

Effect of Different Cereals on the Quality of *Masa*

J.A. Ayo, H. Agu and O.F. Famoriyo

Department of Food Science and Technology, The Federal Polytechnic, Bauchi, Nigeria

Abstract: The pearl millet and maize grains were dehulled, washed, dried and ground while the rice grain was ground using disc attrition grinder. The powdered grain is sieved to produce flour and grit which is added to boiling water and cooked before mixing with the raw flour in the of 1:2. The resulting batter is inoculated with baker's yeast and allowed to ferment (14-16hrs), diluted with trona (kanwa water), salted, stirred vigorously to incorporate air, sized, fried in little oil (3mins on one side, then turned) to produce *masa*. The *masa* (rice, maize and millet based) were analysed for physical (thickness, volume, spread ratio), chemical (fat, moisture, ash, protein, carbohydrate) and sensory (colour, texture, taste, odour) qualities. The dimension of *masa* ranged from 8.40 to 8.97cm in diameter, 2.70 to 3.10cm thickness, 79 to 88.9g weight, 115.57 to 130.35cm³ loaf volume and 1.30 to 1.67 loaf volume index. The proximate composition of the *masa* samples range from 7.59 to 9.21% for protein, 8.82 to 9.60% for fat, 1.8 to 2.1% ash, and 75.16 to 76.99% carbohydrate. The sensory quality means scores range from 5.27 to 8.4 for taste, 6.67 to 8.82 for texture, 5.60 to 7.87 for odour, 2.53 to 8.80 for colour, 6.27 to 8.67 for appearance and 5.27 to 8.67 for general acceptability. Generally maize based *masa* compare favourably with rice based which has been the commonly used cereal for the production.

Key words: *Masa*, cereals, pearl millet, maize grains

Introduction

Masa (waina) is a fermented puff batter or bread like of rice or maize cooked in a pan with individual cuplike depression. *Masa* (or waina) is like the India idle in shape and *dosa* in taste (Nkama *et al.*, 1998) and different from the Mexican '*Masa*' used in tortilla preparation. *Masa* is a very popular staple food consumed by over 80% 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 for sale; it serves as breakfast and snack item. 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 (Bacon, 1980; Badi *et al.*, 1990; Banigo, 1997; Chavon and Kadam, 1997; Desikachar, 1975; Hofvanda and Underwood, 1997; Hubbel *et al.*, 1997; Khetarpaul and Chauhan, 1991) 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 top 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 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 (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/maize/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 inconsistency in the use of varied cereals and spices which has resulted in variations in the quality of the product.

The aim of the work is to asses the effect of different types of cereals on the quality of *masa*.

Materials and Methods

Raw rice (*Oryza Sativa* L.), pearl millet (*Pennisetum americanum*), maize (*Zea mays* L.) and active bakers yeast (*Saccaromyces cerevesiae*) used for the work were purchased bulk from Jos Central Market, Plateau State. *Kanwa* or *trona* (Sodium bicarbonate) was purchased

Ayo et al.: Effect of Different Cereals on the Quality of *Masa*

Table 1: Recipe for *masa* production

Raw	Samples		
	A	B	C
Materials (g)			
Rice(g)	500	-	-
Millet(g)	-	500	-
Maize(g)	-	-	500
Water(cm)	600	600	600
Sugar(g)	30	30	30
*Trona(cm)	10	10	10
Yeast(g)	5	5	5
Frying oil(cm)	12	12	12
Salt	Pinch	Pinch	Pinch

* 20% solution of Trona.

from Yelwa Market, Bauchi State, Nigeria. The recipe for production of *masa* is shown in Table 1. Raw milled rice was cleaned, washed, soaked (for 12 hours at 34°C), ¼ of the rice was cooked and mixed with the ¾ portion (milled into powder). The resulting batter was inoculated with bakers yeast (1.0%) and allowed to ferment overnight (14-16 hours at room temperature 38°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 et al., 1997). The chemical quality (moisture, fat, protein, ash and carbohydrate) were determined (AOAC, 1990). The sensory qualities of the *masa* were later subjected to sensory evaluation by 20 untrained panellists (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 analysed using ANOVA method (Ihekoronye and Ngoddy, 1985).

Results and Discussion

Effect of different cereals on the physical quality of *masa*:

The effect of different type of cereal grain (rice, maize and millet) on the physical quality of *masa* is summarized in Table 2. The average thickness and length of the rice, maize and millet grains based *masa* were 3.10 and 8.53, 3.43 and 8.97 and 2.70cm and 8.40, respectively. The average loaf volumes of the rice, maize and millet based *masa* were 130.4, 129.5 and 115.6cm³, with a corresponding index of 1.65, 1.59 and 1.30,

Table 2: Effects of different cereals on the physical qualities of *masa*

Parameters	Rice	Maize	Millet
Thickness (cm)	3.10±0.3 ^a	3.43±0.6 ^a	2.70±0.7 ^b
Length (cm)	8.53±0.2 ^b	8.97±0.2 ^a	8.40±1.2 ^b
Weight (g)	79.0±9.2 ^b	81.4±0.4 ^b	88.9±6.3 ^a
Loaf volume (cm)	130.4±5.6 ^a	129.5±0.3 ^a	115.6±8.2 ^b
Loaf volume index(cm ³ /g)	1.65±0.2 ^a	1.59±0.2 ^a	1.30±0.4 ^b

respectively. There were no significant difference in the length, volume and volume index of rice and maize based *masa*. The none significance differences, p = 0.05, could be due to similarity in the molecular weight and structures of carbohydrates which are the principal functions of volume development during fermentation (Chavon and Kadam, 1997).

Effect of different cereals on the chemical quality of *masa*:

The effect of different types of cereal grains (rice, maize and millet) on the chemical quality of *masa* are summarized in Table 3. The average protein content of *masa* produced from rice, maize and millet are 8.59, 9.60 and 9.21%, respectively. The relative difference could be due to the chemical composition of the raw materials (cereal). Protein is found in all tissue of cereal grains but the concentration varies from grain to grain (Kent 1984). Rice grain has protein content of 6.8-8.0% while maize and millet have protein content of 9-10% (Kent, 1984; Ihekoronye and Ngoddy, 1985) which is in agreement with the observations.

The average ash (mineral) and fat content of *masa* produced from rice, maize and millet were 1.8 and 9.82, 2.0 and 9.47 and 2.1 and 9.60% respectively. The relatively higher ash content in the respective *masa* could be due to the addition of trona and salt added during production. The relatively high fat content despite the low fat/ oil level of the raw material (cereal) could be due the oil used in toasting with its tendency of been absorbed by the batter. The relatively high oil content in *masa* could endanger the keeping quality of the product, which could be related to the short shelf life of the products as observed by Nkama (1993,1998).

The average moisture contents were 14.80, 13.81 and 12.4% for rice, maize and millet based *masa*, respectively. The cereal based *masa* are relatively high in moisture content which could encourage growth of microbes (Okaka, 2005) within short time. The carbohydrate contents were 64.99, 65.16 and 66.66% for rice, maize and millet based *masa*, respectively. There is no significant deference between the carbohydrates of the cereal based *masa*, p=0.05. The relatively high carbohydrate content could make the product of significant source of energy to the consumers.

The effect of different cereal on the sensory quality of *masa*:

The effects of rice maize and millet in the sensory quality of *masa* are summarized in Table 4. The average means score for taste of *masa* produced from rice,

Ayo et al.: Effect of Different Cereals on the Quality of Masa

Table 3: Effect of different cereal on the chemical qualities of *masa*

Sample	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	CHO (%)	Calorie Kcal/100g
Rice	14.8±0.7	7.59±0.5 ^b	9.82±.8 ^b	1.8±01 ^b	66.99±5.3 ^a	387.70 ^a
Maize	13.81±0.4	9.56±0.4 ^a	9.47±0.4 ^a	2.0±0.3 ^a	65.16±6.1 ^a	384.11 ^a
Millet	12.43±1.2	9.21±0.7 ^a	9.60±0.6 ^a	2.1±0.2 ^a	66.66±6.4 ^a	412.28 ^a

Table 4: Effect of different cereals on the sensory qualities of *masa*

Raw Materials	Taste	Texture	Odour	Colour	Appearance
Rice	8.40±.507 ^a	8.02±.676 ^a	7.87±.640 ^a	8.80±.414 ^a	8.67±.488 ^a
Maize	8.07±.704 ^a	7.87±.95 ^a	6.80±.561 ^b	8.40±.507 ^a	8.40±.507 ^a
Millet	5.27±.799 ^b	6.67±.90 ^b	5.60±1.056 ^c	2.53±1.302 ^b	6.27±.961 ^b

Mean score having the same alphabet along the same column are not significantly different $p = .05$

maize and millet were 8.40, 8.7 and 5.70 respectively. There was no significant difference ($p = 0.05$) between rice and maize in terms of taste. Rice had the highest (8.40) means score for taste and the reason could be because rice is commonly used for the production of *masa* millet was poorly accepted.

The average means score for texture of *masa* produced from rice, maize and millet were 8.20, 7.87 and 6.67 respectively. Low fibre content of flours generally has been observed to improve baking quality of the baked products which could be the reason for the rice based *masa* with 0.7% fibre content. Maize and millet with relatively higher fibre content of 1.2 and 3.0% respectively. Kordylas (1990) have been found to have poor texture quality.

The average mean score for odor of *masa* from rice, maize and millet were 7.87, 6.80 and 5.60 respectively. There were significant different between this cereal based grains with rice having the highest (7.87) and this reason could be due to the adaptability of the consumers to the rice based *masa*

The average mean score for colour of *masa* produce from rice, maize and millet were 8.80, 8.40 and 2.53 respectively. There were no significant difference ($p = 0.05$) between rice and maize in terms of colour. The significant differences of millet based *masa* could be due to the presence of colouring pigment which is inherent in millet flour.

The average mean score for appearance of *masa* produced were rice (8.67), maize (8.40) and millet (6.27). There were no significant difference between rice and maize the reason could be that *masa* produced from rice and maize are alike in appearance while millet looks different (in term of colour).

There was significant difference for general acceptability. The coverage men score for rice; maize and millet were 8.67, 8.13 and 5.27 respectively. Maize was the next cereal grain accepted while millet was poorly accepted.

Conclusion

Rice, maize and millet can be used to produce *masa*. However, there is no significant difference in both the physical, chemical and sensory quality of rice and maize

based *masa* but there is slight difference with that of millet. It can therefore be said that maize could substitute the relatively costly and highly demanded rice in the production of *masa*. The adoption of maize in the production of *masa* will fairly increase the protein content from 7.59 to 9.56% (an increase of 1.97%). Because of the relatively cheap price of maize (1kg of maize is N50.00 and rice of the same quantity is N150.00), maize based *masa* could be cheaper and affordable by the masses.

References

- AOAC, 1990. Official method of Analysis, 14th Edn. Association of Official Analytical Chemists. Washington D.C.
- Ayo, J.A., 2003. Effect of Ammanranthus grains flour on the quality of Biscuits. Int. J. Food Properties, 3: 45-52.
- Bacon, S., 1980. Faccal markers in metabolic balance Studies. Plant Food and Hum. Nutr., 34: 445-9.
- Badi, S., B. Pederson, L. Monowar and B.O. Eggum, 1990. The nutritive value of new and traditional sorghum and millet foods from Sudan; Plant Food for Hum. Nutr., 40: 5-19.
- Banigo, E.B., 1997. Physico Chemical and Nutritional evaluation of protein. Enriched fermented flour. Nig. Food J., 5: 30.
- Chavon, J.K. and S. Kadam, 1997. Nutritional improvement of Cereal by fermentation Crit. Rev. Food Sci. Nutr., 28: 349-400.
- Desikachar, H.S., 1975. Processing of Maize Sorghum and Millet for Food Uses. J. Sci. Industrial Res., 34: 231.
- Gomez, M.I, A.B. Obilatan, D.F. Martin, T. Madzvamase and E.S. Manyo, 1997. Grain Quality Evaluation In: Manual of Laboratary Procedure for quality Evaluation of Sorghum, and Pearl Millet. Tech. Manual No. 2 International Crop Institute for Semi Arid Crops (ICRISAT).
- Hofvanda, Y. and B.A. Underwood, 1997. Processed supplementary foods for Infants and young children with special reference to developing countries. Food Nutr. Bull., 87, 9: 3-9.

Ayo et al.: Effect of Different Cereals on the Quality of *Masa*

- Hubbel, R.B., L.B. Mendel and A.J. Wakeman, 1997. A new salt mixture for use in experimental diet. *J. Nutr.*, 14: 273-85.
- Ihekoronye, A.I and P.O. Ngoddy, 1985. *Integrated Food Science and Technology for the Tropics*, Macmillan Publishing Limited, London and Basinstoke, pp: 223-5.
- Kent, N.L., 1984. *Technology of Cereal*. Pergon Press. 4th Edn. Published by Pergamon Press Oxford. New York., pp: 134-135.
- Khetarpaul, N. and B.M. Chauhan, 1991. Biological utilization of pearl millet flour fermented yeast *Lactobacilli*. *India. Plant Food for Hum. Nutr.*, 14: 309-19.
- Kordylas, J.M., 1990. *Processing and Preservation of Tropical and Sub-tropic Foods*, Published by Macmillan Education London and Basinstoke., 96: 199-208, 210-213.
- Nkama, I., 1993. *Studies on Improving the Nutritional Quality of Masa*. Tradition Nigeria fermented Cereal-based food. A report. United Nations University CFTRI, Mysore India.
- Nkama, I., 1998. Production Utilization and Research Properties. Traditional food preparation of Pearl millet in Nigeria Agriculture. Proceedings of the pre-season National coordination and planning meeting of the national coordinated Research Programme in Pearl millet, Maiduguri, 21-24 April, 1997. Emechebe, A.M. Ikwelle M.C., Ajayi O. Aminu-Kano M. and Auaso A.B., (Eds) Lake Chad Research Institute, Maiduguri Nigeria.
- Nkama, I. and N.G. Malleshi, 1998. Production and nutritional quality of traditional *Masa* form mixture of rice, pearl millet, cowpea and groundnut. *Food Nutr. Bull.*, 19: 336-373.
- Nkama, I. and H.G. Muller, 1989. Description and Evaluation of Husk from Dehulled Rice contaminated with Aflatoxin. *J. Food Agric.*, pp: 46-311.
- Okaka, J.C., 2005. *Food Composition Spoilage Shelf life Extension*. OCJ Academic Publishers. Enugu Nig., pp: 31-51.