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Influence of the Addition of Okra Seed Flour on the Properties of 'Ogi', a Nigerian Fermented Maize Food

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INTRODUCTION

In Nigeria and many developing countries including those in West Africa, cereals especially maize, constitute a very high percentage of the diet of the people. Such cereals are usually processed into various forms and consumed both as weaning foods and adult meals. Most of these cereals are however nutritionally deficient and incapable of supporting good health of the people.

Maize is one of the most prominent of these cereals, and constitutes well over 90% of the cereals consumed in Nigeria and many West African countries. The most popular of the forms of its consumption is 'ogi' a fermented form made into gruels of varying consistencies. Although it is relatively cheap, it is nonetheless highly deficient in essential nutrients, especially in terms of essential amino acids, vitamins and minerals. The situation is even made worse by the method of its processing which involves wet milling, wet sieving and several washings which deplete it of even the little nutrients contained.

Various attempts earlier made for nutrient restoration and fortification include blending with fermented or unfermented legumes (Ekpenyong et al, 1977: Otunola et al, 1998; 2006) and addition of pawpaw slurry at varying levels of substitution (Otunola et al, 2006).

Okra seed is known to be rich in high quality protein especially with regards to its content of essential amino acids relative to other plant protein sources (Oyelade et al, 2003). It is also reputed to be rich in minerals and vitamins. Its addition to predominantly carbohydrate foods therefore may potentially enrich such foods and considerably improve its nutritional status.

The work reported here is therefore aimed at investigating the potentials of okra seeds to improve the nutritional status of 'ogi' a predominantly carbohydrate food that is in very high demand in Nigeria and many Sub- Sahara African countries.

MATERIALS AND METHODS

The maize grains and okra seeds used in the study were purchased from a local market in Ogbomoso, South- Western Nigeria.

'Ogi' flour was prepared in the laboratory essentially by the traditional method as indicated in Figure1, while okra seed flour was prepared by dry milling and sieving to obtain a particle size of less than 3mm.Therafter, ogi powder was supplemented with okra seed flour at substitution levels of 0, 10, 20, 30, 40 and 50%. Each sample was thoroughly mixed in a Kenwood mixer (model KM 300). For each sample, crude protein, crude fibre, fat, ash and moisture contents were determined by standard AOAC procedures (AOAC, 1990). Carbohydrate contents were determined by difference (AOAC, 1990). Calcium, Sodium, Iron and Vitamin C (Ascorbic acid) were also determined by AOAC (1990) methods. All chemical determinations were done in at least duplicates and the mean value recorded in each case.

The pasting profiles of the samples were determined using a Brabender viscoamylograph following the procedures contained in the manual, as used by Henshaw and Adebowale (2004).

The sensory attributes were evaluated by preparing gruel from each sample and serving to a panel of ten judges consisting mainly of students and staff of the Department of Food Science and Engineering, Ladoke Akintola University of Technology, Ogbomoso, Nigeria, who were very familiar with gruels made from maize ogi. The panelists were asked to score each sample on a 9-point Hedonic scale, where 1 and 9 represent dislike extremely and like extremely respectively. Data obtained were subject to appropriate statistical analysis (Duncan, 1955; Larmond, 1980).

RESULTS AND DISCUSSION

Data on the chemical composition of the samples as presented in Table 1 indicated that increasing proportions of okra seed flour in the mixes resulted in gradual but substantial increases in the levels of protein, increasing from 6.50±0.14% in the unsubstituted sample to 12.40±0.14% in the sample with 50% level of substitution. Similar trends were observed with respect to the levels of fat, crude fibre and ash. The values of the carbohydrate content however showed a reverse trend, decreasing from 85.22% in the unsupplemented sample to 74.51% in the sample with 50% okra seed flour. The values obtained here comparable favourably with those obtained by earlier studies in which other plant materials were used to supplement ogi (Otunola et al., 1998; Onilude et al., 1999;. These observations may not be unexpected since okra seed flour has since been adjudged to be far more richer in protein, oil and ash than maize and most other cereals used for ogi production (Ekpenyong et al., 1977; Oyelade et al., 2003). Increases were also observed with respect to Calcium, Sodium, Iron and Vitamin C, the values here being also comparable to those obtained when ogi was supplemented with pawpaw slurry as earlier observed by (Otunola et al., 2006).

Table 1: Chemical composition of 'ogi' fortified with okra seed flour

% of okra seed flour	Protein (%)	Fat (%)	Ash (%)	Moisture %	Crude fiber %	Carbohydrate %	Calcium (mg/g)	Sodium (mg/g)	Iron (mg/g)	Vitamin c (mg/g)
0	6.50 ± 0.14	1.66± 0.04	0.05 ± 0.01	6.30 ± 0.14	0.27 ±0.51	85.22 ± 0.01	0.03± 0.01	0.01± 0.00	0.01± 0.00	0.40± 0.00
10	7.80 ± 0.14	1.72 ±0.01	0.06 ±0.00	7.50 ± 0.14	0.28 ±0.00	82.63 ± 0.01	0.05± 0.00	0.02± 0.00	0.01 ±0.00	0.02± 0.00
20	8.20 ± 0.14	1.80± 0.14	0.08 ±0.00	7.70± 0.51	0.29 ±0.50	81.92 ± 0.01	0.09 ±0.00	0.03 0.00	0.02± 0.00	0.41± 0.01
30	9.00± 0.14	2.10± 0.14	0.09± 0.00	8.00 ± 0.49	0.30± 0.01	80.51 ± 0.01	0.14± 0.00	0.03± 0.00	0.02± 0.00	0.45± 0.00
40	10.20±0.14	2.28 ±0.01	0.10 ±0.01	9.10 ± 0.41	0.30 ± 0.04	77.21 ± 0.01	0.17± 0.00	0.05± 0.01	0.03± 0.00	0.62± 0.00
50	12.40±0.14	2.34 ±0.01	0.11 ± 0.04	10.30±0.04	0.34 ± 0.01	74.51 ± 0.01	0.27± 0.00	0.06± 0.00	0.04± 0.01	0.65± 0.00

Values are means of duplicate determinations.

The results of the pasting characteristics are as illustrated in Table 2.Gradual increases were recorded with increases in the level of substitution with okra seed flour especially with regards to the pasting temperatures and pasting times, implying that a little more heat and a fairly longer time may be needed for cooking to required consistencies when ogi is supplemented with okra seed flour. Although the values of the stability of starch did not present any consistent pattern it appeared that addition of okra seed flour to ogi reduced starch stability to a little extent. This may have implication on the consistency of the gruel prepared from the samples, and this appears reflected in their sensory attributes.

Evaluation of the sensory characteristics of the samples indicated high preference for the un-supplemented ogi in terms of all the attributes tested (Table 3). This was closely followed by the sample with 10% level of substitution. The sample with 20% okra seed flour was fairly acceptable in terms of taste, appearance and colour only (Table 3). Samples containing 30% or more okra seed flour were unacceptable to consumers. This might not be unconnected with the bland taste and the dark brown colour of okra imparted on the final products of the mixes. This observation suggests that in spite of the nutritional advantages of okra seed flour addition to ogi, further supplementation with appropriate colouring and flavouring agents may be needee to promote consumer acceptabililty.

Table 2: Amylograph pasting characteristics of 'Ogi' fortified with Okra seed flour

% okra seed flour in sample	Tp (°C)	Mg (min)	Tvp (°C)	Vp (B.U)	Mn (min)	Vr (B.U)	Ve (B.U)	Mn-Mg (min)	Ve-Vr (B.U)	Vp-Vr {B.U)	Ve-Vp (B.U)
0	74	23	88	212	27	170	340	4	170	42	128
10	75	24	85	180	28	135	320	4	185	45	140
20	75	24	85	170	28	100	300	4	200	70	130
30	76	25	83	140	28	75	230	3	155	65	90
40	77	26	82	90	29	50	160	3	110	40	70
50	78	28	80	40	30	15	110	2	95	25	70

Tp = Pasting temperature; Mg = Gelatinization time; Tvp = Temperature at peak viscosity; Vp = Peak viscosity during heating; Mn = Time to reach peak viscosity; Vr = Viscosity after 30 minutes, holding at 95°C; Ve = Viscosity on cooling to 50°C; Mn-Mg = Ease of cooling; Vp - Vr = Stability of starch; Ve - Vr = Gelatilization index; Ve - Vp = Set back value (retrogradation tendency); B.U. = Brabender unit

Table 3: Mean sensory scores of 'Ogi' porridge prepared from 'Ogi' flour – Okra seed flour mixes.

Sensory attributes

Sample	% okra seed flour	Taste	Appearance	Texture	Colour	Flavour	Overall acceptability
A	0	7.00^{a}	6.88^{a}	6.44^{a}	6.55^{a}	6.22^{a}	6.66^{a}
B	10	5.66^{b}	5.44^{b}	4.55^{b}	5.11^{b}	5.00^{b}	5.77^{b}
C	20	4.77^{c}	5.00^{b}	$4.33^{b,c}$	$4.77^{b,c}$	$4.33^{b,c}$	5.11^{b}
D	30	4.00^{d}	3.77^{d}	$4.11^{b,c}$	$4.22^{d,e}$	$4.11^{c,d}$	4.11^{c}
E	40	3.44^{d}	$3.11^{c,d}$	2.66^{c}	$3.77^{d,e}$	$3.53^{d,e}$	3.22^{d}
F	50	2.22^{e}	2.44^{d}	2.44^{d}	3.66^{e}	3.10^{e}	2.11^{e}

Data in same column with same superscripts are not significantly different at 5% level.
Each value is a mean of the scores of ten panelists.

CONCLUSION

The results of this study have clearly indicated that supplementation of ogi with okra seed flour is a viable and sustainable venture which could even be undertaken on a commercial scale, especially in Nigeria and other developing countries of the world where, due to economic reasons, access to animal sources of protein is minimal. In spite of these potentials however, the need for investigation into the requirements for appropriate colouring and flavouring agents may be crucial if consumer acceptability is to be promoted.

Maize grains
↓
Cleaning
↓
Steeping
↓
Wet milling
↓
Wet sieving
↓
Setting/souring
↓
Decantation
↓
Pressing
↓
Drying (overnight at 600C)
↓
Milling
↓
Maize ‘ogi’ flour

Fig.1: Flowchart for maize ‘ogi’ flour production

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