

Market Survey and Demand Forecasting Studies of Ready-to-Eat Plant-Based Sausage

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Abstract

The growing consumer interest in sustainable and healthier food options has fuelled the growth of the plant-based food market. This study investigates the market demand and consumer preferences for ready-to-eat plant-based sausage through a market survey and demand forecasting analysis. There are 385 respondents collected via structured questionnaire, analysed using chi-square test and cross-tabulation. Observation method analysed using thematic analysis to identify patterns in market trend and purchase behaviour. Through questionnaire, the age group of 18-24 years shows highly demand towards this product which is 41.1% and students are recorded the highest demand with 74.3%. Meanwhile through the thematic, the data of observation and recipes are arranged into themes such as main ingredients, pricing, weight and packaging. Attributes such as health benefits, flavourful taste, packaging and affordability were identified as key factors influencing purchasing decision. This study reveals significant in consumer interest with health benefits and flavourful taste as top priorities.

1. Introduction

Urbanization, personal economic growth, and population expansion are driving increasing demand for meat, which is driving up both global production and consumption of the meat product. The Food and Agriculture Organization (FAO) of the United Nations predicted in 2012 that by 2050, there will be 455 million metric tons of meat consumed worldwide [1]. Plant-based meat substitutes become a reliable source of protein with the same attributes such as texture, colour, flavour and nutrition can imitate the meat itself [1]. The surveys for market research are a dependable way to learn more about the target audience or consumer. Stated differently, surveys aid market researchers in learning more about both present and potential clients. In the meantime, the introduction of a new product is having potential to identify the target market needed. A market research survey has the main goal which is to gain insight into the individuals that purchased the goods from a product.

Forecasting product demand is referring to one of the core challenges in business. Bose, J.H. says that it takes a combination of machine learning techniques and time series approach to handle demand forecasting for these kinds of products [2]. A well-known method was modified to add them in a set of features produced from the raw data. Forecasting serves as a foundation for managerial planning; it is also the process of projecting an uncontrollable future event or circumstance. A lot of companies or businesses rely on demand projections to make long and short-term choices regarding inventory management, sourcing and 2 production planning, due to unsure of the future demand [3].

Ready-to-eat (RTE) meals are also known as products that are pre-cooked, packaged and ready to consume without additional preparation [4]. Plant based sausage has been known for health recommendations and environmental benefits [5]. Hence, this study aims to analyse consumer demand and product concept for ready-to-eat plant-based sausage using market survey and demand forecasting methods.

2. Methodology

2.1 Data Collection

The data used to conduct this study was obtained by questionnaire and observation method (6). The questionnaire designed was a closed-ended question. Meanwhile, the observation data was carried out at the physical market and online market to observe product's availability in the market.

2.2 Competitive Analysis

To conduct the competitive analysis, an observation technique had been used. The observations were carried out at Hypermarket, supermarket, marts, convenience stores and online stores. The locations that been went for observation purpose were hypermarket such as Econsave, Jaya Grocer, Aeon and Lotus. Meanwhile, the observation place at mart and convenience store such as, 7-Eleven, KK Mart, Family Mart, Family Store, CU Mart, and E-Mart has been covered. The data that managed to collect after the observation was done is the sausage brand, ingredients used, nett weight, price, and types of packaging used [7].

2.3 Forecasting Demand and Product Concept

For product concepts, the questionnaires were distributed to 400 respondents from all over other Malaysia's state [8]. The questionnaires were planned to be conducted through online forms and paper sheets. Hence, the questionnaires distributed by online form which is google form. The questionnaire was then reviewed by the experts to obtain a better result. The age range for respondents is around 5 years old to 61 years old. This method was primarily carried out to assess the market viability of the newly launched product concept [9].

2.4 Questionnaire Development

A questionnaire was developed to investigate the possibility of marketing the ready-to-eat plant-based sausage and to gauge customer approval to gauge product demand and the market perception of the product. The four sections of the survey were as follows: A. Demographic Information, B. Existence of plant-based food product, C. Knowledge about ready-to-eat products and D. Multiple choice answers were included in every question to collect the data and highlight the important issues. After the creation of the questionnaire, it has been reviewed by three academic experts to ensure the questionnaire follows the guideline of questionnaire design [10].

2.5 Recipe Survey

The recipe of plant-based sausage is determined with data collected from semi-structured interview [10]. The recipes and supplies needed to prepare ready-to-eat plant-based sausage were obtained by online websites and articles as well as online books. The questions regarding the list of recipes and the technique used for cooking preparation have been noted, and direct questions have been asked for more details.

2.6 Quantitative Data Analysis

The Statistical Package of Social Science (SPSS) software version 24 was used to analyse the quantitative data. The data analysis was conducted in a multi-step process. There is a potential relationship between a few categorical variables that were assessed using the chi-square test and cross-tabulation at a significant level of 5%. In addition, the Microsoft excel version 2016 was also used to filter the data for coding purposes [11]. A pilot run was conducted with 30 respondents. The respondents are from age range 13-17 years, 18-24 years and 25 – 60 years.

2.7 Qualitative Data Analysis

The qualitative data is composed of specific details that are frequently expressed verbally. The qualitative data were analysed with involved reading through a large number of transcripts, comparing and contrasting them, and then identifying themes while creating categories. The data gathered from the observations are transformed into transcript. The transcripts are labelled or annotated with one or more brief content descriptors in the subsequent phase [12]. A software named NVivo was used for managing qualitative data. The data first get familiarized before generating the initial codes with identifying key concepts. Then, the codes generated were refined into a broader theme while using NVivo's node structure to organize and linked towards the coded segments.

3. Results and Discussion

3.1 Competitive Analysis

The observation regarding plant-based sausage and ready-to-eat sausage was conducted at both physical and online stores. The plant-based product that commonly found at supermarkets in Malaysia is plant-based nugget and plant-based burger patty. Despite that, the result from observations through online stores do prove that there are a lot of plant-based sausage was on the market, from different brands in United States and United Kingdom. However, all those products are only available at their countries and a few selected countries where they are distributed. In the meantime, ready-to-eat sausage is known as sausage product that has been fully cooked during manufacturing. It does not require further cooking before consumption that was providing greater convenience for consumers in a hurry [14]. The ready-to-eat sausage can easily be found at convenience stores such as E-Mart and 7-Eleven.

Table 1 Summarize of Observations

Codes/Themes	Plant-based sausage	Ready-to-eat sausage
Main ingredients	Variety of plant-based ingredients, such as soy protein, pea protein, wheat gluten, and natural spices.	Chicken meat, soy protein, starch, vegetable oil, spices.
Pricing	RM 12 to RM 87, varies to size and branding	RM 3.50 to RM 4.80
Weight	227g to 396g	80g for two links
Packaging	All products are vacuum-packed for preservation and freshness.	Vacuum packaging for freshness and longer shelf life
Country of production	Products originated from various countries, with a strong representation from the USA.	Indonesia
Producers	VegeWorld from Malaysia, VBites from UK, and Beyond Meat from US.	Betagro, Kanzler, Dokkaebi

3.2 Forecasting Demand and Product Concept

Table 2 states the demographic data for the market survey conducted in this study. This study involved 385 respondents which consisted of five sociodemographic data labelled as gender, age, race, occupation and dietary preference. The data obtained from the questionnaire reveals that majority of people participate in this study have a range of age 18 years to 24 years old, which representing 45.7% of the study participants. In the meantime, the range of age from 5 years old to 12 years old that collected were 4.9%, age 13 years old to 17 years old were 30.6%.

It indicates that school students are less influenced with the range of targeted as workers which in a biggest range of age, 25 years old until 60 years old were counted 14.8%. As for gender, 47% were male and 53% were female. In terms of race, 71.9% were Malay, 16.6% were Indian, 10.6% were Chinese while 0.8% for other races in Malaysia. As for occupational status, the result found that 70.1% of the respondents were students, 20.8% were employee and the remaining 9.1% were unemployed. Concerning the dietary preference, 10.6% people are vegetarian, 20.5% were flexitarian meanwhile 68.8% of respondents were omnivorous.

In a summarize, a significant proportion which is 45.7% of respondents aged 18-24 years highlights the strong interest among young adults, aligning with [24], that young adults age cohort is more likely to explore and adventurous with food options. In addition, the age range 18-24 years also dominated by students, which from the results obtained, 70.1% highlight the highest interest.

Table 2 Sociodemographic Data

Sociodemographic particular		Frequency (n)	Percentage (%)
Gender	Male	181	47%
	Female	204	53%
Age	5-12 years old	19	4.9%
	13-17 years old	118	30.6%
	18-24 years old	176	45.7%
	25-60 years old	57	14.8%
	>61 years old	15	3.9%
Race	Malay	277	71.9%
	Indian	64	16.6%
	Chinese	41	10.6%
	Others	3	0.8%
Occupation	Student	270	70.1%
	Employee	80	20.8%
	Unemployed	35	9.1%
Dietary preference	Vegetarian	41	10.6%
	Flexitarian	79	20.5%
	Omnivore	265	68.8%

3.2.1 Frequency Demand of Product Ready-To-Eat Plant-Based Sausage

The level of consumer’s interest in trying the plant-based sausage by different age group can be seen in Table 3. The categories with the highest levels of interest are 18 – 24 years old which is 41.1%. This concentration indicates a strong demand as these age groups influence the market and buyers. In addition, 37% of the second higher level goes to the age group of 13 – 17 years old. The interested buyer from the age group of 25 – 60 years old achieve a moderate amount of demand. The age group of 5 – 12 years old and above 61 years old shows the lowest percentage which is 5.3% and 4.4% respectively.

Table 3 Interested Trying Plant-Based Sausage by Different Age Group

Interested	5 – 12 years old	13 – 17 years old	18 – 24 years old	25 – 60 years old	Above 61 years old
Count	17	118	131	39	14
Percentage (%)	5.3%	37.0%	41.1%	12.2%	4.4%

The data from Table 4 states the relationship of individual’s occupation with the sense of need for plant-based sausage. To be mentioned, students represent the highest percentage in acceptance for this ready-to-eat plant-based sausage product. They showed that this product is the desirable snack and convenience for student’s preferences where they can consume healthy and easy snack in the form of sausage. For the second higher percentage regarding demand of this ready-to-eat plant-based sausage are led by employees. This percentage of need is indicating that working people also aware on this beneficial product. The data also shown that 18.2% of respondents are likely to buy a quick and easy to consume meals as they have a fit schedule to spend time during lunch break. Next, the unemployed category contributes 7.4% in need product category. It can be seen due to differences in individual’s priorities regarding food purchasing.

Table 4 Definitely Need Product According to Occupation

Definitely need	Student	Employees	Unemployed
Count	110	27	11
Percentage (%)	74.3%	18.2%	7.4%

Frequency of daily purchasing are detailing by dietary group which consists of respondent’s dietary preferences such as vegetarian, flexitarian and omnivorous. From the Table 5, omnivorous group recorded the highest percentage of frequency daily purchasing, which is 42.1%, followed by equal proportions of vegetarians and flexitarians. This table shows that dietary preferences may influence daily purchasing of ready-to-eat food product even though omnivorous dietary is free to consume any type of food without restriction depending on self-desire. In contrast, vegetarian and flexitarian have an equal percentage regarding frequency purchasing among dietary group which is both recorded 28.9%. In studies, [15] stated that vegetarians and vegans are

consuming higher intake in ultra-processed foods, such as industrial plant-based meat and dairy substitutes than omnivores.

Table 5 Frequency Daily Purchasing by Dietary Group

Frequency purchasing	Vegetarian	Flexitarian	Omnivorous
Count	11	11	16
Percentage (%)	28.9%	28.9%	42.1%

3.2.2 Analysis Product Concept of Ready-To-Eat Plant-Based Sausage

Fig. 1 shows four attributes that are being observed in analysing the product concept for ready-to-eat plant-based sausage which fulfil the consumer preferences. The attributes that are chosen is the criteria prioritized during purchasing, nutritional content, the most preferred flavour and the desired sausage shape. [16] figured that it is an enclosed marketing elements towards sales. Lastly, easy storage attributes contribute the lowest effect of consumer purchasing in term of product concept. The terms of easy storage might be like many people which consumer attracted more on the other attributes. However, the ready-to-eat plant-based sausage product truly indicates an easy storage for consumption, as it is packed with a vacuum sealed packaging.



Fig. 1 The Percentage of Attributes During Purchasing

For nutritional content, Fig. 2 reveals the summarises of consumers preference regarding nutritional content of product ready-to-eat plant-based sausage. From the pie chart, it is clearly shown that protein is the first nutrient factor for consumers to purchase this product. In addition, consumers will be more likely to purchase if the product is high in protein, but low in carbs and low in fat. The high carbohydrate content which is 16.10% as preferred might be attributed to the use of plant-based protein isolate, starches and binding agents that commonly found in plant-based formulations. According to [17], plant-based protein has a lower protein efficiency and lower in micronutrients, differ from animal-derived proteins. Despite that, [18] stated that there are recent developments in the field including other protein sources such as microalgae proteins from spirulina, isolated from insects and collected mycoproteins produced by fungal fermentation. Those studies indicate that nutritional content has a major impact on purchase decisions.

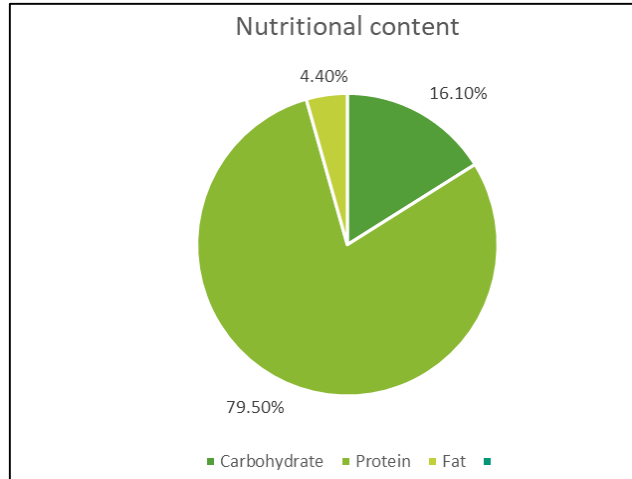


Fig. 2 Percentage Preference of Nutritional Content Among Consumers

As referred to Fig. 3, there are five flavours that being recommended in the form. All five flavours have their own unique taste that suits with ready-to-eat plant-based sausage. The questions about flavour acceptance are required to analyse the demand from consumers towards product concept. The highly preferred flavour in plant-based sausage among consumers is spicy flavour. Spicy flavours are mainly integral to many culinary traditions worldwide. The second higher acceptance regarding flavours is smoked barbeque. Smoked barbeque is characterized by a combination of smoky, sweet and savoury notes. The aromatic profile of meat substitutes is enhanced by various flavouring including the herbs, spices and savoury yeast extract. [19] Hence, according to [20], the acceptance of the smoky odour was identified as a positive attribute that could enhance consumer’s senses towards plant-based sausages. Meanwhile, the third flavours that preferred by respondents is beef, with 17% and chicken with 14%. Both flavours are significant in sausage product as the basic sausage itself originally made of beef and chicken meat. However, it still makes sense on how to infuse the original meat flavours into the plant-based sausage in a meantime meat are prohibited to use in the ingredients. Referring to [21], the meat flavours could be enhanced with specific spices and herbs. Instead, yeast extracts are known to be rich in glutamic acid that contribute to umami flavours. The herb-infused flavour gained 7% respondents in flavour acceptance for product concept. [22] has found that the herbs-infused flavour can be obtained by adding leaves and seeds of herbaceous plants and it used to season the food product.

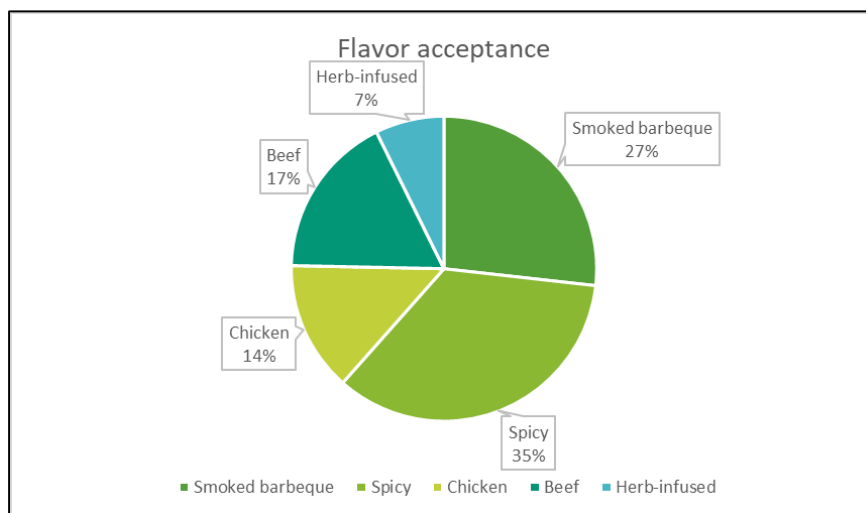


Fig. 3 The Flavour Acceptance Among Consumers

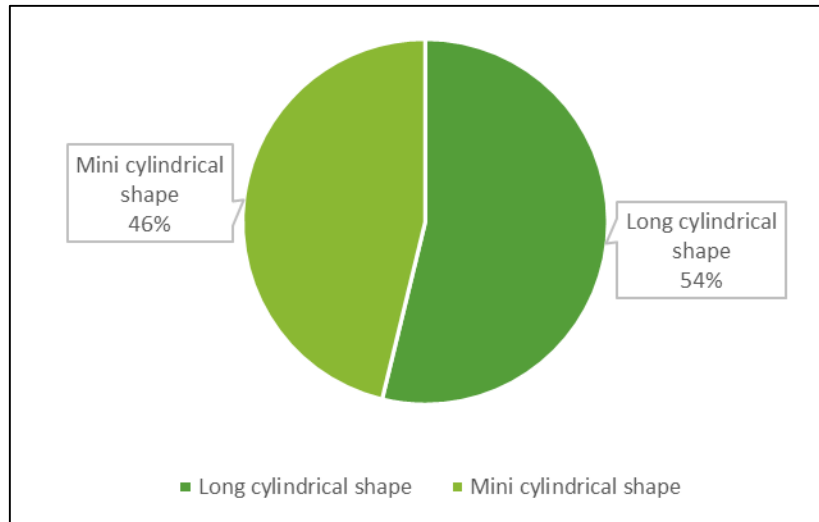


Fig. 4 The Percentage of Selecting Sausage Shape Among Consumers

Fig. 4 present the desired shape of ready-to-eat plant-based sausage where there are two types of shape introduced in this product concept, which is a long cylindrical shape and a mini cylindrical shape or usually known as cocktail. The long cylindrical shape gains the highest demand which is 54% instead of mini sized shape with 46%. The long cylindrical shape might appeal to consumers due to their standard shape, which brings convenience to consumers. However, the acceptance regarding mini cylindrical sausage also holds significant appeal for nearly half of the respondents. Their small size makes this ready-to-eat plant-based sausage more convenient as appetizers, snacks and children's meals. The pie chart also highlights a near balance in consumer preferences for sausage size and reflecting the consumer's demand for marketplace.

3.3 Recipe Survey

The recipe for the plant-based sausage was discovered using an online method. As plant-based sausage is more relevant and becomes a famous healthy snack at Europe countries, the recipes for plant-based sausage can easily accessed. [23] proved that by August 2022, a restaurant in United States named Cracker Barrel starts to introduce a meatless sausage patty as their breakfast menu. In a way, citizens tend to make plant-based sausage at home, with the benefits of natural remedies.

Table 6 Summaries of Recipe Survey Data

Themes	Code	Quotes	Source
Ingredients and functions	Protein	Kidney beans, tofu, soy protein Act as primary protein sources.	Zardy Plants
	Aromatics and flavor enhancers	Garlic, apple cider vinegar, miso paste, chickpea flour, vegan broth Act as flavour enhancers	Plant Based Bistro
	Spices for strong flavour and colour	For strong flavour: fennel, lack pepper, cayenne pepper, red pepper flakes, hickory smoke, sriracha. For colour: red bell pepper, tomato paste, molasses	Chef Julia Dunaway
	Textural additions	Chestnut, mushrooms, kidney beans, tofu, oats, wheat gluten.	Earthy Goodness Kitchen
Preparation methods	Preparing paste or wet ingredients	The garlic, onion powder, soy sauce, miso paste, tomato paste, Dijon mustard, vegan broth and olive oil was blended to turn them into paste. Act as wet ingredients and flavour enhancer.	
	Preparing dry ingredients	All dry ingredients are combined.	

	Shape the sausage	Suggested to use rice paper for casing, to have natural appearance with glaze and diverse cooking options.	Earthy Goodness Kitchen
	Wrapping	Using double layer to wrap sausage. First layer using baking sheets Second outer layer using aluminium foil.	Chef Ani
Cooking tips	Storage	Refrigeration: place in an airtight container for up to 5 days. Freezing: freeze them in safe container can stored up to 3 months.	Zardy Plants, Chef Ani
	Reheating/cooking	Grilling Pan-frying Boiling Microwaving	Chef Julia Dunaway, Plant Based Bistro

4. Conclusion

In conclusion, conducting a market survey and demand forecasting studies regarding development of ready-to-eat plant-based sausage becomes the main objective of this study. This research finds the potential to emphasize plant-based sausage market in Malaysia, particularly in the physical retail sector. The analysis on ready-to-eat plant-based sausage highlighted a critical market gap regarding product availability. The observation method reveals significant differences between plant-based sausages and traditional ready-to-eat sausages, particularly in terms of ingredients, technology, and convenience. Nonetheless, the existing products still fail to address convenience features such as ready-to-eat formats which leave a gap for more consumer-friendly options. The demographic findings reveal a significant insight into the target market for plant-based sausage products. The majority of respondents are young adults which have the range of 18 to 24 year, it is known as a group that open to trying new products. They have strong curiosity about every situation and are free to engage with social media. Further research should focus on optimizing nutritional profiles and introducing affordable and convenient ready-to-eat options that can easily be incorporated into local markets and diverse consumer preferences.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: **study conception and design:** Nurfarisah Aliyah Mohmad Farid, Norhayati Muhammad; **data collection:** Nurfarisah Aliyah Mohmad Farid; **analysis and interpretation of results:** Nurfarisah Aliyah Mohmad Farid; **draft manuscript preparation:** Nurfarisah Aliyah Mohmad Farid, Norhayati Muhammad. All authors reviewed the results and approved the final version of the manuscript.

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