

FACTORS INFLUENCING LEVEL OF VALUE ADDITION FOR EDIBLE MUSHROOMS IN OGUN STATE, NIGERIA

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ABSTRACT

Despite the increasing economic and nutritional importance of edible mushrooms in Nigeria, there remains limited empirical evidence on the factors influencing value addition within the sector. This research investigated the determinants of value addition in the context of edible mushroom production in Ogun State, Nigeria. Primary data were collected through a cross-sectional survey involving 120 respondents selected using a multistage sampling technique from the study area. The study employed dominance analysis, Likert scale, and multiple linear regression techniques. Dominance analysis showed that 47.0% of the respondents have completed secondary education, with an average age of 53.5 years. Major challenges faced by mushroom producers and marketers were: inadequate infrastructure (81.2%), limited value addition equipment (76.7%), low consumer awareness regarding mushroom nutrition (66.6%) and quality control issues (65.2%). Empirical results from the regression model indicated that processing techniques ($\beta = 1.9937$; $p < 0.10$), loan acquisition ($\beta = 0.9642$; $p < 0.01$), education ($\beta = 0.2877$; $p < 0.05$), years of experience ($\beta = 0.2902$; $p < 0.05$), and cooperative membership ($\beta = 0.3923$; $p < 0.10$) significantly influenced value addition in mushroom production. Conversely, sex, branding and packaging, marital status, and household size showed no significant effects. The study concluded that adoption of modern processing methods, improved access to credit, enhanced education and experience, and participation in cooperative societies are key drivers of value addition in edible mushroom production in the study area. It recommends that government and other relevant stakeholders should create an enabling environment that supports technological adoption, capacity development, and financial access for mushroom producers to enhance value addition and market competitiveness.

Keywords: *Agaricus bisporus*; value chain development; processing method; protein.

INTRODUCTION

Historically, humans have incorporated edible mushrooms (*Agaricus bisporus*) into their diets, not only for sustenance but also to promote well-being and extend lifespan. Mushrooms, categorized as fleshy and spore

-bearing fruiting bodies, are members of the fungal kingdom and specifically fall within the class Basidiomycetes and the order Agaricales (Adinya *et al.*, 2012). Mushroom comprises a diverse range of organisms; this group encompasses various sizes, spanning from minuscule microscopic forms to con-

siderably larger ones, mildew, rust, smuts, molds, and toadstools. Mushrooms grow well in grasslands, forest floors, near termite hills, and on dead or living trees (Ekpo, 2001). Lacking chlorophyll, they directly acquire pre-existing organic matter. They exhibit the remarkable capability to flourish on discarded agricultural byproducts like sawdust, straws, sugarcane remnants and coconut waste materials, with about 1,000 mushroom species categorized as edible (Rungjindamai *et al.*, 2024). Renowned globally for their nutritional value, mushrooms are rich in proteins, vitamins, minerals, chitin, and essential amino acids (Mala, 2018; Ayanfunke, 2019). Mushrooms have low fat, calorie, and cholesterol content (Ekpo, 2001). Edible mushrooms serve as both an ingredient and a source of fermentation in processed food items and approximately 3,000 primary species of edible fungi exist (Kalac, 2009). China stands out as the primary cultivator of edible mushrooms, boasting around 967 species and this accounts for nearly half of the globally recognized culturable edible mushroom varieties (Chang-Tian and Shuai, 2022). The United States follows, with a share of around 4.5% of global production. Other significant contributors include the Netherlands, Poland, Italy and South Korea (Harsh and Joshi, 2008).

Mushroom derivatives find application in an array of products, including bakery products like biscuits, bread, and cakes, as well as in fast food options like burgers, cutlets, and pizza. These versatile fungi can be sliced and dried, transformed into powders for augmenting dietary fibre content in various foods, and even serve as a partial substitute for wheat flour in baked goods. Mushrooms are directly integrated into food preparations like soups, biscuits, nug-

gets, and snacks. Innovative mushroom-based foodstuffs like bread, cake, oil-roasted mushrooms, mushroom pâté, and more have been developed to enhance mushroom value and encourage consumption, especially among children and the elderly (Sangeeta *et al.*, 2024). The cultivation of mushrooms not only generates income on a national level but also fosters employment prospects across cultivation, processing, and marketing activities. According to Ayanfunke (2019), Nigeria produces 300 tonnes of mushrooms per year, against the demand of 1200 tonnes. As a result, households and hotels resort to imports since local farmers are unable to meet the mushroom demand. This situation is exacerbated by human activities, leading to the critical endangerment of certain mushroom species.

Primarily, mushrooms are commonly consumed in their fresh state. While they exhibit significant potential within the agribusiness sector, a notable drawback is their limited shelf-life. To address this challenge, it becomes imperative to process mushrooms into more resilient forms, thereby enhancing their value. However, mushrooms are traded in processed variations such as frozen, canned, pickled, and dried formats globally, which both prolong the shelf-life and elevate their worth (Jahan and Singh, 2019). The study by Jahan and Singh (2019), which examined the mushroom value chain and the importance of value addition, provided a thorough classification of the value chain, identifying key players such as input suppliers, producers, traders, processors, and consumers. Among these, spawn suppliers were highlighted as crucial contributors, playing an essential role in the distribution of inputs, product collection, and market promotion. The research emphasized the critical impact of various stakeholders in the mushroom

value chain, with a particular focus on the growing importance of spawn suppliers and the increasing demand for convenient mushroom products, driven by societal shifts. The study calls for a strengthened value chain system, urging a strategic emphasis on enhancing value addition processes within the mushroom industry. Vaidya (2001) in his book revealed a striking revelation that 49% of mushroom cultivators exhibit inefficiencies in the domain of mushroom cultivation techniques and knowledge. Mushroom farmers encounter an array of challenges, including insufficient capital, labour shortages, limited access to credit, scarcity of essential inputs, and a host of miscellaneous concerns like electricity disruptions.

Ayanfunke (2019) explored the training needs of mushroom farmers and identified several challenges impacting mushroom production in Oyo State. Using a multi-stage sampling approach, the research selected 143 mushroom farmers for analysis. The results revealed that a large majority (94.4%) of the farmers were knowledgeable about mushroom production, with 64.3% demonstrating a strong understanding of the benefits of mushrooms. The study also found significant relationships between farmers' educational levels ($\chi^2=9.347$), monthly income ($\chi^2=19.184$), scale of production ($\chi^2=34.493$), constraints ($r=-0.452$) and their need for training. Based on these findings, the study recommends that research institutions and government agencies enhance their efforts in raising awareness and providing training programmes for mushroom farmers to promote higher production in the sector.

Arunachalam *et al.* (2023) examined the trends in mushroom production, exports,

and imports in India, analyzing data from 1997 to 2021. The study revealed a positive growth trend in mushroom production for both India and Tamil Nadu. However, it noted a negative downward trend in both the export and import of mushrooms, as indicated by the Compounded Annual Growth Rate (CAGR) analysis. In a related study, Rath and Mishra (2023) investigated mushroom production trends in Odisha, India, and globally. Their findings showed that from 2013 to 2022, the global CAGR for mushroom production was 3%, while India saw a growth rate of 36%, and Odisha experienced a 16% increase. The study highlighted notable growth in states like Rajasthan, Bihar, and Chhattisgarh. Despite slower progress in some regions, particularly northeastern India, there is considerable potential for growth due to the availability of agricultural residues and advancements in technology, making mushrooms a promising sustainable food source.

Mushroom marketing serves as a vital bridge connecting production and consumption, encompassing various essential services required to bring products to consumers. Nonetheless, the limited value addition within Nigeria's mushroom production sector has led to inefficiencies in commodity marketing, resulting in diminished income for farmers.

In view of these concerns and the persistent challenges faced by edible mushroom producers and marketers, this study examined:

1. The socio-economic characteristics of the respondents,
2. Assessed the constraints faced by the respondents
3. Determined the factors influencing the level of value addition in edible mus-

room processing in the study area, with the aim of providing evidence-based insights for improvement.

METHODOLOGY

The research was conducted in Ogun State, located in the South West Geopolitical Zone of Nigeria. Ogun State is a key center for edible mushroom cultivation sharing borders with Republic of Benin, Oyo, On- do, and Lagos States, facilitating efficient mushroom distribution.

A multistage sampling procedure was employed to select respondents for the study while ensuring a balanced representation of mushroom cultivators. In the first stage, purposive sampling was used to select all four divisions of the state (Ijebu, Egba, Ye- wa, and Remo). The second stage involved the purposive selection of two local govern- ment areas (LGAs) with high mushroom cultivation activity from each division, re- sulting in the selection of eight LGAs for

the study. Specifically, Ijebu Ode and Od- ogbolu LGAs were chosen from the Ijebu division, Abeokuta South and Odeda LGAs from the Egba division, Ado Odo/Ota and Yewa South from the Yewa division, and Sagamu and Remo North from the Remo division. The final stage encompassed a snowball sampling approach, wherein 15 mushroom cultivators from each of the se- lected eight LGAs were selected, culminat- ing in a total of 120 respondents for the study. Primary data were collected through a struc- tured questionnaire designed on inputs, out- puts, production methods, input and output prices, and key socio-economic characteris- tics of mushroom cultivators in the study area.

The first objective was analyzed using domi- nance analysis to identify the most common features among the participants. The second objective was addressed using a Likert scale while the third objective was examined using multiple linear regression analysis.

Model specification

The study used multiple linear regression analysis to identify relationships and patterns with- in the dataset. The regression technique was key in determining the variables that influence the extent of value addition in edible mushroom processing in the study area. It is common- ly used to model the relationship between a dependent variable and multiple independent variables, helping to understand how changes in the independent variables affect the de- pendent variable.

The empirical model is expressed as follows:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9)$$

The explicit equation is;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \epsilon$$

Where:

- Y represents the dependent variable, which is the level of value addition for edible
- β_0 is the intercept term, signifying the expected value of Y when all independent variables are set to zero.

$\beta_1, \beta_2, \beta_3 \dots \dots \dots \beta_9$ are the regression coefficients associated with the respective independent variables.

X_1 = Processing techniques (modern methods = 1, Otherwise = 0)

X_2 = Sex of the mushroom cultivators (male = 1, otherwise = 0)

X_3 = Access to loan (amount of loan access)

X_4 = Branding and Packaging (yes = 1, otherwise = 0)

X_5 = Level of Education (years)

X_6 = Years of experience in mushroom cultivation (years)

X_7 = Marital status (married= 1, otherwise = 0)

X_8 = Household size (number)

X_9 = Membership of cooperative society (yes = 1, otherwise = 0) and

ϵ represents the error term, accounting for unobserved factors that impact Y but are not accounted for by the independent variables.

By estimating the values of the regression coefficients $\beta_1, \beta_2, \beta_3 \dots \dots \beta_9$, the model can provide insights into the magnitude and direction of the relationships between the independent variables and the total value addition in the processing of edible mushrooms (dependent variable). These coefficients offer quantitative interpretations, allowing for a nuanced understanding of how each independent variable contributes to changes in the degree of value addition.

RESULTS AND DISCUSSION

Socio Economic Characteristics of Respondents

Age: Plays a pivotal role in shaping both the augmentation of value and the overall adaptability within the agricultural produce marketing domain. It serves as a significant determinant influencing the extent of value addition. 38.3% of the respondents fall within the age bracket of 51-60 years, with an average age of 53.5 years (Table 1). This

signifies that the majority of individuals engaged in mushroom cultivation are in the older age group, suggesting a greater inclination towards traditional methods of value addition. This observation aligns with earlier assertion of Osinowo and Tolorunju (2019), who noted that age is positively correlated with the acceptance of innovation and risk-taking.

Gender: This plays a role in determining the capacity for physical labour, thus affecting engagement in physically demanding tasks. It is commonly said that men exhibit higher efficiency in physical activities compared to women, potentially due to higher energy levels and capability for arduous work. Majority (88.3%) of the respondents were females (Table 1). This outcome underscores the dominance of female involvement and implies that they expend less energy in value addition of mushroom compared to their male counterparts. Nevertheless, the heightened engagement of women might be linked to lower production costs or input require-

ments within the realm of mushroom cultivation.

Marital status: This holds the potential to reduce labour expenses by harnessing household labour, thereby bolstering income. Majority (81.6%) of the respondents were married, aligning with *a priori* expectations.

Educational attainment: This significantly influences the output and productivity of participants. Those with higher education are better positioned to engage with novel innovations and enhanced practices. The study showed that 47.5% of the respondents have completed secondary education. Education is universally recognized as a pivotal factor in identifying and capitalizing on investment prospects. Educated farmers tend to be more receptive to innovation compared to their less educated counterparts (Osinowo and Tolorunju, 2019).

Household size: This encompasses immediate family members and dependents, thereby shaping the dynamics of available labour and resource allocation. The observation that the majority (50.8%) of the respondents have household sizes ranging from 5 to 8 members reflects this aspect.

Years of experience: This is anticipated to wield a substantial, positive influence on efficiency, knowledge acquisition, and ultimately, resource returns. The study indicates that 51.7% of the respondents have between 7 and 9 years of experience.

Diversified sources of income: These are anticipated to exert an impact on the socioeconomic status of the participants. Given the seasonal nature of mushroom production, relying solely on this endeavor could

adversely affect income level. Most (73.3%) of the respondents supplement their income through sources beyond mushroom production and marketing. Only 33.3% of the respondents belong to cooperative societies.

Constraints Affecting Value Addition of Edible Mushroom Processing

This study looked into the problems affecting value addition of edible mushroom processing. The purpose is to shed light on the most salient limitations that hamper the growth and development of the mushroom value addition. 80.8% of the respondents identified inadequate infrastructure and facilities as one of their most pressing challenges (Table 2). Inadequate infrastructure such as stable power supply, proper storage facilities, processing centers and bad roads can hinder proper value addition and timely delivery of mushrooms to markets. Without proper infrastructure, mushrooms may spoil, leading to losses for producers. This shortage of essential resources impedes the efficient cultivation and distribution of mushrooms, thereby hindering its expansion.

Most of the respondents (76.7%) indicated insufficient value addition equipment, such as drying machines or packaging facilities as one of the constraints facing mushroom cultivators and marketers. This often limits producers' ability to process and preserve their mushrooms effectively.

Most (65.0%) of the respondents equally identified poor quality control as a major constraint affecting mushroom value addition. Ensuring consistent quality is paramount in the food industry, including the mushroom sector. Inadequate quality management measures not only compromise consumer satisfaction but also erode trust in the products. Addressing this challenge calls

for the implementation of stringent quality standards and regulatory frameworks, encouraging adherence to best practices throughout the supply chain.

Low consumer awareness also emerged as a significant constraint as reported by 66.7% of the respondents. Limited knowledge about the nutritional benefits and culinary versatility of mushrooms can hinder market demand. Public awareness campaigns and educational initiatives could be endorsed through policy to inform consumers about the value of including mushrooms in their diets.

Majority (60.0%) of the respondents identified high perishability of edible mushrooms as a pressing constraint in its production. This factor necessitates rapid and efficient post-harvest handling and distribution systems.

Another challenge that was identified by 49.2% of the respondents is the lack of technical expertise in mushroom production. The intricate and specialized nature of mushroom cultivation demands a high level of knowledge, which, unfortunately, is often lacking among the respondents in the study area. Lack of technical knowledge and training in modern cultivation, processing, and value addition techniques can limit the ability of producers to enhance the quality and shelf life of their mushrooms. This constraint can affect the overall competitiveness of their products.

The seasonal aspect of mushroom cultivation poses a unique challenge to 42.5% of the respondents. Mushrooms often have specific growing seasons, limiting year-round production and revenue generation. Therefore, exploring methods to extend

growing seasons through advanced cultivation techniques or investment in controlled-environment agriculture is crucial for sustainable mushroom production. There are multifaceted challenges affecting mushroom producers and marketers for sustainable production and value addition (Table 2).

Factors Affecting the Level of Value Addition for Edible Mushrooms

The model gave an F-statistic of 6.183, and this was statistically significant. This means that, taken together, the explanatory variables have a meaningful effect on value addition among mushroom producers (Table 3). The R^2 value of 0.811 indicates that approximately 81.1% of the variation in value addition is explained by the predictors included in the model, while the Adjusted R^2 (0.798) confirms the robustness of the model after adjusting for degrees of freedom. The assessment for heteroskedasticity, which checks for the presence of uneven variance in the error term, indicated absence of such non-constant variance at the 5% significance level. The chi-square value was 0.04, confirming the appropriateness of the coefficients of the independent variables within the estimated model.

The processing technique coefficient ($\beta = 1.99367$; $t = 1.84698^*$) was positive and statistically significant at 10% level; meaning that adopting effective and modern processing procedures increases the level of value addition in mushroom processing (Table 3). Field observations revealed that processors who use modern methods such as freezing to preserve nutritional value, air drying, freeze drying, and microwave or radiant heat drying for rapid moisture removal produce higher-quality products than those who use only traditional methods such as sun drying or smoking.

Table 1: Socio-Economic Characteristics of Mushroom Producers in Ogun State (n = 120)

Socio-economic characteristics	Frequency	Percentage (%)	Mean
Age (years)			53.5
31–40	10	8.3	
41–50	29	24.2	
51–60	46	38.3	
61–70	23	19.2	
Above 70	12	10.0	
Sex			
Male	14	11.7	
Female	106	88.3	
Marital status			
Single	2	1.7	
Married	98	81.6	
Divorced	6	5.0	
Widowed	14	11.7	
Level of Education			
No formal education	8	6.7	
Primary education	36	30.0	
Secondary education	57	47.5	
Tertiary education	19	15.8	
Household size (members)			6
1–4	18	15.0	
5–8	61	50.8	
9 and above	42	34.6	
Years of experience (years)			18
1–3	12	10.0	
4–6	28	23.3	
7–9	62	51.7	
10 and above	18	15.0	
Other source of income			
Yes	88	73.3	
No	32	26.7	
Membership of cooperative society			
Yes	40	33.3	
No	80	66.7	

Source: Field Survey, 2025

Access to loans ($\beta = 0.96423$; $t = 3.73211^{***}$) significantly increased value addition by 1%. This implies that processors with more access to credit facilities are

better able to invest in enhanced equipment, storage, and processing inputs, improving their level of value addition. This result is consistent with the earlier findings of Kehinde and Aboaba (2016), who found that

Table 2: Constraints faced by Mushroom Producers (%) in Ogun State (n = 120)

Identified constraints	Most severe	Very severe	Severe	Less severe	Not at all
Lack of Infrastructure and Facilities	80.8%	11.7%	7.5%	0.0%	0.0%
Limited Technical Knowledge	49.2%	40.0%	4.2%	6.6%	0.0%
Quality Control Issues	65.0%	23.3%	3.3%	6.7%	1.7%
Access to Inputs	10.0%	41.7%	24.2%	20.8%	3.3%
Market Access and Information	12.5%	8.3%	0.0%	69.2%	10.0%
Value Addition Equipment	76.7%	10.8%	10.0%	2.5%	0.0%
Lack of Marketing Skills	4.2%	2.5%	3.3%	78.3%	11.7%
Seasonal Nature of Mushroom Production	42.5%	19.2%	34.2%	3.3%	0.8%
Consumer Awareness	66.7%	13.3%	10.0%	8.3%	1.7%
Post-Harvest Losses	17.5%	23.3%	51.7%	5.8%	1.7%
High Perishability Nature of Mushroom	60.0%	40.0%	0.0%	0.0%	0%

Source: Field Survey, 2025

access to finance improves processors' working capital and output capacity, resulting in increased income and operational scale.

Education ($\beta = 0.28765$; $t = 2.06423^{**}$) significantly improves respondents' ability to engage in value-added activities in mushroom production and processing. This shows that education is critical in providing mushroom processors with the analytical, technical, and administrative abilities needed to adopt new technology and processing procedures. Educated people are more likely to comprehend the science underpinning mushroom production, post-harvest handling, and preservation. They are better able to understand the significance of upholding hygienic standards, utilising suitable packing materials, and implementing cutting-edge

preservation techniques like vacuum sealing and freeze-drying to preserve product quality. Thus, findings of the study support the prior work of Barmon *et al.* (2012) and Ayanfunke (2019), who emphasized that education improves farmers' and processors' ability for innovation, risk assessment, and adoption of best practices.

The coefficient for years of experience ($\beta = 0.29019$; $t = 2.03973^{**}$) was positive and significant at the 5% level. This suggests that experienced processors produce higher results in terms of mushroom value addition. Experience improves practical knowledge, skill mastery, and adaptability to new methodologies, as earlier noted by Mala (2018) and Ayanfunke (2019).

Membership in a cooperative society ($\beta = 0.39232$; $t = 1.67783^*$) showed a positive and

statistically significant connection with 10% value addition (Table 3). This suggests that cooperative membership serves as a potential driver for leveraging and enhancing the value addition process within the context of mushroom production. Cooperative membership provides access to pooled expertise,

financing facilities, and collective marketing, all of which contribute to higher value-added outcomes. This finding is consistent with Aminu *et al.* (2017), who discovered that cooperative membership increases productivity and value generation among agricultural processors.

Table 3: Linear Regression Analysis of Factors Influencing the Extent of Value Addition in the Context of Edible Mushrooms

Explanatory Variables	Coefficient	t - value
Constant	4.51215**	2.33314
Processing techniques	1.99367*	1.84698
Sex	0.64387	0.29554
Access to loan	0.96423***	3.73211
Branding and Packaging	0.10038	0.45534
Education	0.28765**	2.06423
Years of experience	0.29019**	2.03973
Marital status	-0.14934	-0.88903
Household size	-0.19015	-0.39108
Membership of cooperative society	0.39232*	1.67783
F-value		6.183
R Square		0.811
Adjusted R Square		0.798

***, ** and * denote statistical significance at 1%, 5% and 10%

Source: Field Survey, 2025

CONCLUSION AND RECOMMENDATIONS

The study concluded that the extent of value addition among mushroom producers in the study area is significantly influenced by several socioeconomic and operational factors. Specifically, processing techniques, access to financing, education, years of experience, and membership in cooperative societies were found to have a favourable and significant impact on the level of value

added to mushrooms. This suggests that farmers who use better processing methods, have greater access to capital, have higher educational qualifications, and belong to cooperative groups are more likely to improve the quality and market value of their mushroom products.

As a result, measures to improve financial accessibility, technical training, and cooperative participation, as well as to promote

modern processing technology, would be critical in raising mushroom value addition and profitability among mushroom producers in Ogun State, Nigeria.

Based on the findings of this study, the following recommendations are made to strengthen value addition in mushroom production:

- i. **Capacity Building and Financial Empowerment through Cooperatives and NGOs:** Mushroom farmers' cooperatives, non-governmental organizations, and farmers' associations should take the lead in providing regular training for their members. Such training should focus on modern processing techniques and practical value addition methods. These groups can also help farmers access funds through soft loans, grants, or cooperative savings schemes, making it easier to invest in better processing facilities and technologies.
- ii. **Knowledge Sharing and Mentorship:** Experienced mushroom farmers and processors should be encouraged to mentor new entrants through platforms created by cooperatives or farmers' associations. This will help transfer valuable knowledge, build confidence among new farmers, and promote sustainable practices in the mushroom value chain.
- iii. **Strengthening Cooperative Structures and Partnerships:** Cooperatives, private investors, and research institutions should work together to build stronger farmer groups. Such partnerships should focus on sharing resources, supporting collective marketing, and improving access to modern equipment and reliable market information to enhance value addition efforts.

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