Functional and Pasting Properties of Maize ‘Ogi’ Supplemented with Fermented Moringa Seeds

Jude-Ojei BS1, Lola A2*, Ajayi IO3 and Ilemobayo Seun2

1Department of Nutrition and Dietetics, Rufus Giwa Polytechnic, Owo Ondo State, Nigeria
2Department of Food Science and Technology, Rufus Giwa Polytechnic, Owo Ondo State, Nigeria
3Department of Science Laboratory Technology, Rufus Giwa Polytechnic, Owo Ondo State, Nigeria

Abstract

The process of Ogi production results in remarkable nutrient loss, Moringa seed flour, rich in micronutrients and vitamins, could increase the micronutrient and macronutrient contents of ogi. This study aimed at evaluating the functional and pasting properties of ‘ogi’ supplemented with fermented Moringa seeds. Moringa seeds were de-feathered and fermented for 48 h, dried and milled into flour. Maize ‘ogi’ was produced following traditional methods. Maize-Moringa Ogi was formulated by mixing the samples in ratio 90:10, 80:20 and 70:30 while 100% maize and 100% Moringa flour serves as control. The functional properties, shows that the swelling capacity ranged between (0.94 ml to 0.74 ml), water absorption (18 ml to 13 ml) and bulk density (0.66 g/ml to 0.36 g/ml), and the least gelation for 10% to 30% Moringa seed inclusion results showed no gelation at 2%, 4%, 6% and 8%, weak gel at 10%, 12%, 14% and 16% and strong gel at 18% and 22%. In pasting properties, the result of peak viscosity of the samples ranged between (3552.67 RVA to 15.00 RVA), trough (1842.33 RVA to 8.50 RVA), breakdown (1717.33 RVA to 7.00 RVA), final viscosity (3926.67 RVA to 12.00 RVA), set back (2084.67 RVA to 4.00 RVA) and peak time (5.00 to 4.47 min). The addition of Moringa seed flour to maize-ogi reduced the functional and pasting properties.

Keywords: ‘Ogi’, Moringa; Pasting properties; Functional properties

Introduction

Ogi a fermented gruel from cereal has been recognized as the most popular traditional health-sustaining fermented food in Western Nigeria. It is commonly used as weaning food, food for convalescence, young children and as a standard breakfast cereals in many homes. Ogi usually has smooth texture and is boiled into porridge called pap or cooked and turned into a stiff gel called “agidi” or “eko” prior to consumption [1].

Traditional preparation of ‘ogi’ involved washing, steeping, milling, sieving, fermentation and drying. During these processes, nutrients including protein and minerals are lost from the grains thereby affecting nutritional quality adversely [2,3]. Various studies have been carried out to improve the nutritional value of ‘ogi’ by fortifying it with either plant protein (melon, okro, cowpea, and soybean) or animal protein and minerals are lost from the grains thereby affecting nutritional quality adversely [2,3]. Various studies have been carried out to improve the nutritional value of ‘ogi’ by fortifying it with either plant protein (melon, okro, cowpea, and soybean) or animal protein sources (egg and milk) [4,5]. The application of Moringa for this purpose is however limited to the leaves [6]. Moringa oleifera is known by different names such as benzolive, drumstick tree, kelor, marango, mlonge, mulangay, nébéday, saijhan, and sajna across many regions. It is the most widely cultivated species of a monogeneric family, the Moringaceae, which is native to the sub-Himalayan tracts of India, Pakistan, Bangladesh and Afghanistan. All the parts of the tree have been reported to be edible and are consumed in many parts of the world [7]. Moringa oleifera will be one of the alternatives to most imported food supplies in the treatment of malnutrition. The diet of many rural and urban dwellers is deficient in protein and high in carbohydrate. The plant seeds contain hypotensive activity, strong antioxidant activity and chelating property against arsenic toxicity [8-11]. Seed flour from Moringa oleifera is widely used as a natural coagulant for water treatment in developing countries [11]. It has an impressive range of medicinal uses with high nutritional quality.

When starch-based foods are heated in an aqueous environment, they undergo a series of changes known as gelatinization and pasting. These are two of the most important properties that have effect on quality and aesthetic concerns in the food industry, since they affect texture and digestibility as well as the end use of starchy foods [12]. The aim of this paper therefore is to determine how the addition of fermented Moringa seed will affect the functional and pasting properties of maize ‘ogi’.

Materials and Methods

Materials

‘Swan’ maize used in this research was purchased from let’s farm Agric input store, Akure, Ondo State, Nigeria. The grains were dry when purchased and the Moringa seeds were harvested from the School experimental farm.

Methods

Preparation of Moringa flour: Fermentation of the seeds was achieved by soaking in water and allowed to ferment for 2 days at ambient temperature. Fermented samples were dried at 30°C ± 5°C until constant moisture content was obtained. The dried samples were milled using disc milling machine. The milled samples were kept in air tight plastic container until needed.

Preparation of Maize ‘ogi’ flour: The method described by Akingbala [2] was used for ‘ogi’ manufacture. Maize grain (1 kg) was soaked in water for 48 h. The grain was milled with attrition mill at medium speed for 7 min. The slurry was passed through muslin cloth and the suspension obtained was left to stand for 48 h for the ‘ogi’ to sour, the supernanant was decanted to be able to collect the ‘ogi’. ‘Ogi’...
Table 1: Functional properties of maize-'ogi' supplemented with fermented Moringa seed.

<table>
<thead>
<tr>
<th>Level of substitution</th>
<th>Swelling capacity (g/ml)</th>
<th>Water absorption (ml)</th>
<th>Bulk density (g/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% maize-'ogi'</td>
<td>0.94a</td>
<td>18b</td>
<td>0.66</td>
</tr>
<tr>
<td>10% FMOSD</td>
<td>0.89c</td>
<td>16c</td>
<td>0.57</td>
</tr>
<tr>
<td>20% FMOSD</td>
<td>0.86c</td>
<td>19c</td>
<td>0.57</td>
</tr>
<tr>
<td>30% FMOSD</td>
<td>0.84c</td>
<td>14d</td>
<td>0.55</td>
</tr>
<tr>
<td>100% Moringa</td>
<td>0.74d</td>
<td>13d</td>
<td>0.36</td>
</tr>
</tbody>
</table>

Key FMOSD: Fermented Moringa 'Ogi' Seed

Determination of pasting properties

The pasting profile of the samples was studied using a rapid Visco-Analyzer (RVA) (Newport Scientific Pty. Ltd) with the aid of a thermocline for windows version 1.1 [16]. The RVA was connected to a PC where the pasting properties and curve were recorded. Sample suspension was then prepared by addition of the equivalent weight of 3.0g dry starch to distilled water to make a total weight of 28.0 g suspension in the RVA sample canister.

Data Analysis

Data collected were statistically analyzed with the Statistical Analysis Systems (SAS) package (version 8.2 of SAS institute Inc, 1999) [17]. Statistically significant differences (p ≤ 0.05) in all data were determined by general linear model procedure (GLM) while least significant difference (LSD) was used to separate the means. Correlation coefficient between variables was obtained using Pearson correlation coefficient analysis.

Results and Discussion

The result of the functional properties of maize-'ogi' supplemented with mature Moringa seed is presented in Table 1. The results show that there was gradual decrease in the level of water absorption capacity and bulk density as the addition of Moringa seed flour increases. These compared favorably with the result obtained by substituting 'ogi' with bambara-nut flour by Theodore et al. [18], the decrease in water absorption capacity contents is in line with a conclusion made by Theodore et al. [18], which states that a weaning food should have low water absorption capacity and bulk density in order to have high energy density food which are more suitable as weaning food.

According to Omueti et al. [19] lower water absorption capacity is desirable for making thinner gruels with high caloric density per unit volume. Also, according to Oluoha [20] low bulk density is an advantage because high bulk limits the caloric and nutrient intake per feed per child and infants sometimes are unable to consume enough to satisfy their energy and nutrient requirements. Swelling capacity which is the measure of the ability of starch to imbibe water and swell, ranged from 0.74 to 0.94. The 100% ‘ogi’ sample had the highest value (0.94), while the 100% of Moringa sample had the lowest (0.74). The mixed samples had significant different swelling capacity. The swelling index of granules reflects the extent of associative forces within the granules as reported by Sanni et al. [21]. The swelling capacity of the supplemented sample indicated that the associative forces within their granules were not strongly bonded.

Results of least gelation properties of maize ‘ogi’ supplemented with mature Moringa seed is presented in Table 2. Maize-’ogi’ formed weak gel between 6% and 10% concentration while a strong gel was at 12% concentration and 100% Moringa formed no gel in all the concentration. Maize-Moringa ‘ogi’ samples at the 10%, 20%, 30% level of Moringa seed substitution formed a weak gel between 10% and 16% concentrations. A strong gel was however, formed at 18% concentration. Yadav [22] observed that the variation in the gelling properties of flours could be attributed to the relative ratio of protein, carbohydrates and lipids that makes up the flours and the interaction between the components. From this result, Food prepared from maize ‘ogi’ substituted with fermented Moringa seed will contain more food and therefore nutrients than food produced from 100% maize-‘ogi’.

The result of the pasting properties of maize ‘ogi’ supplemented with mature Moringa seed is presented in Table 3. From this result, the peak viscosity of the ‘ogi’ samples ranged between 15.00 RVA and...
The 100% ‘ogi’ sample had the highest peak viscosity while 100% Moringa seed flour has the lowest. The peak viscosity in the ‘ogi’ samples reduced with increase in the level of substitution with fermented Moringa seed. This is an indication that fermented Moringa seed flour has no ability to gel. This trend was also observed in some of the earlier studies [4,23,24] on the substitution of ‘ogi’ with okra seed flour and in the study of Theodore et al. [18] on the substitution of ‘ogi’ with Bambara-nut. Two factors interact to determine the peak viscosity of cooked starch paste: the extent of granule swelling (swelling capacity) and solubility. Higher swelling index is indicative of higher peak viscosity while higher solubility as a result of starch degradation results in reduced paste viscosity.

The trough of the ‘ogi’ samples ranged between 8.50 RVA and 1842.33 RVA. 100% ‘ogi’ sample had the highest value of 1842.33 RVA while 100% Moringa had the lowest value of 8.50 RVA. The trough which shows the holding capacity of the starch granules showed that 100% maize ‘ogi’ had superior holding capacity due to the crystalline and strength of the starch molecules in it. This implied that 100% maize ‘ogi’ has ability to withstand breakdown cooling. The breakdown viscosity value is an index of the stability of starch [25]. The value in this study ranged between 7.00 RVA and 1717.33 RVA. 100% maize ‘ogi’ had the highest value of 1717.33 RVA while 100% Moringa ‘ogi’ had the lowest value of 7.00RVA. The breakdown viscosity values for all the samples were lower than the peak viscosity values and this is altered by nature of the material, degree of mixing, the temperature used and shear applied to the mixture [16]. The final viscosity which is the change in the viscosity after holding cooked starch at 50°C, indicates the ability of the material to form a viscous gel or paste after cooking and cooling as well as the resistance of the paste to shear force during stirring [26].

The final viscosity of the ‘ogi’ samples ranged between 12.00 RVA and 3926.67 RVA. 100% maize ‘ogi’ had the highest value of 3926.67 RVA while 100% Moringa had the lowest value of 12.00 RVA. The final viscosity was also affected by the mixture of Moringa into the maize. Setback viscosity is an indication of the stability of cooked paste against retrogradation and can be used to predict the storage life of a product prepared from the flour. The setback value ranged between 2084.67 RVA and 396.00 RVA. From the result 100% maize-‘ogi’ had the highest value of 2084.67 while 100% Moringa had the lowest value of 4.00. The setback revealed the gelling ability or retrogradation tendency of the amylose present in the starch. The low setback values of the sample indicate low rate of retrogradation. This implication of this is that maize-Moringa ‘ogi’ may not retrograde fast [27].

The peak time of the ‘ogi’ samples, which is a measure of the cooking time, ranged between 4.47 minutes in 100% Moringa and 5.13 minutes in 10% and 20% samples were significantly different from one another. The pasting temperature ranged between 75.02°C and 79.05°C. 100% fermented Moringa seed flour has no ability to gel hence showed no pasting temperature. The gelatinization time during processing could not be confirmed in 100% Moringa ‘ogi’ sample. Pasting temperature is an index that characterized the initial change due to swelling of starch [27]. It can be deduced from this study that the mixture (ratio) reduced the inherent characteristic of 100% maize ‘ogi’ as seen as the loss in its pasting properties.

### Conclusion

The addition of Moringa seed flour sample to ‘ogi’ increased the protein content, fibre, ash and fat content but reduced the moisture content. And the reduction of functional and pasting properties controlled the starchy swollen granules in the food sample. Therefore, it would be necessary to encourage the use Moringa seed flour as protein source to supplement the local/traditional cereals such as maize, millet and sorghum based which will reduce the incidence of malnutrition.

### Acknowledgement

This Research was sponsored by Tertiary Education Trust Fund and we appreciate the sponsorship. I also acknowledge the effort of Dr. (Mrs.) Lola Ajala for guidance and effort for the completion of this research work.

### References


