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Improvement of Ogi flavour with malted corn

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ABSTRACT

Ogi (pap) is a fermented cereal paste food frequently used for weaning infants. The fermentation process produces sour flavour in Ogi, which is often rejected by infants. This creates a problem for mothers in many African countries and beyond (focus on Nigeria) as they have searched for alternatives like imported formulas, a choice that is exorbitant for low-income parents. This research work improved regular Ogi to Ogi-malt blend by blending de-watered wet-milled corn and dry-milled malted corn in the proportion of 10% solid of wet-milled Ogi (control) and 20% solid of dry-milled three days (72hrs) malted corn (21.3g : 11.48g). Proximate analysis of the samples showed that the malt-blended product had relatively higher protein (7.53%) and fat (3.0%) contents and lower carbohydrate (74.96%) and viscosity (450 centipoises at 80^{O}C) than the regular Ogi (5.77%, 2.50%, 76.83% and "680 centipoises at 80^{O}C" respectively). Sensory evaluation of the samples on a seven-point scale (with 7 = Extremely liked and 1 = Extremely disliked) showed that the flavour and colour of the Ogi-malt blend (6.4 and 6.6) were preferred to those of the regular Ogi (4.0 and 6.0 respectively). Malt-blending can therefore be applied to improve the overall acceptability of Ogi.

KEYWORDS

Ogi;
Viscosity;
Malt-blend;
Sensory evaluation;
Proximate composition.

INTRODUCTION

Ogi, (Akamu) a fermented cereal-grain starch is usually produced from maize, sorghum or millet. It is a popular breakfast product and one of the infant weaning foods in Nigeria[3]. Practically speaking, it is the major weaning food for the reject ogi as meal because of the flavour. Infant rejection of ogi creates problem for mother who have searched for alternatives. In Nigeria's case, these alternatives were filled from imported formulas or dairy products. These products in Nigeria today are out-off-reach for many low-income parents. Thus, infants from such homes have no choice than taking sour-tasty ogi with sugar to mask the tart taste. Masking the sour-taste with sugar may result in excess sugar in the product. This situation poses a task of providing a relatively cheap and available weaning food acceptable to the population.

This work was aimed at using malted corn flour in improving the flavour of traditionally prepared ogi. If this result is successful, it will help in solving the problem of ogi – rejection due to sour taste. Malted corn yields modified starch which is known to be more digestible, besides its malt flavour, its colour may be preferred to the plain colour of traditionally processed ogi[4].

MATERIALS AND METHODS

Materials

The corn used for the production was purchased from Owerri main market in Owerri Municipal, Imo State.

Methods

(a) Malting of maize

Five kilograms of dry whole maize of yellow variety were purchased from Owerri main market. Foreign materials such as pieces of stones, stalks and other seed were removed with damaged maize kernels by winnowing, sieving and hand-picking. The sorted grains were than washed in cold tap water and steeped in fresh cold tap water for hours. At the end of the steeping period, the well soaked grains were re-washed with fresh tap water and visible hard grains removed. Then the wet grains were spread in trays at a grain depth of about 4cm and covered with clean wet nylon fabrics. The trays and contents were placed in a dark well ventilated room (room temperature 28-30^{O}C). The grains were left for 72 hours to sprout with clean water sprinkled on them every morning and evening till the germination of the sprouting operation. During the 72 hours, the percentage of the sprouted grains and rootlet length were determined and recorded. Process was terminated by washing and sundrying the grains. After sundrying, the grains were roasted in an oven for two hours at 80^{O}C to a light brown colour. Most of the rootlets were detached from the grains and the remaining rootlets detached by robbing the grains in between the palms. Rootlet separation was achieved by both sieving and winnowing of the samples. The grains now malted were dry-milled and sieved with 300 micron sieve. The malted-maize flour were packed in container, sealed and stored in a cool place until needed for product formulation.

(b) Preparation of wet Ogi

Ogi (Akamu) was prepared by the traditional wet milling process with non-malted maize grains. In this process, the cleaned grains were soaked in sufficient tap water at room temperature for 48 hours. The steeped grains were washed after one day and wet-milled after the second day of steeping. The wet milling was done in a commercial milling shop and wet mash 18mls of water. The three days malted corn flour was used because of its highly developed malt flavour and colour. The flour and water mixture were then cooked into thin gel with about 200ml of boiling water heated

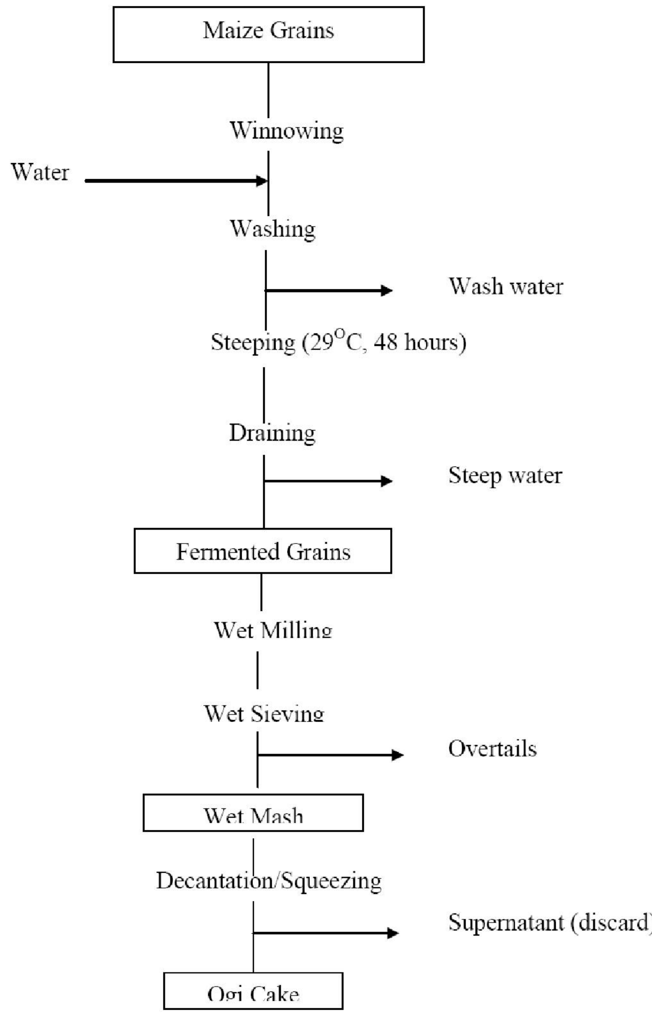

Figure 1 : Flow diagram for the production of Ogi

was sieved using a 300 micron sieve. The slurry was allowed to settle for sometime in a refrigerator to retard further fermentation. The ogi (wet-cake) was recovered by squeezing out excess water with a muslin cloth (see Figure 1).

(c) Method of preparation of Ogi blend

Blends of dewatered wet-milled ogi and the dry milled malted corn were prepared by mixing 10% solid of the dewatered wet milled ogi with 20% solid of dry milled three days malted corn. (21.3g : 11.48g) (Approximately two table spoonful of the malted flour to one table spoonful of ogi i.e. control) and dissolving in

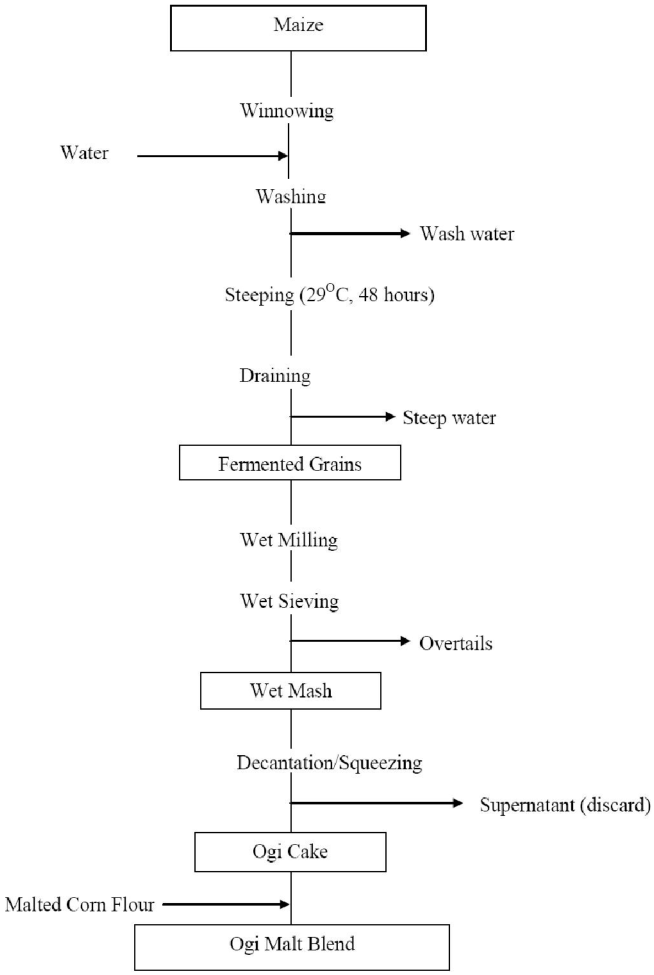

Figure 2 : Flow diagram for the production of Ogi-malt blend

to obtain the desired consistency (see Figure 2).

Methods of analyses

(a) Proximate analysis

The procedures for the proximate analysis were as outlined by the Association of Official Analytical Chemists[1].

(b) Moisture content

Two grams of each sample were weighed into a dried and weighed drying pan. The samples were dried in a Gallemkamp moisture extractor oven at 105^{O}C for 3 hours. The dried samples were allowed to cool in a dessicator and re-weighed. The weight differences were calculated as the percentage of the original samples to give moisture content.

(c) Ash content

Two grams of each sample were weighed into a clean, dried and weighed crucible and dried in moisture extraction oven at 105^{O}C for 3 hours to remove moisture. The samples were then transferred to a muffle furnace ignited at 550^{O}C for 5 hours. They were removed from the furnace, cooled in a dessicator and weighed. The ash content was expressed as the percentage of the original sample.

(d) Crude fat content

Two grams of each sample were carefully wrapped with a filter paper and put into the thimble of a soxhlet extractor. The thimble was fitted to a clean round-bottom flask containing about 120ml of petroleum ether. The samples were slowly heated with a heating mantle for 5 hours. Refluxed petroleum ether was recovered by distillation and sample dried in a moisture extraction oven at 105^{O}C for 3 hours. The same was then cooled in a desicator and weighed. The difference in weight was recorded as weight of oil and calculated as a percentage of the original sample.

(e) Crude protein content

Two grams of each sample weighed into the Kjedahl flask followed by 0.01 gram of copper sulphate and 2.5 grams of anhydrous sodium sulphate granules as catalyst. The samples on the flask were digested on a Kjedahl apparatus. A light green colour was observed after 2 hours. The heating was stopped and the content (digest) in the flask changed from green to colourless. The flasks were placed in the chamber, covered with cotton wool, and allowed to cool. Later, the digests were transferred into the 100ml volumetric flask, and the volume was made up to 100ml with distilled water.

The micro-kjedahl distillation apparatus was used in the distillation of the digest. Twenty millilitres of 2% boric acid solution was put into a 100mls conical flask and 4 drops of methyl red indicator were added in each flask. Twenty millilitres of 50% NaoH solution and distilled water were added into 25mls of the sample to be distilled. The conical flask was then fixed under the condenser of the distilling apparatus. The sample was distilled into a conical flask. The distillate was filtrated with 0.1NHCl, the titre value. The distillate was titrated with 0.1NHCl. The titration was completed when the colourless solution turned pinkish. The blank was also determined.

% Total Nitrogen = [(Titre Value – Blank) x 14 x 0.1N] / Weight of the sample

% Crude Protein = Total Nitrogen x 6.25 x 100

This value was calculated "as – is" and on dry weight basis.

(f) Crude fibre

Two grams of the dried samples were weighed into 200ml of 1.25% H_2S0_4. The content was allowed to boil for 30 minutes. Boiled samples were poured into a Buchner funnel equipped with muslin cloth and secured with elastic band. The samples were filtered in 10 minutes. The residue was washed with boiling water to free it of the digesting acid. The sample was washed with 1% HCl and then with boiling water again to free it of acid. The residue was washed twice with alcohol and petroleum ether. Then, the residue was drained and transferred to a crucible and dried in oven (80^{O}C) to a constant weight. It was cooled in a dessicator and weighed. The sample was ignited in a muffle furnace at 550^{O}C until it turned into ash. It was cooled and weighed. The loss in weight due to ignition was calculated as the percentage of weight after drying in the oven to give crude fibre content.

(g) Carbohydrate content

The carbohydrate value was evaluated by difference. This involved the subtraction from 100 the sum total (in percentage) of all the other components in the samples determined above.

(h) Viscosity determination

The viscosity of each sample was determined using the Brook Field Viscometer (L.V.F. model). The viscometer was mounted on a stand with the end of an attached fastening adjuster. The meter was preset for use by first adjusting the position of the mobile droplet until it fitted into the middle of the balancing circle. A spindle of size number 4 was fitted in, and the sample was immersed into each sample in turn until the sample covered the mark on the spindle. The viscosities of the samples were determined at 29^{O}C, 60^{O}C and 80^{O}C at the speed of 60 revolutions per minute (60 r.p.m.).

(i) Titratable acidity

The acid content of the ogi and ogi-malt blend were determined using 0.1 NaOH and phenolphthalein indicator. Ten grams of each sample was dissolved in some of distilled water and titrated with 0.1 NaOH to the end point. The acidity was expressed as percentage of lactic acid.

Lactic acid = ml. of base x N. of base x lactic acid equivalent x 100

= (ml. of base x 0.1 x 0.09 x 100% lactic acid) / 10

Sensory evaluation

The sensory evaluation was aimed at determining consumer acceptance. The quality parameters assessed were colour, flavour, texture and overall acceptability. The sensory panel was made up of 10 members, selected among workers and students of FUTO (Federal University of Technology Owerri). They were selected on the condition that they were familiar with Ogi (Akamu) and were made to work under carefully controlled conditions to avoid biased results. It was indicated that the cooling system had nothing to do with the quality of the products. A seven point hedonic scale was used in this evaluation. Here represent like extremely down to 1 (dislike extremely).

Statistical analysis

The t-test was carried out to evaluate the difference in terms of product acceptability between the two samples.

RESULTS AND DISCUSSION

Malting performance of the grain

The grain used in this study showed a sorting loss of 6.67% as removed stones, stalks, other grains and noticeable damaged corn kernels. It showed a total weight increase of 28.5% after 24 hours of steeping. After 24 hours of sprouting, during two trials, an average of 80% germination was observed (TABLE 1). The germination value increased to 90% after 48 hours, and reached an average value of 95% after 72 hours. The result length increased from a mean value of 1.11 cm after 24 hours to a value of 3.75 cm in 72 hours. At the end of 72 hours of sprouting, a mean malting loss of 0.25% was observed after during the sprouted grains.

Proximate composition of raw and malted corn flour samples

TABLE 1 : Mean values on rootlet length, percentage germination, and malting loss

Sprouting Period	Percentage Germination	Rootlet Length (cm)	Malting Loss (%)
24 hours	80	1.11	-
48 hours	90	1.75	-
72 hours	95	3.75	6.25

TABLE 2: Mean values on proximate composition of raw corn and malted corn flour samples (%)

Parameters (%)	Raw Corn	Malted Corn Flours		
		24 hours	48 hours	72 hours
Moisture Content	10.31	5.75	5.36	5.32
Crude Protein	9.40	8.97	9.00	9.31
Ash	1.31	1.25	1.23	1.19
Crude fat	3.70	2.90	3.00	3.20
Crude fibre	2.32	1.11	0.95	0.70
Carbohydrate	72.96	80.02	80.35	80.37

The data on proximate composition of the flour samples showed that but for carbohydrate, raw corn flour had relatively high values in all components analyzed (TABLE 2). The 10.31% observed for moisture content of raw corn flour is not surprising realizing that the sample was taken as it is compared to the malted samples which were dried and toasted. In this work, it was observed that the crude fibre decreased in malted samples and that the degree of the decrease, increased with sprouting period. This observation contradicted the expectation since the conversion of carbohydrates, fat and protein during sprouting should lead to higher proportion of fibre in malted samples.

The malted samples showed higher value for carbohydrates (80%) when compared to unmalted sample value (72.96%), but the observed values could be explained by the reduced proportion of the other components. The data obtained did not clearly establish any direct influence of malting on the fat, ash and protein contents of corn, though the fat content of the malted flour samples were relatively less that the value of the unmalted flour. Besides influencing the proportion of the other components in this result, there is nothing striking about the moisture content since that depends on the degree of drying instead of malting effect.

Proximate composition of traditional and experimental Ogi samples

Traditional Ogi, blended with malted corn flour had relatively, higher protein and fat content than the traditional Ogi (TABLE 3). Low protein and fat values in traditional Ogi samples could be attributed to the leaching of these components during wet sieving and press-dewatering. The slight higher value of carbohydrate (76.8%) observed in traditional ogi sample is not surprising that while ogi is almost a starch extract, malted corn flour contained bran and germ. These observations notwithstanding, it can be stated that there is no exciting difference on the proximate composition of the products.

TABLE 3 : Mean values on proximate composition of traditional and experimental Ogi samples (Dry Weight Basis)

Parameters	Ogi-Malted Blend	Ogi (Control)
Moisture	13.19	12.90
Crude Protein	7.53	5.77
Ash	0.28	0.82
Crude Fat	3.00	2.50
Crude Fibre	1.04	1.18
Carbohydrate	74.96	76.83

Viscosity of flour samples in water suspension

At the three temperature levels studied, raw flour suspension in water had higher viscosity than malted flour (TABLE 4). The viscosity of each sample increased with increase in temperature. The observation is expected since viscosity increased with degree of gelation, and gelation increases with temperature. It was observed that at the three levels of temperature studied, the viscosity of the flour suspensions decreased with increase in sprouting period. Thus, at 80^{O}C, the flour from sample sprouted for 24 hour had a viscosity value of 425 centipoise while the flour from sample sprouted for 72 hours had a mean value of 235 centipoise. Also, at 80^{O}C traditional ogi product had a mean viscosity of 680 centipoise while ogi-malted blend had a value of 450 centipoise. Lower viscosity value for malted flour suspension and products containing it might be attributed to the pre-cooking effect of the toasting process on the malt, in addition to the modification of the starch in malted grain. Based on these observations, it could be inferred that the ogi -malt product will exhibit lesser swell when prepared as porridge.

TABLE 4 : Mean viscosity values of corn flour suspensions (in centipoise)

Samples	Temperatures		
	29^{O}C	60^{O}C	80^{O}C
Raw Corn Flour	130	350	430
24-hour Malted Corn Flour	125	295	425
48-hour Malted Corn Flour	120	225	350
72-hour Malted Corn Flour	105	205	235
Ogi-Malt Blend	380	400	450
Ogi (Control)	450	560	680

Titratable acidity for traditional Ogi and Ogi-malt blend samples

Expectedly, flour samples from malted corn had higher titratable acidity than the flour from unmalted corn (TABLE 5). This is so because of the fermentation process that might have occurred during malting. This view is strongly backed by the observation that the titratable acidity values increased with increase in malting period. Traditional Ogi Product had higher titratable acidity than the experimental product. This was so because Ogi unlike unmalted corn flour, is a product of fermentation. This higher titratable acidity (1.02) of Ogi as compared to that of Ogi-malt blend (0.85) was responsible for the tart taste detected by the taste-panelist.

TABLE 5 : Mean titratable acidity values for samples

Sample	Titratable Acidity (%)
Raw Corn	0.54
24-hr Malted Flour	0.94
48-hr Malted Flour	1.05
72-hr Malted Flour	1.18
Ogi – Malt Blend	0.95
Ogi	1.02

Sensory quality of traditional and experimental Ogi (Ogi-Malt Blend) samples

There was no significant difference (<0.05) in the colours of traditional ogi and Ogi-malt blend as scored by the 10-member sensory panel (TABLE 6). Specifically, the panel indicated moderate likeness for the colour of both samples, even though the Ogi-malt blend had a light brown colour compared to the light yellow colour of the traditional Ogi. This consumer panel also observed significant differences (<0.05) in the flavour and texture of traditional and experimental Ogi samples. The flavour of the experimental sample was preferred (moderately liked = 6.4) to the flavour of the traditional Ogi sample (neither liked nor disliked = 0.4). Specifically, the malty flavour of the Ogi-malt blend attracted higher score for that product since the traditional ogi (control) had a tart (sour) taste without sugar.

In texture, the traditional ogi was more preferred (with a score of 6.2) to the experimental product which had a score of 5.4 (slightly liked). Some of the panelist commented that the consistency of the experimental product was "thin and fluidy". On the overall acceptance of the products (control and Ogi-malt blend), the experimental product was more accepted with a score of moderate likeness (6.26) as compared to a score of slight likeness (5.04) for the traditional Ogi, when the parameters were weighed according to their influence in the acceptance of the products.

TABLE 6 : Mean sensory scores of traditional and experimental Ogi samples

Parameters	Estimated Weight	Ogi-Malted Blend		Ogi	
		Raw Score	Weighted Score	Raw Score	Weighted Score
Colour	30% = 0.3	6.6[a]	1.98	6.0[a]	1.8
Flavour	50% = 0.5	6.4[a]	3.20	4.0[b]	2.0
Texture	20% = 0.2	5.4[a]	1.08	6.2[b]	1.24
	Total		6.26	-	5.04

CONCLUSIONS AND RECOMMENDATION

Addition of malted corn flour in the temperature of Ogi was effective in improving Ogi flavour. The resulting product had thinner consistency than the usual Ogi but the thickness could be improved by adjusting the added water during the preparation.

This reduction in viscosity was considered ideal for young child feeding. The reduction in viscosity of the Ogi-malt blend could be as a result of starch degradation caused by the enzymes (amylases). The action of enzymes on starch will also permit a better digestibility of the product. Lowered starch complexity and partial pre-digestion by these enzymes will help in the utilization by weaning children. The nutrient loses that were observed in the traditional Ogi and Ogi-malt blend can be minimized by reducing the steeping time, and use of minimal water in the wet sieving process.

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