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Original Research Paper

POWER OF EDIBLE MUSHROOMS – PRODUCT DEVELOPMENT USING OYSTER MUSHROOM (Pleurotus florida sp) POWDER FOR COOKIES

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ABSTRACT

Edible mushrooms are recognized as functional foods due to their high nutritional value, dietary fiber, and bioactive compounds [Wani, Bodha, & Wani, 2010; Cheung, 2013]. Pleurotus florida is one of the most cultivated oyster mushrooms in the Philippines and has potential for product diversification to increase income of growers [Das & Mukherjee, 2007; PSA, 2023]. The incorporation of mushroom powder into baked products has been explored to enhance nutritional value while addressing post-harvest losses [Chauhan, 2014; Wandee, Uttap, & Puttanlek, 2015].

This study aimed to develop shortbread cookies and chips using oyster mushroom (Pleurotus florida sp.) powder. Four levels of mushroom powder: 22g, 35g, 50g, and 63g, and three parts: whole fruiting body, pileus, and stipe were tested. Sensory evaluation was conducted using a 9-point hedonic scale based on appearance, aroma, taste, texture, sweetness, and overall acceptability following the methods of Lawless and Heymann and Meilgaard, Civille, and Carr. Data were analyzed using ANOVA and Chi-Square Kruskal Wallis test. Return on Expenses [ROE] was computed using standard costing procedures [Gisslen, 2017; PSA, 2023].[2010][2016]

Results showed that 35g of mushroom powder produced the most favorable taste among the treatments. Statistical analysis revealed highly significant differences in taste and texture among treatments, but no significant difference in appearance, aroma, sweetness, and overall acceptability. Respondents preferred cookies made from whole fruiting body powder, followed by pileus and stipe powder. Overall, the mushroom cookies were rated from "Moderately Like" to "Like Very Much" across all sensory attributes. This supports previous findings that oyster mushroom powder can be incorporated into bakery products without negatively affecting consumer acceptability [Wandee et al., 2015].

The developed mushroom cookies yielded a net income with a return on expenses of 0.32%, indicating potential as an additional income source for mushroom growers and entrepreneurs. On a large-scale basis, net income and ROE are expected to improve. The study concludes that oyster mushroom powder, particularly at 35g using the whole fruiting body, is viable for cookie production as it combines nutritional enhancement, sensory acceptability, and economic feasibility.

Keywords: Pleurotus florida, mushroom powder, cookies, sensory evaluation, product development, return on expenses

INTRODUCTION

Mushrooms have long been recognized as functional foods due to their rich content of protein, dietary fiber, vitamins, minerals, and bioactive compounds [Wani, Bodha, & Wani, 2010]. Among edible mushrooms, Pleurotus species or oyster mushrooms are widely cultivated because of their adaptability to various agricultural wastes and short production cycle [Das & Mukherjee, 2007]. Pleurotus florida, a strain of oyster mushroom, is gaining popularity in the Philippines for its good yield and nutritional properties [Chang & Miles, 2004].

Despite the health benefits of mushrooms, consumption in rural communities remains low due to limited product forms and short shelf life. Product diversification through processing is one strategy to increase marketability and provide additional income for mushroom growers [PSA]. One promising approach is the conversion of fresh mushrooms into powder, which can be incorporated into various food products.[2023][Cheung][2013]

Bakery products such as cookies are staple snack foods

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that are widely accepted across age groups. The incorporation of mushroom powder into baked goods has been studied to improve nutritional value while maintaining sensory qualities. Previous studies reported that oyster mushroom powder can be added to cookies without significantly affecting appearance, aroma, and overall acceptability [Wandee, Uttap, & Puttanlek, 2015]. However, the optimal amount and mushroom part to use for best sensory and economic outcomes remain underexplored.[Chauhan][2014]

Therefore, this study was conducted to develop a new mushroom-based product in the form of shortbread cookies and using oyster mushroom powder. Specifically, it aimed to determine the best formulation in terms of amount and mushroom part, evaluate sensory acceptability, and assess the economic viability of the product. The results of this study can provide baseline data for mushroom growers and entrepreneurs in developing value-added mushroom products.

METHODOLOGY

1. Research Design

This study used an experimental research design to develop and evaluate oyster mushroom cookies. The experiment involved varying the amount of mushroom powder and the part of the mushroom used. Sensory evaluation and cost analysis were also conducted.

2. Materials

Fresh Pleurotus florida mushrooms were sourced from mushroom growers in Sta. Maria, Pangasinan. Other ingredients such as flour, butter, sugar, eggs, and baking powder were purchased from local markets. Equipment used included a dehydrator, blender, baking trays, and an oven.

3. Preparation of Mushroom Powder

Fresh oyster mushrooms were sorted into three parts: whole fruiting body, pileus, and stipe. Each part was washed, sliced thinly, and dehydrated at 60°C until crisp. The dried samples were ground into fine powder using a blender and sieved to obtain uniform particle size. The mushroom powder was stored in airtight containers prior to use.[cap][stem].

4. Cookie Formulation and Production

The basic cookie recipe was adapted from Gisslen. Four levels of mushroom powder were tested: 22g, 35g, 50g, and 63g per batch, replacing a portion of flour. Dough was mixed, rolled, cut into desired shapes, and baked at 180°C for 12-15 minutes. Both cookies and chips were produced for sensory testing.[2017].

5. Sensory Evaluation

Sensory evaluation was conducted with 50 untrained panelists from PSU Sta. Maria Campus. Samples were coded and served randomly. Panelists rated the cookies based on a 9-point hedonic scale for appearance, aroma, taste, texture, sweetness, and overall acceptability following the procedures of Lawless and Heymann and Meilgaard, Civille, and Carr.[2010][2016].

6. Data Analysis

Data from the sensory evaluation were analyzed using ANOVA to determine significant differences among treatments. The Kruskal-Wallis test was used for non-parametric data. Post-hoc analysis was done when significant differences were found. Statistical significance was set at $p < 0.05$.

7. Economic Analysis

Return on Expenses [ROE] was computed to determine the profitability of the product. Total production cost including ingredients, packaging, and labor was recorded. Selling price was based on prevailing market rates for specialty cookies. Net income and ROE were calculated using the formula:

ROE=TotalCost Net Income×100

Costing procedures followed guidelines from PSA and Gisslen.[2023][2017]

Processing of Oyster Mushroom-Based Cookies

Processing of mushroom powder-based cookies was done through a trial-and-error method until the desired taste and appearance were derived.

RESULTS AND DISCUSSION

3. RESULTS AND DISCUSSION

3.1 Development of Oyster Mushroom Powder Cookies and Chips

The process for producing shortbread cookies and chips using oyster mushroom (Pleurotus florida sp.) powder was successfully established. Four levels of mushroom powder: 22g, 35g, 50g, and 63g, and three mushroom parts: whole fruiting body, pileus, and stipe were incorporated into the basic cookie formulation.

The use of mushroom powder in bakery products is consistent with previous studies. reported that incorporating oyster mushroom powder into cookies can increase dietary fiber and antioxidant content while maintaining product quality. Product diversification into powder form also addresses post-harvest losses and extends the shelf life of mushrooms.

3.2 Sensory Evaluation of Mushroom Cookies

Table 1 shows the mean sensory scores of cookies with varying amounts and parts of oyster mushroom powder.

Table 1. Mean Sensory Scores of Oyster Mushroom Cookies

Treatment	Appearance	Aroma	Taste	Texture	Sweetness	Overall Acceptability
22g - Whole	7.82	7.65	7.34	7.21	7.90	7.72
35g - Whole	7.88	7.71	8.12	7.95	7.88	7.98
50g - Whole	7.75	7.60	7.45	7.10	7.82	7.55
63g - Whole	7.60	7.52	6.98	6.85	7.75	7.30
35g - Pileus	7.85	7.68	7.89	7.70	7.86	7.80
35g - Stipe	7.70	7.55	7.42	7.25	7.80	7.48

Legend: 9-point Hedonic Scale: 9=Like Extremely, 8=Like Very Much, 7=Like Moderately

Amount of Mushroom Powder

Results showed that 35g of mushroom powder obtained the highest mean scores for taste [8.12] and texture [7.95] and was rated "Like Very Much". Cookies with 63g scored the lowest for taste [6.98] and texture [6.85], described as "Like Slightly". This indicates that too much mushroom powder results in a strong mushroom flavor and gritty texture.

ANOVA and Kruskal-Wallis test revealed highly significant differences [$p < 0.05$] in taste and texture among the different amounts of mushroom powder. This supports who found that moderate levels of mushroom powder are optimal for sensory quality in bakery products.

Part of Mushroom Used

Among the mushroom parts, whole fruiting body powder was preferred by respondents, followed by pileus powder, and then stipe powder. The whole fruiting body likely provided a more balanced flavor and color compared to stipe which is more fibrous and less flavorful.

Other Sensory Attributes

No significant difference was observed in appearance, aroma, sweetness, and overall acceptability across all treatments. All samples were rated from "Like Moderately" to "Like Very Much". This means that the addition of oyster mushroom powder up to 63g did not negatively affect the general appearance and aroma of the cookies. This finding agrees with who reported that oyster mushroom powder can be incorporated into cookies without significantly affecting consumer acceptability.

Overall, the processed mushroom product was acceptable to respondents, indicating good potential for market introduction. Sensory acceptability is critical for new food products as it influences consumer purchasing behavior.

3.3 Economic Analysis: Return on Expenses

The cost and return analysis of producing mushroom cookies is presented in Table 2.

Table 2. Cost and Return Analysis of Oyster Mushroom Cookies per Batch [50 pieces]

Particulars	Amount
Total Production Cost	840.00
Gross Sales	1,000.00
Net Income	160.00
Return on Expenses [ROE]	0.32%

A net income of Php 160.00 was generated with a ROE of 0.32% per batch. While the ROE is modest for small-scale production, it demonstrates that mushroom cookies can be a viable source of additional income for mushroom growers and entrepreneurs.

According to, value-added processing is one of the key strategies to increase income from mushroom production. On a large-scale basis, net income and ROE are expected to improve due to bulk purchasing of ingredients, reduced labor cost per unit, and better market access.

The economic feasibility, combined with the sensory acceptability, suggests that oyster mushroom cookies have potential for commercialization as a health-oriented snack product.

3.4 Summary of Findings

The optimal formulation is 35g of whole fruiting body oyster mushroom powder per batch.

Significant differences were found in taste and texture, but not in appearance, aroma, and sweetness.

The product was generally acceptable to consumers.

The cookies are economically feasible with positive net income and ROE.

The results indicate that Pleurotus florida powder can be utilized as a functional ingredient in cookies to enhance nutritional value while providing livelihood opportunities for mushroom producers.

CONCLUSION

Based on the results of the study, the following conclusions are drawn:

On Product Development

The process for producing shortbread cookies using oyster mushroom [Pleurotus florida sp.] powder was successfully established. Product diversification into mushroom powder addresses post-harvest losses and extends the shelf life of mushrooms while adding value to bakery products.

On Sensory Quality

The optimal formulation is 35g of whole fruiting body oyster mushroom powder per batch. This treatment obtained the highest mean scores for taste [8.12] and texture [7.95] and was rated "Like Very Much".

Statistical analysis revealed highly significant differences [$p < 0.05$] in taste and texture among the different amounts of mushroom powder. Among the mushroom parts, the whole fruiting body was most preferred, followed by pileus and stipe.

No significant difference was observed in appearance, aroma, sweetness, and overall acceptability. All treatments were rated from "Like Moderately" to "Like Very Much", indicating that the incorporation of oyster mushroom powder up to 63g did not negatively affect consumer acceptability.

On Economic Feasibility

The production of oyster mushroom cookies is economically feasible. A net income of Php 160.00 with a Return on Expenses [ROE] of 0.32% was generated per batch of 50 pieces. Although modest at exploratory scale, the positive income indicates potential as an additional livelihood. Large-scale production is expected to further improve net income and ROE due to economies of scale.

In general, oyster mushroom powder can be effectively utilized as a functional ingredient in cookies. The product is sensorily acceptable and economically viable, thus it has good potential for commercialization as a health-oriented snack.

RECOMMENDATIONS

Based on the findings and conclusions, the following recommendations are proposed:

For Product Standardization

Adopt the 35g whole fruiting body powder formulation as the standard recipe for oyster mushroom cookies. Further trials should be conducted to optimize baking parameters, packaging materials, and shelf-life to ensure consistent product quality and food safety.

For Market Development

Conduct wider consumer acceptability testing in different markets and age groups to validate market demand. Product labeling should highlight the nutritional and functional benefits of oyster mushroom to increase consumer awareness and preference.

For Livelihood and Commercialization

The Pangasinan State University – Mushroom Technology and Innovation Center, in coordination with LGUs, DTI, and DA, should conduct technology training for mushroom growers and women's groups. Shared processing facilities should be established to support small-scale entrepreneurs in producing mushroom-based products.

For Future Research

Future studies should include:

Nutritional analysis and health benefit claims of mushroom cookies;

Shelf-life and microbiological stability testing; and

Large-scale cost and benefit analysis to determine profitability and market viability.

The adoption of these recommendations will help improve product quality, increase profitability, and promote oyster mushroom cookies as a sustainable livelihood and functional food product in Pangasinan.

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