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Nutritional analysis and marketability analysis of strawberry enriched yogurt as influence by the type of yogurt used as a requirement in Master of Arts in Technical-Vocational Studies (MATVS)

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Abstract: This study investigated the physicochemical properties and marketability of strawberry-enriched yogurt formulated using three different yogurt bases: plain yogurt, Greek yogurt, and plant-based yogurt. Yogurt's nutritional profile and consumer acceptability were known to be influenced by its base ingredients, especially when combined with nutrient-rich fruits like strawberries. The research aimed to assess how the type of yogurt used affects the product's nutritional composition, sensory characteristics, production cost, and consumer preference. An experimental research design was employed, involving the preparation of strawberry-enriched yogurt samples followed by laboratory-based physicochemical analysis and consumer acceptability testing. The key findings revealed that the Greek yogurt variant exhibited the highest protein and energy content, affirming its superior nutritional quality, followed by plain yogurt. The plant-based yogurt demonstrated the lowest nutritional values. In terms of production cost, the Greek yogurt variant was the most expensive due to the use of premium ingredients, whereas the plant-based variant was the most cost-efficient. However, this cost-effectiveness did not translate into higher consumer approval. Sensory evaluation results indicated that the Greek yogurt variant was the most preferred in terms of taste, texture, and perceived health benefits, while the plant-based option received the least favorable ratings. The study concluded that the type of yogurt base is crucial in determining the quality and market appeal of strawberry-enriched yogurt. These results served as guidance for food product developers aiming to balance nutritional quality, affordability, and consumer satisfaction in functional dairy products.

Keywords: Strawberry-enriched yogurt, Greek yogurt, Marketability, Consumer acceptability, Nutritional value

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INTRODUCTION

Physicochemical analysis of yogurt is important in determining the quality and consistency of any final product. These attributes are important in assessing the product's shelf life, safety, and overall sensory characteristics, which play a significant role in consumer choice. Additionally, marketability analysis examines the product's potential for consumer acceptance, taking into account aspects such as flavor, texture, and health benefits, all of which are influenced by the yogurt base and its interactions with strawberry components.

Yogurt, a popular dairy product known for its health benefits, has evolved into various formulations to cater to different consumer preferences and dietary needs. Among these innovations, fruit-enriched yogurts, such as strawberry yogurt, have gained significant attention due to their nutritional benefits and appealing flavor profiles. Strawberries, a rich source of antioxidants, vitamins, and dietary fiber, are often combined with yogurt to enhance their taste and nutritional value. However, the type of yogurt used as a base in strawberry-enriched yogurt formulations can influence not only its physicochemical properties but also its marketability and consumer acceptance.

This study aimed to explore how different types of yogurts, whether plain, low-fat, or plant-based, affect the physicochemical properties of strawberry-enriched yogurt and, consequently, its marketability. Through the examination of these factors, the research intended to provide valuable insights into the optimal formulation of strawberry-enriched yogurt, thus contributing to both product development and marketing strategies in the dairy industry.

The demand for food products that are both healthier and more creative has significantly increased in recent years. The exploration of functional foods that offer both nutritional benefits and taste satisfaction has been inspired by the shift in consumer preferences. The development of fruit-enriched dairy products, which combine the natural goodness of fruits with the nutritional benefits of dairy, is an example of innovation.

The importance of maintaining a healthy lifestyle is increasing, which makes consumers value food's nutritional content more. Food is now viewed as a way to deliver vital nutrients, prevent diseases linked to poor nutrition, and improve general well-being rather than just being a way to sate hunger or provide pleasure. Food markets are moving toward a new product category: functional and enriched foods, as a result of the growing emphasis on eating healthily (Perina et al., 2015).

Foods or ingredients that provide health advantages beyond basic nourishment are referred to as such. The food industry is therefore putting customer preferences and needs first, developing and improving goods and services to meet these needs.

Among the many products that the dairy industry offers, functionality is frequently emphasized as a crucial component. Furthermore, it has a positive reputation with customers (Batista et al., 2015). Particularly, yogurt and other fermented milk products have been the subject of much research worldwide, and eating them has been associated with several health advantages. Yogurt consumption has increased dramatically in recent years due to its link to improved health. Yogurt is still a popular option since it is acknowledged as a quick, wholesome, and palatable food. Yogurt production and consumption frequently involve the addition of different flours to increase the nutritional value of foods. However, optimizing functional food products requires an understanding of consumer needs, values, and preferences.

Traditional salad dressings and strawberry-infused yogurt salad dressings are two different methods of improving the taste and nutritional value of salads. Historically, conventional dressings, such as vinaigrettes and creamy dressings, have been utilized to enhance the flavor and consistency of salads.

Strawberries are renowned for their abundant vitamins, antioxidants, and phytochemicals, which are responsible for their beneficial effects on health (Giampieri et al., 2020). The addition of strawberries to yogurt not only improves the taste but also increases the nutritional content of the product. Yogurt is a highly nutritious ingredient for a healthy salad dressing due to its abundance of probiotics, proteins, and calcium (Ranadheera et al., 2019).

Strawberry-infused yogurt salad dressing is a novel creation that merges the advantageous qualities of yogurt with the inherent sweetness and nutritional attributes of strawberries. Yogurt is a beneficial source of probiotics, protein, and calcium. Additionally, it can offer a smooth texture without the excessive fat content found in conventional creamy dressings (Ranadheera et al., 2019). Contrarily, strawberries contain a high number of vitamins, antioxidants, and phytochemicals, which can increase the nutritional content of the dressing (Giampieri et al., 2020).

The main focus of the study was the possible health benefits of strawberry-enriched yogurt dressing. The dressing's nutrient content and antioxidant activity are expected to

strengthen its health-promoting properties. Additionally, the probiotic qualities of yogurt can help the digestive system, making this dressing a functional food item (Hill et al., 2019).
A sensory analysis was performed to determine whether yogurt dressing enhanced with strawberries is acceptable to consumers. According to Ares and Varela (2020), taste, aroma, texture, and appearance all impact consumer preferences. The study aimed to optimize the dressing's sensory qualities to achieve a harmonious combination of health benefits and palatability.

The acceptance of strawberry-infused yogurt dressing as a salad dressing is largely due to its sensory appeal. A unique and appealing flavor profile that differs from traditional dressings can be produced by combining the smooth texture of yogurt with the delightful balance of sweetness and tartness from strawberries (Ares & Varela, 2020). Due to its taste and nutritional benefits, this dressing is particularly appealing to consumers looking for healthier alternatives to traditional dressings.

Research on the sensory and nutritional value and market acceptability of strawberry-infused yogurt as a salad dressing is significantly insufficient, despite the abundance of recipes for such a dressing and the wealth of information regarding the health benefits of other fruits like bananas, mangoes, blueberries and yogurt combinations.

This study sought to address this gap through an in-depth evaluation of strawberry-infused yogurt as a condiment for vegetable salads. This included a comprehensive evaluation of its sensory attributes, including flavor, texture, and aroma. In addition, the nutritional composition of the dressing, through an examination of these elements, furnished a potentially market-acceptable strawberry-infused yogurt as an appetizing and nutritious alternative to salad dressings.

Over recent decades, consumer attitudes toward food have shifted significantly. There is a growing emphasis on maintaining a healthy lifestyle, which has led to heightened concern over the nutritional quality of food products. Modern consumers now seek more than just taste and satiety; they expect food to deliver essential nutrients and help prevent diet-related health issues, ultimately supporting overall well-being. In response to this trend, the food industry has seen a growing demand for functional and enriched food products that offer health benefits beyond basic nutrition (Perina et al., 2015). As a result, food manufacturers are increasingly aligning their products with consumer preferences, focusing on the development and refinement of food items that cater to the demand for healthier options.
This research on the use of strawberry-enriched yogurt as a salad dressing is scarce, despite the growing popularity of functional foods. This is especially true when it comes to the product's sensory qualities, nutritional value, and market acceptability. Although the health benefits and culinary versatility of strawberry-enriched yogurt have been studied, little is known about its potential as a salad dressing. This gap in the literature offered a chance to evaluate the nutritional impact of this newly introduced item as well as its performance in terms of taste, texture, aroma, and general consumer acceptance.

Statement of the problem

Generally, the study aimed to determine the physicochemical properties, cost of production, and marketability of the strawberry-enriched yogurt.

Specifically, the study:

1. Identified the physicochemical properties of strawberry-enriched yogurt in terms of:

a. Ash Content
b. Total Sugar
c. Energy
d. Carbohydrates
e. Crude Fat
f. Crude Protein
g. Moisture

2. Computed the cost of production for each variant of strawberry-enriched yogurt:
a. Plain Yogurt
b. Greek Yogurt
c. Thousand Island

3. Assessed the market acceptability of the strawberry-enriched yogurt in terms of:
a. Product acceptability
b. Consumption
c. Perceived health benefits
d. Pricing
e. Product features
f. Competition comparison

METHODOLOGY

Research design

The study employed an experimental research design to determine the physicochemical properties and marketability of strawberry-enriched yogurt as influenced by the type of yogurt base. The procedure was carried out in two major phases: the preparation of yogurt samples and the subsequent analysis of their physicochemical attributes and consumer acceptability.

Respondents and locale of the study

The research was conducted in Mankayan, a municipality situated in the province of Benguet, Philippines. Mankayan is a rural area with a community that is connected to agriculture and traditional practices. This setting provided a unique opportunity to explore nutritional food preferences and health habits within a localized context. The municipality is home to diverse populations that engage in farming and small- to medium-scale business ventures, offering an ideal environment to study the acceptance of new food products, such as strawberry-enriched yogurt, in this rural community.

The study involved all individuals from various groups who were interested and willing to participate in the sensory evaluation and provide feedback on the strawberry-enriched yogurt dressing. This may involve gathering an assortment of individuals with varying age ranges, backgrounds, and dietary preferences to conduct a thorough evaluation of the product's acceptability and desirability.

Research instrument

To evaluate the marketability of the strawberry-enriched yogurt, a Market Acceptability survey questionnaire was administered to a carefully selected group of potential consumers representing diverse age groups and backgrounds. The primary aim of this survey is to assess consumer preferences and identify the most acceptable formulation based on key sensory and presentation

attributes. The questionnaire was structured to evaluate factors that significantly influence consumer choices, including taste, texture, aroma, color, packaging appeal, and overall satisfaction. These aspects are essential in determining whether the product meets consumer expectations and can compete in the local market.

Each participant rated their level of satisfaction for every attribute using a Likert-type scale, which provided a standardized and quantifiable method for measuring subjective consumer perceptions. This allowed the researchers to gather consistent data across all responses. In addition, open-ended questions were included to gather qualitative feedback, allowing respondents to express their opinions and suggestions freely.

Treatment of data

The treatment of data in this study was carried out in alignment with the research objectives to ensure accurate and meaningful results.

1. To determine the physicochemical properties of the strawberry-enriched yogurt, laboratory testing was conducted through the Department of Science and Technology (DOST). The analysis focused on key nutritional parameters such as ash content, total sugar, energy, carbohydrates, crude fat, crude protein, and moisture content. These values were essential in identifying the nutritional differences among the three yogurt variants and in establishing the formulation with the most favorable health benefits.
2. To evaluate the cost of production for each formulation: plain yogurt, Greek yogurt, and Thousand Island, a descriptive analysis was used. Specifically, the descriptive mean was calculated based on the cost of ingredients used in each formulation. This approach provided a clear comparison of the expenses associated with producing each variant and informed the economic feasibility of scaling up the product.
3. Descriptive mean was applied in assessing the market acceptability of the strawberry-enriched yogurt. The data were gathered using a structured Market Acceptability survey questionnaire, which evaluated factors such as overall product acceptability, consumption intent, perceived health benefits, pricing, product features, and comparisons with similar products in the market.

FINDINGS AND DISCUSSION

Physicochemical properties of strawberry-enriched yogurt

The physicochemical properties significantly varied across yogurt base types. Greek yogurt-based samples had the highest ash content, crude protein, and energy values, attributed to its concentrated nutrient profile due to straining. Plain yogurt had moderate levels of nutrients, while Thousand Island-based formulations showed the lowest nutritional quality, particularly in protein. Moisture content was highest in plain yogurt, contributing to a smoother texture, while Greek yogurt had the lowest moisture due to whey removal, resulting in a thicker consistency. Thousand Island variants had intermediate moisture, higher fat, and variable carbohydrate and sugar levels, reflecting its inclusion of ingredients like mayonnaise and ketchup.

Cost of production for each variant of strawberry-enriched yogurt

Greek yogurt-based strawberry dressing was the most expensive to produce at ₱875.00, driven by the cost of Greek yogurt, honey, and olive oil. Plain yogurt-based dressing followed at ₱855.00, offering a balance of cost and nutrition. The Thousand Island-based dressing had the lowest production cost at only ₱109.00 but was nutritionally inferior. The findings suggest Greek yogurt products are suitable for premium markets, while plain yogurt versions may appeal to broader consumers seeking affordable health benefits.

Market acceptability in terms of product acceptability

Consumers rated the product as generally "Acceptable," with an overall mean of 5.88. The highest-rated attribute was texture ("smooth and pleasant") with a mean of 6.20, followed by packaging design (5.96) and taste (5.46). These results indicate the product's appeal lies in its mouthfeel and visual presentation.

Market acceptability in terms of consumption

Participants found the yogurt "Acceptable" for consumption, with an overall mean of 5.54. They particularly enjoyed consuming it at various times of the day (5.64) and deemed it suitable for all age groups (5.63). Including it in a daily diet received a slightly lower rating (5.35), categorized as "Slightly Acceptable."

Market acceptability in terms of perceived health benefits

The yogurt was rated "Acceptable" for its health benefits, with an overall mean of 5.87. It was especially noted for supporting digestive health (6.44). Consumers also considered it a healthy snack alternative (5.69), though integration into a balanced diet received slightly lower acceptance (5.48).

Market acceptability in terms of pricing

Pricing was rated "Slightly Acceptable," with an overall mean of 5.01. While respondents felt the price was fair for the quality (5.54), willingness to purchase despite price increases scored lower (4.71–4.79), suggesting price sensitivity may affect repeat purchases.

Market Acceptability in Terms of Product Features

Product features were deemed "Acceptable" overall, with a mean of 5.84. Clarity of nutritional information on the label (6.19) and absence of preservatives (6.18) were rated highly. Packaging convenience received a "Slightly Acceptable" rating (5.16), indicating potential room for improvement in package design.

Market acceptability in terms of competition comparison

Compared to competing products, the yogurt scored an overall mean of 5.19 ("Slightly Acceptable"). Its health benefits (5.81) were perceived to outperform competitors. However, flavor and taste comparisons scored lower (4.70–5.05), suggesting moderate preference against market alternatives.

Sensory evaluation of strawberry-enriched yogurt salad dressing

Greek yogurt received the highest sensory ratings overall. Its aroma (2.04), texture (2.00), and overall acceptability (2.73) were classified under "Like Very Much" or "Like Moderately." Plain yogurt had a slightly higher taste rating (3.91), but Greek yogurt's consistent appeal across multiple sensory dimensions made it the most preferred variant. All three variants received statistically significant ratings ($p < 0.01$), affirming their sensory distinctiveness.

Significant difference among yogurt variants

ANOVA results revealed a statistically significant difference ($p < 0.01$) among the three yogurt formulations (plain yogurt: $F = 35.01$; Greek yogurt: $F = 12.96$; Thousand Island: $F = 11.11$). These findings confirm that consumers significantly differentiated among the variants, particularly favoring Greek yogurt in key sensory aspects.

CONCLUSIONS

Based on the data treatment and findings of the study, the following conclusions were drawn:

1. The type of yogurt base significantly affects the physicochemical composition of strawberry-enriched yogurt. Among the three formulations, the Greek yogurt variant demonstrated the highest levels of crude protein and energy, suggesting its superiority in terms of nutritional value. The plain yogurt also showed favorable results but was slightly lower in nutrient concentration. Meanwhile, the Thousand Island-based product recorded the lowest values across most nutritional parameters, indicating it may be less suitable as a health-oriented food product.
2. The production cost revealed that the Greek yogurt-based formulation was the most expensive to produce due to the higher cost of Greek yogurt and other premium ingredients such as honey and olive oil. The plain yogurt variant followed closely but remained more affordable. On the other hand, the Thousand Island-based formulation was the most economical, utilizing significantly cheaper ingredients. This implies that while cost-efficiency is achievable, it may come at the expense of nutritional quality.
3. Lastly, the Greek yogurt variant received the highest ratings in terms of product acceptability, perceived health benefits, and product features. Consumers recognized its nutritional advantages despite its higher price. The plain yogurt variant was also well-accepted, especially for its balance between taste and affordability. In contrast, the Thousand Island variant was less favored, particularly in terms of health benefits and overall product comparison with similar market options. These findings suggest that consumers prioritize nutritional value and sensory appeal when choosing functional food products like strawberry-enriched yogurt.

RECOMMENDATIONS

Based on the conclusions drawn from each objective, the following recommendations are provided:

1. Given that the Greek yogurt formulation exhibited superior nutritional content, it is recommended that food developers and manufacturers prioritize Greek yogurt as the base for

producing strawberry-enriched yogurt, especially for health-conscious markets. However, further studies may be conducted to explore methods for reducing the cost of Greek yogurt production without compromising its nutritional quality.

2. Since cost remains a major factor for consumers, particularly in price-sensitive markets, it is recommended to consider the plain yogurt variant as a practical alternative for mass production. The balance between nutritional value and cost makes it a viable option for reaching a wider consumer base. Stakeholders should also explore the use of locally available or seasonal ingredients to reduce overall expenses and enhance sustainability in sourcing.

3. It is recommended that the Greek and plain yogurt variants be prioritized for commercial distribution, with marketing efforts focusing on their health benefits and sensory appeal. Promotional campaigns should emphasize natural ingredients, nutritional content, and product freshness. Additionally, continuous consumer feedback should be gathered to guide product improvement and innovation. For the Thousand Island-based variant, reformulation or repositioning may be necessary to enhance its acceptability, especially in terms of nutritional value and taste perception.

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