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**Annals of Biological Research, 2013, 4 (7):239-242**
*(http://scholarsresearchlibrary.com/archive.html)*

Annals of Biological Research
Scholars Research Library
**ISSN 0976-1233**
**CODEN (USA): ABRNBW**

# Proximate and chemical composition of OGI prepared from whole and powdered grains (Maize, Sorghum and Millet)

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**ABSTRACT**

*Ogi was prepared by steeping whole grains and powdered grains in water for 72 hrs and 18 hrs respectively. Crude Protein, Crude Fat, Crude Fibre and Total Ash content was higher in ogi prepared from steeped whole grains than those made from steeped powdered grains for all the grains used. Nitrogen free extract was observed to be higher in ogi made from steeped powdered grains. All the minerals (Fe, Zn, Mg, Na, K and Ca) analysed were lower in ogi prepared from powdered grains. However the results shows that the removal of antinutrients (cyanide, phytate and Tannin) was achieved more using steeped powdered grains to prepare ogi, though cyanide was not detected in ogi made from millet. Steeping of all the grains before milling is a better method because it produced ogi with a better nutritional quality.*

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## INTRODUCTION

One of the strategies used for child survival the world over includes prolonged and intensive breastfeeding. The breast milk is introduced to the infant as early as possible and this is done exclusively for the first six months of life[1]. In Nigeria, exclusive breastfeeding is usually practiced up to three to four months; this may not be able to support the nutritional needs of the infant after this period. Therefore soft easily swollen foods are introduced to supplement the child's feeding(i.e. weaning). Infants especially of the poor rely on *ogi* as a major weaning meal[2]. *Ogi* also known as *agidi is* a fermented product usually from maize which is grown in all parts of Nigeria. It is known that the traditional method of processing *ogi* results in loss of nutrients[3].

The present study is aimed at producing *ogi* (*agidi* paste) from grains commonly used in Nigeria, i.e. yellow maize, white maize, millet and sorghum using both steeped whole grains (traditional method) and steeped powdered grains. The effect of processing method on the nutrient status of the *ogi* paste so produced is thus investigated.

## MATERIALS AND METHODS

*Sampling and Sample preparation:* White and Yellow maize(*Zea mays*), Sorghum(*Sorghum bicolor*) and Millet(*Pennisetum glaucum*) were purchased from a local market in Ilaro, Ogun state ,Nigeria. The grains were sorted to remove damaged ones. Each grain type was divided into two portions, *ogi* was prepared from one using whole grains while the second portion was used to prepare ogi using powdered grains.

*Steeping of Whole Grains:*100g of each grain type was steeped in distilled water for three days[4]. The grains were then rinsed in clean water, wet milled and sieved. The filtrate was allowed to settle and the water was drained off.

*Steeping of Powdered Grains:* 100g of the grains were milled into flours respectively and steeped in distilled water for eighteen hours[5]. It was sieved, filtered and allowed to settle. The water was drained off and the resulting product is the *ogi.*The pastes produced were kept in well labeled air tight polythene bags in a refrigerator for further analysis.

*Methods:* Triplicate samples were taken for proximate composition determination using the methods of AOAC[6] for moisture, crude fat, crude fiber, ash and protein. A nitrogen conversion of 6.25 was used. Carbohydrate was calculated by difference, energy values were calculated by multiplying protein, fat and carbohydrate by Atwater factor 4.9.4[7] respectively.

Triplicate samples were also taken for minerals and antinutritional factors determination. Prior to mineral analysis samples were digested with a triacid mixture (concentrated nitric, perchloric and sulphuric acids, 4.0:5.0:0.5 v/v). Zinc, Iron, Calcium and Magnesium were analysed by Perkin Elmer, model 403 atomic absorption spectrophotometer. Sodium and Potassium were analysed using flame photometry. Tannic acid was determined in accordance with the procedure of AOAC[6]. Phytic acid determination was done in accordance with the procedure of Ruales and Nair[8]. The cyanide content was determined by the procedure described by De Bruijin[9].

The data obtained from the analysis was subjected to statistical analysis using univariate analysis of variance and significant treatments of means were separated by the multiple range test of Duncan according to the procedure stated in SPSS package[10].

## RESULTS AND DISCUSSION

The percentage proximate composition of ogi on dry matter basis is as presented in table 1.

Generally ogi produced using steeped powdered grains looses more nutrients than the traditional method. Based on the traditional method, millet(SM) ogi has the highest protein content (15.3%) followed by sorghum(SS,13.8%) then yellow maize(SYM,7.60%) and lastly white maize(SWM,7.29% ). Sorghum ogi has the highest fibre content(2.86%) while yellow maize(SYM) has the least fat content(4.27%). Sorghum ogi (SS) is the richest in ash content while yellow maize ogi(SYM) is the poorest in ash content(0.46%).

**Table 1: Proximate Composition Of 'Ogi'[% Dry Matter]**

| Treatments | Protein | Fibre | Fat | Ash | NFE |
|---|---|---|---|---|---|
| SWM | $7.29^{d*}$ | $.68^{c}$ | $6.22^{g}$ | $.49^{a}$ | $85.37^{d}$ |
| SWMP | $4.53^{a}$ | $.55^{b}$ | $4.27^{c}$ | $.24^{a}$ | $87.46^{g}$ |
| SYM | $7.60^{e}$ | $.43^{a}$ | $4.79^{d}$ | $.46^{a}$ | $86.52^{e}$ |
| SYMP | $5.29^{b}$ | $.39^{a}$ | $3.56^{b}$ | $.35^{a}$ | $90.43^{h}$ |
| SM | $15.13^{h}$ | $1.38^{e}$ | $5.17^{e}$ | $1.76^{c}$ | $76.57^{b}$ |
| SMP | $9.96^{f}$ | $1.21^{d}$ | $3.52^{b}$ | $.87^{b}$ | $84.05^{c}$ |
| SS | $13.84^{g}$ | $2.86^{f}$ | $5.33^{f}$ | $2.22^{d}$ | $75.77^{a}$ |
| SSP | $7.17^{c}$ | $2.82^{f}$ | $2.91^{a}$ | $.86^{b}$ | $87.06^{f}$ |
| +SEM** | .75 | .20 | .22 | .14 | 1.03 |

** Mean values in a row denoted with different superscript are significantly different [p<0.05]*

*** Standard error of mean*

*SWM =Soaked White maize, SWMP =Soaked white maize powder, SYM= Soaked yellow maize, SYMP= Soaked yellow maize powder, SM = Soaked millet, SMP= Soaked millet powder, SS = Soaked sorghum ,SSP = Soaked sorghum powder*

Due to processing, the carbohydrate content of ogi produced from powdered grains is the highest (SYMP being the highest at 90.43%). All the other nutrients are lower, this is due to leaching of the nutrients into water because of the larger surface area presented by the powdered grains. The results obtained for the proximate composition of ogi prepared using steeped whole yellow and white maize except crude fibre and crude fat agrees with the findings of De Bruijin[9]. The difference in the proximate composition of ogi produced from sorghum and millet and that of literature could be due to varietal difference, climatic conditions and or soil types.

Table 2 depict some mineral contents of ogi. Generally as it was observed for proximate composition, mineral content are lower in ogi produced from steeping powdered grains. This is probably due to the large surface area of the substrate which hastens leaching of minerals into water. However the high content of mineral in sorghum ogi produced by the traditional method (Fe 97.23mg/100g, Ca 205.10mg/100g, Mg 121.90mg/100g, Na 326.13mg/100g, K134.93mg/100g) justify its high ash content. The results show that sorghum ogi has the least zinc content despite the fact that it has the highest content of all other minerals investigated.

**Table 2: Mineral Composition Of Ogi (Mg/100g Dry Matter)**

| Treatments | Fe | Zn | Ca | Mg | Na | K |
|---|---|---|---|---|---|---|
| SWM | 62.19$^{d*}$ | 7.77$^{g}$ | 180.24$^{g}$ | 111.79$^{g}$ | 300.52$^{g}$ | 191.42$^{g}$ |
| SWMP | 57.26$^{c}$ | 6.76$^{e}$ | 121.64$^{c}$ | 100.65$^{d}$ | 240.53$^{d}$ | 165.29$^{f}$ |
| SYM | 84.15$^{f}$ | 8.36$^{h}$ | 153.41$^{e}$ | 104.86$^{e}$ | 270.31$^{f}$ | 126.01$^{b}$ |
| SYMP | 78.11$^{e}$ | 7.44$^{f}$ | 105.68$^{b}$ | 93.35$^{c}$ | 216.51$^{c}$ | 105.65$^{a}$ |
| SM | 86.19$^{g}$ | 5.22$^{d}$ | 160.26$^{f}$ | 83.44$^{b}$ | 65.27$^{b}$ | 165.30$^{f}$ |
| SMP | 52.05$^{a}$ | 4.74$^{c}$ | 103.15$^{a}$ | 73.36$^{a}$ | 53.80$^{a}$ | 141.42$^{d}$ |
| SS | 97.23$^{h}$ | 2.26$^{b}$ | 205.10$^{h}$ | 121.90$^{h}$ | 326.13$^{h}$ | 159.33$^{e}$ |
| SSP | 54.44$^{b}$ | 2.18$^{a}$ | 139.75$^{d}$ | 107.68$^{f}$ | 265.76$^{e}$ | 134.93$^{c}$ |
| +SEM$^{**}$ | 3.33 | .47 | 7.00 | 3.07 | 20.10 | 5.26 |

** Mean values in a row denoted with different superscript are significantly different [p<0.05]*

*** Standard error of mean, SWM =Soaked White maize, SWMP =Soaked white maize powder, SYM= Soaked yellow maize, SYMP= Soaked yellow maize powder, SM = Soaked millet, SMP= Soaked millet powder,SS = Soaked sorghum,SSP = Soaked sorghum powder*

Infants and young children require vitamins and minerals to replace losses through metabolic turnover and to increase body reserve as they grow[11]. All the ogi samples will supply the infant the RDA of Fe and Mg (11.0mg and 75mg respectively). None of the ogi produced can supply enough Ca and K (270mg and .07g RDA for calcium and potassium respectively). All the ogi samples will provide enough Na and Zn except sorghum which has lower value than the RDA[12]

The results of some of the antinutrients found in ogi are presented in table 3.

It is shown from the results that ogi from steeped powdered grains contain less antinutrients.

Phytates are known to form complexes with iron, zinc, calcium and magnesium making them less available and thus inadequate in food samples especially for children. It is known that 10 – 50mg phytate per meal will cause a negative effect on the absorption of zinc and iron [13]. The phytate content of ogi samples ranged from 167.51mg/100g(SMP) to 304.55mg/100g(SS), these values are far above the aforementioned and so will possess a danger to the utilization of both ions (Fe and Zn).

**Table3: Antinutrients Of Ogi[Dry Matter]**

| Treatments | Cyanide (mg/kg) | Phytate(mg/100g) | Tannin(%) |
|---|---|---|---|
| SWM | .35$^{c}$ | 302.95$^{g}$ | .23$^{cd}$ |
| SWMP | .17$^{b}$ | 227.23$^{b}$ | .14$^{b}$ |
| SYM | .33$^{c}$ | 301.11$^{f}$ | .33$^{e}$ |
| SYMP | .15$^{b}$ | 231.86$^{c}$ | .19$^{bc}$ |
| SM | .00$^{a}$ | 250.03$^{d}$ | .05$^{a}$ |
| SMP | .00$^{a}$ | 167.51$^{a}$ | .03$^{a}$ |
| SS | .34$^{c}$ | 304.55$^{h}$ | .24$^{d}$ |
| SSP | .16$^{b}$ | 286.28$^{e}$ | .15$^{b}$ |
| +SEM$^{**}$ | .03 | 9.53 | .02 |

** Mean values in a row denoted with different superscript are significantly different [p<0.05]*

*** Standard error of mean*

*SWM =Soaked White maize, SWMP =Soaked white maize powder, SYM= Soaked yellow maize,SYMP= Soaked yellow maize powder, SM = Soaked millet, SMP= Soaked millet powder,SS = Soaked sorghum,SSP = Soaked sorghum powder*

Tannins are naturally occurring plant polyphenols. Their main characteristics is to bind and precipitate protein interfering with its digestion and absorption [14]. The tannin content of all the ogi samples are generally low, ranging from 0.3%(SMP) to 0.24% (SS) and are far lower than the lethal dose of 0.7% - 0.9%[15].

Cyanogenic glycosides are found in the edible parts of plants, they are relatively non-toxic, however as a result of enzymatic hydrolysis by beta-glycosidase following maceration of plant tissues as they are eaten or by gut micro flora, they are broken down to release hydrogen cyanide which is toxic[15]. It is toxic because it binds cytochrome oxidase and stops its action in respiration which is a key to energy production in cells. The literature records lethal dose of cyanide to be between 12 and 50mg [16]. Cyanide was not detected in ogi produced from millet using the two methods. The cyanide content ranged from 0.15mg/Kg(SYMP) to 0.35mg/Kg(SWM) for the remaining ogi samples. These levels are far below the lethal dose stated earlier and so the ogi samples are not likely to cause food poisoning.

## CONCLUSION

Considering the effect of processing on the antinutrient factors of the ogi, one will be tempted to suggest that steeping powdered grains to produce ogi is better than traditional methods of production. But the large surface area

of the powdered grain increased the rate of leaching of the nutrients of the grains into the steeping water. Hence traditional methods (steeping of whole grain) of producing ogi is more preferred.

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