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Effect of Groundnut Paste on the Quality of Maize Based *Masa*

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Abstract: The maize grains were dehulled, washed, dried and milled and sieved (flour and grit). The groundnut grain were sorted, toasted, dehulled and milled into paste. The paste was substituted (0- 50%) into the maize flour, cooked and cooled down (32°C). The resulting batter was inoculated with baker's yeast (0.5%) and allowed to ferment (12hrs), diluted with *trona*, salted, stirred vigorously to incorporate air, sized, fried to produce *masa*. The effects of the substituted groundnut paste on physical (thickness, volume, spread ratio), chemical (fat, moisture, ash, protein, carbohydrate) and sensory (colour, texture, taste, odour) qualities on the maize based *masa* were determined. The thickness, loaf volume, specific loaf volume or loaf index and the spread ratio increased from 3.40 to 3.93 cm, 100 to 148cm³, 1.16 to 1.78 and 3.17 to 3.98, respectively, while the weight decreased from 86.04 to 83.3g with increase in percentage groundnut paste. The protein, fat, carbohydrate and calorie value of the groundnut-maize enriched *masa* increased from 9.56 to 13.59%, 9.48 to 13.23% and 64.62 to 66.98% and 382.04 to 441.53 cal/g, respectively while the ash and the moisture content decreased from 2.1 to 0.8% and 14.24 to 5.54% respectively with increase in groundnut paste (0 - 50%). The average mean scores for the taste, texture and colour increased from 5.53 to 6.47, 5.22 to 6.87 and 5.15 to 6.80, respectively, with increase in the groundnut paste from 0 to 20% and decreased from thence to 6.33, 5.67 and 6.10 correspondingly with further increase of the groundnut paste to 50%.

Key words: Maize grains, groundnut grain, *masa*

Introduction

Masa is a fermented bread-like product, which is round in shape with brown smooth boy and crippling edges, made in Nigeria from millet, maize or rice flour. *Masa* (or *waina*) is like the India idle in shape and *dosa* in taste (Nkama and Malleshi, 1998) and different from the Mexican '*Masa*' used in tortilla preparation. *Masa* is a very popular staple food consumed by over 80% (by all aged groups) of the Northern Nigeria population of about 47 million (Nkama, 1993). It is also consumed in Niger, Burkina Faso and Mali (Nkama, 1998). *Masa* is prepared to create variety in cereal food products for sale. It is served as breakfast, snack item and sometimes are served with local soup. The brown crisp edges and the mild sour taste are considered by many consumers as the quality attribute required of *masa*. Though *masa* is as popular as Nigeria *ogi*, it receives very little attraction (Nkama and Malleshi, 1998).

A fairly large numbers of research works has been carried out on cereal products and its enrichment (Bacon, 1980; Badi *et al.*, 1990; Banigo, 1997; Chavon and Kadam, 1997; Desikachar, 1975; Hofvanda and Underwood, 1997; Hubbel *et al.*, 1997; Khetarpul and Chauhan, 1991; Ayo and Olawale, 2003; Ayo *et al.*, 2007; Ayo and Gafa 2002) but not much on *masa*.

Masa is consumed in various forms by all aged groups in the Northern states of Nigeria. *Masa* which results from frying of the fermented dough which is round in shape with brown smooth boy and crippling edges. The brown crisp edges and the mild sour taste are

considered by many consumers as the quality attribute required of *masa*.

Masa is a good source of income for the producers (*waina*) who prepares the traditional product on sale. The addition of cowpea, groundnut or soybeans flour into *masa* during preparation improved the nutritional quality of *masa* (Nkama and Malleshi, 1998). It serves as a breakfast and snack item. Though *masa* is as popular as Nigeria *ogi*, it has received very little attention (Okafor, 1983; Nkama and Muller, 1989).

The raw materials and ingredient including millet, rice, salt, sugar, yeast, *trona* or *mkanwa*, vegetable oil are used. The grain particularly pearl millet or maize is dehulled (rice and *acha* are used directly), washed, soaked (12hrs), dried and milled (disc attrition mill). The ground rice/maze/millet is sieved to produce flour and grits. The grits are added to boiling water and cooked to gelatinization and allowed to cool before mixing with raw flour in the ratio of 1:4. The resulting batter inoculated with bakers yeast and its allowed to ferment over night (14-16hours), salt and sugar are added to the inoculums. The fairly thick batter is then diluted with *trona* (*Kanwa* water) an the batter is stirred (vigorously to incorporate air) and fried in a cup-like depression in which oil has been added to produce *masa*.

The problem of *masa* apart from the short shelf keeping quality, is that of low protein content and inconsistency in the use of varied cereals and spices which has resulted in variations in the quality of the product. The work is a follow up of effect of different cereals on the

quality of *masa*, in which maize has been found to compared favourably with rice that has been commonly and long time used for the product. The work is aimed at assessing the effect of groundnut paste on the quality (physical, chemical and sensory) of maize based *masa*.

Materials and Methods

The groundnut seed was cleaned and roasted and grind into flour and added in varying proportion as shown in Table 1 for different formulations.

Maize (*Zea mays* L.) and active bakers yeast (*Saccaromyces cerevesiae*) used for the work were purchased from Jos Central Market, Plateau State. *Kanwa* or *trona* (Sodium bicarbonate) was purchased from Yelwa Market, Bauchi State, Nigeria. The recipe for production of *masa* is shown in Table 1. The maize grain was cleaned, washed, dry, milled, sieved into grits and flour. The maize grits (1/4 portion) was cooked and cooled down (32°C), mixed with the maize flour (¾ portion). The resulting batter was inoculated with bakers yeast (1.0%) and allowed to ferment overnight (12hours at room temperature 32°C). The fairly thick batter was then diluted with 10cm³ *trona* solution (20%). Salt (pitch) and sugar (6%) was added to the batter, stirred vigorously (using a mortar and pestle to incorporate air) and fried (in a local clay pot with individual cuplike depression in which 12cm³ oil has been added). The batter was fried for 4 minutes on one side, then turned with a small spoon and the other side fried (frying time varies from 6 to 8 minutes) to produce *masa*.

The thickness and width of the *masa* ball was measured using micrometer and ruler, respectively. The loaf volume was determined using seed-displacement method (Ayo, 2003), while the loaf volume was

calculated by dividing the loaf volume by the weight of the *masa* (Gomez, 1997). The chemical quality (moisture, fat, protein, ash and carbohydrate) were determined (AOAC, 1990). The calorie was calculated by multiplying the nutrient content by factors 4, 4 and 9 for carbohydrate, protein and fat respectively. The sensory qualities of the *masa* were later subjected to sensory evaluation by 20 untrained panelists (students and staff) from the polytechnic community. Attributes assessed include flavour, taste, colour, texture appearance and the overall acceptability of *masa* using Nine Hedonic scale (1 and 9 for extremely dislike and extremely like, respectively). The data collected were analyzed using ANOVA method (Ihekoronye and Ngoddy, 1985).

Results and Discussion

Effects on Physical Qualities of Maize based *masa*:

The effect of groundnut paste on the physical quality of maize based *masa* are summarized in Table 2. The thickness, loaf volume, specific loaf volume or loaf index and the spread ratio increased from 3.40 to 3.93cm, 100 to 148cm³, 1.16 to 1.78 and 3.17 to 3.98, respectively, while the weight decreased from 86.04 to 83.3g with increase in the percentage of added groundnut paste (0-50%). The increase in the thickness, specific loaf and spread ratio could be due to the increase in the protein and fat content with added groundnut paste. This agreed with the finding of Fennema (2001); Woodroof (1966); Banigo (1997); Ayers and Davenport, 1997; Nkama (1993) that plant protein has high foaming capacity which could give their products an advantage of rising or spreading. Fats, particularly from plant sources has been noted to improve the spreading ratio of their food products commonly in baking and toasting treatment (Woodroof, 1966; Kent, 1984; Ihekoronye and Nggody, 1985; Nkama, 1993). The addition of *trona* (Sodium bicarbonate) has been noted to assist leavening and sponginess of the *masa* (Nkama, 1993). The decrease in the weight of the *masa* with addition of groundnut paste could be due to increase in the oil content in the paste which has been proofed to be relatively lighter.

Effect of groundnut concentrate on the chemical qualities of maize based *masa*:

The effect of groundnut paste on the chemical quality of *masa* is summarized in

Table 1: Recipe for production of groundnut-maize enriched *masa*

Raw Materials	Sample						
	A	B	C	D	E	F	G
Maize /millet	500	500	500	500	500	500	500
Groundnut seed	0	25	50	75	100	125	250
Water	600	600	600	600	600	600	600
Sugar	30	30	30	30	30	30	30
Trona	10	10	10	10	10	10	10
Yeast	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Frying oil	12	12	12	12	12	12	12
Salt	Pinch	Pinch	Pinch	Pinch	Pinch	Pinch	Pinch

Table 2: Effect of groundnut on the physical quality of maize *masa*

Maize Grit/ flour%	Ground nut %	Thickness (cm)	Weight (g)	Loaf volume (cm)	Loaf volume index (cm ³ /g)	Spread ratio
100	0	3.40±0.8 ^c	86.04±4.5 ^c	100±6.2 ^d	1.16±0.2 ^e	3.17±0.8 ^d
95	5	3.48±0.3 ^{bc}	85.6±4.3 ^{bc}	110±5.2 ^{cd}	1.29±0.3 ^e	3.37±0.4 ^c
90	10	3.56±0.8 ^b	84.0±5.2 ^{bc}	120±4.3 ^c	1.43±0.3 ^e	3.48±0.5 ^c
85	15	3.58±0.2 ^b	83.9±2.4 ^b	132±5.4 ^b	1.57±0.1 ^b	3.61±0.5 ^b
80	20	3.63±0.4 ^b	83.6±2.1 ^b	138±8.3 ^b	1.65±0.4 ^b	3.78±0.2 ^b
75	25	3.70±0.4 ^b	83.5±3.4 ^b	145±4.6 ^b	1.73±0.4 ^b	3.84±0.3 ^{ab}
50	50	3.74±0.3 ^a	83.3±3.2 ^a	148±6.4 ^a	1.78±0.2 ^a	3.86±0.4 ^a

Mean score having the same alphabet along the same column are not significantly different p = 0.05.

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Table 3: Effect of ground on the chemical quality of maize *masa*

Maize %	Ground nut %	Protein (%)	Fat (%)	Ash (%)	Moisture (%)	Carbohydrate (%)	Calorie (Cal/g)
100	0	9.56±1.2 ^c	9.48±0.6 ^c	2.1±0.2 ^a	14.24±2.1 ^a	64.62±5.3 ^a	382.04
95	5	9.79±0.5 ^c	9.69±0.8 ^c	1.9±0.4 ^a	13.4±1.4 ^a	65.22±6.2 ^a	387.25
90	10	10.06±1.3 ^{bc}	9.90±0.9 ^c	1.76±0.2 ^{ab}	11.8±1.3 ^b	66.48±4.2 ^a	395.26
85	15	10.28±0.7 ^b	10.15±1.2 ^{bc}	1.62±0.5 ^b	10.5±0.9 ^b	67.45±3.2 ^a	402.27
80	20	10.56±1.0 ^b	10.43±1.3 ^b	1.46±0.3 ^b	9.6±0.5 ^{bc}	67.95±4.2 ^a	407.82
75	25	11.06±1.3 ^b	10.73±0.8 ^b	1.23±0.1 ^c	8.3±0.5 ^c	68.68±5.2 ^a	415.53
50	50	13.59±0.8 ^a	13.23±0.8 ^a	0.8±0.2 ^d	5.4±0.2 ^d	66.98±2.3 ^a	441.53

Mean score having the same alphabet along the same column are not significantly different p = 0.05.

Table 4: Effect groundnut paste on the sensory quality of maize based *masa*

Maize Grit/flour (%)	Groundnut Paste (%)	Taste	Texture	Colour	Odour	Appearance	General Acceptability
100	0	5.53±1.30 ^c	5.77±1.43 ^b	5.13±1.30 ^d	5.93±1.16 ^b	5.80±1.52 ^d	6.07±1.03 ^d
95	5	5.60±1.59 ^c	5.87±0.99 ^b	5.53±0.99 ^c	5.93±1.16 ^b	6.20±0.91 ^c	6.30±1.35 ^c
90	10	5.93±1.48 ^b	6.20±1.01 ^{ab}	6.03±0.99 ^b	5.67±1.67 ^b	6.67±0.74 ^b	6.27±1.16 ^c
85	15	6.37±1.22 ^a	6.73±0.81 ^a	6.53±0.91 ^a	6.47±1.30 ^{ab}	6.97±0.99 ^b	6.73±1.16 ^b
80	20	6.47±1.30 ^a	6.87±1.30 ^a	6.60±1.24 ^a	6.73±1.17 ^a	7.04±0.96 ^a	7.13±1.10 ^a
75	25	6.33±0.72 ^a	6.33±0.61 ^a	6.70±0.56 ^a	6.70±0.75 ^a	7.10±0.67 ^a	6.90±0.67 ^a
50	50	6.02±0.59 ^b	5.67±0.70 ^b	6.10±0.77 ^b	5.87±0.91 ^b	6.30±0.65 ^c	5.98±0.74 ^d

Mean score having the same alphabet along the same column are not significantly different p = 0.05.

Table 3. The protein, fat, carbohydrate and calorie value of the groundnut-maize enriched *masa* increased from 9.56 to 13.59%, 9.48 to 13.23% and 64.62 to 66.98%, and 382.04 to 441.53 cal/g, respectively while the ash and the moisture content decreased from 2.1 to 0.8% and 14.24 to 5.54%, respectively, with increase in groundnut paste (0- 50%). The increasing effect of the groundnut paste on the protein and fat was significant, p =0.05. The increase could be due to added groundnut paste which has been proved to contain high quantity of protein(36-40%) and fat(24-36%)(Ayers and Davenport 1997; Nkama 1993; Ihekoronye and Ngoody 1985).

Groundnut-maize enriched *masa* could be a source of protein to the consumer particularly in a developing country like Nigeria where cost of feeding on animal source of protein is unaffordable. The high calorie content of groundnut-maize *masa* could be due to the high fat content of the added paste.

Effect of groundnut concentrate on the sensory qualities of maize based *masa*: The effect of the added groundnut paste to the maize based *masa* is summarized in Table 4. The average mean scores for the taste, texture and colour increased from 5.53 to 6.47, 5.22 to 6.87 and 5.15 to 6.80, respectively, with increase in the groundnut paste from 0 to 20% and decreased from thence to 6.33, 5.67 and 6.10 correspondingly with further increase of the groundnut paste to 50%. The average means score of the odour and appearance increased from 5.80 to 6.7 and 5.80 to 7.10, respectively, with increase in the groundnut paste from 0 to 25% and then decreased to 5.87 and 6.30 correspondingly. The effect of the groundnut paste on the assessed qualities is significant at above 25%, p = 0.05, and is poorly

acceptable. The general acceptance quality evaluation showed the maximum acceptability of the product at 20% groundnut paste enrichment. The general acceptable improvement on the assessed quality up to 25% could be due to combined effects of fermentation by-products (Kordylas, 1990) and interactive effect of groundnut protein and the carbohydrate content of maize flour at the high temperature of frying (Fennema, 2001).

Conclusion: The research has shown that maize based *masa* can be enriched acceptably with respect to sensory quality, up to 25% groundnut paste, with corresponding increase of the nutrient content from 9.56-11.06% (19.87% increase), 9.48-10.73% (13.18% increase), 64.62 to 68.68% (6.28% increase) and 382.04 to 441.53 cal/g (15.57% increase) for protein, fat, carbohydrate and calorie, respectively. It could therefore be inferred that the acceptance of groundnut-maize based *masa* by the populace could improve their protein and fat intake.

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