Egyptian Journal of Nutrition
Official journal of the Egyptian Nutrition Society
Print ISSN: 1687-1235
Online ISSN: 2090-2514
Vol. 39 (--): 59 – 68 (2024)
https://ejn.journals.ekb.eg/

Determination of Proximate and Vitamin Composition of Different Varieties of Pap Sold in Owo Market, Ondo State

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ABSTRACT

Pap is an important food in Nigeria, as a popular for its consumption as breakfast meal and as a complementary food for babies. This study was carried out to determine the proximate and vitamin composition of different varieties of pap sold in Owo Market, Ondo State. The proximate and vitamin composition of the samples were determined using the standard methods of the Association of official Analytical Chemists (AOAC). A One-way analysis of variance (ANOVA) was done to analyse the significance difference between the samples and the result was expressed as the mean ± standard deviation. Out of the three samples that were used in this study, Sample 3 (yellow maize, sorghum, sorghum leaf, ginger and jero) has the highest value (51.463%) of moisture compared to the other three samples. The protein composition of the samples shows that yellow maize has the highest value (2.373%) of protein compared to the other samples. The fat content of the samples ranged from (1.07%) for yellow maize to (1.187%) for sorghum, sorghum leaf and ginger. Also, the crude fiber content of the samples shows that sorghum, sorghum leaf and ginger have the highest value (4.663%) of crude fibre, while yellow maize has the least fiber content value (1.973%). The result shows that sample 3 had the highest vitamin D, vitamin B_2, vitamin C, and vitamin B_6 content (1.064mg/g, 2.539mg/g, 11.84mg/g and 0.006mg/g respectively). Pap is indeed a nutritious meal that can be incorporated into an individuals diet for calorie and nutrient supply.

Keywords: nutrient, maize, micronutrient

Received: 29-4-2024 ***Accepted: 29-4-2024*** ***Published: 1-6=2024***

INTRODUCTION

Pap is a traditional food product processed as a paste obtained after fermenting, milling and sieving grains like maize, millet and sorghum. Processing methods used in the preparation of pap through the fermentation of these grains have an impact on the product's appearance, flavor,

odor, microbial load, and consumer acceptance. (**Ike et al., 2019).** Pap in the western part of Nigeria is commonly used as an complimentary foods for infants after 6 months of exclusive breastfeeding. Pap is mainly used as a breakfast meal for adults and as aweaning food for infants especially by low-income earners who cannot afford the more expensive imported weaning foods **(Onu et al., 2019).**

Ogi is prepared by steeping clean grains in water at room temperature for 2 – 3 days for fermentation by microorganisms to take place, followed by decanting, wet milling and sieving through a mesh. After preparation, it can be turned into pap by diluting with water and then boiling until it gelatinizes or it can also be turned into a stiff gel called agidi before consumption **(Olusola et al., 2017)**. The nutritional composition of ogi depends largely on the cereal used in its production since these cereals are found to be nutritious. Millets, sorghum and maize are good sources of carbohydrates, some essential amino acids, phytochemicals, vitamins, and micronutrients **(Laya et al., 2022)**

Malnutrition is one of the major challenges faced by developing countries where there are shortages of nutritious foods for the young and elderly. Inadequate nutrition early in life and amongst the elderly can result in irremediable damage to the developing brain and body of infants as well as complications in the elderly **(Beyene, 2023).** To overcome the challenge of malnutrition, developing countries must exploit every locally available food resources such as "ogi" to address its their malnutrition problems **(James et al., 2015).** Ogi is a traditional Nigerian fermented cereal porridge which is made from maize, sorghum, millet, rice etc. It is usually the first native food given to babies at weaning **(Ukom et al., 2019).**

Determining the nutritional composition of pap will help is establish if pap relevant in preventing malnutrition especially among children under five and the elderly.

MATERIALS AND METHODS

Study Design

Proximate and vitamin determination was experimental in design.

Area of the Study

The study was carried out within Owo Local Government in Ondo state.

Sample Collection

Three (3) varieties of pap samples used for the study were purchased from Oja Oba market in Owo, Owo local government, Ondo State.

Sample Preparation

The pap was weighed and dried in the oven at 50°C. The meals were ground into powder; sieved with No 72-mesh size, stored in plastic containers with screw cap, and then kept in the freezer for analysis.

Proximate Composition

This involved the determination of fat, moisture content, crude fiber, protein, ash and carbohydrate content.

Determination of moisture content

Moisture content was determined according to the standard methods of Association of official Analytical Chemists (AOAC), (2010). Stainless steel oven dishes were cleaned and dried in the oven at 100^0C for 1 hour to achieve a constant weight. They were cooled in a desiccator and then weighed. Two grams of each sample was placed in each dish and dried in the oven at 100^0C until a constant weight was achieved. The dishes together with the sample was cooled in a desiccator and weighed.

% Moisture content = $\frac{(W2-W3)}{(W2-W1)} \times 100$

Where
W1= Weight of dish
W2= Weight of dish + sample before drying
W3= Weight of dish + sample after drying

Determination of ash

Ash determination was carried out according to the AOAC (2010) procedure. Two grams of sample was placed in a silica dish that wich had been ignited, cooled and weighed. The dish and sample were ignited first gently and then at 55^0C in a muffle furnace for 3 hours, until a white or gray ash was obtained. The dish and content were cooled in a desiccator and weighed.

% Ash = $\frac{(W3-W1)}{(W2-W1)} \times 100$

Where
W1= Weight of dish
W2= Weight of dish + sample before ashing
W3= Weight of dish + sample after ashing

Determination of fat

The fat content was determined according to the AOAC (2010) Soxhlet extraction method. A 500ml capacity round bottom flask was filled with 300ml petroleum ether and fixed to the Soxhlet extractor. Two grams of sample was placed in a labeled thimble. The extractor thimble was sealed with cotton wool. Heat was applied to reflux the apparatus for six hours. The thimble was removed with care. The petroleum ether will be recovered for reuse. When the flask was free of ether, it was removed and dried at 105^0C for 1 hour in an oven. The flask was cooled in a desiccator and weighed.

% Fat = $\frac{\text{Weight of fat}}{\text{Weight of sample}} \times 100$

Determination of crude protein

Crude protein was determined using the kjedahl method (AOAC, 2010). Two grams of sample was placed in the kjeldahl flask. Anhydrous sodium sulphate (5g of kjeldahl catalyst) was added to the flask. Concentrated tetra-oxosulphate (VI) acid (H_2S0_4) ((25ml) was added with a few boiling chips. The flask was heated in the fume chamber until the sample solution became clear. The sample solution was allowed to cool to room temperature, then transferred into a 250ml volumetric flask and made up to volume with distilled water. The distillation unit was cleaned, and the apparatus was set up. Five millimeters of a 2% boric acid solution with a few drops of methyl red indicator was introduced into a distillate collector (100ml conical flask). The conical flask was placed under the condenser. Then 5ml of the sample digest was pipetted into the apparatus and washed down with distilled water. Five milliliters of a 60% sodium hydroxide solution was added to the digest. The sample was heated until 100ml of distillate was collected in

the receiving flask. The content of the receiving flask was titrated was 0.049M H_2S0_4 to pink coloured endpoint. A blank with filter paper was subjected to the same procedure.

Calculation:

$$\% \text{ Total Nitrogen} = \frac{(\text{Titre-Blank}) \times \text{Normality of acid} \times N2}{\text{Weight of sample}}$$

Nitrogen Factor = 6.25
Crude protein = % total N X 6.25

Determination of dietary fiber

The dietary fiber of the flour samples was determined according to the AOAC, (2010) method. Two grams of each of the flour was boiled under reflux for 30 minutes with 200 ml of solution containing 1.25g of tetra-oxo-sulphate (VI) acid (H_2S0_4) per 100ml of solution. The solutions was filtered through linen on a flaunted funnel and washed with water until the washing was no longer acidic. The residue was transferred to a beaker and boiled for 30 minutes with 100 ml of solution. The final residue was filtered through a thin but closer pad of washed and ignited asbestos in a gosh crucible. The residue was dried in an electric oven and weighed. The residue was incinerated, cooled and weighed. The dietary fiber content of the fish flour was calculated as follows:

$$\% \text{ Dietary fiber} = \frac{W2-W1}{W1}$$

Where:
W1 = Weight of the sample used
W2 = Weight of crucible plus sample
W3 = Weight of sample crucible

Determination of carbohydrate content

The carbohydrate content was calculated by the nitrogen free extractive method as described in AOAC (2010). It was given as a difference between 100 and the sum total of the other proximate components. Hence, the formula below was used, and the carbohydrate (NFE) will be given by:

$$\% \text{ CHO} = 100 - \% (A+B+C+D+E)$$

NFE = Nitrogen Free Extract
CHO = Carbohydrate
A = Ash content
B = Fat content
C = Crude fiber content
D = Protein content

Vitamin Determination

Determination of vitamin A

A weighed quantity of sample containg not more than 1g of fat and at least 240 unit of vitamin a was mixed with 30ml absolutes alcohol and 3ml of 5% potassium hydroxide and boiled gently under reflex for 30min in a stream of oxygen free nitrogen.

It was allowed to cool rapidly. 30 ml of water was added and transferred to the separator, then washed in with 3x50ml either and the vitamin A was extracted by shaking for 1min. The lower layer was discarded after complete separation and the extracted was washed with 4x50ml water the mixing was done cautiously; during the first two washes to avoid emulsion formation. The

washed extracte was evaporated down to about 5ml and the remain either in a stream of nitrogen was removed at room temperature. Then the residue was dissolved on insufficient isopropyl alcohol to give a solution containing 9-15 units per ml and the extinctions was measure at 300,310,325 and 334nm and he wavelength of maximum absorption **(Achikanu et al., 2013).**

Determination of Vitamin D

Vitamin D content was determined by mixing the carr-price reagent (20% m/v of antimony trichloride in chloroform with 40% pure acetylchloride) freshly prepared and must be free from alcohol. 9ml of the carr-price will be added to 1ml sample extracted with chloroform and the extinction is measure at 500nm against the reagent blank. And the concentration is extrapolated from a standard curve graph using the vitamin D standard **(Achikanu et al., 2013).**

Determination of Vitamin C

The vitamin C content was determined using the ascorbic acid as the reference compound. 200µl of the extract was pipetted and mixed with 300µl of 13.3% of TCA and 75µl of DNPH. The mixture was incubated at 37^0C for 3hrs and 500µl 0f 65% H_2SO_4 was added and the absorbance was read at 520nm **(Achikanu et al., 2013).**

Determination of Vitamin B_3 (Niacin)

5g of the sample was treated with 50ml 1N H_2SO_4 and shaken for 30min. 3drops of ammonia solution were added to the sample and filtered. The filtrate was pipette into a 50ml volumetric flask and 5ml of potassium cyanide was added. This was acidified with 5ml of 0.02N H_2SO_4 and absorbance was measured using a spectrophotometer at 470nm **(Okwu and Josiah, 2006).**

Determination of vitamin B_1 (Thiamin)

5g of the sample was homogenized with 50ml of ethanoic sodium hydroxide. It was filtered into a 100ml conical flask, 10ml of the filtrate was pipette and the colour was develop by addition of 10ml of 1%potassium dichromate and read the absorbance at 360nm. A blank solution is also prepared **(Okwu and Josiah, 2006).**

Determination of Vitamin B_2 (Riboflavin)

5g of the sample was extracted with 100ml of 50% ethanol and shaken for one hour. This was filtered into 100ml flask 10ml of the extract was pipette into 50ml volumetric flask. 10ml of 5% potassium permanganate and 10ml of 30% H_2O_2 was added and allowed to stand over a hot water bath for 30min. 2ml of 40% sodium sulphate was added. This was made up to 50ml mark and the absorbance was measured at 510nm using a spectrophotometer **(Achikanu et al., 2013).**

Determination of Vitamin B_6 (pyridoxine hydrochloride)

Vitamin B6 Twenty milligram of solid (BEV 1307-1308) or 60 ml of liquid samples (SOF 1301-1302, HER 13041305 and ENE 1309-1312) was added into a 125 ml Erlenmeyer flask, filtered and degassed by sonicating for five minutes. A 10 ml aliquot of the degassed sample was placed in each of five 100 ml volumetric flasks which were then made up using 0.1 N HCl after which absorbance was measured at 290 nm **(Achikanu et al., 2013).**

Determination of of folic acid

The standard or sample solution of folic acid 1.0 ml was mixed with 1.0 ml of 4 mol l-hydrochloric acid, 1.0 ml of 1% (w/v) sodium nitrite, 1.0 ml of 1% (w/v) sulfamic acid and 1.0ml of 1% (w/v) *3*-aminophenol which was resulting in an orange-yellow complex. The absorption of complexation was measured at 460 nm using UV-Visiblespectrophotometer. For the analysis of folic acid **(Achikanu et al., 2013).**

Determination of vitamin B12

50mg of the sample was weighed and 10ml of the extraction buffer was added with vortex mixing. After standing for 30 min, the samples were autoclaved at 121C for 25 min at 15 psi and then cooled to ambient temperature in a water bath. Extracts were transferred quantitatively to a 25mL graduated test tube and diluted to volume with extraction buffer. 50microliter of the reagent and immobilize solution was added to 200microlitter of the extract and after 1hr 100microliter of HBS-EP buffer and Cbl-binding-protein, and regeneration solutions were added thereafter absorbance was read at 480nm **(Achikanu et al., 2013).**

DETERMINATION OF VITAMIN K

The procedure for color development, as adapted from Menotti's procedure, is as follows. The solution in which the concentration of vitamin K is being determined is placed in a flask and the sodium pentacyanoamineferroate reagent is added. The solution is stirred and then allowed to stand for fifteen minutes to allow maximum color development. When the blue color has developed, the absorption of the solution is measured by means of a spectrophotometer at 650nm. Standard vitamin K solution. The standard vitamin K solution was prepared by dissolving 5 milligrams of crystalline vitamin K in water and diluting it to 100 milliliters. This solution is stable for 4 to 6 hours. The absorption of the solution was read on a spectrophotometer at 650nm, against a reagent blank **(Parrish, 1980).**

Statistical Analysis

The results were expressed as mean ± standard deviation and the test for statistical significance was carried out using one-way analysis of variance (ANOVA). The Statistical Package for Social Sciences (SPSS, Version 20) software was used to determine significant differences. Significant means was separated using Duncan's New Multiple Range Test (DNMRT) and differences was considered significant at ($p<0.05$).

RESULTS AND DISCUSSION

Proximate Composition of Different Varieties of Pap Sold in Owo Market

The result from Table 1 shows that Sample 3 (yellow maize, sorghum, sorghum leaf, ginger and jero) has the highest value (51.463%) of moisture compared to the other three samples. The protein composition of the samples shows that sample 1 (yellow maize) has the highest value (2.373%) of protein compared to the other samples. The fat content of the samples ranged from (1.07%) for sample 1 (yellow maize) to (1.187%) for sample 2. Also, the crude fiber content of the samples shows that sample 2 (sorghum, sorghum leaf and ginger) has the highest value (4.663%) of crude fibre, while sample 1 (yellow maize) has the least fiber content value (1.973%). The Ash content of Sample 3 was higher (0.52%) compared to the other samples. The result further revealed that sample 1 has the highest carbohydrate content value (50.003%) compared to the other two samples.

Table 1: Proximate Composition of Different Varieties of Pap Sold in Owo Market

Parameters (%)	Sample 1	Sample 2	Sample 3
Moisture	**44.141**	**49.868**	**51.463**
Crude fibre	**1.973**	**4.663**	**2.139**
Crude protein	**2.373**	**2.312**	**1.771**
Ash	**0.44**	**0.29**	**0.52**
Crude fat	**1.07**	**1.187**	**1.112**
Carbohydrate	**50.003**	**41.68**	**42.995**

Keys
Sample 1= Yellow maize
Sample 2= Sorghum, sorghum leaf and ginger
Sample 3= Yellow maize, sorghum, sorghum leaf, ginger and jero

Vitamin Composition of Different Varieties of Pap Sold in Owo Market

The result shows that there was no significant difference (p=0.05) between the three samples, in terms of the vitamin K content they contain. Sample 3 (yellow maize, sorghum, sorghum leaf, ginger and jero) was noticed to have the highest vitamin B_1 content (2.320mg/g) compared to the other two samples. The vitamin A content of the samples shown that sample 3 had the highest vitamin A (8.312mg/g). The result from the table shows that sample 3 had the highest Vitamin D, vitamin B_2 , vitamin C, and vitamin B_6 content (1.064mg/g, 2.539mg/g, 11.84mg/g and 0.006mg/g) respectively. Also, the result from the table further revealed that sample 2 (sorghum, sorghum leaf and ginger) had the highest vitamin B_{12} content value (2.932mg/g) compared to the other samples.

Table 2: Vitamin Composition of Different Varieties of Pap Sold in Owo Market

Vitamins (mg/g)	Sample 1	Sample 2	Sample 3
Vitamin K	**0.00^{a}±0.00**	**0.004^{a}±0.00**	**0.001^{a}±0.00**
Vitamin B_1	**2.311^{b}±0.00**	**2.313^{b}±0.00**	**2.320^{a}±0.00**
Vitamin A	**8.312^{c}±0.00**	**9.450^{b}±0.00**	**11.78^{a}±0.00**
Vitamin D	**0.090^{b}±0.00**	**0.027^{c}±0.00**	**1.064^{a}±0.00**
Vitamin B_2	**2.392^{b}±0.00**	**2.185^{c}±0.00**	**2.539^{a}±0.00**
Vitamin C	**10.498^{b}±0.11**	**5.995^{c}±0.19**	**11.84^{a}±0.00**
Vitamin B_6	**0.011^{a}±0.00**	**0.007^{a}±0.00**	**0.006^{a}±0.00**
Vitamin B_{12}	**0.00^{c}±0.00**	**2.932^{a}±0.00**	**1.521^{b}±0.04**

Values of mean ± standard deviation of duplicate sample
$^{a-c}$ Mean with similar super script in each row are not significantly different (P>0.05)

Keys:
Sample 1= Yellow maize
Sample 2= Sorghum, sorghum leaf and ginger
Sample 3= Yellow maize, sorghum, sorghum leaf, ginger and jero

DISCUSSION

The proximate analysis of the yellow maize, sorghum, sorghum leaf and ginger and yellow maize, sorghum, sorghum leaf, ginger and jero, showed high percentage moisture, carbohydrate content, moderate levels of protein and crude fibre with low levels of ash and fat. The moisture contents of the samples were above the acceptable limit of not more than 10% for long term storage of flour. Ogi made from locally grown grains is an affordable complementary food in West Africa, however its high moisture content makes it prone to spoilinge **(Olaniran and Abiose, 2018).** High moisture content during storage encourages the growth of certain harmful yeast, molds, and bacteria **(Sharma et al., 2020).** Moisture content also affects the physical chemical aspects of food, which relate to with the freshness and stability of the food for a long period of time and the moisture content determines the actual quality of the food before consumption and the subsequent processing in the food sector by the food producers **(Zambrano et al., 2019).**

The crude fibre content recorded in Sample 2 (4.663%) is higher, compared to that of the other samples, though, value recorded for the samples are lower compared to the fibre content reported for Guinea corn (29.79%) and Talinum triangular (31.00%). Fibre plays a role in the increased utilization of nitrogen and the absorption of some other micronutrients **(Barber *et al.*, 2020)**. The low fibre content agrees with the report that food used for complementary feeding should contain low fibre as high fibre can lead to high water absorption and displacement of nutrient and energy needed for the growth of children less than two years **(Forsido et al., 2019).**

The protein composition of the samples showed that sample 1 (yellow maize) have the highest value (2.373%) of protein compared to the other samples. The fat content of the samples ranged from (1.07%) for sample 1 (Yellow maize) to (1.187%) for sample 2. However, a similar study conducted by **Ape et al., (2016),** it was reported that ogi made of maize and sorghum have protein content of 8.75% and 9.10% respectively while the fat content was reported to be 2.4% and 3.10% respectively.

The ash content of the samples is low (0.29%) for Sorghum, sorghum leaf and ginger, low (0.44%) for Yellow maize and also low (0.52%) for Yellow maize, sorghum, sorghum leaf, ginger and jero. Ogi made from only maize has 2.19% ash while Ogi made from sorghum has 2.07% **(Ape et al., 2016).** This indicate that the mineral that would be present in the samples cannot be much. Ash content of a food material can easily be used to measure the level of mineral that will be present in such food material **(Olaniran and Abiose, 2018)**.

The carbohydrate content recorded in the samples ranges from (41.68-50.00%). This is relatively lower than the carbohydrates content of samples reported by **Ilori et al., (2022),** who worked on ogi enriched with date palm fruits (59.92% - 65.90%). Vitamins are linked to the onset or prevention of cancerous disorders and are involved in cellular functions **(Barker, 2023).** Analysis of the pap samples showed that the samples have a certain content of vitamins. The vitamin A content of the samples shown that sample 3 had the highest vitamin A (8.312mg/g). Sample 3 also has the highest vitamin D, vitamin B2, vitamin C, and vitamin B6 content (1.064mg/g, 2.539mg/g, 11.84mg/g and 0.006mg/g) respectively..

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