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Acceptability of fruit powder bar cookies

Gleyn E. Lusaya
College of Education Graduate Programs
Capiz State University Roxas City Main Campus
Roxas City, Philippines
Email: lusayagleyn@gmail.com

Abstract: The study formulated the Fruit Powder Bar Cookies, specifically to evaluate the acceptability qualities in terms of appearance, aroma, color, taste, and texture. The mean and Analysis of variance (ANOVA) were used to analyze the data into alpha level set at 0.01 alpha. Findings on the sensory evaluation of the Fruit Powder Bar Cookies showed that treatment C (Grapes Powder) was the best in all four quality attributes. When the general acceptability was considered in terms of appearance, aroma, color, taste, and texture, Treatment C had the highest mean score, followed by Treatment D and Treatment B with a qualitative description of "Liked Extremely", while Treatment A was following closely with mean score having a qualitative description of "Liked Very Much".

Keywords: Fruit powder, bar cookies, and acceptability

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INTRODUCTION

The food industry produces a substantial amount of by-products that contain significant compounds and have potential use, especially as ingredients of functional foods. This current popular trend offers advantages to the environment, human well-being, and the profitability of the production process. Consumers' favorable opinions of these foods contribute to the ongoing increase in the production of functional foods enriched with byproducts.

When it comes to food preparation, fruits are perhaps one of the most adaptable byproducts; they're additionally suitable for baked dishes and sweets. They may provide taste, color, and nutrients to a range of foods. It contains fascinating plant material that can be consumed raw or prepared and it is widely advertised as healthy. It consists of a broad range of plants with widely differing nutritional and energy contents.

It provides dietary fiber, and a diet high in fiber is associated with a lower risk of obesity and cardiovascular disease. It also supplies the diet with vitamins, minerals, and phytochemicals that function as phytoestrogens, antioxidants, and anti-inflammatory agents through an alternative protective mechanism. These are significant components of the human diet. They are essential food items in terms of nutrition and commerce. These foods have been a part of man's diet for thousands of years because they are tasty, interesting, visually appealing, and suit specific nutritional needs.

Fruits are a delightful inclusion in numerous baked goods, offering not only their sweet and tangy flavors but also their ability to enhance moisture and texture in a wide range of recipes. They are versatile and can be included in a variety of baked goods, including pies, tarts, muffins, breads, and cakes.

Fruits can be used in different forms such as fresh, dried, or preserved. Fresh fruits are great for pies and tarts, while dried fruits are often used in cookies, breads, and cakes. Preserved fruits, like jams and jellies, can be used as fillings or glazes. Using fruits as baked additives also offers health benefits. They provide natural sweetness, reducing the need for

additional sugar. Moreover, fruits contain essential vitamins, minerals, and fiber, which can make your baked goods a bit healthier.

Nowadays, the relationship between nutrition and health has become a trend in constant evolution because consumers are aware of the importance of their diet, so they consume foods that are low in fat, salt, and/or calories and high in nutritional value (Myrisis, G., 2022). Because of its superior functionality, which is attributed to its balanced ratio of soluble/insoluble fiber, higher hydration characteristics, improved fermentability, and presence of phytochemicals, fruit pomace provides a novel ingredient for fiber enrichment in bakery goods. The source of pomace and its processing to form powder by various pre-treatments, drying techniques, and size reduction influences its functionality. Fruit and vegetable pomace can be used to improve the functionality of food by its functional properties.

A variety of fruit and vegetable pomaces are used in a wide array of bakery products like biscuits, buns, cookies, crackers, cakes, muffins, wheat rolls, and scones. Fruit pomaces or fruit marc tend to amalgamate well with bakery products and confer them better sensory properties. An important intervention of fruit and vegetable pomace is the improvement of the storage quality of baked products due to its associated antioxidants. Thus, fruit and vegetable pomace can be used as an effective functional ingredient for the development of fiber-rich bakery products.

Currently, consumers prefer foods with perceived health properties and at the same time, convenient for consumption, storage, and handling. In this sense, ready-to-use products, such as snack bars, are highly appreciated for their convenience (Ramirez, et al., 2018). Baked products are an important part of one's diet, and today, a great variety of such products can be found by adding innovative ingredients to improve their nutritional characteristics. In particular, cookies are frequently eaten by all segments of the population.

Bakery products such as cookies and biscuits are widely consumed all over the world and the enrichment of these products with vitamins, minerals, natural colorants, polyphenols, and fibers may be achieved through the incorporation of rich sources. Physicians recommend fruits for the treatment of many ailments like scurvy, night blindness, asthma, fever, anemia, ulcers, etc. "An apple a day, keeps the doctor away" is a well-known phrase indicating the significance of fruits in the human diet.

The present study is an attempt to utilize different fruit powders as natural sources of antioxidants, flouring agents, fiber, and minerals in baked products. Innovation of food is the development and commoditization of new food products, processes, and services. Right now, it's happening rapidly. It has, therefore, become a challenge to nutritionists, dieticians, food business owners, and even homemakers to provide the young a healthy and flavorful options. This is the very reason why the researcher like to make a study on making a much healthier version of baked products. The abundance and high potential of fruits as a functional food in creating a recipe that is healthier and more nutritious.

Statement of the problem

This study aimed to find out the acceptability of fruit powder in making bar cookies.

LITERATURE REVIEW

Fruit bars

Fruit bars are snacks made from dehydrated fruit pulp. The current study utilized the Central Composite Rotatable Design (CCRD) of Design Expert 7.0 (DX 7.0) to optimize the ingredients for making an energy bar using fruit peel waste. This optimization was based on different physicochemical and organoleptic features. The concept of creating fruit peel bars

that possess favorable sensory characteristics and significant nutritional content will contribute to the advancement of novel technologies in food processing, the development of specialized equipment, and the utilization of by-products. This has the potential to establish a path that requires no waste.

Cookies

Cookies are cake-like treats made with flour, oil, sugar, milk, eggs, salt, starch, chocolate, leavening agents, emulsifiers, and essences. Viscous dough can be baked flat. Their dimensions, forms, textures, compositions, softness, flavors, and hues are endless (Myrisis et al., 2022).

According to Awolu et al. (2016), cookies are widely consumed and heavy in carbohydrates, fats, and calories but low in fiber, vitamins, and minerals. Enriching cookies now improves their nutritional and functional value.

Analysis showed 10.2% protein and 14.40% moisture in the flour combination. These values were higher than banana cookies but lower than wheat flour. The flour mixture had 0.83% ash, lower than banana flour. We tested the cookies' odor, color, flavor, and crispness. Based on these assessments, we chose cookies with 10%, 15%, and 20% banana flour and 8% sesame seeds. In the trial, flours with 10%, 15%, and 20% banana flour showed similar water absorption values (59.97 ± 0.03, 60.00 ± 0.00, 59.97 ± 0.03) but differed in development time, mass stability, and softness. The cookies produced with 20% banana flour and 8% sesame showed a higher antioxidant capacity, with an IC 50 value of 17.52 ± 0.25 mg/mL. Proximal chemical analysis showed moisture (1.88% ± 0.00), protein (10.65% ± 0.001), fat (22.01% ± 0.001), crude fiber (1.01% ± 0.001), ash (1.54%), and carbs (62.91%) (Loza et al., 2017).

Recently, fruits have garnered attention due to their phytochemical content, which is said to offer several health benefits, including antioxidant activity. Bioactive chemical extraction may need drying fresh goods before usage. Dried food is frequently utilized because water removal reduces moisture-driven degradation responses that affect bioproduct quality. The food sector is interested in dried fruits and powders. Drying and grinding during powder manufacturing considerably affect biological material quality. It involves physical, textural, sensory, and functional alterations as well as nutritional ones. Retro engineering is needed to regulate these important modifications. Karam et al. (2016) examined how dry drying and grinding processes affect product physicochemical and functional qualities. Discussions of novel strategies and methods to mitigate the above changes are provided.

Local ingredients like nixtamalized corn flour and nike flour can boost snack bar value and lower production expenses. This trial's snack food bars contained 26.77% nixtamalized corn flour, 6.69% nike flours, 9.37% corn starch, 20.08% chocolate, 13.01% margarine, 13.38% egg whites, and 13.38% sugar, as in the previous study. Our snack food bars were made by weighing, combining, shaping, baking, cooling, and packaging. The baking process had three temperature-time combinations with three duplicates. Bars were baked at 1000C for 20 minutes, then at 1400C, 1500C, or 1600C for 40 minutes. The panelists disliked snack food bars made by baking temperature combination because they tasted like nike flours. Baking temperature C (1000 C for 20 minutes, 1600 C for 40 minutes) scored highest for texture. Snack food bars manufactured had similar nutrient and calorie content to formulation. This study found 10.1751 g fat, 3.5694 g protein, and 32.2681 g carbohydrate per 50 g snack bar. Snack bars have 9.8 g of fat, 5.84 g of protein, and 30.37 g of carbohydrate per 50 g, according to formulation. In this investigation, snack food bars contained 234.926 kcal per 50 g, while the formulation result was 233. This suggests that local snack food bars could become emergency food in the region (Kasim et al., 2017).

Diabetes patients are increasingly using wholegrain foods as high-fiber supplements. With obesity and cardiovascular disease prevalent in Indonesia, diabetes mellitus has virtually doubled and constitutes a serious health danger. Research creates cookie bars with foxtail millet, arrowroot flour, and kidney beans. By choosing the optimal glycemic index formula, physical, chemical, and sensory qualities were assessed. Three cookie bars with varied foxtail millet, kidney bean, and arrowroot flour percentages were tested. F1, F2, and F3 had °Hue values of 53.77, 58.46, and 58.31 with breaking forces of 8.37, 10.12, and 5.87 N. Total crude fat did not differ between formulas, but all other nutritional content did. The F2 cookie bar was chosen for the glycemic index because it has the best sensory qualities, lowest total sugar, and accessible carbohydrate. The 37.6 glycemic index of F2 cookie bars with 15% foxtail millet, 15% arrowroot flour, and 30% kidney beans is low. Since F2 cookie bars have the best physicochemical, sensory, and low glycemic index, they can be developed as diabetic foods (Lestari, 2017).

Kim (2020) tested cookie quality and antioxidant activity with Pleurotus eryngii powder. There were no significant variations in dough bulk density or water content. With more Pleurotus eryngii powder, cookie spread and leavening reduced. However, cookie loss rates were similar. Increasing Pleurotus eryngii powder content decreased L values while progressively increasing them. b values were similar among samples. With more Pleurotus eryngii powder, cookies had higher hardness, total phenol component content, ferric reducing antioxidant power (FRAP), and DPPH radical scavenging activity. Adding Pleurotus eryngii powder boosted color, flavor, palatability, hardness, and graininess in a descriptive test. Color and flavor were highest in the 10% group in a preference test without significant differences. Texture was preferred in control-20% groups without significant differences. Taste and general acceptance were highest in 10%.

The previous study examined the physicochemical and organoleptic effects of replacing wheat flour with legume flour (mung bean and chickpea) in cookies. Cookies were made from (a) Control (100% wheat flour), (b) Mung bean (50% wheat flour + 35% mung bean flour + 15% corn flour), and (c) Chickpea. The physicochemical and organoleptic properties of three cookie kinds were assessed. Cookies had substantial differences in ash, protein, crude fiber, and total carbohydrate ($p<0.05$). Chickpea cookies had the most protein and resistant starch ($p<0.05$) of the three cookies. The mung bean cookies had the highest weight, diameter, height, and spread ratio ($p<0.05$). Chickpea cookies had higher hardness, crispiness, elasticity, gumminess, and chewiness than the other two samples (p<0.05). Taste, crispiness, and aftertaste were significantly different between chickpea and mung bean cookies, but overall acceptability was not (p>0.05). Taste, crispiness, and acceptance were best in chickpea cookies (Aziah, 2022).

Low fat intake may lower atherosclerosis risk. This study tested chocolate bar cookies using okra gum as a fat substitute. Okra gum (OK) or applesauce (AP) replaced margarine and egg yolk in high-fat cookies (CTL). Cookie moisture was measured with a drying oven. Fresh OK (28.3±0.4%) and AP (27.6+1.1%) cookies had higher moisture content than CTL (8.5±0.3%), which persisted for 48 hours ($P<.001$)($n=3$). Fifty-two buyers rated cookies hedonically. Fresh cookies had acceptable sensory scores for color, fragrance, flavor, aftertaste, moistness, and overall acceptability, but fat-free cookies had lower flavor and aftertaste than CTL ($P<.01$). Fat-free cookies had an acceptable and greater moistness rating than CTL after 48 hours ($P<.01$). Okra gum can replace fat in chocolate bar cookies (Romanchik-Cerpovicz, 2022).

A cookie bar with pears, a fruit rich in antioxidants, plant components, and dietary fiber, is a healthy snack for all. Krishnapriya et al. (2021) standardised and prepared pear fruit cookie bars and assessed their quality. Two samples of the pear fruit cookie bar (Sample A, 25 g dehydrated pear shreds; Sample B, 50 g) were tested for moisture, carbohydrate, fiber,

protein, ash, sodium, vitamin C, vitamin K, potassium, vitamin B1, potassium, magnesium, phosphorus, and total antioxidant activity. The most palatable sample was Sample B (50 g dried pear fruit shreds) with increased nutritious content and antioxidant activity.

Study results by Varghese, C. et al., 2022, create and sensory characterize low-cost, high-energy, nutritious cookies that meet the 30% RDA of undernourished adolescents as recommended by the National Institute of Nutrition (NIN), India. LP optimised underused components finger millet, jackfruit seed powder, moringa powder, soy protein isolate, icing sugar, and oil. Fuzzy logic analysis was used to compare the created cookies' sensory qualities to imported BP-100 (RUTF biscuit) and two market-available high-energy biscuits. At an ingredient cost of US$ 1.52/kg, cookies with 506.81 kcal/100 g, 13.46 g protein, and 25.97 g fat were made with 2.2 g vitamin and mineral premix. Consumers liked cookies with greater similarity values more than others. Texture and taste affect sensory acceptance and customer approval most, followed by color, overall acceptability, and flavor.

Consumer trends suggest producing ready-to-eat food with low calories, high protein, fiber, and antioxidant content. Ramírez-Jiménez (2018) examined the nutritional and bioactive content of a snack bar made with common bean and oat flour, as well as its acceptance. A mixture design produced 27 constituent combinations that were ranked to determine the best formulations. Compared to a control bar without beans, the two selected formulations had considerably higher protein, total flavonoids, and antioxidant capacity ($p < 0.05$). Bean-containing snack bars had lower lipids and carbohydrates (8 and 5 g/100 g, respectively), lower energy content (11–12% kcal), and 60% more total dietary fiber. A 9-point hedonic and “just-about-right” scale acceptance test showed that consumers liked textural features including crispness and hardness, but flavor and mouth-feeling sensation must be improved to improve acceptance. Bean inclusion may add value to functional items, according to the results.

Apple is one of the most processed fruits, producing a lot of apple pomace. This substance contains bioactive chemicals that can be employed in culinary and pharmaceutical products to meet current demand for natural, low-side-effect components (Barreira, et al., 2019). Apple processing produces fiber- and phenol-rich apple peel. Muffins were used to test the viability of adding dried apple skin powder (ASP) as a value-added ingredient to bakery foods. Blanched, dehydrated, and ground ASP was used to muffins at 0, 4, 8, 16, 24, or 32% (w/w) to replace wheat flour. The largest replacement (32% w/w) significantly affected baking. A taste panel of 66 found that replacing wheat flour with 8, 16, or 24% ASP in muffins did not alter acceptance. 2020 (Vasantha).

Food formulations can use phenolic bioactive compounds from fruits like apples to enhance health-related functions. Apple peels with high phenolic bioactive content were dehydrated for cereal-based muffins and apple purée. The raw material and apple peel dehydrated (APD) powder were tested for proximate composition, dietary fiber, mineral content, and phenolic-linked antioxidant activity before use in food formulations. The chemical composition, phenolic-linked antioxidant, anti-hyperglycemic effects (α-amylase and α-glucosidase enzyme inhibitory activities), and sensory properties of the prepared food, muffin, and apple puree with and without APD powder integration were assessed. In muffins, APD powder boosted total phenolic content, dietary fiber, antioxidant activity, and anti-hyperglycemic effects. These findings suggested that APD powder could be used as edible additives to improve nutrition, particularly for type 2 diabetes. Apple processing produces fiber- and phenol-rich apple peel. A muffin system containing dried apple skin powder (ASP) as a value-added food component was used to study how baking affects dietary fiber, phenolics, and total antioxidant capacity. In blanched, dehydrated, and crushed ASP, 41% total dietary fiber and 52 mg Trolox equivalents g^{-1} dry weight were found. ASP concentration was favorably linked with muffins' total dietary fiber, phenolic, and antioxidant

capacity. Henríquez (2020) found that baking resulted in a mean recovery of 61%, 57%, 53%, 44%, and 20% of quercetin glycosides, catechins, chlorogenic acid, phloridzin, and cyan

Apple powder, a grain blend, and whole-grain flour form crisp bread rich in nutrients. Enriching ingredients can be added to the recipe to limit fermentation and increase dough acidity in the non-paired method of making crisp bread. Apple powder replaced flour and sugar in the recipe. Experimentally selected prescription component ratios optimized organoleptic qualities of the end product. The added components improved dough structure and mechanics. During the experiment, crisp bread recipes containing 10%, 15%, and 20% apple powder were created. Apple powder and grain mixture boost the vitamin and mineral content of crisp bread and speed up the cooking process by reducing dough fermentation by two times (Pyanikova, et al., 2024).

Krajewska & Dziki (2023) examined how apple powder affects cookie taste. Consumer perception improved when cookies containing apple powder had a distinct apple flavor and scent.

Ting (2015) compared apple varieties for cookie recipes. Granny Smith apples gave the cookies a tart taste, while Fuji apples supplied sweetness, according to the study.

Kırbaş et al. (2019) investigated how apple concentration affects cookie texture. Due to apple moisture retention, cookies with more apples were softer.

Salazar-Orbea et al. (2023) compared fresh apple and apple purée cookies' color properties. Apple purée gave the product a brighter color, improving aesthetics.

Jacobsen (2014) examined apple-infused cookie acceptance. Participants preferred cookies with a balanced apple flavor, highlighting the importance of apple concentration in product creation.

Bananas are high in fiber (43.2-49.7%), carbohydrate (3%), crude protein (6-9%), and crude fat (3.8-11%). The banana peel contains polyunsaturated fatty acids (linoleic and α-linolenic acids), essential amino acids (leucine, valine, phenylalanine, and threonine), and minerals (K, P, Ca, Mg). Lignin (6-12%), pectin (10-21%), cellulose (7.6-9.6%), hemicelluloses (6.4-9.4%), and galacturonic acid are found in banana peel edible fibers. According to Shyamala and Jamuna (2011), banana peel has good antioxidant properties, with polyphenols of three kinds ranging from 200-850 mg equivalent of tannic acid/100g and free radical scavenging activity of 90-62%. Due to their high nutritional value, banana peels treat intestinal lesions, diarrhea, dysentery, ulcerative colitis, nephritis, gout, heart illness, hypertension, and diabetes. (Imam and Akter, 2011, Emaga et al., 2007, Wachirasiri, 2008). It is used fresh or processed in juice, jams, chips, puree/pulp, powder, biscuits, etc. Banana-based product manufacturers squander 40% of fresh bananas as peels (Tchobanoglous et al., 1993).

Antioxidants are in bananas. Additionally, banana pomace may be high in fiber. Banana peel also contains antibacterial and antifungal effects. Banana pomace includes useful components for human consumption, especially in whole-meal bread (Nasution, et al., 2012). High peak viscosity, high final viscosity, and high resistant starch content make 1st and 2nd ripening banana flour a good functional ingredient for baking items. Additionally, banana flours' pseudoplastic nature ($n < 1$) at the first and second stages makes them suitable for emulsions due to their high starch and low sugar content. Banana flour reduces postharvest losses and preserves fresh banana nutrition (Campuzano, et al., 2018). Due to its resistant starch and fiber, unripe banana flour helps colon health. Ripe banana flour contains iron, calcium, potassium, and reducing sugars, which improves blood circulation and reduces nicotine and caffeine cravings. Unripe and ripe banana pulp flour were stored at ambient circumstances for 60 days to compare their physico-chemical, reconstitutional, and sensory properties. Unripe banana flour absorbed more water. FTIR showed that ripe banana flour was dryer than unripe. Ripe banana flour was more hygroscopic than unripe because of

sugars. To test banana flour as a functional food ingredient, cookies and bread were made from unripe and ripe banana flour (Pyanikova, et al., 2024).

According to Stoin et al. (2021), Green banana flour and rice flour are nutritious and might be used to make flour products with better functionality. This study found that rice flour and green banana flour gluten-free cookies can be eaten by celiac disease and non-celiac gluten sensitivity sufferers and those who desire to live a healthy, nutrient-rich lifestyle. The sensory evaluation of rice flour and green banana flour cookies shows that a smaller amount of green banana flour increases consumer approval.

The sensory qualities of banana-powder biscuits were examined by Amini-Khoozani (2021). Banana powder cookies had a strong banana flavor and scent, which increased consumer preference.

Roongruangsri and Bronlund (2015) examined how banana powder processing affects cookie texture. The study discovered that freeze-dried banana powder made biscuits lighter than spray-dried powder, showing that processing might affect product quality.

Shafi (2022) studied banana powder cookie color stability during storage. Antioxidants in banana powder kept cookies brighter for longer, highlighting the relevance of ingredient quality in product development.

A sensory study by Ng et al. (2020) assessed cookie sweetness with different banana powder concentrations. The ratio of ingredients affected taste perception, with cookies with more banana powder seeming sweeter.

Mostafa (2021) examined banana powder-infused cookie shelf life. Banana powder's antibacterial capabilities improved shelf stability, suggesting it could improve product quality and safety.

Wine production produces grapes, which are a byproduct because pomace contains grape skins, pulps, and seeds. Grape pomace (GP) flour can be used in cookies, breads, cereal bars, pasta, vitamins, and drinks. This technique prolongs shelf life and boosts storage. Dehydration of the residue makes nutrients like fibers and phenolic compounds more useful and could boost product nutrition (Boff et al., 2022). Grape cultivar affected dough rheology, sensorial, and antioxidant properties of bread. Grapes are popular for their phenolic constituents. The bioaccessibility of these chemicals on grapes and their derivatives will determine their benefits (Silva et al., 2021).

About 25% of grape pomace remains after pressing. About 50% is peel and 25% is seeds and stems (Kılıç, 1996). Grape flour changed bread volume, stiffness, crumb and crust color, odor, and taste. The inclusion of grape pomace flour led to a stickier, less elastic crumb texture and enhanced aftertaste and sand-like sensation in the mouth (Šporin et al., 2018). According to Nakov et al. Growing amounts of grape pomace powder increased ash, fat, proteins, fibers, free phenolics, anthocyanins, total polyphenol content, antioxidant capacity (DPPH, FRAP), and decreased moisture and pH (2020). Grape pomace contained catechin, gallic acid, quercitin, protocatechuic acid, kaempferol, and apigenin. Phenolic acids and flavonoids increased from 4.1 mg/kg DM (control) to 26.4–60.9 mg/kg (cake with 4%–10% grape pomace powder).

Antonic (2021) found that grape seed flour in waffles transferred its overall phenolic content and antioxidant activity. This matches earlier research that fortified different product types. Fortified items had a firmer texture than the control, but dry matter did not alter. Sensory examination highlighted sample color, consistency, and sweetness discrepancies. The panelists' impression and pricing for tested samples were unaffected by these variances. Even at 10% grape seed flour, the most noticeable physical alterations in the finished product were acceptable to consumers. This shows that grape seed flour can be used as a wine byproduct and make waffles more practical.

Craig (2016) examined grape powder cookies' taste. Cookies with grape powder had a delicate grape aroma and flavor, creating a well-balanced taste profile that consumers liked.

Kuchtová et al. (2018) examined how grape types affect cookie texture. Red grape powder made cookies softer than green grape powder, showing that grape type can affect baked items' mouthfeel.

Nogueira (2024) examined grapes powder-containing cookies' color stability throughout baking. The study found that grapes powder preserved the color and brilliance of cookies, suggesting its use as a natural food coloring.

Pasqualone et al. (2014) tested cookies with different grapes powder concentrations for scent strength. Higher quantities of grape powder gave cookies a stronger grape fragrance, improving customer perception.

Antoniolli et al. (2024) examined grapes powder in cookies for antioxidants. Cookies enriched with grapes powder had higher antioxidant activity, suggesting a health benefit.

METHODOLOGY

Research design

The method used in this study was the experimental-developmental method of research. The experimental method focuses the study on the future (what will be) when the variables or the study are carefully controlled or manipulated (Calmorin, 2010). An experimental method was used to investigate the production of fruit powder in making bar cookies using four (4) treatments. In the developmental research, the product developed was bar cookies using apple powder, banana powder, and grape powder for potential product development and commercialization which undergo random assessment from evaluators/consumers.

Locale of the study and respondents

The study was conducted at CapSU Main Campus and Camburanan National High School. The respondents included 10 food processing and Home Economics teachers from CapSU Main Campus, as well as 100 evaluators comprising mothers, bakers, potential consumers, elementary pupils, and high school students from various year levels at Camburanan National High School. These evaluators were invited to participate and were instructed on how to evaluate the product using a nine-point Hedonic Scale for appearance, aroma, color, taste, and texture. After evaluating the product, their opinions were gathered, tallied, and summarized for further computation.

Research instruments

The research instrument used in the study was a scorecard, which included a nine-point Hedonic Scale for evaluating the quality attributes of the product, such as appearance, aroma, color, taste, and texture.

Data analyses procedure

The data was collected and subjected to statistical analysis using the SPSS software, specifically analyzing the Arithmetic Mean and the Analysis of Variance (ANOVA). The Analysis of Variance (ANOVA) was employed to determine the significant difference in the sensory qualities of the product, specifically in terms of its appearance, aroma, color, taste, and texture. Additionally, it was used to identify the differences among the four treatments (Larson, 2008). The significance level was set at an alpha of 0.01.

FINDINGS AND DISCUSSION

General acceptability of fruit powder bar cookies as evaluated by consumers

The results in the general acceptability of Fruit Powder Bar Cookies indicated that consumers' preference towards the cookies was consistently high across the four treatments. Assessment of appearance, aroma, color, taste, and texture by one hundred (100) participants revealed that the cookies were "Liked Extremely" regardless of the type of fruit powder used.

Specifically, Treatment C had the highest mean score of 8.71, followed by Treatment D with a mean score of 8.52, Treatment B with a mean score of 8.28, and Treatment A also with a mean score of 8.28. This suggests that the four treatments for making fruit powder bar cookies were perceived similarly overall, despite variations in the type of fruit powder used. The findings affirm that fruit powders contribute significantly to enhancing the nutritional values, physical attributes, organoleptic qualities, and microbiological aspects of the cookie batter.

CONCLUSIONS AND RECOMMENDATION

Based on the findings and objectives of the study, several conclusions can be drawn regarding the utilization of fruit flour in making bar cookies. Firstly, fruit flour emerges as a viable and beneficial ingredient for the production of these cookies. Moreover, specific fruit powders, such as Apple Powder, Banana Powder, and Grapes Powder, demonstrate promise as effective ingredients for bar cookie formulations. Through sensory evaluation conducted with 100 consumers, it was determined that Treatment C, incorporating a particular type of fruit powder, was overwhelmingly favored, with participants indicating a preference for its taste, aroma, and overall acceptability compared to other treatments. This highlights the potential of fruit powders to enhance the sensory appeal and consumer acceptance of bar cookies, particularly when carefully selected and incorporated into formulations.

Based on the conclusions drawn from the study, several recommendations can be proposed to further enhance the utilization and marketability of fruit powder bar cookies. Firstly, it is advisable to continue experimenting with different formulations and variations of fruit powder bar cookies to optimize their quality and appeal to consumers. Additionally, exploring various marketing strategies can help increase awareness and promote the benefits of using apple, banana, and grapes powder as substitutes for flour in making bar cookies. Future research endeavors should consider investigating additional variants of fruit powders and their potential applications in bar cookies to broaden the scope of understanding and uncover any untapped uses. This will contribute to the development of innovative products and provide valuable insights for both industry practitioners and consumers alike.

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