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Potential of Mushrooms for Sustainable Food Security among the Okun People of Kogi State

Owa Dele Frank
Integrated Science Department, Federal College of Education
owafrankdele69@gmail.com (08032948925)
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Abstract
This study investigates the potential of mushrooms as a source of food security among the Okun people of Kogi State. Through a comprehensive literature review and interviews with local farmers and community members, the nutritional benefits, cultivation practices, and economic potential of mushrooms were explored, the respondents to the questionnaires were drawn from all the Okun speaking people from the Kogi West senatorial district, this comprises of five Local Government Areas, Yagba East, Yagba West, Mopa/Amuro, Kabba-Bunu and Ijumu respectively. Sixty respondents were randomly selected from each of these Local Government Areas making a total of three hundred respondents. The study surveys the nutritional benefits and traditional usage of mushrooms and how it can solve the problem of food insecurity. The findings revealed that mushrooms have the potential to provide a sustainable and nutritious source of food for the Okun people, who currently face challenges with food insecurity and limited access to traditional food sources. Additionally, the cultivation of mushrooms has the potential to create economic opportunities for the local communities. Overall, this study highlights the importance of further research and investment in the use of mushrooms for sustainable food security among the Okun people and other populations facing similar challenges.

Key words: *Food security, Mushrooms, Sustainable development, Nutritional value, Okun people*

Introduction

In recent years, the concept of sustainable food security has gained attention as a key factor in promoting sustainable development and achieving global food security. With the ever-growing global population the global food crisis poses a severe threat to world peace and security (Aniama, Oricha & Owa, 2019), there are constant disruption and a lot of threat to the biodiversity especially in area of climate change, population explosion and shrinking environmental resources which have seriously affected the rates of food supply and diversity of our ecosystems to face serious challenges identified by United Nations in meeting the Sustainable Development Goals (SDG) in the areas of food security (Aniama, 2023), there is therefore an increasing need for alternative food sources that are both environmentally friendly and economically viable. This has led to a growing interest in the potential of mushrooms as a sustainable food source. Food security is defined as the condition in which all people have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs for an active and healthy life. Sustainable development refers to meeting the needs of the present without compromising the ability of future

generations to meet their own needs. In Kogi state where agriculture is a primary source of livelihood, integrating sustainable practices into food production is crucial.

Mushrooms are a significant part of various cuisines around the world (Amara and El-Baky, 2023), including Okun cuisine. They are not only valued for their flavour but also for their nutritional benefits, economic potential and role in ecosystem health (Ayodele and Okhuoya, 2007). They are rich in proteins, vitamins (especially B vitamins), minerals (such as selenium) and antioxidants (Adebayo, Banjo and Abikoye, 2009; Slusarczyk, Adamska and Czerwik-Marcinkowska, 2021**)**. Okun people have long relied on traditional agricultural practices to meet their food needs but with the increasing threat of climate change and unsustainable farming methods, there is a growing need for alternative sources of food, by incorporating mushrooms into their diets, mushrooms can serve as a vital source of nutrition that compliments traditional diets primarily based on starchy staples. Mushrooms (Esunsun, Iyanrin, Olu) which have specific names in Okun reflecting various characteristics and features such as shape, texture, habitat, taste, growth habit have emerged as a potential solution for sustainable food security among the Okun people as its consumption can help alleviate malnutrition through the provision of essential nutrients that may be lacking in local diets. Not only are mushrooms a nutrient-rich food source with their high nutritional value and ability to thrive in a variety of environments, mushrooms have the potential to provide a reliable and sustainable source of food for the community, they also have a low environmental impact and can be easily grown and harvested (Adedokun and Ataga, 2006; Waktola and Temesgen, 2018). Mushrooms provide income generating opportunities for households and can also enhance food diversity which is crucial for improving overall health outcomes. Research has shown that mushrooms contain high levels of essential vitamins and minerals, making them a valuable addition to any diet, it is worthy of note that their protein content is comparable to that of meat, making them an attractive alternative for individuals looking to reduce their consumption of animal products (Redic, Barudanonovic, Pilipovic, 2010; Waktola and Temesgen, 2018). Moreover, the cultivation of mushrooms requires minimal resources and can be easily integrated into existing agricultural practices (Adebayo, Banjo and Abikoye, 2009). This means that the Okun people can utilize their knowledge of farming and incorporate the cultivation of mushrooms into their traditional farming methods. Furthermore, the local availability of mushrooms makes them an ideal food source for the Okun people. Instead of relying on imported or processed foods, the consumption of mushrooms can provide the community with a sustainable and nutrient-rich source of food, the potential of mushrooms for sustainable food security among the Okun people of Kogi State is significant. By incorporating this overlooked food source into their diets and farming practices, the community has the opportunity to improve their food security in a sustainable manner. Presently, mushrooms have continued to generate a lot of interest, and this is mainly in the areas to cure of diseases (Adejumo and Awosanya, 2005; Kumar, 2015; Waktola and Temesgen, 2018; Niazi and Ghafoor, 2021;). Mushrooms consumed by the Okun people are not only valued for their their nutritional content but also for medicinal properties. Despite these benefits, there are challenges associated with mushroom cultivation among the Okun people. There might be cultural biases against consuming certain types of mushrooms or a lack of awareness regarding their benefits, which could limit acceptance within communities. Climate change poses risks to agricultural productivity overall; thus, mushroom cultivation must adapt to

changing weather patterns that could affect growth conditions. Many farmers may not have access to training on modern mushroom farming techniques or knowledge about edible versus toxic species. Limited access to markets can hinder economic benefits from mushroom sales. Infrastructure issues may restrict farmers from reaching larger markets where they could sell their produce at better prices.

Statement of problem

Okun people of Kogi state are mostly farmers and they rely heavily on these agricultural produce for both nutritional and economic survival, but risks to overall agricultural productivity is eminent due climatic change. Mushrooms consumed by the Okun people are not only valued for their nutritional content, but also for medicinal properties of these mushrooms that naturally grows wild in the area. Despite these benefits, there are challenges associated with mushroom cultivation of mushrooms among the Okun people. There might be cultural biases against consuming certain types of mushrooms or a lack of awareness regarding their benefits, which could limit acceptance within communities. Identifying and documenting different species of mushrooms in Okun is essential for creating awareness of the potentials of these important plants in bringing about food security.

Aim and Objectives of the study

This study investigates the potential of mushrooms as a source of food security among the Okun people of Kogi State.

1. document various species of edible mushrooms found in Okun
2. highlight the potential of mushrooms in meeting the food security needs of the Okun people
3. highlighting their nutritional benefits and suitability for sustainable farming practices

Materials and Methods

Through a comprehensive literature review, questionnaire and interviews with local farmers and community members, the potentials of mushrooms in meeting food security needs were explored.

Sampling Procedure

The respondents to the questionnaires were randomly drawn from the Okun (Yoruba) people of Kogi West senatorial district, this comprises of five Local Government Areas, Yagba East, Yagba West, Mopa/Amuro, Kabba-Bunu and Ijumu respectively. Sixty (60) respondents were drawn randomly from each Local Government Area respectively making a total of three hundred (300) respondents who were served those questionnaires or oral interview for the non-educated respondents using questions on the questionnaires. Through a comprehensive literature review, questionnaire and structured interviews with local farmers and community members, the nutritional benefits and economic potential of mushrooms were explored. The under listed questions were drawn to help the researcher have a focus:

1. Do they have knowledge about edible versus toxic species?
2. What are the cultural biases against consuming certain types of mushrooms?
3. What is the awareness level regarding their nutritional benefits?
4. Do the people have access to training on modern mushroom farming techniques?
5. Do they have access to larger markets for mushroom sales?

Result

Table 1: Edible mushrooms found in Okun (Yoruba) and their traditionally known importance

	Botanical names	Common names	Okun/Yoruba names	Traditionally known Importance
1.	*Agaricus arvensis*	Horse mushroom	Eran-igbó	Food and medicine
2.	*Agaricus bisporus*	Table or button mushroom	Esusun Ọpọlọ	Food and medicine
3.	*Agaricus campestris*	Common mushroom	Efo Iyanrin	Food and medicine
4.	*Aleuria aurentia*	Orange peel		Food and medicine
5.	*Auricularia auricular Judae*	Jew's jelly ear	Eti-ologbo	Food and medicine
6.	*Auricularia polytrica*	Hairy Jew's ear	Eti-ologbo	Food and medicine
7.	*Calvatia cyathiformis*	Puffballs	Iso-oloko	Food and medicine
8.	*Calvatia fragilis*	Puffballs	Iso-oloko	Food and medicine
9.	*Cantharellus cibarius*	Girolle	Eran-gbẹ́rẹ́, Eyin Alawọ	Food and medicine
10.	*Coprinopsis africana*	Ink cap	Ajeimutin	Food and medicine
11.	*Flammulina velutipes*	Enoki Mushroom		Food and medicine
12.	*Lactarius trivialis*	Tacked milk cap	Ẹran-ilẹ	Food and medicine
13.	*Lactarius volemus*	Weeping milk cap	Oju Ojukwu	Food and medicine
14.	*Laetiporus sulpureus*	Chicken of the woods	Ẹran-Adiẹ	Food and medicine
15.	*Lentinula edodes*	Shiitake Mushroom	Amunututu , eran-atakata	Food and medicine
16.	*Lentinus arcularius*	Spring polypore	Eti aja	Food and medicine
17.	*Lentinus squarrosulus*	Sawgill fungus	Olu-awo, Erirokiro	Food and medicine
18.	*Lentinus subnudus*	Sawgill fungus	Ogiri-agbe ero-ata	Food and medicine
19.	*Lycoperdon perlatum*	Gem–studded puffball	Esunsun-ilẹ	Food and medicine
20.	*Macrolepiota procera*	Parasol mushroom	Esusun-omi	Food and medicine
21.	Microporellus dealbatus	White polypore	Ẹsunsun-adodo	Food and medicine
22.	*Microporellus obovatus*	Obovate polypore	Eti-oloko	Food and medicine
23.	*Morchella esculenta*	Yellow Morel		Food and medicine
24.	*Pleuretus tuberregium*	King tuber	Ranrankiran	Food
25.	*Pleurotus ostreatus*	Oyster	Iyanrin	Food
26.	*Pleurotus pulmonarius*	Phoenix	Ranrankiran	Food and medicine
27.	*Psathyrella atroumbonata*	Crumble cap	Wowo	Food and medicine
28.	*Psathyrella delineata*	Corrugated cap	Eyin-Aja	Food

29.	*Psilocybe cubensis*	African Magic mushroom	Wuruku	Food and medicine
30.	*Russula vesca*	Brittle gill		Food and medicine
31.	*Termitomyces clypeatus*	Black mouse deer	Takele	Food and medicine
32.	*Termitomyces eurrhizus*		Esunsun- Ilẹkoko	Food and medicine
33.	*Termitomyces letestui*	Termite mushroom	Amunruweru, Eran-oko,	Food and medicine
34.	*Termitomyces microcarpus*	Termite mushroom	Eyin Oko, Olu-Oran	Food and medicine
35.	*Termitomyces robustus*	Termite mushroom	Esunsun- eyhee, Ewe	Food and medicine
36.	*Thelephora penicillata*	Urchin earthfan	Ese -Adie	Food and medicine
37.	*Volvariella volvacea*	Paddy straw	Esunsun-ọdẹ, Eran-iyin, Eyin Ofada, Oju-Oloko,	Food and medicine

The respondents interviewed provided vital information on the indigenous uses of mushrooms especially those of edible and medicinal mushrooms identified. 37 different species of mushrooms were identified in this study as shown on Table 1 above. It was discovered that most of species are used both for food and medicinal purposes. The medicinal purposes here are majorly partly as the people believe that food is medicine

Fig. 1: Pictures of some identified edible mushrooms in Okun land

The figure above show picture of some edible mushrooms found among the Okun people of Kogi state Nigeria.

Knowledge about edible versus toxic species: People's Perception about edible versus toxic species 69.2% of the respondents agreed that it is difficult to identify the differences between the poisonous (toxic) and non-toxic (edible) mushrooms, while only 30.8% agreed that they can differentiate between the poisonous (toxic) and non-toxic (edible) mushrooms. This could be the reason for people not being fascinated to mushrooms.

Cultural biases against consuming certain types of mushrooms : Various reasons were given why edible mushrooms were consumed in the study areas, these reasons include majority of the people (78%) believed that it is meant for poor people as it can stand as substitute for meat, others (68.4%) agree that the taste is palatable, about 40.7% of the respondents agreed with the use for

medicinal purposes, it seem that the educated ones are those that consented to the nutritional values and very few (32%) agreed with its use for soup thickening. Majority of the people (65%) are not aware that some edible mushrooms can be cultivated; this could be as a result of its abundance in wild where they are collected freely during its season. Mushrooms are tied to rituals or traditional celebrations, 58.3% agreed that those who take mushrooms are spiritualists. Mushrooms bring bad luck while agreed that mushrooms bring good luck

The awareness level regarding their nutritional benefits: Their knowledge on nutritional value of mushrooms is also very low as only 43.6% are aware of the nutritional values of mushrooms. Majority of this percentage are educated elite, majority of the percentage that are not aware belong to the illiterate or low educated class.

Access to training on modern mushroom farming techniques: Almost all the respondents (94%) said that they have no access to training on modern mushroom farming techniques; they said mushrooms are collected from the wild.

Access to larger markets for mushroom sales: Majority (92.7%) respondents believed that they do not have access to larger markets while only 7.9% agreed that they can have access to larger market, this may be as a result of most of the mushrooms being collected from the wild by elderly women and sold in the local markets

Table 2: Mushroom Nutritional Value (per 100g)

Mushroom	Carbohydrates	Protein	Fat	Fiber	Calories (per 100g)	Vitamins and Minerals
Agaricus arvensis	3.6g	2.5g	0.3g	1.5g	22	Potassium, Selenium
Agaricus bisporus	3.3g	3.1g	0.3g	1g	22	Vitamins (B2, B3, D), Selenium , Potassium, Iron
Agaricus campestris	3.3g	3.5g	0.3g	1.2g	22	Potassium, Phosphorus, Vitamin B2, B1and B3
Aleuria aurentia	5.0g	2.5g	0.5g	1.0g	30	Vitamin B2, B3), Potassium and Phosphorus
Auricularia auricula	8.0 g	2.5 g	0.1 g	3.0 g	30	Vitamin (B2,B12), Calcium, Iron
Auricularia auricular Judae	6.0g	3.0g	0.4g	2.5g	35	Vitamin B1, B2), Iron, Calcium and Magnesium
Calvatia cyathiformis	9.0 g	2.0 g	1.0 g	4.0 g	25	Potassium
Calvatia fragilis	7.9 g	2.0 g	<1 g	3.6 g	20	Potassium
Cantharellus cibarius	6.4 g	1.5 g	0.2 g	3.0 g	38	Vitamin D, Potassium
Coprinopsis africana	7.0g	2.8g	0.3g	1.5g	40	Vitamins (B3, B5), Selenium and Potassium
Flammulina velutipes	7.9g	2.7g	<0.1g	2.7 g	37	Niacin (B3), Vitamin D, Iron, Potassium
Lactarius deliciosus	4.0g	2.0g	1.0g	2.0g	30	Vitamin C, Magnesium

Lactarius trivialis	3.6g	2.5g	<0/5g	1.0g	22	Vitamins (B2, B3, D), Phosphorus, Potassium, Magnesium
Lactarius volemus	4.5g	3.0g	<0.5g	1.0g	30	Vitamins (B1, B2, C), Selenium, Potassium, Iron
Laetiporus sulpureus	10.0g	4.0g	1.0g	3.0g	50	Vitamins (B5, B9), Potassium, Iron
Lentinula edodes	6.8g	2.2g	0.2g	2.5g	34	Vitamins (B2, B5, B6 D), Copper, Potassium, Iron
Lentinus arcularius	7.0g	3.5g	0.5g	2.0g	35	Vitamins (B2, B5, B6 D), Copper, Potassium, Iron
Lentinus squarrosulus	7.0g	4.0g	<1g	2.0g	35	Vitamins (B2, B3), Copper, Selenium
Lentinus subnudus	8.0g	4.5g	<1g	3.0g	40	Vitamins (B2, B3, B12), Potassium, Magnesium
Lycoperdon perlatum	6.0g	2.0g	<0.5g	1.0g	25	Vitamins B, Copper, Selenium, Calcium, Phosphorus
Macrolepiota procera	7.0g	4.0g	<1g	3.0g	34	Vitamins (B2, D), Potassium, Phosphorus
Microporellus dealbatus	8.0g	3.0g	1.5g		40	Vitamins (B2, B5, B6 D), Copper, Potassium, Iron
Microporellus obovatus	9.5g	3.2g	1.2g		45	Vitamins (B2, B5, B6 D), Copper, Potassium, Iron
Morchella esculenta	6.3g	3 .1g	0 .5g	2.8g	31	Potassium
Pleuretus tuberregium	7.0g	3.5g	1.0g	2.5g	70	Vitamin B, Calcium, Phosphorus, Potassium, Magnesium
Pleurotus ostreatus	9.9g	3.3g	0.8g	2.6g	33	Vitamins (B1, B2, C, D,), Potassium, Iron, Calcium, Sodium, Magnesium,
Pleurotus polmunarius	6.5 g	3.5 g	0.3 g		33	Calcium, Sodium, Potassium, Magnesium, Vitamin C
Psathyrella atroumbonata	6.0g	2.5g	<1g		30	Vitamin (B2, B3, B5), Phosphorus, Potassium, Selenum
Psathyrella delineata	5.8g	2.4g	<1g		28	Vitamin (B1, B2), Copper, Iron
Psilocybe cubensis	4.5g	3.1g	<1g		22	Vitamin (B2, B3, D), Calcium, Phosphorus, Potassium, Magnesium

Russula vesca	4.0g	2.0g	<1g		25	Vitamin (B2, B9) Potassium, Iron, Zinc, Selenium
Termitomyces clypeatus	7.0g	2.0g	0 g	3.0g	35	Vitamin B, Magnessium, Zinc
Termitomyces eurrhizus	8.0g	4.0g	<1g		40	Vitamin (B3, B5), Potassium, Zinc, Copper
Termitomyces microcarpus	7.0g	2.0g	0 g	3.0g	30	Vitamins (C, D), Iron, Calcium, Sodium, Potassium, Magnesium,
Termitomyces robusta	7.0g	2.0g	0 g	3.0g	35	Calcium, Sodium, Potassium, Magnesium, Vitamin C
Thelephora penicillata	6.0g	3.0g	<1g		30	Vitamin (B2, B3), Potassium, Magnesium
Volvariella volvacea	6.8g	2.9g	0.3g	3.5 g	34	Calcium, Sodium, Potassium, Magnesium, Vitamin C

Source: USDA Food Data Central (2024); Mycobank Database, 2023

The above table provides a comprehensive overview of some edible mushrooms known among the Okun people along with their respective nutritional values per hundred grams serving size. These mushrooms provide low-calorie options that are high in protein relative to their caloric content. They also contain essential vitamins and minerals that contribute to overall health. Fibre content varies among species but generally contributes to digestive health. Mushroom is generally low in calories and fat but rich in fibre, vitamins which supports metabolism, protein and minerals, they also contains selenium which is important for antioxidant defence.

Discussion

The findings revealed that mushrooms have the potential to provide a sustainable and nutritious source of food for the Okun people, who currently face challenges with food insecurity and limited access to traditional food sources. They provide essential nutrients such as proteins, vitamins (especially B vitamins), minerals (like selenium), and dietary fibre. This makes them an important component of the local diet, contributing to food security and nutrition. The consumption of mushrooms can help alleviate malnutrition by providing essential nutrients that may be lacking in local diets. This is particularly important for vulnerable populations such as children and pregnant women. Incorporating mushrooms into the diet of the Okun people can significantly improve nutrition levels within this community by providing excellent source of protein that is essential for growth and development, vital micronutrients that may be lacking in traditional diets dominated by starchy staples, improved immune function and reduced risk of chronic diseases due to their antioxidant properties, improve their food security and promote sustainable agricultural practices. However the Cultural biases against consuming certain types of mushrooms and difficulty in differentiating edible from non-edible mushroom makes people not being fascinated to mushrooms. Cultivating mushrooms can provide the potential to create economic opportunities for

the local community. Overall, this study highlights the importance of further research and investment in the use of mushrooms for sustainable food security among the Okun people and other populations facing similar challenges.

Conclusion

The edible mushrooms listed above are not only delicious but also provide significant nutritional benefits when included in a balanced diet. In Okun, a region known for its rich biodiversity, several edible mushroom species which are diverse group of fungi found in various environments, including forests, grasslands, and urban areas can be harvested. The potential of mushrooms as a sustainable food source among the Okun people of Kogi State is substantial. By exploiting local resources for cultivation, enhancing nutritional intake through diverse diets, and improving economic opportunities via market access, mushroom could play a critical role in addressing food security challenges faced by this community.

Recommendations

To leverage mushrooms effectively for food security among the Okun people, several strategies can be implemented:

Enlightening of people on Nutritional value of mushrooms: Campaigns aimed at educating communities about the nutritional benefits of mushrooms could increase demand and consumption rates within local diets, the people should also be taught various ways of identifying edible and poisonous mushrooms as this will alleviate their fear of consuming poison.

Education and Training Programs: creating awareness among the locals that mushrooms can be cultivated and not only collected from wild during its season is important and establishing workshops or training sessions focused on mushroom cultivation techniques by experts can empower local farmers with knowledge about best practices on cultivating mushrooms.

Community-Based Initiatives: Forming cooperatives can help small-scale farmers' pool resources for better market access and collective bargaining power when selling their products.

Policy Support from Governmental Bodies: Local governments should consider policies that support sustainable agricultural practices including mushroom farming through subsidies or grants aimed at enhancing food security initiatives.

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