Vitamin A Status Among Infants At Nine Months of Age

Thesis

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Abstract

Background: Vitamin A is required for normal functioning of the visual system, and maintenance of cell function for growth, epithelial integrity, red blood cell production, immunity and reproduction, its deficiency is considered of one of the major public health problems but also toxicity from vitamin A witch occurs after consuming large amounts of vitamin A over a short period of time, typically within a few hours or days or when large amounts of vitamin A build up in the body over a long period of time is considered hepatotoxic and because of the long half-life of vitamin A in the liver (50 days to 1 year),the fibrotic process may continue due to the slow release of hepatic vitamin A stores despite discontinuation of oral intake of the vitamin.

Objective: To assess the level of vitamin A status in infants at 9 months of age who were not supplemented by vitamin A, and in infants at 9 months who were supplemented with 100,000 IU of vitamin A.

Methods: A hundred healthy breast fed infants were enrolled in this cross-sectional study, 50 of them received a compulsory doses of 100.000 IU of vitamin A.

We assessed growth by anthropometric measurements and clinical examination. We assessed retinol level by high frequency liquid chromatography.

Results: The mean of serum retinol was 53.18±8.74 in the non -supplemented group and a mean of 59.78±7.07 supplemented group (p value=0.00) which is all within the normal range (11.3 and 64.7 mcg/dL). The mean of serum AST, ALT and albumin in un-supplemented group was 4.83±2.57, 7.83±2.81 and 3.55±0.41 respectively while the mean of serum AST, ALT and albumin in supplemented group was 6.37±2.28, 19.96±3.42 and 3.91±0.46 respectively and There was a positive statistically correlation between serum retinol level and liver functions (AST, ALT and albumin) between both groups (p value =0.000, 0.002, 0.000, 0.0000) respectively. All values are also within the normal range of liver function. There was no correlation between the serum retinol level and the sex, weight and height of the studied groups (p value =1.000, 0.672, 0.338) respectively.

Conclusion: This study showed that level of serum retinol was within normal range before and after the vitamin A supplementation in infants at nine months of age. The study found the need for vitamin A at 9 months is questionable, yet the sample size and its confinement to a small geographic area that is not representative of Egyptian variance call for more prospective trials to define timing of decline of serum retinol and support need for its supplementation and time of supplementation if needed.

Key words: Vitamin A, serum Retinol level, Retinol Binding Protein, vitamin A supplementation.

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List Of Abbreviations

AI	:	Adequate Intake
ALT	:	Alanine transaminases
APC	:	Antigen presenting cells
APL	:	Acute promyelocytic leukemia
AML	:	Acute myeloid leukemia
AST	:	Aspartate transaminases
ATRA	:	All-trans retinoic acid
B cell	:	B lymphocyte
BMI	:	Body mass index
Cox-2	:	cyclooxygenase-2
CAD	:	Coronary artery disease
c-AMP	:	Cyclic adenosine monophosphate
C-cells	:	Parafollicular cells
CD40L	:	CD40 ligand
CSA	:	Cross-sectional area.
DC	:	Dendritic cells.
DEMPU	:	Diabetic Endocrine Metabolic Pediatric Unit.
DNA	:	Deoxyribonucleic acid.
DHS	:	Demographic and Health Survey
EAR	:	Estimated average requirement
EGFR	:	Epidermal Growth Factors Receptor
ELISA	:	Enzyme-linked immunosorbent assay
FNB	:	Food and Nutrition Board
HIV	:	Human immunodeficiency virus
HPLC	:	High performance liquid chromatography
HR-NBL	:	High risk neuroblastoma
HSCs	:	Hepatic Stellate Cells

Ht	:	Height
IBD	:	Inflammatory bowel diseases
IgA-ASC	:	Immunoglobulin A-antibody secreting cells
IL1	:	Interleuken 1
IU	:	International units
Kcal	:	Kilocalories
MDGs	:	The Millennium Development Goals
MRDR	:	Modified relative dose response
NBL	:	Neuroblastoma
NDHS	:	Nepal Demographic and Health Survey
LC-MS	:	Liquid chromatography-mass spectroscopy
LICs	:	Leukemia initiating cells
PEM	:	Protein energy malnutrition
PML-RARA	:	protein promyelocytic leukemia-retinoic acid receptor alpha
RA	:	Retinoic acid
RAE	:	Retinol activity equivalents
RAR	:	Retinoic acid receptor
RBP	:	Retinol binding protein
RDA	:	Recommended dietary allowance
RDIs	:	Recommended dietary intakes
RE	:	Retinol equivalents
RCT	:	Randomized controlled studies
RPE	:	Retinal pigment epithelium
RXR	:	Retinoid X receptor
SPSS	:	Statistical Package for Social Science
Tc	:	Cytotoxic T cell
T cell	:	T lymphocyte

Th	:	T helper cell
TNF-alpha	:	Tumor necrosis factor alpha
T(reg) cells	:	Regulatory T cells
VA	:	Vitamin A
VAD	:	Vitamin A deficiency
VEGF		Vascular endothelial growth factor
UNICEF	:	The United Nations International Children's Emergency Fund
UL	:	Upper Intake Level
WHO	:	World Health Organization
Wt	:	Weight
13-cis-RA	:	13-cis retinoic acid

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Introduction

Vitamin A is the name of a group of fat-soluble retinoids, including retinol, retinal, retinoic acid, and retinyl esters. It is involved in immune function, vision, reproduction, and cellular communication. It is an essential component of rhodopsin, a protein that absorbs light in the retinal receptors, and because it supports the normal differentiation and functioning of the conjunctival membranes and cornea and also supports cell growth and differentiation. It plays a critical role in the normal formation and maintenance of the heart, lungs, kidneys, and other organs **(Johnson and Russell, 2010).**

In developing countries, vitamin A deficiency typically begins during neonatal period, when the neonates do not receive adequate supplies of colostrum or breast milk. The most common symptom of vitamin A deficiency in young children is xerophthalmia. One of the early signs of xerophthalmia is night blindness, or the inability to see in low light or darkness. Vitamin A deficiency also increases the severity and mortality risk of infections particularly diarrhea and measles even before the onset of xerophthalmia **(Mayo et al., 2011**).

In developed countries, the amounts of vitamin A in breast milk are sufficient to meet infants' needs for the first 6 months of life. The prevalence of vitamin A deficiency in developing countries begins to increase in young children just after they stop breastfeeding **(Oliveira et al., 2010).**

Vitamin A is fat soluble, the body stores excess amounts, primarily in the liver, and these levels can accumulate, the manifestations of hypervitaminosis A depend on the amount and rapidity of the excess intake. The symptoms of hypervitaminosis as nausea, irritability, anorexia, vomiting, blurry vision, headaches, hair loss, muscle and abdominal pain and weakness, drowsiness, and altered mental status, follow sudden, massive intakes of vitamin A and with consumption of too much vitamin A. The tissue levels take a long time to fall after they discontinue intake, and the resulting liver damage is not always reversible. The tolerable upper intake levels for preformed vitamin A for the age from 0–12 months in males and females is 600 mcg retinol activity equivalents (RAE) (2,000 IU) which is a unit of measurement that researchers have developed for evaluating the degree to which carotenoid forms of vitamin A can be converted into retinoid forms **(Ross, 2010).**

Combining the administration of bolus vitamin A supplements with immunization is a part of the effort done for the elimination of vitamin A deficiency. Since 1987, WHO has advocated the routine administration of vitamin A with measles vaccine in countries where vitamin A deficiency is a problem **(Burton et al., 2009).**

Aim of the work

The aim of this work is to address the need for bolus vitamin A at 9 months by assessing the level of vitamin A status in infants at 9 months of age before and after receiving the compulsory dose of vitamin A.

Physiology of vitamin A

Introduction

The term "vitamin A" makes it sound like there is one particular nutrient called "vitamin A," but that is not true. Vitamin A is a broad group of related nutrients. Each of these nutrients provides us with health benefits, but these benefits may be quite different and they may be provided in different ways **(Bailey et al., 2012)**.

Vitamin A is a lipid-soluble vitamin that is essential for cellular differentiation. It is ingested either as the preformed retinyl ester or carotenoid provitamins (including beta-carotene) from plant sources and stored in the liver. It is transported from the liver to the rest of the body by retinol binding protein (RBP) and gains entry into cells via a specific receptor. Once intracellular, it is transformed to retinoic acid and modulates gene regulation and transcription. Overt deficiency occurs when hepatic retinol stores are exhausted **(Sommer, 2009).**