Effect of Different Cereals on the Quality of Masa

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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 ratio 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, 115.67 to 130.35cm² 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 Ogis, it receives very little attraction (Nkama and Malleshi, 1998).

A fairly large numbers of research works has been carried out on cereal products (Bacon, 1960; Badi et al., 1990; Banigo, 1997; Chavon and Kadam, 1997; Desikachar, 1975; Hofvanda and Underwood, 1991; 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 boy and crisp 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 mkana, 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 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 (Saccharomyces cerevisiae) used for the work were purchased bulk 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. Raw milled rice was cleaned, washed, soaked (for 12 hours at 34°C), ¾ of the rice was cooked and mixed with the ¼ portion (milled into powder). The resulting batter was inoculated with bakers yeast (1%) and allowed to ferment overnight (14-16 hours at room temperature 36°C). The fairly thick batter was then diluted with 10 cm³ 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 12 cm³ 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 5 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 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 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 2.70 cm and 8.40, respectively. The average loaf volumes of the rice, maize and millet bases masa were 130.4, 129.5 and 115.6 cm³, with a corresponding index of 1.65, 1.59 and 1.30, 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 Kadarm, 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,
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Table 3: Effect of different cereal on the chemical qualities of masa

<table>
<thead>
<tr>
<th>Sampless</th>
<th>Moisture (%)</th>
<th>Protein (%)</th>
<th>Fat (%)</th>
<th>Ash (%)</th>
<th>CHO (%)</th>
<th>Calorie Kcal/100g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>14.3±0.7</td>
<td>7.56±0.51</td>
<td>9.82±.8</td>
<td>1.8±0.1</td>
<td>66.99±5.3</td>
<td>367.70</td>
</tr>
<tr>
<td>Maize</td>
<td>13.8±0.4</td>
<td>9.56±0.41</td>
<td>9.47±0.4</td>
<td>2.0±0.3</td>
<td>65.16±6.1</td>
<td>384.11</td>
</tr>
<tr>
<td>Millet</td>
<td>12.4±0.3</td>
<td>9.2±0.71</td>
<td>9.60±6.6</td>
<td>2.1±0.2</td>
<td>68.86±6.4</td>
<td>412.28</td>
</tr>
</tbody>
</table>

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. Maze 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 8.60, 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**


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