, 2018; Spano, 2019; Askew, 2020). Fifty percent of consumers used alternative proteins due to a perception of healthfulness, and 36% viewed alternatives as a good source of protein (FMI, 2020). Other reasons include environmental concerns and animal rights issues (Spano, 2019; Askew, 2020). Twenty-seven percent of the consumers studied were concerned about environmental impact compared with 24% concerned about animal welfare (FMI, 2020).

Market Share Data Analysis

The global outlook for alternative protein on market share (both volume and percentage) is represented in Figure 3. Meat and poultry are currently the predominant protein source globally. Although the current market of alternative proteins based on both value and volume share is less than 5%, the Compound Annual Growth Rate is twice as high as the current rate for meat and poultry segment (3% and 6% for meat alternatives and traditional meat, respectively) (Transparency Market Research, 2018).



Source: Transparency Market Research, 2018

Figure 3. Comparison of global market share of meat and poultry versus meat substitutes.

Table 1. Value and volume of meat and meat alternatives in the US

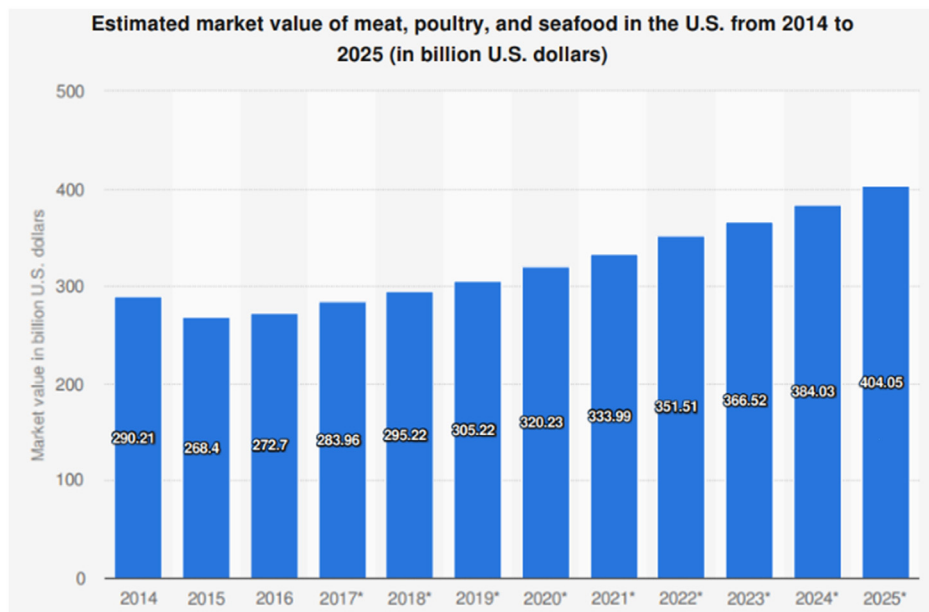
	Meat Alternatives	Meat
US Market Value	1.35 billion USD	305 billion USD
US Market Volume	121,143 MT	45 million MT

Sources: North American Meat Institute, 2017; Transparency Market Research, 2018.

MT = Metric tons; USD = US dollars.

When we evaluate the market trends in the US, data indicate (Table 1) that the market value of meat alternatives is less than 0.5% in comparison to meat and poultry. On the other hand, recent reports from the Good Food Institute indicate that alternative proteins account for closer to 1% of dollar sales for all retail meat (GFI, 2019). Figure 4 conveys the US meat industry potential for the next 5 y, highlighting the stronger position that animal proteins/meat products hold in the food industry (Statista, 2018a).

The available market share for alternative proteins relative to meat is thought to be like that of plant-based milk relative to dairy, implying that alternative protein may increase to 13% of the total protein market share, about a \$9 billion market value potential. In addition, the niche category of hybrid meat products is also noteworthy in this context. This segment, which combines both meat and alternative proteins/plant-based foods, is also set to have increased appeal in certain consumer segments (FMI, 2020). In 2018, Food Ingredients First



Source: Statista, 2018a

Figure 4. Estimated market value of meat, poultry, and seafood in the US from 2014 to 2025.

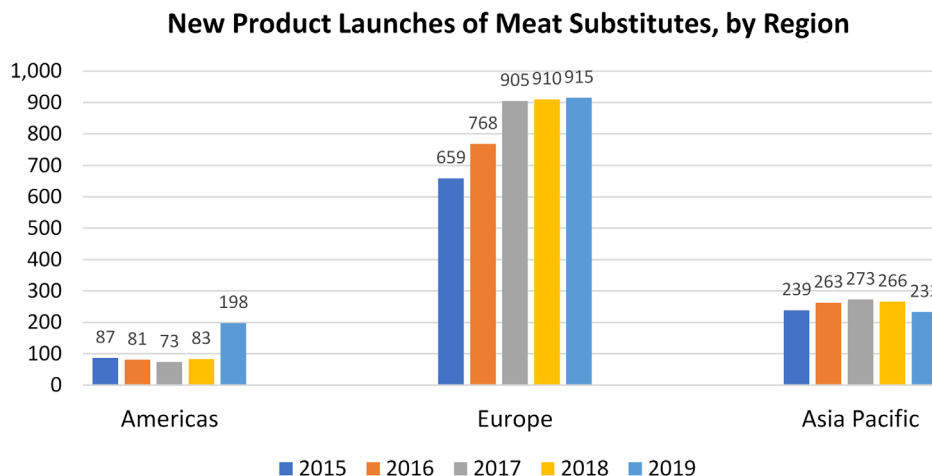
published a statement saying that a category between meat and meat-free (hybrids) could substitute as much as 10%–15% of all meat production (Green, 2018).

New Product Launches

New product launch (NPL) analyses from trusted food industry databases reveal interesting trends when it comes to both meat and poultry and alternative protein products. For example, Figure 5 represents the NPL in 3 global regions spanning 5 years, from 2015 to 2019, in which Europe had a greater and constant percentage growth of NPL (Mintel, 2020). Figure 6 shows the

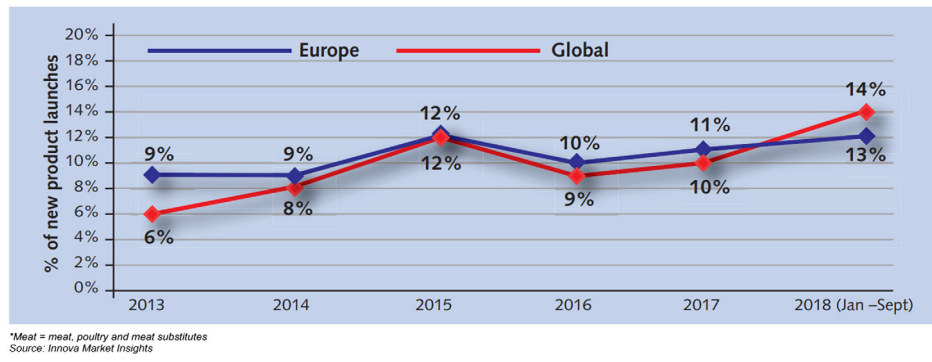
global trend, which corroborates that of Europe in recent years, indicating a steady/consistent growth in demand for meat substitutes (Innova Market Insights, 2018). Furthermore, the specific claims attributed to new products launched in Europe are shown in Figure 7, with vegan claims in Europe seeing the largest growth during the 2014–2019 period (Mintel, 2019).

Frozen products have been the typical format/distribution channel; momentum in the refrigerated section for alternative products is emerging (Figure 8; Transparency Market Research, 2018). While frozen products’ dollar sales grew only 4% in the last year, refrigerated products saw a dollar sales growth of 63% (GFI, 2019). In addition, refrigerated protein



Source: Mintel, 2020

Figure 5. New product launches in the alternative category from 2015 to 2019, by region.



Source: Innova Market Insights, 2018

Figure 6. Europe and global: Meat substitute launches as a percentage of meat launches.

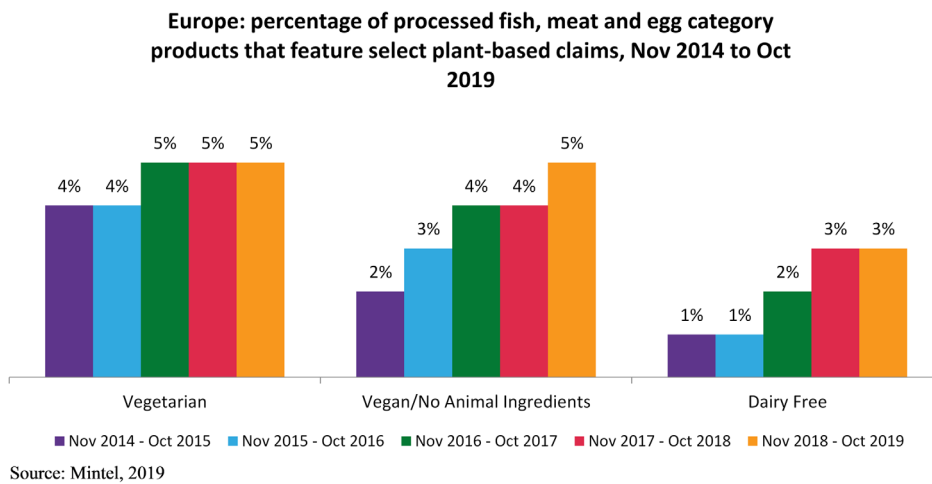
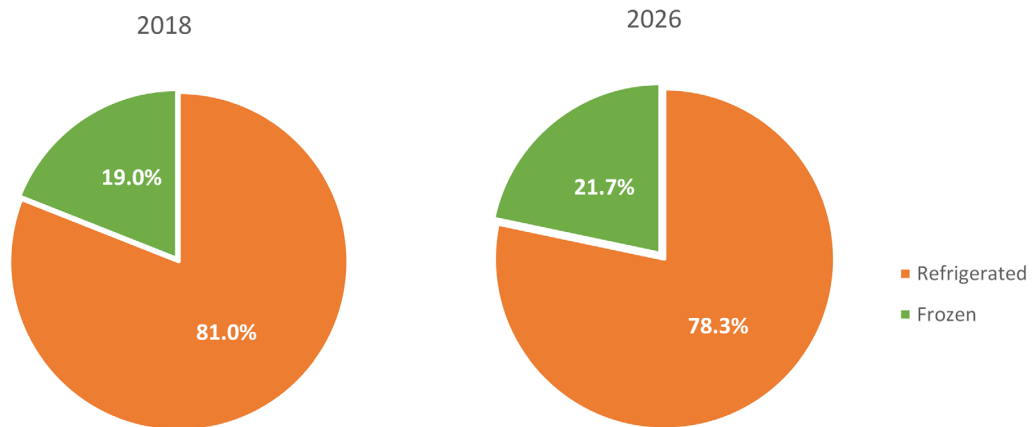


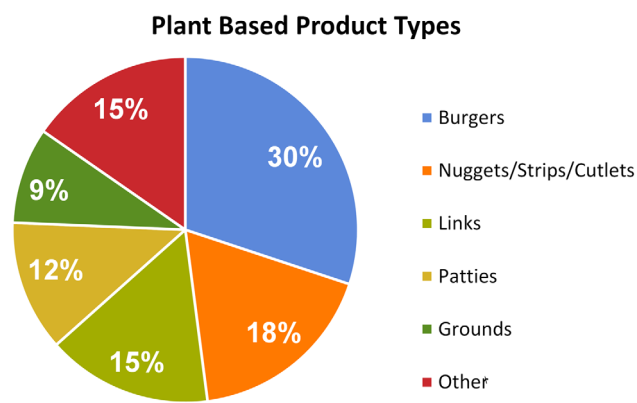
Figure 7. Processed products with plant-based claims by category, 2014–2019.

Frozen vs. Refrigerated Alternative Meat Market Share 2018 and 2026



Source: Transparency Market Research, 2018

Figure 8. Global meat alternatives market analysis by category, 2018 and 2026.



Source: GFI, 2019

Figure 9. US plant-based meats (alternative proteins) formats in market.

alternatives are expected to experience increased year-over-year growth from the 6% up to 8% by 2026. By contrast, frozen alternative proteins are expected to have a constant year over year increase of 6% (Transparency Market Research, 2018). The product categories that meat alternatives target specifically in the US (GFI, 2019) are presented in Figure 9. Burgers are the most preferred segment, and it is hypothesized that this is due to food service and quick service restaurants choosing these options.

Alternative Proteins: Major Sources

Plant-based proteins of various types constitute the majority of alternative protein products (Statista,

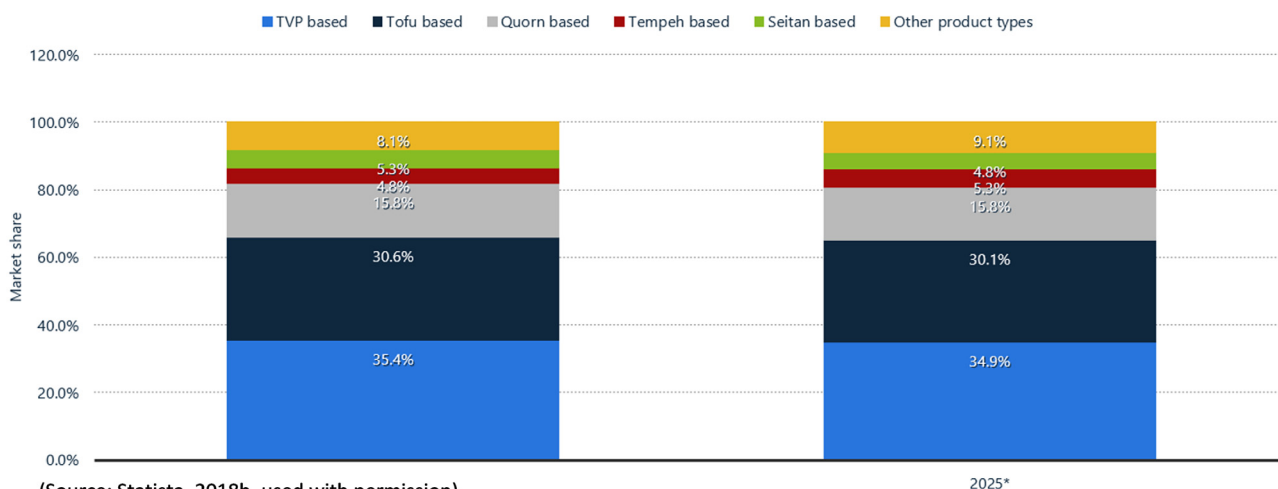
2018b). Textured vegetable protein holds significant market share of vegetable meat substitutes globally at approximately 35% (Figure 10), and minimal changes are expected in the 8-y projections of 2017–2025. The textured vegetable protein-, tofu-, and Seitan (wheat protein)-based substitutes are estimated to decline minimally, while mycoprotein (Quorn)-based substitutes will not change. On the other hand, tempeh and other product types are estimated to increase market share by 2025. In the US, the trend is similar, with soy being the leading alternative protein source (Figure 11). All types of substitute base are set to grow by 2022, with soy-based, vegetable/plant-based, single-cell-protein-based, and other grain-based alternatives have predicted growth of 10%, 23%, 24%, and 17%, respectively (Agriculture and Agri-Food Canada, 2019). An interesting development to note is the market expansion of non-soy-derived plant proteins, especially pea protein, which is projected to reach a potential of US\$1.5 billion by 2022 (Innova Market Insights, 2019).

Consumer Research on Meat Alternatives

Although alternative proteins are on the rise globally, alternative protein acceptance differs greatly in different countries for complex reasons (Bryant et al., 2019). When a customer purchases a meat, they are incorporating a web of marketing, sensory, and psychological factors (Font-i-Furnols and Guerrero, 2014). These factors establish an expectation of what

Estimated market value share of meat substitutes worldwide in 2017 and 2025, by product type

Global meat substitutes market share by type 2017-2025



(Source: Statista, 2018b, used with permission)

Figure 10. Estimates of market value share of meat substitutes worldwide in 2017 and 2025, by type.

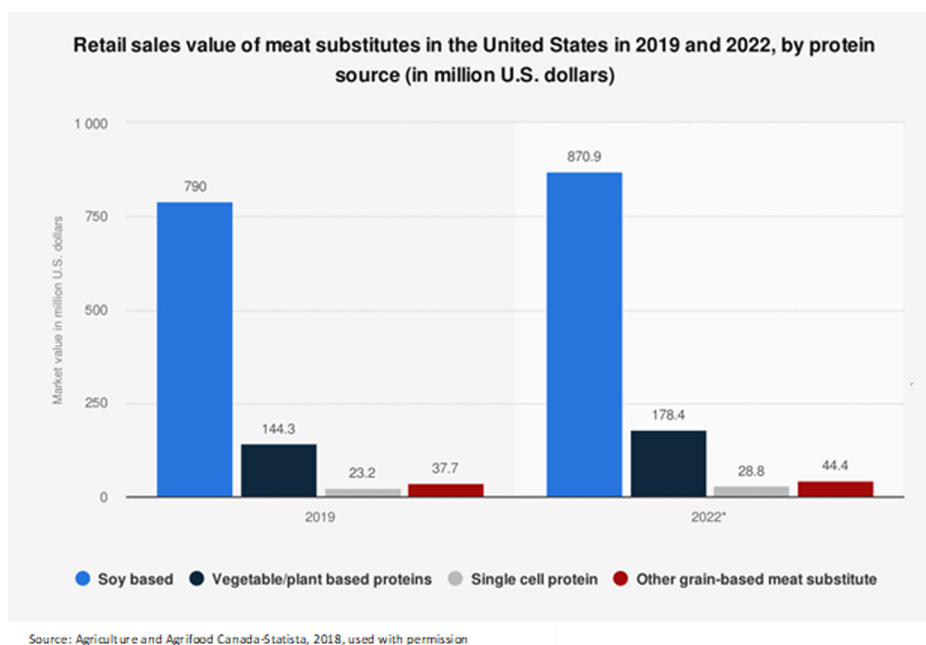


Figure 11. Sales value of meat substitutes in the US in 2019 and 2022, by protein source.

a meat is, with price, appearance, taste, and texture most influencing a consumer's decision to purchase repeatedly (Font-i-Furnols and Guerrero, 2014; FMI, 2020). Evaluating customer responses in these categories provides a good baseline for what consumers want and expect from alternative proteins.

Regional analysis

Meat alternative acceptance varies greatly between regions and countries. Among the most accepting are India and China, where 64.2% of Chinese respondents and 69.6% of Indian respondents reported being very or extremely likely to try alternative proteins (Bryant et al, 2019). This high acceptance is coupled with few respondents who are not at all likely to try alternative proteins (3.4% and 4.6%, respectively) (Bryant et al., 2019). Chinese and Indian participants were also more likely to regularly purchase alternative proteins than participants from other locations (Bryant et al., 2019). Small proportions of the population were not at all likely to replace conventional meat (6.0% of Chinese participants and 6.8% of Indian respondents) compared with other locations (Bryant et al., 2019). This remained the case when the Indian population was controlled for proportion of vegetarians (Bryant et al., 2019). In general, there is a lack of research on the acceptance of alternative protein meat products in these regions.

Alternative proteins are less accepted in the US. Only 26.1% of American respondents were very or

extremely likely to try alternative proteins, and 24.1% of respondents said that they would be not at all likely to try alternative proteins. Although a quarter of those studied were willing to try alternatives, US respondents were unlikely to purchase alternatives regularly (25.3% not at all likely) or replace conventional proteins with alternatives (29.9% not at all likely) (Bryant et al., 2019). Surveys of the US population still find conventional meat to be the dominant form of protein, with over 50% of those surveyed never or only once trying alternative proteins (FMI, 2020). Few studies exist examining other North American countries' attitudes toward alternative proteins.

Studies have also been conducted on the acceptance of alternative proteins in Europe. In 2011, Hoek and colleagues conducted a study of consumers in the United Kingdom and the Netherlands, asking about their opinions and usage of meat alternatives. In general, consumers in the UK were far more likely to use alternative protein products than those in the Netherlands. Thirty-five percent of those surveyed in the UK were found to be medium users of alternative proteins, and 44.7% were found to be nonusers, with medium use being defined as using alternative proteins more than once a month (Hoek et al., 2011). In the Netherlands, only 15.7% of participants were medium users of alternative proteins, and 68.9% of participants were nonusers (Hoek et al., 2011). Few other studies have been conducted in European countries, and in general they find differences between different countries' acceptance levels of alternative proteins. For

example, in places such as Belgium and Finland, meat attachment is found to be high, with Finnish consumers preferring meat, as they perceive it to be healthy and necessary for human diet (Vanhonacker et al., 2013; Pohjolainen et al., 2015). Few studies exist studying and comparing each country's preferences in a uniform way. European acceptance of alternative protein is variable between countries, and caution should be taken when attempting to generalize to this region.

Overall, countries tend to differ from each other when it comes to acceptance of alternative proteins. While China and India have similar ideas about meat alternatives, ideas in the US and in European countries can differ greatly. More abundant and geographically diverse research is needed to fully understand the acceptance of alternative proteins in countries and regions at large, with specific focus on European, Asian, and non-US North American countries.

Increasing consumer acceptance

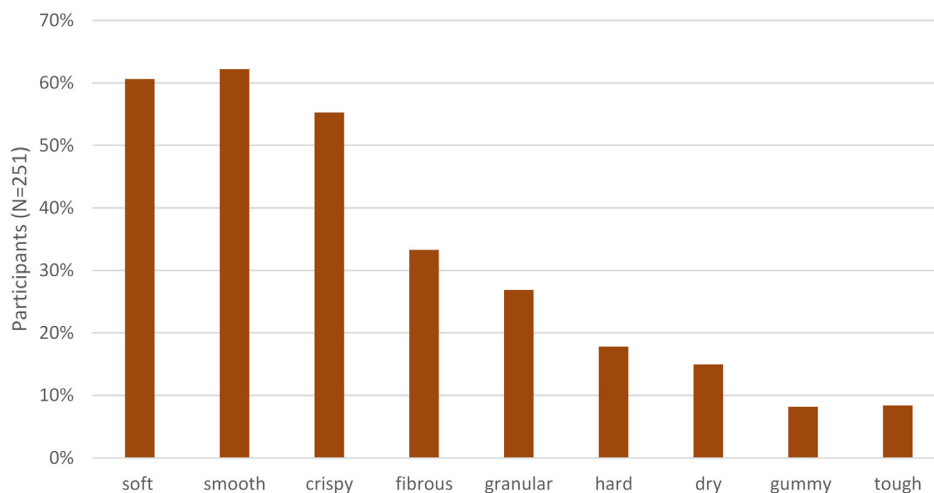
In order to increase consumer acceptance of alternative proteins, it is important to understand what factors influence purchase and enjoyment of these alternatives. Lessons can be taken from conventional meat science to design studies and interpret current data within the lens of meat products. Some studies suggest that consumers are looking for alternatives to look, taste, feel, cost, and behave similarly to meat. This was found to be especially true for those that are currently using alternatives less than 5 times a week (Hoek et al., 2011).

In conventional meats, price is the single largest driver of consumer choice (FMI, 2020). For 15 y, price per pound ranked highest as a purchase decision factor, and in 2020, 58% of respondents ranked it as either first or second priority when choosing what to purchase (FMI, 2020). Studies on meat alternatives demonstrate that consumers may feel similarly about price in countries with low alternative protein acceptance. Forty-five percent of US respondents said they were not at all likely to pay a higher price, indicating that price may be posing a large barrier for some consumers (Bryant et al., 2019). However, studies from the Netherlands have indicated that other factors are more likely to be hindering consumers from trying alternative proteins, although price was still a consideration (Hoek et al., 2011). Factors including sensory appeal, familiarity, and a feeling of luxury were more likely to be positively associated with meat than price, among consumers who favored neither conventional nor alternative protein (Hoek et al., 2011). Despite the different

locations of these studies, it is still likely that price is an important factor to consumers, and the expense of alternative proteins may be deterring some consumers.

The second most important category for consumers of conventional meat is color and appearance (FMI, 2020), though it is unclear the extent to which this affects consumer preference for alternative proteins. Few studies have been conducted to determine the effects of product color on meat alternative consumers. When self-reporting the importance of appearance on purchasing and using alternative proteins, consumers said that a similar appearance to meat was less important than a texture or taste that was similar (Hoek et al., 2011). However, when consumers were asked what colors they found appropriate for cooked alternative proteins, they most frequently chose brown by a large margin, followed by red for all types of meals (Elzerman et al., 2011). Green was scored the least appropriate for every meal category (Elzerman et al., 2011). These answers closely match what consumers look for in conventional meats as red and brown are the common colors for cooked meat and green is perceived as an off-color (Aaslyng et al., 2006; Font-i-Furnols and Guerrero, 2014). This would suggest that even though consumers do not actively prioritize alternative proteins having a similar appearance to conventional meat, they still subconsciously prefer that alternatives are similar in color and are not colors that would be deemed "off." The reality is that more research is needed to understand the relationship between color and consumer acceptance, especially since color is known to have a large impact on conventional meat purchase.

Texture is another important factor in consumer enjoyment of meat and meat alternatives, and consumers react favorably to textures like those found in meat. In Figure 12, the proportion of respondents who found certain textures appropriate is demonstrated. The top positive responses were soft, smooth, and crispy, and the bottom responses were tough, gummy, and dry (Elzerman et al., 2011). This closely aligns with consumer preferences for meat texture, as consumers generally want juicy and tender meat, corresponding to a protein alternative that is not dry or tough (Aaslyng et al., 2006; Font-i-Furnols and Guerrero, 2014). A "smooth" texture could also be understood as being an analogue to tenderness in meat. In addition, some consumers, especially those who are younger, want a crunch or crumble in their meat (Aaslyng et al., 2006). This aligns with the want for crispiness that was reported by Hoek and colleagues (2011). Consumers prefer more meat-like textures in alternative proteins



Source: Elzerman, 2011

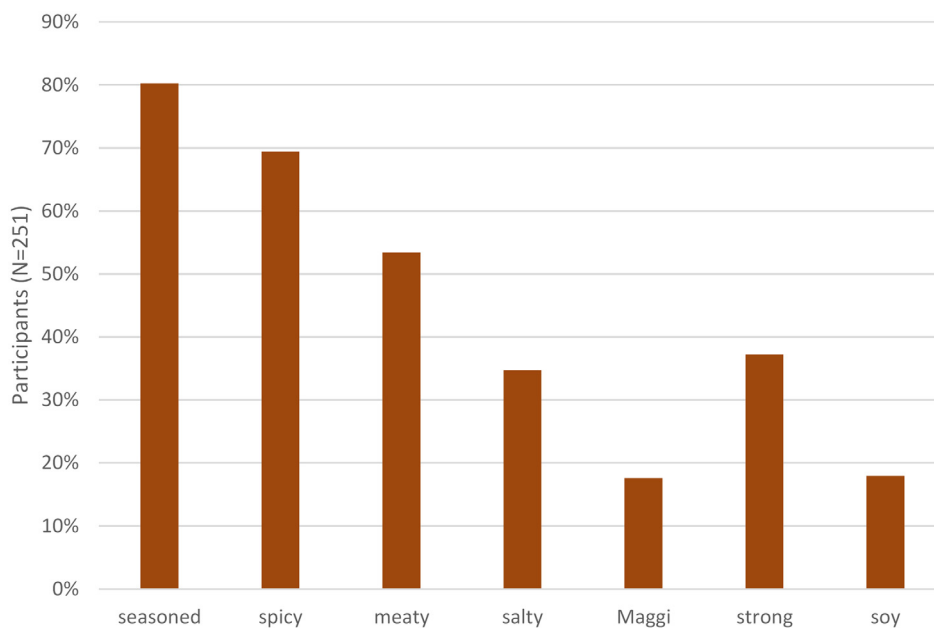
Figure 12. Preferred alternative protein textures.

and are responding positively to proteins textured like those they are analogs of. Some research suggests that texture may be one reason hybrid meats have become popular, as the addition of plant protein to conventional meat can increase perceived juiciness (FMI, 2020).

Taste is a concern for many who wish to try alternative proteins. In general, consumers have a well-defined expectation for meat tastes and often prefer a meaty, fried flavor (Font-i-Furnols and Guerrero, 2014). This is echoed in alternative proteins. As can be seen in Figure 13, consumers indicated they would want alternative protein flavors like seasoned, spicy, and meaty (Elzerman et al., 2011). This inclusion of

meaty as a preferred flavor would indicate that consumers wish alternative proteins to mimic the flavors of meat. Mimicking meat flavors may increase acceptance, as in some studies up to 34% of respondents indicated that they were not actively trying alternative proteins because they believed they would not like the taste (Clark and Bogdan, 2019). By familiarizing the taste of meat alternatives, it is possible that consumers would be able to overcome fear of taste.

Consumers in locations with lower acceptance of protein alternatives may want alternatives to look, taste, and feel like meat. Studies should be conducted in more direct settings to determine how the factors



Source: Elzerman, 2011

Figure 13. Preferred alternative protein tastes.

affecting meat purchase and enjoyment correlate to alternative proteins. Despite a wealth of market research, there remain gaps to understanding the ways in which texture, taste, and color affect the way consumers experience alternative proteins.

Conclusions

Alternative proteins are increasingly being used by consumers in many global markets, with vegetable proteins expected to experience the greatest increase as a base. Despite accounting for a modest portion of the market now, alternative proteins are experiencing a market growth rate double that of conventional meat. However, some sections of the alternative protein market are faring better than others. Refrigerated alternatives are gaining popularity more quickly than frozen, and hybrids stand poised to account for a large part of the alternative protein market in the coming years. There remains a limited amount of information on consumers' ideal sensory experience of alternative proteins, and the present information suggests a high level of variability between countries. As more research is conducted, a greater understanding will emerge and will likely increase consumer interest in alternative proteins. This will also enable scientists and food technologists to contribute actively to new product development, addressing the gaps in appearance, texture, and quality eating experience of protein products. Hopefully then, alternative proteins could be a part of the solution to the challenge of feeding a rapidly growing population while offering flexibility in protein choices.

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