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Nutrient Composition of selected Traditional Dishes commonly consumed in Plateau State, Nigeria.

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Abstract

With the trend in global food insecurity and malnutrition that pervades rural Africa, including Nigeria, there is need to investigate some traditional dishes that are readily available within the study area. The study is to assess the proximate minerals and anti-nutrients composition of traditional dishes commonly consumed in Plateau State, Nigeria. The dishes (Gwote, Tere, Amora, Mashor and Tuwon dawa and Pululuk soup) were prepared following their traditional methods of preparation. Their proximate compositions were determined as well as their mineral element (Ca, Mg, Fe, Cu, Zn, Na and K). The quantitative analyses of the anti-nutrients (Oxalate, Saponin, tannins, trypsin Inhibitors and Phytate) composition was also carried out according to standard methods. Results obtained in the study were presented as percentage, mean and standard deviation. The Ash ranged between 1.42± 0.24 and 3.69± 0.11%, Crude protein 3.18±0.35 to 7.47±0.23% and Crude fat, 3.72±0.49 to 10.57± 0.74%. Zinc content ranged from 7.18±0.10 to 51.68±0.09mg/100g, iron content ranged between 41.67±0.97and 80.21±0.08mg/100g, Calcium values ranged from 0.51±0.01 to 1.09±0.06mg/100g and Phosphorous content ranged from 38.42±0.13 to 58.18±0.38mg/100g. Phytates (0.23± 0.01 to 1.08± 0.06mg/100g). The study shows that the foods items are rich in varying composition of energy, fibre, fat and essential minerals for man. However, their consumption should be regulated due to the presence of some anti-nutritional substances in diverse form and quantity.

Keywords: *Traditional dishes, nutrients, Amora, Plateau State, Nigeria*

Introduction

Food is the basic necessity of man. Food is any substance consumed to provide nutritional support for the body. It is usually of plants and animals origin and contains a mixture of different nutrients such as carbohydrate, protein fat and oil, vitamins and mineral.

Traditional foods are foods of native populations which qualify for cultural cuisine (Burlingame, 2000). Traditional diets include more organic farming and seasonal foods according to food origins. Traditional foods vary with availability of local resources such as corn and beans in farming towns as well as with cultural and religious customs and taboos in some cases the crops and domestic animal that characterize a traditional food have been replaced by modern high-yield crops and are no longer available (Mason, 2003). Traditional food resources of indigenous people provide a wealth of nutritional and cultural benefit to the people using them and an understanding of these food species and how they are prepared and used contributes to human knowledge (Kuhnlein and Receveur, 1996; Burlingame, 2000).

In Nigeria, the dietary behavior of the citizenry depends on the climatic features and the vegetative zones which influence the agricultural output. In other words, these traditional foods are mainly made from crops that are cultivated and processed within or around such a locality in which a particular ethnic group dwells.

The Northern region because of its vast size is privileged to have diversely unique physico-climatic characteristics ranging from Sahel in the far North, Sudan savanna in the North East to derived savanna in the North Central resulting in immense biodiversity in its domain. Because of the diversified agro climatic conditions in the region and within the member states, there is a

tremendous diversity of plant foods grown. In addition, the range of available animal species is vast and abundant. There are also a number of wild plants which constitute the foods for many isolated communities in the region.

Despite a great variety of foods grown in the region, it is one of the most nutritionally vulnerable regions with the existence of malnutrition affecting mostly infants, children, pregnant and lactating women. According to the report of NDHS (2008), more than half of the Nigeria's malnourished children are found in the northern region. The availability of accurate food composition data for the region is, therefore, absolutely essential to address the issues of malnutrition in the region.

Food composition studies are carried out to identify and determine the chemical nature of the principle in foods that affect human health. These studies are also concerned with the mechanisms whereby chemical constituents exert their influence and provide the basis for early development of the science on nutrition. Current knowledge of nutrition is still incomplete, and studies are still required, often at over increasing level of sophistication into the composition of foods and the role of these components and their interactions in health and disease. Studies of the relationship between diet and health have led to increased interest in the range of biologically active constituents present in foods that accompany the nutrients, and data for those constituents are required.

Dietary change, with increase in the consumption of market food and decreasing consumption of traditional food coupled with decreasing physical activity, has resulted in increasing frequency of malnutrition (Bjerregaard and Young, 1998). Micronutrients deficiencies are of great public health concern worldwide. About 1 billion people, almost all in developing countries, are suffering the effects of these deficiencies and another billion are at risk (World Bank, 1994). The risk of specific mineral deficiencies depends on a variety of factors such as intake and chemical form of the minerals, food processing practices, presence of other dietary factors that may enhance or inhibit mineral bioavailability health, and physiological status of the individual (O'Dell, 1983).

Although there are various food composition tables available for use in developing countries (Gibson and Ferguson, 1999) many of these however, contain gap in terms of food and several nutrients, are not recent and are mostly on raw dishes (Onabanjo and Oguntona, 2003).

Due to the scarcity of data on the nutrient composition of traditional dishes especially in the Northern Nigeria this work is designed to determine the nutrients composition of commonly consumed traditional dishes among selected tribes in Plateau State of Nigeria.

Material and method

Preparation and cooking of Dishes

Five traditional dishes commonly consumed among the Beroms, Afezeres, Mupuns, Challas and the Gumai people of Plateau State were purposively selected and analyzed. The recipes and method of preparation of these dishes were obtained from the natives of these tribes while the ingredients used in the preparation of the dishes were purchased from three major markets: the Anguwan Rukuba and Bukuru market in Jos, Plateau state and also from Alahamis market in Lafia, Nasarawa State. The dishes were prepared using the kitchen facilities of the Department of Home Science and Management, Nasarawa State University, Shabu- Lafia Campus, according to the method for standardized recipes described by Oguntona and Akinyele (1995).

Table1: Recipes of standardized dishes.

Local name of the dish	Ingredients	Scientific names of basic ingredients
Tuwon Dawa and pululuk Soup.	Thick sorghum pottage eaten with soup made by mixing karkashi, dadawa Busur (Locust Bean), gauta (garden egg), taukan shenyi, dargaza and water.	*Sorghum. Bicolor, Artemisia spp , Grewia mollis spp*
Gwote	Maize grits cooked together with spinach, yakuwa, dadawa (locust bean) boso, gauta (garden egg), onions, and water and cooked into gruel.	*Zea mays, Seratonia siliqua, Spinacia oleracea*
Tere	Acha cooked together with spinach, yakuwa, gauta (Garden egg), dadawa (locust bean), kanwan (Potash), onions cabbage, and water and cooked into gruel.	*Hungary rice* (*Digitaria exilis*), *Solanum melongena, Seratonia siliqua, Spinacia oleracea, Brassica oleracea*
Amora	Amora (Irish potato) flour cooked together with dry fish, Spinach, dadawa (Locust bean), onions, tomatoes, palm oil, pepper, salt, and water and made into pottage.	*Solanum tuberosum, Seratonia siliqua, Spinacia oleracea*
Mashor	Boiled beans mixed together with toasted and pounded black sesame (beni seed) with palm oil and salt	*Vigna unguiculata, sesamum indicum*

Preparation of samples for Laboratory Analysis

The food samples for analysis were prepared by homogenizing the large samples into small sizes and amounts in laboratory. The remaining portions were subsequently dried in a hot oven then grinded to a fine smooth-texture and kept in a well labeled moisture-free container.

Analysis

After the preparation of the samples, they were taken for analysis to determine the proximate composition (moisture content, energy, carbohydrate, fat, crude fibre and ash), the mineral composition (calcium magnesium, potassium, sodium, manganese, iron, zinc, copper and phosphorus) and the anti- nutrient composition (phytate, oxalate, hemagglutanin, trypsin inhibitors, tannic acid and saponin).

Proximate Analysis

Proximate analysis of the samples for moisture, crude protein, crude fat, ash, fiber and carbohydrate contents were carried out in triplicates according to standard methods of AOAC (1990). Total carbohydrate (g/100g) was determined by subtracting the percentage content of moisture, protein, Ash and fat from 100. Energy of food sample was computed using the factors of carbohydrate x 4, protein x 4 and fat x9.

Mineral determination

The mineral content (potassium, iron, calcium, magnesium, copper, zinc, sodium, and manganese) was determined according to the standard methods of the Association of Official Analytical Chemists AOAC (2005), using an atomic absorption spectrometer while Phosphorus was determined spectrophotometrically by the vanadomolybdate method (AOAC, 1990). The sample

was ashed at 550°C and the ash boiled with 10 mL of 20% HCl in a beaker and then filtered into a 100 mL standard flask. All samples were analyzed in triplicate.

Results and Discussion

The proximate composition of the dishes is presented in Table 2. The moisture content of the samples ranges from 77.32 ± 0.04% for Gwote to 81.00 ± 1.32% in Amora. Study has shown that the amount of moisture is dependent on the type of dish and the amount of water used in preparation (Ponka *et al.*, 2016) hence the high moisture content in Amora may not be unrelated with the water added during the preparation. The values obtained in this study was lower compared to the values (83.7 and 84.7g/100g per edible portion) reported by Madukorshi *et al;* (2009) in Tuwon Acha with miyan toka and Tuwon dauro with miyan toka (ready to eat foods dishes) prepared from Acha (Hungary rice) and millet which are commonly consumed by pregnant and lactating women in Bassa LGA of Plateau State of Nigeria. However, the value is higher than moisture content of 45g/100g edible portion found by Olayiwola and Okhiria (2012) in beans porridge. The high levels of moisture observed in all the studied samples suggests that they would not store for long without spoilage since high water activity could enhance microbial action bringing about food spoilage (Olusanya, 2008).

The energy value of the dishes varied from 77.67 ± 0.14 in Tere to 120.81 ± 0.42% Kcal/100g in Amora. The energy content of the samples was similar to the value of 77 Kcal/100 g edible portion found for composite dishes consumed in South Africa by Spearing et al.(2012) . However, the energy content were lower than180.8 Kcal/100 g edible portion reported for Ekomba *by* Ponka *et al* (2016) for traditional dishes consumed in Cameroon.

The dishes had values of carbohydrate ranging from 0.79 ± 0.42% to 9.71±0.16% with Amora having the lowest carbohydrate content and Gwote having the highest carbohydrate content. The high carbohydrate value in Gwote may be due to maize grits added which is rich in carbohydrate. According to Emebu and Anyika (2011) carbohydrates are vital nutrients required for adequate diet with the sole role of providing energy required for the body. The body uses carbohydrates preferentially as a source of energy when it is adequately supplied in the diet, thus sparing protein for tissue building. The values of the carbohydrate content in the studied samples were lower than carbohydrate content of 20.89% for *Oka* (*Ptercarpus milbreadi L*) consumed in south-South ,Nigeria (Kolawole and Obueh. 2012) and 52.4% found in Jollof rice, consumed in Nigeria (Otemuyiwa and Adewusi,2014).

The fat requirement mainly depends upon the energy needs of the individual. From physiological point of view there can be wide variation in fat intake and still good health can be maintained. The dietary fats are good source of essential fatty acids. Just like carbohydrates deficiency, the energy needs will not be met if the diet is deficient in fat content leading to underweight, weakness and lowered work efficiency. Also, the deficiencies of the essential fatty acids is believed to lead to a skin condition known as 'phyrnoderma' (toad skin) in which the skin becomes rough in certain areas of the body, notably the thighs, buttocks and trunk. The fat content in the samples ranged from 3.72 ± 0.49% for Gwote to 10.57±0.74% in Amora. The high fat in Amora may be attributed to the high fat content of palm oil one of the main ingredient of the dish. The fat content of Amora is comparably higher than those of *Tuwon acha and Miyan karkashi* (3.77±0.38%) as well as that of *Tuwon dauro and Miyan toka* (4.0±0.28%) reported by Madukorshi *et al;* (2009) for commonly consumed traditional dishes by pregnant and lactating women in Bassa LGA of Plateau State of Nigeria. However, the values obtained is lower than those of *Mgbam* (36.35±2.32%) and *Nduduagworagwo* (18.75±0.06%) both Nigerian traditional foods as reported by Amadi *et al*

(2011) and DuruMajesty *et al* (2012) respectively, but similar to the 10.74± 0.05% reported for *uha* soup by Obiakor-Okeke *et al;* (2014).

Proteins are very essential for life processes, as there is hardly any important physiological function in which proteins do not participate. Many proteins have highly specialized functions in the regulation of body processes. All chemical reaction in the body is carried out by enzymes, which are protein in nature. Proteins are also a constituent of hemoglobin, which is necessary to carry oxygen from lungs to tissues and bring back CO_2, governing the body reaction are hormones, which are also proteins. Plasma protein has a fundamental role in the maintenance of water balance. Blood proteins also help in maintaining acid base balance of the body. The protein content of the dishes ranges from 3.81 $\pm$ 0.35% in *Tuwon dawa and miyan pululuk* to 7.47 $\pm$ 0.23% in *Mashor*. The reason for the high protein content in *Mashor* could be attributed to the beans (*Vigna unguiculata)* and sesame (*sesamum indicum)* used in preparation of the dish that are known to be high in protein (Kolawole and Obueh, 2009). The Protein content of Mashor is comparably lower than those of *Mgbam* (30.63±0.23%) and *Nduduagworagwo* (12.12±0.04%) as reported by Amadi *et al* (2011) and DuruMajesty *et al* (2012) respectively. However, the protein content of Mashor (7.47 $\pm$ 0.23%) was comparably higher to 5.99% obtained by (Kolawole and Obueh (2009) for Shaki and banga soup (Offals+Elaeis genesis Kernel soup, a traditional diet of South-South Nigeria). The low level of protein means that more animal source of protein should be inculcated into the preparation of the dishes.

Lack of adequate dietary fibre in diets had been reported to leads to constipation and colon cancer. Fibre helps in the cleansing of the digestive tract by removing potential carcinogens from the body. Also some of the dietary fibers like gum and mucilage's in our diets have been shown to lower blood cholesterol in hypercholesterolemia subjects and blood sugar in diabetes. The crude fibre values ranges between 0.62 $\pm$ 0.03% in Amora and 3.53 $\pm$ 0.13% in Tere. Tere has the highest crude fibre content because of the vegetables added, and vegetables have been proven to contain high amounts of fibre. The value is similar to those of *Mgbam* (3.78±0.12%) *and Nduduagworagwo* (3.15±0.09%) as reported by Amadi *et al.* (2011) and DuruMajesty *et al.* (2012) respectively.

Table 2: Proximate composition of traditional dishes

Dish	Moisture content %	Protein %	Fat %	Crude fibre %	Ash %	Carbohydrate%	Energy %
Tuwon dawa + pululuk Soup	80.29±0.10	3.81±0.35	5.88±0.19	3.00±0.02	3.69±0.11	3.34±0.16	81.52± 0.23
Amora	81.00±1.32	5.63±0.09	10.57±0.74	0.65±0.03	1.42±0.24	0.79±0.42	120.81±0.42
Mashor	78.30±0.13	7.47±0.23	5.00±0.09	1.60±0.09	2.12±0.08	5.53±0.01	97.0±0.11
Tere	80.51±0.25	6.50±0.27	5.31±0.12	3.53±0.13	3.18±0.02	0..97±0.04	77.67±0.14
Gwote	77.32±0.04	5.13±0.09	3.72±0.49	2.21±0.06	1.92±0.01	9.71±0.16	92.84± 0.25

Minerals play important roles in the body system, their function include provision of building materials and aiding chemical processes in body system. Table 3 reveals the mineral element composition of the traditional dishes.

Zinc content of the traditional dishes ranged between 7.18±0.10 and 51.68±0.09mg/100g, with the highest values obtained Tere (diet prepared from Acha and Green vegetables) and lowest values obtained in Tuwo dawa and Miyian Pululuk (Sorghum based diet). The zinc values met the 15.0mg RDA for adult in Tere, (51.68±0.09mg/100g) and Gwote (44.90±3.98mg/100mg) while the value obtained for Amora, Mashor and Tuwon dawa da miyan pululuk will meet the RDA by 94.7, 85.2 and 47.9 percent respectively. Zinc is an important trace element essential for immune function

and normal growth and development during pregnancy, childhood, and adolescence. A daily intake of zinc is required because the body has no zinc storage system

Table 3: Mineral composition of the traditional dishes (mg\100g)

Food	Ca	Mg	k	Na	Mn	Fe	Zn	Cu	P
Tuwon Dawa da Miyan Dululuk	0.63±0.01	0.33±0.02	0.17±0.01	51.30±0.06	53.36±0.79	41.67±0.97	7.18±0.10	3.56±0.08	52.63±0.94
Amora	0.51±0.01	0.22±0.01	0.18±0.01	59.97±0.16	71.99±0.09	58.55±0.08	14.20±0.05	9.65±0.12	58.18±0.38
Mashor	1.09±0.06	0.81±0.03	0.33±0.01	69.99±0.17	63.02±0.09	80.21±0.08	12.78±0.31	8.08±0.06	56.30±0.11
Tere	0.80±0.01	0.50±0.01	0.33±0.01	35.37±4.18	59.07±0.58	47.77±0.67	51.68±0.09	3.21±0.08	47.89±0.47
Gwote	0.63±0.01	0.30±0.02	0.27±0.01	48.25±0.17	62.75±0.62	54.22±0.04	44.90±3.98	1.80±0.02	38.42±0.13

Iron ranged from 41.67 ± 0.97 to 80.21±0.08 mg/100g, the highest value was reported for Mashor. The values obtained in this study met the 10.8mg RDA for adult and is also higher than the values reported by Otemuyiwa and Adewusi (2014) for both the conventional and ethnic foods such as jollof rice, fried rice, amala and cowpea. An adequate dietary iron intake is important in the synthesis of new blood cells to assist in growth and development and insufficient iron intake causes anemia which may result in negative and permanent effects on brain development. Encouraging the consumption of this iron rich traditional dishes especially among women will help in reducing the incidence of anemia where iron deficiency anemia is endemic but to enhance bioavailability they should be encouraged to increase the intake of fish or organic acids such as ascorbic acid to enhance absorption. Calcium is required for healthy bones and teeth, and needed for muscle function, nerve transmission, and contraction and dilation of blood vessels. Calcium apart from lowering the serum total cholesterol and low density lipoprotein cholesterol concentration through reduction in absorption of dietary fat, it may also help in the prevention of osteoporosis. The calcium content of these dishes ranges from 0.51± 0.01mg/100g in Amora to 1.09± 0.06mg/100g in Mashor. Mashor has high calcium content because, the black sesame used to prepare the food contains considerable amounts of calcium. However, the results obtained shows that the calcium content of these traditional dishes are low and therefore would not meet the 800mg RDA for adult as recommended by FAO/WHO (2005) but the concentration of calcium in the dishes are higher than 0.40mg/100g reported (Duru majesty *et al.,* 2012) for 'Ndudugworagwo' a traditional food consumed in Imo state, Nigeria. The Phosphorous content of these dishes ranges from 38.42± 0.03mg/100g in Gwote to 58.18± 0.38mg/100g Amora. Phosphorous in the body system works to facilitate the roles of calcium in the body (Turan *et al,*. 2003). FAO/WHO (2005) recommended good calcium and phosphorous ratio close to 1mg/100g. The ratio in this study is 58 which could predict good calcium to phosphorous absorption of the traditional dishes on consumption, digestion and its assimilation. According to Olayiwola *et al.* (2012), studies have shown that there are no known benefits of high sodium consumption and therefore suggested that Sodium intakes >1 g/day tend to aggravate a genetically determined susceptibility to hypertension, and intakes above >7 g/day may induce hypertension even in individuals who have no specific genetic susceptibility. Sodium content of the traditional dishes ranged from 35.37±4.1 to 69.99±0.17 mg / 100 g, with the highest value observed for Mashor. Sodium content of traditional food reported by

Duru Majesty *et al*. (2012) was 0.32 mg/100 g. The high sodium content observed in the present study may be due to the use of large quantity of table salt to the dishes during preparation for taste. High dietary sodium intake has been implicated for the development of high blood pressure and stiffening of the arterial walls and therefore, one of the risk factor for Coronary Heart Disease, which is a major cause of oedema or water retention (Otemuyiwa and Adewusi, 2014). The standard sodium-potassium ratio that favoured non-enhancement of high pressure disease is given as 0.60 all dishes in the present study exceeded this ratio.

The copper element is known to aid iron metabolism as an integral part of ceruloplasmin that converts ferrous to ferric prior to its transportation via transferring. Copper also participates in Immune system, function, red and white blood cells maturation and cholesterol and glucose metabolism. The copper content ranged from 1.80± 0.02 to 9.65 ±0.12mg/100g this values are higher than the values reported (0.25mg/100g) reported by Obiakor-Okeke *etal*., (2014) for ofe-ose soup thus suggesting that the traditional dishes are good sources of copper.

Table 4 reveals the anti nutrient composition of the traditional dishes. The phytate content of these dishes ranges from 0.23±0.01% in Gwote to 1.08±0.02% in mashor. The high phytate value may be due to the beans and sesame used. Studies have shown that appreciable amount of phytate of 4-9mg/100g is said to decrease iron absorption 4-5 fold (Hurrel *et al*, 1992). The recommendation daily intake (RDI) should be between 180-747mg/day (Ogbonna *et al,* 2004).

The oxalate content of these foods ranges from 1.89±0.04% in Tere to 4.11±0.02% in tuwon dawa da miyan pululuk. The high amounts of oxalates in this food may be due to high oxalate content found in karkashi. A daily intake of 450mg of oxalic acid has been reported to interfere with metabolism (Jahnen and Heynck, 1992).

The hemagglutanin content of these dishes ranges from 1.40±0.05% in Amora to 2.11±0.04% in both gwote and tuwon dawa da miyan pululuk. The high hemagglutanin content in these foods may be due to high amounts found in grains (maize and sorghum), (de Azipurua *et al,* 1988)

The tannic acid content of these foods ranges from 1.53±0.05% in tuwon dawa da miyan pululuk to 3.10±0.17% in Tere. The high content in Tere is nutritionally acceptable because the general daily intake should not be more than 60mg/100g (Chung *et al* 1998). The saponin contents of these dishes ranges from 2.33±0.12% in Gwote to3.83±0.13 in Mashor. The saponin content of these foods is generally high because saponin cannot be lowered by cooking process, and this allows saponin to bind with cholesterol causing leaky guts thereby leading to mal-absorption of calcium (Rao and Sung 1995: Anderson and Wolf, 1995).

Table 4: Anti-Nutrient composition of the traditional dishes

Food	Phytate %	Oxalate %	Hemagglutinin %	Trypsin Inhibitions %	Tannic Acid %	Saponin %
Tuwon Dawa	0.97±0.02	4.11±0.02	2.11±0.56	0.23±0.01	1.53±0.05	3.77±0.38
Amora	1.07±0.02	2.67±0.11	1.40±0.05	0.30±0.001	2.38±0.03	3.08±0.05
Mashor	1.08±0.02	3.90±0.05	1.48±0.12	0.32±0.01	2.53±0.05	3.83±0.13
Tere	0.30±0.01	1.89±0.04	1.84±0.01	0.22±0.01	3.10±0.17	5.70±0.21
Gwote	0.23±0.01	2.11±0.09	2.11±0.04	0.20±0.01	1.72±0.16	2.33±0.12

Traditional foods which are of native origin have been abandoned for market foods due to one reason or the other. Traditional foods consumed in Plateau State are mainly from natural origin which nourishes the body with nutrients and helps to reduce the incidence of malnutrition. The increasing rate of malnutrition is over whelming probably because foods were inappropriately combined together, poor or inappropriate preparation methods. Knowing the nutrient composition

of these traditional dishes is very essential in determining the availability of nutrients after the food must have been cooked and the various anti-nutrients which can hinder or reduce digestion or absorption of the food nutrients. The methods in which these selected foods were prepared helps to improve taste, digestion and absorption of the food. The dishes selected for this study were analyzed showing results for their macronutrient, mineral and anti-nutrient contents.

Conclusion.

The study shows that the foods items are rich in varying composition of energy, fibre, fat and essential minerals for man. However, their consumption should be regulated due to the presence of some anti-nutritional substances in diverse form and quantity.

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