

Formulation and evaluation of mixed veggies seasoning

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Abstract: This study focused on formulating and evaluating Mixed Veggies Seasoning as a healthy alternative to commercial flavor enhancers. The seasoning was created using a developmental research design from dehydrated and powdered vegetables, including cauliflower, broccoli, carrots, and others. Organoleptic properties were evaluated through a 9-point Hedonic Scale by 80 respondents across four demographic groups: children, teenagers, adults, and food experts. The seasoning was tested in a meatball recipe across three treatments and evaluated in terms of appearance, aroma, taste, and texture. Nutritional analysis confirmed high carbohydrate and fiber content, with low moisture and fat levels, ensuring shelf stability. Statistical analysis, including ANOVA and post-hoc tests, revealed significant differences in acceptability among treatments, with Treatment 2 rated most favorably across all sensory criteria. Results affirm the seasoning's viability as a nutritious, acceptable, and cost-effective food product. Further research is recommended to explore its micronutrient content and potential for broader culinary applications.

Keywords: Mixed Vegetable Seasoning, Sensory Evaluation, Nutritional Analysis

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Seasonings play a crucial role in enhancing the flavor of various dishes. However, many commercially available options contain high levels of sodium and artificial additives such as monosodium glutamate (MSG), which have been linked to serious health risks, including hypertension, heart disease, and kidney-related conditions (Udom et al., 2024; Bayram et al., 2023).

Al-Agili (2020) reported that frequent MSG consumption may negatively affect immune function, metabolic health, and vital organs such as the kidneys and liver, as evidenced by both animal studies and human clinical trials. Meanwhile, vitamins and minerals, collectively known as micronutrients, are essential for maintaining good health. Micronutrient deficiencies, or "hidden hunger," occur when individuals do not consume enough of these crucial nutrients. The consequences are severe: impaired cognitive development, reduced productivity, increased maternal and infant mortality, and even childhood blindness.

According to the World Bank's 2021 report *Undernutrition in the Philippines: Scale, Scope, and Opportunities for Nutrition Policy and Programming*, the country has seen little to no progress in addressing undernutrition over the past three decades. One in three children under five years old (29%) is stunted, meaning they are too short for their age. Additionally, 19% are underweight, and 6% are "wasted," or underweight for their height. The Philippines ranks fifth in the East Asia and Pacific region for stunting and is among the top ten countries globally with the highest number of stunted children. These sobering statistics highlight the urgent need for

healthier food products, including seasonings that not only enhance taste but also provide vital nutrients.

While research has examined the health benefits of individual plant-based seasonings, little has been done to explore comprehensive powdered seasoning blends. A critical gap remains in the areas of food innovation and sustainability, particularly in the underutilization of surplus or discarded vegetables. Locally grown produce, such as cauliflower, broccoli, cabbage, bell pepper, carrots, celery, parsley, garlic, and onion, is often wasted due to overproduction, market standards, or post-harvest losses. Despite being rich in nutrients, these vegetables frequently end up in landfills instead of being transformed into functional food products. By repurposing these ingredients into a powdered seasoning blend, this study addresses public health challenges while also promoting food sustainability and waste reduction.

This research aligns with the United Nations Sustainable Development Goals (SDGs), specifically SDG 2: Zero Hunger, which advocates for food security and improved nutrition through sustainable practices, and SDG 3: Good Health and Well-being. By formulating a nutritious, plant-based powdered seasoning using underutilized local vegetables, the study contributes to innovative food solutions that combat hunger, malnutrition, and food waste.

Despite growing awareness of the health risks associated with artificial seasonings, many consumers continue to rely on commercial products due to the lack of healthier alternatives that provide comparable flavor. To bridge this gap, developing a vegetable-based powdered seasoning presents a promising solution, combining nutritional benefits, flavor satisfaction, and sustainability.

Hence, this study aims to contribute to the advancement of food innovation and public health by offering a viable alternative to conventional seasonings. The goal is to create a flavorful, health-conscious, and environmentally responsible product derived from natural, locally sourced ingredients, supporting better nutrition and overall well-being.

Research objectives

This study aimed to develop Mixed Veggies Seasoning as an alternative healthy seasoning and to evaluate its quality through organoleptic assessment. Specifically, it sought to identify and describe the processes involved in preparing the mixed veggies seasoning and determine its nutritive content. The study also aimed to evaluate the level of acceptability of the seasoning when used in a meatball recipe, as assessed by different groups of respondents: adults, children, food experts, and teenagers. Furthermore, it aimed to assess the general level of acceptability of the product in terms of appearance, aroma, taste, and texture. The study also sought to determine whether there is a significant difference in the general level of acceptability of the mixed veggies seasoning across different treatments based on its sensorial properties. Additionally, it aims to analyze whether significant differences exist in the level of acceptability across the various groups of respondents. Lastly, the study endeavored to conduct a cost-benefit analysis of the developed mixed veggies seasoning to evaluate its economic viability.

METHODOLOGY

Research design

This study employed a Developmental Research Design to systematically develop and assess the organoleptic properties of mixed vegetable seasoning. An organoleptic evaluation was conducted using a quantitative approach, employing a 9-point Hedonic Scale to assess key attributes such as

appearance, aroma, texture, taste, and overall acceptability. A panel of respondents, including adults, children, food experts, and teenagers, provided feedback on the seasoning's sensory characteristics. Statistical analysis was performed to determine the level of acceptability of the product.

Developmental procedure

After securing and preparing the necessary tools and materials, the development of the Mixed Veggies Seasoning followed a two-stage process: vegetable preparation and seasoning formulation. Fresh, high-quality vegetables, including cauliflower, broccoli, carrots, cabbage, bell pepper, parsley, celery, garlic, and onion, were thoroughly washed, peeled, sliced, and dehydrated. Once dried, the vegetables were ground into fine powders, sifted to ensure uniform texture, and properly stored. These individual vegetable powders were then accurately measured, blended with salt and black pepper, mixed thoroughly, and finally packaged and labeled to produce the finished seasoning product.

Data gathering procedure

Permission to conduct the study through sensorial evaluation was requested from the respondents, consisting of adults, children, teenagers, and food experts. Once permission was granted, the questionnaire was administered. Clear instructions on how to complete the questionnaire checklist were provided, and the questionnaires were retrieved after completion. The sensorial evaluation, conducted through the questionnaire checklist, gathered data on the sensory attributes of the mixed vegetable seasoning. Finally, the sensorial evaluation was used to determine the acceptability of the mixed vegetable seasoning in terms of aroma, appearance, taste, and texture.

Data gathering instrument

The instrument consisted of evaluation criteria on "The Organoleptic Evaluation of Mixed Veggies seasoning. The study employed a 9-point Hedonic Scale and Questionnaire to determine the acceptability of Mixed Veggies seasoning.

Sensory evaluation

After the development of the food product, it was subjected to a sensorial evaluation. Eighty (80) evaluators from various age groups were selected: adults (10), children (30), teenagers (30), and food experts (10). Convenience sampling was used to select the general respondents, comprising adults, children, and teenagers, who were residents of Barangay Baculud, City of Ilagan, Isabela, based on their availability and willingness to participate. Meanwhile, random sampling was employed in selecting the food experts from Isabela State University (ISU), Ilagan, TESDA Ilagan, and among restaurant owners and chefs within the City of Ilagan, Isabela. All evaluations were conducted within the City of Ilagan.

Before the tasting, respondents were properly oriented on what and how to evaluate using structured evaluation instruments. The meatballs with mixed vegetable seasoning were then served for tasting. Each respondent was asked to provide comments and recommendations for the further improvement of the food product. Data on the product's appearance, aroma, texture, and taste were collected and subjected to statistical analysis.

RESULTS AND DISCUSSION

Product development

The development of the Mixed Veggies Seasoning involved several stages. The first step was the preparation of the selected vegetables, which included selecting, washing, peeling, slicing, drying, grinding, sifting, and storing. Following this, the mixed veggies seasoning was prepared through measuring, mixing, packaging, and labeling. Throughout these stages, careful observation and analysis were conducted to ensure the quality and consistency of the final product.

Nutritive content of mixed veggies seasoning

The proximate composition of the mixed vegetable seasoning—made from cauliflower, broccoli, carrots, cabbage, bell pepper, parsley, celery, garlic, onion, salt, and pepper—highlights its nutritional and functional potential. Moisture content ranged from 9.39% to 10.30%, indicating effective dehydration and ensuring shelf stability. Ash content (2.00%–2.35%) represents essential minerals derived from vegetables and added salt. Lipid and protein contents were low, ranging from 0.03%–0.034% and 0.14%–0.1424%, respectively, which is typical for non-leguminous plant-based products. Fiber content (0.23%–0.241%) provides modest digestive benefits. Carbohydrates comprised the majority of the composition (87.03%–88.21%), serving as the primary energy source. Metabolizable energy ranged from 348.96 to 353.67 kcal per 100g, consistent with carbohydrate-rich, dehydrated food products. The results, verified by food analyst Denson M. Liday, align with studies on dried vegetable powders and confirm the product's viability as a natural, energy-dense, clean-label flavor enhancer. Further analysis of micronutrients and bioactive compounds is recommended to assess their functional food potential.

Level of acceptability of the developed mixed veggies seasoning used in the meatball recipe as evaluated by the different groups of respondents

The study assessed the acceptability of a developed mixed veggies seasoning used in a meatball recipe, evaluated by children, teenagers, adults, and food experts across three treatments and four sensory criteria: appearance, aroma, taste, and texture. In Treatment 1, food experts rated both appearance and texture highest at 8.07 ("Very Agreeable"), while children gave the lowest score of 5.81 for appearance ("Slightly Agreeable"). Adults rated taste at 8.03, and overall means were highest for adults (7.93) and food experts (7.90), with children lowest at 6.02. In Treatment 2, acceptability peaked across all groups. Children gave the highest rating of 8.68 for appearance ("Extremely Agreeable"), and teenagers rated taste at 8.67.

The lowest Treatment 2 score, 8.23 for taste by food experts, still fell under "Very Agreeable." The overall mean was 8.59 for both children and teenagers, 8.35 for adults, and 8.38 for food experts. In Treatment 3, food experts again rated highest with 8.80 for aroma. Children gave the lowest rating of 7.17 for appearance, rated "Moderately Agreeable." The highest overall mean in Treatment 3 was 8.65 (food experts), and the lowest was 7.30 (children). Results confirm Treatment 2 as the most universally accepted, highlighting demographic influence on sensory preferences.

General level of acceptability of the developed mixed veggies seasoning using Treatment 1

The general level of acceptability of the developed mixed veggies seasoning in Treatment 1 was consistently rated as "Moderately Agreeable" across all sensory criteria. For appearance, mean scores ranged narrowly from 6.65 to 6.68, with the highest rating for being "visually appetizing," and an overall appearance mean of 6.66. Aroma followed a similar trend, with scores between 6.61 and 6.71; the scent of mixed vegetables rated highest, leading to an overall aroma mean of 6.67.

Taste received slightly higher evaluations, particularly for the statement on a "harmonious flavor profile," which scored 6.83. The overall taste mean was 6.79, nearing the upper bound of the "Moderately Agreeable" range. The highest ratings were in texture, where the seasoning's ability to integrate without overpowering scored 7.06—the highest individual score across all criteria, resulting in a texture mean of 6.95.

Overall, Treatment 1 was moderately well-received, with texture as its strongest attribute. Findings support Andersen et al. (2019), highlighting that taste and texture are key drivers of food acceptance, suggesting improvements in appearance and aroma could further boost the product's overall appeal.

General level of acceptability of the developed mixed veggies seasoning using Treatment 2

The sensory evaluation of the developed mixed veggies seasoning in Treatment 2 showed highly favorable results across all criteria. Appearance received the highest mean rating of 8.63 for being "visually appetizing," with an overall mean of 8.55, classified as "Extremely Agreeable." Aroma was equally well-rated, with an overall mean of 8.55; the highest score (8.63) was for enhancing the meatball's desirability. Taste also received consistent and excellent ratings (mean scores 8.54–8.55), with the highest for "savory, well-balanced flavor." Texture, while slightly lower, still had a strong overall mean of 8.50, with the best score (8.58) for "smooth and enjoyable mouthfeel."

These results indicate that Treatment 2 is the most acceptable formulation, especially in appearance, taste, and aroma. The findings align with Andersen et al. (2019) and Dawodu et al. (2023), supporting that taste, texture, and local ingredient-based seasonings significantly influence consumer acceptability and product success.

General level of acceptability of the developed mixed veggies seasoning using Treatment 3

The overall acceptability of the mixed veggies seasoning in Treatment 3 was favorable, with all sensory attributes rated as either "Moderately Agreeable" or "Very Agreeable." Appearance received the lowest overall mean (7.48), just below the "Very Agreeable" threshold, suggesting visual presentation needs slight enhancement. Aroma was consistently well-rated, with an overall mean of 7.52, highlighting a clear and appealing scent. Taste emerged as a strong attribute, earning the highest score (7.63) for its savory and well-balanced flavor, with an overall mean of 7.60, indicating a reliably satisfying profile. Texture received the highest average among all criteria at 7.64, with remarks on smooth mouthfeel and seamless integration with meatballs.

In summary, Treatment 3 was positively received, particularly in taste and texture, while appearance showed room for improvement. These findings align with Hoppu et al. (2021), who emphasized that enhancing sensory traits like flavor and mouthfeel increases consumer acceptability in vegetable-based food products.

Comparison on the general level of acceptability of the developed mixed veggies seasoning as used in the different treatments in terms of its sensorial evaluation

An ANOVA test revealed statistically significant differences in the acceptability of the mixed veggies seasoning across Treatments 1, 2, and 3 in terms of appearance, aroma, taste, and texture. All four attributes yielded p-values of 0.0000, prompting rejection of the null hypothesis and confirming that each treatment was perceived differently. Appearance ($F = 81.64$) and aroma ($F = 87.41$) showed distinct variations among age groups, suggesting different visual and scent preferences. Taste ($F = 82.10$), a key acceptability factor, also showed significant differences, with flavor perceptions varying across treatments and demographics. Texture ($F = 63.26$) was rated differently as well, likely due to mouthfeel and consistency. These findings confirm that treatment formulation significantly affects sensory perception, with Treatment 2 emerging as the most preferred overall. The results align with research by Rungjindarat et al. (2023) emphasizing the value of statistical methods in evaluating consumer responses to food products.

Post-hoc analysis on the general level of acceptability of the developed mixed veggies seasoning as used in the different treatments in terms of its sensorial evaluation

The post-hoc analysis of the mixed veggies seasoning's acceptability revealed significant differences in sensory ratings across age groups. Children consistently rated the seasoning higher than teenagers and adults in all categories—appearance, aroma, taste, and texture—with statistically significant mean differences. For instance, children rated appearance more favorably than teenagers and adults (mean differences = 1.8875 and 0.8208, respectively), and teenagers rated it higher than adults (1.0667). Similar trends were seen in aroma, taste, and texture, indicating a clear pattern of decreasing preference with age. These results suggest that age strongly influences sensory perception, with younger individuals showing greater liking for the seasoning. Supporting literature, such as studies by Coulthard & Blissett (2009), Rolls et al. (1984), and Coppens et al. (2020), confirms that children often prefer more flavorful and textured foods due to heightened sensory responsiveness. Thus, the seasoning may be particularly suited for younger consumers, guiding product refinement and targeted marketing strategies.

Comparison of the level of acceptability of the developed mixed veggies seasoning across different treatments as evaluated by different groups of respondents

The ANOVA results indicate varied acceptability of the mixed veggies seasoning among treatments and respondent groups. Treatment 1, with an F-value of 25.7762 and p-value of 0.0000, shows significant differences in ratings among children, teenagers, adults, and food experts, highlighting group-specific preferences. Similarly, Treatment 3 ($F = 14.1300$, $p = 0.0000$) also received significantly different ratings, suggesting perceptions varied by age or expertise. In contrast, Treatment 2 ($F = 0.9256$, $p = 0.4324$) had no significant differences among groups,

indicating a consistent level of acceptability. Thus, Treatment 2 appears to be the most universally appealing formulation.

Post-hoc analysis on the general level of acceptability of the developed mixed veggies seasoning as used in the different treatments in terms of its sensorial evaluation

The post-hoc analysis revealed significant differences in how evaluator groups perceived the mixed veggies seasoning, especially in Treatment 1. Children rated it significantly higher than teenagers, adults, and food experts, indicating a strong preference among younger participants. Teenagers also rated it higher than adults and experts, while adults and experts showed no significant difference in ratings. In Treatment 3, children, teenagers, and adults had similar acceptability scores, but food experts rated it significantly lower. These results suggest that Treatment 1 appeals more to younger consumers, while Treatment 3 is generally accepted by non-experts but not favored by professionals, emphasizing audience-specific product formulation.

Cost and benefit analysis of mixed veggies seasoning

The cost-benefit analysis of the developed mixed veggies seasoning confirms its economic viability and market readiness. From 18 kg of fresh vegetables, 1,150 grams of powder were produced, yielding 143 sachets of 15 grams each. The total production cost was ₱3,907.40, including raw materials (₱2,300), cabinet dryer operation (₱1,350), and packaging (₱257.40), resulting in a unit cost of ₱27.33 per sachet. With a proposed selling price of ₱40, the total revenue would be ₱5,720, generating a net profit of ₱1,812.60 and a benefit-cost ratio of 1.46. Although the cost is higher than commercial alternatives, its nutritional value and clean-label appeal justify the premium. Supported by Panikkar's (2019) study on the economic viability of vegetable-based seasonings, the findings highlight the product's profitability and potential. Optimizing ingredient ratios and processing efficiency could further enhance cost-effectiveness, ensuring sustained market competitiveness and consumer appeal.

CONCLUSIONS

The study concludes that mixed veggies seasoning is a viable and health-conscious alternative to commercial flavor enhancers. Its nutritional value and sensory appeal make it suitable for younger consumers and health-focused markets. Consistency in acceptability across age groups for Treatment 2 indicates strong market potential. The product supports the promotion of vegetable intake and clean-label trends in the food industry. Economically, it shows profitability, justifying its premium price through nutritional benefits. Further improvements in visual appeal and aroma can enhance consumer satisfaction, while refining processing efficiency may lower production costs and expand market reach.

RECOMMENDATIONS

In light of the findings and conclusions, the study recommends the following:

The results of the study should be communicated to the school administrator, particularly the Office of the Research and Extension Unit of the campus, for possible development into an income-generating enterprise (IGE).

Food technology teachers, students, homemakers, and entrepreneurs are encouraged to conduct further research and innovations in producing quality food products, particularly those that emphasize nutritional value and the use of locally available ingredients and materials.

The seasoning formulation may be revised by increasing the proportion of cost-effective, high-yield vegetables such as garlic, carrots, and onions, while reducing or replacing expensive, low-yield ingredients like parsley. This will improve cost-efficiency and overall yield.

The product should be positioned as a clean-label, MSG-free, and nutrient-rich alternative to commercial seasonings. Marketing efforts should emphasize its health benefits and natural ingredients to appeal to organic, vegan, and health-conscious consumers.

Invest in moisture-resistant, food-grade packaging that extends shelf life and preserves aroma, flavor, and texture. Vacuum sealing or resealable pouches may be considered to enhance consumer convenience and freshness retention.

Future sensory evaluations should include broader demographic groups beyond children, teenagers, adults, and food experts. This will provide more generalizable insights into consumer preferences across income levels, regions, and dietary needs.

Consider developing product line extensions such as spicy, low-sodium, or flavor-specific variants tailored to specific cuisines or dietary requirements. This can attract a wider range of consumers and improve market competitiveness.

The developed products should be pursued for commercialization, publication, patenting, and funding opportunities.

The developed mixed veggies seasoning should be submitted to the Department of Agriculture (DA) and/or the Department of Science and Technology (DOST) for support in packaging, labeling, and marketing.

The mixed veggies seasoning should be promoted as a versatile flavor enhancer suitable for a variety of culinary applications. Due to its balanced taste profile and favorable sensory acceptance, it can be incorporated into recipes such as soups, stews, sauces, marinades, and meat dishes. Additionally, it can be used to season vegetables, rice, pasta, and snacks, offering a convenient and nutritious way to enhance everyday meals.

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