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SEASONAL VARIATIONS AND CONTRIBUTIONS OF CASSAVA TO THE NUTRIENT INTAKES OF RURAL FARM HOUSEHOLDS

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ABSTRACT

Nutritional assessment of 72 subjects from randomly selected 34 rural farm households of Ohosu community in Edo State, Nigeria was done using anthropometric measurements of weight and height. A four day weighed food intake study was carried out in the months of August (S_1), November (S_2), February (S_3), and May (S_4) 1998 - 1999. Analysis of weight for height compared with standards for children and adults showed that 52.78% of the subjects were wasted. The nutrient intakes were below the FAO/WHO requirement values for over 80% of the subjects. The most wide - spread nutrient deficiencies were protein, thiamin and riboflavin. Vitamin A intake was adequate for over 95% of the subjects. Cassava products were consumed by 99% -100% of the subjects in any one day of the seasons. Cassava was the major source of nutrients in their diets. It contributed between 6% and 23% of the daily nutrient intake. The energy intake of women (155.6% of requirement) aged 31-40 years was significantly higher in S_1 than in all the other seasons (LSD. 05 = 51.84).

Key words: Nutrient intake, seasonal variation, farm households, cassava, supplementary foods.

INTRODUCTION

Food consumption patterns in Nigeria are characterized by seasonal variations and fluctuations. Other factors that influence food intake are socioeconomic status and cultural practices. Seasonal factors are important in the rural areas where food intakes are reduced during the planting season (the wet season). This is the season when work output is greatest and requires high nutrient intakes. Most communities and environments have some seasonal variations in both climate and crop patterns. These variations are most extreme where there is a monomodal rainy season and where the population depends on locally grown crops (Bates *et al.*, 1994). The communities virtually do not depend on imported foods as a result of weak cash-base of the economy and lack of transport (Bates *et al.*, 1994).Such a situation is commonly seen in rural farming areas of countries like the Gambia (Roberts *et al.*, 1982).

Micronutrient deficiency is a wide spread problem in many developing countries where meat and dairy products are scarce. In Gambia, pregnant and lactating women met less than 50% of their energy requirements in the wet season which was reflected in lower birth weights of babies and reduced breast milk output compared with the dry season (Roberts *et al.*, 1982).Seasonal fluctuations in riboflavin status was related to changes in the balance between energy intake and output rather than to seasonal changes in riboflavin intake (Bates *et al.*, 1994). In Nigeria, no seasonal differences were observed in the energy intakes of pre-school children and pregnant women. However, there was lower intakes of protein, calcium and vitamin C in the wet season and higher intakes of fat and vitamin A in the dry season (Nnanyelugo *et al.*, 1985).

Socio-economic status will determine purchasing power as well as influence the quality and quantity of the diet. In particular, the poor have only limited access to expensive animal products, while sources of vegetable proteins such as legumes form a very important part of their diet (Nnanyelugo *et al.*, 1985).Poor households must have to make substantial food purchases to meet basic nutritional needs such as energy and protein (Marten and Abdoellah, 1988).
In male dominated societies like Nigeria important sociocultural factors such as who was first served food; who got the first choice of food; the sequence in which meals were served and the attitude towards food which was often positive for preferred food influence food distribution in the household (Okeke and Nnanyelugo, 1989). There were differences of the order of 17%-67% between energy intakes of adult males and other family members (Okeke and Nnanyelugo, 1989). Prestige foods were often reserved for men to attend to first before women and children (Okeke and Nnanyelugo, 1989).

This study was undertaken to assess seasonal variations and the contributions of cassava to the nutrient intakes of predominant cassava producers and consumers of Ohosu community in Edo State of Nigeria.

Table 1: Calendar of farming activities in Ohosu

ACTIVITY		MODE		
		Minor	Regular	Peak
Land Clearing		-	Nov-March	Feb-April
Planting:		-		
	Cassava	-	March-April	April-June
	Maize (early)		March-June	-
	Maize (late)	-	Aug -Sept	-
	Yam	-	March-May	-
Wedding:		-	-	April - Nov.
Harvesting:		-	-	-
	Cassava	March-Oct	-	Nov-March
	Maize (early)	-	May -July	--
	Maize (late)	-	Nov - Jan	-
	Yam		Sept -Jan	
Processing:				
	Cassava	May-Sept	-	Nov- March
	Oil Palm	-	-	Feb -May

Table 2: Age group, sex, mean heights and weights, of the subjects

Age group (years)	Sex	N	Height (m) (mean ±SD)	Weight (kg) (mean ±SD)	Percent --under weight (wasted)	Interpretation
Pre-school children (3-5)	M	14	0.96±0.2	12.1±0.4	57.14(8)	<80% NCHS median value
	F	8	0.98±0.5	12.8±0.3	62.50(5)	<80% NCHS median value
School children (10-12)	M	10	1.35±0.3	26.5±03	60.00(6)	<80% NCHS median value
	F	23	1.35±0.1	23.3±0.6	56.52 (13)	<80% NCHS median value
Adults (31-40	F	17	1.61±0.5	48.7±0.6	35.29 (6)	<18.5 WHO body mass index (BMI)

Number of subjects found underweight is in parentheses

MATERIALS AND METHODS

Study Area

The study was done in Ohosu community in Edo State of Nigeria. Ohosu belongs to the mandate areas of International Institute of Tropical Agriculture (IITA) Ibadan. Cassava is predominantly produced and consumed in Ohosu. The community was chosen for this study on the basis of the IITA mandate crops of which cassava is one. Ohosu is a rural community with wet (April to October) and dry (November to March) seasons. Farming and post harvest processing of farm products go on all the year round (Table1) and most of the farm products are commercialized. The major staple is cassava (*Manihot esculenta*) and the other foods include maize (*Zea mays*), cocoyam (*Colocasia esculenta*), plantain (*Musa paradisiaca*), melon (*Colocythis spp.*) and yam (*Dioscorea spp.*). However, fruits and vegetables are seasonal.

Ohosu is a new settlement of twenty two years old (22 years). The settlers migrated from fourteen different tribes in Delta and Edo States. Most of the settlers were full-time farmers. There were 112 farm households in Ohosu community residing in 15 different camps.

The natural vegetation of Ohosu has been described elsewhere (Nweke *et al.*, 1988). Ohosu falls within the tropical rainforest, characterized by tall evergreen trees with dense undergrowth. Rainfall in a year ranges between 1,147mm and 2,200mm. The three very dry months in Ohosu are December, January and February.

Ohosu has only one primary school. Above all, there is no local market, rather inhabitants go to a 5-day market located in a neighbouring town, Ugbogui. The major sources of water supply are streams and private wells. The source of light is mainly kerosene hurricane lamps and candles. There is a health post with dispensary and maternity sections to provide a daily service for the sick. However, drugs are usually out of stock.

Table 3: Mean daily nutrient intakes of preschoolers, school age children and adult females compared with FAO/WHO recommended intakes

	Energy (MJ)	Energy (Kcal)	Protein (g)	Calcium (mg)	Iron (mg)	Vitamin A (μg)	Thiamin (mg)	Riboflavin (mg)	Ascorbic Acid (mg)
Pre-schoolers *3 – 5 yrs.*[a] *N = 22*	63	1051.4 (41.2)[b]	1.3 (0.41)	306.4 (12.11)	5.2 (0.12)	315.3 (19.44)	0.3 (0.01)	0.3 (0.02)	10.2 (1.22)
FAO/WHO *Recommended intake 3 – 5yrs*	5.5	1595	27.5	450	7	400	0.6	.95	20
% FAO/WHO *recommended intake*		65 9	48.4	68.1	74.3	78.8	50.0	31.6	51.0
School age children *10-12yrs*[a] *N = 33*	9	2153.4 (4.33)[b]	22.0 (0.19)	455.5 (12.51)	6.4 (4.35)	776.0 (31.34)	0.43 (0.01)	0.42 (0.02)	15.6 (3.07)
FAO/WHO *Recommended intake 10-12yrs*	10.4	2475	46	650	12	500	1.0	1.4	25
% FAO/WHO *recommended intake*		87	48	70	53	155.2	43	30	62.4
Adult female *31-40yrs* *N = 17*	8.6	2046 (85.05)[b]	20 7 (341)	355 5 (6.65)	12.18 (0.29)	975 0 (21.36)	0.4 (0.02)	0.39 (0.02)	19.5 (0.35)
FAO/WHO *Recommended intake 31-40yrs*	92	2200	45	450	21	500	0.9	1.3	30
%FAO/WHO *recommended intake*		93	46	79	58	195	44	30	65

a ▷ sex combined
b ▷ ± Standard error of the mean (SEM)
Protein intake calculated for a diet of score 65.

Subjects

A total of 72 subjects from randomly selected 34 farm households out of 112 households were used for the study. Every third household was chosen for the study. Household members were fully informed about the study and those who consented were measured.

Anthropometric Measurement

Weight and height of the 72 subjects aged 3-40 years were measured using the procedure of Jelliffe (1966) as outlined in Nnanyelugo and Ngwu (1985). Values were compared with National Center for Health Statistics (NCHS, 1976) and World Health Organisation (WHO, 1997) reference standards.

Nutrient intake Data

Assessment of nutrient status based on 24 hr dietary recall, individual food intake measurement and observations of nutritional practices was conducted on the 72 subjects. Individual dietary measurement was taken for 4 days in four different farming seasons: August (S_1, very wet); November (S_2, dry); February (S_3, very dry) and May (S_4 wet). Way master dietary scales (C.M.S. Weights Ltd., London) were used to weigh all the raw food ingredients used in preparing meals. The total cooked food was weighed and individual food share was weighed and recorded at each meal. The left-overs and inedible portions at each meal were weighed. The quantity of cooked foods was calculated as raw quantities using water conversion factors where necessary (Nnanyelugo *et al.*, 1985).

Nutrient intakes were calculated using food composition tables (FAO, 1968 and Platt, 1975). The data were compared with Food and Agriculture Organization and World Health Organization (FAO/WHO, 1988); Food and Agriculture Organization, World Health Organization and United Nations Universities (FAO/WHO/UNU, 1985) as modified in Okeke and Nnanyelugo (1989) for rural Nigerian population; (FAO/WHO, 1970); WHO (1967) and FAO (1962) standard nutrient

Table 4: Seasonal food consumption pattern (24 hr dietary recall) *

Foods	$^{S}1$(%)	$^{S}2$(%)	$^{S}3$(%)	$^{S}4$(%)
Cassava (*Manihot esculenta*)	99.4	100.0	100.0	100.0
Meat	10.0	12.0	15.0	8.0
Fish	71.1	80.1	75.4	81.6
Eggs	0	5	3	8
Milk	5.0	2.0	0.0	5
Melon (*Colocythis-vulgaris*)	64.0	65.3	55.3	50.5
Yam (*Dioscorea spp.*)	39.5	38.2	50.5	50.1
Maize (*Zea mays*)	21.3	30.1	18.6	25.4
Plantain (*Musa spp.*)	9.2	10.6	10.8	11.3
Beans (*Vigna spp.*)	19.1	18.8	20.2	16.2
Rice (*Oryza sativa*)	25.4	30.9	28.1	20.4
Oranges	16.3	20.3	15.3	12.3
Groundnut	1.4	2.1	0.0	0.0
Banana (*Musa spp.*)	1.3	1.2	0.0	3.0
Vegetable	40	40	40	35

*Values are given as % of households consuming the foods in any one day

Table 5: Mean (±SD) Seasonal Changes in Energy, Protein, Calcium, Iron, Vitamin A, Thiamin, Riboflavin and Ascorbic Acid Intakes of the Subjects by Age Group. Values are expressed as percentage of FAO/WHO recommended intakes

Age group (yrs)	Seasons	Energy (%)	Protein (%)	Calcium (%)	Iron (%)	Vit A (%)	Thiamin (%)	Riboflavin (%)	Ascorbic acid (%)
Pre-schoolers	1	63.13± 11.08	38 75±14.50	51.88±22.88	60.25±15.70	96.25±29.61	37.23±14.33	39 33±11.28	58.13±14.18
3 – 5[a] yrs	2	75.35±18.90	45.50±12.80	50.73±20.08	67 48±10 88	105.34±22 13	33.98±23 13	33.00±19.45	61.45±10 30
n – 14	3	85.28±14.43	45.93±18.48	58.75±15.55	56.48±23.73	101.68±10.93	26.85±22.70	35.40±18 75	65.93±13 33
	4	77.33±18.93	48.55±13.60	46.84±26.73	62.43±16 28	125.10±35.16	47 45±10.70	42.90±22 75	51.00±22 55
FAO/WHO recommended intake 3 – 5 yrs		5.5MJ (1595Kcal)	27.5g	450mg	8mg	275μg	0.6mg	0.95mg	20mg
School age children	1	77.21±18.79	48.23±18.61	57.86±19.44	80.16±20.25	160.18±18.35	49.50±23.36	37.35±10.12	77.51±16.9[illegible]
10 – 12[a] yrs	2	80.64±15.50	41.80±11.75	50.88±18.83	79.24±16.25	185.25±25.23	40.80±23.06	40 83±12.16	78.24±22.3[illegible]
n = 14	3	61.55±26 57	35.61±14.80	65.33±14.12	87.24±16.75	98.21±34.96	43.38±12.77	40.63±11.60	68.20±16.29
	4	80.55±24.46	33.59±13.12	50.23±12 13	98 74±23 02	130.34±16 44	45.63±20.01	48.88±7 03	69.25±25
FAO/WHO recommended intake 10 – 12 yrs		10MJ (2475Kcal)	46g	650mg	8mg	575μg	1.0mg	1 5mg	20mg
Adult Females	1	155.55±15.63*	48.55±16.76	50.32±10.50	89 73±15.34	136.16±20.37	28.41±13.8	32.85±9.61	86.21±16 35
31-40yrs	2	76.80±25.71	38.17±11.23	57.27±22.08	119.82±24.14	185.18±16.22	29 62±11.58	26.20±8.25	93.41±20.11
n = 17	3	89.18±18.10	40.27±10.18	64.18±18.04	101.53±15.25	145.19±20.33	28.85±9 28	32 93±10.25	89.34±19.12
	4	75.05±11.47	45.75±28.20	59.12±15.22	98.55±13.21	143.22±26.43	33.26±11.33	36.02±12.69	85.16±18.22
		LSD.05=51.48							
FAO/WHO recommended intake Adult females		9.2MJ (2200Kcal)	45g	450g	21mg	750μg	0.9mg	1 3mg	30mg

a sex combined
* Significant

requirement tables used for developing countries.

NUTRIENT ADEQUACY RATIO

Nutrient adequacy ratio (NAR) for each individual was estimated as percentage of recommended dietary intake (RDI) FAO/WHO (1988) FAO/WHO/UNU (1985); FAO/WHO (1970); WHO (1967) and FAO (1962)
Nutrient adequacy ratio is taken as:

$$\frac{\text{Nutrient intake} \times 100}{\text{RDI}}$$

Statistical Analysis

Data collected were coded and entered into a computer. Descriptive statistics such as frequency, percentage, means and standard deviations were calculated for each group of the subjects. Chi-square test for proportion, analysis of variance (ANOVA) and Pearson's correlation tests were done where applicable.

RESULTS

General Characteristics of the Study Group

Analysis of the weight for height compared with standards for children and adults showed that 57.14% pre-school males; 62.50% pre-school females: 60.00% school males; 56.52% school females; and 35.29% adult females were wasted (Table 2).

As shown in Table 3, the intakes of energy, protein, calcium, iron, thiamin, riboflavin and ascorbic acid were below the requirement levels. Energy intake ranged from 66% for pre-scholars to 93% for adult females. The most wide spread nutritional deficiencies were protein (46-48 percent), thiamin (43-50 percent) and riboflavin (30-32 percent). Vitamin A intake was adequate for over 95% of the subjects.

Cassava Contribution to Daily Nutrient Intake

Cassava contributed between 20% and 21% of the daily energy intake of the pre-school children, school children and adult women. Cassava contribution to their protein intake ranged from 6% to 10% and for iron between 19% and 21%. The contribution to thiamin and riboflavin were between 12% and 15% and between 14% and 19%, respectively (Fig. 1).

Seasonal Nutrient Intakes

In Table 4, cassava was consumed by 99% -100% of the subjects in any one day of all the seasons. Fish, bought from the local market and eaten in small quantity was consumed by over 70% of the subjects in any one day. Less than 21% of the subjects consumed beans in any one day.

Intakes of protein (33.6% - 48.6%); thiamin (26.9% - 49.5%) and riboflavin (33% - 48.9%) were grossly deficient (Table 5). No significant seasonal differences were observed in the nutrient intakes of the subjects ($P>0.05$). Vitamin A intakes of the children ranged between 96 and 185 percent of the FAO/WHO recommended levels. Over 80 percent of the children met requirement for Vitamin A. A mean energy intake of 155.6% by adult females in S_1, month of August was significantly higher than the intakes in the other seasons (LSD.05 = 51.84). Vitamin A intakes for over 95% of the subject in all age groups were adequate in most seasons. The energy and protein intakes of the age groups were below requirement in all seasons (Table 5)

DISCUSSION

The reduced protein, thiamin and riboflavin intakes were due to consumption of more cassava – based diet without supplementing with enough of other foods such as beans, groundnut and soybeans. Cassava is low in many essential nutrients. Cassava dominated diet will hardly supply enough nutrients to meet dietary requirements. It is high in bulk and reduces the intake of other foods. The adequate intake of vitamin A in this study is attributed to usual consumption of traditional soup (Banga) which is made from palm fruits. Palm oil from palm fruits contains pro-vitamin A.

There have been reports on the relationship between the work load of women and the nutritional status of their dependants, especially young children (Crittenden *et al.*, 1988). In Ohosu farming activities go on all the year round (Table 1).Various production and processing of cassava are carried out by women. In addition, cassava production and processing are labour intensive and are of high-energy expenditure. The continuous labour cost involved in farm work may displace time allocation of women in favour of cassava production and processing as income generating activities. The women of Ohosu may give primary attention to cassava production and processing and secondary attention to food preparation, home management and family care which may result in high prevalence of protein – energy malnutrition.

The replacement of foods of high nutrient density by cash crops such as cocoa and rubber is a notable past experience in Nigeria (personal records). Pernetta and Hill (1980); Bogan and Crittenden (1987); Gillespie and Mason (1991) have all reported inverse relationship between cash cropping and nutritional status. Poor households must have to make substantial food purchases even to meet basic nutritional needs such as energy and protein (Marten and Abdoellah, 1988). The community under study is dependent on foods produced in the locality as observed by Rao (1985). Moreover, in traditional Nigerian culture women are not in control of household income and as such marginal percentage of income will be spent on food purchases. The farmers are more market oriented in production than in consumptio as observed by Gillespie and Mason (1991). In a previous study, Nnanyelugo *et al.* (1988) reported that the population appeared to have adapted to the environment diet and occupational stress through growth retardation which precipitates high incidence of stunting and wast ing. Similar observation was reported in Anambra State

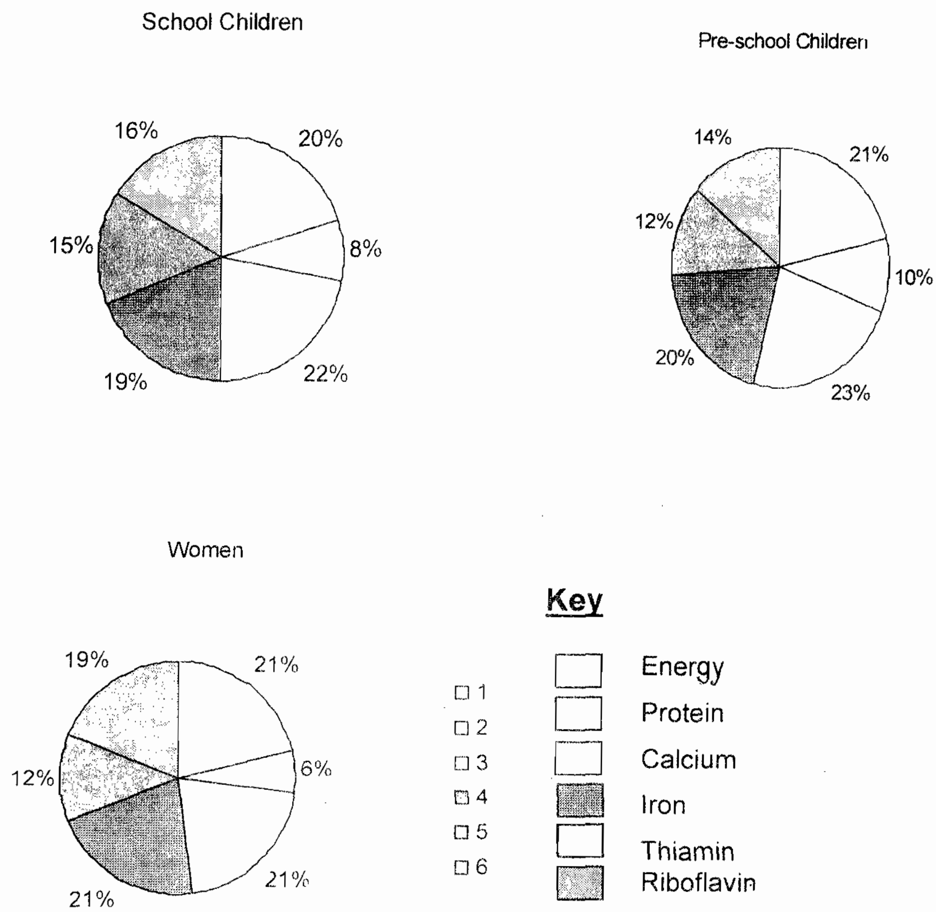

Fig. 1: Contribution of cassava to mean daily nutrient intakes of pre-school children, school children and women

among children fed mainly starchy roots and tubers (Nnanyelugo, 1983).

The absence of seasonal changes in the intakes of all nutrients for over 75% of the subjects is not surprising. This is because the study area predominantly produces cassava both for food and income. Melville *et al.* (1988) have shown that low-income households depend on home grown foods to meet the family's nutrient needs. Ohosu people live on their own agricultural products with the result that the pattern of the diet and quantity of food consumed in the seasons were almost uniform. Melville *et al.* (1988) reported similar finding among farmers in rural low land zone engaged in sugar cultivation. Nnanyelugo *et al.* (1985) reported no seasonal differences in the energy intake among pre-school children and pregnant women in Anambra State. However, protein, calcium, and vitamin C intakes were lower in wet season while fat and vitamin A were higher in dry season. Bates *et al.* (1994) reported seasonal variation in vitamin A and C intakes among rural Gambian community. Seasonal fluctuation in riboflavin status was related to changes in the balance between energy intake and output rather than to seasonal changes in riboflavin intake (Bates *et al.*, 1994). In Gambia, pregnant and lactating women met less than 50% of their energy requirements in the wet season which was reflected in lower birth weights of babies and reduced breast milk output compared with the dry season (Roberts *et al.*, 1982). In this study, the adequacy in energy intake of women (155% of requirement) in S_1 (the month of August and very wet season) agrees with farming calendar in Ohosu. Less farm work goes on in August and mothers found time to prepare food for the families. Moreover, the high energy consumption of the adult women is related to their bigger stomach capacity which influences the quantity of bulky cassava based diet consumed by both adults and children (Nnanyelugo *et al.*, 1985). Okeke and Nnanyelugo(1989) reported differences of the other of 20% -50% between energy intakes of adults and children . The absence of adult males in this study was due to the men's inability to complete the study seasons. Moreover, family food share of men does not represent the true household food distribution pattern (Okeke and Nnanyelugo, 1989).

CONCLUSION

There is evidence of malnutrition in the community studied. Cassava was the major source of nutrients. All groups combined failed to meet their requirements for energy, protein, calcium, iron thiamin and riboflavin. This problem is directly related to high consumption of cassava based diet and poor intake of supplementary foods such as cowpeas and soybeans. Both agricultural and nutritional solutions should be formulated jointly and more meaningfully to solve the societal problems of malnutrition. Activities to improve the food consumption practices of a community should be closely linked to the educational programme of agricultural and community development agencies designed to motivate food producers. Such approach will aim at reducing the constraints of small scale farm holders. It is possible that remarkable improvement may occur to meet nutrient adequacy with intensive intercropping of cassava with legumes and cereals in the area.

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