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IMPROVEMENT ON THE NUTRITIONAL VALUE (PROTEIN QUALITY) OF MAIZE BASED PAP WITH SOYBEAN.

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ABSTRACT

Akamu or pap which is a common food for weaning babies is usually low in protein (8-12%), This research was carried out to determine the possibility of improving the nutritional value (protein content) of pap using soybean. The maize was wet-milled along with different percentages of soybean (10-50%), and allowed to ferment together. The protein determination using Kjeldalh method showed that the pap sample without soybean has the lowest protein content (16.1%) while that with 50% soybean has the highest protein content (43.05%). There was no clear difference between the total microbial count of the pap prepared with soybean and that without soybean. More than 75% of the people who were asked for sensory evaluation of maize+50% soybean pap liked it. Hence, processing maize along with up to 50% soybean will tremendously improve nutritional value of pap given to babies, as the pap will not need the addition of milk (which is more expensive than soybean) after preparation.

KEYWORDS: Akamu, Kjeldalh.

INTRODUCTION

Pap (Akamu or Ogi) is a fermented porridge or gruel from West Africa which could be made from maize (Zea mays). It serves as a major weaning food for the infant in West Africa (Oyewole, 1997).

Lactic acid bacteria and Yeasts have been identified as the most predominant microorganisms involved in the fermentation of pap. These microorganisms responsible for the fermentation of pap play important role in the production of aroma and flavour (Omemu et al.,2007).

Several traditional fermentations have been up-graded to high technology production systems and this has undoubtedly improved the general well-being of the people as well as the economy (Achi, 2005).

Fermentation of pap most of the times is spontaneous but could also be induced. The combination of different types of cereals in the production of pap increases the protein quality and relative nutritive values which would have been lost during steeping, milling and sieving processes compared to use of single cereal (Amusa et al 2005). Several strategies have been used to increase the protein content and minimize nutrient loss (Inyang and Idoko, 2006).

Currently in Africa, efforts are being made to modify the processing of pap with a view to enhancing its nutritive value and shelf-life. One of such methods of achieving this is by blending with legume that is high in protein, such as soybeans (Lasekan and Akintola, 2008). Several authors have also reported improvement in nutritional quality of pap by soybean alone (Oluwamukoni, et al, 2005; Kolapo and Sanni, 2005;Adeleke and Oyewole, 2010; Akambi et al, 2010; Adesokan et al, 2011).The main purpose of this work is to investigate the possibility of improving the protein content of maize based pap by processing the maize along with some quantity of soybeans; and its effect on the acceptability of the product.

MATERIALS AND METHODS

Collection of Samples.

The maize (Zea mays) and soybeans (Glycine max) used in this study were bought from Eke Oko market in Orumba North Local Government Area of Anambra State, Nigeria.

Processing of maize for pap.

Some quantity of the maize grain was washed and steeped in clean water for 2days using plastic containers with cover. The water was decanted after 2days the maize washed 3 times in water to reduce fermenting odour and then wet-milled into paste. The paste was sieved using clean muslin cloth, which separated the pomase from the filtrate. The filtrate was then allowed to

settle and ferment for 3days.Total microbial counts were carried out during the fermentation of the pap.

Processing of maize and soybean for pap.
The maize was washed, steeped in clean water for 2days and washed again after to reduce the odour as usual. The soybean was parboiled for 20minutes, after which it was de-hulled manually. The soybean was added to the softened maize and both were wet-milled.

This was then sieved using muslin cloth and the filtrate allowed settling and fermenting for 3days. Total microbial counts were also carried out during the fermentation process. The maize and the soybean were measured using the usual market cup. Several samples of the pap with different percentages of soybean were prepared as shown in Table 1.

Table 1: Maize to Soybean ratio and the corresponding percentage of Soybean in the Pap sample.

Sample	Ratio of Maize to Soybean	% Soybean in the Pap
A	Only maize (dry)	0
B	Only maize pap	0
C	9:1	10
D	4:1	20
E	3:1	25
F	2:1	33.3
G	1:1	50

Crude protein determination of samples A-G
The protein content of the prepared maize-soybean pap was determined using the micro-Kjeldahl method as described by A.O.A.C, (1990). The sample (0.5g) was weighed into the micro-kjeldahl flask. To this was added 0.2g of selenium catalyst and 20ml of concentrated H_2SO_4. These were set in the appropriate hole of the digestion block heater in a fume cupboard. The digestion was left on for 4 hours after which a clear colourless solution was left in the tube. The digest was carefully transferred into 100ml volumetric flask, thoroughly rinsing the digestion tube with distilled water and the volume of the flask made up to 100ml mark with distilled water. Then 5ml portion of the digest was pipetted into Kjeldahl apparatus and 5ml of 40% w/v NaOH added.

The mixture was then steam distilled and the liberated ammonia collected into a 50ml conical flask containing 10ml of 2% boric acid plus mixed indicator solution. The green colour solution was then titrated against 0.01normal HCl solution. At the end point, the green colour turns to wine colour, which indicates that,all the nitrogen has been trapped as ammonium chloride. The percentage nitrogen was calculated by using the formula:

%N = Titre value x atomic mass of nitrogen x normality of HCl used x 4

The crude protein is determined by multiplying the percentage nitrogen by a constant factor 6.25 (AOAC1990).

Total microbial count.
The microbial count of the raw pap prepared with maize alone and that prepared with maize + soybean was determined over 3days of fermentation, using pour plate method. 1ml of 10^{-4} dilution of the sample was used to inoculate duplicate plates of Nutrient agar (NA) and Sabouraud dextrose agar(SDA,with 0.1mg of cyclohexamide in 100ml). The NA plates were incubated at $37^{O}C$ for 24hours while the SDA plates were incubated at $25^{O}C$ for 3days.

Sensory Evaluation of the pap prepared with maize and soybean.
The pap processed with maize and soybean (50%) was prepared with boiled water and the sensory evaluation carried out by eighty untrained panel (students) drawn from the Department of Science Laboratory Technology, Federal Polytechnic Oko. Using six point hedonic scales, the panel were asked to determine the general acceptability of the pap based on the taste, colour and mouth feel. The six point scales are: Extremely like, Like very much, Like moderately, Dislike moderately, Dislike very much and Extremely dislike.

RESULTS
The results of the crude protein determination of the pap samples is shown in Table 2, while the result of the total bacteria count, total yeast and mould count is shown in Table 3. The result of sensory evaluation indicates that greater number of people liked the pap (maize soybean).

Table 2: Protein content of the fortified pap samples.

Sample	% Soybean in the Pap	Protein content (%)
A	0	16.1
B	0	12.95
C	10	14.55
D	20	17.35
E	25	18.4
F	33.3	26.6
G	50	43.05

Table3: Total Microbial Count

Fermentation	NA(Bacteria)		SDA(Yeast & Mould)	
Time	Maize pap	Maize+ Soybean	Maize pap	Maize+ Soybean
Day 1	$1.6x10^4$	$1.1x10^4$	$2.8x10^3$	$3.2x10^3$
Day 2	$3.0x10^6$	$2.0x10^6$	$1.1x10^5$	$3.7x10^5$
Day 3	$4.8x10^7$	$5.3x10^7$	$2.4x10^6$	$1.3x10^6$

Table 4: Sensory evaluation of the 50% soybean fortified pap.

Scale of Evaluation	Number of Persons
Extremely Liked	20
Like Very Much	24
Like Moderately	16
Dislike Moderately	12
Dislike Very Much	8
Extremely Disliked	0

DISCUSSION AND CONCLUSION

In this study**,** there is a tremendous improvement on the protein value of the pap processed with different percentages of soybean. The protein value increases as the percentage of soybean in the pap increases. Several authors have also reported the improvement in the nutritional quality of ogi or pap by soybean fortification (Oluwamukomi *et al* 2005; AdelekeOyewole, 2010). It was observed in the research that the protein content of the dry maize is higher than that of processed pap. This justifies earlier report that the nutritive values would have been lost during steeping, milling and sieving processes (Adesokan et al, (2011).

It can be observed from Table 3 that there is no significant difference between the microbial populations of the soybean fortified pap and that of the unfortified one. This does not agree with the work of Akanbi *et al*, (2010), who reported an increase in microbial population upon addition of soybean to cereals in the production of ogi. Adesokan *et al*, (2011) also reported that the aerobic organisms of the fortified samples increased significantly than the unfortified samples. However, there was a steady increase in the in the microbial population of both samples over the fermentation period of 3days. Similarly, Adesokan *et al*, (2011) reported a steady increase in yeast population during fermentation period of soybean fortified pap.The sensory evaluation of the 50% soybean fortified pap showed that 60 out of the 80 people liked the pap. This observation is in agreement with the report of previous study byAdesokan *et al*, (2011), who reported that incorporation of 10% soybean in their pap were accepted by the taste panel. This study have revealed that incorporation of up to 50% soybeans in the pap greatly improved the protein value and was generally acceptable by the taste panel. However, further studies are required to determine the effect of the presence of soybeans on the shelf life of the pap.

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