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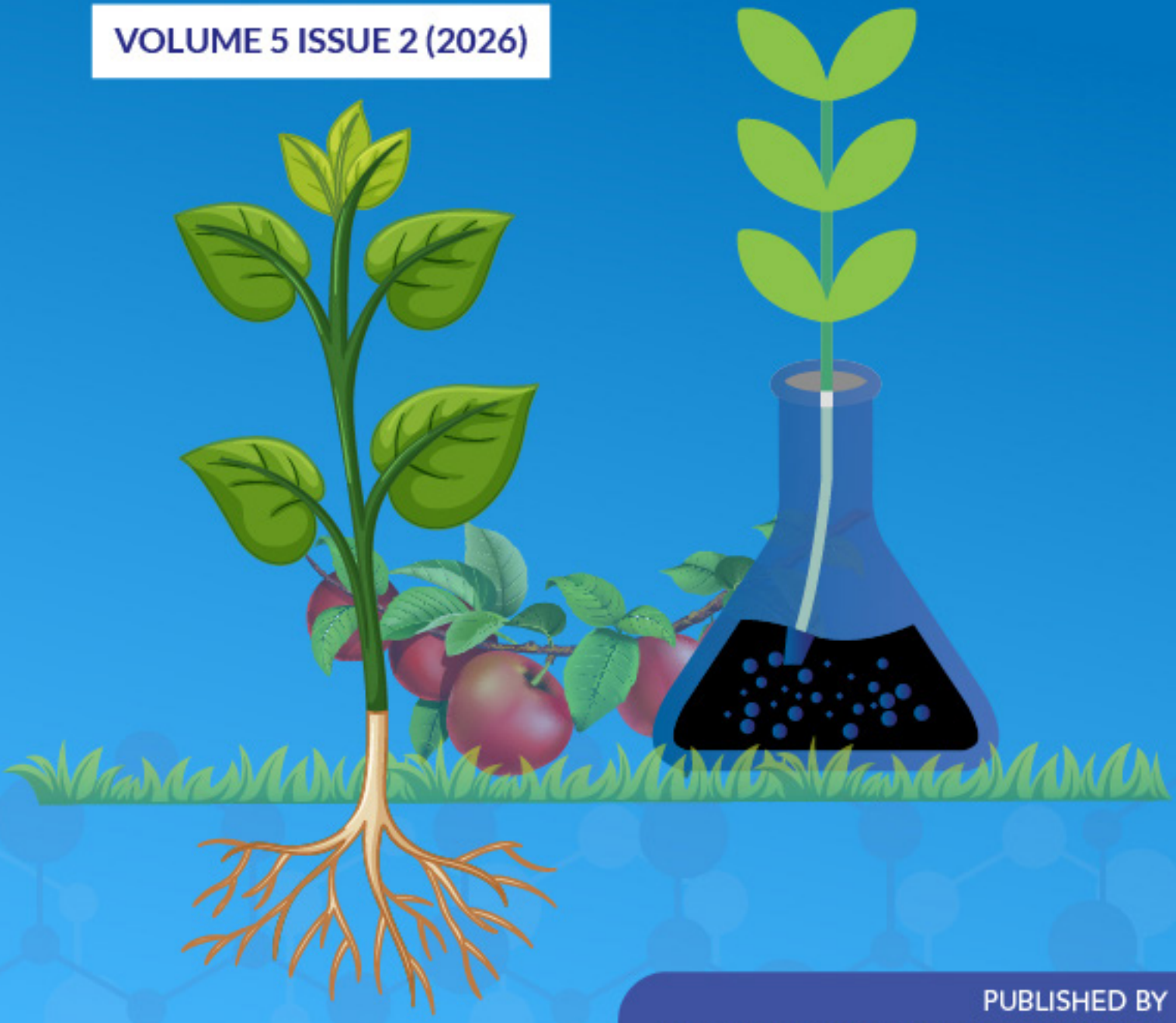

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Squash-Veggie Biscuits with Beans

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ABSTRACT

Veggie biscuit, traditionally made from wheat flour, is innovatively developed using squash and beans. This study aimed to develop squash-veggie biscuits with beans of three varieties: red bean, white kidney bean, and mung bean. The sensory qualities and general acceptability of the three treatments were evaluated, and significant differences among them were identified. Additionally, microbial and proximate analyses and shelf-life tests were conducted on the best-performing product. An experimental-developmental research design was employed, and sensory evaluation was carried out using a nine-point Hedonic scale. The product was evaluated by 110 evaluators, including 10 semi-trained panelists, 50 consumers, and 50 students. The results indicated that the squash veggie biscuit with white kidney bean outperformed the other treatments in all sensory attributes and received the highest acceptability ratings. Significant differences were only observed in appearance among the three treatments, favoring the squash veggie biscuit with kidney beans. Microbial analyses confirmed that the biscuits were safe, exhibiting low coliform counts, absence of Salmonella, and minimal yeast and mold presence. Nutritional analysis revealed that the biscuits were primarily carbohydrate-based, with moderate fat and low protein, fiber, and other nutrient contents. Moreover, the findings revealed that squash vegetable biscuits containing beans exhibited an unstable shelf-life at room temperature, lasting only 3 days.

INTRODUCTION

The Philippines is facing a problem in terms of malnutrition. This scenario calls for pressing reforms to ensure that this longstanding issue will be resolved. Although the economy has grown significantly, the country is suffering from what can be referred to as a double burden of malnutrition that includes both the existence of high rates of undernutrition as well as the presence of higher incidences of overweight and obesity problems (Development Initiatives, 2022). As noted by UNICEF, one of the biggest public health issues affecting the Philippines continues to be the issue of undernutrition, with stunting remaining rampant among children coming from poor families. An estimated 3.6 million Filipinos aged below five years are underweight, while approximately 4 million children experience stunting (Unilab, 2025). The sad thing is that the problem continued into 2022 and 2023, where more Filipinos are experiencing the existence of both undernutrition and overnutrition. This has made fortified and enriched foods important.

There are multiple reasons why biscuits can be considered a remedy for this defect. Biscuits are widely consumed by people from all age categories and socio-economic classes. Furthermore, they have proven to be highly adaptable, as recent scientific advances have allowed for the development of biscuits fortified with important nutrients that meet the nutritional needs of high-risk populations, such as babies, toddlers, seniors, and patients suffering from diabetes and obesity. Biscuits not only provide energy but are also functional foods that promote wellness and reduce the risks associated with nutrition-related diseases (Gaupholm *et al.*, 2023). Through the use of biscuits, nutrition programs can be improved to better tackle both malnutrition and obesity among Filipinos (Nogueira *et al.*, 2018).

There has been increased interest in the use of vegetable flours in the production of biscuits because of the positive impact that vegetable flour can have on the nutritional value of the biscuits. Different types of vegetable flours made from spinach, beetroot, broccoli, cauliflower, artichoke, fennel, zucchini, and mushrooms have been investigated for the ability to boost fiber, vitamins, minerals, and antioxidants in biscuits (Mishra *et al.*, 2015). The inclusion of vegetable flours helps in improving the dietary fiber level in the diet, thereby promoting good digestion and glycemic control. The antioxidants have a protective effect on the body. Vegetable flours also help in reducing food wastage by adding value to vegetables.

One of the best examples is the partial substitution of wheat flour with garden cress (Lepidium sativum L.) seed powder in making biscuits. According to Afify (2022), adding 7% garden cress seed powder helped in increasing protein, fat, dietary fiber, and ash levels, along with providing significant antioxidants such as phenolic and flavonoids. Through sensory evaluation, it was found that biscuits made from this substitution level had the maximum acceptability, which means that improved nutrition does not affect their quality. In this way, it is possible to use garden cress seed powder for making nutritious and tasty biscuits.

Squash and bean flours are also potential food ingredients

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in biscuits owing to their various characteristics. According to Mukherjee *et al.* (2022), powdered waste from squashes can be utilized for making baking flour for cookies because they produce highly acceptable sensory scores on aroma, texture, appearance, and taste. Similarly, gluten-free muffins supplemented with squash seed flour were found to have an enhanced content of dietary fiber, protein, and unsaturated fatty acids, as well as better sensory qualities.

It can also be noted that bean flour is considered to be a low glycemic index ingredient, owing to the relatively poor digestibility of the starches present, and, therefore, it constitutes a healthier choice than wheat flour (Losada & Morales, 2022). By adding bean flour to frequently consumed products, like cookies, the nutritional value can be increased by offering protein, dietary fibers, and microelements, along with glycemic benefits. Such properties coincide with the public health targets that seek to reduce the number of non-communicable diseases associated with nutrition by reconfiguring staple products using healthy ingredients (Losada & Morales, 2022). Moreover, replacing wheat flour with mung bean flour in products like brownies can provide a variety of nutritional benefits and contribute to food security, thanks to the locally produced and protein-iron-calcium-Vitamin A-enriched nature of mung beans (Choiriyah, 2022; Setyaningsih *et al.*, 2019; Pakhri *et al.*, 2020).

Since there are numerous benefits for utilizing these flours in terms of nutrition, flavor, and functionality in bakery products, they will be applied in the formulation of biscuits in this study. This can be as an affordable and effective solution towards improving the nutritional status by developing nutrient-packed biscuits based on local taste preferences.

This study aimed to develop squash veggie biscuits with beans. Specifically, this study sought to: determine the sensory qualities of squash veggie biscuits with beans in terms of their appearance, aroma, taste, and texture; determine the general acceptability of squash veggie biscuits with beans among the three (3) treatments in terms of appearance, aroma, taste, and texture; find out if there is a significant difference in the level of sensory qualities of squash veggie biscuits with beans among the three (3) treatments in terms of appearance, aroma, color, and texture; find out if there is a significant difference in the general acceptability of squash veggie biscuits with beans among the three(3) treatments; determine the shelf-life of the product at room temperature; and determine the microbial and proximate analysis of the best product.

LITERATURE REVIEW

Biscuits are among the most popular foods consumed by people, because of their accessibility, being ready-to-eat products, prepared with ingredients such as wheat flour, fat, and sugar (Goubgou *et al.*, 2021). The popularity of these foods has been attributed to the wide range of flavors, long shelf-life, consumer acceptability, convenience, and affordability of biscuits. In light of the intensifying market competition, consumers are increasingly preferring healthy and natural foods, therefore prompting efforts aimed at modifying the nutrient content of biscuits to improve their nutritive value and functionality. Consequently, fortification of biscuits has become a popular approach in the production of functional foods (Campos-Rodríguez *et al.*, 2022).

The research of Miranti *et al.* (2019) involved the use of alternative sources of biscuit ingredients by incorporating yellow pumpkin flour (Cucurbita moschata) and coconut flour, which were known to have good nutritional value. The yellow pumpkin flour was considered because of its high content of beta carotene (pro-vitamin A), and its proteins that were easy to digest and could be used to feed babies. Coconut flour brought fiber into the biscuits and provided an intrinsic savory taste, thus improving the biscuits' nutritional value and palatability. Four combinations of yellow pumpkin flour at different proportions (10%, 15%, 20%, and 25%) were mixed with coconut flour.

In another study, McArthur-Floyd and Brako (2024) stated that when pumpkin flour is added to foods such as cookies, their nutritional values increase considerably. It was noted that the addition of pumpkin flour raises the levels of moisture, protein, dietary fibers, vitamins, and minerals in foods. The beta-carotene present in pumpkin ensures healthy eyes and protects against conditions caused by vitamin A deficiency. Moreover, dietary fiber assists in digestion and prevents constipation and colon cancer. On the other hand, iron, manganese, calcium, and potassium minerals help in maintaining healthy blood, bones, and cardiovascular system. Likewise, squash also has folic acid, which studies show contains cellular health, and reduces the risk of birth defects. Beyond its nutritional value, pumpkin has traditionally been used as a natural diuretic and to alleviate thirst and excessive body heat.

Adelaïde *et al.* (2021) studied the use of squash pulp powder, which is produced in Cameroon for making biscuits. Their study revealed that squash powder contains pro-vitamin A (carotenoids), vitamin C, fiber, and potassium. Carotenoids are known to be potent antioxidants and can alleviate vitamin A deficiency, which is common in pregnant mothers and young children. Vitamin C strengthens the immune system and facilitates iron absorption, fiber regulates glucose and cholesterol levels in the body and improves digestion, while potassium minimizes the risk of hypertension, among other diseases. Squash has several health benefits that include being antidiabetic, antimicrobial, hypocholesterolemic, anticancerous, and antiparasitic, as proven in both animal and human trials. For instance, the polysaccharides in squash were found to lower blood glucose and cholesterol levels in mice, and squash juice helped in reducing the blood glucose levels of patients with diabetes. High moisture-retention capacity makes squash powder ideal for baking purposes. Adding squash powder (10%) to biscuits enhanced their nutritional value

and garnered consumer preference.

According to Hussain *et al.* (2023), biscuit samples were developed using replacement levels ranging from 0%, 5%, 10%, and 15% of pumpkin (Cucurbita maxima) peel, pulp, and seed powders in place of wheat flour. The researchers found that the biscuits' rheological and physical properties remain satisfactory at 15% replacement. Dough water absorption capacity and dough development time increased substantially as more pumpkin peel and seeds powders were used, mainly because of their high amounts of fiber and protein, respectively. Dough stability, on the other hand, decreased substantially at 15% replacement, indicating weakened gluten structure due to dilution by the addition of non-gluten protein and fiber. Initially, the mixing tolerance index was higher as more pumpkin powders were added; however, it was substantially lower at higher replacement. The mixing time was reduced when more pumpkin powder was used, due to its relatively lower gluten content.

Further studies conducted by Han *et al.* (2022) explored the effect of adding white kidney bean flour to wheat noodles and found that a 20% substitution level helped improve the viscoelasticity of the dough, resulting in smoother noodles and contributing to a continuous protein-starch matrix formation, improving both sensory and textural properties. Regarding the nutritional aspects of this practice, it allowed for a significant reduction in starch hydrolysis rates due to decreased levels of rapidly and slowly digestible starch, and an increase in the level of resistant starch. This process is explained by the dietary fiber content and the inhibitory activity of the α-amylase enzyme. Besides, the addition of white kidney bean flour allowed achieving a high L* value, thus increasing the brightness and attractiveness of the noodles and other baked or staple food products.

In addition, Hammad *et al.* (2025) reported that replacing wheat flour with white bean flour at a level of 20% in biscuit preparations significantly improved sensory attributes and overall acceptability. Sensory evaluations showed that there was a significant improvement in taste, texture, crispy quality, and consumer preference when compared with control samples prepared using only wheat flour. Panelists ranked the biscuits formulated with white bean flour highest in terms of sensory attributes, where maximum values were recorded in the biscuits containing the maximum white bean flour.

Przeor and Ahmed (2024) researched the development of snacks formulated from beans fortified with white mulberry (Morus alba) leaves for diabetic patients. Four different snacks were created by combining red and white beans with white mulberry leaves, which have antidiabetic properties. Nutritional analysis showed a high percentage of dietary fiber (36.66% to 48.49%) and protein (18.25% to 21.22%). Red bean snacks were rich in protein, while white bean snacks contained higher amounts of carbohydrates. Insoluble fiber predominated in the snacks, but the white bean snacks had more soluble fiber. Antioxidant activity tests showed high results, and the red bean snack Ra showed more radical-scavenging capacity. All the snacks demonstrated effective inhibition of alpha-glucosidase activity, with the white bean snack having the most potent activity, indicating their possible use for regulating carbohydrate metabolism and glucose levels. In sensory evaluation, the white bean snacks received higher scores for taste and texture than the red bean snacks, which performed better visually. The snacks' low glycemic index (40) makes them a promising choice for functional food development for diabetic patients.

The red kidney bean (Phaseolus vulgaris L.) is known for its nutritious properties that include an adequate amount of plant protein, fiber, iron, potassium, magnesium, and folic acid. Their protein value is higher than many cereal grains, and fiber ensures healthy digestion and promotes the growth of good bacteria in the intestines. Because of the low glycemic index and slow digestion of starches, kidney beans help control blood sugar levels for patients with diabetes and heart diseases. Besides, fiber is involved in reducing bad cholesterol and lowers the risks of developing chronic diseases like heart disease and cancers. Kidney beans do not contain gluten. Moreover, the presence of antioxidants that consist of phenolics and flavonoids have anti-mutagenic and anti-proliferative properties. The amino acid profile, which is enriched with arginine, leucine, and lysine, completes cereals and provides protein required for vegetarians (Shabir & Khan, 2024).

According to Abirami and Kaur (2023), red beans are rich in both macronutrients and micronutrients. This is because they have high amounts of protein, carbohydrates, dietary fiber, and low levels of fats. Red beans are great sources of vitamins and minerals such as folic acid, iron, potassium, magnesium, vitamin B6, vitamin C, and zinc. Vitamins and minerals play significant roles in ensuring that processes such as DNA production, oxygen transportation, immune reaction, and tissue regeneration are effectively done in the body. The fiber content of red beans aids in digestion and helps prevent diseases.

Moreover, Sampson *et al.* (2026) highlighted that sensory analysis revealed high consumer acceptability for gluten-free biscuits, particularly in taste, texture, and overall appeal, with scores averaging above 7 on a 9-point hedonic scale. Proximate analysis indicated that soybean-enriched biscuits contained 14.5% protein, significantly higher than the 8.2% found in wheat-based biscuits, while sorghum contributed 5.8% dietary fiber compared to 2.3% in the control.

The study Ihotu and Etim (2024) explored enhancing the nutritional value and functional properties of carbohydrate-rich diets by incorporating soybeans into millet, cassava, and yam. Soybeans, known for their high protein, unsaturated fats, and micronutrients, were used to fortify these staple foods. Proximate analysis assessed the macronutrient content of both the original and soybean-enriched samples, while functional properties such as water and oil absorption capacities, swelling

index, bulk density, and gelation capacity were evaluated. Results showed significant increases in protein content, particularly in the millet-soybean mixture (29.81%), with relatively low levels of fat and ash. Functional assessments indicated millet's highest gelation capacity and cassava's superior water absorption. These findings suggest that soybean fortification can improve carbohydrate-rich diets' nutritional quality and versatility.

MATERIALS AND METHODS

Methods of Research

The researcher used the experimental-developmental research method. The OECD's Frascati Manual (2015) explains that developmental research is systematic in its nature because it combines what has been learned from past research and practical experience to develop or improve products, processes, or services. Developmental research is concerned with developing or improving products and processes. Hence, in this study, the experimental method was used to investigate the acceptability of veggie biscuits formulated with squash and bean flour. The developmental method was used to formulate the veggie biscuit as part of the product development process.

Experimental Design

The study utilized a Completely Randomized Design (CRD), in which squash veggie biscuits with bean flour were evaluated with successive replications.

Tools and Equipment

The tools and equipment used in the study included five (5) aluminum baking pans (8 in × 13 in), one (1) plastic chopping board, one (1) chef's knife (8 cm in length), one (1) portable digital weighing scale (0.1 g accuracy), one (1) set of plastic measuring cups and spoons, one (1) cookie cutter, four (4) mixing bowls, two (2) spoons, two (2) flour sifters, one (1) rolling pin, one (1) improvised molder, ten (10) small plastic containers, five (5) plastic tablespoons, two (2) rubber spatulas (26 cm in length), two (2) wooden spatulas (26 cm in length), one (1) working table (3 ft × 4 ft), one (1) non-stick pan, one (1) steamer, one (1) blender, and one (1) portable oven.

Ingredients Used in the Study

The ingredients used in making the squash veggie biscuit with beans are presented in Table 1.

Table 1: Ingredients used in making squash veggie biscuits with beans.

Ingredients	Treatments		
	A	B	C
Squash Flour	25 g.	25 g.	25 g.
Red bean Flour	20 g.	-	-
WhiteBean Flour	-	20 g.	-
MungBean Flour	-	-	20 g.
Baking powder	1 g.	1 g.	1 g.
Salt	2 g.	2 g.	2 g.
Powder Milk	15 g.	15 g.	15 g.
Vanilla	1 ml	1 ml	1 ml
Egg	15 g.	15 g.	15 g.
Butter	5 g.	5 g.	5 g.
Lard	3 g.	3 g.	3 g.

Experimental Procedure

Procedure for Making Squash-Veggie Biscuit with Beans

a. **Procedure for Making Squash Flour**

The procedures for making flour from squash are as follows. First, weigh the 5,000 grams (5 kg) of squash and steam in a steamer for 30 minutes, then allowed to cool. Next, prepare a grater and a tray. Grate the squash into small shreds using the grater, and afterward, dry it under the heat of the sun until it is fully dried and ready for pulverization. Then, grind it until it becomes very fine and sieve it to separate any unnecessary particles. Finally, it is weighed again according to the desired amount needed for each treatment.

b. **Procedure in Making Bean Flour**

The procedures for producing bean flour are as follows. First, weigh the 500 grams (0.5 kg) of beans and roast in a frying pan at 230°F (110°C) until dry and golden brown. The roasted beans are subsequently ground into a fine powder and sieved to eliminate coarse or undesirable particles. The resulting flour is then reweighed according to the specific quantity required for each treatment.

c. **Procedure in Making Veggie Biscuit**

The ingredients used for making the biscuits were first sorted out. The squash and bean flour are then sieved and measured separately in accordance with the quantity needed for each treatment method. A mixture comprising 15g of eggs, 15g of powdered milk, 1ml of vanilla, 5g of butter, and 1g of salt is stirred in the mixing bowl. After stirring thoroughly, 1g of baking powder is added and mixed well. The sieved flour of squash and beans is then slowly introduced to the mixture to create an even dough

after blending. The dough is kneaded and rolled into shape with the use of the rolling pin before molding. The pan is greased slightly using the butter, while the molded dough is carefully placed in the greased pan with proper spacing among the biscuits. The biscuits are then baked at 280° F (138° C) for 15 minutes.

Collection of Data

To determine the sensory properties of the squash veggie-biscuits with beans, a rating scale was employed in this study. It focused on the sensory properties of the food product such as its appearance, smell, taste, and texture. The four sensory characteristics mentioned were considered to determine the acceptability of Veggie Biscuit.

The evaluators were invited and instructed on how to evaluate the product. There were two groups of evaluators involved in the process. The first group consisted of 10 experts, who specialize in Food Technology. Samples of the three treatments were presented to this group for evaluation. Their comments and suggestions for product improvement were incorporated into the final preparation of the product.

The second group comprised of 100 evaluators, including 50 consumers and 50 students from a National High School in the Municipality of Maayon, where the researcher is stationed. During the evaluation, the participants were provided with evaluation sheets to complete.

After the evaluation of the product, the evaluation sheets were gathered, tallied, and summarized, and were ready for computation. Mean was used to determine the sensory qualities of the Veggie biscuit in terms of appearance, aroma, taste, texture, and general acceptability.

Scoring of Variables

In scoring the variables, the researcher used the Hedonic Nine-Point Rating Scale to rate the product. This method of scoring variables required the evaluators to rate the products based on their judgment. The product was scored, weighted, arithmetically, and categorized according to appearance, aroma, taste, and texture.

To have a better understanding of the result, the researcher also gave an equivalent interpretation for each scale that corresponds to the Nine-Point Hedonic Rating Scale.

Statistical Tools and Analysis

The data were tabulated and statistically analyzed using the SPSS software, employing the arithmetic mean and analysis of variance (ANOVA).

The mean was used to determine the sensory acceptability of the three (3) treatments in terms of the developed veggie biscuit. The Kruskal-Wallis test was performed in order to analyze the significant differences in sensory attributes of the product concerning appearance, smell, taste, and texture in the three treatments. The Analysis of Variance was done to find the differences in overall acceptability of the product by the consumers among the three treatments. The alpha level for this analysis was fixed at $\alpha = 0.01$.

RESULTS AND DISCUSSIONS

Sensory Qualities of Squash-Veggie Biscuit with Beans (Red Beans, White Kidney Beans, and Mung Beans)

The characteristics of the sensory analysis for the squash-veggie biscuits containing different types of beans (red beans, white kidney beans, and mung beans) were assessed based on appearance, smell, flavor, and texture. For appearance, the mean score of 8.23, which was considered "Extremely Appealing," was recorded for Treatment B (squash and white kidney bean). On the other hand, the mean score of 8.03 and 7.87 were recorded for Treatment A (squash and red bean) and Treatment C (squash and mung bean), respectively, which fell under the category of "Very Much Appealing." This indicates that the veggie biscuit containing squash and white kidney bean was more appealing in its appearance. According to Han *et al.* (2022), white kidney bean flour had favorable results for the appearance of foods due to high lightness.

Based on the sense of aroma, Treatment B, which was made up of squash and white kidney bean, showed an outstanding performance with an average score of 8.37, rated as "Extremely Pleasant," while Treatment C, which comprised squash and mung bean, scored an average score of 7.90, labeled as "Very Much Pleasant." Treatment A, consisting of squash and red bean, recorded the lowest average score of 7.08, which was "Moderately Pleasant." The results indicate that the pairing of squash and white kidney bean was aromatically better than the other treatments. This could be attributed to the work by Han *et al.* (2022), where it is noted that the white kidney bean contains some chemicals like aldehydes, alcohols, and ketones, which create an aromatic flavor.

Concerning the taste aspect, the only treatment that scored Extremely Delicious was Treatment B (squash + white kidney bean) with a mean score of 8.37. The other two treatments, A (squash + red bean) and C (squash + mung bean), were categorized as "Very Much Delicious," scoring 7.93 and 7.80, respectively. Based on the above data, it is clear that Treatment B had flavors that were highly appreciated by consumers. This is in agreement with the results reported by Han *et al.* (2022), where white kidney bean flour was observed to improve the nutritional value and taste of noodles despite its low inclusion rate.

Regarding texture, Treatment B (squash with white kidney bean) had an average score of 8.27, which was characterized as "Extremely Crispy." Treatment A (squash with red bean) and Treatment C (squash with mung bean) both scored above 8 on average, with a score of 8.07 and 7.70, respectively, and were characterized as "Very Much Crispy." The results indicate that the enriched veggie biscuit prepared using white kidney beans had the best texture quality compared to the other two treatments.

This observation is supported by the study conducted by Salazar *et al.* (2020), where they discussed how kidney bean flour had a high water absorption capacity and high protein content, which helped improve its texture.

Consequently, the study results revealed that the white kidney beans had superior sensory properties compared to the red and mung beans, implying that the unique features of the beans made them more appealing to consumers. The results are supported by the findings of Isaskar *et al.* (2021), who emphasized the importance of sensory properties in influencing consumer choices regarding food products.

General Acceptability of Squash-Veggie Biscuits with Beans (Red beans, White Kidney Beans, and Mung Beans)

The general acceptability of the squash-veggie biscuits made with beans (red beans, white kidney beans, and mung beans) with respect to their appearance, aroma, taste, and texture was assessed based on evaluations made by 100 evaluators. Among all the treatments tested, Treatment B (squash with white kidney bean) obtained the highest general acceptability, with a mean score of 8.40, which is referred to as "Liked Extremely". It has scored excellently in all the sensory attributes tested. As for its appearance, the mean score obtained was 8.44, which is also "Liked Extremely". In terms of its aroma, the mean score is 8.43, "Liked Extremely". As far as its taste is concerned, the mean score is 8.30, which is also "Liked Extremely".

The treatment with squash and red bean flour scored second highest in overall acceptability with a mean score of 8.01, which can be translated as "Very Much Liked." In terms of appearance, aroma, taste, and texture, the mean scores were 7.95, 7.96, 8.09, and 8.03, respectively, and they were all translated as "Very Much Liked."

The treatment with squash and mung bean flour scored the lowest in overall acceptability with a mean score of 6.95, which can be translated as "Moderately Liked." In terms of appearance, the verbal rating was "Very Much Liked," with a mean score of 7.20. In terms of aroma, taste, and texture, the mean scores were 6.97, 6.71, and 6.92, respectively, and they were all translated as "Moderately Liked."

The findings imply that inclusion of white kidney bean flour into squash flour for making veggie biscuits gave the highest levels of acceptability than other two varieties of beans, earning high sensory scores in all sensory characteristics. These results tally with the findings by Hammad *et al.* (2025), whose study established that inclusion of white kidney bean flour in the formulation of biscuits led to an improvement in sensory attributes such as appearance, texture, flavor, and appeal. They found out that kidney beans not only improved the nutritional value of the biscuits but also made them more desirable to consumers.

Difference in the Sensory Qualities of Squash-Veggie Biscuits with Beans (Red Beans, White Kidney Beans, and Mung Beans)

The data show the variance in sensory properties of squash-veggie biscuits made from three types of beans (red beans, white kidney beans, and mung beans). The findings revealed that out of the three treatments of squash-veggie biscuits made from beans (red beans, white kidney beans, and mung beans), only the appearance was statistically significant, with Treatment B scoring higher.

Regarding the appearance, Treatment A had a p-value of .007, Treatment B had a p-value of .136, and Treatment C had a p-value of .699.

Based on the findings, the appearance of the veggie biscuits under the three treatments was statistically significant because at least one of the p-values is less than 0.05.

Concerning the aroma, no significant difference is evident between the two treatments, for which the p values are .113 and .890. On the other hand, the mung beans have a significant difference with a p-value of .013. Concerning the taste, no significant difference occurs between the two treatments with p values of .354 and .288. However, the red beans exhibit a significant difference with a p-value of .011. Concerning the texture, no significant difference is found between the two treatments with p values of .131 and .272. But the white kidney beans have a significant difference with a p-value of .048.

The results were consistent with those found by Han *et al.* (2022), where white kidney bean contributed significantly to the look of food products owing to their higher value of lightness than other beans, thus making them look lighter and more attractive. To conclude, the null hypothesis, which claimed that there is no significant difference in sensory characteristics of veggie biscuits under the three treatments, was not rejected. This means that beans have an impact only on the appearance of veggie biscuits but not on their taste, smell, and texture.

Difference in the General Acceptability of Squash-Veggie Biscuits with Beans (Red Beans, White Kidney Beans, and Mung Beans)

The data also show the acceptability of squash-veggie biscuits with beans (red beans, white kidney beans, and mung beans). When the overall acceptability of the squash veggie biscuits for the three (3) treatments was evaluated, the researcher found a significant difference with p=.000. The post hoc analysis revealed that Treatment B (squash and kidney bean flour) has a significant difference from Treatment A (squash and red bean) and Treatment C (squash and mung bean) in favor of Treatment B. Also, Treatment A (squash and red bean) significantly differs from Treatment C (squash and mung bean) in favor of Treatment A.

This implies that there is a significant difference in the general acceptability of the three (3) treatments. The outcomes from this study can be supported by Hammad *et al.* (2025), who discovered that biscuits made using composite flours, including white kidney bean flour, were more acceptable than ordinary wheat flour. Therefore, the null hypothesis is rejected, postulating that there is no significant difference in the general acceptability of veggie biscuits in the three (3) treatments can be rejected. This suggests that the three (3) varieties of beans in the three (3) treatments have distinct characteristics affecting consumers' choices.

Shelf-Life of Squash-Veggie Biscuit with Beans

Table 2 indicates the shelf-life of the squash veggie biscuits with beans. Shelf-life was established by keeping the product in room temperature storage conditions. The results showed that the shelf-life of the product lasted only three days. There was an indication of molds after five days into the observation period. This means that the squash veggie biscuits with beans were not stable and were vulnerable to spoilage in that period. This shows that the squash-veggie biscuit with beans was not stable in terms of shelf-life at room temperature.

Table 2: Shelf-life of squash-veggie biscuit with beans.

	1 day	2-3 days	4-5 days
Room Temperature			
Red beans	-	-	+
White kidney beans	-	-	+
Mung Beans	-	-	+
Legend: Negative (-) no mold formation Positive (+) mold formation is observed			

Microbial Analysis of the Best Treatment of Squash-Veggie Biscuit with Beans

Table 3 presents the findings of the laboratory examination of Microbial in squash-veggie biscuit with beans, as performed by Negros Prawn Producers Cooperative Analytical and Diagnostic Laboratory, Door No. 1&2, NOLKFI Bldg., 6th Street, Barangay. 7, Bacolod City. As shown in Table 3, the levels of total coliform and fecal coliform in the food sample were both found to be lower than 3.0 MPN/g. This means that there is an extremely low presence of the bacteria mentioned above in the food sample.

In addition, no Salmonella bacteria were present in a sample weight of 25 grams, which shows that there is no presence of this dangerous microorganism in the food item. Moreover, there is no presence of any type of yeast or mold in the food item in amounts greater than the limit of 10 colony-forming units per gram.

Table 3: Microbial analysis of the best treatment of the squash-veggie biscuit with beans.

Sample Description	Parameter		Result
	Total Coliferm (MPN/g)		< 3.0
	Fecal Coliferm (MPN/g)		< 3.0
Veggie biscuit (25 grams)	Salmonella		Absent in 25 grams
	Yeast Count (CFU/g)		Not detected at 101
	Mold Count (CFU/g)		Not detected at 101

Proximate Analysis of the Best Treatment of Squash-Veggie Biscuit with Beans

The proximate analysis of the squash-vegetable biscuit (Table 4) containing beans showed that it had a high carbohydrate content, which comprised 78.5% of its weight. This implies that the product is mainly meant to be an energy source. Fats made up 12.4% of the product's weight, implying that there is an intermediate amount of fats in the product. However, there were lower amounts of proteins (4.7%), fibers (1.1%), moisture (2.1%), sugars

Table 4: Proximate analysis of the best treatment of the squash-veggie biscuit with beans.

Sample Description	Parameter		Result
	% Fat		12.4
	% Carbohydrates % Moisture		78.5 2.1
Veggie biscuit 40 g	% Fiber		1.1
	% Sugar		5.8
	% Protein % Ash Sodium, %Flame AES		4.7 1.3 0.05

(5.8%), ashes (1.3%), and sodium (0.05%).

CONCLUSION

The use of white kidney beans to increase the level of squash flour will improve sensory characteristics of Veggie Biscuits. Thus, it may be stated that we can produce healthier snacks using vegetables.

The higher acceptability of the mixture of squash and white kidney beans implies higher consumer satisfaction with the production of vegetable biscuits.

Choosing right types of beans' flour varieties is the key to improving consumers' acceptability of Veggie Biscuits.

Molds existed during a five-day period when observing the biscuit, thus, there is a necessity for correct handling and timely eating of veggie biscuits. Proper hygiene is maintained by the absence of salmonella and relatively low numbers of coliform bacteria, which are very important in food handling. The biscuit itself consists mainly of carbohydrates, some fat and low amounts of proteins and fibers.

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