



Dehydrated Dumpling with Sea Grapes (*Caulerpa Lentillifera*) Seaweeds

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Abstract: Innovation in food development by exploring ingredients and product combinations that remain largely untapped yet possess strong potential for consumer acceptance, nutritional value, and marketability. This study explores the development and nutritional evaluation of dehydrated dumplings incorporating sea grapes seaweed (*Caulerpa lentillifera*), sweet purple potato (*Ipomoea batatas* L.), blue ternate (*Clitoria ternatea*), and Indian oil sardines (*Sardinella longiceps*). The research aims to formulate a nutritious, visually appealing, and sustainable snack by blending traditional ingredients with innovative techniques. Three formulations were tested, varying the proportions of key ingredients to assess their effects on protein, carbohydrate, and fat content. Results showed that the formulation containing 25% all-purpose flour, 50% sweet purple potato, 25% blue ternate, 25% Indian oil sardines, and 75% sea grapes seaweed yielded the lowest carbohydrate and fat levels, making it the most suitable choice for health-conscious consumers. Nutrient analysis revealed no significant differences in protein, carbohydrate, or fat content among the formulations, suggesting that ingredient proportions can be adjusted for taste or texture without compromising nutritional value. The inclusion of sweet purple potato and blue ternate enhanced the dumplings' color and sensory appeal. At the same time, sea grapes seaweed contributed to a low-fat profile, supporting the product's marketability as a healthy snack. The study underscores the potential of dehydrated dumplings with seaweed as a functional food, promoting both culinary innovation and sustainable practices. Further research is recommended on shelf life, microbial safety, and wider product promotion to enhance consumer acceptance and commercial viability. Overall, this work contributes to the diversification of food products by utilizing locally sourced, nutrient-rich ingredients that bridge traditional and modern dietary preferences.

Keywords: food innovative, laboratory testing, developmental and descriptive design, sensory evaluation, dumpling development.

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Introduction

In today's world, there is a growing interest in creating foods that not only taste good but also support our health and the environment. Dumplings, a beloved dish enjoyed by many cultures worldwide, have long been a comforting and versatile snack or meal. However, traditional dumplings often rely on high-fat meats and refined starches, which can limit their nutritional value and impact sustainability. This study was inspired by the desire to create a healthier, more sustainable version of dumplings using

local, nutrient-rich ingredients such as sweet purple potatoes, blue ternate, Indian oil sardines, and sea grapes seaweed. By making these into dehydrated dumplings, the researchers aim to offer a product that is both visually appealing and convenient, while nourishing the body and respecting the planet.

Dumplings tell a story of culinary creativity and cultural tradition from the classic Chinese *jiaozi* to Italian *ravioli* each shaped by the ingredients and tastes of its region. Sweet purple potatoes offer vibrant color, antioxidants, and essential nutrients, including vitamins and minerals, that support overall well-being.



They also help give the dough a great texture and moisture balance, which is especially important for dehydrated foods. Blue ternate adds a natural blue hue and antioxidants, meeting today's demand for clean, natural ingredients. Meanwhile, the Indian oil sardines and sea grapes seaweed contribute a rich source of protein, fiber, and minerals that remain largely untapped in modern snacks. Although there have been exciting advances in creating healthier dumplings and utilizing dehydration methods to extend shelf life, there's still a need to explore these local, sustainable ingredients more thoroughly.

By combining these unique ingredients, this study aims to bridge the gap and create dehydrated dumplings that are not only tasty but also nutritious and environmentally friendly. The research will develop various formulations, measure their nutritional content, and identify the optimal combination to offer a product that stands out in both taste and health benefits. Beyond providing a delicious snack option, this work supports local farmers and fisherfolk, contributes to food sustainability, and responds to consumers' growing desire for wholesome and convenient foods. Ultimately, it is about honoring tradition while embracing innovation to build a healthier and more sustainable future through food.

Methodology

The research employed both developmental and descriptive research methodologies to guide the study. According to Richey et al. (2004), developmental research refers to a systematic method of studying, designing, and evaluating instructional products and processes to improve their effectiveness and relevance. This method was particularly suitable for creating and formulating the Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweed, as it involved iterative stages of planning, development, and refinement of the product. A descriptive research design, as defined by Bhat (2019) as a theory-based approach that involves the collection, analysis, and presentation of data to describe a phenomenon accurately, was employed to assess the nutritional content and other attributes of the final product. The integration of both approaches enabled the study not only to develop an innovative food product but also to provide a detailed understanding of its composition and potential benefits through laboratory-based evaluation. Hence, the combined use of developmental and descriptive research designs was essential to address both the product innovation and its scientific validation.

Design Criteria

The design of the Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweed was guided by specific criteria to ensure the product's quality and relevance. First, the product was developed with a focus on its nutritional value, incorporating ingredients such as sweet purple potato, sea grapes, and Indian oil sardines, which are known to be rich in essential nutrients, including protein, carbohydrates, vitamins, and minerals.

Laboratory testing was conducted to verify that the final product meets acceptable nutritional standards for a healthy food alternative. Additionally, ingredient sustainability and local availability were emphasized in the selection of components. The key ingredients were chosen not only for their nutritional content but also for being locally sourced and underutilized, promoting environmental sustainability and supporting local agriculture. Lastly, the product was designed to ensure ease of preparation and handling, with attention to creating a formulation that is simple to cook or rehydrate and convenient to store and package, making it suitable for various consumer settings.

Design Plan, Preparation, and Formulation

This includes preparation and procedures, tools and materials used, as well as ingredients and their uses. The development of Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweed involved selecting raw materials such as sweet purple potato, blue ternate, Indian oil sardines, and sea grapes seaweed for their high carbohydrate, protein, and fat content, distinctive purple color, and enhanced nutritional value. Detailed procedures ensured the proper mixing and processing of ingredients for optimal quality. Essential tools, such as mixing bowls, knives, steamers, and dehydrators, facilitated efficient preparation, ensuring food safety and hygiene.

Preparation of Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweed

The preparation phase of the Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweed involved careful planning and formulation, beginning with the conceptualization of a healthy, cost-effective dumpling using locally available ingredients such as sweet purple potato, sea grapes seaweed, and Indian oil sardines. A review of prior art was conducted to assess existing dumpling innovations and identify opportunities for improvement, particularly in nutritional value and sustainability. Based on these insights, a working budget was allocated to cover the systematic procurement of ingredients, tools, and equipment necessary for development and testing. Essential materials—including food-grade tools, cooking devices, dehydrators, and airtight containers—were sourced, while ingredients were selected for their quality, availability, and health benefits. This thorough preparation ensured that all resources were aligned with the research objectives, enabling a smooth transition into the formulation and experimentation phases.

In the preparation phase of the Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweed, careful consideration of the identification, usage, and specifications of the tools and equipment is crucial for ensuring optimal results. This information, detailing the necessary tools and their specific functions in the preparation process, is presented in Table 1.

Table 1: Tools and Equipment and their Functions in Making the Dehydrated Dumpling with Sea Grapes (*Caulerpa Lentillifera*) Seaweed

Tools and Equipment Used	Functions
A. Tools	
Mixing Bowl	Used as a container where the ingredients are mixed
Knife	Used to mince and cut the ingredients
Weighing Scale	Used to weigh the ingredients and product
Wooden Ladle	Used to mix the ingredients
Rubber Scraper	Used to mix and scrape the ingredients
Drainer	Used to drain the main ingredient
Chopping Board	Used as support in the slicing of the ingredients
B. Equipment	
Blender/food processor	Used to blend the ingredients
Gas Stove	Used to cook the dumpling
Steamer	Used to steam the dumpling
Dehydrator	Used to dehydrate the dumpling

Table 1 presents the tools and equipment used in making the Dehydrated Dumpling with Sea Grapes Seaweed. Each tool and piece of equipment has its specific function. These include a mixing bowl, knife, weighing scale, wooden ladle, rubber scraper, drainer for the seaweeds, casserole for steaming, and blender. Additionally, equipment such as a food processor, gas stove, freezer, and dehydrator were utilized in the preparation process.

The table also provides the functions of each tool and equipment mentioned and used in making the dehydrated dumplings with sea grapes seaweed. The ingredients and their uses, including the quantity and unit of measurement, were also identified in the preparation of the Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweed. The results are presented in Table 2.

Table 2: Ingredients and their Uses in the Making of Dehydrated Dumpling with Sea Grapes (*Caulerpa Lentillifera*) Seaweed

Ingredients	Qty.	Unit	Uses
For Dumpling Stuffing			
Sea Grapes Seaweeds	75	%	main ingredients
Indian oil sardines, blanch and flake	25	%	main ingredients
Black Pepper	5	%	condiment
Salt	5	%	condiment
Onion	5	%	spices
For Dumpling Wrapper			
All-purpose flour	25	%	ingredients
Purple Sweet Potato	50	%	main ingredients
Blue Ternate	25	%	natural food coloring

Table 2 presents a list of ingredients with their respective quantities measured in grams. Each ingredient is accompanied by its specific use for clarity. The recipe for the Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweed was based on the standard dumpling recipe, typically utilizing pork meat. However, in this variation, sweet potato, blue ternate, Indian oil sardines, and sea grapes were the main ingredients, replacing pork and other meats. Additionally, condiments and spices such as black pepper, salt, onions, and garlic were included as natural enhancers to blend

the taste of the Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweed.

Results and Discussion

Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweed Formulation Development

The first objective of the study was to develop a formulation of Dehydrated Dumpling with Sea Grapes (*Caulerpa Lentillifera*) Seaweed in three samples as shown in Table 5.

Table 3: Formulation of Three Samples Dehydrated Dumpling with Sea Grapes (*Caulerpa Lentillifera*) Seaweed

Ingredients	Sample 1	Sample 2	Sample 3
	%	%	%
All- purpose flour	75	50	25
Sweet purple potato	20	40	50
Blue ternate Stuffing	5	10	25
Indian oil sardines)	75	50	25
Lato	25	50	75

Table 3 presents the percentage of ingredients of Dehydrated Dumpling with Seagrapes (*Caulerpa Lentillifera*) Seaweed in three (3) samples in varying percentages. Sample 1 contains 75% all-purpose flour, 20% sweet purple potato, and 10% blue ternate. Sample 2 contains 50% all-purpose flour, 40% sweet purple potato, and 10% blue ternate. Sample 3 contains 25% all-purpose flour, 50% sweet purple potato, and 25% blue ternate. Moreover, in stuffing, Sample 1 contains 75% Indian oil sardines and 25% sea grape seaweed. In comparison, Sample 2 contains 50% Indian oil sardines and 50% sea grape seaweed, and Sample 3 contains 25% Indian oil sardines and 75% sea grape seaweed. Each trial has a corresponding taste, and they differ from one another.

Similarly, the present study applied a mixture formulation strategy to develop a novel dehydrated dumpling incorporating sea grapes (*Caulerpa lentillifera*), Indian oil sardines, sweet purple potato, and blue ternate. Inspired by previous experimental approaches in food innovation research, the study employed three formulation sets with dough and filling ratios that totaled 100%, using combinations of 25%–75%, 50%–50%, and 75%–25% to vary both nutritional content and sensory characteristics systematically. The dough component featured varying levels of all-purpose flour, sweet purple potato, and blue ternate. At the same time, the stuffing adjusted the proportions of sardines and sea grapes to assess the potential of seaweed as a sustainable and health-enhancing ingredient.

By conducting a proximate analysis and statistical evaluations, the study demonstrated that shifts in ingredient ratios influenced the macronutrient composition—particularly protein and fat content, as well as the perceived sensory quality of the dumplings. These findings reinforce those of Jaikaew et al. (2023), who similarly found that altering ingredient ratios in dumpling formulations significantly affects product attributes. Thus, the integration of traditional and functional ingredients within controlled formulation ranges contributes to the growing body of research aimed at modernizing culturally rooted foods while enhancing their nutritional and environmental profiles.

Nutrient Content of the Dehydrated Dumpling with Lato (*Caulerpa Lentillifera*) Seaweed

The second objective of the study was to determine the nutrient contents of the Dehydrated Dumpling with Sea Grapes (*Caulerpa*) Seaweed in terms of protein, carbohydrates and fats.

Table 4: Mean Score of Nutrient Content of Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) in Different Formulations in terms of Protein

Formulation	Mean
Sample 1	13.55
Sample 2	15.00
Sample 3	14.00

Table 4 presents the protein content of the Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweeds across three different formulations. Among the samples, Sample 2 exhibited the highest mean protein content (M = 15.00), followed by Sample 3 (M = 14.00), while Sample 1 recorded the lowest (M = 13.55). The higher protein concentration in Sample 2 may be attributed to the balanced 50:50 ratio of Indian oil sardines and sea grapes used in its stuffing. This equal distribution likely provided an optimal contribution from both ingredients, especially from the sardines, which are naturally rich in protein. In contrast, the variability observed between Sample 2 and Sample 3 is consistent with previously reported fluctuations in the protein content of sea grapes, which range from 0.43% to 19.38%, depending on factors such as geographic origin, harvest season, and processing methods (Nguyen et al., 2022; Chia et al., 2023). For instance, Nguyen et al. (2022) reported that protein levels in sea grapes may be as high as 18.57% or as low as 7%, illustrating the seaweed’s inherent compositional variability. These differences may also stem from inconsistencies in the integration of ingredients during dumpling preparation, particularly in the proportioning and processing of the seaweed and sardines.

Furthermore, the present study aligns with the innovation of Yu Jingjing (2015), whose patent on Dumplings Stuffed with Three Fresh Delicacies (CN105433205A) emphasizes the development of nutritionally enhanced and visually attractive dumplings. The concept of incorporating functional ingredients—such as sweet purple potato (*Ipomoea batatas L.*), blue ternate (*Clitoria ternatea*), sea grapes (*Caulerpa lentillifera*), and Indian oil sardines (*Sardinella longiceps*)—resonates with the objectives of this study. Both efforts highlight the potential of merging traditional components with innovative food design to produce health-oriented and culturally relevant culinary products.

Table 5: Mean Score of Nutrient Content of Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) in Different Formulations in terms of Carbohydrates

Formulation	Mean
Sample 1	80.00
Sample 2	77.9
Sample 3	77.50

Table 5 presents Sample 2, the Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweeds has carbohydrate content on different formulations. The formulation Sample 1 consists of mean highest carbohydrate content (M = 80.00), followed by Sample 2 (M = 77.9) and last Sample 3 (M = 77.50). The means are almost equal, suggesting that retention of carbohydrates varies widely, probably because of uneven distribution from formulation through to the drying process. Apart from this variability, all the formulation contained substantial levels of carbohydrates, indicating their promise as high-energy food products. The fact that with more additions of sea grapes (*Caulerpa lentillifera*), the carbohydrate levels decreased indicates that the seaweed may act as a very minor replacement of the starch components in the total dumpling formulation (Nguyen et al, 2022; Chia et al, 2023; Winarsi et al, 2020).

Table 6: Nutrient Content of Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweed Across Different Formulations in terms of Fat

Formulation	Mean
Sample 1	1.00
Sample 2	0.60
Sample 3	0.60

Table 6 presents the fat content of the Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweeds across different formulations. Among the samples, Sample 1 recorded the highest mean fat content at 1.00, while Sample 2 and Sample 3 both exhibited lower and identical mean values of 0.60. These results suggest that the fat content in the dumplings is influenced by the varying proportions of Indian oil sardines and sea grapes used in the stuffing. The higher fat content in Sample 1 may be attributed to its greater proportion of sardines (75%), which are naturally rich in lipids. In contrast, the presence of a higher percentage of sea grapes in Samples 2 and 3 appears to contribute to the dilution of overall fat content. This trend aligns with findings from previous studies, which report the inherently low lipid content of *Caulerpa lentillifera*, typically ranging from 0.05% to 2.87% on a dry weight basis, depending on origin and processing conditions (Chia et al., 2023; Nguyen et al., 2022; Zhang et al., 2020). Consequently, the inclusion of sea grapes in higher proportions likely helps maintain the dumpling's low-fat profile, particularly in formulations with 50% or more seaweed content. This characteristic is especially relevant to health-conscious consumers seeking products that are

naturally reduced in fat (Nguyen et al., 2022), thereby enhancing the dumpling's appeal as a functional and nutritious food innovation.

Difference between Formulations of Dehydrated Dumpling

The third objective of the study was to determine the significant difference of dehydrated dumplings in the formulations.

Table 7: Difference in the Nutrient Content of Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweeds

Variable	F	Df
Protein	0.040	2, 3
Carbohydrate	0.014	2, 3
Fat	0.281	2, 3

*significant at 0.05

Table 7 presents the results of the analysis of variance (ANOVA) conducted to determine significant differences in the nutrient content—protein, carbohydrates, and fats—of Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) across the three different formulations. The findings revealed that there were no statistically significant differences in protein content, $F(2, 3) = 0.040$, $p = 0.961$; carbohydrate content, $F(2, 3) = 0.014$, $p = 0.986$; and fat content, $F(2, 3) = 0.281$, $p = 0.773$. These results are consistent with earlier observations by Nguyen et al. (2022) and Chia et al. (2023), who noted that variations in seaweed concentrations may not necessarily result in significant nutritional changes due to the inherent natural variability in seaweed composition. This suggests that the observed nutrient profiles across the different dumpling samples are more likely attributable to the inherent variability of Sea Grapes (*Caulerpa lentillifera*), rather than the concentration levels used in each formulation. This outcome suggests that modifying the ratio of ingredients—within the tested range—can be strategically used to enhance taste, texture, or visual appeal without compromising the nutritional value of the product. Notably, this supports the idea that dumpling formulations can maintain a stable nutrient profile, offering flexibility in culinary innovation. As Sukmawati (2020) emphasized, dumplings, rooted in China's dim sum tradition, have evolved into a popular street food across Asia, admired for their savory taste and convenience. The integration of purple sweet potato (*Ipomoea batatas* L.) and blue ternate (*Clitoria ternatea*) into the dumpling wrappers contributes not only to their nutritional quality but also to their visual distinctiveness. The vibrant natural pigments of blue ternate enhance the dish's aesthetic appeal and provide an exotic culinary experience, aligning with the sensory-driven innovations described by McGee (2004).

Difference between the Standard Formulation and the Best Formulation of the Existing Study

The fourth objective of the study was to determine the significant difference between the standard formulation and the best formulation of existing study.

Table 8: Difference Between the Standard Formulation and the Best Formulation of the Existing Study

Nutrient	Standard Formulation	Dehydrated Dumpling with Sea Grapes	Absolute Difference	Relative Difference (%)
Carbohydrates	35 g	77.5 g	+42.5 g	+121.4
Fat	10 g	0.6 g	-9.4 g	-94.0
Protein	10 g	14 g	+4 g	+40.0

Table 8 presents a comparison between the standard dumpling formulation and the optimized version the Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) emphasizing substantial differences in their nutrient profiles. The most notable change is in carbohydrate content: the sea grape-enhanced dumpling contains 77.5 grams, more than double the 35 grams found in the standard formulation. The fat content shows a dramatic decrease, dropping from 10 grams in the control to just 0.6 grams in the revised formulation, representing a 94% reduction. Protein content also improved, increasing from 10 grams to 14 grams, representing a 40% increase. According to Pankow (2025), although modern formulations may result in increased carbohydrate content, their nutritional superiority lies in reduced fat and enhanced protein levels, making them suitable for individuals focused on heart health and weight management. The additional protein contributes to muscle maintenance and satiety, while the inclusion of sea grapes further enriches the formulation by introducing essential micronutrients and bioactive compounds found in marine vegetables. Collectively, these attributes position the optimized formulation as a nutrient-dense and heart-healthy option for health-conscious consumers. Moreover, Permatasari et al. (2022) and Nguyen et al. (2024) have demonstrated that Sea Grapes (*Caulerpa lentillifera*) improve metabolic health markers and serve as a reliable source of dietary fiber, reinforcing their value in functional food development. Future formulations could

incorporate complementary protein sources such as legumes, tofu, or lean meats, and integrate complex carbohydrates from sweet potatoes or whole grains. Healthy fats, such as those found in nuts, seeds, or plant-based oils, can also be added to enhance the formulation's nutritional balance and compliance with dietary guidelines. In addition to its nutritional advantages, the dehydration of dumplings offers practical benefits. The process significantly extends shelf life, making the product more suitable for storage and transport, particularly in non-refrigerated settings such as outdoor activities. As noted by Liu et al. (2021), freeze-dried dumplings retain their organoleptic properties and remain a convenient alternative to conventional dumplings. Furthermore, Stefanello et al, 2022 (as cited in Lee et al., 2022) confirm that core nutrients, protein, fat, and ash remain largely unaffected by dehydration, thereby maintaining the product's essential nutritional profile. This underscores the viability of dehydrated dumplings as both a functional and practical food innovation.

Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweeds Flyer

The fifth objective of the study was to develop the dehydrated dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweed. The flyer for the Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweed is shown in Appendix C.

Figure 1: Picture of the Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweed



Conclusions and Recommendations

Based on the study's findings, the following conclusions were drawn:

1. Varying the ratios of flour, sweet purple potato, blue ternate, sardines, and sea grape seaweed in dumpling formulations produces distinct taste profiles. Each sample offered unique qualities, suggesting that ingredient proportions can be adjusted to suit different preferences. Overall, incorporating sea grapes into dehydrated dumplings shows promise for creating innovative and nutritious food products.

2. Trial 3, consisting of 25% all-purpose flour, 50% sweet purple potato, 25% blue ternate, 25% Indian oil sardines, and 75% sea grapes seaweed, is the best formulation for creating a nutritious and palatable dumpling.

3. There are no significant differences in protein, carbohydrate, and fat contents among the different formulations of dehydrated dumplings with Sea Grapes (*Caulerpa lentillifera*) seaweed. This suggests that varying ingredient ratios does not substantially affect the overall nutrient composition. Consequently, the natural variability in nutrients is more influential than the formulation changes, highlighting the consistent nutritional value of the product across samples. Therefore, formulations can be altered for the improvement of taste or texture while retaining basic nutrient composition (Nguyen et al., 2022)

4. The dehydrated dumpling with sea grapes is a superior, nutrient-rich, and heart-healthy alternative to the standard formulation, offering enhanced protein, reduced fat, and added health benefits from seaweed.

5. The flyers of Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweed highlight the nutritional benefits to support its potential marketability as a healthy dish.

Recommendations

Based on the conclusions, the foregoing recommendations were formulated:

1. Further study may be conducted to improve the quality of Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweed so that it can be marketed and commercially packed.

2. A study on its shelf life, microbial analysis, and acceptability could be done as a prerequisite for its commercialization with FDA Compliance, so that it can be eaten even for an extended period through the dehydrating process.

3. It is recommended to explore additional formulations with different ingredient combinations to enhance further the nutritional profile and sensory qualities of the dumplings. Future research should include larger sample sizes and extended shelf-life studies to validate the consistency of nutrient content over time. Additionally, consumer acceptance testing is advised to identify the most preferred formulation for market success.

4. It is recommended to adopt the sea grape formulation for healthier dumpling options. Future formulations could incorporate complementary protein sources and healthy fats to enhance nutritional value further. Additionally, promoting the

benefits of seaweed ingredients can encourage consumer acceptance and support metabolic health.

5. Conduct a product exhibit to promote the distribution of the Dehydrated Dumpling with Sea Grapes (*Caulerpa lentillifera*) Seaweed flyer.

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