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Consumers' Acceptability of Vegan-meatball Varieties as Commercial Meatballs

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ABSTRACTS

This study aimed to learn about the level of acceptability of plant-based meatballs in terms of food quality and to determine whether there is a significant difference in the overall acceptability of each formulation developed. The production was set up using the study's product formulation, and a quantitative-descriptive research design was employed. To evaluate the products, respondent-consumers were chosen randomly near the residences in Sultan Kudarat province. After the three formulations were prepared according to a specific procedure, these respondents tasted and evaluated the vegan meatballs. The results revealed that each food quality of the three formulations received a high level of acceptability, with formulation 1 having the highest computed mean and low standard deviation, followed by formulations 3 and 2, respectively. The ANOVA results have also suggested that the overall acceptability of the three formulations has no significant difference, which results in accepting the null hypothesis tested. This study concluded that the food quality of the three vegan-meatball formulations in terms of appearance, taste, aroma, texture, and overall acceptability received a high level of acceptability as an alternative to commercial meatballs. There is also no significant difference in the overall acceptability of the three formulations. Lastly, formulation 1 is the most preferred vegan-meatballs substitute.

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1. INTRODUCTION

Throughout history, humans have considered meat an essential part of their diet. Meats are believed to be the most often consumed and preferred food, particularly among youths, leading to a disregard for vegetables. Globally, beef, pork, and chicken products are the highest in demand, with the United States and Australia topping the charts for the highest annual meat consumption (Mudrak *et al.,* 2019). Although meat is an important source of nutrients, it is also evident that a great consumption of this source of proteins also has a negative environmental impact, as well as eating too much meat could be bad for the health and can result in health concerns such as obesity.

Considering the concerns about the environmental sustainability of the global food supply, the human health effects of meat consumption, and animal welfare ethics that have been increasing for decades, there has been a growing interest in the development and production of plant-based meat. Lee *et al.* (2020) study defined plant-based meat as made from plants designed and created to look like, taste like, and cook like conventional meat. While earlier products like tofu and seitan were meant to replace meat, newer products are trying to mimic its taste, texture, smell, and appearance.

Moreover, this way of eating has significantly impacted the Philippines, with an increasing number of vegan options accessible in supermarkets from both small enterprises and larger corporations, such as Beyond Meat. However, there are not as many plant-based meats products created in the Philippines as there are in other countries. Furthermore, no research has been conducted into the acceptability of the food quality of plant-based meat in the Sultan Kudarat province.

As a result, we were encouraged to make vegan meatballs, learn about the level of acceptability of plant-based meat, particularly meatballs, specifically in terms of food quality, and establish whether there is a significant difference in the overall acceptability of each formulation.

2. METHODS

2.1 Research design

This is a quantitative-descriptive study in which measurable data from a population sample is collected for statistical analysis. The descriptive research method is concerned with describing the characteristics of a demographic segment rather than explaining why a particular phenomenon occurs (Atmowardoyo, 2018). As a result, this study produced vegan meatballs, evaluated the acceptability of its food quality, and compared the overall acceptability of each formulation.

2.2 Respondents of the study

Twenty (20) people evaluated the food quality of plant-based meatballs in terms of their appearance, taste, aroma, texture, and overall acceptability. Due to limited mobility as a result of the pandemic, the respondents were randomly chosen from local barangays in the Philippines.

2.3 Preparation of ingredients

The ingredients were obtained from the local market near the residence. After acquiring the materials, we performed the meatball procedure based on the designed treatment of the study.

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2.4 Meatball-making procedure

After the preparations, these were the steps to make plant-based meatballs: (1) take all of the ingredients that have been prepared, and (2) combine everything in a medium-sized mixing bowl. Next, (3) to make a thick but slightly wet, chunky batter, mix all ingredients in the mixing bowl, then (4) roll the batter into even-sized balls with a small ice cream scoop and place them on a tray. (5) Preheat the frying pan and then pour in some oil. After that, (6) when the oil is hot, drop in the molded balls and cook until done. Once cooked, (7) it is ready for the respondents to taste.

2.5. Statistical analysis

The Single-factor analysis of variance, also known as One-way ANOVA, was used for this study to determine whether there are any statistically significant differences between the means of two or more independent or unrelated groups (Kim, 2017).

3. RESULTS AND DISCUSSION

Table 1 provides the evaluators' ratings of the three formulations in terms of appearance. The size, shape, color, structure, transparency or turbidity, dullness or gloss, and degree of wholesomeness or damage all contribute to a food's appearance. Radulescu *et al.* (2021) defined appearance as all observable attributes resulting from interactions between a substance or object and its surroundings as seen by a human observer. According to Nwachukwu (n.d.), the appearance and presentation of food are equally as important as the taste and flavor of a dish. The appearance of the three formulations is determined to be extremely similar using the 5-point hedonic scale, with a verbal description of "like very much," implying that they are widely accepted by the evaluators, with formulations 1 and 3 having the highest mean of 4.85 and the lowest SD of 0.37, followed by formulation 2 with a mean of 4.50 and an SD of 0.61. Considering the means at the table, all three product formulations' food quality is appetizing and extremely acceptable. The products were well-made and had great attention to detail, which certainly passed as an alternative to meat products for the evaluators. There are no studies that contradict or are similar to this conclusion; nevertheless, the research of Cordelle *et al.* (2022) determined that for meat substitutes to be accepted by non-vegetarian customers, they must fit into the meal; thus, the shape and appearance appear to be significant. This means that the product's appearance has a major role in the acceptance of the product.

Table 1. Summary of appearance as rated by evaluators.

Formulations	Mean	SD	Verbal Description
F1	4.85	0.37	Highly acceptable
F2	4.50	0.61	Highly acceptable
F3	4.85	0.37	Highly acceptable

Highlighted taste as the sense by which the brain distinguishes the chemical characteristics of food in the mouth based on information presented by the taste buds. **Table 2** presents the taste evaluations for the three formulations, with a "highly acceptable" description based on the mean interpretation. As can be seen, formulation 3 has the highest mean, 4.65, followed by formulations 1 and 2, which have mean values of 4.55 and 4.25, respectively. As can be seen, formulation 3, with a mean of 4.65, has the highest mean, followed by formulation 1, with a mean of 4.55, and formulation 2, with a mean of 4.25. Looking back to the mean

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interpretations, it has been shown that the food quality of all three product formulations in terms of taste is delectable and extremely acceptable. The product proved to be well-made and to have excellent attention to detail so that it can certainly pass as an alternative to meat products.

Table 2. Summary of taste as rated by evaluators.

Formulations	Mean	SD	Verbal Description
F1	4.55	0.51	Highly acceptable
F2	4.25	0.79	Highly acceptable
F3	4.65	0.58	Highly acceptable

As most people know, the aroma can be synonymous with odor and smell. Cariño (2018) defined aroma as the sensation experienced when volatile substances are inhaled through the nose. **Table 3** shows that the aromas of the three formulations were highly rated by the evaluators, with a "highly acceptable" description based on the mean interpretation. Furthermore, it has the highest computed mean, specifically in formulation 1, with a mean of 4.90, close to 5.00, indicating that evaluators prefer its aroma. Formulations 2 and 3, on the other hand, both had a mean of 4.70, trailing only Formulation 1. Therefore, the result indicates that most of the evaluators gave a numerical rating of 5 (4.21–5.00), making all three formulations' food quality in terms of aroma extremely appetizing and extremely acceptable. The result shown cannot currently be compared to any research; however, Ouyang *et al.* (2018) suggested that aromas significantly influence how people perceive food. Additionally, studies have demonstrated that the flavor modality—which encompasses both aroma and taste—increases the feeling of fullness, stifles appetite, and lowers food consumption (Bolhuis & Forde, 2020).

Table 3. Summary of aroma as rated by evaluators.

Formulations	Mean	SD	Verbal Description
F1	4.90	0.30	Highly acceptable
F2	4.70	0.57	Highly acceptable
F3	4.70	0.57	Highly acceptable

Pellegrino *et al.* (2021) described the texture as the characteristics of food experienced through oral and manual contact. Michel *et al.* (2020) study shows that frequent meat alternative consumers are the main source of positive reactions to meat substitutes. Regular consumers of meat alternatives rated them as better than meat when asked to rate the texture of the two options; moderate users of meat alternatives gave balanced ratings but were more complimentary of meat; and non-users of meat alternatives rated meat as significantly superior to meat alternatives (Michel *et al.,* 2021). As shown in **Table 4**, the textures of all three formulations were described as "highly acceptable" according to the means' interpretation. As a result, despite being rated by non-users of meat alternatives, all three formulations are highly rated. This result shows that all three product formulations' food quality in terms of their texture is appetizing and extremely acceptable.

Food's overall acceptability is determined by both the product's sensory quality and the consumer's attitude toward the food. In the current study, the evaluators described the overall acceptability of the three formulations, as shown in **Table 5**, as "highly acceptable," with formulation 1 having the highest mean of 4.65, indicating that it is the most acceptable formulation, followed by formulation 3 with a mean of 4.50, and formulation 2 with a mean of 4.45, indicating a.05 difference from formulation 3 and a.20 difference from formulation

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1. Given that the food quality of all three product formulations also has a numerical rating of 5 (4.21–5.00), the products can be deemed extremely appetizing and acceptable. Overall, the product was created with great effort and given attention to every detail. This indicates that all three formulations passed as an alternative to meat products. There are only a few studies to refer to, and no similarities or differences are found in any of them. According to He *et al.* (2020) research, consumers have a low acceptance level for most plant-based meat substitutes. The elements that affect consumer attitudes toward these substitutes can be classified into personal and product-related factors, such as sensory effects.

Table 4. Summary of texture as rated by evaluators.

Formulations	Mean	SD	Verbal Description
F1	4.60	0.59	Highly acceptable
F2	4.60	0.50	Highly acceptable
F3	4.57	0.59	Highly acceptable

Table 5. Summary of texture as rated by evaluators.

Formulations	Mean	SD	Verbal Description
F1	4.65	0.58	Highly acceptable
F2	4.45	0.69	Highly acceptable
F3	4.50	0.61	Highly acceptable

With a significance level of 0.05, the analysis of variance reveals whether or not there is a significant difference between all the results (**Table 6**). The null hypothesis will be rejected if the p-value is lower than the significance level of 0.05. Since the ANOVA table indicates that the p-level is 0.580613, which is greater than 0.05, the null hypothesis was accepted. This suggests that there is no significant difference between the overall acceptability of the three formulations.

Table 6. ANOVA table.

Source of Variation	SS	Df	MS	F	P-value	Decision
Between Groups	0.433333	2	0.216667	0.548889	0.580613	Accept null hypothesis
Within Groups	22.50000	57	0.394737			
Total	22.93333	59				

4. CONCLUSION

Each of the twenty chosen evaluators has rated the food quality of the three formulations highly in terms of its appearance, taste, aroma, texture, and overall acceptability. Thus, each food quality of the vegan meatball received a high level of acceptability. Considering the ANOVA results, we conclude that there is no significant difference between the overall acceptability of the three formulations. Therefore, this suggests that the null hypothesis under test was accepted. Overall, we conclude that each food quality of the three formulations is highly accepted. Formulation 1 had the highest ratings, followed by formulation 3, and lastly, formulation 2, indicating that formulation 1 is the most preferred vegan-meatball substitute.

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