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Some Nutrient Composition of Ready-to-Eat Foods Consumed by Pregnant and Lactating Women in Bassa LGA of Plateau State, Nigeria

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Abstract: The need to evaluate the nutrient intake of pregnant and lactating women in the developing countries, with a view to applying adequate intervention for a successful pregnancy course and lactation period, has long been highlighted. The ready-to-eat foods consumed by pregnant and lactating women in Bassa local government area in Nigeria, were analyzed for proximate and some elemental composition using standard methods. Our results showed that among the seven indigenous foods, "tuwon acha/miyan touse (basically made up of *Digitaria exiglis*) contains higher levels of fat 14.06±1.36 and crude protein 48.79±8.67 (g/100g dry matter), than the rest of the foods. Its minerals content were similar to those determined from "tuwon douro/miyan touse" (basically made up of *Pennisetum typhoides*). These were calcium 74.18±1.74, magnesium 300.96±20.4 and iron 40.60±1.8 (mg/100g dry matter). On the other hand, the Nitrogen Free Extract (NFE) and total calorie determined from all the food samples were low. The estimated intake of crude fat and the mineral element iron were within the acceptable literature levels. Contrarily the intake of calcium was far below the recommended value. It is recommended that these foods be improved through food fortification.

Key words: Nutrient, pregnant, lactating, women, foods

INTRODUCTION

Women (and children) are often more vulnerable to malnutrition than men. This is particularly so in the developing countries where women are known to be underfed and at the same time overworked both on the farm and in household chores (Onimawo, 2001).

The vulnerability of women to malnutrition is heightened during conditions of pregnancy and lactation-periods characterized with increased nutritional needs as a result of induced stress. These nutritional needs include the requirement for energy, protein, vitamins and minerals. Among the essential mineral elements are iron, calcium, phosphorus, iodine, zinc and magnesium, some of which are often deficient in the diet of many Nigerians (Onimawo, 2001; FOS/UNICEF, 1999; UNICEF, 1993).

In the present study, the proximate and some elemental composition of the ready-to-eat meals consumed by pregnant and lactating women from the rural parts of Bassa Local Government Area (LGA) of Plateau State were determined. The mineral components of these foods were compared with those from urban Jos North LGA of the same Plateau state. Ready-to-eat foods whose nutrient contents were adequate for normal nutrition were identified for onward recommendation in nutrient supplementation programmes. On the other hand, those foods whose nutrient contents were inadequate were not. The later could be further developed and improved upon, so that they could be beneficial to the pregnant and lactating women.

MATERIALS AND METHODS

The staples, tuwon acha (basically made of *Digitaria exilis)*, tuwon dauro (basically made of *Pennisetum typhoides*) and the soups, miyan touse, made up of *Hibiscus subdariffa* or red sorell leaves, miyan karkashi (made up of *Artemisia spp* leaves), miyan toka (ash obtained from Amaranthus leaves "-alaihu koya" and *Arachis hypogea* leaves) miyan dargaza (*Grewia mollis spp*), were collected from our subjects residing in rural Bassa LGA of Plateau State. The other meals, Jellof rice, rice/beans porridge (porridge made from black eyed beans), beans porridge, yam/vegetable porridge, tuwon massara (Z*ea mays*) /egusi/ogbono vegetable soup (made from seeds of *Citrullus vulgaris* and *Irvingia gabonensis*) and moin-moin (basically made up of black eyed beans), were obtained from subjects living in urban Jos north LGA. All the food samples were collected at three different occasions within a period of 12 months.

The proximate composition of the food samples were determined according to the method described by AOAC (1980). The protein determination (N×factor) was done by Kjeldahl method, fat as ether extract, crude fibre as the portion of carbohydrate insoluble in dilute acids and alkalis under the given conditions and the Nitrogen Free Extract (NFE) as the remainder after accounting for crude fat, protein, fibre and ash. Estimation of cations in the ashed food samples were carried out using a Hitachi model 180-80 polarized Zeeman automatic Atomic Absorption Spectrophotometer.

Table 1: Recipes of Prepared Meals

Ready-to-eat-foods	Recipes	English or Scientific Name
1. Tuwon acha/miyan touse	Acha yakuwa locust bean cake, smoke fish, dried melon seed, salt, red pepper (fresh), onion, red palm oil, and water	Hungary rice (*Digitaria exilis*) Fresh sorrel leaves (*Hibiscus subdariffa*) *Parkia dappertoniana*, *Cutrullus vulgaris*
2. Tuwon acha/miyan karkashi	Acha, karkashi leaves, locust bean cake, smoked fish, tomatoes (very little) potash, salt, red pepper (fresh) onions, red palm oil and water	*Artemisia spp*
3. Tuwon dauro/miyan toka	Dauro, senyi (ash from alaihu kaya, groundnut leaves or maizecob) locust bean cake, salt, (little), red pepper (fresh), onions, no palm oil and water.	Millet, (*Pennisetum typhoides*) Ash from (*Amaranthus caudatus, Arachis hypogea, Zea mays* cob)
4. Tuwon dauro/miyan dargaza	Millet, dargarza stem locust bean cake, salt, red pepper (fresh) onions and water.	*Grewia mollis spp*

Table 2: Proximate Composition of some Ready-to-eat foods commonly Consumed by Indigenes in Bassa LGA of Plateau State

	Proximate composition of cooked foods (g/100g dry matter)						
Nutritional parameters	Towonacha and Miyan touse	Tuwon acha and Miyan Karkashi	Tuwon dauro and Miyan toka	Tuwon acha and Miyan toka	Tuwon acha and Miyan dargaza	Tuwon Dauro and Miyan touse	Tuwon Dauro and Miyan dargaza
Moisture	76.62±0.52	75.79±3.32	84.73±1.94	83.79±2.3	83.43±2.94	74.12±2.12	83.93±1.60
Dry matter	23.38±0.52	24.21±3.32	15.27±1.94	16.21±2.3	16.57±2.94	25.9±2.5	16.07±1.6
Crude fat	14.06±1.36	3.77±0..38	4.0±0.28	8.12±2.86	3.15±0.07	13.31±1.00	3.5±0.51
Crude protein	48.79±8.67	41.06±4.19	28.64±3.39	30.2±1.24	40.03±1.71	40.02±0.55	40.12±0.2
Crude fibre	14.0±0.17	20.0±0.71	32.5±1.35	32.2±1.91	22.5±3.46	24.5±2.83	22.4±1.2
NFE	17.15	30.97	28.26	23.88	28.12	15.57	28.18±1.1
Caloric value (kcal)	418.18	394.51	385.6	401 96	384.65	413.53	394.30
Ash	6.0±0.06	4.2±1.1	6.6±0.85	5.6±0.57	6.2±0.85	6.6±0.28	5.8±1.13

Tabulated values were means±SD of three batches (ND-Not detected)

Table 3: Some Mineral Composition of Ready-to-eat Foods commonly Consumed by Indigenes in Bassa LGA of Plateau State

	Mineral composition of cooked foods (mg/100g dry matter)						
Mineral elements	Towon acha and Miyan touse	Tuwon acha and Miyan karkashi	Tuwon dauro and Miyan toka	Tuwon acha and Miyan toka	Tuwon acha and Miyan dargaza	Tuwon Dauro and Miyan touse	Tuwon Dauro and Miyan dargaza
P	66.0±0.28	50.00±3.54	64.00±5.37	56.00±1.41	53.32±9.93	56.26±2.04	51.12±4.81
Ca	74.18±1.74	14.76±0.7	43.32±0.96	42.39±0	57.26±1.67	74.47±1.72	58.17±1.74
Na	1607.87±7.8	886.90±4.5	503.74±0.01	245.72±1.68	1415.43±1.24	956.87±0.66	956.18±2.90
K	1142.52±4.8	642.60±4.5	2581.12±19.2	2012.86±7.84	622.29±2.48	971.52±8.58	979.56±12.76
Mg	300.96±2.4	193.05±1.5	205.18±1.28	211.46±0.56	234.73±0	231.99±1.32	187.40±0.58
Zn	3.41±0.04	2.60±0.02	3.05±0.02	2.89±0	2.69±0.03	3.03±0.033	3.12±0.01
Cu	0.62±0.003	0.49±0.002	0.63±0.01	0.57±0.01	0.46±0.01	0.82±0.02	0.69±0.001
Fe	40.60±1.8	25.85±1.25	33.82±0.77	33.76±0.39	11.08±0.04	39.04±1.78	26.44±0.64
Mn	2.36±0.042	1.52±0.05	2.42±0.032	1.92±0.011	2.14±0.06	2.22±0.09	2.67±0.07
Pb	0.01±0.001	ND	$3.99x10^{-3}$±0.003	ND	ND	0.02±0.01	ND
Cd	ND	ND	ND	$5.74x10^{-3}$±0.001	ND	ND	ND

Tabulated values were means±SD of three batches. (ND-Not detected)

The estimation of inorganic phosphate as phosphorus was carried out by phosphomolybdic acid method (Oser, 1976).

RESULTS

The proximate components determined from the seven indigenous foods from Bassa LGA ranged from 67.10 to 86.67 for moisture, 3.08 to 15.42 for fat, 25.25 to 57.46 for crude protein, 13.83 to 34.11 for crude fiber, 3.1 to 7.45 for ash and 15.57 to 30.57 for NFE (g/100g dry matter) (Table 2).

On the other hand the mineral content ranged between 43.39 to 69.37 for phosphorus (P), 14.66 to 76.19 for calcium (Ca), 244.04 to 1615.67 for sodium (Na), 619.81 to 1147.32 for potassium (K), 166.82 to 303.36 for magnesium (Mg), 2.58 to 3.45 for zinc (Zn), 0.45 to 0.84 for copper (Cu), 11.04 to 42.40 for iron (Fe), 1.47 to 2.74 for manganese (Mn), 0 to 0.03 for lead (Pb) and 0 to 6.74×10^{-3} for cadmium (Cd) (mg/100g dry matter) (Table 3).

The levels of the mineral elements determined from the six ready to-eat foods from Jos north LGA were in the range 22.86 to 137.29 for P 3.09 to 46.42 for Ca, 551.08 to 1794.42 for Na, 490.83 to 2349.87 for k, 67.88 to 412.53 for Mg, 3.11 to 6.83 for Zn, 0.34 to 1.32 for Cu, 7.96 to 52.58 for Fe, 0.38 to 3.77 for Mn, 0.009 to 0.07 for Pb and 0 to 0.04 for Cd (mg 100g dry matter) (Table 4).

DISCUSSION

The proximate compositions of the seven main dishes consumed by the indigenes from Bassa LGA of Plateau State were examined in the light of their nutrient

Table 4: Mineral Composition of some Ready-to-eat Foods Consumed by Indigenes in Jos L.G.A of Plateau State

	Mineral composition (mg/100g dry matter)					
Mineral elements	Jellof rice	Rice and Porridge beans	Beans porridge	Yam porridge with vegetable	Tuwon masara/agusi/ ogbono/vegetable soup	Moin-moin
P	27.43±4.57	42.72±1.56	72.0±1.41	39.44±0.84	128.80±8.49	67.69±5.09
Ca	3.28±0.19	10.39±0.45	20.97±1.31	28.97±2.08	46.24±0.18	30.41±1.11
Na	1320.62±0.69	1192.75±1.92	1397.45±12.96	1262.01±38.40	551.08±0	1743.54±50.88
K	496.32±5.49	736.52±3.84	1809.08±36.0	2217.07±132.80	836.23±1.38	1189.49±18.50
Mg	68.57±0.69	133.39±1.44	328.03±2.88	198.42±0.8	409.77±2.76	246.79±0
Zn	3.12±0.01	3.93±0.01	6.74±0.09	3.25±0.01	6.46±0.03	4.8±0.03
Cu	0.34±0.003	0.66±0.013	1.03±0.01	1.11±0.01	1.27±0.05	0.85±0.004
Fe	9.76±0.12	45.85±1.25	12.12±0.10	8.37±0.39	52.35±0.23	12.12±4.16
Mn	1.01±0.27	1.5±0.024	3.53±0.24	0.43±0.054	1.98±0.032	1.74±0.134
Pb	0.02±0.01	0.02±0.005	0.03±0.01	0.04±0.01	0.06±0.01	0.02±0.011
Cd	ND	ND	0.04±0	ND	$8.32x10^{-4}$±0.001	ND

Tabulated values were means±SD of three batches (ND-Not detected)

contents, calorie sources and their contribution to the energy intake. In addition, the mineral components of the foods, from both Bassa and Jos North LGA's, were examined and compared in order to identify foods with higher contents of the essential minerals.

The proximate composition

Fat: The fat content of touse-based meals determined from Bassa LGA was about 17% of mean calorie, which was higher than those of the other foods (Table 2). This trend had been shown in the work of Oguntona and Akinyele (1995). The sources of this fat were mostly from plants and vegetables. Plant foods are known to have low content of saturated fatty acids but high in polyunsaturated fatty acids.

Protein: The mean level of protein determined from the foods was high and consequently represented a high percentage of the food calorie. However our determinations showed that toka-based meals had a remarkably lower protein content, 28.64±3.39 to 30.2±1.24, than the other foods from Bassa, LGA 40.03±1.71 to 48.79±8.67 (g per 100g dry matter). This difference was in part attributed to the methods of processing used. For example toka-based foods were prepared using ash derived from incinerated vegetable products.

The determined proteins, thought representing a high percentage of estimated calorie intake, were mostly cereal-based. Cereal proteins are known to provide little amount of the essential amino acids and are limiting in lysine (WHO, 1985; Okoh, 1998).

Nitrogen Free Extract (NFE): The NFE determined from our present work contributed an average of about 24% of the energy supply from these foods. Judging from literature recommendations (King and Burgess, 1995), NFE's contribution to the energy intake was deemed low.

Crude fiber: Our estimation suggested that the intake of fiber among the pregnant and the lactating women in Bassa was higher than the guideline in the above cited reference. Fiber, although essential in nutrition, when in high level in a diet could lower the available energy present in such foods (King and Burgess, 1995). If this occurred, the availability of some nutrients (such as proteins and minerals.) for cell metabolism would be impaired.

Mineral components: The mineral content of *Digitaria exilis* and *Pennisetum typhoides* (the two basic staples consumed in Bassa) were reported to be similar quantitatively (Osagie and Eka, 1998). In the present work some differences were observed which were attributed to the mineral supply from the soups. For example, tuwon acha/miyan touse which had the highest content of phosphorus, calcium, sodium, magnesium, zinc, iron and lead, was similar in mineral content with tuwon douro/miyan touse. Both staples were consumed with the same type of soup, miyan touse.

Calcium content of both foods from Bassa and Jos LGA were very low when compared to the RDA (Recommended Daily Allowance) of 1,200mg recommended for pregnancy and lactation (WHO, 1985; King and Burgess, 1995).

The RDA for iron is 18mg, out of which 10-15% is expected to be absorbed (Linder, 1991). However in pregnancy and lactation extra 30-60 mg/day is recommended (Tietz, 1987). Going by these recommendations, it would appear that the mean iron intake in Bassa LGA (30.08±10.09 mg/10 g dry matter), was adequate. However the amount absorbed in the body depends, not only on the quantity consumed but on other factors such as the bioavailability conditions.

Lead (Pb): About 0-0.03mg/100g dry matter of Pb was determined from the touse-based foods (tuwon acha/miyan touse and tuwan dauro/miyan touse). The sources of Pb in these foods seemed to come from the red sorrel leaves (yakuwa), which was the basic ingredient in touse soup (Table 1). On the other hand a higher range 0.01-0.02mg per 100g dry matter was

determined in foods from Jos North LGA. Jos is one of the major mining areas in Nigeria and as such it is possible that Pb contamination of the environment is having its toll on the bioaccumulation of the element in the plants grown in the region from where they get into human foods.

Lead is capable of inhibiting the activity of some enzymes (especially those that depend on the presence of free sulhydryl group for their action), block acetylcholine release and interfere with channels used by calcium (Linder, 1991). Also, its materno-foetal transfer had been reported in pregnancy (Carbone *et al*., 1998). These workers agreed that lead, apart from giving rise to low birth weight and causing some neural defects, could also place the infants at risk of impaired renal functions and lead toxicity which would require prolonged monitoring.

Conclusion: This study assessed the nutritional status of the pregnant and lactating women in Bassa LGA of Plateau State, through their food intake analysis. However it is recognized that the quantity of nutrient/energy obtained by means of chemical determination does not expressly represent the amount available to the body for absorption.

The proximate determinations showed that the ready-to-eat-foods which were cereal-based contained a lot of fibre, protein and moderate fat. Contrarily the determined NFE and total calorie were low and hence appeared inadequate for this population of women. It is postulated that the protein-sparing action of the food-carbohydrates might be interfered with, in individuals subsisting on these foods.

Among the mineral elements determined, foods from Bassa showed a higher content of iron, manganese and potassium than those from Jos North LGA. This was attributed to the soup content-miyan touse. On the other hand, those foods from Jos North LGA had higher levels of P, Na, Mg, Zn, Cu and the toxicant, Pb. Much of the mineral elements were derived from the *Zea mays/Cucumeropsis mannii*-based food.

The iron content of the foods from Bassa was in consonant with the RDA. From our results, the pregnant and lactating women in these areas might not be in danger of iron deficiency problems. However other secondary factors, such as high Pb levels, might mediate and antagonize iron metabolism causing anaemia in pregnancy.

The calcium content of foods from Bassa LGA, though higher than those from Jos North LGA was found to be far below the RDA for pregnancy and lactation. These findings are in consonant with our earlier reports (Obienu-Madukosiri and Adoga, 2001).

Recommendation: Compliance with nutritional recommendation would be a lot easier, when such guidelines are based on foods from one's own environment. Foods analyzed in the present work were indigenous, available and 'low-cost'. It is hoped that this type of study, when conducted in other regions would contribute to solving the problem of malnutrition among pregnant and lactating women in the developing countries. Adequate base-line information on the food habit of the targeted population should always be obtained before embarking on nutrient supplementation programmes. This would be necessary so as to avoid mineral over-load.

Iron-rich foods should be accorded adequate popularity during nutrition counseling in ante-natal and post-natal clinics. On the other hand, the low calcium content of the foods should be viewed with concern and improved upon through food fortification programmes. The fibre component should be reduced to acceptable levels by further processing, so as to render the foods more beneficial to the pregnant and lactating women who depend on them for their nutritional needs.

In the aspect of the toxicants Pb and Cd, proper legislation which should be environmental friendly could be adopted, so as to reduce the amount of toxic chemicals released into the environment. In addition, the bioavailability of the nutrients should be ascertained because of the presence of anti-nutritional factors known to be present in plant foods. Some of these measures, among others, when put in place would make it possible for the pregnant and lactating mothers, particularly those in Bassa LGA and by extension to others who are vulnerable to malnutrition, to obtain their nutritional requirement from foods available in their environment.

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