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Optimization of Peas-Mushroom (Pisum Sativum-Agaricus Bisporus) As Plant-Based Meat Alternative

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ABSTRACT

The increasing global demand for sustainable protein sources has driven research into plant-based meat alternatives. Pisum Sativum (Commonly known as Peas) and Agaricus bisporus (common mushroom) present significant potential as a meat substitute due to their favorable texture, nutritional profile, and environmental sustainability compared to conventional livestock production. This study investigated the optimal utilization of Pisum sativum-Agaricus bisporus in developing high-quality, nutritionally complete meat alternatives, addressing gaps in integration methods, quality enhancement techniques, and market viability assessment.

A mixed-method approach was employed, combining quantitative and qualitative assessments. Sensory evaluations were conducted in controlled environments with 10 food experts and 40 consumer participants to ensure study reliability. A multi-component formulation using a two-stage cooking process was developed and tested across different mushroom concentrations. The developed formulation successfully produced stable and appealing patties, with the 100-gram mushroom variant achieving "Acceptable" sensory ratings across all evaluation criteria. Statistical analysis revealed no significant differences between formulations, indicating flexibility for diverse product line development. Market evaluation demonstrated unanimous "Acceptable" ratings, reflecting exceptional consumer acceptance with strong cross-demographic appeal and premium pricing potential.

Pea-Mushroom plant-based meat alternatives show exceptional commercial viability and consumer acceptance, positioning them as potentially disruptive products in the plant-based protein sector. The superior nutritional benefits, sensory satisfaction, and functional properties demonstrate the potential to fundamentally shift consumer preferences toward sustainable protein consumption while capturing substantial market share in the rapidly expanding alternative protein market.

Keywords: Plant-based meat alternative, favorable texture, nutritional profile, environmental sustainability, market potential

Introduction

The global food system has been under increasing strain in recent years as a result of resource constraints, population increase, climate change, and growing health concerns. Consequently, customer attitudes have significantly shifted in favor of healthier and more sustainable food options, especially plant-based meat substitutes. These products are made to mimic the flavor and consistency of traditional meat while

providing advantages for the environment and human health. Subsequently, they are showing promise in addressing some of the world's most urgent problems, such as malnutrition.

Malnutrition is a serious global health concern in all of its manifestations, including undernutrition, micronutrient deficiencies, and overnutrition. According to the FAO (2023), more than 2.3 billion people worldwide suffer from moderate to severe food insecurity. Despite being high in nutrients, traditional meat is either unavailable or too expensive for those with modest incomes. When prepared correctly, plant-based meat substitutes provide a scalable, affordable protein source that can be enhanced with vital elements like iron, vitamin B12, and amino acids. Certain plant-based foods can be nutritionally equivalent to animal-based meats when properly fortified and balanced, (Tso et al. 2021).

It is therefore within this context that research on the nutritional optimization, cost, and cultural acceptance of plant-based meat in low-resource contexts is desperately needed. Further, this study aims to investigate how the plan based meat substitutes might be used to lessen the worldwide incidence of malnutrition by utilizing prior research and spotting areas for innovation in formulation, distribution, and policy support.

Conceptual Framework

The research adopts the Input-Process-Output (IPO) Model to examine the enhancement of pea-mushroom (Pisum sativum-Agaricus bisporus) as a plant-based meat substitute in a sequential manner. This framework gives a systematic way of analyzing the different aspects of the formulation, sensory attributes, and market prospects of pea-mushroom-based meat substitutes. By adopting this model, the study can have a clear line of research from the identification of properties of pea-mushrooms, formulation, testing, acceptability, and commercial potential. The IPO model is suitable for this study because it enables one to consider both the scientific and economic aspects of the mushroom-based meat production. This also makes it easier to follow a systematic approach in the research process, where each phase is examined before moving to the next phase, hence increasing the reliability of the findings.

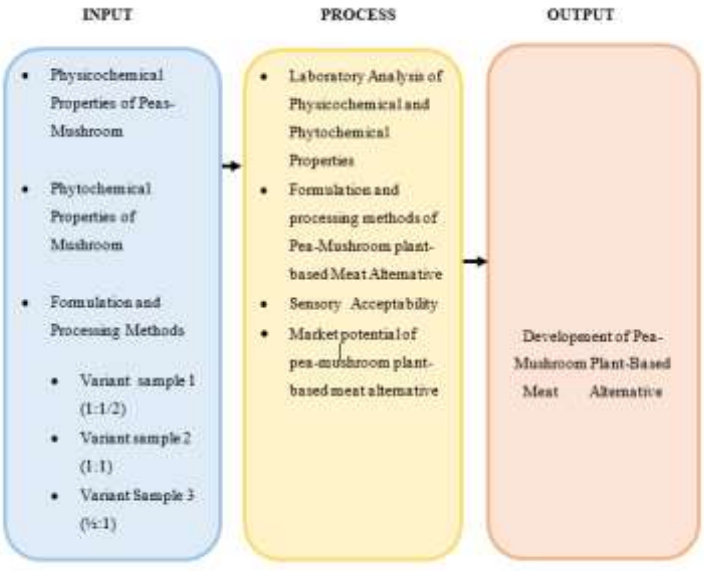

Figure 1. Research Paradigm

Statement of the Problem

This study aimed to determine the optimization of pea-mushroom (Pisum sativum-Agaricus bisporus) as a plant-based meat alternative.

Specifically, this sought to answer the following questions:

1. What is the phytochemical properties of pea-mushroom (Pisum sativum-Agaricus bisporus)?
2. What is the physicochemical properties of pea-mushroom (Pisum sativum- Agaricus bisporus)?
3. What are the formulation techniques and processing methods involved in developing pea-mushroom (Pisum sativum-Agaricus bisporus) as a plant-based meat alternative?
4. What is the sensory acceptability of pea-mushroom (Pisum sativum-Agaricus bisporus) as a plant-based meat alternative in terms of Appearance, Aroma, Palatability and Texture?
5. Is there a significant difference in sensory acceptability of pea-mushroom (Pisum sativum-Agaricus bisporus) as a plant-based meat alternative?
6. What is the market feasibility potential of the pea-mushroom (Pisum sativum-Agaricus bisporus) plant-based meat alternative?

Hypothesis

There is no significant difference in the sensory acceptability of pea-mushroom (Pisum sativum- Agaricus bisporus) as a plant-based meat alternative based on the variables cited in Problem 5.

METHODS

Research Design

The research design of this study is mixed-methods, and the specific objectives of the study include the physicochemical and phytochemical properties of pea-mushroom (Pisum sativum-Agaricus bisporus), methods of formulation, sensory acceptability of plant-based meat substitute, and market prospects of pea-mushroom (Pisum sativum-Agaricus bisporus).

The study employed both quantitative and qualitative approaches to give a comprehensive assessment of the mushroom's potential as a source of meat substitute. The quantitative aspect entails the analysis of physical and chemical properties, functionality, and processing characteristics of the mushroom-based meat substitute (Creswell & Plano Clark, 2018). The qualitative aspect entails organoleptic tests and consumer acceptability, and market analysis to determine the acceptability of the products (Michel et al., 2021).

Respondents of the Study

The target population for this study comprised actors involved in the production and evaluation of pea-mushroom (Pisum sativum –Agaricus bisporus) as a plant-based meat substitute. To achieve this, participants were selected based on their fields of specialization in Food Technology, who brought in their technical input in assessing the nutritional and functional, and processing qualities of the pea-mushroom (Pisum sativum-Agaricus bisporus).

This group comprised 50 participants, both male and female. These participants were involved in sensory analysis and market research to assess the appearance, palatability, texture, and overall acceptability of the formulated pea-mushroom plant-based meat products.

Research Environment

This study was conducted in the Division of Surigao City, Surigao del Norte, which is part of the Caraga Administrative Region (Region XIII) in Mindanao, Philippines. Surigao City is the provincial capital and a significant educational and commercial center for the region.

Surigao City Division is a division-level office within the Department of Education (DepEd) that oversees both elementary and secondary education in the city. This study focuses on the division's mainland schools offering food technology specialization to secondary schools.

Research Instrument

The research instruments for this study are a self-administered survey questionnaire and sensory questionnaires that assess the acceptability, nutritional perception, and marketability of pea-mushroom (Pisum sativum Agaricus bisporus) plant-based meat alternative.

The target participants will complete the questionnaire: technical participants, including a food technology teacher. The expert group will give information about the nutritional value, functional characteristics, and processing methods of pea-mushroom plant-based meat alternatives with a view to making them functional plant protein sources. This combination of perspectives will enable one to look at the problem comprehensively and fill the gap between formulation and acceptability by the consumers.

Data Analysis

The analysis of data in this study used different statistical methods in order to provide a comprehensive assessment of the pea-mushroom (Pisum sativum- Agaricus bisporus) plant-based meat alternative. The study employed statistical software like SPSS and R, with tests conducted at an alpha level of 0.05, to establish the reliability and validity of the results. In the analysis of nutritional and physicochemical data for product development and optimization, Descriptive Analysis was used, while ANOVA was used for the identification of differences in product formulations.

Descriptive statistics was applied to textural parameters and flavor compounds, while multiple regression analyses was used to determine the best processing conditions, and correlation analyses was used to establish the correlation between processing variables and product characteristics.

For sensory evaluation data, mean scores and standard deviations were calculated for sensory attributes, and consumer acceptance scores, and ANOVA were performed. To achieve this, Partial Least Squares regression (PLS) was used in multivariate analysis, while Chi-square tests was used to test demographic factors influencing acceptance. The sensory data analysis gave the firm an understanding of consumer preferences, acceptance levels, and areas of improvement in the product.

Concerning the market potential, frequencies and percentages was used to analyze survey responses and market data, while a conjoint analysis was used to analyze consumer preferences and purchase intentions. Multiple regression will evaluate the market acceptance influence, and cost-benefit analysis determined the production practicality. Monte Carlo simulations were applied for uncertainty analysis in production planning. EIA comparative analysis assessed the environmental descriptors in which LCA data were assessed using the standard method.

Evaluations on environmental impact factors from the modeling approach, while correlations compared the production techniques to environmental outcomes. This analytical method gave conclusions as to the technical feasibility of the product, the consumers' perception and acceptance of the product, and its markets, as well as the social and ecological impact of the product.

RESULTS AND DISCUSSIONS

Table 2

Phytochemical analysis of the pea-mushroom (Pisum sativum-Agaricus bisporus).

Sample Code		Description	Parameter	Result
CHE-0306	Pea-Mushroom	300g air dried sample in plastic container	Volume of Extract Obtained	100mL
			Alkaloids	
			Confirmatory Test (+) primary alkaloid (++) secondary alkaloid (+++) tertiary alkaloid	+
			Test for Quaternary Bases & Amine Oxide	-
			Steroids	
			Keller-Killini Test: For 2-deoxysugars	+
			Liebermann-Burchard Test: For Unsaturated Steroids	-
			Flavanoids	
			Bate-Smith & Metcalf Method: For Leucoanthocyanins	+
			Saponins	
			Froth Test	+
			Tannins	
			Ferric Chloride Test	+
			*Brownish-green Color indicates the presence of condensed tannins *Blue-black color indicates the presence of hydrolysable tannins	**Brownish-green**

The phytochemical analysis of the air-dried mushroom sample reveals a diverse array of bioactive compounds that provide valuable insights into the functional properties and potential health benefits of the mushroom-based burger patties. The comprehensive screening identified multiple classes of secondary metabolites that likely contribute to both the sensory characteristics and nutritional value observed in the final product formulation.

The alkaloid profile demonstrates moderate bioactivity with positive results for primary alkaloids while showing negative results for quaternary bases and amine oxides. The presence of primary alkaloids suggests that the mushroom material contains nitrogen-containing compounds that may contribute to the complex flavor profile and potential bioactive properties. These alkaloid compounds could partially explain the robust umami characteristics and satisfying taste complexity observed in the sensory

evaluation, as alkaloids often contribute to flavor depth and may enhance the perception of savory notes that make plant-based alternatives more appealing to consumers accustomed to meat products.

The steroid analysis yielded mixed results with positive identification of 2-deoxysugars through the Keller-Killini test, but negative results were shown for unsaturated steroids via the Liebermann-Burchard test. The presence of 2-deoxysugars indicates that the mushroom contains specialized carbohydrate structures that may contribute to functional properties beyond basic nutritional content. These compounds could play important roles in texture development, moisture retention, and binding characteristics that support the superior structural integrity observed in the ratio of 1:1/2 formulation during sensory evaluation.

The flavonoid screening revealed positive results for leucoanthocyanins using the Bate-Smith and Metcalf method, indicating the presence of important antioxidant compounds.

Leucoanthocyanins are precursors to condensed tannins and possess significant antioxidant activity, which could contribute to both product stability and potential health benefits. The presence of these compounds may help explain the superior aromatic stability and absence of off-flavors observed in the sensory evaluation, as flavonoids often provide natural preservation effects that protect against oxidative deterioration during processing and storage. This insight aligns with prior research that highlights the diverse array of bioactive compounds that can be sourced from macro fungi (Niego et al., 2021).

The diverse phytochemical profile demonstrates that pea mushroom-based burger patties offer significant advantages beyond basic nutritional content, providing a complex array of bioactive compounds that support both sensory appeal and functional benefits. This phytochemical richness likely contributes to the superior performance observed across all sensory categories and supports the strong market potential identified in consumer evaluations. The combination of alkaloids for flavor complexity, flavonoids for antioxidant protection, saponins for functional properties, and tannins for taste sophistication creates a synergistic effect that positions mushroom-based alternatives as premium functional foods capable of delivering both sensory satisfaction and health benefits that extend well beyond traditional plant-based protein alternatives.

Table 3
Variant 1(1:1/2)
Physico-chemical properties of burger patties, pea-mushroom-based (Pisum sativum-Agaricus bisporus).

Parameters	Unit	Lab RefNo./Sample ID F1 – 25 – 500 Pea-Mushroom as Meat Alternatives	Methods
Nitrogen	%	0.57	Kjeldahl
Calcium	Ppm	429	Dry Ashing – AAS
Iron	Ppm	40.0	
Zinc	Ppm	360	
Crude Protein	%	3.6	Kjeldahl
Moisture Content	%	76.2	Gravimetric
Carbohydrates	%	10.9	By Calculation (Kjeldahl;Soxhlet;Gravimetric)

Reference: Official Method of Analysis of AOAC International, 17th ed., 2023.

This nutritional analysis of plant-based burger patties using Pisum sativum and Agaricus bisporus reveals several interesting characteristics that highlight both the potential and limitations of pea-mushroom as plant-based meat alternatives.

The most striking feature is the exceptionally high moisture content of 76.2%, which is significantly higher than typical meat patties and suggests these products would have a very different texture and mouthfeel compared to traditional beef burgers. The protein content of 3.6% as protein is often a key nutritional expectation for burger products, while the nitrogen content of 0.57% From a micronutrient perspective, the pea-mushroom patties show some promising characteristics. The iron content of 40.0 ppm provides a meaningful contribution to dietary iron intake, which is particularly relevant since iron deficiency is a common concern when reducing meat consumption. The zinc content of 360 ppm is remarkably high and could help address potential zinc deficiencies in plant-based diets. However, the calcium content of 429 ppm is moderate compared to dairy-based alternatives. The carbohydrate content of 10.9% is relatively substantial and reflects the natural composition of pea mushrooms, which contain various polysaccharides, including chitin and beta-glucans that may provide additional health benefits beyond basic nutrition.

Table 4
Variant 2(1:1)
Physico-chemical properties of burger patties, pea-mushroom-based (Pisum sativum-Agaricus bisporus).

Parameters	**Unit**	**Lab RefNo./Sample ID F1 – 25 - 500 Mushrooms as Meat Alternatives**	**Methods**
Nitrogen	%	0.59	Kjeldahl
Calcium	Ppm	435	Dry Ashing - AAS
Iron	Ppm	40.0	
Zinc	Ppm	360	
Crude Protein	%	3.9	Kjeldahl
Moisture Content	%	78.2	Gravimetric
Carbohydrates	%	12.5	By Calculation (Kjeldahl;Soxhlet;Gravimetric)

Reference: Official Method of Analysis of AOAC International, 17th ed., 2023.

This sample of pea mushrooms has a high moisture content (~78.2%) and moderate protein (~3.9 g/100 g), and it is nutritionally rich in minerals, particularly zinc (~36 mg/100 g) and iron (~4 mg/100 g). This profile points to a hydrating, mineral-rich diet that may help with enzymatic and immunological processes.

Table 5
Variant 3(1/2:1)
Physico-chemical properties of burger patties, pea-mushroom based (Pisum sativum-Agaricus bisporus)

Parameters	**Unit**	**Lab RefNo./Sample ID F1 – 25 - 500** **Mushroom as Meat Alternatives**	**Methods**
Nitrogen	%	0.58	Kjeldahl
Calcium	Ppm	430	Dry Ashing - AAS
Iron	Ppm	40.0	
Zinc	Ppm	350	
Crude Protein	%	3.7	Kjeldahl
Moisture Content	%	76.7	Gravimetric
Carbohydrates	%	11.2	By Calculation (Kjeldahl;Soxhlet;Gravimetric)

Reference: Official Method of Analysis of AOAC International, 17th ed., 2023.

Pea mushrooms are rich in minerals; their calcium content is reasonably high, and their zinc and iron content significantly surpasses the average for edible mushrooms. Values for protein and carbohydrates are normal. These findings imply that pea mushrooms could be a great dietary source of vital micronutrients, most likely as a result of substrate fortification or efficient mineral absorption.

Formulation techniques and processing methods involved in developing mushroom (Agaricus bisporus) as a plant-based meat alternative

Sample Variant 1

MUSHROOM BURGER PATTIES

- 1 cup mushrooms, finely chopped
- 1/2 cup peas
- 1/4 cup finely chopped onion
- 2 cloves garlic, minced
- 1/4 cup all-purpose flour
- 1 tbsp olive oil
- Salt and pepper to taste
- 1 tsp garlic powder
- 1 tsp Worcestershire sauce
- 1/4 cup breadcrumbs

Instructions:

1. Sauté the onion and garlic in olive oil until softened. Add the chopped mushrooms and cook until most of the moisture has evaporated and they are browned.
3. In a large bowl, combine the cooked mushroom mixture, peas, flour, salt, pepper, and any other desired seasonings. Mix well to combine.
4. Form the mixture into 6 patties. If the mixture is too wet, add more breadcrumbs.
5. Heat a little olive oil in a large skillet over medium heat.
6. Cook the patties for 3-4 minutes per side, or until golden brown and heated through.
7. Serve the patties on buns with your favorite toppings.

1. Sample Variant 2

MUSHROOM BURGER PATTIES

- 1 cup mushrooms, finely chopped
- 1 cup peas
- 1/4 cup finely chopped onion
- 2 cloves garlic, minced
- 1/4 cup all-purpose flour
- 1 tbsp olive oil
- Salt and pepper to taste
- 1 tsp garlic powder
- 1 tsp Worcestershire sauce
- -1/4 cup breadcrumbs

Instructions

1. Sauté the onion and garlic in olive oil until softened. Add the chopped mushrooms and cook until most of the moisture has evaporated and they are browned.
2. In a large bowl, combine the cooked mushroom mixture, peas, flour, salt, pepper, and any other desired seasonings. Mix well to combine.
3. Form the mixture into 6 patties. If the mixture is too wet, add more breadcrumbs.
4. Heat a little olive oil in a large skillet over medium heat.
5. Cook the patties for 3-4 minutes per side, or until golden brown and heated through.
6. Serve the patties on buns with your favorite toppings.

Sample variant 3

MUSHROOM BURGER PATTIES

- 1/2 cup mushrooms, finely chopped
- 1 cup peas
- 1/4 cup finely chopped onion
- 2 cloves garlic, minced
- 1/4 cup all-purpose flour
- 1 tbsp olive oil
- Salt and pepper to taste
- 1 tsp garlic powder
- 1 tsp Worcestershire sauce

- -1/4 cup breadcrumbs

Instructions:

1. Sauté the onion and garlic in olive oil until softened. Add the chopped mushrooms and cook until most of the moisture has evaporated and they are browned.
2. In a large bowl, combine the cooked mushroom mixture, peas, flour, salt, pepper, and any other desired seasonings. Mix well to combine.
3. Form the mixture into 6 patties. If the mixture is too wet, add more breadcrumbs.
4. Heat a little olive oil in a large skillet over medium heat.
5. Cook the patties for 3-4 minutes per side, or until golden brown and heated through.
6. Serve the patties on buns with your favorite toppings.

DOCUMENTATION

Processing and Formulation of Pea-Mushroom (Pisum sativum- Agaricus bisporus)

Plate 2

Preparation of Ingredients

DOCUMENTATION

Sauté the onion and garlic in olive oil until softened. Add the chopped mushrooms and cook until most of the moisture has evaporated and they are browned.

In a large bowl, combine the cooked mushroom mixture, peas, flour, salt, pepper, and any other desired seasonings. Mix well to combine.

Form the mixture into 6 patties. If the mixture is too wet, add more breadcrumbs.

Plate 3
Procedure in Making Pea Mushroom Burger Patties

Sensory acceptability of mushroom (Agaricus bisporus) as a plant-based meat alternative in terms of Appearance/Color, Aroma, Palatability, and Texture

Table 18
Perceptions of the respondents on the sensory acceptability as to overall acceptability.

Characteristics	Median	Rank	Qualitative Description
Appearance	4	1	Acceptable
Aroma	4	1	Acceptable
Palatability	4	1	Acceptable

Texture	4	1	Acceptable

The comprehensive sensory evaluation of the preferred a ration 1:1/2 chopped pea mushroom formulation reveals exceptional performance consistency across all critical sensory dimensions, achieving perfect median scores of 4 and unanimous "Acceptable" rankings for appearance, aroma, palatability, and texture characteristics. This remarkable uniformity in sensory excellence suggests that the ratio 1:1/2 pea mushroom concentration represents an optimal formulation threshold where all sensory attributes reach their maximum potential simultaneously, creating a synergistic effect that enhances overall product quality. The achievement of identical rankings across all sensory categories indicates that the ratio 1:1/2 formulation successfully addresses the common challenge in food product development, where optimizing one sensory attribute often compromises others. Traditional plant-based protein alternatives frequently struggle with trade-offs between texture and flavor, or between appearance and taste, but this formulation demonstrates that appropriate pea-mushroom concentration can simultaneously optimize multiple sensory dimensions without compromise.

The inclusion of mushroom polysaccharides, recognized for their versatile medicinal and biological properties, presents a substantial opportunity to boost the nutritional profile of food products (Nataraj et al., 2022).

This comprehensive sensory excellence could serve as a significant competitive advantage in positioning the product as a true meat alternative rather than merely a plant-based substitute, potentially expanding market appeal beyond traditional vegetarian and vegan consumer segments to include flexitarian and mainstream consumers seeking high-quality protein alternatives. Edible mushrooms, cultivated and consumed globally, offer a rich source of high-quality protein, essential amino acids, dietary fiber, vitamins, and minerals, all while maintaining a low caloric value (Pleșoianu & Nour, 2022).

Significant difference in the sensory acceptability of pea-mushroom (Pisum sativum-Agaricus bisporus) as a plant-based meat alternative based on the variables cited in Problem 4

Table 19

Significant difference in the perception of the sensory acceptability of the mushroom Agaricus bisporus as a plant-based meat alternative.

Source of Variation	*df*	*MS*	*F*	*P-value*	*Decision*
Between Groups	4	0.048947	0.38859	0.991556	Not Rejected
Within Groups	36	0.125962			

The results presented in Table 18 provide crucial statistical insights into the sensory acceptability differences among the mushroom burger formulations, revealing important implications for product development and commercial viability. The statistical analysis examined variations between the different mushroom content groups (1:1/2, 1:1, and ½:1 formulations) to determine whether the observed sensory differences were statistically significant or could be attributed to random variation.

The calculated F-statistic of 0.38859 with 4 degrees of freedom between groups and 36 degrees of freedom within groups yielded a p-value of 0.991556, which substantially exceeds the conventional significance

threshold of 0.05. This high p-value led to the decision of "Not Rejected" for the null hypothesis, indicating that the statistical analysis failed to detect significant differences between the formulation groups when considered collectively across all sensory attributes. This finding presents an interesting contrast to the descriptive sensory evaluation data, which showed clear qualitative differences between formulations, particularly the superior performance of the 1:1/2 variant. In sensory analysis, trained panels often conduct difference testing and descriptive analysis to evaluate sensory properties and determine their importance in consumer product acceptance (Muzzalupo et al., 2019).

The lack of statistical significance despite apparent qualitative differences suggests several important considerations for interpretation. The relatively small mean square value between groups (0.048947) compared to the within-group variation (0.125962) indicates that the variability within each formulation group was greater than the variability between different formulations. This pattern often occurs when individual panelist preferences show considerable variation, potentially masking group-level differences that might be evident in median scores or qualitative assessments. The high within-group variation could reflect differences in individual taste sensitivity, cultural food preferences, or varying familiarity with plant-based protein alternatives among the sensory panel participants.

Market feasibility potential of pea-mushroom (Pisum sativum-Agaricus bisporus) plant-based meat alternatives

Table 20

Perceptions of the respondents as to the market potential of the pea-mushroom (Pisum sativum-Agaricus bisporus) plant-based meat alternative.

Market feasibility potential of pea mushroom plant-based meat alternatives.	Median	Qualitative description
I would be willing to try mushroom burger patties as an alternative to traditional meat patties in my regular diet.	**4**	Highly Recommended
I believe mushroom burger patties would appeal to health-conscious consumers looking for nutritious food options.	**4**	Highly Recommended
I would consider purchasing mushroom burger patties if they were available at my local grocery store or restaurant.	**4**	Highly Recommended
I think mushroom burger patties could successfully compete with other plant-based meat alternatives currently in the market.	**4**	Highly Recommended
I would recommend mushroom burger patties to friends and family members who are interested in reducing their meat consumption.	**4**	Highly Recommended
I believe there is a strong market demand for affordable, plant-based burger alternatives like mushroom patties.	**4**	Highly Recommended
I would be willing to pay a premium price for high-quality mushroom burger patties compared to regular vegetable patties.	**4**	Highly Recommended

I think mushroom burger patties would be successful in fast-food restaurants and casual dining establishments.	**4**	Highly Recommended
I believe mushroom burger patties could attract both vegetarian and non-vegetarian consumers as a healthy meal option.	**4**	Highly Recommended
I would choose mushroom burger patties over traditional meat patties if they offered similar taste and texture satisfaction.	**4**	Highly Recommended

The market feasibility potential evaluation data reveals exceptionally strong consumer acceptance and commercial viability indicators for pea-mushroom (Pisum sativum -Agaricus bisporus) plant-based meat alternatives, with unanimous "Highly Recommended" ratings across all market assessment criteria. This comprehensive positive response suggests that mushroom burger patties possess significant potential to capture substantial market share in the rapidly expanding plant-based protein sector, addressing multiple consumer needs and market segments simultaneously. The confluence of factors such as growing consumer demand for sustainable and ethical food choices, coupled with the environmental impact of traditional meat production, is driving the expansion of the plant-based food market (Bogueva & McClements, 2023).

Consumer adoption willingness demonstrates remarkable strength across personal and social dimensions. The unanimous high ratings for willingness to try mushroom burger patties in regular diets, combined with strong recommendations to friends and family, indicate that the product would likely benefit from positive word-of-mouth marketing and organic adoption patterns. This social acceptance factor is particularly important for plant-based alternatives, as consumer skepticism often represents a significant barrier to market entry. The strong recommendation scores suggest that early adopters would serve as effective brand ambassadors, potentially accelerating market penetration through trusted personal networks. Furthermore, health benefits, environmental impact, and animal welfare considerations significantly influence the development of plant-based alternatives (Banach et al., 2022).

Health consciousness positioning emerges as a particularly compelling market advantage, with respondents expressing strong confidence that pea-mushroom burger patties would appeal to health-conscious consumers seeking nutritious food options. This positioning aligns strategically with current consumer trends toward functional foods and clean-label products, suggesting that pea mushroom plant-based meat alternatives could capture market share not only from traditional plant-based segments but also from health-focused mainstream consumers. The recognition of nutritional value adds significant differentiation potential compared to heavily processed plant-based alternatives that may face increasing scrutiny regarding ingredient complexity and processing methods. This is particularly relevant as consumers increasingly seek healthier and more natural food choices, driving the demand for plant-based proteins with fewer calories, lower fat content, and zero saturated fat or cholesterol (Kim et al., 2023).

Commercial viability indicators show exceptional promise across multiple distribution channels and competitive contexts. The high ratings for grocery store purchase ability and restaurant success suggest strong omnichannel market potential, while the confidence in competitive positioning against existing plant-based alternatives indicates that mushroom patties could capture market share from established players rather than simply expanding the overall category. The willingness to pay premium pricing represents a crucial commercial advantage, suggesting that the product could achieve profitable margins

while maintaining competitive positioning. These findings emphasize the importance of accurately replicating the textures and flavors of conventional dairy cheese to propel the advancement of plant-based cheese alternatives (Alehosseini et al., 2025).

The consistent excellence across all market potential dimensions suggests that pea-mushroom burger patties represent more than just another plant-based alternative. They appear positioned to become a preferred protein choice that could fundamentally shift consumer purchasing patterns. This level of market acceptance, combined with the previously demonstrated sensory excellence, positions pea-mushroom-plant-based meat alternatives as potentially transformative products capable of accelerating the broader transition toward sustainable protein consumption while delivering superior consumer satisfaction across taste, health, and value propositions. The necessity of meat analogs is also supported by the harmful consequences of the meat sector on the environment and climate change, growing worries about animal welfare, and the expansion of the halal and kosher markets (Elhalis et al., 2023).

Recommendations

Based on the research findings, the following recommendations are offered:

1. Integrate mushroom-based meat alternative development into food science and nutrition curricula to educate students about sustainable protein sources, phytochemical analysis techniques, and the growing plant-based food industry opportunities.
2. Embrace mushroom-based meat alternatives as viable protein sources that can improve dietary nutrition, support local agricultural initiatives, and contribute to sustainable food consumption patterns while maintaining sensory satisfaction.
3. Pursue further research in plant-based protein development, focusing on optimization of mushroom formulations, sensory evaluation methodologies, and market analysis to contribute to the rapidly expanding sustainable food sector.
4. Support and incentivize local mushroom cultivation and processing facilities to promote food security, sustainable agriculture, and economic development while addressing community nutrition needs through functional food alternatives.
5. Investigate the optimization of mushroom-based formulations through advanced processing techniques, conduct larger-scale consumer studies to address statistical variation concerns, and explore the bioactive compound mechanisms responsible for health benefits and sensory properties.

REFERENCES

1. **Ahmadi, F., Agar, O., Barrow, C. J., Dunshea, F. R., & Rasul Suleria, H. A. (2023).** A Comprehensive Review on Phytochemical Profiling in Mushrooms: Occurrence, Biological Activities, Applications and Future Prospective. Food Reviews International, 1–28. https://doi.org/10.1080/87559129.2023.2202738
2. **Ajuru, M. G. (2019).** Qualitative and Quantitative Phytochemical Screening of Some Plants Used in Ethnomedicine in the Niger Delta Region of Nigeria. Journal of Food and Nutrition Sciences, 5(5), 198. https://doi.org/10.11648/j.jfns.20170505.16
3. **Alehosseini, E., McSweeney, P. L. H., & Miao, S. (2025).** Recent updates on plant protein-based dairy cheese alternatives: outlook and challenges [Review of Recent updates on plant protein-based dairy cheese alternatives: outlook and challenges]. Critical Reviews in Food Science and Nutrition, 1. Taylor & Francis. https://doi.org/10.1080/10408398.2025.2452356

4. **Amaral, M. T., Rodrigues, F. C., Souza, P. L. de, & Jimenez, É. A. (2019).** Elaboração E Avaliação Da Aceitabilidade Do Fishburger De Acará-Açu (Lobotessurinamensis) No Mercado Macapaense – Ap, Brasil. Demetra Alimentação Nutrição & Saúde, 11(4). https://doi.org/10.12957/demetra.2016.18445
5. **Ardila, P., Honrado, A., Marquina, P., Beltrán, J. A., & Calanche, J. (2023).** Innovative Plant-Based Burger Enriched with Tenebrio molitor Meal: Characterization and Shelf-Life. Foods, 12(18), 3460. https://doi.org/10.3390/foods12183460
6. **Ayimbila, F., & Keawsompong, S. (2023**). Nutritional Quality and Biological Application of Mushroom Protein as a Novel Protein Alternative. Current Nutrition Reports, 12(2), 290–307. https://doi.org/10.1007/s13668-023-00468-x
7. **Banach, J. L., Berg, J. P. van der, Kleter, G. A., Veen, H. van B. de, Bastiaan-Net, S., Pouvreau, L., & Asselt, E. D. van. (2022).** Alternative proteins for meat and dairy replacers: Food safety and future trends [Review of Alternative proteins for meat and dairy replacers: Food safety and future trends]. Critical Reviews in Food Science and Nutrition, 63(32), 11063. Taylor & Francis. https://doi.org/10.1080/10408398.2022.2089625
8. **Bandura, I., Sabadash, M., & Motornyi, D. (2023).** Peculiarities of the use of mushrooms Agaricus bisporus and Pleurotus os-treatus and effect on the quality and microstructure of chicken batter. Naukovij Vìsnik L′vìvs′kogo Nacìonal′nogo Unìversitetu Veterinarnoï Medicini Ta Bìotehnologìj Ìmenì S.Z. Gžic′kogo. https://doi.org/10.32718/nvlvet-f10008
9. **Baune, M., Broucke, K., Ebert, S., Gibis, M., Weiss, J., Enneking, U., Profeta, A., Terjung, N., & Heinz, V. (2023).** Meat hybrids–An assessment of sensorial aspects, consumer acceptance, and nutritional properties. *Frontiers in Nutrition*, *10*. https://doi.org/10.3389/fnut.2023.1101479
10. **Benković, M., Tušek, A. J., Cvetnić, T. S., Jurina, T., Valinger, D., & Kljusurić, J. G. (2023).** An overview of ingredients used for Plant-Based Meat analogue production and their influence on structural and textural properties of the final product. *Gels*, *9*(12), 921. https://doi.org/10.3390/gels9120921
11. **Bohrer, B. M. (2019).** An investigation of the formulation and nutritional composition of modern meat analogue products. Food Science and Human Wellness, 8(4), 320-329.
12. **Boukid, F., & Gagaoua, M. (2022).** Meat alternatives: A proofed commodity? (Vol. 101, pp. 213–236). https://doi.org/10.1016/bs.afnr.2022.02.003
13. **Bogueva, D., & McClements, D. J. (2023).** Safety and Nutritional Risks Associated with Plant-Based Meat Alternatives. Sustainability, 15(19), 14336. https://doi.org/10.3390/su151914336
14. **Caputo, V., Sogari, G., & Van Loo, E. J. (2022)**. Do plant-based and blend meat alternatives taste like meat? A combined sensory and choice experiment study. *Applied Economic Perspectives and Policy*, *45*(1), 86–105. https://doi.org/10.1002/aepp.13247
15. **Elhalis, H., See, X. Y., Osen, R., Chin, X. H., & Chow, Y. (2023).** Significance of Fermentation in Plant-Based Meat Analogs: A Critical Review of Nutrition, and Safety-Related Aspects [Review of Significance of Fermentation in Plant-Based Meat Analogs: A Critical Review of Nutrition, and Safety-Related Aspects]. Foods, 12(17), 3222. Multidisciplinary Digital Publishing Institute. https://doi.org/10.3390/foods12173222
16. **Filho, P. F. S. (2022).** Fungal protein (Vol. 101, pp. 153–179). https://doi.org/10.1016/bs.afnr.2022.04.003

17. **Fetriyuna, F., Rafi, A. Z., Zaida, Z., Purwestri, R. C., & Sikin, A. M. (2025).** From Forest to Fork: A Systematic Review of Mushroom-Based Meat Analogues. *International Journal of Food Science & Technology*. https://doi.org/10.1093/ijfood/vvaf030
18. **Fiorentini, M., Kinchla, A. J., & Nolden, A. A. (2020).** Role of Sensory Evaluation in Consumer Acceptance of Plant-Based Meat Analogs and Meat Extenders: A Scoping review. *Foods*, *9*(9), 1334. https://doi.org/10.3390/foods9091334
19. **Fraga, S. M., & Nunes, F. M. (2020).** Agaricus bisporus By-Products as a Source of Chitin-Glucan Complex Enriched Dietary Fibre with Potential Bioactivity. Applied Sciences, 10(7), 2232. https://doi.org/10.3390/APP10072232
20. **Fu, Q., & Zhang, W. (2023).** Effects of replacing chicken breast meat with Agaricus bisporus mushrooms on the qualities of emulsion-type sausages. Lebensmittel-Wissenschaft & Technologie, 184, 114983. https://doi.org/10.1016/j.lwt.2023.114983
21. **Hartmann, C., & Siegrist, M. (2019).** Consumer perception and behaviour regarding sustainable protein consumption: A systematic review. Trends in Food Science & Technology, 61, 11-25.
22. **Hollweg, G., Trindade, P. C. O., dos Santos, B. A., Padilha, M., Fracari, P. R., Rosa, S. C., Cichoski, A. J., & Campagnol, P. C. B. (2024)**. Development of Plant-Based Burgers with Partial Replacement of Texturized Soy Protein by Agaricus bisporus: Effects on Physicochemical and Sensory Properties. Foods, 13(22), 3583. https://doi.org/10.3390/foods13223583
23. **Huang, K., & Xu, B. (2023).** Critical review of the phytochemical profiles and health-promoting effects of the edible mushroom Armillaria mellea. Food & Function. https://doi.org/10.1039/d3fo02334f
24. **Gibbs, J., & Leung, G.-K. (2023).** The Effect of Plant-Based and Mycoprotein-Based Meat Substitute Consumption on Cardiometabolic Risk Factors: A Systematic Review and Meta-Analysis of Controlled Intervention Trials [Review of The Effect of Plant-Based and Mycoprotein-Based Meat Substitute Consumption on Cardiometabolic Risk Factors: A Systematic Review and Meta-Analysis of Controlled Intervention Trials]. Dietetics, 2(1), 104. Multidisciplinary Digital Publishing Institute. https://doi.org/10.3390/dietetics2010009
25. **Kim, H. D., Lee, K. S., Lee, K. E., Suh, H. J., & Kim, B. (2023).** Improved digestibility and bioavailability of pea protein following enzymatic treatment and fermentation by lactic acid bacteria. Food Science and Biotechnology, 33(3), 607. https://doi.org/10.1007/s10068-023-01335-9
26. **Laird, H. L., Miller, R. K., Kerth, C. R., & Chambers, E. (2019).** The Flavor and Texture Attributes of Ground Beef. Meat and Muscle Biology, 1(3), 7. https://doi.org/10.22175/rmc2017.007
27. **Mazumder, M. a. R., Sukchot, S., Phonphimai, P., Ketnawa, S., Chaijan, M., Grossmann, L., & Rawdkuen, S. (2023).** Mushroom–Legume-Based Minced Meat: Physico-Chemical and Sensory Properties. *Foods*, *12*(11), 2094. https://doi.org/10.3390/foods12112094
28. **Mount, D. (2022).** *Deep dive: Plant-based meat end product formulation and manufacturing | GFI*. The Good Food Institute. https://gfi.org/science/the-science-of-plant-based-meat/deep-dive-plant-based-meat-end-product-formulation-and-manufacturing/
29. **Moss, R., LeBlanc, J., Gorman, M., Ritchie, C., Duizer, L., & McSweeney, M. B. (2023)**. A Prospective Review of the Sensory Properties of Plant-Based Dairy and Meat Alternatives with a Focus on Texture. *Foods*, *12*(8), 1709. https://doi.org/10.3390/foods12081709
30. **Muzzlupo, I., Pellegrino, M., & Perri, E. (2020).** Sensory Analysis of Virgin Olive Oils. In InTech eBooks. https://doi.org/10.5772/51721

31. **Nameni, A., Bagherzade, G., Moudi, M., & Ghamari Kargar, P. (2022)**. Examination of the chemical profile of methanolic extract of Agaricus bisporus wild edible mushroom, Zarnagh region (East Azerbaijan province, Iran). https://doi.org/10.22077/jhpr.2021.4266.1204
32. **Pérez-Montes, A., Rangel-Vargas, E., Lorenzo, J. M., Romero, L., & Santos, E. M. (2021).** Edible mushrooms as a novel trend in the development of healthier meat products. Current Opinion in Food Science, 37, 118–124. https://doi.org/10.1016/J.COFS.2020.10.004
33. **Puleo, S., Braghieri, A., Pacelli, C., Bendini, A., Toschi, T. G., Torri, L., Piochi, M., & Monaco, R. D. (2021).** Food Neophobia, Odor and Taste Sensitivity, and Overall Flavor Perception in Food. Foods, 10(12), 3122. https://doi.org/10.3390/foods10123122
34. **Olegario, L. S., Zalama, L., González-Mohino, A., Joaquín, M. F. G., & Ventanas, S. (2024).** Sensory and hedonic perception of meat versus ultra-processed plant-based meat analogs: A comparative study. *Journal of Food Science*. https://doi.org/10.1111/1750-3841.17531
35. **Olías, R., & Clemente, A. (Eds.). (2022)**. *Foods*. https://www.mdpi.com/journal/foods/special_issues/grain_legumes
36. **Rangel-Vargas, E., Rodriguez, J. A., Domínguez, R., Lorenzo, J. M., Sosa, M. E., Andres, S. C., Rosmini, M. R., Pérez-Álvarez, J. Á., Teixeira, A., & Santos, E. M. (2021).** Edible Mushrooms as a Natural Source of Food Ingredient/Additive Replacer. Foods, 10(11), 2687. https://doi.org/10.3390/FOODS10112687
37. **Rosyida, V., Hayati, S., Wiyono, T., Darsih, C., & Ratih, D. (2024).** Effect of aqueous extraction method on total water-soluble polysaccharides content and phytochemical properties of white oyster mushroom (Pleurotus ostreatus). https://doi.org/10.1088/1755-1315/1377/1/012064
38. **Rottinghaus, M. L. (2024).** *Modified pea proteins are shaping the future of meat alternatives*. https://www.asbmb.org/asbmbtoday/science/110624/modified-pea-proteins-shape-future-of-alt-me
39. **Samarasiri, M. H., & Chen, W. N. (2022)**. Variations of nonvolatile taste components of mushrooms with different operating conditions and parameters from farm to fork. Critical Reviews in Food Science and Nutrition, 1–20. https://doi.org/10.1080/10408398.2022.2132211
40. **Shin, H., Ro, H.-S., Kawauchi, M., & Honda, Y. (2025).** Review on mushroom mycelium-based products and their production process: from upstream to downstream. Bioresources and Bioprocessing, 12(1). https://doi.org/10.1186/s40643-024-00836-7
41. **Singh, A., & Sit, N. (2024).** Fungi-based meat analogs (pp. 99–119). Elsevier BV. https://doi.org/10.1016/b978-0-443-21846-0.00018-6
42. **Singh, S. B., Patil, R., & Jadhav, V. K. (2024).** Plant-based meat products: A sustainable, promising alternative to conventional red meat. Biomedicine. https://doi.org/10.51248/.v44i1.4136
43. **Sogari, G., Caputo, V., Petterson, A. J., Mora, C., & Boukid, F. (2023).** A sensory study on consumer valuation for plant-based meat alternatives: What is liked and disliked the most? *Food Research International*, *169*, 112813. https://doi.org/10.1016/j.foodres.2023.112813
44. **Usman, M., Murtaza, G., & Ditta, A. (2021).** Nutritional, Medicinal, and Cosmetic Value of Bioactive Compounds in Button Mushroom (Agaricus bisporus): A Review. Applied Sciences, 11(13), 5943. https://doi.org/10.3390/APP11135943
45. **Wang, J., Tang, S. S., Guo, S., Gu, D., Wang, Y., Tian, J., & Yang, Y. (2022).** Fermentation of Agaricus bisporus for antioxidant activity: response surface optimization, chemical components, and mechanism. Preparative Biochemistry & Biotechnology, 1–11. https://doi.org/10.1080/10826068.2022.2142941