

## Vitamin A and Iron Deficiency in Pregnant Women, Lactating Mothers and Their Infants in Adamawa State, Nigeria: A Prospective Cohort Study

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### Summary

We determined the breast-feeding patterns, Vitamin A and Iron supplement intake between various age groups of pregnant women in Adamawa state, Nigeria. Of the 161 pregnant women screened for this study, 73% were from Njoboliyo (NJ) (n=118) while 27% from GD Chanrai Memorial hospital (CMH) (n=43). Of the 161 women from the two study sites, women within the 15-24 age brackets had the highest number of study participants [65] 40%. Two-thirds of the study participants take supplements of Iron and Vitamin A (68%) in both study sites, while (22%) in Njoboliyo and (20%) in CMH breast-feed their infants for more than 6months. The intake of iron and vitamin A was observed to be higher in women of age 25-34, but it was statistical not significant (P=0.12, DF=3, X<sup>2</sup>=0.65). Comparing breast-feeding patterns irrespective of age, we observed that 94.1% of the pregnant mothers breast-feed their infants as opposed to the 5.9% that do not breast-feed, but the pattern showed no significant relationship when compared across the various age groups (P=0.62, DF=3, X<sup>2</sup> =3.05). We therefore recommend that proper awareness campaign and seminars be put in place by the government to help enlighten pregnant women on the need to continue breast-feeding their infants even after 6months.

**Keywords:** Iron and vitamin A supplements; Breast-feeding; Pregnant mothers; Adamawa state

### Introduction

#### An overview

Nutrition is science that studies the provision to the body, of the materials that are required for the support of life. These materials are usually in the form of food. These foods contain nutrients, which are chemical substances that a living thing needs to live and grow, and survive. A balanced diet containing all necessary nutrients is the most important requirement for a healthy life. Nutrients that are needed by the body in large quantities are known as macronutrients while those that are needed by the body in relatively smaller amounts are known as micronutrients [1]. Micronutrients function to ascertain that all the cells in our body work efficiently; examples include Vitamins, Minerals and Trace elements. Vitamins and minerals are essential for metabolism in the body. There are two kinds of vitamins namely water soluble (vitamin B<sub>6</sub>, Biotin, Thiamin, Niacin, Folate, vitamin B<sub>12</sub>, Pantothenic acid, Riboflavin and vitamin C) and fat soluble (vitamins A, D, E, and K). Calcium aids in the structure of bones and teeth while sodium helps to regulate body functions like the contractions of the heart and muscles [2]. Major minerals include Calcium, Chloride, Magnesium, Phosphorus, Potassium, Sodium and Sulfur. There also trace minerals such as Copper, Chromium, Fluoride, Iodine, Iron, Selenium, Manganese, Molybdenum, and Zinc [2]. This paper will focus on Vitamin A and Iron.

Vitamin A (or Retinol) is a fat-soluble organic compound. Humans are not capable of manufacturing vitamin A themselves, and as such have to rely on other sources outside the body for its provision. It has numerous uses in the body including maintaining good vision, promoting a healthy immune system and also giving healthy strong bones. This Vitamin has both plant and animal's sources. In plants, it is found in the form of pro-vitamin A Carotenoid which is eventually converted into retinol when ingested by humans. Carotenoids are usually found in green, yellow, orange and red vegetables for example; Carrots, Spinach, Tomatoes, Mango and Papaya. In animals, it is found

in the form of retinol, which can be directly absorbed by the body. Sources include milk, eggs, chicken and cheese [3].

Iron is an important metal for all living things. In humans, it is a component of hemoglobin, which is the protein molecule in red blood cells that carries oxygen. Other functions of hemoglobin include regulation of cell growth and differentiation, conversion of nutrients into energy and manufacture of new Deoxyribonucleic acid (DNA). Most important function however, is to transport oxygen all over the body. Iron is found in all cells in the body and is needed to synthesize Adenine Tri-Phosphate (ATP) into energy. Iron is derived from diet, from both plant and animal sources. Red meat, fish, poultry, shellfish, eggs, legumes, dried fruits and fortified cereals are sources of Iron [2]. Iron can be found in the human blood and stored in the liver, spleen and bone marrow [4]. When iron is assimilated in the human body with other minerals, it depends on the amount of acid in the stomach. Vinegar is a good source of acid and when eaten increases the acid in the body [4].

### Micro-nutrients deficiency (vitamin A and Iron)

Even though micronutrients are needed only in small amounts, the consequences of their absence in the human body can be very severe. An unbalanced diet can have disastrous impacts on health ranging from minor effects such as tiredness and less alertness and more severe effects such as diabetes. In young children particularly, poor nutrition can affect proper growth and development. This is due to the fact that

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people living in developing countries have less access to a good and regular supply of food due to poverty levels, and other environmental factors such as drought and famine. Another factor that can cause this high level of micronutrient deficiency in developing countries is the lack of or inadequate health education on the benefits of eating a healthy and balanced diet [5]. In addition to the adverse health effects posed by micronutrient deficiencies, it also has severe implications on economic development and productivity. This is particularly so with respect to the huge public health costs and loss of human capital. Along with iodine deficiency, vitamin A and Iron deficiency together form the three most common forms of micronutrient malnutrition the world over [6].

Iron Deficiency Anemia (IDA) is the most prevalent and widespread disorder in the world today, and is also the only micronutrient deficiency that has posed a problem in industrialized countries. This disease reduces the work capacity of an individual when affected, and subsequently the entire population at large, resulting in serious economic consequences that inhibit national development [7,8]. According to a nationwide food consumption and nutrition survey carried out, 34% of children less than 5 years of age (infants), 24% of mothers, and 48% of pregnant women have IDA in Nigeria [9]. Vitamin A Deficiency Disorder (VADD) is characterized by impaired vision and it is responsible for increasing the risk of diseases and death due to severe infections. In pregnant women for instance, this deficiency causes night blindness and increases their susceptibility to mortality. It occurs mostly during the last trimester of pregnancy, when demand from the unborn child increases, and that of the mother is also at the highest level. In children, the deficiency of this Vitamin causes severe visual impairment and increases susceptibility to severe illness which in extreme cases can result to death [10]. A nationwide food consumption and nutrition survey carried out showed the percentage of VADD in Nigeria to be; 23.2% children below the age of five, 13% of mothers, and 19% of pregnant women [11].

### Cause of Iron and vitamin a deficiency

In developing countries such as Nigeria, occurrences of famine and drought can inhibit an individual from getting all the required nutrients necessary for growth. A deficiency can be obtainable when an individual does not take the required daily amounts of any given micronutrient. Some reasons attributed to nutrient intake failure by certain individuals could be due to gastrointestinal diseases that interfere with absorption of nutrients e.g. Crohn's disease, alcoholism and diet practices e.g. vegetarianism [11].

The United States Institute of Medicine (IOM) and the National Academy of Sciences came up with values known as Dietary Reference Intakes (RDI's) for both Vitamins and Minerals. The RDI comprises of three sets of values which are: RDA (Recommended Dietary Allowance), AI (Adequate Intake) and The Tolerable Upper Intake level (UL). The RDA is defined as the average amount of micronutrient that is needed to meet the health needs of 97-98 percent of the population on a daily basis. The AI is an estimate set used when there is not enough information given to define the RDA. The UL is defined as the average of the maximum amount of the micronutrient that can be taken daily, without any fear of side-effects. RDAs and ULs for iron are measured in milligrams (mg) while that of Vitamin A is measured in both micrograms and International Units (IU) [7,8] (Table 1).

### Benefits of breast feeding

Infant breast feeding by is a habit that has been recommended to

RDI for Iron		
GROUP	RDA (mg)	UL (mg)
0-6months	0.27	Not established
7-12 months	11	Not established
1-3years	7	40
4-8years	10	40
Pregnant women	27	45
Breastfeeding women> 19years	9	45
RDI for Vitamin A		
GROUP	RDA	UL
0-6months	1330	2000
7-12 months	1670	2000
1-3years	1300	2000
4-8years	1330	3000
Pregnant women	2500	3000
Breastfeeding women> 19years	4300	3000

Table 1: Showing Recommended Dietary Allowance (RDA) for Iron and Vitamin A.

maternal mothers to ensure that they give proper nutrition to their infants. Several international agencies have recommended that mothers exclusively breast -feed their infants for the initial 6months after birth due to its health benefits to the infants [12]. For mothers who indulge in breastfeeding, breastfeeding does provides a healthy alternative to their infants plus it has serves as an effective means of reducing cost of feeding for infants. Unfortunately, the trend in breastfeeding patterns amongst women has been on the decline with statistics showing the decline in breastfeeding habits of mothers with time. For example in the United States, a research found out that 73.9% of infants received breast milk after birth while still at the hospital, but that percentage declined to 43.4% and 20.1% after 6months and 1 year, respectively (Centers for Disease Control and Prevention (CDC), 2006). Some of the known benefits of breast feeding to the mothers as well as the infants include:

- It reduces the risk of ovarian cancer and breast cancer in breast feeding mothers;
- It lessens the amount of blood lost by mothers during menstrual cycle
- It provides some required antibodies for the infant that helps to protect the infant against disease infections.
- Breastfeeding also aids in weight maintenance for both the mother as well as the child.

### Supplementation and detection of vitamin A and Iron

**Supplements of vitamin A and Iron:** Supplementation is a term used to describe the provision of relatively large doses of micronutrients, usually in the form of pills, capsule or syrup. It is generally made in a highly absorbable form and has the advantage of being able to supply the body with an optimal amount of a particular micronutrient. Among individuals already identified as deficient in a micronutrient, supplements have been identified as one of the fastest ways to control the deficiency. Supplementation programs have been widely used in developing countries to provide iron and folic acid in pregnant women, and Vitamin A to infants. Barriers to the success of supplementation include high expenses and lack of compliance [6].

**Detection of vitamin A and Iron deficiency:** Symptoms of VAD

Age Groups	No. of pregnant mothers (%)
15-24	65(40)
25-34	63(39)
35-44	30(19)
45-54	3(2)
Total	161(100)

**Table 2:** Distribution of study participants according to age.

No. of pregnant women per study site	No. of children					Total
	1	2-4	5-6	7	8	
Njoboliyo (n=118)	23% (n=27)	44% (n=52)	19% (n=22)	13% (n=15)	2% (n=2)	488
CMH (n=43)	40% (n=17)	37% (n=16)	0.12 (n=5)	0.12 (n=5)	nil	146
Total						634

**Table 3:** Showing the number of children in Njoboliyo village and CMH.

include impaired vision, weakened immune system, hyperkeratosis (goose-bump like appearance on the skin) on the forearms and thighs initially, and eventually spreading all over the body and increased susceptibility to viral infections [8].

Symptoms of IDA include lack of energy, feelings of weakness, feeling cold frequently, increased infections, irritability, decreased performance, sore or swollen tongue and the urge to eat dirt or other non-food substances [7].

**Role of the Nigerian government and the Non-Governmental Organizations:** The Nigerian Government has recently embarked on a mission to stop or at least reduce micronutrient deficiency in the country. This mission includes strategies such as food fortification, micronutrient supplementation, dietary diversification, food security and nutrition education. Among all these, food fortification has been recognized as the most sustainable strategy in combating micronutrient deficiency. In a country of over 155 million people, IDA affects 69% of infants and 67% of pregnant women while VAD is found in 25% of children [13]. In the year 2002, the Nigerian Government successfully launched its 'National Food & Nutrition Policy' aiming to reduce malnutrition among infants. The launched campaign also concentrated on reducing iodine deficiency disorders, Vitamin A deficiency and Iron deficiency anemia by 50% before the year 2010 [13].

In recognizing the need for a global solution to vitamin A and iron deficiency, the World Health Organization (WHO) has lately developed an all-inclusive package of public health measures which have helped to address all aspects of Iron deficiency and anemia. Such measures are currently being implemented in countries with a high level of this deficiency. Example of such measures include; the increment of iron intake by diversification of diet through food fortification, food enrichment, enhancement of iron-absorption and iron supplementation. Other measures include; the control of deadly infections e. g. malaria as well as the prevention and control of other nutritional deficiencies.

Our research therefore, aims to establish the breast-feeding patterns, Vitamin A and Iron supplement intake between various age groups of pregnant women in Adamawa state, Nigeria. In so doing, we can be able suggest and recommend that proper awareness campaign plus seminars be put in place by the government to help enlighten these pregnant women on the need to continue breast-feeding their infants even after 6months.

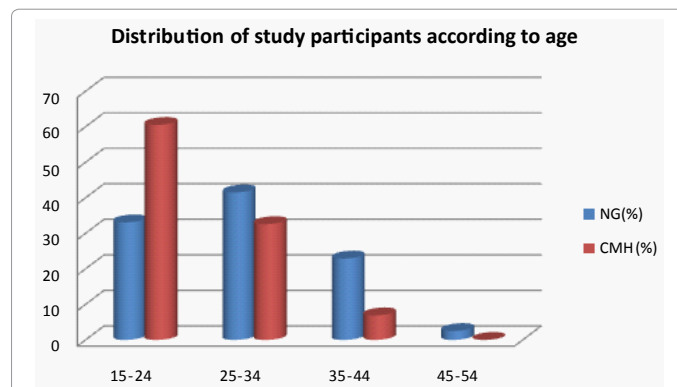
## Methods

### Study population and design

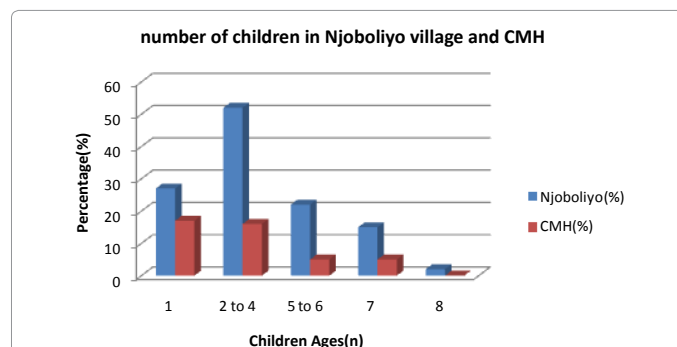
This is a prospective study carried out in Adamawa state, Nigeria between the periods of October to November 2011. Several short trips were made to Chanrai Memorial Hospital in Adamawa state for data collection where the medical records of the study participants were collected and stored in excel files. Within the same period, questionnaires were prepared and shared out to the pregnant women in Njoboliyo village and G D Chanrai hospital (Ngurore). These questionnaires were translated in Hausa so as to enable the pregnant women provide valid information to be used for the study. The medical cards were randomly selected and mandatory ethical procedures were followed (this included obtaining the informed consent of the subjects). Some of the information obtained from the questionnaire and the medical cards included;

- i. patients' dietary patterns during pregnancy i.e. looking at their intake of vitamin A and iron supplements;
- ii. Records of their antenatal visits;
- iii. Breast feeding patterns of the pregnant mothers;
- iv. Plus other records such as age, para, gravid, abortions and infant birth weights.

Patient cards were obtained from the clinic registers (n=118) and



**Figure 1:** Showing the distribution of the study participants according to age. For the ages of the study participants: (15-24), 33.1% in NJ & 60.5% in CMH; (25-34), 41.5% in NJ & 32.6% in CMH; (35-44), 22.9% in NJ & 6.9% in CMH; (45-54), 2.5% in NJ & 0% in CMH.



**Figure 2:** Showing the number of children in Njoboliyo village and CMH. The percentage of mothers with only a child, 23% in NJ & 40% in CMH; with 2 to 4 children, 44% in NJ & 37% in CMH; with 5 to 6 children, 19% in NJ & 12% in CMH; with 7 children, 13% in NJ & 12% in CMH; with 8 children, 2% in NJ & 0% in CMH.

Pregnant women	Incorporate foods like liver, kidney, vegetables	Take Vitamin A supplements	Take Iron Supplements	Received education on Vitamin A	Received education on Iron	Visit Antenatal clinics	Breastfeeding for more than 6 months
NJ women (n=118)	86% (n=101)	68% (n=80)	68% (n=80)	68% (n=80)	68% (n=80)	92% (n=106)	22% (n=25)
CMH women (n=43)	100% (n=43)	none	none	none	none	none	20% (n=6)

**Table 4:** Showing results obtained from questionnaire data of study participants.

on subsequent visits to study site, four qualified nurses were brought to help dispense appropriate doses of vitamin A and iron supplements to the pregnant women and lactating mothers. Likewise, the nurses helped to give vitamin A supplements to the children below 5 years of age.

### Statistical analysis

Data collected was analyzed using the data analysis feature of the Microsoft excel program. Means, median and standard deviations were computed for continuous variables. A proportional difference for trends or for any independence was tested using the chi-square (goodness of fit) test. The one-way analysis of variance (ANOVA) was used to test for differences in mean values. Statistical significance was set at 95% confidence limit and a value of  $P \leq 0.05$  was used to define statistical significance.

### Ethical considerations

This study undertaken was in compliance with the Declaration of Helsinki and the International Guidelines of Biomedical Research involving human subjects. All participants in this project have read and have signed written consent forms agreeing to participate in this study. Consent from the Village Chief in Njoboliyo was obtained before the study was undertaken and also from the staff in the Antenatal clinic at GD Chanrai Memorial Hospital, Ngogure.

### Results

#### Distribution of study participants by age groups

The results of this study discovered that out of the 161 pregnant women that participated, the highest number of study participants came from women between the ages of 15-24 (40%). The other age group distributions were 25-34 (39%), 35-44 (19%) and 45-54 (2%).

We compared the age distribution for the two study sites where we discovered that 33.1% in NJ and 60.5% in CMH for the women of 15-24 age groups. The result for the other age groups revealed; 41.5% in NJ versus 32.6% in CMH for 25-34 age groups, 22.9% in NJ versus 6.9% in CMH for 35-44 age groups and 2.5% in NJ against 0% in CMH for 45-54 age bracket (Figure 1 and Table 2).

#### Comparing number of children between Njoboliyo women and CMH women

From the medical records collected, we discovered a total number of (n=634) children from both Njoboliyo and CMH women. Our results further revealed that the women from Njoboliyo had a total number of (n=488) children while the total number of (n=146) children was counted for the women from CMH. Looking at the number of children in the two study sites and taking number of child deliveries e. g. 1 child, 2-4 children, 5-6 children, 7 or 8 children into consideration (Figure 2 and Table 3).

#### Vitamin A and Iron supplements plus breastfeeding patterns among study participants (Njoboliyo and CMH combined)

Out of the 161 women from the two study sites that participated

in this study, our result showed that 80 of the women (68%) take supplements of vitamin A and iron. The intake of Vitamin A and Iron in the total study population (n=161) showed that women between the ages of 25-34 consume a higher dosage of these supplements, but the result was statistically not significant ( $P > 0.05$ ). We also found out the breast feeding pattern in the women which revealed that 22% of women from Njoboliyo and 20% from CMH breastfeed their infants for more than 6months. We further more made comparisons of breast-feeding patterns irrespective of age where we observed that 94.1% of the pregnant mothers breast-feed their infants as opposed to the 5.9% that do not breast-feed. This breastfeeding pattern showed no significant relationship when compared across the various age groups ( $P = 0.62$ ,  $DF = 3$ ,  $X^2 = 3.05$ ) (Table 4).

### Discussion and Conclusion

Nutritional anemia caused by vitamin A and Iron deficiency is a growing concern among pregnant women in developing countries like Nigeria. Research has shown that there is a 50% prevalence of anemia in pregnant women in Africa [14]. Our findings in this study showed that 68% of the pregnant women take supplements of iron. The higher prevalence (68%) of iron supplements intake revealed in our study was similar to that observed by Scholl Theresa in 2005 who also recorded a higher prevalence of 72% iron supplements intake [15].

Exclusive breastfeeding has been recommended by international agencies to mothers for the initial 6months after birth due to its health benefits to the infants [12]. Breast milk contains vitamin A, Iron and other nutrients needed for infant nourishment and as such, it is necessary for pregnant mothers to provide breast milk to their infants. In our study, we discovered that 94.1% of the pregnant mothers breast-feed their infants and this was similar to the 93.8% number of breastfeeding mothers [16]. When we combined our result from the two study sites, we found that only 42% of the women continue with breastfeeding after 6months unlike the 53% observed in Scott et al. [16] study in 2006.

Research has shown that the iron content in breast milk usually gets depleted in infants after their 1<sup>st</sup> year and as such, scientist have recommended that iron supplements be given to infants even after 6months of age [12]. The importance of breastfeeding to infants cannot be over emphasized. Apart from its nutritional value to the infants, it also poses serious health implications if it gets depleted in body of both the mother and child. We found no recent study to support or contradict our finding in which we observed that the intake of iron and vitamin A was higher in women of age 25-34, even though it was statistical not significant.

We therefore recommend that for future research in this particular study, taking the serum levels of mother and child is required. This would help in determining the levels of micronutrient deficiency in their systems. We also recommend remedies to help eliminate the prevalence of vitamin A and iron deficiencies in pregnant mothers and children. The short term remedy would be to promote exclusive infant breastfeeding by mothers and providing vitamin A supplementation to protect babies from VAD. For a long term remedy, we recommend that Vitamin A rich diets and food fortification be promoted. Finally,

we recommend that proper awareness campaign and seminars be put in place by the government to help enlighten pregnant women on the need to continue breast-feeding their infants even after 6 months.

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