Nutrients intake Adequacy of Adults in Akwa Ibom and Cross River States, Nigeria

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ABSTRACT

Background: *Nutritional inadequacies constitute serious health concerns among individuals in all age groups, including adults.*

Aim: *To assess nutrient intake adequacy of adults in Akwa Ibom and Cross River States, Nigeria.*

Methods: *The descriptive cross sectional study adopted multistage sampling technique to select adults, aged 20 – 64 years old for the study. Dietary intake assessment was conducted using a multi-pass 24-hour dietary recall. Nutrient intake values were derived using the Total Dietary Assessment (TDA) Software by Harcourt Inc., 2001, and compared with the Reference Nutrient Intakes (RNIs) to assess adequacy. Data were analysed using descriptive and inferential statistics. Statistical significance was determined at* $\alpha_{0.05}$.

Results: *The study included 1320 adults. Mean energy, protein, fibre, vitamin A, C, calcium, zinc and iron intakes were (2000.5±869.8 to 2238.6±1137.5)kcal, (60.7±35.1 to 62.3±36.8)g, (15.0±12.3 to 19.0±11.5)g, (568.1±463.1 to 617.3±531.0)RAE, 107.2±82.9mg, (401.1±278.6 to 488.2±359.1)mg, (11.2±6.5 to 12.0±7.4)mg and (17.2±12.1 to 20.0±14.7)mg in Akwa Ibom and (1969.3±807.9 to 2407.7±884.6) kcal, (68.7±41.3 to 72.5±43.4)g, (15.1±11.0 to 18.0±14.4)g, (550.8±459.3 to 561.5±349.1)RAE, 97.5±67.0mg, (350.9±243.1 to 404.1±283.9)mg, (11.7±7.8 to 11.8±7.2)mg and (14.4±6.7 to 15.2±10.7)mg in Cross River State, respectively. Mean nutrient intake values differed significantly by States ($p < 0.05$), and by urban-rural settings, especially in Cross River State, $p<0.05$.*

Conclusion: *This study revealed sub-optimal intake levels for energy, dietary fibre and calcium among adults in both States. Adults in Akwa Ibom and Cross River States should be assisted to increase the consumption of nutrient dense food sources through appropriate nutrition intervention programmes.*

Keywords: Energy intake; Protein; Micronutrients; Calcium.

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INTRODUCTION

Malnutrition, caused by suboptimal nutritional intakes remains a serious problem, most especially in low income settings (1), and has been blamed on the monotonous diets consumed often in these settings (2). In Nigeria, both underweight and overweight were projected to affect significant proportions of males and females, while up to 55.9% of women of

reproductive age were projected to suffer from anaemia in 2019 (1). Malnutrition often leads to increased morbidity and mortality in individuals. Morbidity further hinders all forms of development and quality of life, rendering any malnourished adult less productive.

The adult life signals a shift in physiological functions of growth and development to that of maintenance of good health, vitality and longevity. The aim of adequate nutrition in adulthood is to maintain body functions and prevent or delay the onset of various age related diseases commonly associated with the age group. Adequate nutrition at this stage can also mitigate the adverse effects of various diet-related disorders that may have developed (3). Nutritional needs are therefore tailored towards achieving the desired long term health. For instance, because of the decline in energy needs in advanced years, adults are expected to limit energy consumption to amounts necessary to sustain stable body weight and long-term good health while allowing for adequate levels of physical activity (4). Also, selected nutrients are found to play vital roles in different physiological functions that ensure optimum health in adults and therefore demand special considerations in their diets. These include those concerned with regulation of body weight, bone health, blood pressure control, antioxidants and immune functions (4). However, recent findings on selected dietary intake studies in Nigeria indicate that, the diets of adult Nigerians rarely meet recommendations for essential nutrients, including vitamin A and vitamin C, B-vitamins, calcium, phosphorous, iron and zinc (5, 6, 7). Nevertheless, energy and macronutrients intakes of adults from two States in the South South region in Nigeria was reported to exceed recommended levels (8).

Cross River and Akwa Ibom States are both situated within the South South geo-political zone in Nigeria and share several cultures in common. Geographical location influences food intake, due to several reasons including the type of foods cultivated and available for consumption in a given setting (9). Predominant economic activities in both Cross River and Akwa Ibom States are characterized by various forms of agricultural activities, both in land cultivation and fishing (10), leading to the same kinds of traditional food items available for consumption in both settings. However, traditional dietary patterns may change over time due to influx of other food cultures brought about by industrialization and nutrition transition (9). Report from the recent Nigerian Demographic and Health Survey indicates notable variations in nutrition indices between the two States (11). It is not certain whether or not there are differences in nutrient intakes among adults between the two States. Such information can furnish policy makers with the current nutrition situations in each setting for informed decisions and subsequent actions. This study was designed to assess nutrient intake adequacy among adults in Akwa Ibom and Cross River States in Nigeria.

METHODOLOGY

Study Design and Participants

This study adopted a descriptive cross-sectional design to assess nutrients intake adequacy of adults in two States in the South South region of Nigeria. Participants were adults 20 to 64 years old, resident in Akwa Ibom and Cross River States, for at least the previous two years. Pregnant women, lactating mothers and individuals with unusual food intakes within the study duration were excluded from the study.

Sampling Technique

A multistage sampling technique was used to select participants for this study. Akwa Ibom and Cross River States were selected purposively for the study because of their similarity in food culture. Simple random sampling was used to select Local Government Areas (LGAs), wards and communities for this study. Two LGAs, (from where one urban and two rural wards were chosen) were selected from each of the three senatorial districts within each State. Subsequently, one community was selected within each ward for the study. Systematic random sampling was adopted to select the required number of eligible households within each community, using sampling intervals determined based on total number of households within respective communities. Within a

household, adults, 20 to 64 years old were selected to participate in the study.

Ethical considerations and Informed Consent: Approval for the study was obtained from the Human Ethics Committee of the University of Ibadan/University College Hospital (UI/EC/21/0098). Information obtained for the study were treated with utmost confidentiality. Study included only participants who gave informed consent to participate in the study.

DATA COLLECTION

Socio-demographic Information

Socio-demographic information, including age, sex, setting, education, marital status and occupation were obtained using a semi-structured, interviewer administered questionnaire.

Dietary Intake Assessment and Analyses

Dietary intake assessment was conducted using a four steps multi-pass 24-hour dietary recall (12), administered by trained interviewers. Nutrient intake values were derived using the TDA Software (version 3.0.), from information obtained from dietary intake assessment. The age/sex specific population mean BMI and height values (obtained using standard procedures) were used to identify daily average energy requirements for each age/sex group (13). The population sex specific mean weights were used to calculate the 0.83g protein/kg body weight (14). Carbohydrate requirements were derived based on the Appropriate Macronutrient Distribution Ranges of 55.0% of total energy requirements (15) for age/sex specific populations. Adequate Intake (AI) values (16) were adopted to assess adequacy in dietary fibre intakes. Vitamins and minerals intake values were compared with joint FAO/WHO RNI values (17). Adequacy of intake was estimated as percentage of requirements for each group (18), using the formula:

$$\frac{\text{Mean Nutrient intake}}{\text{Requirement}} \times \frac{100}{1}$$

Adequacy was defined as mean intake value ≥ 100.0% of the RNI value.

Statistical Analyses

All data were analysed using the IBM-SPSS statistical software package, version 20. Findings on nutrient intakes were presented in mean±SD. Independent samples t-test was conducted to examine differences in mean intakes among adults between the two States, sex and urban-rural settings. Statistical significance was determined at $\alpha_{0.05}$.

RESULTS

Socio-demographic Information of Adults

A total of 1,320 adults, with mean age of 35.4±11.2 years, participated in this study. A total of 55.5% were from Akwa Ibom State, 65.0% resided in rural communities, and 50.4% were females. About 66.1% were at most forty years; 73.4% attained at least secondary education and 54.0% were married. Major occupations included farming/fishing (27.0%), registered businesses and artisans (15.5%).

Energy and Nutrient Intake Adequacy

Energy intakes were below requirements for most adults, except for females aged ≥60 years. Protein intakes were adequate among adults. Carbohydrate intakes were mostly inadequate among males, except males aged ≥60 years in Cross River State. Females had adequate carbohydrate intakes, except females aged 20 to 29.9 years in Cross River State. Dietary fibre intakes were grossly inadequate among adults in the two States for both males and females. While vitamin A intake adequacy exceeded requirements among females, intakes were inadequate among males. There were adequate intakes of Vitamin C. Thiamine and riboflavin intakes were inadequate for both males and females in the two States and in the whole sample. While females had adequate niacin intakes, intakes were below recommendations among males. Calcium intakes were generally low among adults, with no sex or age group attaining up to 50% adequacy in intake. Zinc intakes were generally adequate among adults. Iron intakes were adequate among both males and females, except females aged ≤50 years.

The study revealed some significant differences in

mean nutrient intakes between States. While most macronutrients intakes were higher in Cross River State, micronutrients intakes were higher in Akwa Ibom State. Mean energy intakes were higher in Cross River State than in Akwa Ibom State and were observed among males 30 to 59 years old, (2278.8±924.4kcal in CRS and 2048.4±937.8kcal in AKS, p = 0.002); females 20-29.9 years (2380.1±985.8kcal in CRS and 2059.2±805.2kcal in AKS, p = 0.008); and females 30 to 50 years old (2234.3±932.1kcal in CRS and 2000.5±869.8kcal in AKS, p = 0.001). Likewise, protein intakes were higher in CRS among both males (72.5±43.4g in CRS and 62.3±36.8g in AKS, p = 0.002) and females (68.7±41.3g in CRS and 60.7±35.1g in AKS, p = 0.008). Carbohydrate intakes were significantly higher in CRS and were observed among males 20-29.9 years old (380.0±148.7g in CRS; 337.7±159.2g in AKS, p = 0.046); males aged 30 to 59 years old (355.6±163.3g in CRS; 317.7±156.0g in AKS, p = 0.003); females aged 20-29.9 years (380.5±178.5g in CRS; 310.5±133.0g in AKS, p = 0.001) and females aged 30 to 50 years old (355.1±177.0g in CRS; 310.3±145.4g in AKS, p = 0.000).

For micronutrients, mean vitamin C intake was higher in AKS (107.2±82.9mg in AKS; 97.5±67.0mg in CRS, p = 0.023); riboflavin intake was higher only among males in AKS (1.0±1.1mg in AKS; 0.8±0.7mg in CRS, p = 0.002). Calcium intakes were higher in AKS (424.5±295.7mg in AKS; 356.4±253.4mg in CRS, p = 0.002) among males and among females aged ≤50 years, (401.1±278.6mg in AKS; 350.9±243.1mg in CRS, p = 0.020). Iron intakes were significantly higher in AKS (18.3±12.4mg in AKS; 15.1±8.3mg in CRS, p = 0.000) among males; (17.2±12.1mg in AKS; 15.2±10.7mg in CRS, p = 0.030) among females aged ≤50 years, and (20.0±14.7mg in AKS; 14.4±6.7mg in CRS, p = 0.049) among females ≥50 years, respectively.

Gender Differences in Mean Energy and Nutrient Intake Values

Table 2 presents findings on gender differences in nutrients intakes among adults within States and in the whole sample. There were no significant gender differences in energy and macronutrients intakes among adults in the study. However, females aged ≥60 years had significantly higher carbohydrate intakes - (403.9±197.5g among females vs. 252.9±103.2g among males; p = 0.040) in Akwa Ibom State and (373.0±192.9g among females vs. 281.2±124.6g among males; p = 0.037) in the whole sample. There were no significant differences in micronutrients intakes between males and females in the study.

Urban-rural differences in Mean Energy and Nutrient Intake Values

Findings on nutrient intakes between urban and rural settings are presented in table 3. Energy intakes differed only among males aged 30 to 59 years in Cross River State, and was higher in urban (2318.6±998.3 kcal) than in the rural setting (2116.0±846.9), p = 0.047. Protein intakes varied significantly in the whole sample and was higher in the urban (69.1±41.3g) than in the rural setting (63.6±37.8g), p = 0.014. For carbohydrate intakes, consumptions varied only among adults ≥60 years in Cross River State, with rural setting having a higher intake (356.7±179.6 g) than the urban (246.1±91.5 g), p = 0.024. There were no significant urban-rural differences in the intakes of vitamins A, thiamine, riboflavin, niacin and zinc in the study. Vitamin C differed only in Cross River State (103.3±69.9mg in rural and 88.1±61.0mg in urban; p = 0.008) and in the whole sample (107.3±80.6mg in rural and 94.7±67.1mg in urban; p = 0.003); and was higher in rural when compared to urban settings. Calcium intake differed only in Cross River State, and was higher in rural (374.9±257.5mg) than in the urban setting (326.6±236.0mg), p = 0.020. Iron intake was higher in rural, when compared to urban settings in Akwa Ibom State (18.6±13.1mg in rural versus 16.4±10.7mg in urban; p = 0.020), Cross River State (15.8±10.2mg in rural versus 13.9±7.7mg in urban; p = 0.015), and in the whole sample (17.5±12.0mg in rural versus 15.2±9.4mg in urban; p = 0.000).

Table 1a: Energy and Macronutrients intake Adequacy of Adults in Akwa Ibom and Cross River States, Nigeria

Components	Requirement for age (years) and sex			Akwa Ibom		Cross River		Total		p-value
				Mean Intake	IREQ	Mean Intake	IREQ	Mean Intake	IREQ	
Energy (Kcal)	M	20-29.9	2800	2180.4±970.0	77.9	2407.7±884.6	86.0	2274.6±940.3	81.2	0.072
		30-59.9	2600	2048.4±937.8	78.8	2278.8±924.4	87.6	2150.7±938.2	82.7	0.002*
		≥60	2150	2048.4±937.8	95.3	1969.3±807.9	91.6	1813.9±729.2	84.4	0.085
	F	20-29.9	2400	2059.2±805.2	85.8	2380.1±985.8	99.2	2198.1±900.1	91.6	0.008*
		30-59.9	2200	2000.5±869.8	90.9	2234.3±932.1	101.6	2104.5±904.9	95.7	0.001*
		≥60	1950	2238.6±1137.5	114.8	2254.6±1103.8	115.6	2247.4±1098.8	115.3	0.970
Protein (g)	M		49.1	62.3±36.8	114.8	72.5±43.4	133.6	66.8±40.1	123.1	0.002*
	F		47.5	60.7±35.1	115.5	68.7±41.3	130.8	64.2±38.1	122.2	0.008*
Carbohydrate(g)	M	20-29.9	385.0	337.7±159.2	87.7	380.0±148.7	98.7	355.3 ±156.0	92.3	0.046*
		30-59.9	357.5	317.7±156.0	88.9	355.6±163.3	99.5	334.6±160.3	93.6	0.003*
		≥60	295.6	252.9±103.2	85.6	296.9±135.2	100.4	281.2±124.6	95.1	0.381
	F	20-29.9	330.0	310.5±133.0	94.1	380.5±178.5	115.3	340.8±157.9	103.3	0.001*
		30-59.9	302.5	310.3±145.4	102.6	355.1±177.0	117.4	330.2±161.6	109.2	0.000*
		≥60	268.1	403.9±197.5	150.7	347.9±191..8	129.8	373.0±192.9	139.1	0.447
Fibre (g)	M	20-50	38	16.8±11.3	44.2	18.0±14.4	47.4	17.3±12.7	45.5	0.263
		> 50	30	15.0±12.3	50.0	15.1±11.0	50.3	15.7±11.5	52.3	0.682
	F	20-50	25	17.5±11.3	70.0	17.2±10.5	68.8	17.4±11.0	69.6	0.730
		> 50	21	19.0±11.5	90.5	17.4±13.0	82.9	18.3±12.2	87.1	0.562

IREQ = Intake as percentage requirement:
M=Male; F= Femal;
*=differnces in mean intakes between States are significant at a0.05

Table 1b: Micronutrients Intake Adequacy of Adults in Akwa Ibom and Cross River States, Nigeria

Components	Requirement for age (years) and sex			Akwa Ibom		Cross River		Total		p-value
				Mean Intake	IREQ	Mean Intake	IREQ	Mean Intake	IREQ	
Vitamin A (RAE)	M		600	568.1±463.1	94.7	561.5±349.1	93.6	565.2±416.0	94.2	0.842
	F		500	617.3±531.0	123.5	550.8±459.3	110.2	587.7±501.1	117.5	0.084
Vitamin C (mg)			45	107.2±82.9	238.2	97.5±67.0	216.7	102.9±76.4	228.7	0.023*
Thiamine (mg)	M		1.2	1.0±0.6	83.3	1.0±0.6	83.3	1.0±0.6	83.3	0.637
	F		1.1	1.0±0.6	90.9	1.0±0.5	90.9	1.0±0.5	90.9	0.952
Riboflavin (mg)	M		1.3	1.0±1.1	76.9	0.8±0.7	61.5	1.0±0.9	76.9	0.002*
	F		1.1	1.0±1.1	90.9	0.9±0.8	81.8	1.0±0.9	90.9	0.207
Niacin (mg)	M		16	14.9±8.7	93.1	14.6±8.8	91.3	14.7±8.7	91.9	0.777
	F		14	14.8±8.6	105.7	14.6±8.5	104.3	14.7±8.5	105.0	0.793
Calcium (mg)	M		1000	424.5±295.7	42.5	356.4±253.4	35.6	394.2±279.6	39.4	0.002*
	F	20-50	1000	401.1±278.6	40.1	350.9±243.1	35.1	378.8±264.4	37.9	0.020*
		51-65	1300	488.2±359.1	37.6	404.1±283.9	31.1	449.6±327.3	34.6	0.271
Zinc (mg)	M		7.0	12.0±7.4	171.4	11.8±7.2	168.6	11.9±7.3	170.0	0.857
	F		4.9	11.2±6.5	228.6	11.7±7.8	238.8	11.3±7.1	230.6	0.411
Iron (mg)	M		11	18.3±12.4	166.4	15.1±8.3	137.3	16.9±10.9	153.6	0.000*
	F	20-50	24	17.2±12.1	71.7	15.2±10.7	63.3	16.3±11.5	67.9	0.030*
		51-65	9	20.0±14.7	222.2	14.4±6.7	160.0	17.4±12.0	193.3	0.049*

IREQ = Intake as percentage requirement:
M=Male; F= Femal;
*=differnces in mean intakes between States are significant at a0.05

Table 2: *Gender Differences in Mean Intake Values of Adults in Akwa Ibom and Cross River State, Nigeria*

Components		Akwa Ibom		p-value	Cross River		p-value	Total		p-value
		Male	Female		Male	Female		Male	Female	
Energy (Kcal)	20-29.9	2180.4±970.0	2059±2±805.2	0.207	2407.7±884.7	3280.1±985.8	0.837	2274.6±940.3	2198.1±900.1	0.374
	30-59.9	1994.7±923.6	1950.6±890.0	0.608	2244.1±948.8	2147.6±877.0	0.318	2150.7±938.2	2104.5±904.9	0.363
	≥60	1534.2±476.4	2238.6±1137.5	0.081	1969.3±808.0	2254.6±1103.8	0.402	1813.9±729.2	2247.4±1098.8	0.086
Protein (g)		62.3±36.8	60.6±35.1	0.530	72.49±43.4	68.7±41.3	0.279	66.8±40.1	64.2±38.1	0.227
Carb (g)	20-29.9	337.7±159.2	310.5±133.0	0.131	380.0±148.7	380.5±178.5	0.982	355.3 ±156.0	340.8±157.9	0.324
	30-59.9	309.0±155.0	304.7±148.0	0.763	349.1±171.3	340.9±174.1	0.654	334.6±160.3	330.2±161.6	0.625
	≥60	252.9±103.2	403.9±197.5	0.040*	296.9±135.2	347.9±191.8	0.383	281.2±124.6	373.0±192.9	0.037*
Fibre (g)	20-50	16.8±11.3	17.5±11.3	0.418	18.0±14.4	17.2±10.5	0.479	17.3±12.7	17.4±10.9	0.927
	> 50	15.0±12.3	19.0±11.5	0.178	16.2±11.0	17.4±13.0	0.673	15.7±11.5	18.3±12.2	0.196
Vitamin A (RAE)		568.1±463.1	617.3±531.0	0.181	561.6±349.1	550.8±459.3	0.751	565.2±416.0	587.7±501.1	0.374
Vitamin C (mg)		108.7±82.8	105.7±83.1	0.624	98.0±65.1	97.1±69.0	0.882	103.9±75.6	101.9±77.2	0.267
Thiamine (mg)		1.0±0.6	1.0±0.6	0.580	1.0±0.6	1.0±0.5	0.940	1.0±0.6	1.0±0.5	0.644
Riboflavin (mg)		1.0±0.9	1.0±0.9	0.932	0.8±0.7	0.9±0.9	0.351	1.0±0.9	1.0±0.9	0.592
Niacin (mg)		14.8±8.7	14.8±8.6	0.984	14.6±8.8	14.6±8.5	0.991	14.7±8.7	14.7±8.5	0.994
Calcium (mg)		424.5±295.7	410.3±288.8	0.510	356.4±253.4	356.8±248.0	0.984	394.3±279.6	386.5±272.5	0.609
Zinc (mg)		11.9±7.4	11.2±6.5	0.149	11.8±7.3	11.7±7.8	0.784	11.9±7.3	11.4±7.1	0.220
Iron (mg)		18.3±12.4	17.5±12.4	0.406	15.1±8.3	15.1±10.3	0.996	16.9±10.9	16.5±11.6	0.493

*=*differnces in mean intakes between males and female are significant at a0.05*

Table 3: Urban-rural differences in Mean Intake Values of Adults in Akwa Ibom and Cross River State, Nigeria

Components		Akwa Ibom			Cross River		p-value	Total		p-value
		Urban	Rural	p-value	Urban	Rural		Urban	Rural	
Energy (Kcal)	20-29.9	2186.0±1001.7	2072.4±804.8	0.328	2347.6±962.8	2418.0±925.8	0.622	2249.0±987.1	2226.3±876.3	0.802
	30-59.9	1946.3±880.1	1983.7±918.1	0.687	2318.6±998.3	2116.0±846.9	0.047*	2140.6±960.2	2037.6±891.3	0.141
	≥60	2014.3±87.5	1924.5±1008.7	0.698	1843.4±961.6	2228.0±946.7	0.286	1869.7±880.5	2083.2±977.4	0.462
Protein (g)		65.0±38.4	59.7±34.6	0.071	73.6±43.9	68.8±41.3	0.190	69.1±41.3	63.6±37.8	0.014*
Carb (g)	20-29.9	329.1±163.8	320.3±134.2	0.633	372.8±163.4	384.4±166.1	0.638	346.1±164.4	348.8±152.4	0.859
	30-59.9	299.9±146.8	309.7±153.4	0.525	364.0±187.3	332.6±161.3	0.102	333.4±171.9	319.0±156.9	0.250
	≥60	308.7±73.1	341.1±185.1	0.661	246.1±91.5	356.7±179.6	0.024*	255.8±89.3	349.2±180.3	0.078
Fibre (g)	20-50	16.4±10.4	17.6±11.7	0.165	17.9±15.8	17.4±10.1	0.683	17.1±13.1	17.5±11.1	0.560
	> 50	13.8±6.7	17.9±12.5	0.158	14.5±9.3	18.0±13.0	0.190	14.3±8.7	17.9±12.7	0.061
Vitamin A (RAE)		552.6±516.1	612.5±489.4	0.134	547.8±410.5	561.2±407.1	0.699	550.3±467.8	590.7±456.6	0.131
Vitamin C (mg)		100.8±71.9	110.3±87.7	0.118	88.1±61.0	103.3±69.9	0.008*	94.7±67.1	107.3±80.6	0.003*
Thiamine (mg)		1.0±0.6	1.0±0.6	0.389	1.0±0.7	0.9±0.5	0.470	1.0±0.7	1.0±0.6	0.256
Riboflavin (mg)		0.9±0.7	1.0±1.0	0.228	0.8±0.8	0.9±0.9	0.256	0.9±0.7	1.0±0.9	0.084
Niacin (mg)		14.7±9.3	14.8±8.3	0.935	14.8±9.3	14.5±8.2	0.731	14.7±9.3	14.7±8.3	0.878
Calcium (mg)		424.3±311.4	414.0±282.6	0.664	326.6±236.0	374.9±257.5	0.020*	377.3±281.7	397.4±272.7	0.213
Zinc (mg)		11.1±6.7	11.8±7.1	0.253	11.3±6.8	12.0±8.0	0.303	11.2±6.8	11.9±7.5	0.120
Iron (mg)		16.4±10.7	18.6±13.1	0.020*	13.9±7.7	15.8±10.2	0.015*	15.2±9.4	17.5±12.0	0.000*

**=differnces in mean intakes between urban and rural settings are significant at a0.05*

DISCUSSION

The aim of this study was to report nutrients intake adequacy among adults in Akwa Ibom and Cross River States in Nigeria. Participants were distributed equally between States and sex, though slightly higher in Akwa Ibom State, and were mostly literate. Age and sex specific energy and nutrient requirements were used to ascertain adequacy in nutrient intakes. This limited the chances of judging individual intakes based on cut off points that fall outside respective age and sex group RNIs for individuals.

Inadequate energy intakes were noted among most adults in the study. The mean energy intake values reported in this study can be compared with the range reported among adults in two South Eastern States in Nigeria (18). Higher intake values have been reported for adults in Delta and Cross River States, Nigeria (8). However, lower intakes were recorded for women in South West, Nigeria (7). It was also noted that, energy intakes among females aged 60 to 64 years exceeded daily recommendations. This finding is comparable to the report among older females in South West Nigeria, where daily energy intakes among older women exceeded DRI value (19). Increased energy intake above requirements among older women can predispose women to various chronic diseases that often impact negatively on their wellbeing (4). While individuals must avoid excessive energy intakes, consuming diets that provide sufficient intake of energy, particularly when selected from nutrient dense foods is desirable to cater for daily energy needs while ensuring adequate intake of nutrients, and as well protect against problems of protein energy malnutrition on a long term basis. Where energy intake is sub-optimal, consumption of other essential nutrients are likely to fall below recommended levels (20).

Protein intake adequacy among adults in this study exceeded 100% of the RNI values for both men and women. Adequate protein intakes have been observed in adult populations in selected locations in Nigeria. A study in South West Nigeria indicated that, up to 85.6% of the study population attained adequate protein intake (7). However, adults in South Eastern Nigeria had protein intake adequacy that ranged from 74.2% to 98.9% (18). The observation that both males and females exceeded protein recommendations in this study is contrary to the common notion that, the African diet is most often characterized by poor consumption of protein sources –(20). Akwa Ibom and Cross River States in Nigeria are located in coastal regions. This implies that individuals and families in the region could have good access to ample supplies of assorted sea foods, in addition to other protein sources in the region. The availability of these foods in the region again translates to sufficient consumption of high quality proteins in the population.

Fibre intakes were generally low among adults in this study. The low intake of dietary fibre could have resulted in part from limited data on dietary fibre contents of most indigenous foods/dishes in Nigeria. It could also have resulted from the changing dietary intake patterns recently observed in developing countries (21). Moreover, consumption of vegetables (which constitutes a proven strategy for ensuring optimum intake of dietary fibre) now falls below recommended intake levels in most settings (22).

There were inadequate intakes of selected micronutrients among adults in the study. The study in South Eastern Nigeria (18) reported adequate intake levels for calcium to range from 50.9% to 80.9% in the study populations. This range is however higher than 34.6% to 39.4% reported in the present study. Whereas, only 1.6% attained adequate calcium intake levels among women in South West Nigeria (7). Low consumption of calcium often observed in populations corroborates the notion that, much needs to be done to ensure affordability of dairy products by individuals and households in Nigeria (23). Consequences of low calcium intakes, especially among females are enormous. The risk of osteoporosis is increased in the instances of low calcium intake, especially when vitamin D intake is lacking to support optimum calcium absorption (4). Iron intake was particularly low among younger women in the present study. A lower mean intake value for iron was reported among women from South Eastern Nigeria (18) whereas,

women from South West Nigeria had a higher mean intake value (7). In order to prevent the negative health impacts of poor iron nutrition, women of reproductive age need to be assisted in ensuring they consume sufficient amounts of dietary iron to meet physiological needs for the nutrient. Some other micronutrients inadequacies, particularly those of thiamine, riboflavin and niacin were notable. Inadequate micronutrient intakes constitute a common problem globally, including Nigeria (19, 24). These findings corroborate the report that, the continuous decline in the micronutrient density of meals occurs only in the African region (25). Micronutrient deficiencies as observed in this study may have resulted from the prevailing dietary patterns in the African region, where diets consist predominantly of starchy staples, with minimal intakes of protein sources, fruits and vegetables (25, 26).

The study revealed significant differences in mean intake values between the two States. Energy and the macronutrients – protein and carbohydrate intakes were higher in Cross River State, especially among those in younger age groups. On the other hand, most of the micronutrients, including vitamin C, riboflavin, calcium and iron intakes were higher in Akwa Ibom State. Cross River State is an agrarian setting, known for predominant production of staple food crops –grains and tuber food crops and some fishing activities especially in the south (27). This could probably explain the higher intake of energy and macronutrients in the State. On the other hand, the reason for higher micronutrient intake in Akwa Ibom State cannot be explained in this study. However, there are indications that, dietary diversity- an effective means of attaining nutrient intake adequacy (7), constitutes one important feature of dietary patterns in Akwa Ibom State (28, 29).

Nutrient intake adequacy seemed to be higher among females and those in older age groups. The RNI values for energy, carbohydrate and fibre seem to be higher for individuals in younger age groups and males than otherwise. Analyses revealed no significant differences in mean energy and nutrients intakes between males and females in the study. As such, the observation that, inadequate energy and nutrients intakes were common among males than females could be attributed to higher dietary intake requirements for males, when compared to females. These observations were also noted in selected micronutrients (vitamin A, niacin and iron) intake adequacy. It is obvious from these findings that, dietary intakes among adults in this study are not tailored to meet physiological needs per age and sex groups.

The urban-rural differences in intake levels differed for various nutrients, but were mostly higher in rural settings, especially in Cross River State. The study on nutrients intakes in South East Nigeria also observed some urban-rural differences in nutrient intakes among adults (18). This observation is contrary to the assumptions that the urban setting may be associated with higher diet quality than the rural setting because of a number of advantages in the urban settings – education, income (30), as well as availability of assorted food materials (31). It has been argued that the urban-rural differences often observed in dietary patterns can be attributed to changing incomes and living conditions usually seen in rural-urban migration, rather than the urban location itself (32). This situation may have been applicable in dietary intakes of the rural people in this study.

CONCLUSIONS

This study revealed inadequate intake levels for energy (although energy intake was higher among older women), dietary fibre and micronutrients including the B-vitamins (thiamine, riboflavin and niacin) and calcium among adults in Akwa Ibom and Cross River States. Iron intake was low among younger women. Nutrient intakes differed by State. While macronutrients intakes were higher in Cross River State, micronutrients intakes were higher in Akwa Ibom State. Most nutrient intake levels were higher in rural settings, especially within Cross River State. It is therefore recommended that, appropriate policies, aimed at increasing the consumption of nutrient dense meals among

adults be put in place. Such policies and programmes should take into cognisance the various factors that influence nutrient requirements, especially age and sex.

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