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Formulation, analysis and acceptability of sweet corn cob flour in baked products

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Abstract: The objective of this research was to assess the acceptability of sweet corn cob flour in baked goods such as butterscotch, cookies, and cupcakes. The research employed a developmental-experimental method using a Completely Randomized Design (CRD), with three treatments in three trials as evaluated by ten (10) semi-trained panelist and involved the evaluation of one final product by 100 tasters to gauge consumer preference. Data collection utilized scorecards with Nine Point Hedonic Scales. The analysis included the calculation of arithmetic means and the application of Analysis of Variance (ANOVA) to detect significant differences among treatments. Results from sensory evaluations of baked products Butterscotch, Cookies, and Muffins revealed that Treatment C (25 % corn cob flour and 75% flour), with a specific proportion of sweet corn cob flour, received the highest ratings from semi-trained panelists, described as "Extremely Appealing, Pleasant, Delicious, and Soft/Crisp". During consumer acceptability evaluation, all three baked products containing sweet corn cob flour were highly preferred by consumers. Regardless of sensory characteristics, consumers consistently rated these products as "Liked Extremely."

Keywords: Product Formulation, Sweet Corn, Cob Flour, Butterscotch, Cookies, and Chiffon Cupcake

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INTRODUCTION

The urge for quick meals made from flour has increased in numerous developing countries due to urbanization, population growth, and changing dietary trends in the past few decades. Undeniably, Filipinos possess a strong passion for eating. Baking in the Philippines has been practiced for over a millennium. Due to the country's abundant agricultural resources, the locals have developed their distinct method of preparing delicious sweet delicacies that are rich in flavor and possess a traditional texture.

To reduce reliance on imports and improve the livelihoods of local farmers, it is important to encourage the use of local sources of flour for partial substitution in food items as the price is growing on the global market. Also, it is widely grown and consumed as a staple food in tropical countries.

A kind of maize developed for human consumption with a high sugar content and high fiber content is termed sweet corn, also known as sugar corn and pole corn. The corn plant itself consists of roots, stalk, husk, silk, leaf, tassel, and the most well-known part, the cobs. The cob is a cylindrical structure upon which kernel development occurs.

The researcher utilized the sweet corn cob, which is typically thrown away and consumed. Making bread and pastries with an eye on health and nutrition is essential since consumers today value food's nutritional worth in addition to its taste.

The researcher wants to venture in producing baked products out of sweet corn cob flour aside from its rare application in foods but also its longer shelf-life since it is dry due to baking process. Promoting the advantages and nutritional worth of sweet corn cob flour, as well as helping local farmers and maximizing the potential usage of sweet corn cob to address zero waste and zero hunger in the country which is very prevalent issues among Filipinos. The nutritional value of sweet corn cob flour has been the subject of previous

research. Give us food that is aesthetically beautiful and has the nutrition our bodies require. Thus, the study was realized.

Statement of the problem

Generally, the objective of this research was to utilize sweet corn cob flour in making (butterscotch, cookies, and chiffon cupcake). Specifically, it aimed to:

1) Describe the sensory qualities of baked products made from sweet corn cob flour using different proportions in terms of appearance, aroma, taste, and texture;

2) Determine the general acceptability of baked products in different proportions in terms of four sensory qualities.

LITERATURE REVIEW

Butterscotch

The peanut butterscotch square recipe consists of the following ingredients: 780g of all-purpose flour, 360g of brown sugar, 125 ml of glucose, 220g of butter, 15 ml of maple syrup, 30g of eggs, 2g of baking powder, 10 ml of vanilla, and 480g of aflatoxin-free peanuts (Dolojan et. al, 2017).

The invention provides a method for producing butterscotch. The method involves the following steps: obtaining beef tallow and heating it to create a solution, adding maltose and complex carbohydrate to the solution and boiling it to form a mixture, performing whipping and air supplementation on the mixture, cooling and shaping it to create a beef tallow candy, and finally slicing the candy using a candy slicing machine to produce butterscotch. High-quality butterscotch with an extended shelf life can be produced (Zhaoxia, 2016).

Cookies

A method for manufacturing cookies by blending partially swollen unpolished rice and wheat flour in an optimum mixing ratio to increase a taste, nutrition, and functionality is provided. Therefore, the manufactured cookies have a roasted nutty taste and a crispy texture as well as nutrition.

A mixture of shortening, sugar, and salt is creamed in a kneader and added with an egg white to produce soft cream. Then, partially swollen unpolished rice is mixed with wheat flour in a ratio of 30:70 and agitated with flavorings and baking soda. The dough is pushed to give a thickness of 0.5cm, formed in a cookie frame having a diameter of 4cm and then baked at 190deg.C (Bang, 2014).

According to the method for producing cookies with enhanced flavor of the present invention, the first step is to prepare a first mixture containing margarine, sugar, and salt; A second step of preparing a second mixture further comprising starch syrup, cream cheese, and an emulsifier in the first mixture; A third step of preparing a third mixture further comprising whole egg liquid in the second mixture; A fourth step of preparing a fourth mixture further comprising starch, nut powder, baking powder, and bread flour in the third mixture; A fifth step of preparing a dough further comprising rum, fruit extract, and syrup in the fourth mixture; And a sixth step of forming the dough into a preset cookie shape and then baking it in an oven into a finished cookie (Kim, et.al, 2023).

Muffin

The innovation presents a recipe for a chia seed muffin cake and a technique for preparing it. The chia seed muffin cake is made with the following ingredients by weight: 100% low-gluten flour, 80-160% fresh egg liquid, 60-100% white granulated sugar, 60-81% pure milk,

60-80% salad oil, and 2-3.2% chia seeds. The ingredients are mixed in the right proportions to make the batter.

The batter is then poured into a mold. The baking process consists of two stages. In the first stage, the upper heating temperature is set between 175-195 degrees Celsius, while the lower heating temperature is set between 155-175 degrees Celsius. The first stage of baking lasts for 20-24 minutes. In the second stage, the upper heating temperature is set between 195-215 degrees Celsius, and the lower heating temperature is set between 175-195 degrees Celsius. The second stage of baking lasts for 4-6 minutes.

After the baking process is complete, the cake is cooled at room temperature and removed from the mold, resulting in the chia seed muffin cake. The preparation process involves utilizing chia seeds as a primary ingredient, resulting in an improved concentration of nutritional components such as omega-3 fatty acids and dietary fibers in the cake. Additionally, the cake is made with minimal amounts of oil and sugar, satisfying the preferences of consumers (He; Chen, 2019).

Corn and baked products

Agriculture has a vital role in providing livelihoods for the people of the Philippines. In 2014, the agricultural sector accounted for 10% of the country's Gross Domestic Product (GDP) and provided employment to 31% of the total workforce. Corn is the second most significant staple crop in the Philippines and serves as the main livelihood for several small-scale farmers. In 2016, the nation's corn production reached a total of approximately 7.2 million metric tons (Salpietra, 2017).

Plant waste contains compounds that have the potential to be used as food ingredients or as nutritional supplements, examples of which are pectin from apple pomace or citrus peel, phenolic compounds from potato peels, as well as lycopene from tomatoes and other red fruits (Mirabella et al., 2014).

Sweet corn cob (SCC) is a substantial amount of agricultural lignocellulosic waste that is produced by the corn processing industry. However, the utilization of SCC for the creation of high-value products is limited, with the majority of it being either discarded or employed for the production of biomasses. Therefore, the investigation of the extensive application of SCC as a functional meal is particularly interesting (Lau, 2018).

Gluten free (GF) products are often inferior in quality attributes, nutritional content and consumer acceptability. The use of GF by-products is a novel strategy to improve the structure and nutritional profile of these products. Sweet corn cob (SCC) is a by-product of sweet corn processing containing a considerable amount of fibre and ferulic acid. The effect of baking on ferulic acid content, colour, texture and physical characteristics on muffins incorporated with SCC flour (SCCF) as a value-added food ingredient was investigated using a GF model system.

The freeze-dried SCCF, containing ferulic acid (6.02 mg g−1) was used to replace the rice flour at varying levels of 10, 20, and 30%. In general, SCCF increased dietary fibre and free ferulic acid content of muffins. Inclusion of 20% SCCF showed an increase in terms of the height of the muffin and number of air cells in the crumb, along with a decrease in the hardness of muffins. Muffins with SCCF showed higher mean overall liking scores than rice flour muffin (Oruna-Conchaa et al., 2022).

METHODOLOGY

Research design

The design utilized in this study was the complete randomized design, wherein each group of tests or bars is studied only once, followed by the application of subsequent treatments to

determine the cause of any observed changes. Unlike other designs, there was no specific control group in this design; however, subjects underwent randomization procedures (Calmorin, 1985).

Locale of the study and respondents

The evaluators were invited and were given instructions on how to evaluate the products. The evaluation sheet was given to the participants, experts, teachers, students, and consumers with their honest opinions were solicited. The evaluators were instructed to evaluate the product using a nine-point hedonic scale as to appearance, aroma, taste, and texture. The fifty consumer respondents comprised of 10 TLE teachers, 20 Grade 10 cookery students, 20 Grade 9 cookery students, and 50 potential consumers evaluated the acceptability of the product prepared in three treatments.

Research instruments

The instrument used in this study was the evaluation sheet; it dealt with the variables used to evaluate the product such as appearance, aroma, taste, and texture. One hundred ten (110) evaluators composed of 10 panel experts and 100 consumers who evaluated the product in terms of appearance, aroma, taste, and texture. The study employed three treatments.

The evaluation sheets were disseminated to the evaluators which were randomly selected to ensure the reliability of the data. The evaluators were oriented on how to evaluate the product in the said variables. The data gathered will be tabulated and will be statically analyzed using the prescribed statistical tools.

For sensory evaluation, the instrument used a scorecard. It will look into the quality attributes of the product such as appearance, aroma, taste, and texture. These four (4) sensory qualities include determining the general acceptability of the sweet corn cob flour in making baked products.

Data analyses procedure

After evaluation of the product, the evaluation sheets were collected, calculated, examined, and interpreted using SPSS software. The mean was employed to assess the sensory qualities of sweet corn cob flour in making baked products, in terms of its appearance, aroma, color, taste, and texture, as well as its general acceptability. ANOVA was employed to examine and explain the significant difference among the three treatments of the product set at a significance level of 0.01.

FINDINGS AND DISCUSSION

Sensory qualities of baked products (butterscotch, cookies, cupcakes) from corn cob flour

Based on the sensory evaluation of corn cob butterscotch, Treatment A is described as "Very Much Appealing," with a mean score of 7.70. Treatment B also received a rating of "Very Much Appealing," with a mean score of 7.60. Notably, Treatment C was rated "Extremely Appealing," with a mean score of 8.20. These findings highlight the favorable sensory qualities of the different treatments, demonstrating their appeal to the panelists.

In terms of aroma, Treatment A was described as "Very Much Pleasant," with a mean score of 7.60. Treatment B was also rated "Very Much Pleasant," with a mean score of 7.90, while Treatment C received an "Extremely Pleasant" rating, supported by an 8.20 mean score.

Regarding taste, Treatment A was perceived as "Very Much Delicious," with a mean score of 7.60. Treatment B similarly garnered a rating of "Very Much Delicious," with an 8.10 mean score, while Treatment C was rated "Extremely Delicious," supported

by an 8.30 mean score. These results indicate the high satisfaction levels among participants concerning the taste of the different treatments.

In terms of texture, Treatment A was characterized as "Very Much Chewy and Soft," with a mean score of 7.30. Treatment B similarly received a rating of "Very Much Chewy and Soft," supported by a mean score of 7.50. Notably, Treatment C was perceived as "Extremely Chewy and Soft," with an impressive mean score of 8.20.

Overall, Treatment C consistently ranked highest across all quality attributes, followed by Treatment B, while Treatment A received the lowest ratings. These findings highlight the superior sensory qualities of Treatment C compared to the other treatments.

Sweet corn cob (SCC) is a by-product of sweet corn processing containing a considerable amount of fiber and ferulic acid. The effect of baking on ferulic acid content, color, texture, and physical characteristics of muffins incorporated with SCC flour (SCCF) as a value-added food ingredient was investigated using a GF model system (M.J.Oruna-Conchaa et al., 2022).

Table 4.1 shows the sensory qualities of Corn Cob Cookies in terms of appearance, Treatment A was rated as "Very Much Appealing," with a mean score of 7.60. Treatment B also received the same rating, supported by a mean score of 7.90, while Treatment C was perceived as "Extremely Appealing," with an impressive mean score of 8.20.

Regarding aroma, all treatments received high ratings of "Very Much Pleasant." Treatment A had a mean score of 7.90, Treatment B received a mean score of 7.80, and Treatment C scored the highest with a mean of 8.00.

In terms of taste, all treatments were rated as "Very Much Delicious." Treatment A received a mean score of 7.70, Treatment B scored 7.80, and Treatment C had the highest rating of 8.10. Regarding texture, all treatments were described as "Very Much Crisp." Treatment A achieved a mean score of 7.60, Treatment B scored 7.70, and Treatment C received the highest score of 8.00.

Overall, Treatment C consistently ranked highest in all quality attributes, followed by Treatment B, while Treatment A received the lowest ratings.

Table 4.2 shows the sensory qualities of Corn Cob Muffin, In terms of appearance, Treatment A was rated as "Very Much Appealing," with a mean score of 7.30. Treatment B received the same rating, supported by a mean score of 7.50, while Treatment C was perceived as "Extremely Appealing," achieving an impressive mean score of 8.40.

In terms of aroma showed that Treatment A was “Very Much Pleasant” as supported by the 7.30 mean. Treatment B was “Very Much Pleasant” as supported by the 7.50 mean and Treatment C was “Very Much Pleasant” as supported by the 8.10 mean.

In terms of taste showed that Treatment A was “Moderately Delicious” as supported by the 6.90 mean. Treatment B was “Very Much Delicious” as supported by the 7.70 mean and Treatment C was “Extremely Delicious” as supported by the 8.20 mean. In terms of texture showed that Treatment A was “Moderately Soft” as supported by the 6.90 mean. Treatment B was “Very Much Soft” as supported by the 7.50 mean and Treatment C was “Extremely Soft” as supported by the 8.40 mean.

In general, Treatment C ranked first in all quality attributes followed by Treatment B and the lowest was Treatment A.

General acceptability of corn cob baked productsas evaluated by consumers

Table 5 revealed the results in the general acceptability of corn cob baked products in terms of sensory qualities as evaluated by a group of consumers using the best treatment of each product. Product 1 (Butterscotch) mean of 8.40 in terms of appearance, 8.51 in terms of aroma, 8.40 in terms of taste, 8.16 in terms of texture and the general acceptability got a mean of 8.36 described as “Like Extremely”.

Product 2 (Cookies) mean of 8.62 in terms of appearance, 8.48 in terms of aroma, 8.54 in terms of taste, 8.41 in terms of texture, and the general acceptability got a mean of 8.74 described as “Like Extremely”.

On the other hand, Product 3 (Muffin) mean of 8.53 in terms of appearance, 8.49 in terms of aroma, 8.38 in terms of taste, 8.17 in terms of texture, and the general acceptability got a mean of 8.39 described as “Like Extremely”.

This implies that the three baked products with corn cob were found “Liked Extremely” by the consumers regardless of the sensory qualities.

The result of the study conforms to the of Lau et al. (2022), results indicate that Sweet Corn Cob could be considered as an alternative GF flour or value-added food ingredient for bakery products, functional foods, and nutraceuticals.

CONCLUSIONS AND RECOMMENDATION

The results indicate that using sweet corn cob flour into baked items such as cookies, cakes, and pastries could be beneficial. Overall, these items received high acceptance ratings from both partially trained panelists and customers, suggesting widespread satisfaction.

Remarkably, there were no discernible disparities noted in the sensory attributes and overall desirability of the baked products that contained sweet corn cob flour. Moreover, the microbiological analysis provides confirmation that these items adhere to the safety requirements established by the BFAD for baked goods, therefore guaranteeing their suitability for consumption.

Incorporating sweet corn cob flour improves the sensory characteristics and consumer acceptance of baked items. This implies that conducting additional study and advancement in this field could result in the creation of highly sought-after and financially profitable items enhanced with sweet corn cob flour.

According to recognized generalizations, it is recommended to use sweet corn cob flour as an effective component for making baked goods. This is because it has shown positive outcomes in terms of sensory characteristics and consumer approval. The positive feedback from both partially trained experts and consumers indicates that promoting these products in different markets could take advantage of their attractiveness.

Displaying baked items crafted from sweet corn cob flour at events such as school food fairs and food exhibitions may generate interest due to their novelty and distinctive flavor profile. In order to ensure the durability of these products, it is recommended to seal their packaging, thereby preserving their freshness during transportation and for display in food centers.

Moreover, promoting other researchers to investigate additional variations or aspects that were not addressed in the present study could result in more profound understandings and advancements in the utilization of sweet corn cob flour in the manufacture of baked goods. By following these suggestions, stakeholders can efficiently exploit the capabilities of sweet corn cob flour, thereby improving its marketability and attractiveness to consumers in the baked products sector.

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