

PROXIMATE COMPOSITION AND SENSORY PROPERTIES OF FREEZE - DRIED NIGERIAN SOUPS

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ABSTRACT

Two Nigerian soups (Egusi soup and bitter leaf soup) were prepared and freeze - dried to produce instant soups. These instant soups and the freshly prepared portions were subjected to proximate and sensory analysis using standard methods. The results of the analysis showed that instant egusi soup contained 10.89 % moisture, 16.93 % ash, 19.73 % crude protein, 15.19 % fat, 13.95 % crude fibre and 23.30 % carbohydrate; while the freshly prepared portion had 66.11 % moisture, 2.06 % ash, 16.42 % crude protein, 10.44 % fat, 2.01 % crude fibre and 3.14 % carbohydrate. The instant bitter leaf soup had 12.46 % moisture, 19.52 % ash, 11.32 % crude protein, 9.89 % fat, 16.16 % crude fibre and 30.65 % carbohydrate; while the fresh portion of the bitter leaf soup had 74.02 % moisture, 3.66 % ash, 6.99 % crude protein, 8.03 % fat, 1.68 % crude fibre and 5.62 % carbohydrate. Sensory evaluation results indicated acceptability of all the soups. However significant difference ($p < 0.05$) existed among the soups in appearance, taste, mouth feel, and overall acceptability, but there was no significant difference ($p > 0.05$) in the aroma and consistency of the soups. Instant bitter leaf soup was most preferred when compared to instant egusi soup.

Key words: freeze- dry, instant, proximate composition, sensory properties, soups

INTRODUCTION

The word soup came from French "Soupe" (Kayode *et al.*, 2010). Soup represents a popular and important food, generally served warm or cold and it is made by combining ingredients such as meat and vegetables with stock, juice, water or another liquid (Goltz, 2008). Traditionally soups are classified into two main groups; clear soups and thick soups (Goltz, 2008). Soups are similar to stews and in some cases there may not be a clear distinction between the two, however soups generally are more liquids than stews (Goltz, 2008). Soups can also be said to be those special sauces that accompany the major Nigerian food commonly known as fufu. Fufu is a generic name for food we swallow during the eating process. Fufu is generally tasteless and rely on the richness of the soups to make the meal delicious (Kayode *et al.*, 2008). It is common knowledge that Nigerians, especially the Igbos from the eastern part of the country, usually take fufu as a square meal per day. This is why soups are very essential to Nigerian food recipes. All Nigerian soups are served with eba (garri), Agidi, Amala, Semolina, Pounded yam or cassava fufu among others (Goltz, 2008). Nigeria is multi - cultural society with different traditional soups which are

indigenous to the different ethnic and cultural society (Kayode *et al.*, 2010).

Egusi soup is made using ground dried melon seeds and is enjoyed in most parts of Nigeria. Melon seeds are rich in proteins and fats. The soup is usually complimented with leafy vegetables which make it more nutritive and appealing (Kayode *et al.*, 2010). It is one of the most popular soups for all Nigerians and non - Nigerians that like fufu recipes. Bitter leaf soup is made with washed bitter leaf and cocoyam mash which acts as the thickener. All these soups contain vegetables as part of their ingredients and they are all cooked using crayfish, salt, pepper, traditional condiment, seasoning cubes, water, palm oil and meat or fish. They are very tasty and therefore serve as good accompaniment to fufu and other forms of swallows. Instant foods are processed foods that have undergone instantization, so that they can be easily and rapidly reconstituted by bringing them into contact with a liquid such as milk or water. Common instant foods include gravy granules, instant noodles, milk powders, instant coffee and tea powders. Instantization processing of dried foods is done in a way that facilitates preparation or reconstitution of the final product (Miller, 1995). Common techniques used in instantization

include agglomeration of particles and lecithination. Instant soup is a type of soup designed for fast and simple preparation. Some are homemade and some are mass produced on an industrial scale and treated in various ways to preserve them (Miller, 1995). A wide variety of types, styles and flavors of instant soups exist. Commercial instant soups are usually dried or dehydrated, canned, or treated by freezing. They are often prepared by freeze drying. One of the important merits of instant foods is that they can be stored to preserve for long periods of time, the water content cannot exceed 12 % (Ihekoronye and Ngoddy, 1985). The major objective of the study was to prepare two Nigerian soups, instantize them by freeze - drying and evaluate their proximate composition and acceptability.

MATERIALS AND METHODS

Materials

All the materials used were obtained from Ogige market at Nsukka, in Enugu state, Nigeria. The materials were: Fresh beef, dried melon (*Citrullus vulgaris*), dried fish (mangala), cocoyam (*Colocasia esculenta spp.*), Fresh bitter leaf (*Vernonia amygdalina*), Fluted pumpkin (*Telfairia occidentalis*), Crayfish, Stockfish, ogiri okpei (*Prosopis africana*), Onions (*Allium spp.*), ogili igbo (*Ricinus communis*), palm oil, knorr, pepper and salt. The two selected soups were prepared in the laboratory of the Department of Food Science and Technology, University of Nigeria, Nsukka. Freeze - drying was carried out using a freeze dryer at the Bioresearch Institute, Achara Nsukka. The preparation methods used for the selected recipes were those earlier established by Cookery and recipe books (Nigerian food recipes, 2012, Faleti, 1999, Food specialty Nigeria, 1998) with some modifications. Each soup was prepared and analysis carried out on both the freshly prepared portions and the freeze dried portions. The ingredients and the flow diagram for the preparation of fresh and instant Egusi soups are shown in Table 1 and Figure 1, respectively while the ingredients and the flow diagram for the preparation of fresh and instant bitter leaf soups are shown in Table 2 and Figure 2, respectively.

Methods

For the preparation of fresh Egusi soups, the meat, dried fish and stock fish were washed and boiled with addition of other ingredients (crayfish, pepper, salt and seasonings). Palm oil was added, after which ground melon seeds was added to the stock and allowed to boil for further 25 minutes. The vegetables (pumpkin leaves) which was initially washed properly in brine solution and shredded; was then added to the soup pot. The soup was stirred and the heat was turned

off. For the preparation of bitter leaf soup, the bitter leaves used for the soup were washed thoroughly, by squeezing and changing the water constantly until there was no trace of bitterness, the cocoyam was washed properly to remove dirt and sand before boiling it for about 20 minutes. The cocoyam was strained to remove water, and the coat was peeled off manually. The cocoyam was pounded to form a smooth paste. The meat and the fish were washed properly in a brine solution. Using a clean pot, the meat and fish were boiled for 25 minutes until it became soft, palm oil, crayfish, pepper, seasonings, salt and ogiri were all added to the stock, containing the meat and fish, it was allowed to cook for 15 minutes. Cocoyam paste was added, stirred and allowed to boil for 10 minutes. The washed bitter leaf was added and boiled for about 10 minutes until the cocoyam lumps dissolved. It was stirred, tasted for salt, and allowed to simmer for further 5 minutes. The heat was turned off, and bitter leaf soup was ready.

Freeze-drying of the soups was done at -44°C for 48 hours in a Christ freeze dryer (alpha 1-2LDplus).

Sensory Evaluation: The four soup samples were subjected to sensory evaluation to determine their acceptability. The instant soups were reconstituted in the ratio of 1:10 (water: freeze dried soup), while the fresh soups were cooled and they were all presented to a 20 semi - trained panelists from the Department of Food Science and Technology and Agricultural Extension who were selected based on their familiarity with the soups. The soups were evaluated for attributes of appearance, taste, aroma, mouth feel, consistency and overall acceptability using a 9 - point Hedonic scale from 9 (extremely like) to 1 (extremely dislike) (Ihekoronye and Ngoddy, 1985). Water was provided for rinsing of mouth between the evaluations.

Statistical Analysis: The experiment was laid out in a completely randomized design (CRD). Data were subjected to Analysis of Variance (ANOVA) using statistical package for social sciences (SPSS) version 17.0. Duncan's new multiple range test (DNMRT) was used to compare the treatment means. Statistical significance was accepted at ($p < 0.05$) (Steel and Torre, 1980).

RESULTS AND DISCUSSION

Proximate Analysis: The results of the proximate composition of the freeze - dried instant soups and freshly prepared soups (egusi and bitter leaf) are shown in Table 3. The moisture content of the local instant egusi soup was 10.89 % and the moisture was found to be lower than that of the instant bitter leaf soup 12.46 % which

though appeared drier. The moisture content of the freeze - dried instant soups was comparable to that of exotic instant soups by Mannie (2010). While the moisture content of the freshly prepared samples were 66.11 % for egusi soup, and 74.02 % for bitter leaf soup, respectively even though the same quantity of water was used in the preparation. This may be because boiled cocoyam has very high moisture content of about 55.17 % (Enwere, 1998) as against dried melon which has 7.3 % moisture content. The high moisture content of the freshly prepared portions is an evident that soups have high water content, which is one of the characteristics of soups. The moisture content of the freshly prepared portions was comparable to those of Kayode *et al.* (2008). The drastic reduction in moisture content of the instant soups will help in the extension of the shelf-life of the soups. The protein content of the freshly prepared egusi and bitter leaf soups were comparable to that of Kayode *et al.* (2008). The instant egusi soup had protein content of 19.73 % while the instant bitter leaf soup had protein content of 11.32%. This could be attributed to the fact that melon seed has higher protein content than cocoyam which was the thickener used in bitter leaf soup. The protein content of dried melon seed was found to be 27.37 % (Kayode *et al.*, 2008) while for boiled cocoyam was 2.56% (Enwere, 1998), so this could have contributed to the significance difference in the protein content of the instant egusi soup, because the meat used and every other ingredient was proportioned. The Enwere, 1998). In the fresh soups, the carbohydrate contents were lower probably because of high moisture content of the products. During freeze - drying, the moisture content of the products reduced drastically, making the product more concentrated.

ash content of the freshly prepared soup portion was 3.66 % for bitter leaf soup and 2.06 % for egusi soup. This compared favourably with values of 4.670 % and 1.05 % obtained by Kayode *et al.* (2008). The local instant bitter leaf soup had ash content of 19.52 %, egusi soup had 16.93 % ash content and this could be attributed to its low moisture content, because it was more concentrated as a result of the freeze drying process. The fat content of the fresh soup portions were comparable to that of Kayode *et al.* (2008). The local instant egusi soup's fat content (15.19 %) was higher than that of bitter leaf soup (9.89 %). This could be attributed to the fact that egusi (melon seed) being a leguminous plant has a very high oil content of about 49.7 % (Enwere, 1998). The crude fiber content of the fresh portions of egusi and bitter leaf soups were 2.01% and 1.68 %, respectively. They were comparable to that of Kayode *et al.* (2008). But the crude fiber of the local instant bitter leaf soup and egusi soup were 16.16 % and 13.95 %, respectively. This showed higher fiber content than the fresh portion. The reason could be because they had less moisture. The carbohydrate value for the freeze - dried instant egusi soup was 23.30 % but for freeze - dried instant bitter leaf soup it was 30.65 %. This could be attributed to the fact that the main raw material used in preparation of the bitter leaf soup has more carbohydrate (cocoyam, 40.19 % and bitter leaf, 14.08 %) than the main raw material for egusi soup, melon seed and fluted pumpkin (12 % and 8.40 %, respectively) (

Table 1: Ingredients for preparation of egusi soup

Ingredients	Scientific names	Quantity
Ground melon	<i>Citrullus vulgaris</i>	300g
Beef		300g
Red oil		125ml
Dried fish		100g
Stock fish		100g
Ground fresh Pepper		50g
Ground crayfish		50g
Salt		50g (to taste)
Ogiri okpei	<i>Prosopis africana</i>	10g
Knorr cubes		15g
Fluted pumpkin	<i>Telfairia occidentalis</i>	100g
Onions	<i>Allium spp.</i>	25g
Water		1.5 litres

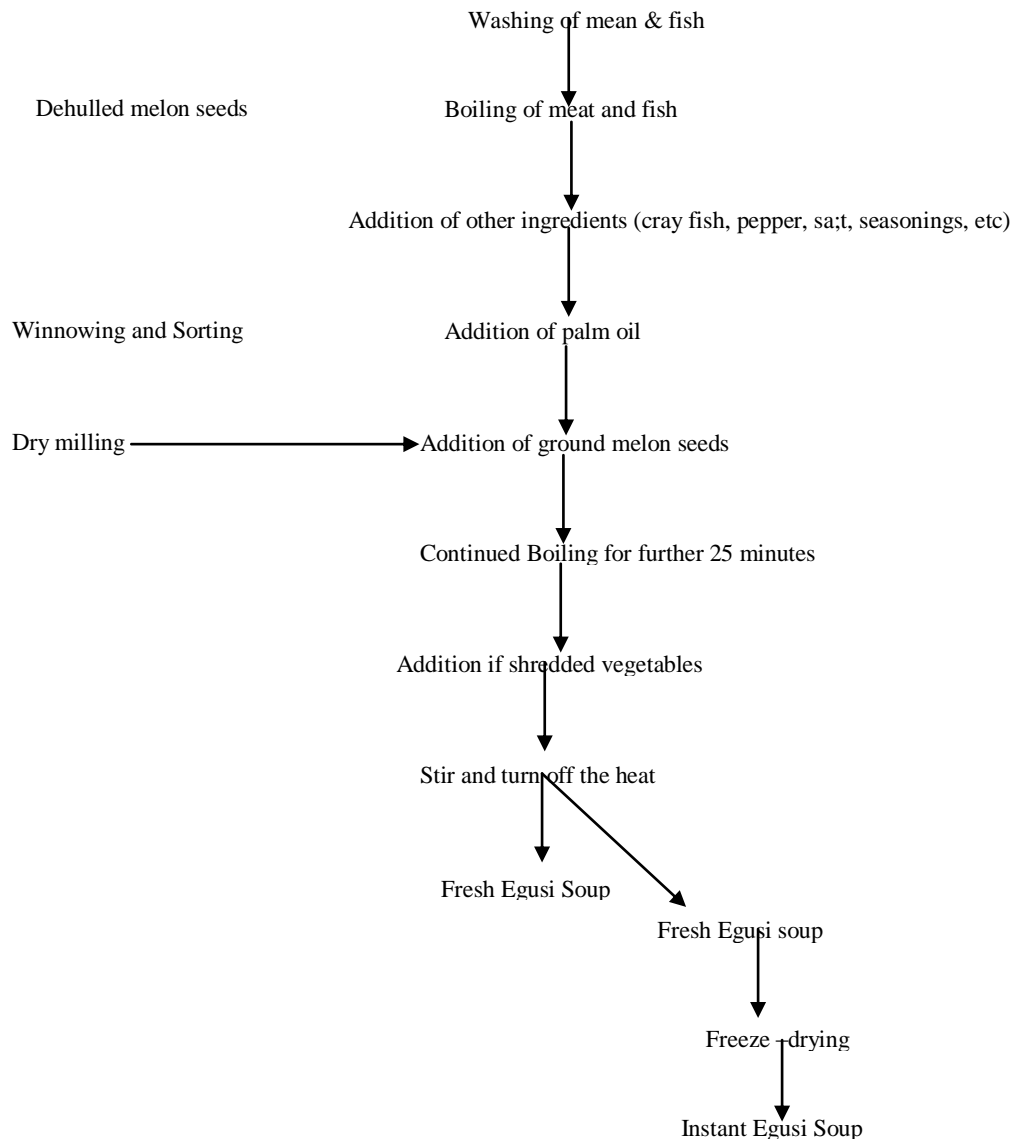


Figure 1: Preparation of Fresh and Instant Bitter leaf Soups

Table 2: Ingredients for preparation of bitter leaf soup

Ingredients	Scientific names	Quantity
Washed and squeezed bitter leaf	<i>Vernonia amygdalina</i>	100 g
Cocoyam	<i>Colocasia esculenta spp.</i>	300 g
Palm oil		220 ml
Beef		300 g
Dried fish		100 g
Stock fish		100 g
Crayfish		50 g
Papper		50 g
Knorr cube		15 g
Salt		50 g (to taste)
Ogili igbo	<i>Ricinus communis</i>	10 g
Water		1.5 liters

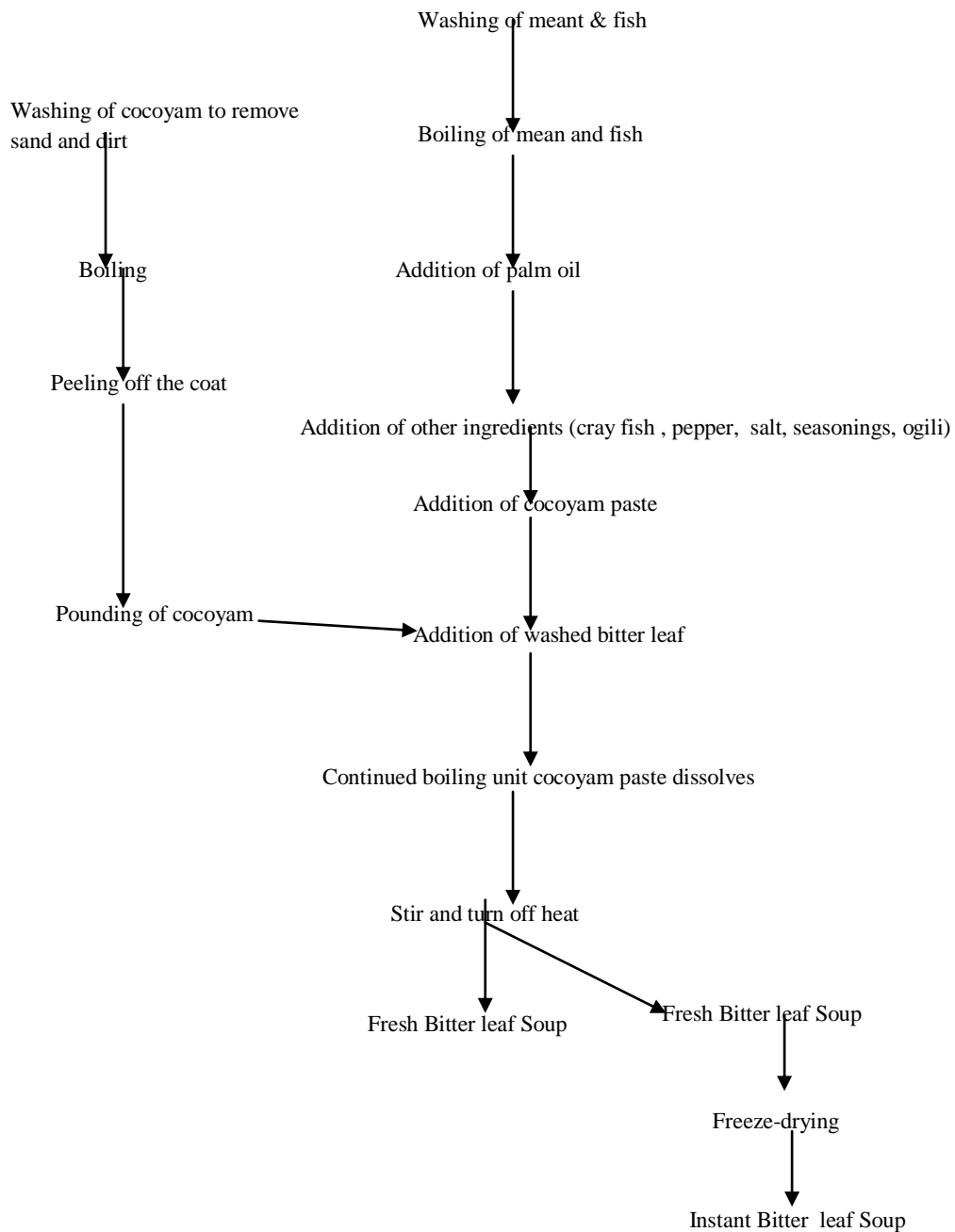


Figure 2: Preparation of Fresh and Instant Bitter leaf Soups

Table 3: The proximate composition of the freeze-dried instant soups and freshly prepared soups (egusi and bitter leaf)

Samples	Moisture	Ash	Fats	Crude Fibre	Protein	Carbohydrate
FBS	74.02 ± 1.05 ^a	3.66 ± 0.03 ^c	8.03 ± 0.02 ^d	1.68 ± 0.07 ^d	6.99 ± 0.02 ^d	5.62 ± 0.97 ^c
IBS	12.46 ± 0.46 ^c	19.52 ± 0.36 ^a	9.89 ± 0.21 ^c	16.16 ± 0.06 ^a	11.32 ± 0.63 ^c	30.65 ± 0.62 ^a
FES	66.11 ± 1.19 ^b	2.06 ± 0.02 ^d	10.44 ± 0.14 ^b	2.01 ± 0.04 ^c	16.42 ± 0.04 ^b	3.14 ± 1.05 ^d
IES	10.89 ± 0.22 ^d	16.93 ± 0.06 ^b	15.19 ± 0.03 ^a	13.95 ± 0.05 ^b	19.73 ± 0.33 ^a	23.30 ± 0.17 ^b

Values are means ± S.D of triplicate determinations. Values in the same column with different superscripts were significantly ($p < 0.05$) different. FBS = freshly prepared Bitter leaf soup, IBS = Instant Bitter leaf soup (reconstituted), FES = freshly prepared Egusi soup, IES = Instant Egusi soup (reconstituted).

Table 4: Sensory mean scores of the Instant soups and freshly prepared soups samples

Samples	Appearance	Taste	Flavour	Mouth feel	Consistency	Overall Acceptability
FBS	7.75 ± 0.79 ^b	8.05 ± 0.89 ^a	7.95 ± 0.94 ^a	8.30 ± 0.86 ^a	7.90 ± 0.72 ^a	8.10 ± 0.55 ^a
IBS	7.60 ± 1.43 ^b	7.00 ± 0.79 ^{bc}	7.35 ± 0.99 ^a	7.10 ± 1.07 ^b	7.75 ± 1.25 ^a	7.20 ± 0.69 ^b
FES	8.60 ± 0.59 ^a	7.65 ± 1.23 ^{ab}	7.90 ± 0.72 ^a	8.40 ± 0.88 ^a	8.00 ± 0.79 ^a	8.15 ± 0.81 ^a
IES	6.65 ± 1.18 ^c	6.65 ± 1.98 ^c	7.35 ± 1.23 ^a	7.10 ± 1.25 ^b	7.80 ± 1.01 ^a	6.80 ± 1.19 ^b

Values are mean ± SD of scores of 20 panelists. Samples with different superscripts within the same column were significantly different ($p < 0.05$). FBS = freshly prepared Bitter leaf soup, IBS = Instant Bitter leaf soup (reconstituted), FES = freshly prepared Egusi soup, IES = Instant Egusi soup (reconstituted).

Analysis of Samples:

Chemical Analysis: The moisture, protein, fat, ash and crude fibre contents of each of the soups were determined according to the methods of AOAC (2010). The carbohydrate was determined by difference

Sensory evaluation: The results of the sensory properties of the freeze - dried instant soups and freshly prepared soups (egusi and bitter leaf) are shown in Table 4. The result of the sensory evaluation revealed that there were significant differences ($p < 0.05$) among the soup samples in appearance, taste, mouth feel, and overall acceptability but there was no significant difference ($p > 0.05$) among the samples in aroma and consistency of the soups. The fresh egusi soup scored the highest in appearance, followed by the instant bitter leaf soup and the fresh portions. The instant egusi soup had the lowest rating because it had a dull appearance which could be as a result of the freeze drying process. The instant egusi soup rated the lowest in taste. All the soups were still acceptable to the panelists as indicated by their mean scores for the overall acceptability. The results showed that freeze drying process did not affect the sensory properties of the instant soup samples ($p > 0.05$).

CONCLUSION

The results obtained from this research showed that freeze - dried instant soups still maintained their nutritive value after the process. They are high in nutrient content just as the fresh portions and they create convenience. The reduction in the moisture content of the product from 74 % to 12 % adds to its shelf life. The freeze - drying process has lower effect on food

nutrient than other dehydration methods which use high temperatures. The sensory data revealed that the soups were all generally accepted though significant difference existed between the freeze - dried instant soups and the fresh portion at ($p < 0.05$).

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