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Nutrient and Phytochemical Composition of Some Commonly Consumed Traditional Dishes of Nasarawa State, Nigeria

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Abstract

This study evaluated the nutrient and phytochemical composition of some commonly consumed traditional soups, drink and dish of Nasarawa State, Nigeria. The soups include Miyan ridi with white sesame seed as main ingredient, Miyan ngbandar with okra leaves as main ingredients, Miyan karkashi with tender leaves of black beni seed as the main ingredient and Miyan karkashi manya with leaves of black beni seed and palm oil as main ingredients. The dish is jack bean pudding while the drink is made from sorghum. The nutrient and phytochemical composition of the food samples were analyzed using standard methods. Moisture content was high in all the samples and ranged from 66.81% for Zhepo to 83.20% for Miyan karikashi. Carbohydrate was low and ranged from 0.38% for Miyan ngbandar to 18.49% for Zhepo. Protein content was poor in all the samples and ranged from 3.10% for Miyan ridi to 6.38% for Miyan ngandar. Fat content ranges from 3.01±0.06 for Egbekpen to 11.17±0-12 for Miyan karkashi manya, while the fibre content ranges from 1.60±0.05 for Egbekpen to 4.12±0.08 for Miyan ngbandar and ash contents varied widely among samples at relatively low levels and ranges from 0.48±0.01 for Miyan ridi to 3.36±0.01 for Miyan ngbandar. The food samples have high contents of all the mineral screened and could serve as good source of them to consumers. Phytates content of the samples ranges from 0.30±0.01 in Miyan karikashi and Miyan ngbandar to 0.86±0.01 in Zhepo, also the Trypsin inhibitors content were found to be very low in all the food samples ranging from 0.27±0.01 in Miyan ridi and Miyan ngbandar to 0.58±0.02 in Zhepo. Saponin content ranged highest among the phytochemicals in the samples. Hemogglutinin and tannin were relatively low and ranged from 1.19% to 2.67%. Tannins act as antioxidants in food and in human when consumed. The food samples are better consumed interchangeably to derive adequate nutrition from them.

***Keywords**: Nutrient composition, phytochemical, traditional dishes, soups, drinks*

Introduction

Food is one of the basic needs of man and varies across the globe among nations, ethnic groups, sects, families and even among family members according to types, processing and methods, and the combinations in which they are served.

Indigenous diets of any group of people are influenced by their socio-cultural practices and types of food crops commonly available in their environment. Nasarawa state is in the North-Central zone of Nigeria with more than 40 tribes of diverse but interwoven

culture and traditions. These people have many indigenous diets prepared with many ingredients in their usual traditional methods. The staple foods of these people are mainly cereal grains, including rice, sorghum, millet, acha and maize; and sparingly tubers, including cassava and yam and rarely legume grains. Their nutritional value is enhanced through processing into various forms, cooking and then eating varieties of these foods. Sufficient data are available on the nutrient composition of these staples since they are valued and consumed in several other parts of Nigeria (Oyenuga, 1968; Ihekoronye and Ngoddy, 1985; Enwere, 1998). They are purely starchy foods and are enjoyed by people of other tribes of Nigeria. There are documented adequate nutritional information on the traditional 'foo-foo' since they are the same types consumed in many other tribes of Nigeria where their nutrient composition have been adequately evaluated and documented.

However, information on nutrient and phytochemical composition of most of their indigenous dishes, particularly the soups, drink and dish is not yet documented. Such information will be used in making nutritional guide line and nutrition education to the people for healthier living. This will help in handling most food-related misconception and ailments of these people. This study is therefore designed to evaluate nutrient and phytochemical composition of popular traditional soups, drinks and dish of Nasarawa State, Nigeria.

Materials and Methods

Sample collection and preparation: The food ingredients for each of the traditional soups, sauce or dish as shown in Table 1 were purchased from rural farmers in Lafia market in Nasarawa State, Nigeria. These were sorted, washed, and cooked in the right proportion as shown in Table 1 into the ready-to-eat forms. The prepared samples were each carefully packaged in plastic containers and taken to the laboratory for analysis.

Chemical analysis: Homogenous blends of each of the three vegetables were ground into fine powders and duplicate samples of each analyzed for proximate composition using the standard methods of the AOAC (2000). Moisture content was calculated from a weighed sample after heating at 105^0C or 4 h. Total nitrogen was determined by the Micro-Kjeldahl method, and crude protein estimated by multiplying the total nitrogen (N) by 6.25, a conversion factor. Total lipids were estimated by petroleum ether extraction, using Tecator Soxhlet apparatus. Total carbohydrate content was determined by difference. The total ash was estimated after incinerating in an ashing muffle furnace for 12 h at 550^0C. The mineral contents, namely calcium, iron, potassium, sodium, zinc, copper and cadmium were determined on the ash samples after dissolving in distilled water, using a Buck Model 200A flame atomic absorption spectrophotometer while phosphorus content was determined using the venadomolybdonate method (AOAC,

2000) as described by Onwuka, 2005.. Energy value was determined multiplying the protein, fat and carbohydrate contents by the Arwart factor of 9, 9 and 4.5 respectively.

Phytochemical analysis

Determination of oxalate content: Oxalate content of samples was determined as described by Oke (1966). A blend of each ground plant sample (1.0 g), 190 ml of distilled water and 10 ml of 6M HCl in 250 ml volumetric flask was digested in a water bath at 90^0C for 4 hours, and then centrifuged at 2000 rpm for 5 min. The supernatant was diluted to 250 ml with distilled water; and then titrated with concentrated ammonium hydroxide solution in drop wise, using methyl orange as an indicator which changed from pink colouration to faint yellow at the endpoint of titration. The resulting solution was heated at 90^0C for about 20min. on a water bath and 10ml of 5 % Calcium Chloride ($CaCl_2$) solution to precipitate oxalate as Calcium oxalate. The resulting solution was allowed to stand overnight, centrifuged and the residue dried at 60^{oC} for 48 h. The dry precipitate was weighed and triplicate weights expressed as percentage oxalate content. Each determination was done in triplicates and the mean values taken.

Determination of total alkaloid content: The alkaloid content of samples was determined as described by Harborne (1973). Ground samples (5.0 g) of test material was mixed with 50 ml of 10 % acetic acid in absolute ethanol and allowed to stand for 4 h. The mixture was filtered through whatman no 1 filter paper and the filtrate concentrated to one-quarter of its original volume on a water bath maintained at 90^0C. Alkaloid was precipitated from each sample, using a concentrated ammonium hydroxide solution (NH_4OH) and then allowed to sediment. Precipitates were collected, washed with concentrated NH_4OH and then dried in a hot air oven. The residue is alkaloid and is calculated thus: %Alkaloid = W2-W1 / W x 100,

Where, W_1 = Initial weight before drying, W_2 = Final weight after drying, W = weight of sample..

Saponin content determination: Ground sample (20 g) of the test material was extracted for 3 h with 100 ml of 20 % acetone using a Tecator soxhlet unit, applying extraction method of AOAC (2000). Each determination was done in triplicates and the mean values taken.

Phytate content determination: Phytate content was determined by the photometric method of Latta and Eskin (1980). Each test sample (2 g) was extracted with 100ml of 2.4 % HCl by shaking vigorously in a vortex mixer for 1h at room temperature (26 ± 2^{oC}) and then filtered through Whatman no 5 filter paper. The filtrate (5ml) was mixed with 1 ml of 0.1M Na-EDTA, 0.75M NaOH solution and then made up to 25 ml with distilled water before being placed on an ion-exchange (AG1X4, 100-200 mesh) column. The column was washed with 15ml of distilled water and then15ml of 0.1M

NaCl before being eluted with 15ml of 0.7 M NaCl. The eluate was collected and wet digested in a Kjeldhal apparatus with a mixture of concentrated H_2SO4 (0.5 ml) and HCl (3 ml). The digest was cooled to room temperature, 10 ml of distilled added, and the mixture heated again on a water bath at 80^0C for 10 min. The resulting solution was mixed with 2 ml of 2.5% ammonium molybdate solution in 1 N H_2SO_4, 1 ml concentrated sulphonic acid; and then made up to 50 ml in a 50 ml volumetric flask. Each solution was allowed to stand for 15 min before reading absorbance at 640 nm against a blank without the plant material. Each determination was done in triplicates

Tannin content determination: Tannin content was determined using the Vanillin-HCl method as described by Price and Betler (1977).Ground test material (0.5 g) was extracted at room temperature (26 ± 2^0C) with 3 ml of methanol for 60 seconds. The extracts were each reacted with 3 ml of 0.1 M $FeCl_3$ in 0.1 N HCl and 3 ml of 0.008 M $K_3Fe(CN)_6$. Absorbance of samples were read after 2 min at 720 nm, Tannic acid was used as a standard and values expressed as mg / 100g of test materials. Each determination was done in triplicates and the mean values reported.

Trypsin inhibitor content determination: The content of trypsin inhibitors in the food samples was determined using spectrophotometric as described by Arntfield *et al.*, 1985; and results expressed as percentage trypsin inhibitors in the samples.

Hemagglutinin content determination: Hemagglutinin contents of the samples were determined using microtitration procedure as described by Onwuka (2005).

Results and Discussion

Table 1 shows the recipes and modes of preparing popularly consumed traditional meal (Egbekpen), drink (Zhepo) and soups (Miyan ridi, Miyan karkashi, Miyan Karkashi manya and miyan ngbandar) of Nasarawa State, Nigeria. Eghekpen is puddy-like with lima bean as the base ingredient. It is ceremoniously served in almost all Egon (a tribe in the state) traditional marriage. Zhepo is a popular, drink with sorghum as the base ingredient, and it is mostly prepared by house wives. It is derished and taken by both young and old at any time of the day. The soups miyan ridi, miyan karkshi, miyan karkarshi manya and miyan ngbandar are respectively prepared with white sesame seeds, karkashi and okra leaves as the base ingredients. Miyan karkashi, miyan karkarshi manya and miyan ngbandar are draw soups while miyan ridi is a non-draw soup, just similar to melon soup. Either of the soups can be used for any of the popular foo-foo (tuwon-doya (yam), tuwon-dawa (sorghum), tuwon-rogo (cassava) and tuwon shinkafa (rice)). Miyan karkashi and miyan karkashi manya are claimed to reduce the incidence of hypertension in consumer. A good knowledge of their chemical composition is important for proper use in tackling the malnutrition problems.

Shown in Table 2 is the proximate composition of these traditional meal, drink and soups. Their moisture contents were relatively high (66.8 to 83.2%). The moisture contents were 83.2% for miyan karkashi, 80.6% for miyan. Ridi, 79.9 % for miyan ngbandar and 77.4 % for miyan karkarshi manya. The lima beans puddy, eghekpen had 50. 2 % moisture content. High moisture contents of these types of food indicate high susceptibility to microbial spoilage at ambient storage. They should therefore be consumed immediately after preparation or stored under cold storage or reheated before consumption to avoid microbial food poisoning. Energy, most of which came from carbohydrate, was high in all the samples. Carbohydrate provides energy to the cells in the body, particularly the brain, the only carbohydrate-dependent organ in the body (Effiong *et al*., 2009). The protein contents of the soups ranged from 3.10% for miyan ridi to 6.38% for miyan ngbandur. While Miyan karkashi and miyan karkashi manya had 4.4% and 4.6% protein contents respectively this is below the recommended dietary allowance of protein (FAO\ WHO 1998). These soups are usually served with starchy foo-foo meals that are averagely low in protein. This means that a person who takes these soups as components of main meal is supposed to take varieties of other protein-rich diets. Miyan karkashi and egbekpen are relatively poor in fat content (3%). Zhepo, a local drink, is a good source of fat (7.14%). Miyan ridi, miyan karkashi, miyan karkashi (manya) and miyan ngbandar also have high fat contents (10.85%, 11.7% and 6.58% respectively). Fibre contents of the traditional puddy, drink and soups were high (1.6 to 4.12%) and could be anti-hypertensive to consumers. Fibre has some physiological effects in the gastrointestinal tract. These effects include variation in faecal water, faecal bulk, transit time and elimination of bile acids and neutral sterols, which lowers the body cholesterol pool; thereby reducing the incidence of coronary and breast cancer (Lintas, 1992; Effiong *et al.*, 2005) Their high ash contents 0.6% for zhepo drink to 4.12% miyan ngbandar soup indicate high contents of most minerals needed in the body.

The mineral contents of these food samples are shown in Table 3. The drink (zhepo), jack beans puddy (egbekpen) and soups (miyan ridi, karkashi, ngbandar and karkashi manya) are relatively good sources of minerals. They generally have high contents of calcium, (Ca), magnesium (Mg) and potassium (K). Calcium content ranged from 0.39% in miyan ridi to 1.02% in miyan ngbandar. Magnesium and potassium contents ranged from 0.21% and 0.12% to 0.78% and 0.42% respectively. Other minerals were relatively lower and were expressed in mg/g in Table 3. Zink content was relatively low in miyan karkashi, miyan ngbandar, zhepo and miyan ridi but high in miyan karkashi manya and egbekpen. Iron (Fe) content ranged from 29.76m/g for miyan ridi to 82.16mg/g in miyan ngbandar.

The high values for minerals obtained in this study are consistent with report (Enechi and Odonwodo, 2003) who emphasized the important roles of minerals in the living systems. Others (Talwar *et al*., 1989) suggested that Iron, magnesium, zinc and manganese strengthen the immune system as antioxidant while zinc and selenium prevent cardiomyopathy, muscle degeneration, growth retardation, alopecia, dermatitis and bleeding disorder (Chaturvedi *et al*., 2004

Table 4 shows the phytochemical composition of these traditional dishes. Phytochemicals consist of a large group of non-nutrient compounds that are biologically active in the body. As implied in the name, phytochemicals are found in plants, including fruits, vegetables, legumes grains, herbs and their processed forms. In short, they are secondary metabolites of plants known to exhibit diverse physiological and biochemical effects in living organisms Table 4 indicate high contents of many important phytochemicals in the screened food samples. Phytate content was highest (0.86%) in zhepo and lowest (0.30%) in miyan ngbandar and miyan karkashi manya. Though the phytate values obtained in this work is higher than the values (0.04 to 0.11 mg\100) reported by Anigo etal (2009), but still less than 1% reported to interfere with minerals availability (Edman,1979). Therefore the bioavailability of nutrients in these samples may be high due to low levels of phytates. Low levels of phytates obtained in this study may be due to the processing methods such as germination used in the preparation of the sample which has been reported to reduce the concentration of antinutritional factors in foods (Gillooly, 1983). At low levels, most phytochemicals are of health benefit to consumers. Phytates are stable compounds that chelate excess divalent metals and control their excess absorption, thereby lowering the incidence of cancer in human (oboh *et al.*, 2003). Phytates chelate excess iron, thereby blocking iron-driven hydroxyl radical generation.

The oxalate content ranged from 1.53% in egbekpen to 5.18% in zhepo. Oxalate has been reported to be antinutritional and toxic to man at level of 2 – 5g (Oke, 1996). Dietary oxalate has also been shown to complex with calcium, magnesium and iron, forming insoluble oxalate salts which cause oxalate stone (Oke,1966) oxalate has also been reported to positively reduce the incidence of oxidative degenerative diseases by reducing the radical initiating divalent metals. This effect is at low concentration.

The contents of saponin (2.99% to 6.17%) obtained in this result is in agreement with range recommended (), moderately and tolerance level for normal adults. Saponins possess a carbohydrate moiety attached to a triterpenoid or a steroidal aglycone (Sridhar and Bhat, 2007) saponin reduces the uptake of glucose and cholesterol at the gut through intralumenal physicochemical interactions. This could confer a chemo-

protection against heart disease to users because of the hypo-cholesterolemic effect (Price *et al*., 1987). It may also and in liver efficiency.

The haemagglutinin content of the samples was very low. This compound is anti-nutritional, largely present in most cereals and legumes but is very heat-labile. Thus cooking account for the low contents of these phytochemicals in the soup (1.19 to 1.72%) and jack bean pudding (1.53%).

Also the Trypsin Inhibitor content of the samples is very low (0.27 to 0.58%), probably due to destruction by heat during cooking which result in increase in the nutritive value of protein (Manay et al, 2008). The zhepo drink which received relatively low heat treatment retained the highest contents of these last phytochemical components. High levels of the Trypsin Inhibitor has been reported to result in growth retardation by not only impair protein digestion but also due to the endogenous loss of essential amino acids (Manay et al, 2008).

Table 1: Identification of basic food ingredients of most commonly consumed soups, jack bean puddy and drink

Local name	**Type of food**	**food ingredients**	
		Basic	
		Common name	**Scientific name**
Miyan ridi	Soup	Sesame seed	*Sesamum radiatum*
Miyan ngbandar	Soup	Tender leaves of okra	*Abelmoschus esculentus*
Miyan karkashi	Soup	Tender leaves of black beni seed	*Sesamum indicum.*
Miyan karkashi manya	Soup	Leaves of black beni seed	*Sesamum indicum.*
Egbekpen	Jack bean pudding	Jack bean	*Canavalia ensiformis*
Zhepo	Drink	Sorghum	*Sorghum bicolor*

Table 2: Proximate composition of traditional foods in Nasarawa State

Dishes	**Moisture %**	**Carbohydrate %**	**Protein %**	**Fat %**	**Fibre%**	**Ash %**
Zhepo	66.8±0.38	18.49±0.03	5.07±0.18	7.14±0.14	1.88±0.00	0.60±0.00
Miyan ridi	80.56±0.86	1.09±1.16	3.10±0.13	10.85±0.32	3.94±0.11	0.48±0.01
Miyan karkashi	83.20±0.04	4.77±0.08	3.10±0.13	10.85±0.32	2.01±0.04	2.51±0.00
Miyan ngbandu	79.87±0.91	0.38±0.42	6.38±0.09	6.58±0.10	4.12±0.08	3.36±0.10
Miyan karikashi manya	77.44±0.17	2.26±0.06	4.60±0.05	11.17±0.12	2.45±0.08	2.10±0.01
Egbekpen	80.17±0.08	9.19±0.00	3.97±0.04	3.01±0.06	1.60±0.05	2.06±0.02

Table 3: Mineral composition of the dishes

Dish	Ca (mg/100g)	Mg (mg/100g)	K (mg/100g)	Na (mg/100g)	Mn (mg/100g)	Fe (mg/100g)	Zn (mg/100g)	Cu (mg\100g	P (mg\100g)
Zhepo	88.2±0.02	39.2±0.02	2.0±0.00	43.20±0.12	90.21±0.64	51.06±0.23	11.70±0.24	7.1±0.18	53.02±0.04
Miyan ridi	39.3±0.01	21.3±0.00	12.0±0.01	36.24±0.50	59.20±1.25	29.76±0.35	5.25±0.21	2.20±0.04	41.09±0.29
Miyan karkashi	57.4±0.01	31.1±0.01	18.2±0.07	37.77±1.19	49.7±0.88	61.15±0.10	4.03±0.08	1.98±0.04	48.77±0.20
Miyan ngbandu	102.6±0.01	78.6±0.01	42.1±0.00	60.15±0.10	71.3±0.13	82.16±0.50	6.26±0.10	5.33±0.09	59.97±0.22
Miyan karikashi manya	68.3±0.01	40.2±0.01	2.0±0.00	61.12±0.39	65.05±0.25	66.16±2.96	56.78±0.62	4.41±0.12	60.08±0.27
Egbekpen	88.7±0.00	26.4±0.35	33.2±0.00	61.11±0.17	58.30±0.06	60.05±20.38	45.46±0.09	1.57±0.01	29.69±0.6

Table 4: Phytochemical composition of the dishes

Dish	Phytate (%)	Oxalate (%)	hemagglutinin (%)	Trypsin inhibitor (%)	Tannin (%)	Saponin (%)
Zhepo	0.86±0.01	5.18±0.16	2.67±0.15	0.58±0.02	1.79±0.06	4.01±0.04
Miyan ridi	0.52±0.01	1.99±0.03	1.19±0.11	0.27±0.01	2.31±0.06	6.17±0.08
Miyan karkashi	0.42±0.01	3.42±0.65	1.72±0.04	0.36±0.01	1.71±0.06	2.99±0.09
Miyan ngbandu	0.30±0.01	2.12±0.01	1.62±0.04	0.27±0.01	2.11±0.03	3.85±0.10
Miyan karikashi (oil palm)	0.30±0.01	2.50±0.09	1.64±0.12	0.30±0.00	2.19±0.05	4.30±0.02
Egbekpen	0.40.00	1.53±0.08	1.71±0,06	0.32±0.00	2.02±0.05	5.50±0.60

Conclusion

The results of this study show that none of the food sample is capable of supplying all the nutrients to adequately support the nutritional requirement of consumers. However, when the meals are consumed regularly and in combination, their compositions suggest that they could meet nutritional requirement of healthy individuals. Thus by taking these popular meals regularly and in combination, the people balance their nutritional requirement from their available food stuff. They combine to serve nutrition adequacy; and their regular consumption is encouraged.

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