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Microbiological, Nutritional and Sensory Evaluation of Ogba Instant Native 'Ukashi' Soup

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Abstract

Ogba native soup prepared using indigenous leafy vegetables is relished by the people irrespective of social status. Although native soups are popularly known to be nutritious, they are predisposed to microbial contamination that poses a threat to human health. In this study, cooked and uncooked native 'ukashi' soups were prepared and the samples were subjected to microbiological and proximate analysis using Standard methods. Sensory evaluation of the samples involved the use of 9 point Hedonic scale. Heterotrophic bacterial count and total fungal count of uncooked 'ukashi' soup (UUS) is 7.15 $\log_{10}$CFU/ml each, whereas no values was recorded for cooked 'ukashi' soup (CUS). Yeasts were found in the UUS. In the same sample, *Vibrio* spp., *Enterobacter* spp., *Salmonella* spp., *Citrobacter* spp., *Klebsiella* spp., and *Pseudomonas aeruginosa* were present while *Salmonella* spp. and *Enterobacter* spp were found in the CUS. The moisture, ash, carbohydrate, lipid, crude fibre and protein of CUS/UUS is 27.1/33.65 %, 4.60/3.85 %, 32.89/31.11 %, 19.71/15.49 %, 7.41/5.45 %, and 8.30/10.45 %, respectively. Based on the sensory evaluation report, cooked 'ukashi' soup is preferable than uncooked 'ukashi' soup.

Keywords: Leafy Vegetables; Native Soups; *Gnetum africanum*; Foodborne Pathogens

Abbreviations: UUS: Uncooked 'Ukashi' Soup; CUS: Cooked 'Ukashi' Soup; ONELGA: Ogba/Egbema/Ndoni Local Government Area; TSIA: Triple Sugar Iron Agar; GIT: Gastrointestinal Tract; FSANZ: Food Standards Australia New Zealand; THBC: Heterotrophic Bacterial Count; TFC: Total Fungal Count

Introduction

Different tribes in Nigeria enjoy eating varieties of soups which is usually part of their culture [1,2]. Soup is enjoyed by low, middle and high class individuals in the society [3]. Instant 'ukashi' soup is a native soup associated with the people of Ogba in Rivers state, Nigeria. Ogba is one of the three major ethnic groups in Ogba/Egbema/Ndoni Local Government Area (ONELGA) of Rivers state. The land mass of the LGA is 1, 621 sq. km. Estimtaed population of the residents is 350, 000 [4]. Traditionally, instant 'ukashi' soup is prepared using 'okazi' leaves (*Gnetum africanum*) without subjecting it to cooking. The process of preparing instant 'ukashi' soup by the people of Ogba without subjecting it to heat predisposes the soup to contamination by microorganisms. Depending on individual's choice, 'ukashi' soup can be mixed with other types of soup such as 'egusi' or 'okro'. A study carried out by Hart, et al. [5] in Rivers state reported that soup prepared using 'okazi' is consumed by 4 % and 8 % of households in Port Harcourt and Igwuruta, respectively. Soups are liquid foods popularly known for its savory characteristics. It is prepared using stewing ingredients which include fish, meat, vegetables and indigenous thickeners/legumes such as '*ogbono*', '*achi*', groundnut seeds and cocoyam. Most people prefer to be served hot soup. 'Drinking' and 'eating' soups are two categories of soups consumed by Nigerians [2]. The first category of soup is consumed alone by drinking it from a bowl whereas the second category is eaten alongside heavy starchy foods such as pounded yam, 'tuwon shinkafa', 'eba',

'amala', 'tuwon masara', 'fufu', 'tuwon dawa', among others which ordinarily have a bland taste, but consumers enjoy eating it together with soups [1].

Incorporating indigenous leafy vegetables to soup could serve as a good supply of minerals, vitamins, fats and proteins to promote good health. In addition, eating reasonable quantity of vegetables aid digestion and help to prevent diseases [6-8]. Indigenous leafy vegetables is known to improve the sensory characteristics of diets [9,10]. Dada, et al. [11] evaluated the nutritional and medicinal values of some indigenous green leafy vegetables which include 'okazi' scientifically known as *Gnetum africanum.* It is known as '*Eru or Kok*', '*Koko*' and '*Ntuoumou*' in Cameroun, Republic of Central Africa and Angola, respectively. In Nigeria, it is called '*Afang*' or '*Okazi*' by the Efik and Igbos, respectively [12]. The nutritional and anti-nutritional composition of *Gnetum africanum* have been extensively reported by different researchers [6,13,14]. The leaves of *G. africanum* is rich in protein (7.2-17.9 %), fiber (25.5-87.8 %) and carbohydrate (0.2-44.0 %). It can be used in the treatment of sore throats and enlarged spleens, among others [15]. The leaves can be eaten raw [16]; sliced and used for preparing stews and soup especially by the Igbos in the South-Eastern part of Nigeria [16-18].

The nutiritonal composition of native soups to some extent meets the nutritional needs of the people. Generally, native soups are delicious. The people regard native soups as nutritious and safe for human consumption. There is dearth of information from published works to support the notion that varieties of native soups are microbiologically safe, nutritious and well acceptable based on sensorial attributes. A study carried out by Obiakor-Okeke, et al. [19] reported that moisture, ash, protein, fat, fibre and carbohydrate content of 'nsala' soup prepared with 'okazi' leaves is 52.49, 4.94, 31.77, 8.20, 8.20 and 46.52 %, respectively. During preparation of soup, it could be contaminated by microorganisms [2]. Eke-Ejiofor, et al. [20] reported the presence of *Staphylococcus* sp. in both native and afang soup while *Escherichia coli* was found in afang soup prepared using 'okazi' leaves. The contamination of leafy vegetables and other ingredients used in preparing soups by pathogenic microoganisms could result in foodborne infections and intoxication. Therefore, this study is aimed at carrying out microbiological analysis, proximate composition and sensory evaluation of cooked and uncooked 'ukashi' native soup.

Materials and Methods

Okazi leaves (*Gnetum africanum*), potash, okra, onions, salt, seasoning, local brand of palm oil, and fresh fish were obtained from Akabuka market using a big sterile polythene bag. Okazi leaves used in the study was authenticated and identified in the Department of Plant Science and Biotechnology, University of Port Harcourt. All the materials were transported to the Food and Industrial Microbiology Laboratory, University of Port Harcourt in less than 12 hours from the time of purchase. Ogba 'ukashi' soup was prepared in the laboratory using the soup ingredients purchased from the market. Map showing the ancestral home of Ogba people in Ogba/Egbema/Ndoni Local Government Area (ONELGA) of Rivers State is depicted in Figure 1. The flow chart for the preparation of cooked and uncooked Ogba instant 'ukashi' native soup is shown in Figure 2. The freshly prepared 'ukashi' soup is depicted in Figure 3.

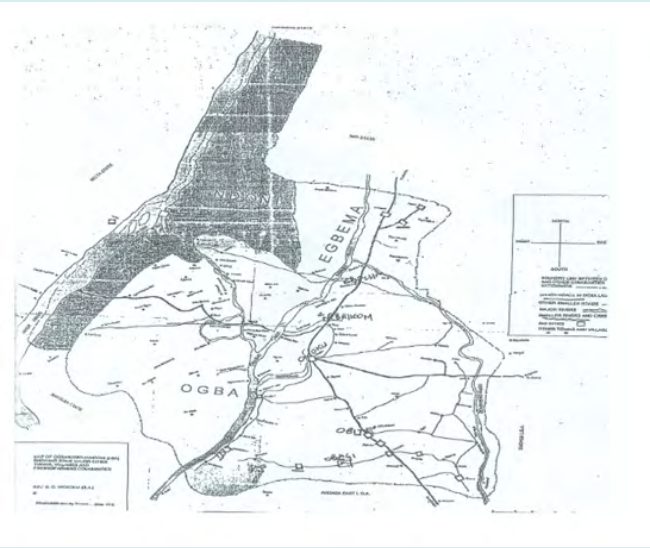


Figure 1: Map of Ogba/Egbema/Ndoni Local Government Area (ONELGA) of Rivers State showing where Ogba people reside Source: Ononugbo, et al. [21].

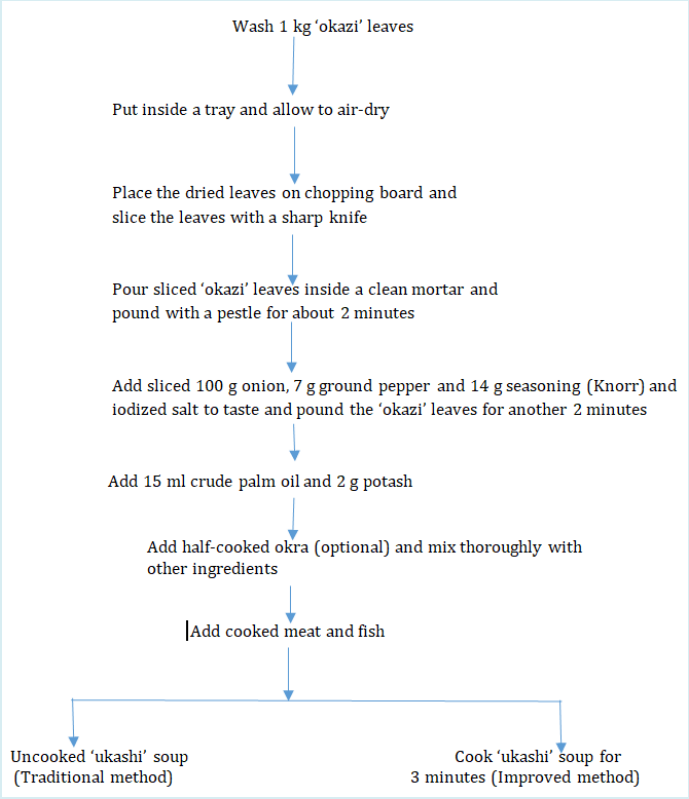


Figure 2: Flow chart for preparation of cooked and uncooked 'ukashi' instant soup.

Figure 3: Freshly prepared 'ukashi' soup.

Serial Dilution

Twenty-five (25) grams of 'ukashi' soup was added to 225 ml of sterile normal saline (1:9) in a sterile conical flask to obtain the inoculum. From the inoculum, 1 ml was pipetted into 9 ml sterile normal saline. Ten-fold dilution was carried out by stepwise transfer of 1 ml dilution from the first test tube into subsequent tubes using sterile pipettes for each transfer. Exactly 1 ml dilution 10^{-4}, 10^{-5} and 10^{-6} was pipetted into separate sterile Petri dishes in duplicate.

Microbiological Analysis

Under aseptic conditions, 1 ml dilutions 10^4, 10^5 and 10^6 was transferred into sterile Petri dishes in duplicate and 15 ml of freshly prepared nutrient agar were added to the Petri dishes containing the diluted samples. The dishes were rocked gently to achieve uniform distribution of the samples and the medium. The inoculated plates were incubated at 37°C for 24 hours. Isolation of fungi involved inoculating 1 ml dilutions 10^4, 10^5 and 10^6 into a sterile Petri dishes in duplicate followed by addition of 15 ml freshly prepared potato dextrose agar. The inoculated plates were incubated at room temperature (25± 2°C) for 72 hours. The colony forming units observed on the Petri dishes were counted and recorded.

Obtaining Pure Isolates

Discrete bacterial colonies on the Petri dishes were picked using a sterile wire loop and plated on freshly prepared nutrient agar and incubated at 37°C for 24 hours. Similarly, discrete fungal isolates were also plated on potato dextrose agar and incubated at room temperature (25± 2°C) for 5 days. The pure isolates obtained were stored in slants for further identification.

Identification of Isolates

The colonial morphology of the bacterial isolates in the Petri dishes were observed and noted. Gram staining of the bacterial isolates were carried out, followed by biochemical reactions which include catalase, citrate, oxidase, motility, indole, methyl red Voges Proskauer, triple sugar iron agar (TSIA) and sugar fermentation tests. The colonial morphology of the fungal isolates were noted followed by lactophenol cotton blue staining. The stained fungal isolates were viewed using 10X and 40X objective lens of the microscope.

Proximate Analysis

The method described by Lawal, et al. [7] was adopted. Both cooked and uncooked 'ukashi'soups in liquid state was dried using hot air flow at 65°C for 4 hours. Thereafter, the temperature of the hot air flow was reduced to 50°C; maintained at that temperature (50°C) until the samples were completely dried. The proximate composition of the dried samples were determined using standard methods described by AOAC [22]. The proximate parameters evaluated were crude protein, crude fiber, moisture, ash content and crude fat. The carbohydrate content was calculated by difference [23].

Sensory Evaluation

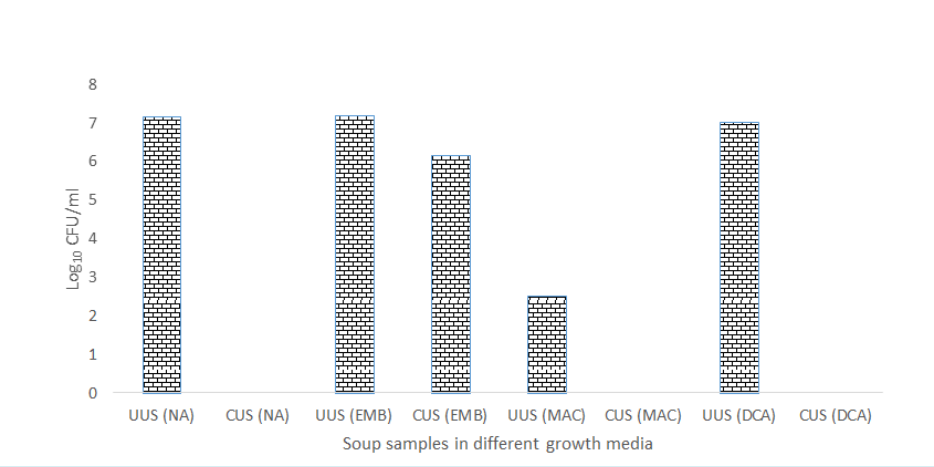
The method described by Mepba, et al. [9] was adopted in carrying out sensory evaluation of the soups. A nine (9) point Hedonic scale which ranged from 9 to 1 representing like extremely and dislike extremely, respectively was used in evaluating the colour, mouth feel, taste, aroma, appearance, and overall acceptability of the soups. Ten (10) panelists between the ages of 18 to 25 years familiar with soups were served freshly prepared uncooked and cooked ukashi instant soup coded with three alphabets UUS and CUS, respectively. Potable water in glass cups was provided for the panelist to rinse their mouth after evaluating each sample. Sensory evaluation of the samples were carried out under bright light at room temperature (25 ± 2°C).

Statistical Analysis

The data obtained were subjected to statistical analysis to obtain means and standard deviation using SPSS (Statistical Package for Social Science) version 20.

Results

Presented in Figure 4 is the total heterotrophic bacterial count (THBC) and enteric bacterial population in cooked and uncooked 'ukashi' soups. The THBC recorded for uncooked ukashi soup (UUS) is 7.15 Log_{10}CFU/ml. No viable bacterial growth was observed in cooked ukashi soup (CUS) cultured in nutrient agar, deoxycholate cholate agar, eosin methylene blue agar and MacConkey agar. Total fungal count (TFC) recorded for cooked and uncooked 'ukashi' soup is presented in Table 1. No viable fungal count was recorded in CUS whereas 7.15 Log_{10}CFU/ml was recorded for UUS. Presented in Table 2 is the biochemical characteristics of bacterial isolates from cooked and uncooked 'ukashi' soup. The bacterial species isolated from uncooked 'ukashi' soup were *Vibrio* spp., *Enterobacter* spp., *Salmonella* spp., *Citrobacter* spp., and *Klebsiella* sp., and *Pseudomonas aeruginosa* while *Salmonella spp.* and *Enterobacter* spp were present in the cooked 'ukashi' soup. The fungi isolated from uncooked 'ukashi' soup is yeasts.



Keys: UUS-Uncooked ukashi soup; CUS-Cooked ukashi soup; NA-Nutrient agar; EMB-Eosin methylene blue agar; MAC-MacConkey agar; DCA-Deoxycholate citrate agar

Figure 4: Total heterotrophic bacterial count and enteric bacterial population in cooked and uncooked 'ukashi' soups.

Sample	Media	Dilution	CFU/ml	Log_{10}CFU/ml
UUS	PDA	10^{-5}	1.46 x 10^{7}	7.15
CUS	PDA	10^{-4}	NG	NG

Keys: UUS-Uncooked ukashi soup; CUS-Cooked ukashi soup; PDA- Potato dextrose agar; NG-No growth
Table 1: Total fungal count of cooked and uncooked 'ukashi' soup.

Isolates	Oxidase	Catalase	Indole	Motility	Lactose	Sucrose	Glucose	MR	VP	Shape	Citrate	H_2S	Gas	But	Slant	Gram reaction	Suspected organism
UUS1	-	+	+	+	AG	AG	AG	+	-	Rods	+	+	+	B	A	-	*Citrobacter* spp.
UUS2	-	+	-	+	AG	A	A	+	-	Rods	+	+	+	A	A	-	*Enterobacter* spp.
UUS3	+	+	+	+	AG	AG	A	+	-	Rods	+	+	+	A	B	-	*Vibrio* spp.
UUS4	-	+	+	-	A	A	A	+	-	Rods	-	+	+	A	B	-	*Citrobacter* spp.
UUS5	-	+	-	-	B	A	AG	+	-	Rods	+	+	-	A	B	-	*Klebsiella* spp.
UUS6	+	+	-	+	AG	AG	A	+	-	Rods	+	-	+	A	B	-	*Pseudomonas aeruginosa*
UUS7	+	+	-	+	AG	AG	AG	+	-	Rods	-	+	+	A	A	-	*Citrobacter* spp.
UUS8	+	+	+	+	AG	AG	AG	+	-	Rods	+	+	+	A	B	+	*Vibrio* spp.
UUS9	-	+	-	+	A	A	A	+	-	Rods	-	-	+	A	B	-	*Vibrio* spp.
UUS10	-	+	-	-	B	AG	AG	+	-	Rods	+	+	+	A	B	-	*Salmonella* spp.
CUS1	-	+	-	+	B	AG	AG	+	-	Rods	+	+	-	A	A	-	*Salmonella* spp.
CUS2	-	+	-	+	AG	AG	A	+	-	Rods	+	+	+	A	A	-	*Enterobacter spp.*

Keys: UUS-Uncooked ukashi soup; CUS-Cooked ukashi soup; A-Acid; AG-Acid and gas; A-Acid; B- Base; + Positive; -Negative; MR-Methyl Red; VP-Voges Proskauer
Table 2: Biochemical characteristics, and gram reaction of suspected bacterial isolates from cooked and uncooked 'ukashi' soup.

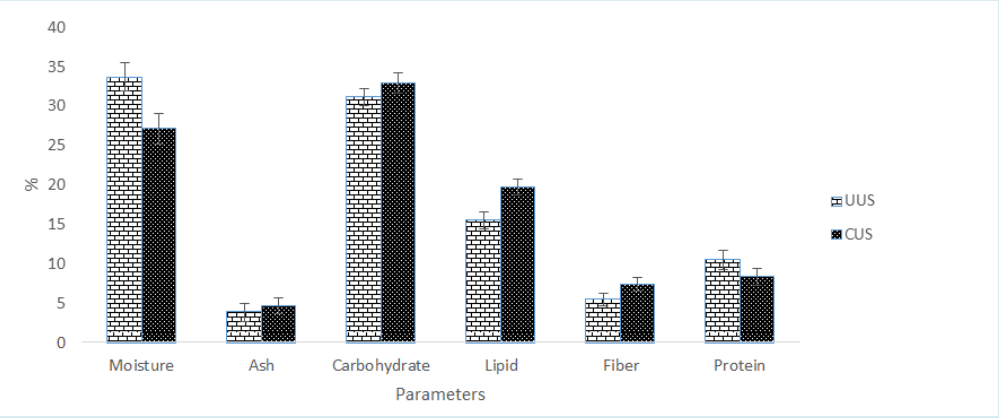
The cultural and morphological characteristics of fungal isolates from uncooked and cooked 'ukashi' soup is depicted in Table 3. Presented in Figure 5 is the proximate composition of cooked and uncooked 'ukashi' soup. Table 4 depicts the average sensory score of cooked and uncooked 'ukashi' soup.

Sample	Cultural characteristics	Microscopy	Suspected organism
UUS	White shiny clustered colony in chains of two and three	White-like colony in budding form	Yeast
CUS	No growth	No growth	No organism

Keys: UUS-Uncooked ukashi soup; CUS-Cooked ukashi soup.
Table 3: Cultural and morphological characteristics of suspected fungal isolate from uncooked and cooked'ukashi' soup.

Sample	Colour	Mouthfeel	Aroma	Appearance	Taste	Overall acceptability
UUS	5.3±0.9	7.5±1.2	4.2±0.8	5.6±1.0	8.0±0.8	6.7±0.7
CUS	7.4±0.7	6.6±0.9	8.1± 0.8	7.5±1.3	7.0±0.9	8.0±0.6

Keys: UUS-Uncooked ukashi soup; CUS-Cooked ukashi soup
Sensory score: 9= Like extremely, 8=Like very much 7 = Like moderately 6 = Like slightly, 5= Neither like nor dislike, 4 = Dislike slightly, 3 = Dislike moderately, 2 = Dislike very much, 1 = Dislike extremely.
Table 4: Average score of sensory attributes of cooked and uncooked 'ukashi' soup.



Keys: UUS-Uncooked 'ukashi' soup; CUS-Cooked 'ukashi' soup
Figure 5: Proximate composition of cooked and uncooked 'ukashi' soup.

Discussion

The results obtained in this study indicate that ukashi instant soups both cooked and uncooked were contaminated with high bacterial population. The heterotrophic bacterial count of uncooked ukashi soup is 7.15 $\log_{10}$CFU/ml whereas no viable bacterial count was recorded for cooked ukashi soup (CUS). This could be as a result of heat applied during cooking of ukashi soup which killed a lot of viable microorgansims in the soup. The use of enrichment media (EMB) for microbiological analysis of CUS indicate that the sample was contaminated with fecal bacteria (6.15 $\log_{10}$CFU/ml). It is worthy to note that bacterial population was recorded for uncooked 'ukashi' soup cultured in various enrichment media used in this study. In a related study, Akter, et al. [24] reported that total viable bacteria in homemade cooked ready-to-eat chicken soup samples is 1.3 x 10^3 CFU/g whereas no fungal count was recorded. This result is in agreement with the findings from this study which reported no viable fungal count in cooked 'ukashi' soup. However, total fungal count (7.15 $\log_{10}$CFU/ml) was recorded for uncooked 'ukashi' soup.

According to Food Standards Australia New Zealand (FSANZ), the microbial acceptable limit for cooked ready-to-eat food is as follows: Standard plate count is < 10^5 CFU/g; *Enterobacteriaceae* 10^2 to < 10^4 CFU/g; *Escherichia coli* and coliforms 3 to < 10^2 CFU/g; other pathogens 10^2 to 10^3 CFU/g [24]. The result obtained from this study shows that cooked and uncooked 'ukashi' soup did not meet all the requirement stipulated by FSANZ. Therefore, consumption of the soup could pose a threat to public health if it is not heated properly and consumed immediately after preparation. The result obtained from this study revelaed that ten (10) bacterial isolates were encountered in uncooked 'ukashi' soup. The percentage occurrence of the isolates belonging to six (6) bacterial species are *Citrobacter* spp. (30 %),*Vibrio* spp. (30 %), *Enterobacter* spp. (10 %), *Klebsiella* sp. (10 %), *Salmonella* spp (10 %) and *Pseudomonas aeruginosa* (10 %). Only two (2) bacterial isolates namely *Enterobacter* sp. (50 %) and *Salmonella* sp. (50 %) were found in cooked 'ukashi' soup. The absence of four (4) bacterial species in cooked 'ukashi' soup that were earlier detected in uncooked 'ukashi' soup could be attributed to the effect of heat/cooking that killed the microorganisms. It is worthy to note that two (2) predominant bacterial species – *Citrobacter* sp. and *Vibrio* sp. that were encountered in uncooked 'ukashi' soup were not detected in cooked 'ukashi' soup.

The presence of *Citrobacter* sp. in uncooked 'ukashi' soup could be traced to 'okazi' leaves (*Gnetum africanum*) used in preparing the soup. The bacterium was not detected in cooked 'ukashi' soup. This could be attributed to the effect of heating the soup in the process of cooking which killed the bacterium. In a related study, Adegun, et al. [25] reported the presence of *Citrobacter* spp. in African spinach (tete), worowo, egg plant and jute leaf (ewedu). Okwu, et al. [8] reported the presence of Leuconostoc spp., Streptococcus spp., *Bacillus cereus*, *Staphylococcus aureus* and *Aspergillus brasilensis* in sliced and unsliced leaves of *Gnetum africanum*. Apart from vegetables, *Citrobacter* sp. is usually isolated from water and soil. The diseases associated with the bacterium include neonatal septicemia, neonatal meningitis, urinary tract infections, and brain abscess [26]. In some parts of Iran, Aminharati, et al. [27] reported outbreak of foodborne diseases associated with *Citrobacter freundii*. Therefore, the presence of *Citrobacter* species in 'ukashi' soup might pose a threat to health status of consumers. One of the possible sources of *Vibrio* spp in uncooked 'ukashi' soup is the fish used in preparing the soup. According to Sampaio, et al. [28] *Vibrio* spp is capable of surviving in marine and fresh water which usually contaminate aquatic animals. Consumption of food contaminated with some species of *Vibrio* could cause diarrhea, gastroenteritis, and vibrosis.

Findings from this study shows that uncooked 'ukashi' soup was contaminated with *Pseudomonas aeruginosa*. In a related study, Ire and Eruteya [29] isolated *Pseudomonas aeruginosa* strain PG1 from 'atama' soup. This bacterium is a common opportunistic bacteria ubiquitous in nature. It is known to cause food spoilage.Therefore, the presence of *P. aeruginosoa* in uncooked 'ukashi' soup might lead to quick spoilage of the soup.

Enterobacter sp was isolated from both cooked and uncooked 'ukashi' soup. *Klebsiella* sp. was only reported in uncooked 'ukashi' soup. In a related study, Kone, et al. [30] reported the presence of *Enterobacter cloacae*, *E. aerogenes, E. amnigenus, E. asburiae, Klebsiella pneumoniae* in fish soup and other foods sold in restaurants located in university campuses.*Klebsiella* sp. and *Enterobacter* sp. are implicated in urinary tract infections. *Salmonella* species is one of the bacterial genera isolated from cooked and uncooked 'ukashi' soup. This result is in agreement with the findings of Abakari, et al. [31] from a related study which reported the presence of *Salmonella* species in 'tuo-zaafi' which refers to a local meal prepared using maize flour and served with soup ('ayoyo'). Preparation of the soup involves mixing dry okra, raw vegetables and meat followed by cooking. Samuel [32] also reported the presence of *Salmonella* sp. in street vended owho, banga and egusi soup. Consumption of food contaminated with *Salmonella* sp. could cause a disease known as salmonellosis. The bacterium inhabit the gastrointestinal tract (GIT) of both domestic and wild animals. Contaminated vegetables among few other foods and the environment are possible sources of *Salmonella* sp. Food handlers who are carriers of the bacterium; poor hand washing commonly observed among food handlers increases the risk of contaminating food with *Salmonella* sp. The bacterium has been linked with several foodborne outbreak illnesses in different parts of the world [33].

Proximate analysis of uncooked 'ukashi' soup indicate that protein (10.45± 1.26 %) and moisture content (33.65± 1.80 %) is higher than the corresponding values 8.3 ± 1.10 % and 27.1±1.94 % for cooked 'ukashi' soup, respectively. In a related study, Kolawole and Obueh, et al. [34] reported that protein and moisture content of afang + beef (*Gnetum africanum*) purchased from food sellers is 4.59 % and 56.81 %, respectively. The significant differences in protein and ash content of the soup samples could be as a result of different types of ingredients and quantity of each ingredient used in preparing the soup, different cooking procedures and cooking time. Proximate analysis of cooked 'ukashi' soup shows that the ash content (4.6±1.02 %), lipid (19.71±0.96 %), and fiber (7.4±0.90 %) and carbohydrate content (32.89±1.27 %) is higher than the values recorded for uncooked 'ukashi' soup which is 3.85±1.14 %, 15.49±1.08 % and 5.45±0.82 % and 31.11±1.03 %, respectively. According to Kolawole and Obueh (2012), the ash, fat, crude fibre and carbohydrate content of afang + beef (*Gnetum africanum*) soup is 2.14 %, 9.98 %, 6.71 % and 19.77 %, respectively. Overall acceptability of cooked 'ukashi' soup was assigned an average sensory score interpreted as liked very much by the panelist. Although the process of cooking 'ukashi' soup probably enhanced its overall acceptability and drastically reduced the level of microbial contamination, it might have resulted in lower protein content of the soup when compared with the value recorded for uncooked 'ukashi' soup. The interpretation of average sensory score assigned to uncooked 'ukashi' soup based on overall acceptability is liked slightly. The mouthfeel of cooked 'ukashi' soup was assigned an average sensory score interpreted as liked slightly whereas other sensory parameters of the soup sample which include colour, appearance, and taste were assigned average sensory scores interpreted as liked moderately. As for the uncooked 'ukashi' soup, the interpretation of average sensory score for taste is liked very much. A slightly lower sensory score interpreted as like moderately was assigned to mouthfeel of the uncooked soup sample. The panelist neither liked nor disliked the colour and appearance of uncooked 'ukashi' soup based on the interpretation of the average sensory scores assigned to the two parameters. Going by the average sensory score assigned to aroma of uncooked soup sample, the panelist disliked it [35].

Conclusion

The population of different bacterial species isolated from uncooked 'ukashi' soup is higher that the result recorded for cooked 'ukashi' soup. A total of six (6) bacterial species which include *Vibrio* spp., *Klebsiella* sp., *Enterobacter* spp., *Salmonella* spp., *Citrobacter* spp., and *Pseudomonas aeruginosa* were isolated from uncooked 'ukashi' soup while two (2) bacterial species namely *Salmonella sp.* and *Enterobacter* sp were found in cooked 'ukashi' soup. Yeast was isolated from uncooked 'ukashi' soup but no viable fungal species were detected in cooked 'ukashi' soup. The carbohydrate, ash, lipid and fibre content of cooked ukashi soup is higher than the values recorded for uncooked 'ukashi' soup. The uncooked 'ukashi' soup had higher moisture and protein content compared with the values recorded for cooked 'ukashi' soup. Based on the overall sensory evaluation report, cooked 'ukashi' soup is preferable than uncooked 'ukashi' soup.

Recommendation

'Okazi' leaves and other soup ingredients which include onions, pepper, meat and fish obtained from the market should be washed properly before using them to prepare Ogba 'ukashi' soup. The use of clean kitchen utensils and potable water in cooking the soup is recommended. Longer

cooking time (5-10 minutes) compared with 3 minutes applied during preparation of cooked 'ukashi' soup could eliminate pathogenic microorgansims in the soup. Handlers of soup ingredients in the market should observe good personal and environmental hygienic practices. Good kitchen hygiene practices should be implemted during preparation of cooked 'ukashi' soup and other soup varieties to prevent cross contamination.

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