Effect of Maternal Vitamin A status on Neonatal Kidney Size

Thesis Submitted for Partial

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By

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Special thanks to my patients, wishing them a happy and healthy life.

List of abbreviations

BC	Before Christ
BMI	Body mass index
Caco	Human colonic adenocarcinoma cells
CBC	Complete blood count
CRBP	Cellular retinol-binding protein
DNA	Deoxyribonucleic acid
GDNF	Glial cell-line-derived neurotrophic factor
HOXB	Homeobox B gene
HPLC	High-performance liquid chromatography
IOM	Institute of Medicine
IU	International unit
IUGR	Intrauterine growth restriction
LDL	Low density lipoprotein
LRAT	Lecithin retinol acyltransferase
MCH	Mean corpuscular hemoglobin
MCHC	Mean corpuscular *hemoglobin* concentration
MCV	Mean corpuscular volume
NHANES	Nutrition Examination Survey
NRC	*National Research Council*
PAX2	Paired box gene 2
RAR	Retinoic acid receptor
RAREs	Retinoic acid response elements
RBP	Retinol-binding protein
Ret	Ret
RNA	Ribonucleic acid
RXR	Retinoic X receptors
TTR	Transthyretin
UNICEF	United Nations Children's Fund
USDA	United states department of agriculture
VAD	vitamin A deficiency
VLDL	Very low density lipoprotein
WHO	World Health Organization

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Introduction

Vitamin A is an essential nutrient because of its important roles in vision, cellular differentiation, embryonic development, reproduction, growth, and the immune system. The need for vitamin A is particularly critical during periods of rapid growth and tissue development such as occur in pregnancy and early childhood; there is a slightly increased requirement during the third trimester of pregnancy, Serum retinol levels decline during pregnancy, especially during the third trimester, followed by a rapid increase postpartum. Hemodilution and inadequate nutritional status contribute to this pattern.

For a long while vitamin A deficiency was known to be prevalent only in children but recent studies have shown that it is also very common during pregnancy ***(Vinutha et al ; 2000)*** and so vitamin A supplementation during pregnancy is an important issue. The effect of vitamin A on kidney development and size in animals is well established but in human few data are available about this issue, this study try to prove this effect on human.

Aim of the work

1- Assesment of vitamin A status of sample of pregnant Egyption women.

2- Correlate between maternal vitamin A status with neonatal vitamin A.

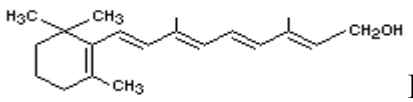
3- Correlation between maternal vitamin A status with neonatal kidney

History:

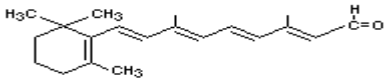
The relationship of night blindness to a dietary deficiency was recognized as early as 1500 BC ***(Friedrich et al., 1988).***In 1913, McCollum and Davis reported the presence of a lipid-like substance in butter and egg yolk that was necessary for growth in rats ***(McCollum and Davis 1913).*** In 1916, the substance was named fat-soluble A. McCollum related fat-soluble A deficiency to xerophthalmia in children in the following year, providing the first indication of the diverse functionality of the vitamin ***(McCollum et al., 1917).***The name, vitamin A, was first used in 1920 to signify the early discovery of the growth factor and to differentiate it from water-soluble vitamins, collectively called vitamin B at that time.The structure of vitamin A was determined in 1931. The vitamin A activity of β-carotene was demonstrated in 1929. The term "provitamin A" is accepted to differentiate carotenoid precursors of vitamin A from carotenoids without vitamin A activity. Plant carotenoids are, therefore, the precursor of vitamin A found in the animal kingdom. Dietary vitamin A is designated 'preformed vitamin A' when consumed as a dietary constituent of animal products. ***(Ronald et al., 2008)***

Chemistry of vitamin A

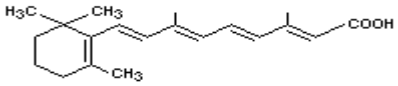
Vitamin A is a fat-soluble vitamin that is essential for humans and other vertebrates. Vitamin A comprises a family of molecules containing a 20 carbon structure with a methyl substituted cyclohexenyl ring (beta-ionone ring) and a tetraene side chain with a hydroxyl group (retinol), aldehyde group (retinal), carboxylic acid group (retinoic acid), or ester group (retinyl ester) at carbon 15. The term vitamin A includes provitamin A carotenoids that are dietary precursors of retinol. The term retinoids refers to retinol, its metabolites, and synthetic analogues that have a similar structure. Carotenoids are polyisoprenoids, of which more than 600 forms exist. Of the many carotenoids in nature, several have provitamin A activity, but food composition data are available for only three (α-carotene, β-carotene, and β-cryptoxanthin). The all-trans isomer is the most common and stable form of each carotenoid; however, many cis isomers also exist. Carotenoids usually contain 40 carbon atoms, have an extensive system of conjugated double bonds, and contain one or two cyclic structures at the end. ***(IOM, 2001)***



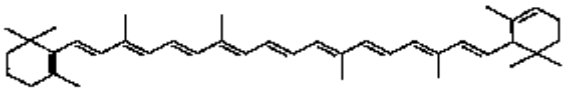
Retinol, the alcohol form



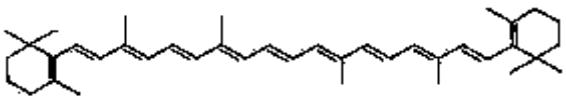
Retinal, the aldehyde form



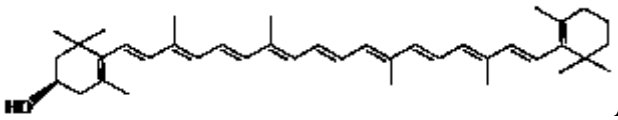
Retinoic acid, the acid form



All trans-α-carotene



All trans-β-carotene



All trans cryptoxanthin

Figure (1) structure of retinol and provitamin A carotenoids *(George, 2009)*

Sources of vitamin A

Retinol is found in foods that come from animals such as whole eggs, milk, and liver. Provitamin A carotenoids are abundant in darkly colored fruits and vegetables. The 2000 National Health and Nutrition Examination Survey **(NHANES)** indicated that major dietary contributors of retinol are milk, margarine, eggs, beef liver and fortified breakfast cereals, whereas major contributors of provitamin A carotenoids are carrots, cantaloupes, sweet potatoes, and spinach ***(Harrison et al ., 2005)***. Tables show some dietary sources of vitamin A and provitamin A carotenoids.

Table(1) shows Selected animal sources of vitamin A*(USDA, 2004)*

Food	Vitamin A (IU)*	%DV**
Liver, beef, cooked, 3 ounces	27,185	545
Liver, chicken, cooked, 3ounces	12,325	245
Milk, fortified skim, 1 cup	500	10
Milk, whole (3.25% fat), 1 cup	249	5
Cheese, cheddar, 1 ounce	284	6