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Assessment of vitamin a status and anthropometry among school age children (6-12 years) in aba north local government area, Abia state, Nigeria

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Abstract
Vitamin A deficiency is a serious and widespread public health problem in developing countries. This research was conducted in Aba North local Government Area of Abia State, to determine the prevalence of vitamin A deficiency among school age children (6-12 years). The survey also incorporates food consumption, nutrition survey and anthropometry. A total of one hundred and sixty children were randomly selected from public and private schools in the area. About 20% of the population had their blood samples collected by venepuncture. Spectrophotometric method of ultraviolet destruction of vitamin A was used for determination of serum vitamin A levels. On their weight-for-age scores, 100% of the subjects were normal. For the height-for-age scores, 0.6% were stunted. For the BMI-for-age; 1.3% were overweight, 1.3% were obese while 97.4% were within the normal range. No subject was wasted. For vitamin A status, about 25% of the males and 56.2% females had high serum retinol levels. 25.5% females and 50% males had adequate serum retinol levels, while 12.5% males and 6.2% females had very high serum retinol level. However, 6.2% females had a low serum retinol level. Widespread Vitamin A supplementation, fortification of staple foods, activities of international agencies in checkmating vitamin A deficiency, promotion of exclusive breast feeding as well as awareness and consumption of Vitamin A rich foods could all have had bearing on the results observed in the study area.

Keywords: vitamin A, anthropometry, school age children, aba north L.G.A, Nigeria

Introduction
Vitamin A is a fat soluble vitamin, an essential micro nutrient necessary for normal functioning of the eyes, growth and development, maintenance of epithelial cellular integrity, immune function and reproduction (Shubhagani, 2008; Srilakshmi, 2011) [17]. Vitamin A deficiency (VAD) is a major public health problem (WHO, 2000). It is the leading cause of preventable visual impairment and blindness. Vitamin A deficiency occurs when body stores are depleted to the extent that physiological functions are impaired. The integrity of the epithelial barriers and the immune system are compromised (ACC/SCN, 2006) [1] Malnutrition especially micronutrient deficiency diseases is of public health concern in the developing countries, Nigeria inclusive. The economic realities of the time coupled with nutrition knowledge deficit have impacted negatively on the diet quality of most families, in situations like this; women and children tend to be the worst hit (Afam-Anene, 2002) [2]. Improving Vitamin A status of deficient children increases their chances of survival (West, 2002) [20]. In Nigeria, Vitamin A rich foods, for example palm oil, green vegetables are in abundance in all regions of the country. Despite this fact, the Nigerian National Health Demographic Survey (2013) [11] and the National Micronutrient Survey (1993) [10] indicates that Vitamin A deficiency was a problem of public health significance; this situation may have resulted from nutrition knowledge deficit, poverty, food fads and habits that hinder dietary diversification. The School age children are at the receiving end of the spectrum since they are left with no choice but to eat whatsoever they are given in the family. Studies have shown that 34% - 64% of childhood blindness in Nigeria is caused by corneal opacity, which results mainly from an interplay of vitamin A deficiency, measles and harmful, traditional eye practices. However, vitamin A deficiency which manifests in the eye as xerophthalmia is the dominant problem in children (Rabiu *et al.*, 2002) [14]. An estimated 250,000 to 500,000 vitamin A deficient children become blind every year and about half of them die within a year of becoming blind (FAO/WHO,1992). VAD significantly increases the risk of severe illness and death from common childhood infections particularly diarrhoea diseases and measles (McLaren, 2001) [9]. Improving the vitamin A status of young children can reduce child deaths by 20 – 50% (West, 2002) [20] suggesting that a substantial portion of their mortality is attributed to vitamin A deficiency.

The school aged child is a child between the ages of 6years to 12years. They are highly active and like to explore their world. School age children usually have smooth and strong motor skills. However, their co-ordination (especially eye-hand), endurance, balance and physical abilities vary. As this is an active age group, nutrition plays a large role in their continued health and wellbeing (Humphrey *et al.*, 1992). School age children constitute an important segment of any society as they represent the future generation. They comprise between 20% and 30% of the population; thus, understanding the nutritional status of school children has far reaching implications for development of any society. Available information indicates that malnutrition is a public health issue in developing countries. The focus all the while has been on children less than 5 years even though other groups need to be monitored, for example, the school age children (Oguizu, 2014) [12]. This study was carried out to Assess Vitamin A Status and Anthropometry among School

Age Children (6-12 Years) in Aba North Local Government Area, Abia State Nigeria.

Materials and Methods

Study design

This was a cross sectional study of school age children (6 – 12years) in Aba North Local Government Area, Abia State.

Study area

Aba North Local Government Area is one of the seventeen Local Governments in Abia State. It was created in 1991. It is bounded on the Northern flank by Osisioma Ngwa Local Government, on the South by Aba South Local Government, on the East by Ugwunagbo Local Government and on the West by Obingwa Local Government Area. According to the 2006 National Population Census, Aba North has a total population of 106,844 people with males being 53,016 and females 53,828. The area is predominantly inhabited by Igbos with a sprinkling of other ethnic nationalities. The predominant occupation is trading, craft man ship and civil servants. Aba North forms the hub of what is known as the commercial nerve centre of the state and hosts the Ariaria International market.

Population of the study

The study population consisted of school age children (6 – 12 years) in Aba North Local Government Area, Abia State.

Sampling and sampling technique

Sample Size and sample size calculation

The sample size was calculated using the formula:

$$Ns = (\frac{Z}{E})^2 \text{ x P (1-P)} \text{ (Uzoagulu, 1998)}$$

Where;
Ns = sample size
Z = confidence interval which is 1.96, approximately 2
X = width of confidence interval at 5% level of probability.
National percentage of people with vitamin A deficiency was estimated at 28% (National Micronutrient Survey, 2013) [11].
Based on this, sample was calculated as shown:

$$Ns = (\frac{1.96}{0.05})^2 \text{ x } 0.28 \text{ x } 0.72$$

$$Ns = 158.05$$

The sample size calculated is 158.05 but it was approximated to 160 respondents to make room for dropouts or incorrectly filled questionnaires.
Therefore, $Ns \cong 160$

Sampling procedure

Aba North LGA has 14 communities and 100 registered public and private primary schools. Systematic random sampling was used to select four (4) communities for the study. Systematic random sampling was also employed to select 10 schools out of the registered schools in Aba North; five (5) public and five (5) private schools. Using the class register, 16 children were systematically selected from each school. One hundred and sixty (160) children were selected for the study

Preliminary activities

Preliminary visit/Informed consent

A visit was made to the head teachers of the selected schools with an introductory letter explaining the aim of the research and seeking their co-operation to facilitate the study. A letter was sent to parents of selected children, seeking their consent for the participation of their wards in the research.

Training of research assistants

The research had two trained medical laboratory technicians to assist in collection of blood samples from respondents and for appropriate labelling.

Ethical approval

This was obtained from Abia State Ministry of Education.

Data collection instruments and methods

Questionnaire

A structured questionnaire was designed to obtain information on personal data, household and demographic information, socio-economic status, monthly income range and frequency of consumption of vitamin A rich foods. The questionnaire was validated, reliability was assumed by pre-testing on subjects not used for the survey. The questionnaires were administered through interviews by the researcher and research assistants.

Collection of blood samples

The blood samples of the children were drawn by a trained and experienced medical laboratory technician using standard procedure (IVACG, 1989) [7]. The blood samples were stored in trace element free tubes, centrifuged for 10 minutes at 4,000 revolutions per minute (rpm) and stored at -20^0C pending further analysis.

Biochemical analysis of vitamin A

An experienced medical laboratory technician obtained 2ml of venous blood in twenty percent of the study population (32). Blood samples were stored in serum collecting tubes free from trace elements. They were centrifuged for 10 minutes at 4,000 revolutions per minute (4,000rpm) and the serum stored at -20^0c for subsequent analysis. 2ml of ethanol was added to 0.5ml of serum to give a 50% solution. Petroleum ether was used to digest it and after digestion, it was dehydrated and then re-dissolved by adding 0.1ml of chloroform acetic anhydride. Spectrophotometer model number spectrum lab 23A was used to read the absorbance at 15 seconds and 30 seconds. Sodium EDTA was used as anticoagulant.

Food frequency questionnaire

The frequency of consumption of vitamin A rich foods were assessed using a food frequency questionnaire. Respondents were expected to indicate how often they consumed the available foods listed routinely.

Weight

Weight was taken using a portable Hanson bathroom scale. Light clothing was worn by the subjects without shoes or other encumbrances so as to obtain an accurate reading. The scale was pre-set to zero (0) before subjects were weighed and the reading was calculated to the nearest gram (Cogil, 2003) [4].

Height

The height was taken using a portable height meter with a headboard. The subject stood erect, looked ahead, with back of the head against the vertical surface of the height meter.

The headboard was lowered on the highest point of the head with enough pressure to compress the hair. The reading was taken to the nearest 0.01cm.

Statistical analysis

Descriptive statistics; frequency and percentage distribution, mean and median were used to present data. Spearman's correlation co-efficient test was used to test for significant differences or relationships between the variance while Chi-square statistical test was used to test for significant differences or relationships in the socio-economic data and vitamin A status. Students' T-test was used to compare anthropometric measurements as well as vitamin A levels between males and females. Statistical Package for Service Solution (SPSS) version 20 was used.

Results

Table 1 shows the personal information of the children studied. About 44.9% of the children were male while 55.1% were female. Majority of the respondents (54%) indicated family size of 5 persons and above.

Table 1: Background information of the children

Variables	No	%
Age (years)		
6-7	46	29.1
8-9	43	27.2
10-11	46	29.1
12	23	14.6
Total	158	100
Gender		
Male	71	44.9
Female	87	55.1
Total	158	100
Family size		
3-4 persons	72	45.6
5 and above	86	54.4
Total	158	100

Table 2 below shows that over five percent (5.1%) of fathers and 4.4% of mother received income above N120, 000 while 11.4% of fathers and 6.3% of mothers received income between N90, 000- N119,000. About 12.0% of mothers and 1.3% received income below N30, 000. About 21.5% of fathers and 34.8% of mothers were civil servants while over thirty percent (38.6%) of fathers and mothers (32.3%) were traders by occupation. Majority of fathers and mothers (67.7% and 61.4%) had secondary education as their highest level of education. The study observed that more women (38.0%) than men (20.9%) had tertiary education.

Table 2: Socioeconomic variables of the respondents

Variables	Fathers		Mothers	
	No	**%**	**No**	**%**
Occupation				
Trading	61	38.6	61	32.3
Farming	12	7.6	2	1.3
Self employed	49	31.0	45	28.5
Civil servant	34	21.5	55	34.8
Not employed	2	1.3	5	3.2
Total	158	100	158	100
Income				
Below N30,000	90	1.3	19	12.0
N30,000- 59,999	40	57.0	99	62.7
N60,000-89,999	18	25.3	23	14.6
N90,000-19,999	8	11.4	10	6.3
Above N120,000	2	5.1	2	4.4
Total	158	100	158	100
Education				
No formal	12	7.6	-	-
Primary	6	3.8	1	0.6
Secondary	107	67.7	87	61.4
Tertiary	33	20.9	60	38.0
Total	158	100	158	100

Table 3 shows that 84.2% of the respondents were aware of vitamin A rich foods. About 55.1% of the respondents got the information from health workers, 10.1% got the information through friends, and 10.8% got the information from relatives while 8.2% got from TV and radio.

Table 3: Vitamin A awareness of the respondents

	Frequency	Percentage
Vitamin A awareness		
Yes	133	84.2
No	25	15.8
Total	158	100
Source of information		
Na	25	15.8
TV/radio	13	8.2
Friend/	16	10.1
Relative	17	10.8
Health workers	87	55.1
Total	158	100

Table 4 shows the vitamin A status of the school children. About 56.2% females and 25% males had high vitamin A status, 25.5% females and 50% males had adequate vitamin A levels. About 6.2% females had a low vitamin A status. About 6.2 % females and 12.5% males had very high vitamin A levels. About 33.3% females and 66.7% males had very high vitamin A levels.

Table 4: Vitamin A status of the children studied (n=32)

Variables	Females		Males		Total	
	No	%	No	%	No	%
Deficient (< 0.35 µmol/L)	-	-	-	-	-	-
Low(0.35-0.79 µmol/L)	1	6.2	-	-	1	3.1
Marginal (0.80-1.99 µmol/L)	1	6.2	2	12.5	3	9.4
Adequate (2.00-2.99 µmol/L)	4	25.5	8	50	12	37.5
High (3.00-3.99 µmol/L)	9	56.2	4	25	13	40.6
Very high (>4.00 µmol/L)	1	6.2	2	12.5	3	9.4
Total	16	100	16	100	32	100

Table 5 outlines the anthropometric indices of the subjects; their height-for-age, weight-for-age, and BMI-for-age (by sex and age). From the weight for age, 100% had normal weight. According to the height for age column, 99.4% fell within reference ranges while 0.6% were stunted. For the BMI for age, 97.4% had normal weight, 1.3% were overweight and 1.3% obese. From the research findings, there was no child that was wasted.

Table 5: Nutritional status of the children studied

	Male		Female		Total	
Variable	No	%	No	%	No	%
Height-for-age						
Normal	72	100	85	98.8	157	99.4
Stunted	-	-	1	1.2	1	0.6
Total	72	100	86	100	158	100
Weight-for-age						
Normal	72	100	86	100	158	100
Wasted	-	-	-	-	-	-
Total	72	100	86	100	158	100
BMI-for-age						
Normal	68	94.4	86	100	154	97.4
Overweight	2	2.8	-	-	2	1.3
Obese	2	2.8	-	-	2	1.3
Total	72	100	86	100	158	100

Table 6a below shows the relationship between vitamin A and stunting. There was no positive correlation between stunting and vitamin A status in the respondents

Table 6b shows the relationship between vitamin A status and wasting. There was no positive correlation between vitamin A and wasting. Table 6c below shows the vitamin A status and BMI-for-age of the children studied. About 3.1% of the subjects who had an adequate vitamin A status were obese, while 6.2% of the subjects with very high vitamin A status were overweight.

Table 6a: Vitamin A Status and Stunting (n=32)

	Normal		Stunted		Total		p-value
Variable	No	%	No	%	No	%	
Low	-	-	1	100	1	3.1	0.239
Marginal	3	9.7	-	-	3	9.4	
Adequate	12	38.7	-	-	12	37.5	
High	12	38.7	-	-	12	37.5	
Very high	3	9.7	-	-	3	9.4	
Total	31	100	1	100	32	100	

Table 6b: Vitamin A Status and Wasting (n=32)

	Normal		Wasted		Total		p-value
Variable	No	%	No	%	No	%	
Low	1	3.1	-	-	1	3.1	0.369
Marginal	3	9.4	-	-	3	9.4	
Adequate	12	37.5	-	-	12	37.5	
High	13	40.6	-	-	13	40.6	
Very high	3	9.4	-	-	3	9.4	
Total	32	100	-	-	32	100	

Table 6c: Vitamin A Status and BMI-for-age (n=32)

	Normal		Overweight		Obese		Total		p-value
Variable	No	%	No	%	No	%	No	%	
Low	1	3.4	-	-	-	-	1	3.1	0.321
Marginal	3	10.3	-	-	-	-	3	9.4	
Adequate	11	37.9	-	-	1	100	12	37.5	
High	13	44.8	-	-	-	-	13	40.6	
Very high	1	3.4	2	100	-	-	3	9.4	
Total	29	100	2	100	1	100	32	100	

Table 7 shows that almost all the children took vegetables (99.4%) and palm oil (100%) daily. About 27.2% of the children under study took milk at least once a day. The least consumed daily food by the respondents was mango; only 0.6% of the children consumed it daily. More than fifty percent of the children consumed water melon (66.5%), pawpaw (51.9%) and mango (75.9%) at least once a week. Only a few of the children ate oatmeal (6.3%) and oysters (8.9%) once a week. More than 50% of the children claimed to have consumed fish (58.8%), sweet potato (62%) and tomatoes (82.2%) at least two to three times a week. Virtually all respondents stated that their children ate thrice daily.

Table 7: Food consumption pattern of children, with emphasis on Vitamin A rich foods

Foods	1-3x daily		1x weekly		2-3x weekly		No response		
	No	%	No	%	No	%	No	%	Total
Milk	43	27.2	43	27.2	72	45.5	-	-	158
Liver	-	-	19	12	4	2.5	35	85.4	158
Egg	18	11.3	73	46.2	22	13.9	-	-	158
Fish	18	11.3	47	29.7	93	58.8	-	-	158
Sweet Potato	3	1.9	52	32.9	98	62.0	5	3-2	158
Orange	16	10.1	55	34.8	80	50.6	7	4.4	158
Tomato	2	1.3	23	14.6	130	82.2	3	1.9	158
Pawpaw	3	1.3	82	51.9	21	13.3	52	32.9	158
Plum	4	2.5	41	28.9	9	5.7	104	65.8	158
Vegetables	157	99.4	-	-	1	0.6	-	-	158
Oatmeal	2	1.3	10	6.3	1	0.6	145	91.8	158
Bitter leaf	1	1.6	30	19.0	1	0.6	126	79.7	158
Oyster	-	-	14	8.9	2	1.3	142	89.9	158
Cod liver oil	-	-	24	15.2	-	-	134	84.8	158
Water melon	5	3.2	105	66.5	46	29.1	2	1.3	158
Mango	1	0.6	120	75.9	21	13.2	16	10.1	158
Avocado	6	-	58	36.7	11	6.9	83	52.5	158
Icheku (*Dialium guineense*)	3	1.8	116	73.4	25	15.8	14	8.9	158
Palm oil	158	100	-	-	-	-	-	100	158

Discussion

More than 50 percent of the respondents were females; this is in contrast with the National Demographic and Health Survey (NDHS, 2013) [11] where it was recorded that in households, there were more males (81.5%) than females (18.5%). Majority of the respondents indicated having a family size of 5 persons and above. Large family sizes and increased number of children affect the food available to the family members and children in particular. Less than a quarter of the parents were civil servants this is in line with the report of NDHS. (2013) [11] the percentage of parents found to be traders in this survey is in line with that observed in NDHS. (2013) [11] in Abia State. Majority of fathers and mothers had secondary education as their highest level of education; this is also in line with the report of NDHS, 2013. The study observed that more women than men had tertiary education. A large percentage of the respondents were aware of vitamin A rich foods. More than half got the information from health workers, while a few got the information through friends, relatives TV and radio. This result is in contrast with the report of NDHS, 2013 where it was observed that 43.6% and 22.8% of women and men respectively had assess to three forms of media (Television, Radio and Newspaper) at least once a week which helps to create awareness on health and products trends. The low percentage of respondents getting their information from the media especially with TV and radio may be attributed to the poor power outage experienced in the Country. More than half of both male and female respondents had high vitamin A status. Only a few females had a low vitamin A status. This actually relates positively to a study in Pakistan by Lindblad *et al*. (1998) that age and sex are important factors in determining normal retinol levels. According to the study, women tended to have lower serum retinol levels than men. This sex difference in serum retinol levels was however not evident in infants whose serum retinol levels were normally lower than what would otherwise be considered normal. Although less than one third females and more than half males had very high vitamin A levels, there was no fear of hyper toxicity since dietary vitamin A rarely predispose to hypervitaminosis. Hypervitaminosis would have been a reality where oral supplementation led to such levels of vitamin A (Bryd-bredbenner *et al*., 2013) [3]. For anthropometric indices of the subjects all of the subjects had normal weight- for- age. For height- for- age 0.6% was stunted. For the BMI- for- age, 1.3% were overweight and 1.3% obese. From the research findings, no child was wasted. This is contradictory with a study carried out in Ikwuano Local Government Area, Abia State by Oguizu and Okoro. (2016) [16]; they found that 28.1% of the respondents were stunted, and more females were overweight than males. In this instance, males as opposed to females were found to be in the overweight and obese categories. This may be attributed to males having voracious appetite than females at this stage of life. The relationship between vitamin A, stunting and wasting, showed there was no positive correlation between stunting, wasting and vitamin A status in the respondents. The children that participated in this study tended to have better nutritional status compared to children in other studies in Nigeria. Global Health Observatory (GHO) data of the World Health Organisation (2015), showed that the prevalence of stunting, wasting and underweight among children <5 years of age worldwide, have significantly decreased since 1990; Wasting in <5 years old group decreased by 13% from 1990 to 2013. Almost all the children took vegetables and palm oil. Palm oil and paw-paw were some of the foods that were readily available and of low cost; their regular intakes may have accounted for the high status of vitamin A observed in the study. Virtually all respondents stated that their children ate thrice daily. Food of animal origin mostly consumed by the respondents was milk, followed by fish. Oyster was relatively not well consumed probably because it was not very common in that part of the country. The economic status and living conditions as well as consumption of a varied diet abundantly rich in both dark green vegetables and orange yellow fruits may have had a positive impact on the nutritional status of the children studied (Khan *et al.*, 2008; Byrd- Bredbenner *et al.*, 2013) [8, 3].

Conclusion

Majority of the children, both male and female were within the 6-7 years age range. Family size of 5 persons and above had the highest number. Most of the fathers were traders. A greater percentage of the mothers were also traders; this is not surprising, considering that Aba, the area of the study is the commercial nerve centre of Abia State as well as a hub of small and medium enterprises. The families that participated in the study could generally be described as medium income. More fathers had secondary education while more mothers continued on with tertiary education; this also could be attributed to the pressure on males within the study area to make money faster as to take care of their families. A large number of the respondents had a good knowledge of vitamin A rich foods and the health worker took the lead as being the source of information.

For the vitamin A status, there was no deficient subject, majority had high vitamin A levels; this could be explained by the activities of international agencies which have worked assiduously to reduce vitamin A deficiency in Nigeria by promoting exclusive breastfeeding, fortification of foods and educational programmes to increase home gardening of vitamin A rich fruits and vegetables. In correlating vitamin A status with stunting, there was no significant correlation; this may not be the real picture as the low number recorded could be attributed to the sample size.

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