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PRODUCTION, PROXIMATE, AND SENSORY ASSESSMENT OF *AWARA* PRODUCED FROM FRESH AND SUN DRIED SOYBEAN CURD MIX

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ABSTRACT
In developed countries, there is a renewed awareness on the utilization of legumes, because they are regarded as versatile functional ingredients that are nutritionally similar to meat and serve as replacements for animal protein. The primary aim of the work was to produce a sun dried Awara (soybean curd) mix that will serve as a preliminary research base, aimed at providing a readily available, acceptable, and affordable protein supplement when further processed. The mix was obtained by first sun drying a fresh curd of soybean prepared using a standard acceptable procedure. Therefore, 4/5 of the dry curd was ground into flour, which was separated into different particle sizes, using sieves with pore diameters of 250µ, 180µ, 132µ, and 118µ respectively. The remaining 1/5th of the dried curd was left unground. It was observed that the flours from 250µ and 180µ aperture sizes did not form curds after reconstitution, due to lack of cohesion. However, flours from aperture sizes of 132µ, 118µ and the unground flour formed curds of increasing cohesion respectively. This indicated that the unground flour has higher cohesion ability than the other flours, therefore less tendency to scatter during further processing. On the overall acceptability, no significant difference was observed at 1% and 5% between Awara made from fresh curd and that made from dried unground Awara flour.
Keywords: Awara, curd, proximate analyses, sensory analyses, soybean.

INTRODUCTION

In developing countries, lack of sufficient protein in the diet of a large percentage of the population is becoming a major setback for human development (Liu, 2000). Efforts are aimed at finding alternative sources of protein from legume seeds in order to meet protein demands in places where animal protein is either grossly inadequate or relatively expensive. In such areas, legumes are the most important high protein foods (Chrispeels and Savada, 1994). In developed countries, there is a renewed awareness on the utilization of legumes. This is because they are regarded as versatile functional ingredients that are nutritionally similar to meat, and serve as replacements for animal protein (Snyder, 1993). Among the legumes, soybean is the most widely cultivated, with 65% of worldwide soybean production taking place in the United States (Salunkhe *et al*., 1992). It is a very good source of dietary protein that ranks high among the great world protein sources, which are meat, fish, eggs and milk (Liu, 1997). Production of soybean curd is done from coagulation of boiling soy milk. A solution of the coagulant is stirred into boiling soymilk, until the mixture curdles into a soft gel (Berk, 1992). The most common types of coagulants used are salt coagulants (example calcium sulphate, magnesium chloride, and calcium chloride), and acid coagulants (example, glucono delta lactones – GDL).

The curd is then processed in different ways depending on the desired end product. There is no available literature on the processing of dry soybean curd for the purpose that this research was carried out. *Awara* is a common processed soybean curd in Nigeria, commonly eaten as a snack. It is made from spiced and seasoned soybean curd. The ready to eat snack is obtained by frying slices of the seasoned curd. The primary aim of the study was the production of dry *Awara* mix, to find out how the process of moisture removal and reconstitution had affected its overall acceptability. The results obtained in the study can serve as a prerequisite for a line of further studies that could result in the production of an *Awara* mix that is readily available, with less strenuous preparation methods, reduced preparation time, and a longer shelf life.

MATERIALS AND METHODS

The soybean specie *Glycine max* belonging to the sub-genus *Glycine soja* was used. The specie in this study was obtained from Sabon Gari Market within Kano metropolis. The study was carried out in the Food analysis and Food processing laboratories, in Kano University of Science and Technology, Wudil. Soybean (5Kg) was cleaned, soaked for three hours, and wet milled. The slurry was diluted and filtered using a muslin cloth to obtain the soymilk. The milk obtained was lightly boiled and coagulated using citric acid. The curd obtained was seasoned with 10g of table salt [sodium Chloride] and 50g of dry red bell pepper powder. The seasoned curd was then sun dried until its initial moisture content of 85% was lowered to 3%. Dry curd (4/5) was then ground into flour, which was separated into different particle sizes, using sieves with pore diameters of 250µ, 180µ, 132µ, and 118µ respectively. The remaining 1/5th of the dried curd was left ungrounded. The different flours and the dry ungrounded curd were then respectively reconstituted to reform the fresh curds.

The different mixtures were molded, sliced, and fried into *Awara*. Sensory evaluation based on a 9-member panelist was carried out on the respective products. The quality of the products with respect to taste, texture, flavour, smell, and overall acceptability was analyzed on a 5-point hedonic scale. Proximate analyses of the fresh and dried curds were carried out respectively, using the AOAC (2000).

Statistical Analysis

The degree of variance and the overall acceptability of the samples were obtained by analysis of variance (ANOVA). The results were interpreted at 1% and 5% levels of significance, with no significant difference between the two samples.

RESULTS

Table 1 shows the results of the proximate analysis of the fresh *Awara* curd and the dry *Awara* mix. The results are percent compositions of the analysed parameters on wet basis. Table 2 displays the sensory analyses results of *Awara* made from fresh curd, and *Awara* made from dried ungrounded flour.

Table 1: Proximate Composition of fresh and dried curd of *Awara*

Parameter (%)	Fresh Curd (%)	Dried *Awara* Mix (%)
Moisture	85.00 ± 0.4	3.00 ± 0.3
Protein	7.80 ± 0.2	53.50 ± 0.2
Fat	4.20 ± 0.5	26.70 ± 0.4
Crude Fibre	0.2 ± 0.2	0.6 ± 0.2
Carbohydrate	2.60 ± 0.2	11.40 ± 0.2
Ash	0.20 ± 0.2	4.80 ± 0.2

Key: The data are mean values ± Standard Deviations (SD) of triplicate samples.

Table 2: Sensory analysis of *Awara* made from fresh curd and *Awara* made from dried unground flour

Sample	Taste	Texture	Flavour	Smell	Overall Acceptability
A	$4.9^a \pm 0.31$	$4.7^a \pm 0.50$	$4.8^a \pm 0.44$	$4.0^a \pm 0.71$	$4.7^a \pm 0.50$
B	$4.2^a \pm 0.83$	$3.1^b \pm 1.45$	$3.9^a \pm 0.60$	$3.4^a \pm 1.33$	$4.2^a \pm 0.73$

A = Sample from fresh curd, B = Sample from unground flour. Any two means followed by the same superscript are not significantly different at both 1% and 5% significant levels.

DISCUSSION

The results from Table 1 show a higher concentration of the parameters in the dried mix, with the exception of moisture. This is because the results of the dried mix are obtained on a moisture free basis or dry basis. It was observed that the total moisture remaining after drying was very low (3%) and within the range of water activity (0.6) that does not support microbial growth. This is because according to Adams and Moss (2007), the limiting value of water activity for the growth of any microorganism is about 0.6, and below this, the spoilage of foods is not microbiological, but may be due to other factors like insect damage, or chemical reactions such as oxidation. The flours from the different sieves had varying textures and colours. As the aperture sizes of the sieves reduced, flours with decreasing degrees of cohesion were obtained. The degree of cohesion is attributed to the rate of gelling and gel firmness, which depends on temperature of processing, time of heating, and protein concentration (Visser and Thomas 1987). The lack of cohesion could be attributed to surface plasticization of the particles of the product, due to exposure to high temperatures during drying (Menkov and Durakova, 2005). Another reason could be due to the effect of temperature on the oil content during processing of the curd (Salunkhe *et al.*, 1992). This is because the oil in the dry curd is more concentrated due to drying, and to a certain extent expressed due to grinding in the ground powders, thereby reducing the cohesiveness of the particles during reconstitution. Also, drying affects the water binding properties of a food material, the extent depending on the nature, degree of processing, structural design, and composition of the food product (Labuza, 1980). In most cases, food substances when dried loose their orderly crystalline structure and become amorphous, which change their physical characteristics (Zografi, 1988).

Sensory analyses results carried out on *Awara* prepared from the fresh curd and that prepared from the dried ungrounded mix are shown in table 2. The results show a significant difference in texture, with the texture of the *Awara* from fresh curd being more acceptable. This indicates that the effect of drying and reconstitution had a marked negative effect on the texture of the end product. According to Brennan *et. al.* (1990), the texture of reconstituted dried foods depends on the rate and extent to which these foods pick up and absorb water, to revert back to a condition resembling the un-dried material. It depends largely on the crystalline structure of the dried pieces, and the extent to which the water holding components, mainly proteins and starch, had been affected by the drying process. Factors like the wetting ability, the sinking ability, the dispersing ability, and the solubility of the dried material during reconstitution has an overall effect on the final appearance and texture of the end product. For a dried material to exhibit good reconstitution and textural characteristics, there needs to be a correct balance between the individual properties mentioned above. All other factors in the sensory analysis are not significantly different in the sample from the fresh curd and that from the dried unground flour.

CONCLUSION AND RECOMMENDATION

Based on the results obtained from the study, it can be concluded that moisture removal and the process of grinding and sieving negatively affects the functional property of curd formation of dry *Awara* mix, with the property being more adversely affected at increased sieving levels. It can also be concluded that the *Awara* from the dry unground mixture compares favourably with that made from the fresh curd. However, to achieve a dry *Awara* mix with little or no difference with the fresh curd, the following recommendations are to be considered:

- Reducing the fat content of the beans or the soymilk prior to formation of the curd.
- Use of a surface active agent to improve the wetting ability
- Use of a Calcium salt at an acceptable level to increase cohesion.
- Drying at lower temperature under controlled conditions to prevent surface plasticisation.
- Sorption, microbiological, and packaging studies should be carried out on the dried mix in order to conclude its packaging and storage requirements.

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