



RESEARCH ARTICLE

Development and Characterization of a Culinary Bouillon Cube from Wild Edible Mushrooms in Benin

¹Houssou-Goe Mawutin Justine Bérénice, ¹Tchekessi C. K. Célestin, ¹Kinsou Djossou D. Appolinaire, ²Gandeho G. Justin, ³Dassou G. Hospice, ⁴Houdanon D. Roël, ⁵Dabade D. Sylvain, ⁶Badoussi M. Eric, ¹Bleoussi Roseline, ¹Djogbe Anayce, ¹Bokossa Yaou Innocent and ¹Baba-Moussa A. K. Farid

¹Food Health Safety Research Unit of Laboratory of Microbiology, Food Technology and Phytopathology, Department of Plant Biology, Faculty of Sciences and Techniques, University of Abomey-Calavi, Benin

²Laboratory of Nutrition and Food Sciences, Departement of Nutrition and Food Sciences, Faculty of Agronomy, University of Parakou, Bénin

³Laboratory of Plant Sciences and Pharmacopoeia, Department of Plant Biology, Faculty of Sciences and Techniques, University of Abomey-Calavi, Benin

⁴Laboratory of Ecology, Botany and Plant Biology, Faculty of Agronomy, University of Parakou, Benin

⁵Laboratory of Sciences and Food Technologies, Faculty of Agronomic Sciences, University of Abomey-Calavi, Benin

⁶Laboratory of Biochemistry and Food and Medicinal Formulations, National Higher School of Biosciences and Applied Biotechnologies, National University of Sciences, Technologies, Engineering and Mathematics, Benin

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Corresponding Author:

Tchekessi C. K. Célestin,
Food Health Safety Research Unit of
Laboratory of Microbiology, Food
Technology and Phytopathology,
Department of Plant Biology, Faculty of
Sciences and Techniques, University of
Abomey-Calavi, Benin
Tel: +229 01 97 81 00 40

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Abstract

Background and Objective: The consumption of industrial culinary bouillons is widespread in West Africa, although their formulation often relies on high salt contents and the use of food additives. This study aimed to develop a culinary bouillon based on the local edible mushroom *Volvariella volvacea* as an alternative to industrial bouillons available in Benin.

Materials and Methods: The bouillon cube was formulated using edible mushroom powder (40%), natural spices (17.86%), salt (10.71%), starch (2.86%) and water (28.57%) and was subsequently subjected to physicochemical, microbiological and sensory evaluations.

Results: The production process yielded 81.17%. Physicochemical analyses showed moisture, salt, protein and ash contents of $6.41 \pm 0.02\%$, $4.83 \pm 0.09\%$, $19.38 \pm 0.17\%$ and $2.15 \pm 0.013\%$, respectively. Microbiological analyses indicated satisfactory hygienic quality of both the mushroom powder and the finished bouillon, with the absence or low levels of the main microorganisms investigated. Sensory evaluation, conducted in comparison with a commercial bouillon, showed greater acceptance of the developed product in terms of texture, aroma, taste, aftertaste and overall acceptability, whereas its color received a slightly lower score.

Conclusion: Overall, the *Volvariella volvacea*-based culinary bouillon cube exhibited satisfactory physicochemical, microbiological and sensory characteristics and represents a promising approach for valorizing locally available edible mushrooms in Benin.

INTRODUCTION

Industrial culinary bouillons have gradually become essential ingredients in West African cooking, with household

penetration rates approaching 100% in countries such as Nigeria, Senegal and Burkina Faso¹. Their low cost, constant availability and the speed they add to meal preparation explain this widespread adoption, even among rural and low-

income households, for whom bouillon remains, after water and salt, one of the most commonly consumed food products on a daily basis¹. This widespread use has even led some public health programs to consider bouillon as a potential vehicle for micronutrient fortification, precisely because of its almost universal consumption². However, the composition of the majority of these bouillons sold in West African markets raises growing health concerns. These products contain sodium levels far above recommended levels, as well as various synthetic flavor enhancers such as monosodium glutamate, disodium inosinate and disodium guanylate³. A recent assessment conducted in Nigeria showed that most of the bouillon cubes analyzed significantly exceeded the sodium threshold recommended by the World Health Organization, exposing consumers to an increased risk of cardiovascular diseases, stroke and high blood pressure⁴. Moreover, repeated consumption of monosodium glutamate has been linked to the development of metabolic disorders, including dysregulation of insulin secretion and excessive weight gain in some consumers⁵. At the sub-regional level, Talata *et al.*⁶ also raised concerns about the presence in several bouillon cubes marketed in West Africa of additives such as disodium guanylate and inosinate, the use of which is nevertheless prohibited in children.

Given these well-documented health risks and the growing distrust of consumers toward imported industrial bouillons, the search for natural and local substitutes has become a necessity for the African food industry. In this context, edible mushrooms represent a particularly promising resource. Their richness in free amino acids, 5'-nucleotides and volatile compounds gives them a recognized umami intensity, capable of naturally reproducing the flavor-enhancing effect sought in bouillons without resorting to the criticized synthetic additives⁷. Despite this potential, edible fungal resources remain largely underexploited in West Africa, particularly in Benin. More than 160 edible species have been recorded across the entire sub-region, with a significant number present in Benin⁸.

It is from this perspective of promoting an underutilized local resource, combined with a public health concern related to reducing the consumption of synthetic additives, that this study is framed. It aims to offer a healthy, natural and accessible alternative to the industrial bouillons currently available on the Beninese market, based on the organoleptic and nutritional properties of local edible mushrooms. The main goal of this study is therefore to develop a culinary bouillon cube based on wild edible mushrooms from Benin.

MATERIALS AND METHODS

Study area: The collection of edible mushrooms used in this study was carried out in the town of Covè, located in the Zou Department and in the town of Akpadanou, located in the Ouémé Department, within the Adjohoun Municipality of Benin. The mushrooms were obtained either from local collectors and sellers or collected directly by the researchers to ensure the freshness of the raw material. The choice of these collection sites was justified by the availability of edible mushrooms, particularly the species *Volvariella volvacea*, which generally grows on felled and decomposing palm trees (Fig. 1 and 2).

The production was carried out at the Food Safety Research Unit (URSSA), while the microbiological analyses were conducted at the Laboratory of Microbiology, Food Technology and Phytopathology (LAMITAP) of the Faculty of Science and Technology (FAST), located on the campus of the University of Abomey-Calavi (UAC). The physicochemical analyses were performed at the Research Unit in Enzymatic and Food Engineering (URGEA) of the Laboratory for Study and Research in Applied Chemistry (LERCA) at the Polytechnic School of Abomey-Calavi (EPAC), which is part of the University of Abomey-Calavi (UAC).

Materials: The biological materials mainly consisted of the edible mushroom *Volvariella volvacea*, as well as other ingredients, including turmeric, fresh celery leaves, fresh parsley leaves, thyme leaves, fresh onion, fresh garlic, corn starch and salt.

The technical materials included a precision scale for weighing the ingredients; a knife and cutting board, a dehydrator or oven for drying the mushrooms and other ingredients; a grinder for reducing the ingredients to powder; clean, airtight containers for storage and laboratory equipment, including beakers, test tubes, pipettes, a pH meter and appropriate reagents, used for physicochemical and microbiological analyses.

Study methods

Process for producing broth from edible mushrooms: The broth production process used in this study was based on the method described by Bamba⁹, which was modified for the production of African locust bean-based broth. Two major modifications were made: The plant raw material was replaced with the edible mushroom *Volvariella volvacea* and the monosodium glutamate used by those authors was substituted with various spices selected for their nutritional and flavor properties. The overall production process is shown in Fig. 7.



Fig. 1: *Volvariella volvacea* on a palm trunk



Fig. 2: *Volvariella volvacea* collected

Process for producing edible mushroom powder: The preparation of the edible mushroom *Volvariella volvacea* was carried out through several successive steps, as illustrated in the diagram shown in Fig. 3.

Sorting: The freshly harvested mushrooms were manually sorted to remove damaged, deformed, or otherwise unsuitable specimens. Only specimens in good overall condition were retained for subsequent processing.

Washing and draining: The sorted mushrooms were washed with drinking water to remove surface impurities, including soil and plant debris. They were then drained to remove excess water before the subsequent processing steps.

Cutting: The drained mushrooms were cut into small, uniform pieces to increase the surface area and facilitate heat transfer during drying, thereby ensuring more uniform dehydration.

Drying: The mushroom pieces were oven-dried at 48.4°C for 56.4 hrs.

This mild temperature was selected to preserve heat-sensitive aromatic and nutritional compounds while ensuring sufficient reduction in moisture content. Drying was continued until a dry and stable product was obtained.

Grinding: The dried mushrooms were ground using a mechanical grinder to obtain a fine and uniform powder. The powder was then stored in clean, airtight containers and protected from moisture until use in the formulation.

Production process of complementary ingredient powders: The complementary ingredients, including seasonings such as celery leaves, parsley leaves, thyme leaves, onion, garlic, ginger, bay leaves and turmeric, were collected fresh and their preparation involved several consecutive steps, as illustrated in the diagram shown in Fig. 6.

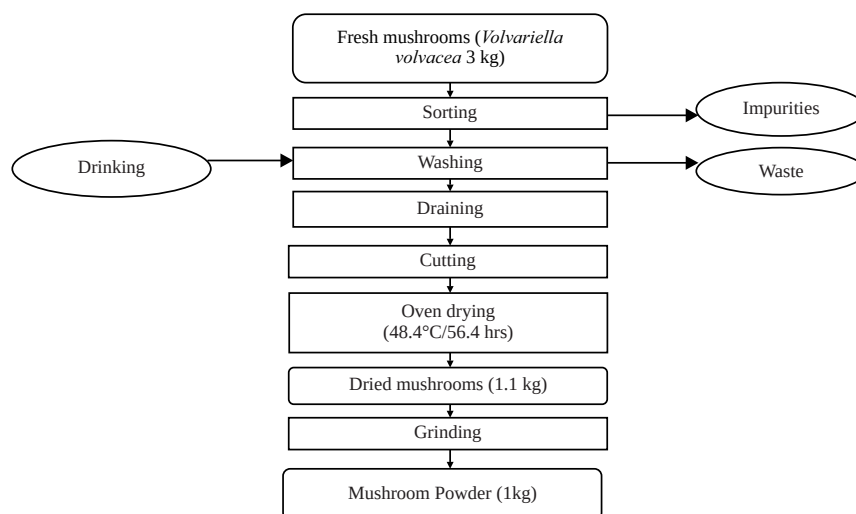


Fig. 3: Production process for mushroom powder



Fig. 4: Dried *Volvariella volvacea*



Fig. 5: *Volvariella volvacea* powder

Sorting: Each ingredient underwent manual sorting to remove damaged, yellowed, or otherwise impaired parts, as well as any foreign materials that might be present. Only healthy parts were retained for the subsequent processing steps.

Washing and draining: The sorted ingredients were carefully washed with drinking water to remove soil residues, dust and other surface impurities. They were then drained to remove excess water before cutting.

Peeling and Trimming: The ingredients that required peeling, particularly onions, garlic and ginger, were peeled and trimmed to retain only the edible and flavor-active parts.

Cutting: The prepared ingredients were cut into small pieces to increase the surface area for heat exchange and facilitate rapid and uniform drying.

Drying: The resulting pieces were dried in a dehydrator at 52°C for 48 hrs. Each ingredient was dried separately to account for the characteristics of each raw material and to best preserve its aromatic and bioactive properties.

Grinding: After drying, each ingredient was ground separately using a mechanical grinder to obtain fine and distinct powders. Grinding each ingredient separately allowed better control of the particle size of each powder before they were combined during formulation. The resulting powders were stored away from moisture and light until use.

Broth formulation and shaping: The broth formulation was carried out using a multi-step process, as shown in the diagram in Fig. 7.

Weighing and mixing: The different powders (mushroom and seasonings), as well as salt and corn starch, were weighed

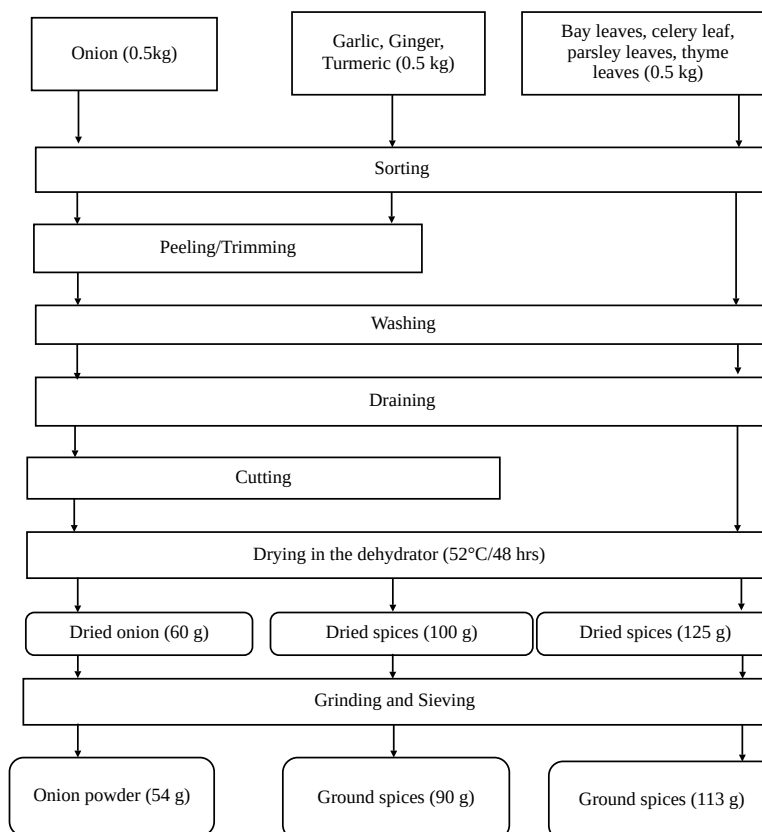


Fig. 6: Production process for powdered spices

Table 1: Experimental formulation of the mushroom-based broth: ingredient proportions and masses for a total batch mass of 77 g, adapted from Bamba *et al.*⁹

Ingredient	Percentage	Mass (g)
Mushroom powder (<i>Volvariella volvacea</i>)	40	30.8
Water (binder, added to the mix)	28.57	22
Salt	10.71	8.25
Onion powder	3.57	2.75
Ginger powder	3.57	2.75
Bay leaf powder	3.57	2.75
Powder of Thyme, Parsley and Celery leaves	3.57	2.75
Cornstarch	2.86	2.20
Garlic powder	2.14	1.65
Turmeric powder	1.42	1.10
Total	100	77

using an electronic scale according to the proportions defined in Table 1 and then mixed until a homogeneous mixture was obtained.

Final molding and drying: To shape the product into cubes, 22 g of drinking water was added to the dry mixture to activate the corn starch and provide the plasticity required for molding. After molding, the cubes were dried in an oven at 52°C for 24 hrs to remove the remaining water and obtain a stable, ready-to-eat product.

Packaging: The finished product was packaged in airtight containers and stored away from moisture and light until analysis.

Physicochemical analyses of the formulated mushroom broth: Physicochemical analyses were carried out to assess the quality of the formulated mushroom broth. The parameters analyzed were water content, dry matter content, pH, total ash content and salt content. These analyses were performed using standard AOAC methods¹⁰.

To determine the water content, a known mass (5 g) of the broth sample was weighed in a previously tared container. The sample was then placed in an oven set at 105°C for 24 hrs. After drying, the container was removed, cooled in a desiccator and weighed. Drying was continued until a constant weight was obtained¹⁰.

The same amount (5 g) of the sample was placed in a previously weighed crucible to determine the ash content of the product. The crucible was then placed in a muffle furnace set at 550°C for approximately 6 hrs, until the organic matter was completely burned off. After cooling in a desiccator, the crucible was weighed¹⁰.

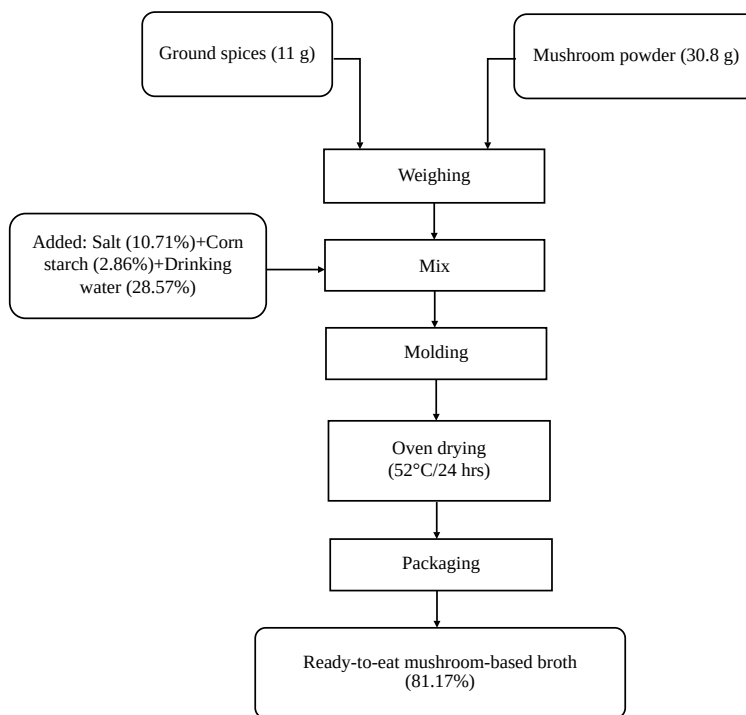


Fig. 7: Production process for the mushroom-based broth

For the salt content, an aqueous solution of the broth was prepared and then titrated with a silver nitrate (AgNO_3) solution using potassium chromate as an indicator. The volume of the silver nitrate solution used at the equivalence point was recorded. The salt content was calculated from the volume of titrant used according to the formulas described by AOAC¹⁰ and expressed as a percentage of sodium chloride in the sample.

The percentage of crude protein in the dried mushroom samples was determined from the nitrogen content using the Kjeldahl method¹¹.

Microbiological analyses of the formulated mushroom

broth: The microbiological parameters investigated in this study included total aerobic mesophilic flora, lactic acid bacteria, total and thermotolerant coliforms, sulfite-reducing anaerobic bacteria (SRB), *Staphylococcus aureus*, yeasts and molds and enterobacteria. The microbiological analysis protocol included sample preparation, microbial detection and colony counting. The culture media were prepared according to the manufacturer's instructions.

The stock suspension was prepared according to the ISO 6887 method¹². Ten grams (10 g) of the edible mushroom-based broth sample were aseptically collected using a sterile spatula and placed in a sterile stomacher bag containing 90 mL of Sterile Distilled Water (SDW). The mixture was

homogenized using a stomacher at 200 rpm. A series of successive decimal dilutions was then prepared from this stock suspension.

Total aerobic mesophilic flora was counted using Plate Count Agar after incubation at 30°C for 72 ± 2 hrs¹³. *Staphylococcus aureus* was counted on Mannitol Salt Agar after incubation at 37°C for 24 hrs¹⁴. Lactic acid bacteria were enumerated according to ISO 15214¹⁵ using the deep culture method. The Petri dishes were incubated at 30°C for 72 hrs under anaerobic conditions.

Yeasts and molds were enumerated on Sabouraud medium supplemented with chloramphenicol after incubation at 25°C for 5 days¹⁶.

Total coliforms were enumerated according to ISO 4832¹⁷, classification index V08-015 (2006), while thermotolerant coliforms were enumerated according to the method described by Teramura *et al.*¹⁸. Total coliforms were enumerated on VRBL (Violet Red Bile Lactose) agar after incubation at 37°C for 24 ± 2 hrs. Thermotolerant coliforms were also enumerated on VRBL agar but after incubation at $44 \pm 1^\circ\text{C}$ for 24 ± 2 hrs.

Sulfite-reducing anaerobic bacteria (SRB) were enumerated using TSN (Tryptose Sulfite Neomycin) agar according to ISO 15213-1¹⁹. The plates were placed in a desiccator used as an anaerobic incubation chamber and incubated at 37°C for 48 hrs, allowing the characteristic colonies to develop.

Finally, Gram staining was performed according to the conventional method described by Smith and Hussey²⁰. The staining was carried out on representative bacterial colonies obtained from the total aerobic mesophilic flora count to determine their Gram reaction and microscopic morphology. An isolated colony was aseptically collected and spread onto a clean microscope slide containing a drop of sterile water. Crystal violet, Lugol's iodine (Gram's iodine) and safranin were then used to prepare the slide, which was examined under a light microscope to determine the Gram reaction, cellular morphology and arrangement of the bacteria.

Sensory analysis of the broth: The sensory evaluation of the culinary broth made from *Volvariella volvacea* was carried out using a paired comparison test with a reference, according to the method described by Civil *et al.*²¹. The panel consisted of 36 judges who were familiar with dishes prepared using commercially available Maggi bouillon cubes.

Two samples of tomato sauce served with white rice were presented to the judges: a control sample (T), prepared with a commercial Maggi cube and a test sample (B), prepared with the cube-shaped culinary broth made from edible mushrooms and formulated in this study.

The sensory attributes evaluated were color/appearance, texture, smell, taste, aftertaste and overall acceptability. Additional open-ended questions were used to collect the judges' qualitative perceptions regarding the main perceived difference between the two samples, the acceptability of product B, their preference between samples B and T and their intention to consume the product if the broth were marketed.

Statistical analysis: The data from the physicochemical and microbiological analyses were organized using Microsoft Excel 2016 and subsequently subjected to statistical analysis using Minitab 20. The results were presented in Tables and Graphs.

RESULTS

Physical characteristics and yield of the culinary broth: The culinary broth developed from *Volvariella volvacea* was obtained in cube and heart shapes. The product was compact, uniform and dark greenish-brown in color, without the addition of artificial coloring. This natural coloration resulted from the combination of *Volvariella volvacea* powder, which

constituted the largest proportion of the formulation (40%) and the dried seasonings included, notably thyme, parsley, celery, turmeric and bay leaf.

At the end of production, starting from 55 g of dry raw materials and 22 g of water used as a technological binder, for a total of 77 g of raw materials, 25 bouillon cubes weighing 2.5 g each were obtained, corresponding to a total finished product weight of 62.5 g. The production yield was therefore 81.17%, as shown in Table 2.

Physicochemical characteristics of the produced culinary

broth: The results of the physicochemical analyses carried out on the produced culinary broth are presented in Table 3. The parameters analyzed were water content, protein content, salt (NaCl) content and total ash content. These values were compared with the proportions recommended by the Senegalese Standard NS 03-146:2018 for culinary broths.

The water content of the produced broth was $6.41 \pm 0.02\%$. This value slightly exceeded the threshold recommended by the Senegalese standard, which is set at 5%. In contrast, the salt (NaCl) content was $4.83 \pm 0.096\%$, which remained well below the limit set by the standard, at 55%. The ash and protein contents were $2.15 \pm 0.013\%$ and $19.38 \pm 0.17\%$, respectively.

Microbiological characteristics of the produced mushroom

powder: The results of the microbiological analyses carried out on the produced mushroom powder are presented in Table 4. The total aerobic mesophilic flora was 3.2×10^3 CFU/g, a value clearly below the standard threshold ($\leq 3 \times 10^4$ CFU/g). Total coliforms were 1.5×10^2 CFU/g, which was also within the specified criterion ($\leq 10^3$ CFU/g). Yeasts and molds, thermotolerant coliforms, *Staphylococcus aureus* and sulfite-reducing anaerobic bacteria were absent from the powder.

Microbiological characteristics of the produced culinary

bouillon cube: The results of the microbiological analyses carried out on the produced culinary broth are presented in Table 5. The parameters assessed were compared with the microbiological criteria defined by the Senegalese Standard NS 03-146:2017 for culinary broths.

The total aerobic mesophilic flora was 6.5×10^3 CFU/g, a value within the limit specified by the standard (10^4 CFU/g). Yeasts and molds were present at 1.0×10^2 CFU/g, which also

Table 2: Yield of culinary broth production from local edible mushrooms

Dry matter mass (g)	Binding water (g)	Total mass used (g)	No. of cubes obtained	Unit mass (g)	Total mass of finished product (g)	Yield (%)
55	22	77	25	2.5	62.5	81.17



Fig. 8: Produced mushroom broths

Table 3: Physicochemical characteristics of the produced culinary broth

Sought physicochemical parameters	Obtained values	Recommended proportions according to ASN ²² the Senegalese standard (NS 03-146: 2017)
Water content (%)	6.41 ± 0.02	5%
Protein content (%)	19.38 ± 0.17	-
Salt content NaCl (%)	4.83 ± 0.096	55%
Ash content (%)	2.15 ± 0.013	-

Table 4: Microbiological characteristics of the produced mushroom powder

Sought microbiological parameters (CFU/g)	Obtained values	Microbiological criteria (Codex standard 39-1981 ²³ relating to edible mushrooms and derived products)
Total aerobic mesophilic flora	3.2 × 10 ³	≤ 3 × 10 ⁵
Yeasts and molds	Absent	-
Total coliforms	1.5 × 10 ²	≤ 10 ³
Thermotolerant coliforms	Absent	≤ 10
<i>Staphylococcus aureus</i>	Absent	≤ 10 ²
Sulfite-reducing anaerobic bacteria (ASR)	Absent	≤ 30

Table 5: Microbiological characteristics of the produced culinary bouillon cube

Sought microbiological parameters (CFU/g)	Obtained values	Microbiological criteria (Standard NS 03-146: 2018, related to Broth) ²²
Total aerobic mesophilic flora	6.5 × 10 ³	10 ⁴ -10 ⁵
Yeasts and molds	10 ²	10 ² -10 ³
Total coliforms	Absent	-
Thermotolerant coliforms	Absent	-
<i>Staphylococcus aureus</i>	Absent	10 ² -10 ³
Enterobacteria	Absent	10 ² -10 ³
Sulfite-reducing anaerobic bacteria (ASR)	Absent	-

met the specified criteria (10²-10³ CFU/g). Total coliforms, thermotolerant coliforms, *Staphylococcus aureus*, enterobacteria and sulfite-reducing anaerobic bacteria were absent from the product.

Sensory characteristics of the produced culinary bouillon cube: The results of the sensory evaluation of the culinary bouillon made from *Volvariella volvacea* (sample B), compared with the commercial control (Maggi cube, sample T), are shown in Fig. 8.

DISCUSSION

The results show that the culinary broth made from edible mushrooms has generally satisfactory physical, physicochemical, microbiological and sensory characteristics. Regarding the physical characteristics and production yield, the broth had a dark brownish-green, homogeneous and natural color. This coloration mainly resulted from the *Volvariella volvacea* powder, which was the main ingredient in the formulation, as well as the added seasonings. It differs

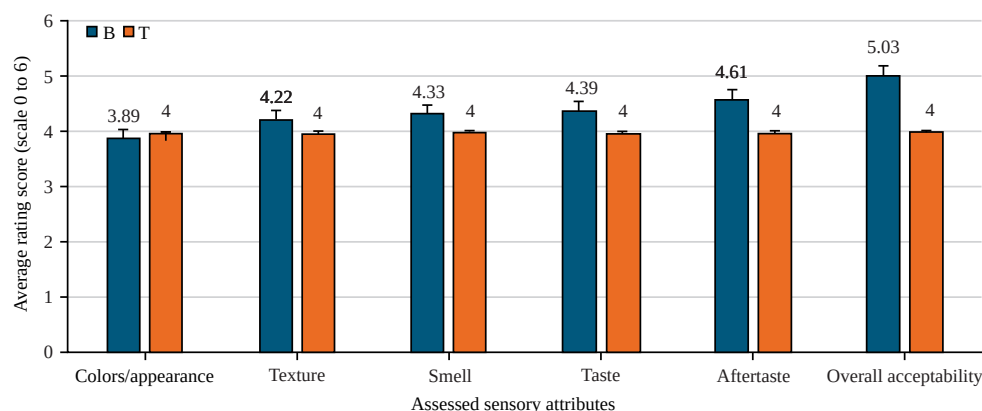


Fig. 9: Tomato sauce with broth made from edible mushrooms, T (Control): Tomato sauce with Maggi cube

from many commercial broths sold in West Africa, whose color is often enhanced with food colorants to achieve a uniform appearance⁶. The production yield of 81.17% indicates good control of the manufacturing process. The recorded losses (18.83%) were mainly attributed to the evaporation of binding water during the final drying step, which was necessary to ensure product stability. A similar observation was reported by Bamba *et al.*⁹ during the development of a culinary broth made from fermented *Parkia biglobosa* seeds, where mass losses were also associated with dehydration operations. These results confirm that drying is one of the main processing steps affecting the yield of culinary broths made from natural ingredients.

Regarding the physicochemical characteristics, the water content of the broth ($6.41 \pm 0.02\%$) was slightly higher than the maximum value of 5% set by the Senegalese Standard NS 03-146²². This difference suggests that optimization of the final drying step could further improve the product's stability during storage by limiting the risk of microbial growth. Nonetheless, this content was still much lower than that reported by Sahoré *et al.*²⁴, who found a moisture level of $81.00 \pm 0.53\%$ in fresh *Volvariella volvacea* samples sold in markets in Abidjan, Côte d'Ivoire.

This difference is expected because the authors analyzed fresh fruiting bodies, whereas the present study focused on a culinary broth that underwent a drying step to reduce its water content and improve its shelf life. According to Fellows²⁵, dehydrated foods with a water content below 10% generally have a longer shelf life because of reduced enzymatic and microbial activity. The value obtained in this study was below this level, suggesting that the produced broth may have good storage stability.

The protein content ($19.38 \pm 0.17\%$) found in this study was higher than that reported by Kouamé *et al.*²⁶ for

Volvariella volvacea ($15.73 \pm 0.11\%$). This difference could be explained by the broth formulation, which combined mushroom powder with other ingredients that may contribute protein, as well as by differences in the nature of the raw materials and processing methods. Nonetheless, this value confirms that *Volvariella volvacea* is a potentially valuable raw material for developing food products with high nutritional value and highlights the protein content of the broth produced. Edible mushrooms are recognized as a good source of proteins. Cheung²⁷ reported that proteins are among the main nutritional components of mushrooms and contribute to their potential use in the development of functional foods. The protein content obtained in this study could therefore contribute to dietary protein intake among consumers.

Moreover, the salt content ($4.83 \pm 0.10\%$) was well below the maximum limit of 55% set by the Senegalese Standard NS 03-146²². This low concentration represents a potential nutritional advantage compared with industrial broths, which may contain substantially higher amounts of sodium. The World Health Organization (WHO)²⁸ recommends reducing salt intake to less than 5 g/day in adults to lower the risk of high blood pressure and cardiovascular diseases. Therefore, the broth developed in this study has a potentially favorable nutritional profile compared with highly salted commercial bouillon cubes.

The ash content ($2.15 \pm 0.01\%$) reflects the presence of mineral matter derived from the mushrooms and herbs used in the formulation. Although, the Senegalese Standard NS 03-146²² does not specify a reference value for this parameter, this level is consistent with the mineral composition of products made from *Volvariella volvacea*. In fact, Sahoré *et al.*²⁴ showed that this species contains significant amounts of sodium, potassium, calcium and magnesium, highlighting its nutritional value as a source of minerals.

The analyzed microbiological parameters met the criteria of the Senegalese Standard NS 03-146²² and CODEX STAN 39-1981²³, which apply to the broth and mushroom powder, respectively. The produced broth showed a total aerobic mesophilic flora count of 6.5×10^3 CFU/g, a value below the acceptable limit of 10-10 CFU/g. Its yeast and mold count was 1.0×10^2 CFU/g, which corresponded to the lower limit specified by the Senegalese standard. The produced broth contained no total coliforms, thermotolerant coliforms, *Staphylococcus aureus*, enterobacteria, or sulfite-reducing anaerobic bacteria. However, the mushroom powder had a low level of total coliforms (1.5×10^2 CFU/g) before incorporation into the formulation. These coliforms were absent from the final produced broth.

These results are consistent with those obtained by Bamba⁹ during the production of broth from fermented *Parkia biglobosa* grains in Côte d'Ivoire. This author also reported the absence of pathogenic microorganisms in the finished product and concluded that the production process, combined with appropriate packaging, ensured good sanitary quality and satisfactory shelf life. The low level of microbial contamination observed in the present study may be attributed to the drying process at 52°C for 24 hrs, the reduction in water activity associated with dehydration and the airtight packaging of the product, which may limit microbial growth during storage.

The results of the sensory evaluation showed that the culinary broth made from *Volvariella volvacea* was generally well accepted by the tasters. The scores for texture, smell, taste, aftertaste and overall acceptability were higher than those of the commercial reference broth. Only the color received a slightly lower rating (3.89 compared with 4.00), which may have been related to the natural brownish-green coloration of the product. These results are consistent with those of Bamba⁹, who also reported good sensory acceptability of a culinary broth made from *Parkia biglobosa*. This positive reception could be related to the presence of compounds associated with umami taste, particularly glutamate, guanylate and inosinate, which naturally occur in plants and mushrooms⁷. These compounds can enhance food flavor and contribute to sensory acceptability. Therefore, the developed broth shows potential as a natural alternative to commercial broths.

CONCLUSION

This study aimed to develop a culinary broth made from local edible mushrooms (*Volvariella volvacea*) in response to the need for a healthy and natural alternative to commercial

broths. The selected formulation (40% mushroom powder, 10.71% salt, 2.86% starch and complementary seasonings) enabled the production of a finished product in the form of uniform cubes, with a satisfactory production yield of 81.17%. From a physicochemical perspective, the broth had a salt content well below the specified standard limit, representing a potential nutritional advantage, as well as a considerable protein content. Microbiological analyses showed satisfactory sanitary quality of the broth, with none of the targeted pathogenic microorganisms detected, indicating compliance with the applicable microbiological standards. Similarly, in the mushroom powder, only total aerobic mesophilic flora and total coliforms were detected and their microbial loads were low and below the specified limits. Finally, sensory evaluation showed that the mushroom-based broth was generally better accepted than the commercial control, except for color. Overall, these results demonstrate the potential of *Volvariella volvacea* as a raw material for the development of a natural, locally available flavor enhancer with promising potential as an alternative to commercial broths.

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