Agro-Science Journal of Tropical Agriculture, Food, Environment and Extension
Volume 11 Number 2 May 2012 pp 9 – 16
ISSN 1119-7455

CONSUMPTION PATTERNS OF IRON AND VITAMIN A RICH FOODS AND CONTRIBUTIONS OF FOOD GROUPS TO NUTRIENT INTAKES OF PREGNANT WOMEN IN NSUKKA LOCAL GOVERNMENT AREA OF ENUGU STATE, NIGERIA.

Eze S.N. and Okeke E.C.
Department of Home Science, Nutrition and Dietetics, University of Nigeria, Nsukka.

ABSTRACT

The consumption patterns of iron and vitamin A rich foods and contributions of food groups to nutrient intakes of pregnant women in Nsukka Local Government Area of Enugu State, Nigeria were assessed. A total of 386 pregnant women randomly selected from 3 communities in Nsukka Local Government Area were used for the study. A validated structured questionnaire was used to collect information on respondents' food consumption patterns. The contributions of food groups to respondents' nutrient intakes were assessed using a 3-day weighed food intake study. The iron-rich foods most frequently consumed by the respondents were legumes, green leafy vegetables, nuts and seeds which respectively, made 41.9%, 17.1% and 11.2% contributions to iron intakes of the women. Vitamin A-rich foods most frequently consumed by the respondents were palm oil and vegetables which respectively, contributed 76.8% and 21.5% of vitamin A intakes of the women. Animal foods made very little contributions to the respondents' nutrient intakes and foods of vegetable origin form very important part of the diet of the study population. Nutrition education on proper processing techniques of foods to conserve their micronutrients, and the need for consumption of ascorbic acid-rich fruits with meals to enhance bioavailability of iron in the diet are imperative. Government subsidization of animal foods to make them more affordable, and biofortification of locally produced foods to increase the bioavailability of micronutrients are also recommended.

Key words: Food consumption pattern, nutrient intakes, pregnant women, Nigeria.

INTRODUCTION

Considerable changes occur in the body of a pregnant woman. In addition to the developing foetus and placenta, there are changes in her own tissues with an expansion of the plasma volume and red cell mass, increase in the size of the uterus and mammary glands, and deposition of fat (Barasi, 1997). A diet that meets maternal nutritional needs is required for these adjustments so that maternal wellbeing is safeguarded with the birth of a healthy, thriving infant of normal birth weight. Consequently, nutrient requirements increase during pregnancy to support foetal growth and maternal health. Pregnant women must eat well and are encouraged to eat a variety of foods. Their diet should include the basic nutrients necessary to meet the needs of the pregnant woman and the needs of the developing foetus. In addition, adequate nutrition is necessary to enable the pregnant woman build up nutrient stores for use during breastfeeding.

Iron is essential to most life forms and to normal human physiology, and is an integral part of many proteins and enzymes that maintain good health. The main part of iron in the body (about two-third) is present in red blood cells as essential component of haemoglobin which carries oxygen from the lungs to the tissues. The risk associated with haemorrhage, the commonest cause of maternal death, is complexed by iron deficiency. Iron deficiency in pregnancy also increases the risk of premature delivery and low birth weight (Allen, 2000). In the same vein, vitamin A is essential for a variety of biological processes many of which are related to growth, cellular differentiation and interactions of cells with each other or with the extra cellular matrix. Maternal vitamin A deficiency is associated with increased rates of intrauterine growth retardation and premature births (Shah and Rajalakshmi, 1984). Poor maternal nutrition also affects activity level, overall performance and ability to care for children and home (ACC/SCN, 1990).

Pregnant women are generally vulnerable to malnutrition due to the social and

DOI : http://dx.doi.org/10.4314/as.v11i2.2

biological stresses caused by pregnancy (ACC/SCN, 1992). The simultaneous roles played by pregnant women in reproduction, economic production and home production, often have damaging consequences on nutritional status (ACC/SCN, 1990). In addition, pregnant women in developing countries have been observed to consume diets with low contents of minerals and vitamins (Ene-Obong, 2001). Ene-Obong (2001) also observed that food choices of pregnant women are based on ignorance, misconceptions, superstitions and traditional/cultural beliefs resulting in poor dietary patterns and lifestyles. This work was designed to assess the consumption patterns of iron and vitamin A rich foods among pregnant women in Nsukka Local Government Area of Enugu State and the contributions of food groups to their mean daily nutrient intakes.

MATERIALS AND METHODS

A total of 386 pregnant women randomly selected from 3 communities (Nsukka urban, Ede-Oballa and Okpuje) in Nsukka Local Government Area were used for the study. Each community was selected by balloting from one development council area of Nsukka Local Government Area. Instruments used for data collection were questionnaire and food intake study.

Questionnaire

A validated structured questionnaire was used to collect information on respondents' food consumption patterns. The questionnaire was validated by lecturers in the Department of Home Science, Nutrition and Dietetics, University of Nigeria, Nsukka. The questionnaire was pretested on 30 ante-natal women in Ibagwa-Aka Cottage Hospital in Igboeze-south Local Government Area of Enugu State to ascertain its clarity.

Food intake study

The respondents' nutrient intakes and the contributions of food groups to respondents' nutrient intakes were assessed by a 3-day weighed food intake following the standard method outlined by Olusanya (1977) and modified by Okeke (1988). The 3 days included two week-days and one week-end day. All raw ingredients that were used in preparing each meal consumed by the respondents were weighed. The preparation methods were all noted. The whole meal after cooking was weighed and the weight of the cooking pot subtracted from it to get the actual weight of the cooked food. The respondent's food portion was weighed as well. The plate wastes were weighed and subtracted from the weight of the respondent's food portions to get the actual food intake of the respondent. All snacks taken throughout the period were also weighed. The foods eaten outside the home were estimated using household measures or selling weights.

The quantity of each ingredient in the women's food portions were estimated by simple proportion from the weight of the different ingredients in the recipe. The conversion factor was obtained by dividing the actual weight of food consumed by the respondent by the total weight of the cooked food. Subsequently, the weight of each ingredient consumed by the respondent was obtained by multiplying the conversion factor by the weight of each ingredient. The respondents' nutrient intakes and contributions of food groups to nutrient intakes were estimated by simple proportion using food composition tables (Food and Agriculture Organization [FAO], 1969; Platt, 1975).

Data analysis

Frequency distribution, percentage and means were adopted for data analysis. The nutrient intakes were analysed as percentages of FAO/WHO daily requirement values for pregnant women.

RESULTS

Table 1 presents the respondents' frequency of consumption of haem iron sources. It showed that most of the haem iron sources (liver, egg, beef, goat and poultry meats) were occasional foods for higher percentages of the respondents, while snail was never consumed by up to half (49.5%) of the respondents. Only fish and crayfish were consumed at least once daily by higher percentages (61.6% and 77.4%, respectively) of the respondents and were consumed by all the respondents. The respondents' frequency of consumption of sources of non-haem iron is presented in Table 2. It was shown that locust bean, green leafy vegetable and cowpea were the most frequently consumed sources of non-haem iron, followed by dikanut kernel, bambara groundnut and groundnut. Soya bean and cashew nut were the least consumed.

Table 1: Respondents' frequency of consumption of sources of haem-iron

Sources of haem-iron	At least once daily		2 or more x weekly		Once weekly		Occassionally		Never		Total
	F	%	F	%	F	%	F	%	F	%	
Liver	36	9.7	38	10.2	52	14.0	185	49.7	61	16.4	372
Egg	44	12.2	55	20.6	74	20.6	180	50	8	2.2	360
Beef	58	15.9	45	12.3	71	19.5	177	48.5	14	3.8	365
Fish	228	61.6	73	19.7	52	14.1	17	4.6	0	0	370
Crayfish	279	77.4	55	14.7	31	8.3	0	0	0	0	375
Snail	8	2.2	23	6.3	48	13.2	105	28.8	180	49.5	364
Goat meat	23	6.3	36	9.9	49	13.5	234	64.5	22	6.1	363
Poultry meat	17	4.5	38	10.1	74	19.6	242	64.4	5	1.3	376

Key: x: times F: frequency %: percentage

Table 2: Respondents' frequency of consumption of sources of non-haem iron

Total	At least once daily		2 or more x weekly		Once weekly		Occasionally		Never		
	F	%	F	%	F	%	F	%	F	%	
Green leafy vegetable	190	49.2	84	21.8	70	18.1	42	10.9	0	0	386
Bambara groundnut	119	32.8	77	21.2	91	25.1	66	18.2	10	3.8	363
Cowpea	180	47.6	90	23.8	61	16.1	47	12.4	0	0	378
Pigeon pea	62	16.2	96	25.1	104	27.2	91	23.8	20	7.1	383
Soya bean	43	11.3	48	12.6	61	16	142	37.2	88	23	382
Locust bean	198	52.5	64	17	53	14.1	41	10.9	21	5.6	377
Groundnut	107	27.9	93	24.3	85	22.2	95	24.8	3	0.8	383
Cashew nut	54	14.5	88	23.7	101	27.2	117	32.5	12	3.2	372
Oil bean seed	72	20	78	21.7	99	27.5	95	26.4	0	0	360
Melon	80	21.4	87	23.3	118	31.6	67	18	21	5.6	373
Dikanut kernel	130	33.7	120	31	104	26.9	32	8.3	2	0.5	386

Key: x: times F: frequency %: percentage

Table 3: Respondents' consumption frequency of sources of preformed vitamin A

	At least once daily		2 or more x weekly		Once weekly		Occasionally		Never		Total
	F	%	F	%	F	%	F	%	F	%	
Liver	36	9.7	38	10.2	52	14	185	49.7	61	16.4	372
Eggs	44	12.2	55	20.6	74	20.6	180	50	8	2.2	360
Poultry meat	17	4.5	38	10.1	74	19.6	242	64.4	5	1.3	376
Margarine	19	5.1	21	5.6	25	6.7	117	31.2	193	51.5	375
Milk	70	18.3	62	16.2	79	20.6	119	31.1	53	13.8	383
Fish	228	61.6	73	19.7	52	14.1	17	4.6	0	0	370

Key: x: times F: frequency %: percentage

Table 3 presents the respondents' frequency of consumption of sources of preformed vitamin A. It was shown that only fish was consumed at least once daily by higher percentage (61.6%) of the respondents. Other sources (poultry meat, egg, liver and milk) were occasional foods for higher percentages of the respondents (64.4%, 50%, 49.7% and 31.1%, respectively). Margarine was never consumed by more than half (51.5%) of the respondents. The consumption pattern of sources of provitamin A carotenoids is presented in Table 4. It was shown that palm oil and pepper were the most frequently consumed sources of provitamin A carotenoids as almost all the respondents (99.5% and 95.1%, respectively) consumed them at least once daily. Green leafy vegetables and paw-paw were also consumed by all the respondents. Tomato and avocado pear were consumed once weekly by 36% and 30.9% of the respondents, respectively, while sweet potato, carrot and mango were consumed occasionally by 52.6%, 37.6% and 36.3% of the respondents, respectively.

Table 4: Respondents' consumption frequency of sources of provitamin A carotenoids

	At least once daily		2 or more x weekly		Once weekly		Occassionally		Never		Total
	F	%	F	%	F	%	F	%	F	%	
Red palm oil	384	99.5	2	0.5	0	0	0	0	0	0	386
Carrot	76	21.1	69	19.1	49	13.6	136	37.6	31	8.5	361
Green leafy vegetables	190	49.2	84	21.8	70	18.1	42	10.9	0	0	386
Paw paw	138	35.8	90	23.3	96	24.9	62	16.1	0	0	386
Mango	114	29.8	64	16.7	93	24.3	139	36.3	11	2.9	384
Pepper	365	95.1	4	1	0	0	8	2.1	5	1.3	384
Tomato	110	28.5	97	25.1	140	36.3	36	9.3	3	0.8	386
Sweet potato	24	6.3	33	8.6	65	17	201	52.5	60	15.7	383
Cashew apple	173	45.3	52	13.6	66	17.3	90	23.6	2	0.5	382
Avacado pear	48	12.8	76	20.3	116	30.9	97	25.9	38	10.1	375

Key: x: times F: frequency %: percentage

Table 5: Mean daily nutrient intakes of respondents expressed as percentages of FAO/WHO requirement values

	Ener-gy (Kcal)	Pro-tein (g)	Fat (g)	CHO (g)	Iron (mg)	Vita-min A (RE)	Thia-min (mg)	Ribo-flavin (mg)	Niacin (mg)	Ascor-bic acid (mg)	Cal-cium (mg)
Mean intake	2570 ±531	67.3 ±7.0	77.1 ±9.4	356.8 ±67.2	26.7 ±3.8	1401.2 ±258	1.5 ±0.34	0.95 ±0.08	12.2 ±2.7	155.3 ±6.1	938.7 ±176
FAO/WHO Requirements	2550	59*	53.5	348	28	800	1	1.5	16.8	55	1000-1200
Intake as % of requirement	100.8	114.1	144.1	102.5	95.4	175.2	150	63.3	72.6	282.4	93.9

Sources of FAO/WHO requirements: Beaton and Patwardhan (1976); FAO (2001); FAO/WHO/UNU (1985); FAO/WHO (1988)

*Protein requirement for average net protein utilization (NPU) of 60 and 70.

NPU 60 = staple cereal diet with few other sources of protein (use these values for diets based on starchy roots and tubers).

NPU 70 = mixed cereal-legume diet with small amounts of animal foods.

n = 77

Table 6: Percentage contributions of food groups to respondents' mean daily nutrient intakes

	Ener-gy (Kca	Pro-tein (g)	Fat (g)	CHO (g)	Iron (mg)	Vita-min A (RE)	Thia-min (mg)	Ribo-flavin (mg)	Nia-cin (mg)	Ascor-bic acid (mg)	Cal-cium (mg)
Mean intake	2570	67.3	77.1	357	26.7	1401	1.5	0.95	12.2	155	939
Starchy roots and tubers	591	6.5	0.6	124	4.1	4.63	0.21	0.12	1.6	28.1	58.4
% contribution	23	9.7	0.8	34.7	15.4	0.3	14	12.6	13.1	18.1	6.2
Legumes	586	35.2	7.1	117	11.2	0.8	0.8	0.27	4.05	0	223
% contribution	22.8	52.3	10.1	32.8	41.9	0.1	53.3	28.4	33.2	0	23.8
Cereals	356	9.8	4.4	69.6	2.5	0	0.34	0.13	1.97	0	11.8
% contribution	13.9	14.6	5.7	19.5	9.4	0	22.7	13.7	16.1	0	1.3
Vegetables	69.8	6	0.78	9.58	4.56	302	0.11	0.3	2.2	121	317
% contribution	2.7	8.9	1	2.7	17.1	21.5	7.1	31.6	18	77.7	33.8
Nuts and seeds	152.7	4.73	10.7	5.93	3	0.1	0.02	0.09	0.29	0	49.8
% contribution	5.9	7	13.9	1.7	11.2	0	1.3	9.5	2.4	0	5.3
Palm oil	534	0	49.3	0	0	1076	0	0	0	0	0
% contribution	20.8	0	63.9	0	0	76.8	0	0	0	0	0
Animal foods	31.6	5.3	0.65	0.2	1.14	9	0.02	0.02	1.42	0	258
% contribution	1.2	7.9	0.2	0.1	4.3	0.6	1	2.5	11.6	0	27.5

n = 77

Table 5 presents the mean daily nutrient intakes of the respondents expressed as percentages of FAO/WHO daily nutrient requirement values. The results showed that the respondents' energy, protein, carbohydrate, iron and calcium intakes were adequate (100.8%, 114.1%, 102.5%, 95.4% and 93.9% of the requirements, respectively). The respondents' intakes of fat, vitamin A, thiamin and ascorbic acid were much higher than the requirements (144.1%, 175.2%, 150% and 282.4%, respectively). However, riboflavin and niacin intakes were low (63.3% and 72.6% of the requirements, respectively).

The percentage contributions of food groups to the daily mean nutrient intakes of the respondents are presented in Table 6. The result showed that starchy roots and tubers made the highest contribution to energy (23%) and carbohydrate (34.7%) intakes of the respondents. Legumes made the highest contribution to respondents' intakes of protein (52.3%), iron (41.9%), thiamin (53.3%) and niacin (33.2%), and also made substantial contribution to energy (22.8%), carbohydrate (32.8%), riboflavin (28.4%) and calcium (23.8%) intakes of the respondents. Cereals contributed substantially to energy (13.9%), protein (14.6%), carbohydrate (19.5%), thiamin (22.7%) and niacin (16.1%) intakes of the respondents. Vegetables made the highest contribution to riboflavin (31.6%), ascorbic acid (77.7%) and calcium (33.8%) intakes of the respondents, and also made substantial contribution to iron (17.1%) and vitamin A (21.5%) intakes of the respondents. Nuts and seeds accounted for 13.9% and 11.2% of fat and iron intakes of the respondents, respectively. Palm oil made the highest contribution to respondents' fat (63.9%) and vitamin A (76.8%) intakes, and contributed substantially to energy (20.8%) intake of the respondents. It was also shown that animal foods made very little contributions to most of the respondents' nutrient intakes except for calcium (27.5%) and niacin (11.6%).

DISCUSSION

The high consumption of crayfish and fish as the major sources of haem iron was due to their availability and lower cost compared to other animal foods (liver, egg, beef etc.), which were occasional foods for higher percentages of the respondents due to high cost. These results agreed with some earlier reports that the diet of South-eastern Nigerians/Igbo indigenous people were plant-based, and animal foods were consumed frequently only by the rich (Madukwe and Ene-Obong, 2002; Okeke *et al*., 2009a). The very low consumption of snails among the respondents further confirmed that food taboos were still practised among pregnant women as earlier reported (Okeke *et al*., 2009a). Food taboos appear to be a universal problem. Halminton, Popkin and Spicer (1984) observed that food taboos, characteristically attached on protein foods and directed to pregnant and lactating women, are common worldwide.

The adequacy of respondents' iron intake that met 95.4% of FAO/WHO requirement was attributed to high consumption of legumes, green leafy vegetables and nuts and seeds that featured very prominently in the diets of the respondents and contributed 41.9%, 17.1% and 11.2% respectively, to iron intakes of the respondents. The high consumption of legumes found in this study was similar to earlier observation of some researchers (Nnanyelugo, Ngwu, Asinobi, Uwaegbute and Okeke, 1992) who reported that legumes were eaten widely in Nigeria, especially in the southern part of Nigeria. Legumes, green leafy vegetables, nuts and seeds are known to contain appreciable amount of iron. However, the adequacy of iron intake of the respondents needs careful interpretation because the iron composition (non-haem iron) of plant foods is prone to low digestibility and bioavailability (Madukwe and Ene-Obong, 2002), coupled with the low consumption of sources of more bioavailable (haem) iron. Low bioavailability of dietary iron must have been responsible for the high prevalence of iron deficiency anaemia (55.9%) among the study population (Eze, 2011). The very low contribution of animal foods to the respondents' iron intake (4.3%) accord the report of ACC/SCN (1992) that in Sub-Saharan Africa and South Asia, iron supplies from animal sources were extremely low resulting in very low absorption of iron.

The high consumption of fish as a source of preformed vitamin A and low consumption of other sources was attributed to high cost of most animal foods. Okeke *et al*. (2009a) reported that milk and milk products were generally consumed by the affluent, the sick, and in very small quantity, by children due to high cost. The high vitamin A intake of the respondents was associated with consumption of meals regularly prepared with palm oil, red or yellow pepper, and most often, with green leafy vegetables and fruits rich in provitamin A carotenoids, which were available during the study period (rainy season). The high consumption of red palm oil observed in this study confirmed report of Okeke *et al*. (2009a) that almost all the dishes consumed in Southern Nigeria were prepared with palm oil. The frequent consumption of pepper, green leafy vegetables and paw-paw demonstrated that the foods were available to the respondents within the study period. Weekly consumption of tomato by higher percentage of the respondents, and the much lower consumption of carrot by the rural respondents was associated with cost and availability. Contrary, occasional consumption of sweet potato and mango by higher percentages of the respondents was due to seasonality and poor knowledge of nutritional importance, respectively.

The adequate energy intake of the respondents based on FAO/WHO requirements was at variance with the report of Nnanyelugo *et al.* (1992). They reported low energy intake among pregnant women in Nigeria. However, Ngwu (2001) reported 93% energy intake among adult females in Ohusu community in Edo State. Other available studies of food consumption during pregnancy and lactation in African countries indicated that daily energy intakes ranged from 1400 – 2000Kcal (Gebre Medhin and Gobezie, 1975; Prentice, 1980). The adequate energy intake observed in this study was attributed to high carbohydrate intake from starchy roots and tubers, legumes and cereals, as well as high fat intake from palm oil.

The adequacy of protein intake of the respondents agreed with earlier result of Okeke *et al.* (2009b) who reported adequate protein intake among mothers in Igbo culture area in Nigeria. The adequate protein intake observed in this study was however, at variance with that of Ngwu (2001) who reported 46 – 48% protein intake among cassava producers and consumers in Ohusu area of Edo State. The adequacy of protein intake observed in this study was due to the respondents' high consumption of legumes and cereals which contributed up to 52.3% and 14.6% respectively, to their total protein intake. This observation agreed with earlier report that legume as a source of vegetable protein, form a very important part of the diet of low socio-economic citizens in Nigeria (Ankroyd and Doughty, 1984).

The adequate thiamin intake was associated with the respondents' high consumption of whole maize and legume based traditional dishes. In the same vein, legumes and vegetables were the major contributors of calcium intakes of the respondents. The low consumption of milk and its products by the respondents may likely be due to high cost in line with earlier report of Okeke *et al*. (2009a). The low intakes of riboflavin and niacin as against their requirements were due to low consumption of milk and meat which are rich sources of the nutrients. Legumes and dark green leafy vegetables were the major contributors of the respondents' intakes of the nutrients.

The high ascorbic acid intake of the respondents could be attributed to the period of the study (green leafy vegetables were in abundance due to rainy season, and contributed up to 77.7% to the total ascorbate intake). However, the high level of ascorbate intakes of the respondents should be interpreted with caution. This is because losses in ascorbate abound during cooking and processing. The high intakes of some of the nutrients such as vitamin A, thiamin and ascorbic acid supported earlier observation (Sayer *et al*., 1974) that foods of vegetable origin were consumed in developing countries in quantities which contained most of the essential elements in excess of individual requirements when total intakes are compared with requirements.

CONCLUSION

The iron-rich foods most frequently consumed by the respondents were legumes and green leafy vegetables, and vitamin A-rich foods most frequently consumed by the respondents were palm oil and vegetables. Varied nutrient sources precipitated adequate intakes of both macro and micronutrients by the pregnant women except niacin and riboflavin. Foods of vegetable origin form very important part of the diet of the study population, as the respondents' nutrient intakes were mostly from plant sources. Animal foods made very little contributions to the respondents' nutrient intakes. Nutrition education on proper processing techniques of plant foods to conserve the water-soluble, air, light and heat sensitive micronutrients is required. Women should also be educated on the need for consumption of ascorbic acid-rich fruits with meals to enhance bioavailability of iron in the diet. Animal foods which are rich sources of more bioavailable (haem) iron and vitamin A must be made more available at much affordable

cost through government subsidization. Biofortification of locally produced foods to increase the bioavailability of micronutrients is imperative.

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