MICROBIAL QUALITY AND SENSORY CHARACTERISTICS OF INSTANT NIGERIAN *EGUSI* SOUPS

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Abstract
This study evaluated the microbial and sensory evaluation of instant dried egusi soups. Egusi soup is a popular Nigerian soup prepared with dried melon seed .Instant egusi soup with vegetable (ESV) and instant egusi soup without vegetable (ESWV) were prepared and dried at 50ºC for 8 hours to have instant dried egusi soups. These instant egusi soups were subjected to proximate, microbial, physiochemical and sensory analysis using standard methods. The result of proximate composition of instant dried egusi soups with vegetable [ESV] and the dried egusi soup without vegetable showed that there were significant differences (p<0.005) in moisture ,ash, crude protein, lipid, crude fiber and carbohydrate contents. The results of the microbial analysis showed that the dried egusi soup with vegetable (ESV) contained less bacterial load than the egusi soup without vegetable. The bacterial isolates from the two soups include Bacillus sp., Nesseria sp.and Croynebacterium sp. while fungi species isolated from the dried egusi soups include Aspergillus sp., Aspergillus niger and Penillium sp. The results of the sensory evaluation of the soups showed the acceptability of all the soups and revealed that significant difference (p<0.005) existed among the soups in colour, taste, aroma, texture and over all acceptability, but there was no significant difference (p>0.05) in the aroma and consistency of the soups .Dried egusi soup with vegetable had the most over all acceptability when compared to dried egusi soup without vegetable. The instant egusi soup with vegetable (ESV) had a better microbial quality, shelf-life and overall acceptability than instant egusi soup without vegetable (ESWV).While the dried egusi soup without vegetable was rated the lowest in taste by the panelist as indicated by their mean scores for the overall acceptability. The result showed that egusi soup without vegetable (ESWV) was not preferred compared to the egusi soup with vegetable (ESV) with a significant difference (p<0.005). The bacteriological and mycological evaluation of the soups will give consumer confidence regards safety of the food. The use of HACCP systems will also assist in quality assurance and control of the soups for safety.

Keywords: Vegetable, egusi, microbial quality, bacteria, fungi

Received: 09.05.2019 Reviewed: 23.09.2019 Accepted: 25.09.2019

1. INTRODUCTION

Soup is defined as a liquid food, usually savoury, made by stewing ingredients such as meat, vegetables, and fish, often in a stock and with seasoning (Kayode *et al*., 2008). There are different types of soups in the different culture and tribes in Nigeria such as *afang, ewedu, ogbono, editan,egusi, ofe-nsala, white soup, okro, egusi* soup etc. Spoilage is the process in which food deteriorates to the point when it is not fit for consumption to humans or its quality becomes reduced. Various external forces are responsible for the spoilage of food. Food such as soup rendered it unfit for human consumption due to the physical and chemical changes that take place in it as a result of the influences of air, heat, light and moisture, which foster the growth of microorganisms. Foods take different periods of time to lose their natural form through spoilage (Anderson and Harrison, 2006). Food spoilage is an undesirable change taking place in food or departure from the food's normal state which eventually leads to its rejection. Such a change can be detected with the senses of smell, taste, touch, or vision.

There has been an increased interest in the use of natural preservatives from plant origin as antimicrobials in soup (Davidson and Naidu, 2000). This is as a result of increased resistance in pathogenic strains against chemical food preservatives as well as declining consumer preference due to residual effect of chemical

preservatives and consumer safety (Yadav and Singh, 2004). *Egusi* soup is a soup with the ground melon seeds and popular in West Africa, with considerable local variation. Besides the melon seeds, water and oil, *egusi* soup typically contains leafy vegetables, seasonings, dry fish and meat. Egusi soup is very rich in Omega-3 Fatty acids, vitamins, protein, zinc, potassium, iron and calcium (Pierre and Kirsten, 2005). The time span of usability of egusi soup is generally short and protection is for the most part through refrigeration and warming. Power isn't promptly accessible and warming additionally prompts loss of supplements; consequently this examination tried to research the microbial quality and timeframe of realistic usability of moment egusi soup. Soup is characterized as a fluid food, typically exquisite, made by stewing ingredients, for example, meat, vegetables, and fish, frequently in a stock and with seasoning (Kayode *et al.*, 2008). Nigeria is multi-social society with various conventional soups which are indigenous to the diverse ethnic and social society. Examples include afang, ewedu, ogbono, editan, edikaikong, Ofe onugbu (bitter leaf soup), egusi, ofe-nsala, white soup, okro, pepper soup, miyan taushe, banga soup, miyan shuaka etc. In Nigeria, we have two (2) kinds of soups, served hot: “drinking” soups and “eating” soups. These soups could be light or thick and arecommonly flavoured with crayfish, fermented seeds and nuts and other ingredients. So, from this, we have three types of soups which are drinking light, eating light and eating thick. As already pointed to, soups have two major uses in the Nigerian culture, for drinking and for eating starch, depending on the type of soup in question. This implies that some soups are drunk alone without starch accompaniments of any kind whereas some others are eaten with a whole lots of accompaniments like pounded yam, tuwon shinkafa, eba, amala, tuwon masara, cassava fufu, tuwon dawa, etc. More so, there are some other soups that are eaten in conjunction with other soups. That is, they have better tastes when eaten together with other soups. For example, white okra soup could better be enjoyed with pepper soup and a swallow starch. Soup is often used to help in the recovery of sickness, particularly if the patient is only able to digest liquids. A soup additionally goes about as a starter taken toward the start of a supper to animate the hunger and help in the stream of stomach related squeezes in the stomach (Singh and Chaudhary, 2015). Food consumption is a vital pathway for microscopic organisms to taint people, subsequently the nearness of antimicrobial safe microorganisms in foods warrants specific consideration. Antimicrobial safe microbes have been recouped from both sound people (Okeke *etal.*, 2000) and a wide assortment of foods, which incorporate vegetables, confectionary meat and meat items and poultry (Schoeder *et al.*, 2004). Thus food sullied by fecal material from solid people might be a vital wellspring of anti-infection safe creatures that later reason human diseases (Schoeder *et al.*, 2004). Pollution of soup may happen amid and in the wake of preparing of such soup. Tainting of soup is of essential concern on the grounds that such living beings might be pathogenic along these lines prompting flare-up of food-borne disease. Food-borne sicknesses may happen when food sources that contain pathogenic microorganisms are expended crude or inappropriately cooked (Sangoyomi *et al.*, 2012). The wellbeing suggestions can't be over-underscored *E. coli* for example can initiate gastroenteritis (Olowe *et al.*, 2008); *Staphylococcus aureus* confines have been embroiled in various clinical cases (Serrano *et al*., 2004; Adegoke *et al*., 2010).

Additionally, non-pathogenic living beings that may sully man's food anchor occasionally may fill in as repository of qualities for antimicrobial opposition in creatures. These qualities are encoded by integrons that happen on plasmids or that are coordinated into the bacterial chromosome. Antimicrobial safe strains of creature or human commensals that don't deliver illness may transmit their opposition qualities to pathogenic life forms at

whatever point they happen in people (Adegoke and Komolafe, 2009). The time span of usability of egusi soup is moderately short and protection is fundamentally through refrigeration and warming.Electricity is not readily available and reheating reduces the nutritional quality of *egusi* soup; thus this study sought to investigate the microbial quality and sensory evaluation of instant *egusi* soups.

2. MATERIALS AND METHODS

Study Area

The research was carried out at Microbiology Laboratory of Ibrahim Badamasi Babangida University, Lapai, Niger State, Nigeria. Lapai situated in Lapai Local Government Area of Niger State, which is adjoining the Federal Capital Territory.

Ingredients for Preparation of *Egusi* Soup

The materials (ingredients) used for the preparation of *Egusi* soup included meat, palm oil, onion, tomato, dry fish, spinach leaves, fresh ground pepper, salt, grounded crayfish, cow skin (kpomo), seasoning cubes, and melon seeds. These were all purchased at the local market in Lapai.

Preparation of *Egusi* Soups

The preparation of egusi soups were done according to a standardized method described by Ndukuba (2016). All ingredients were weighed as shown in table 1 below. The palm oil was poured into the heated pot on low heat, the chopped onions were added and stirred for 3 minutes. The curee and chopped tomato were then added, stirred and left to cook for 10 minutes but was stirred every 2 minutes. While that was cooking, water and the melon seeds were mixed together in a separate bowl until a smooth paste was formed. The melon seeds mixture was added in parts to the tomato stew. It was not stirred until it sets and appears lumpy. The heat was reduced at this point. It was then left to cook for 5 minutes, while stirring as often as possible to prevent the egusi from getting burnt. The crayfish, seasoning cubes, salt and fresh grounded pepper were added and stirred all together and left to cook for 5 minutes. All the meats (beef, cow skin, and dried fish) were added, stirred together and left to boil for about 5 minutes. And lastly, the sliced spinach leaves were added when the soup was almost done for ESV while spinach was not added for ESWV. The soup was mixed well together and left to cook for another 5 minutes for each soup respectively. At this point, the instant *egusi* soups were ready. The *egusi* soup were then divided into two halves. One part of the soups were used fresh for determination of temperature, pH and sensory evaluation. Meanwhile, the other half were dried at 50°C for 8 hours in a hot air oven and allowed to cool for 2 hours at room temperature (37±2 ^{0}C).

Table 1: Measurement of ingredients for preparation of Egusi Soup

S/N	INGREDIENTS	MEASUREMENTS
1	100% Palm oil	400 ml
2	Chopped tomato	800g
3	Tomato Puree	200g
4	Melon Seeds	150g
5	Spinach leaves	2 bags
6	Beef	1kg
7	Dried Fish	200g
8	Crayfish	50g
9	Cow Skin (Kpomo)	500g
10	Chopped Onions	300g
11	Star Seasoning Cubes	4 x 4g
12	Salt	To taste
13	Fresh Ground Pepper	To taste
14	Water	As required

Preparation of Media

The media used in this study were prepared according to the manufacturers instructions.

Microbial Analysis of Instant Egusi Soups

The microbiological examination was done on the soups to check the microbial quality. Twenty five (25) gram of the egusi soup was added to 225 ml of typical saline (1:9) in a sterile conical flask to get the inoculum. From the inoculum, One (1) ml was taken to the next tube and continously until ten fold dilution was obtained. Exactly 1ml of tubes $10^4 – 10^6$ were piptted into seperate sterile petri dishes in

duplicate respectively and 15ml of the prepared nutrient agar were added to the petri dishes containing the diluted samples. The dishes were rocked to accomplish uniform distribution of the samples and the medium, the plates were incubated at 37^0C for 24 hours. The Potato Dextrose Agar (PDA) was used for the isolation of fungi species from the egusi soups. The plates were incubated at 26 ± 1^0C for 5 days.

Cultural, Morphological and Biochemical Identification of Bacterial and Fungi Isolates from Instant Egusi Soups

The identification of the bacterial isolates were based on colonial morphology, cellular morphology and biochemical tests . Parameters, such as colour, shape, elevation surface, consistency edge and capacity were observed and recorded for their morphology. The biochemical tests used for the identification of the bacterial isolates were Gram's staining, catalase, coagulase, manitol, urease and sugar fementation test (Chesebrough, 2006; Oyeleke and Manga, 2008).The fungi isolates were also observed using lactophenol cotton blue and slides were viewed using 10X and 40X objectives.

Sensory Evaluation of Instant Egusi Soups

A 20 man panelist who are used to egusi soup with vegetable (ESV) and egusi soup without vegetable (ESWV) were used for the sensory evaluation of the soup prepared from each premix samples. A seven (7) point hedonic scale which ranged from 7 to 1 representing like extremely and dislike extremely, respectively were used for the evaluation of the prepared soups for colour, ,taste,aroma,texture and overall acceptability. The soups were served to the panelists in the Food Laboratory of Microbiology Department at room temperature (37 ± 2^0C).

Statistical Analysis of Data

All the data obtained were subjected to statistical analysis using one-way analysis of variance (ANOVA) while significant means were separated and compared using Multiple Range Test (DMRT) at $p < 0.05$ significant level.

3. RESULTS AND DISCUSSION

The cultural, morphological and biochemical characterization of predominant bacterial isolates from instant dried *egusi* soup samples showed the presence of *Bacillus* sp,*Neisseria* sp and *Corynebacterrium* sp (Table 2).

Table .2: Cultural, Morphological and Biochemical Identification of Bacteria isolates from Instant Egusi Soups

Sample Code	Shape	Gram reaction	Coagulase	Catalase	Urease	Citrate	Mannitol	Fructose	Lactose	Sucrose	Suspected Organisms
ESV_1	Bacilli cluster	–	–	+	+	+	–	A	AG	AG	*Bacillus* sp.
ESV_2	Bacilli single	+	–	+	–	+	–	A	AG	AG	*Corynebacterium* sp.
ESV_4	Cocci chain	–	–	–	–	+	–	AG	AG	AG	*Bacillus* sp.
$ESWV_4$	Rod	–	–	–	+	+	–	AG	AG	AG	*Neisseria* sp.
$ESWV_1$	Rod	–	–	+	–	+	–	AG	AG	AG	*Bacillus* sp.
$ESWV_2$	Rod	–	–	+	–	+	–	AG	A	AG	*Bacillus* sp.
$ESWV_3$	Cocci chain	–	–	–	–	+	–	A	A	AG	*Neisseria* sp.
$ESWV_4$	Bacilli cluster	+	–	+	–	+	–	AG	AG	AG	*Bacillus* sp.

ESV: Egusi soup with vegetable, ESWV: Egusi soup without vegetable, +: positive, -: negative, A: Acid production, G: Gas production, AG: Acid and Gas production.

The total occurrence of bacteria isolates from dried instant Egusi soup samples revealed that. Bacillus sp had 55.5%, Neisseria sp (25.00%) and Croynbacterium sp (12.50%).The Bacillus sp had the highest frequency of occurrence as 62.50% (Table 3).

Table 3: Occurrence of Bacteria Isolates from Instant Egusi Soups

Isolate	Number	Percentage (%)
Bacillus sp.	5	62.50
Neisseria sp.	2	25.00
Croynebacterium sp	1	12.50
Total	**8**	**100**

While the total occurrence of fungi isolates from instant dried egusi soup samples showed that Aspergillus sp had 33.3% occurrence, Aspergillus niger (33.3%) and Penicillium sp. had 33.3% (Table 4).

Table 4: Occurrence of Fungi Isolates from Instant Egusi Soups

Isolate	Number	Percentage (%)
Aspergillus *niger*	1	33.3
Aspergillus sp.	1	33.3
Penicillium sp.	1	33.3
Total	**3**	**100**

The figure 1 showed the result of microbial load of instant dried *egusi* soup samples with and without vegetable. It indicated that *egusi* soup with vegetable (ESV) had lower bacterial and fungal load than the one without vegetable (ESWV) samples.

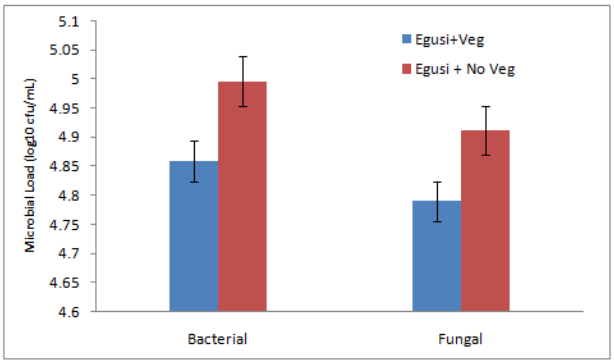

Fig. 1: Microbial Load of Instant Dried Egusi Soup

However, the levels microbial load for both soups were relatively low and within safety limit (Table 5).

Table 5 Proximate Composition of Instant Dried Egusi Soups

COMPOSITION (%)	DRIED EGUSI SOUP + VEGETABLE	DRIED EGUSI SOUP – VEGETABLE
Moisture	5.8	5.6
Ash	3.8	3.5
Crude Fiber	3.7	3.6
Crude Protein	38.61	28.61
Crude Lipid	47.0	34.0
Carbohydrate	1.81	1.71

Assessment of instant dried *egusi* soup samples showed that the temperature profiles were relatively stable from week 0 to 5. *Egusi* soup with vegetable (ESV) had temperature profile of range 34.5^{0}C, 34.4^{0}C, 34.6^{0}C and 34.5^{0}C while for the dried *egusi* soup without vegetable (ESWV) had range of 34.5^{0}C, 34.3^{0}C, 34.2^{0}C and 34.6^{0}C respectively. The dried *egusi* soup with vegetable had the highest temperature (Fig.2).

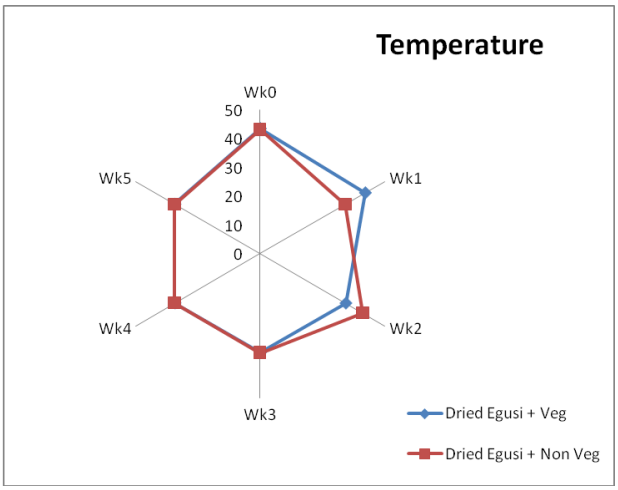

Fig. 2: Temperature of Instant Dried Egusi soups

Assessment of instant dried *egusi* soup samples showed that the pH profiles were also relatively stable from week 0 to 5. *Egusi* soup with vegetable (ESV) had pH range of 4.12, 4.11, 4.13, 4.10, 4.90 while for the dried *egusi* soup

without vegetable samples (ESWV) had pH range of 4.11, 4.14, 4.10 and 4.90 respectively (Fig.3).

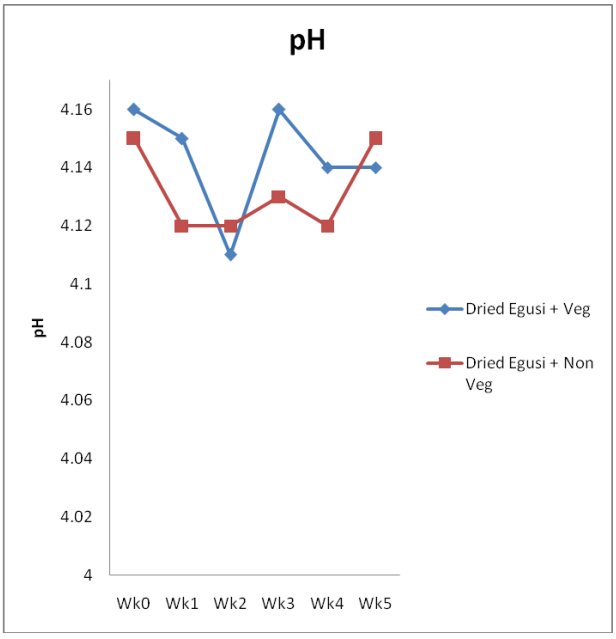

Fig. 3:pH of Instant Dried Egusi Soups

The results of proximate composition of instant *egusi* soup with vegetable (ESV) showed moisture of 5.8%, ash (3.8%), crude fibre (3.7%), crude protein (38.61%), crude lipid (47.0%) and carbohydrates (1.18%). While the result of the proximate composition of instant *egusi* soup without vegetable (ESWV) samples showed the moisture content of 5.6%, ash (3.8%), crude fiber (3.6%), crude protein (28.61%), crude lipid (34.0%) and carbohydrate (1.71%) (Table 6).

Table 6: Sensory evaluation of Instant Egusi Soups

Parameter	ESV	ESWV
Colour	2.55±0.51[a]	1.45±0.51[b]
Taste	2.30±0.73[a]	1.35±0.49[b]
Aroma	2.20±0.52[b]	1.30±0.47[a]
Texture	2.00±0.73[a]	1.30±0.47[b]
Overall Acceptability	2.60±1.59[b]	1.36±0.29[a]

ESV: *Egusi soup with vegetable,* ***ESWV:*** *Egusi soup without vegetable,* [ab]*Means with different superscripts on the same row are significantly different(p<0.05)*

The sensory evaluation result showed that the over all acceptibility of instant *egusi* soup with vegetable (ESV) samples had 2.60 ± 1.59[b] while the *egusi* soup without vegetable (ESV) samples had 1.36 ± 0.29[a].There were significantly different ($p < 0.05$). *Egusi* soup samples with vegetable had the highest sensory score and most preferable with overall acceptability among the panelist (Table 6).

The result of this study has shown that instant *egusi* soup with vegetable (ESV) is less susceptible to microbial contamination than the one without vegetable (ESWV). This indicates that the vegetable added to it could serve as a natural preservative for increasing the shelf-life of the soup. This is similar to the findings of Alozie and Bamson (2014) and Akinnibosun and Ojo (2015). Similarly, species of fungi and bacteria were isolated from the two soups, These species of fungi include *Apergillus niger*, *Aspergillus* sp. *Penicillium* sp., while bacterial include *Bacillus* sp,*Neisseria* sp and *Corynebacterium.* This is also similar to the report of Akinnibosun and Ojo (2015). pH and temperature of the two soups did not differ significantly throughout the five (5) weeks. Proximate compostion of the soups indicated that the moisture content of the *egusi* soup without vegetable was 5.6% and was found to be lowest than *egusi* soup without vegetable with 5.8%. Similar difference in other proximate compostion of the two soups could be as a result of the differences in the their compostion. This is similar to the findings of Mannie (2010). The report of the sensory evaluation revealed that there were significant differences ($P<0.05$) among the soup samples in colour, table, aroma, texture and overall acceptability but there was no significant differences ($P>0.05$) among the samples in aroma and consistency of the soups. *Egusi* soup with vegetable scored the highest in overall acceptability than the *egusi* soup without vegetable which was rated the lowest in taste to the panelist as indicated by their mean scores for the overall acceptability. The results showed that *egusi* soup without vegetable is not preferable to the *egusi* soup with vegetable

(P>0.005). Furthermore, sensory evaluation of the two soups showed better acceptability for instant *egusi* soup with vegetable (ESV) than instant *egusi* soup without vegetable (ESWV). This finding is in agreement with that of Alozie and Bamson (2014) and Kiin-Kabari and Akusu (2017).

4. CONCLUSION

The results obtained from this research showed that the dried *egusi* soup with vegetable still maintained their nutritive value after the processing line. Theere were gowth of some bacterial and fungi species when the soups were kept for few days with egisi soup without vegetable having the highest microbial load. The sensory data revealed that the soups were all generally accepted though differences existed between *egusi* soup without vegetable (ESV) and *egusi* soup with vegetable(ESWV).

Recommendations

Based on the findings of this study, instant *egusi* soup with vegetable is recommended as a preference over the one without vegetable because of the better microbial quality, longer shelf-life and overall acceptability.

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