Portunus pelagicus (Blue Manna Crab) Shells as Polvoron

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DOI: 10.47760/cognizance.2024.v04i05.012

Abstract— The primary purpose of this study was to develop a polvoron produced from P. pelagicus (blue manna crab) shells. It sought to answer the questions: (1.) Was Portunus pelagicus crab capable of producing polvoron? (2.) What were the characteristics of Blue marna crab polvoron in appearance, aroma, taste, and texture? This study employed an experimental research design conducted in five phases: (1) dehydration of P. pelagicus shells, (2) pulverization of P. pelagicus shells, (3) polvoron production, (4) sample preparation and delivery, and (5) sensory evaluation of the polvoron. This study used an experimental research design to develop a polvoron produced from P. pelagicus (blue marna crab) shells. This study used a research-made questionnaire as the primary tool for gathering data, consisting of two parts, the Descriptive Rating Test and the Hedonic Rating Scale, to evaluate the product’s characteristics. Based on criteria, a Random Sampling Method was utilized by identifying thirty (30) participants, consisting of fourteen (14) Canteen Staff, two (2) TLE teachers, and fourteen (14) Fetchers, who were chosen as evaluators. Based on the findings, the research showed that the P. pelagicus (blue marna crab) shells could make polvoron and were highly acceptable in appearance, aroma, taste, and texture.

Keywords— Malnutrition, Portunus pelagicus crab shells, Polvoron, Health benefits, Acceptability

I. INTRODUCTION

Crabs, particularly the blue marna crab (Portunus pelagicus), are integral to the global food supply, contributing 0.19% to world production from capture fisheries (DA-BFAR, 2004). DA-BFAR (2004) further stated that, in the Philippines, blue crabs, locally known as alimasag or kasag, play a vital role in fisheries production, representing 1.89% of the country’s total marine production in 2001. With significant economic benefits, crabs ranked fifth in export volume and fourth in export value in 2001, totaling 5,650 tons and PhP1.52 billion, respectively. The diverse export forms include fresh frozen, crab meat, soft shell crabs, and live crabs, with a predominant share (over 80%) going to the US market. This highlights the economic importance of crabs as a valuable marine resource in the Philippines.

Providing sufficient food of adequate quality to the increasing populations in developing countries remains a significant challenge, mainly due to the prevalence of malnutrition resulting from low protein and mineral intake
levels. Addressing this challenge requires urgent attention and innovative approaches to increase protein and mineral intake among the average citizens. One potential solution could be the utilization of Chitin from crab shells, particularly *Portunus pelagicus* (Blue manna crab).

*Portunus pelagicus* is a crab species found in Southeast Asian waters, particularly in the Philippines (Rahman et al., 2017). This type of crab is also found in the waters of Placer and Surigao City, Surigao del Norte. This species is rarely eaten despite its abundance, and its shells are frequently discarded as waste. People do not know that crab shells are essential as they contain Chitin.

According to Renaudo (2006), using an exoskeleton as an ingredient is a concept introduced previously. While it may be true that using exoskeletons as an ingredient is not a new concept, it is essential to consider the context of the Philippines. The use of exoskeletons, particularly from blue manna crabs, in producing food products such as polvoron is still common in the country. With that, the findings of this study could have far-reaching implications for the Philippine food industry, particularly in promoting the sustainable use of local resources and reducing waste. Furthermore, the findings of this study could aid in developing new products that generate revenue for the company.

Jiran et al. (2023) state that Chitin is the most abundant natural amino polysaccharide, showing various practical applications owing to its functional properties. Chitin is a rich source of fiber, which can help promote digestive health and reduce the risk of certain diseases such as colon cancer. This type of carbohydrate can be extracted from crab shells, which makes it a sustainable and eco-friendly ingredient, as it is derived from a byproduct of the seafood industry. This food substance can be processed into chitosan and has been shown to have antimicrobial properties, which can help protect against bacterial and fungal infections. Kumar et al. (2019) further stated that research has shown that chitosan has antimicrobial and antioxidant properties, which can extend the shelf life of food products.

In addition, Chitin can be used as a biopolymer in various industrial and medical applications. It is helpful in the production of synthetic fibers, drug delivery systems, and biopolymer-based materials such as hydrogels and scaffolds. It has also been used for wound healing and tissue engineering.

Incorporating Chitin into the polvoron (shortbread cookies) recipe adds a unique texture and flavor to the treat. With this, it is possible to increase the fiber content of the treat and make it a more nutritious snack or dessert option. Since there is a growing consumer demand for healthier food options, supplementing traditional products, including shortbread cookies, is necessary when consumer expectations for healthy food grow (Dziki et al., 2022).

Using Chitin extracted from blue manna crabs in shortbread cookies could have positive economic and environmental implications. The blue manna crab is an abundant and often underutilized species that can be harvested sustainably, providing a source of income for local communities. Therefore, it is critical to maximize the potential of crab shells in polvoron production. The distinctive characteristics of the crab shells may result in a polvoron with a distinct fragrance and flavor.

### II. STATEMENT OF THE PROBLEM

The primary purpose of this study was to develop a polvoron produced from *P. pelagicus* (blue manna crab) shells. Specifically, this study seeks to answer the following:
1. What ingredients are used to produce *P. pelagicus* (Blue Manna Crab) Shells as Polvoron?
2. How do the basic nutritional facts of polvoron produced from *P. pelagicus* (blue manna crab) shells compare to commercially available polvoron and other food products?
3. Evaluate the general Acceptability using the Hedonic Rating Scale in terms of:
   - 3.1. Appearance
   - 3.2. Aroma
   - 3.3. Taste
   - 3.4. Texture
4. Evaluate the general recommended ability using the Descriptive Rating Scale in terms of:
   - 4.1. Appearance
   - 4.2. Aroma
   - 4.3. Taste
   - 4.4. Texture
III. ASSUMPTION

The use of *P. pelagicus* (blue manna crab) shells in the production of polvoron has no significant effect on its characteristics in terms of appearance, aroma, taste, and texture. It does not result in a product that is generally acceptable to consumers.

IV. METHODOLOGY

This study employs the experimental research design to develop a polvoron produced from *P. pelagicus* (blue manna crab) shells. The study will be conducted in five phases: (1) dehydration of *P. pelagicus* shells, (2) pulverization of *P. pelagicus* shells, (3) polvoron production, (4) sample preparation and delivery, and (5) sensory evaluation of the polvoron. This study aims to determine the potential of *P. pelagicus* shells and evaluate the polvoron in terms of appearance, aroma, taste, and texture. Data were collected through the following: Sample Preparation and Delivery. The materials of this study are evaluated using sensory evaluation. Basic Nutritional Facts Analysis was used to examine the product composition and quality of the polvoron. The assessors are instructed to provide a glass of water to rinse their mouths out before tasting the sample to remove all traces of previous taste from other foods to further elaborate the taste of the gummies. The participants were given a product sample and evaluation sheet to answer. From the evaluation given, the data was collected, interpreted, and analyzed to determine the development needed for the product. The participants were given a product sample and evaluation sheet to answer. From the evaluation given, the data was collected, interpreted, and analyzed to determine the development needed for the product.

V. RESULTS AND DISCUSSION

This chapter presents the results and discussion of the data obtained from the responses of thirty (30) respondents of selected Canteen staff, TLE teachers, and Fetchers of St. Paul University Surigao. Those data were carefully analyzed, presented, discussed, and interpreted according to the perimeter of this research to answer the problem sought for this study.

### Table 1. Summary of the Used Ingredient

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>f</th>
<th>(P)%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chitin</td>
<td>283g</td>
<td>63.2%</td>
</tr>
<tr>
<td>Margarine</td>
<td>30g</td>
<td>6.7%</td>
</tr>
<tr>
<td>Sodium chloride</td>
<td>5g</td>
<td>1.1%</td>
</tr>
<tr>
<td>Sugar</td>
<td>55g</td>
<td>12.3%</td>
</tr>
<tr>
<td>Powdered Milk</td>
<td>75g</td>
<td>16.7%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>448g</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 1 outlines precise ingredient details in a formulation. Chitin takes the lead at 63.2%, underscoring its central importance. Margarine follows with 6.7%, influencing flavor and consistency. Sodium chloride, though minimal at 1.1%, Sugar contributes sweetness at 12.3%, and powdered milk adds texture and nutrition at 16.7%. The cumulative total of these ingredients is 100%.

### Table 2.1 Basic Nutritional Facts Analysis

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Polvoron made by Crab Shells with Ingredients Chitin, Sugar, Iodized Salt, Powdered Milk, Margarine</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium, %</td>
<td>1.3</td>
<td>Dry Ashing</td>
</tr>
<tr>
<td>Crude Protein, %</td>
<td>13.3</td>
<td>Kjeldahl</td>
</tr>
<tr>
<td>Crude Fat, %</td>
<td>3.5</td>
<td>Soxhlet</td>
</tr>
<tr>
<td>Carbohydrates, %</td>
<td>39.4</td>
<td>By Calculation</td>
</tr>
<tr>
<td>Calories/100g</td>
<td>242</td>
<td>(Kjeldahl; Soxhlet, Gravimetric)</td>
</tr>
</tbody>
</table>

Table 2.1 shows the fundamental nutritional analysis presented on the product's label. The sodium content is 1.3%, aligning with a commercialized polvoron at 2%, meeting taste preferences and preservation standards. The substantial carbohydrates at 39.4% suggest vitamin and mineral content, albeit lower than the commercial...
polvoron at 56%. Still, it remains a carbohydrate-rich source, providing significant energy. The crude protein at 13.3% surpasses the commercial polvoron at 7%, indicating the potential to reduce malnutrition. The low crude fat at 3.5%, compared to the commercial version at 37%, signifies a reduced fat intake. With 242 calories per 100g, the sample offers a desirable energy source, though lower than the commercial polvoron at 520 per 100g (Nutritionix, n.d.).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Polvoron made by Crab Shells with Ingredients Chitin, Sugar, Iodized Salt, Powdered Milk, Margarine</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ash, %</td>
<td>41.3</td>
<td>Gravimetric</td>
</tr>
<tr>
<td>Moisture, %</td>
<td>2.5</td>
<td></td>
</tr>
</tbody>
</table>

Table 2.2 Basic Nutritional Facts Analysis

Table 2.2 presents the nutritional analysis. The ash content is 41.3, which is relatively high compared to other food products. As stated by McClemments (n.d.), the ash contents of fresh foods rarely exceed 5%, although some processed foods can have ash contents as high as 12%. High ash content can indicate a higher concentration of inorganic minerals in the food product. The moisture content at 2.5 indicates a relatively moist composition. According to the Food and Drug Administration (n.d.) Most foods have a water activity above 0.95, providing sufficient moisture to support the growth of bacteria, yeasts, and mold. This significantly impacts whether or not the products reach their advertised use-by date.

<table>
<thead>
<tr>
<th>Attributes</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>7.63</td>
<td>LVM</td>
</tr>
<tr>
<td>Aroma</td>
<td>7.53</td>
<td>LVM</td>
</tr>
<tr>
<td>Taste</td>
<td>8.83</td>
<td>LE</td>
</tr>
<tr>
<td>Texture</td>
<td>7.73</td>
<td>LVM</td>
</tr>
</tbody>
</table>

Table 3. Sensory Evaluation in terms of Acceptability

Table 3 presents Sensory Evaluation based on Acceptability. (Sharif et al., 2017) emphasize the paramount importance of taste and aroma in determining overall product acceptability. In the table, taste receives a high score of 8.83, falling within the "Like Extremely" range (LE), reinforcing its crucial role in consumer satisfaction. Aroma, with a score of 7.53, also falls into the "Like Very Much" range (LVM), substantiating its impact on product acceptability. (Creusen & Schoormans, 2004) Contribute insights on the visual aspect, highlighting the significance of appearance in consumer perception. In the provided table, the appearance attribute scores 7.73, placing it in the "Like Very Much" range (LVM), which supports the notion that visual appeal is a crucial factor influencing consumer liking. These findings underscore the importance of a holistic sensory evaluation approach, where attributes like taste, aroma, and appearance collectively contribute to the overall Acceptability of a product.

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Table 4 presents Sensory Evaluation based on Recommendability, where taste emerges as the most distinguished attribute with the highest score of 3.53, categorizing it as "Highly Recommendable" (HR). This aligns with established research emphasizing taste as a critical factor in consumer preferences (Hoyer & Stokburger-Sauer, 2011). Aroma closely follows with a score of 3.23, placing it in the "Recommendable" (R) range. Studies by (Andersen et al., 2019) corroborate the impact of aroma on overall product recommendation, reinforcing the significance of this finding. Texture and appearance received scores of 3.13 and 3.06, respectively, falling into the "Recommendable" (R) category. While appearance ranks the lowest, it is noteworthy that it still falls within the "Recommendable" range, suggesting an overall positive evaluation. A study by (Andersen et al., 2019b) underscores the importance of texture and appearance in consumer satisfaction and product recommendation.

VI. CONCLUSIONS

Based on the findings, it is concluded that the *P. pelagicus* (blue manna crab) shells have the potential to make polvoron and are highly acceptable in terms of taste, texture, aroma, and appearance. Considering the findings of this study, it recommended that future researchers should explore ingredient variations to enhance the appearance, taste, and nutritional balance. Sustainability considerations, such as eco-friendly practices, must be integrated into production. Market feasibility studies and collaboration with industry partners are essential for scaling production and bringing crab shell-derived polvoron to a broader audience. Conducting sensory studies and comparing the product with existing ones will further refine its potential benefits for global food security and sustainable nutrition.

ACKNOWLEDGEMENT

First and foremost, the researchers wish to extend their utmost gratitude to the Almighty Father, acknowledging the bestowed gift of wisdom and knowledge and expressing appreciation for the inspiration to pursue this study.

To the parents, the proponents extend their gratitude for the moral and financial support provided, enabling the completion of this research. The parents also deserve acknowledgment for permitting the proponents to collaborate with their team and dedicate time to work on the project.

To the faculty and staff of the Senior High School Department of the school, profound gratitude is extended for their understanding of the purpose behind this endeavor. The researchers express their heartfelt thanks.

Special appreciation is also directed towards Sr. Emelita S. Alvarez, SPC, the principal of St. Paul University Surigao, for granting permission to conduct a survey and validate the collected data for the students.

The researchers thank the esteemed panelists, Mrs. Myrna D. Ariar, Ms. Bernah Rizza Mae Galvez, and Mr. Rodnie M. Tagubar, for their invaluable contributions. Their thorough corrections, insightful ideas for improvement, and exemplary guidance have been crucial to the research process.
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