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Intervention Trial To Improve vitamin A status in children aged 2-5 years

Thesis

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ABSTRACT

This thesis aimed to improve vitamin A status in children and decrease the morbidity concerning diarrhea and respiratory tract infection by giving vitamin A orally.

One hundred and eighty children constituted the material of the study. These children were visiting the health center in Badrashin, Giza.

Serum vitamin A, retinol-binding protein, Zinc & immunoglobulin G, A, M, are measured at baseline. Then ninety children were given 200.000IU of vitamin A orally. After one month, serum vitamin A was measured again & children were followed up for 6 months after supplementation, for diarrhea & respiratory tract infection.

Results of this study showed significant increase in serum vitamin A after supplementation in the supplemented children. Also, there was a decrease in the attacks of diarrhea & respiratory tract infection in the supplemented group during the six month follow up period.

Key-Words:

Pediatrics – vit. A rich source food – diarrhea – respiratory tract infection – serum vit. A – Zinc – R.B.P.

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LIST
OF
ABBREVIATIONS

Vit. A	:	Vitamin A
RBP	:	retinol binding protein
IU	:	International unit
RE	:	retinol equivalent
RDA	:	recommended dietary allowance
Wt	:	Weight
Ht	:	Height
MAC	:	mid upper-arm circumference
BMT	:	Body Mass Index
Fig.	:	Figure

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INTRODUCTION

INTRODUCTION

Nutritional status, or nutriture, is an important concept that often to be misunderstood. It is sometimes thought to be represented by dietary intake, but this is not so. A financial analogy may be helpful. A person may have an income, probably from a number of sources, and also an expenditure on a variety of things. If income exceeds expenditure then that person's financial balance or status is positive (in the black) and if expenditure exceeds income the status is negative (in the red). In this analogy "income" may be replaced by "nutritents in the diet" and "expenditure" by "utilization of nutrients". Then the resulting nutritional status (balance) may be either deficient (negative) or normal (positive). No analogy is perfect and whilst no one would object to having a very high financial status, excess nutrient intake, including that of vitamin A, may be harmful.

Vitamin A is an organic dietary constituent necessary for life, health and growth ***(Krugman, 1992)***. In 1913, Mccollum and Marguerite in Wisconsin showed that butter or egg yolk contained an essential growth factor for rats. They termed this factor "fat soluble A". Obsorn and Mendel in New Haven found a similar fat-soluble growth factor in cod liver oil and butter. Thus 1913, marks the beginning of modern nutritional history of vitamin A ***(Olsen, 1994)***.

Vitamin A is a fat soluble found in foods in two forms:-

1. Retinol which is colorless and found only in animal foods
2. Carotene that is yellows and found mainly in yellow or green plant foods.

The body changes much of the carotene to retinol, six molecules of carotene make one molecule of retinol.

Fat, protein, zinc and vitamin E help the body to absorb or use vitamin A. Human, animals, birds and fish store vitamin A in their livers ***(Savage and Burgess, 1993)***.

Vitamin A is essential for a number of physiological processes, normal vision, growth, cellular differentiation, gene expression maintenance of body epithelial tissues and immune function. Vitamin A was termed the "anti-infective vitamin" ***(Zachaman, 1989)***.

Clinical trials have now demonstrated that vitamin A supplementation reduce severe morbidity and mortality from infectious diseases among children who have acute measles or who are from areas in which vitamin A deficiency is endemic ***(Semba, 1994)***.

Administration of 100.00 IU vitamin A at the time of measles immunization is currently recommended for infants in developing countries ***(Semba et al, 1995)***.

Vitamin A helps the body to resist infections. It helps to keep all the cells on the surface of the body healthy so that it is difficult for microorganism to enter the body. These body surfaces include the skin, the surface of the eye, inside the mouth, the cells that line the gut, and the cells that line the respiratory tract. When there is vitamin A deficiency, immunity is depressed and mucus production is decreased, so that bacteria can stick more easily to respiratory mucosa ***(Chandra, 1988)***. Because of this event mild vitamin A deficiency may increase susceptibility to respiratory disease.

Vitamin A keeps the eye healthy, as it keeps the front of the eye (cornea and conjunctiva) strong, clear and wet. It helps the eye to see in dim light and helps the children to grow properly ***(Savage and Burgess, 1993)***.

Vitamin A deficiency is the most prevalent cause of blindness worldwide. The impact of vitamin A deficiency is more extensive than the ocular effects. Xerophthalmia and low vitamin A levels are associated with increased mortality and severity of morbidity and gastro-intestinal disease. It is therefore very important that not only the sever cases of hypovitaminosis A be diagnosed as for immediate treatment, but also the marginal cases of vitamin A deficiency vulnerable population be diagnosed early as possible, so that appropriate preventive measures are implemented ***(De. Oliveira, 1990)***.

Recent finding have indicated that vitamin A is a key modulator of immune system and may play a role in preventing the development of cancer. Sufficient vitamin A stores could significantly reduce the risk of transmission of HIV from infected mothers to their babies ***(Cervinskas and Loffi, 1996)***.

In Egypt acute respiratory infection (ARI) and diarrhea disease were the leading cause of death in children under five year in the period 1970, 1982. Since 1982, child mortality from acute respiratory infection declines less than child mortality from diarrhea diseases. So that by 1987 acute respiratory infection stood as the leading cause of child death .

Relationship between vitamin A deficiency and the incidence of respiratory infection among Egyptian preschool children needs special attention.

It is hypothysed during this work that improving and monitoring vitamin status of those children will reduce episodes or respiratory infection and diarrhea diseases will be reduced.

AIM OF WORK

1. To improve vitamin A status in a group of children aged 2-5 years.
2. To estimate their nutrient intake especially that for vitamin A.
3. To implement an interventional trial for part of those children.
4. Finally to find out the impact of this interventional trial on the morbidity status of those children especially those for respiratory tract infection and diarrheal disease.


REVIEW
OF
LITERATURE

BIOCHEMISTRY OF VITAMIN A

Vitamin A is a very pale yellow substance, soluble in fat or fat solvents. Vitamin A occurs in food and functions in the body in several chemical forms-retinol (the alcohol), retinol (the aldehyde), and Retinoic acid (the acid). The relationship among these three forms is shown in the fig. (I).

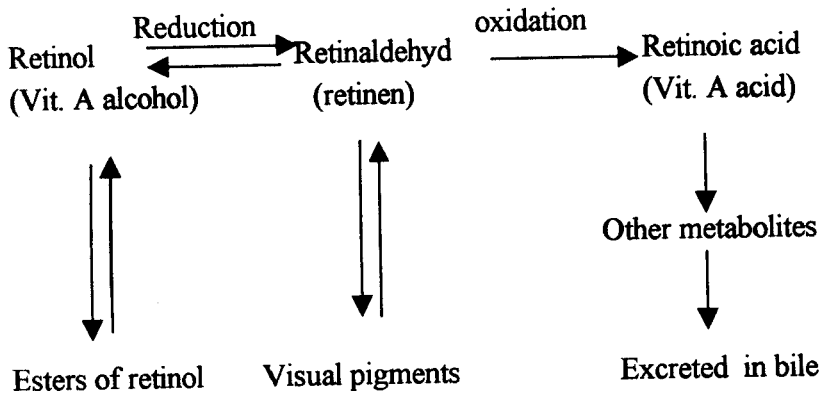


Fig. (I): Relationship of biological forms of vitamin A ***(Guthrie, 1989)***.

Whereas retinol and retinal can be reversibly oxidized and reduced, once retinoic acid has been produced by oxidation, it cannot be reduced back to either one of the other two forms ***(Guthrie, 1989)***.

This explains why studies on the roles of vitamin A have shown that some forms are effective in certain functions and others in different functions (table I)

Table (I): Effectiveness of various forms of vitamin (A) in various functions of the vitamin *(Guthrie, 1989).*

	Retinol	Retinal	Retinoic acid
Growth	+	+	+
Epithelium	+	+	+
Bone	+	+	+
Vision	+	+	–
Reproduction	+	+	–

The performed biologically active form of vitamin A is found only in foods of animal origin. Many plants, however, are rich in a group of compounds; carotenoids, which are chemically related to vitamin A. They are known as precursors or provitamins. They are hydrocarbons having the empirical formula C40 H_{56}. Various carotenoids and cryptozanthin, are biologically active as vitamin A ***(Olson, 1987)***.

Retinol:-

It is the correct chemical name of vitamin A. It is an organic alcohol, with the hydroxyl (OH) group characteristic of alcohol being attached to a polyunsaturated hydrocarbon chain that end in a hydrocarbon ring ***(Noy, 1991)***.

It is found as an ester (retinyl palmitate) in ocean fish oils, fats and in liver, butterfat, and egg yolk, is biologically active as an alcohol, an aldehyde, and an acid. The alcohol, the most common form, is usually referred to as retinol, the aldhyde as retinal, or retinene, and the acid as retinoic acid ***(Ensminger et al, 1995)***.

Dehydroretinol:-

Dehydroretinol, or vitamin A_2 differs from retinol in that it has an extra double bond, and it has about 40% of the biological value (activity). It is found only in fresh water fish and in birds that eat these fish; hence, it is of limited interest.

Today, the general term vitamin A is used for both retinol and dehydroretinol ***(Ensminger et al, 1995)***.

Retinol can be converted into all major members of the vitamin A family, except β-carotene, and retinoic acid is a 'terminal product' of vitamin A metabolism in the sense that it cannot be converted back into any other form of vitamin A. The irreversibility of the formation of retinoic acid explain why it can perform only some of the activities associated with vitamin A: it can support growth and allow most cells to differentiate, for example, but it cannot support vision (which requires retinal) or reproduction (which requires retinol) ***(Guthrie and picciano, 1995)***.

Carotenes:-

Composed of two molecules of vitamin A joined together. They are found in several fruits and vegetables carotene is also called provitamin A, because it can be converted to vitamin A in the body; and also called precursor of vitamin A, because it precedes vitamin A. At least 10 of the carotenoids found in plants can be converted with varying efficiencies into vitamin A. Four of these carotenoids alpha-

carotene, beta-carotene,gamma-carotene, and cryptoxanthine (the main carotenoid of the corn) – are of particular importance due to their provitamin A activity. Of the four, beta-carotene has the highest vitamin A activity and provides about two-thirds of the vitamin A necessary for human nutrition ***(Ensminger et al, 1995)***.

Most of the conversion of β-carotene to vitamin A occurs in the entrocyte. The conversion involves a cleavage at the center of the molecule. The cleavage dose results in the production of two molecules of vitamin A, but in one molecule of vitamin A plus a by-product. The cleavage of β-carotene to form retinol, followed by the reduction of retinal to retinol. The retinol is converted to retinyl ester, packaged in chylomicrons, and exported in lymphatic system ***(Brody, 1994)***.

VITAMIN A ABSORPTION, METABOLISM AND TISSUE DISTRIBUTION

Provitamin A carotenoids may be absorbed intact or converted to vitamin A before absorption. Carotenoids in food are usually associated with membranes and lipoproteins. In food, performed vitamin A is present mainly as retinyl ester. After ingestion of food, retinyl esters and various carotenoids are released from associated proteins by the proteolytic action of pepsin in the stomach and of chemotrypsin and trypsin in the small intestine. During this stage, the liberated carotenoids (provitamin A or β crotene) and vitamin A are hydrolized, and the products are associated firstly with lipid globules and then with bile salt-containing micelles in the intestinal lumen. Bile salts solubilize both vitamin A and β carotene. Carotenoids are then absorbed through the plasma membrane of the mucosal cells lining the intestine and may directly enter into the blood. Carotenoids and retinol may also be transported by endocytosis into mucosal cell ***(Hathcock et al, 1990)***.

Both vitamin A and carotenoids are absorbed best in the upper part of the small intestine; absorption efficiency decreases lower in the gut. β carotene also differs in several ways:

1. In physiological amounts, retinol is more efficiently absorbed

(70-90%) than are carotenoids (20-50%).

2. As the amount ingested increases, the efficiency of retinol absorption remains high (60-80%) whereas that of carotenoid absorption falls markedly (<10%)
3. At low physiological intakes, vitamin A is transported by a carrier-mediated process, whereas carotenoid absorption seems to occur by diffusion ***(Olson, 1987)***.

The absorption of carotenoids is increased by the presence of bile salts, lipids, proteins, antioxidants and zinc. Approximately 25-75% of the carotenoids consumed are not absorbed and can be found in the feces unchanged ***(Olson, 1989)***.

Absorbed retinol is largely esterified with palmitic acid in the intestinal mucosal cells and incorportaed into the lipid phase of chylomicrons. β Carotene and other biologically active carotenoids are cleaved in the cytoplasm of intestinal cells to retinaldehyde, which is reduced mainly to retinol and then esterified to retinyl palmitate and other similar esters. Some carotenoids are incorporated directly into chylomicrons and some retinaldehyde is oxidized to retinoic acid chylomicrons, which contain uncleaved cartenoids and most of their vitamin A is ester linkage, pass first into the lymph and then into the systemic circulation. They are then converted rapidly by the action of lipoprotein lipase to chylomicron remnants, which are taken up by the hepatocytes in the liver ***(Blomhoff et al, 1992)***. When initial liver reserves of vitamin A are low, part of the newly absorbed vitamin A is released into the blood as a 1:1 complex with plasma retinol-binding protein (RBP) and part is stored as retinyl ester in hepatocytes ***(Mckenna et al, 1983)*** With very little transferred to stellate cells.

When liver reserves of vitamin A are adequate (>20μg/g or 0.07 μmol/g), however, much of the newly absorbed vitamin A is transferred to stellate cells of the liver and is stored as retinyl ester ***(Olson et al, 1983, Hendriks et al, 1985 and Blomhoff et al, 1985)***.

In the hepatocyte prior to the release of retinal, a specific binding protein (apo. RBP) is synthesized. The apo-RBP binds retinal in a 1:1 molar complex in the cytoplasm and resulting in holo-RBP is taken up by Golgi fraction and secreted into the blood. In the plasma the RBP-retinal complexes with a prealbumin called transthyretin (TTP) and circulated as such. The RBP in holo-RBP is recognized by surface receptors as target cells, retinal is transferred across the plasmalemma into the cell, and resultant apo-RBP is modified and released. Modified apo-RBP is removed and hydrolyzed mainly in the kidney. Approximately 80% of the retinal transported to preripheral target cells is re-circulated back to the liver ***(Green et al, 1985)***.

In well-nourished persons, the liver contains > 90% of the total body stores of vitamin A. Unlike vitamin A, carotenoids are deposited mainly in human adipose tissue, relatively small amounts are stored in the liver. The corpus luteum contain a very high concentration of carotenoids ***(Olson, 1987)***.

Recommended daily allowance of vitamin A (RDA):

The food and Agriculture Organization and World health Organization (FAO, WHO) recommended both basal and safe level of

vitamin A intake, with basal level approximately 50% of the safe level *(FAO, WHO, 1988)*.

The basal level of intake is sufficient to meet all physiologic needs of the individual without providing for body reserves to meet needs for approximately 4 months on a diet low in vitamin A and during periods of stress, such as fever or diarrhea *(Olson, 1994)*.

The mean intake of vitamin A in the form of provitamin carotenoids and of performed vitamin A differs considerably in different parts of the world. In Europe the daily intake is 666 RE carotenoids and 531 RE preformed vitamin (comparable – figures are Africa 725 and 170; Asia 564 and 103; and the Americas 437 and 483 respectively *(FAO, WHO, 1989)*.

Allowances at different ages:

The infant allowance is based on the average retinal content of human milk (40ug/DL). If 850 ml of milk is ingested, breast feeding would supply about 300μg of retinal. Because of large body stores in the liver, a precise daily requirement for infant is not known. The allowance for adult is based on many experimental nutrition studies and amounts to 1000μg of retinol per day for men and 800μ for women. Concerns remain that this level is too high for elderly people *(Russell and Suter, 1993)*.

The allowance for children and adolescents is extrapolated between the values for infants and adults. Pregnancy adds nothing to

allowance, because the total body pool of the Fetus is small; lactation adds 500μg .

Table (II): National Research Council recommended daily Allowances of vitamin A.

	Ag (yr)	Retinol equivalent	International units IU
Males and Females	Birth-0.5	420	1,400
	0.5-1	400	2,000
	1-3	400	2.000
	4-6	500	2.000
	7-10	700	2.500
Males	11-14	1.000	5.000
	15-18	1.000	5.000
	19-22	1.000	5.000
	23-50	1.000	5.000
	51+	1.000	5.000
Females	11-14	800	4.000
	15-18	800	4.000
	19-22	800	4.000
	23-50	800	4.000
	51+	800	4.000
Pregnant	—	1.000	5.000
Lactating	—	1.200	6.000

***Assumed to be half as retinol and half as β carotene except for infants, when calculated from international units:** $\frac{\text{IU-retinol}}{3.33} + \frac{\text{IU-carotene}}{10} = \text{RE}$

(Gliman et al, 1985).

Retinol equivalents:

Since 1969, the RDAs have been given as retinol equivalents (RE) ***(Solomons and Bulux, 1993)***.

Because there are two types of vitamin A in food, vitamin A was measured (both carotene and retinol) as retinol equivalents. Because people need very small amounts of vitamin A, it was measured in micrograms (μg).

1gram = 1000 000 μg.The short way to write 'μg retinol equivalents' is RE

1 μg retinol = 1 μg retinol equivalent = 1 RE

6 μg beta carotene = 1 μg retinol equivalent = 1 RE

1 retinol equivalent =1μg all-trans-retinol
= 6μg β-carotene
= 12μg of mixed dieta carotenoids

(Savage and Burgess, 1993).

Table (III): Daily vitamin A needs for different sex of age groups *(Savage and Burgess, 1993)*:

Age (years)	Weight (kg)	Vitamin A (RE)
Children both sexes:		
0-1	7.3	350
1-3	11.9	400
3-5	15.9	400
5-7	19.6	400
7-10	25.9	400
Boys:		
10-12	34.0	500
12-14	43.2	600
14-16	54.5	600
16-18	63.6	600
Girls:		
10-12	35.4	500
12-14	44.2	600
14-16	51.5	550
16-18	54.6	500
if pregnant		600
Men – active:		
18-60	65.0	600
> 60	65.0	600
Women – active		
Childbearing age	55.0	500
Pregnant	55.0	600
Lactating	55.0	850
> 60	50.0	500

= 3.3 |μ of activity from retinol

= 10|μ of activity from β - carotene

The accepted 6 : 1 equivalence of β-carotene to vitamin A has been questioned because of inefficient bioconversion of plant carotenoids ***(Solomons and Bulux, 1993)***.

Most commonly vitamin A activity in foods is expressed in international units (|μ). One international unit is being equal to 0.3 μg of all trans – retinol or 0.6 μg of β-carotene ***(Solomons and Bulux, 1993)***.

Some vitamin A medicines and supplements are still measured in international unit (|μ).

One RE = 3.33 |μ retinol or 10 |μ β-carotene.

One |μ retinol = 0.3 RE;

One |μ β-carotene = 0.1 RE.

(Savage and Burgess, 1993).

Interaction of vitamin A with other nutrients:

Vitamin A status is affected by intake of protein, fat, iron, zinc and vitamin E. Any nutritional imbalance should adversely affect the functions of vitamin A ***(Olson, 1990)***.

- **Protein:**

Protein deficiency reduces carotenoid cleavage and the synthesis of

retinoid – binding proteins and receptors. On the other hand by restraining growth, Protein – Calorie Malnutrition (PCM) retards the development of acute xerophthalmic signs of vitamin A deficiency ***(Oslon, 1994)***.

Failure to form the protein carrier may explain, at least in part, the low level of circulating vitamin A that has been observed in protein deficiency childrens ***(Stare and Mcwiliam, 1984)***.

Protein deficiency interferes with intestinal absorption of performed vitamin A, conversion of β-carotene to vitamin A_1 hepatic storage and transport of vitamin and also utilization at the tissue level ***(Srikantia, 1982)***.

- **Fat:**

Fat required for the efficient intestinal absorption of vitamin A and caroteinoids. Although a daily Fat intake of only 10 to 20g is sufficient, the concomitant ingestion of fat and vitamin is essential ***(Olson, 1994)***.

- **Iron:**

Iron status, as indicated by plasma hemoglobin concentrations, is depressed in vitamin A deficiency and enhanced by vitamin A supplements. Although the mechanism is not clear, vitamin A might act on the metabolism and storage of iron or, more probably, on the differentiation of red blood cells in the bone marrow ***(Olson, 1994)***.

Table (IV): Food sources of vitamin A (RDA for adults: Women, 800 µg RE; men, 1000 µg RE)

	Quantity	Vitamin A (pg RE)		Quantity	Vitamin A (pg RE)
Bread, cereal, rice, pasta:			Meat, Polutry, fish, dry beans, eggs, nuts		
This food group is not an important source of vitamin A			Clams (canned)	3 oz	144
Vegetables:			Egg-whole	1 large	78
Asparagus	½ cup	196	Liver, beef	3.5 oz	10,831
Best greens	½ cup	1110	Liver, chicken	3.5 oz	4912
Book choy cabbage	½ cup	790	Salmon, pink (raw)	3 oz	30
Broccoli (fresh)	1 med stalk	1350	Milk, dairy products:		
Broccoli (frozen)	½cup-chopped	721	Cheddar cheese	1 oz	90
Brussels sprouts	½ cup-4	121	Milk, low-fat 2% (fortified)	8 fl oz	150
Carrots (raw)	sprout	2379	Milk, skim (fortified)	8 fl oz	150
Collard greens	½ cup (1 med)	2223	Milk, whole (unfortified)	8 fl oz	101
Corn	½ cup	93	Ricotta cheese, whole milk	½ cup	182
Dandelion greens	½ cup	1843	Swiss cheese	1 oz	72
Green beans	1 sm cob	102	Yogurt, whole	8 A oz	84
Green peas	½ cup	144	Fats, oils, sugar:		
Kale	½ cup	1369	Butter	1 tbsp	138
Lima beans	½ cup	60	Margarine	1 tbsp	141
Mustard greens	½ cup	1218			
Pumpkin(canned)	½ cup	2352			
Romaine lettuce	½ cup	157			
Spinach	½ cup	2187			
Summer squash	½ cup	123			
Sweet potato (baked in skin)	½ cup chopped	2769			
Tomato (cooked)	½ cup	325			
Winter squash	½ cup	1021			
Fruits					
Apricot(dried)	1 med	490			
Apricot (fresh)	½ cup	867			
Avocado	½ cup	189			
Banana		69			
Canteloupe	4 halves	1386			
Grapefruits(pink)	3 med	162			
Orange juice	1 med	75			
Papaya	1 med	735			
Peach	¼ med	399			
Prunes (dried)	½ med	207			
Tangerine	½ cup	108			
Watermelon	1 cup (cubes)	753			
	1 med				
	4 prunes				
	1 med				
	1wedge(4x8in)				

Mejia and Arroyave (1992) showed that there is a relationship between vitamin A and iron. Fortification of sugar with vitamin A had a favorable effect on the metabolism of iron. Preschool children in

Guatmala received fortified sugar with vitamin A for 6 months, showed improvement in serum levels of vitamin A, RBP and iron.

In zinc deficiency, vitamin A in the plasma decreases but that in liver rises, the synthesis of proteins and nucleic acids is impaired in most organs, including the eye, and night blindness can ensue ***(Mejia, 1986)***.

Embryogenesis is impaired by deficiencies of both vitamin A and zinc. Because of the "zinc finger" structure required for binding of many nuclear transcription factors to deoxy-ribonucleic acid (DNA), zinc seems to play a general role in gene expression ***(Olson, 1990)***.

- **Vitamin E:**

Vitamin E protects vitamin A from oxidation in the gut and presumably in storage globules of liver and other organs as well. Vitamin E also reduces the rate of hydrolysis of retinyl esters in the liver ***(Wolf, 1991)***.

Children at high risk of vitamin A deficiency also show low plasma vitamin E levels and low ratios of plasma vitamin E to total lipid ***(Bergen et al, 1988)***.

Vitamin A is known to fulfill a number of physiological functions in various animal and human tissue. It is essential for stimulation of growth and proper development of skeletal tissues, for normal reproduction, for maintenance of rod vision and most important for preservation of the differentiated functions of mucus secreting epithelial tissues. The clinical effects of vitamin A are many and seem

to involve all human cells in one way or another, possibly through its effect on DNA expression ***(Koussoulakos, and Anton, 1991)***.

Maintenance of visual purple for vision in dim light:

The biochemistry of the action of vitamin A in dark adaptation to allow vision in dim light is its only clearly defined function.

In the form of the aldehyde, retinal, oxidized from the retinol provided from the blood, vitamin A combines with the protein opsin to form visual purple or rhodopsin. This photorecptor pigment occurs in the special cells known as rods in the retina of the eye, which are responsible for vision in dim light. As light strikes the retina, the visual purple is bleached to visual yellow, and retinaldehyde is separated from opsin, with this action a stimulus is transferred from the retina through the optic nerve fibers to the brain. During the process some vitamin A is split off from the protein and reduced to retinol, most of which is reconverted to retinaldehyde to recombine with opsin to regenerate visual purple, or rhodopsin. A small amount of retinol is lost, and vitamin A to replace it must come from the blood. The amount available in the blood determines the rate at which the rhodopsin is regenerated and is available to act again as a receptor substance in the retina. Until the cycle has been completed, vision in dim light is not possible ***(Guthria, 1989)***. The mechanism involved is shown in Fig (II).

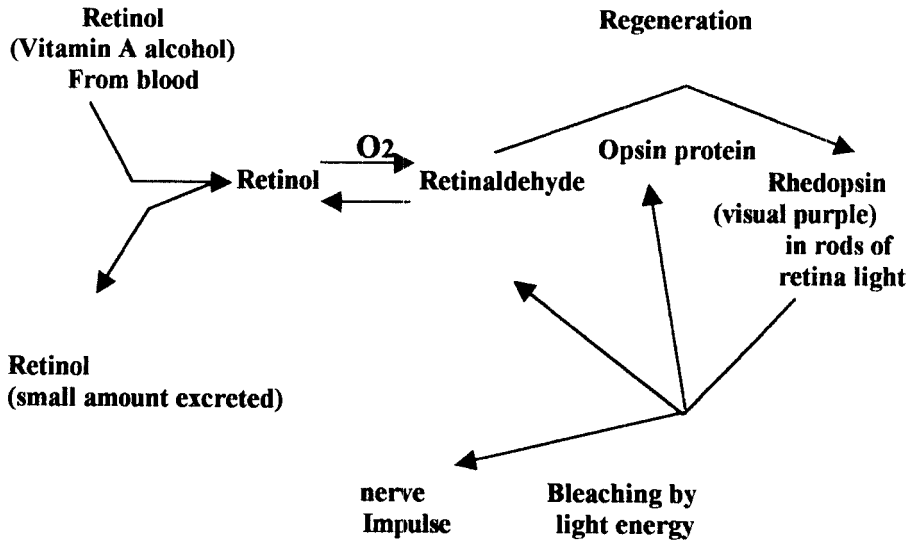


Fig. (II): Role of vitamin A in dark adaptation *(Guthria, 1989)*.

The "dark adaptation" test, the speed of recovery of visual acuity in dim light as measured by a specially designed apparatus, is considered the most sensitive measure of vitamin A status.

• Growth regulation and differentiation:

Nutrition is the driving force behind growth and development ***(Krugman, 1992)***. The role of vitamin A in growth is the result of its effect on (1) the development and maintenance of epithelial tissue and (2) the development of bone.

- **Bone development:**

It is well established that vitamin A is essential for normal bone growth. In deficiency, bones fail to grow in length, the remodeling process that is an essential phase of bone growth is poorly controlled, and the skull and spinal column do not continue to enlarge to accommodate the growing nervous system *(Guthrie, 1989)*. The function of vitamin A in bone growth has been attributed to its role in the conversion of immature cells to osteoblasts (bone-forming cells) and to osteoclasts (bone destroying cells).

- **Reproduction:**

The role of vitamin A in promoting fertility in animals was one of the first discovered. In the absence of vitamin A, the male's body fails to produce sperm cells and female's body resorbs a fetus. In the female, a decrease in estrogen synthesis observed in vitamin A deficiency, while in the male, vitamin A acts directly on testes rather than through hormones *(Guthrie, 1989)*.

- **Cancer: Anti-tumor promoter:**

Vitamin A deficient animals have been shown to be more susceptible to cancer. The protective value of vitamin A against many forms of cancer probably result from anti-oxidant potential of β-carotene and the effects of retinol and retinoic acid in regulating cell growth *(Devlin, 1986)*.

Human epidemiology studies demonstrate an inverse correlation

between serum levels of vitamin A and the incidence of lung cancer. **Edes and McDonald (1991)** suggested that vitamin A may have a role in cancer prevention and that retinol and retinol-binding protein (RBP) may be useful in lung cancer screening for selecting a high risk population that warrants further examination against some forms of cancer ***(Alexandrev et al, 1991)***.

• Anemia:

Many studies have indicated development of anemia in human volunteers receiving vitamin A deficient diet ***(El-Shamy et al, 1989, Goswamii and Dutta, 1991, & Udomkesmalee et al, 1992)***. Other investigators suggested that vitamin A deficiency alter the metabolism of iron that in turn, may lead to anemia ***(Staab et al, 1984, Devlin, 1986)***.

Devlin, (1986) concluded that with vitamin A deficiency, iron appears to be retained in storage tissue and is not taken up as rapidly as normal by erthrocytes. This phenomenon implicated vitamin A in the regulation of iron released from liver. This relationship was later confirmed by **Goswami & Dutta, (1991)** who showed that hemoglobin synthesis was depressed because of impairment in mobilization of iron from the liver to the hematopeiotic system. Recent studies have shown that retinol and/or retinoic acids are required for the synthesis of the iron transport transferrin ***(Blomhoff et al, 1992)***.Anemia with vitamin A deficiency is biochemically equivalent to iron deficiency anemia, but in the presence of adequate iron intake.

In Egypt, similar finding were previously reported by **El-Naggar and Hussien (1982)** who showed positive significant correlation between plasma vitamin A and Hb level among 63 rural pupils.

El-Shamy et al, (1989) have shown also a positive association of anemia with low or deficient levels of vitamin A, the relationship however disappeared at high serum vitamin A level.

The antioxidant function of carotenoids:

The antioxidant function of carotenoids has been demonstrated that in animal and human studies ***(Kunert and Tappel, 1983)*** found that injection of β-carotene in vitamin C-deficient guinea pigs decreased lipid peroxidation induced by carbon tetrachloride. **Polozza and Krinsky (1992)** observed a greater decrease of lipid peroxidation in rat liver microcosoms, when β-carotene was administrated with α-tocopherol than was obtained with antioxidants individually. **Dixon et al, (1993)** conducted a clinical trial of β-carotene depelation (0.06 mg/d) with adequate dietary vitamin A and noted increases in thiobarbituric acid-reactive substance (TBARS) in plasma and decreases in superoxide dismutase activity in red blood cells. This effect of β-carotene depletion was reversed following repletion with 151mg/d of β-carotene supplementation for 28d. **Mobarhan et al (1990)** observed a decrease in serum lipid peroxidation in healthy male volunteers following supplementation with β-carotene after a 2-weeks carotene depeletion period.

The concentration β-carotene in human plasma is much lower than that of α-tocopherol ***(Ito et al, 1990)***. **Ojima et al, (1993)** have indicated that carotenoids may protect tocopherols from oxidative loss induced by singlet oxygen in the plasma. It seems that supplemental β-carotene in vivo and in vitro decrease lipid peroxidation by acting synergistically with other antioxidants and/or by increasing the availability of antioxidant enzyme in vivo.

β-Carotene is an efficient quencher of single oxygen ***(Rousseau et al, 1992)***, and there is increasing evidence that it is also effective quencher of peroxyl radicals. In biological system, β-carotene reacts with perioxyl radicals generated from lipid peroxidation and forms a resonance stabilized carbon-countered radical ***(Palozza and Krinsky, 1992)***.

ASSESSMENT OF VITAMIN A STATUS

Vitamin A status can be classified into five categories: deficient, marginal, adequate, excessive and toxic (TableV) ***(Garrow et al, 1993)***. The deficient and toxic states are characterized by clinical signs, whereas the other three states are not. In the marginal state, individuals do not show clinical signs of deficiency but may have some impaired physiologic responses, such as the immune response, as a result of inadequate concentrations of vitamin A in the liver and in other tissues. In the excessive state, individuals also do not show clinical signs of hypervitaminosis A, but such signs may be induced by yet larger vitamin A intakes or by infection, such as viral hepatitis. In a worldwide public health sense, indicators of the deficiency state and of the marginal state are or most importance ***(Olson, 1990)***.

• Clinical assessment:

The most useful clinical sign is the Bitot's spot with conjunctival xerosis, termed XIB by WHO ***(WHO, 1982)***. A public health problem is assumed to exist if the prevalence in preschool age children is greater than 0.5%. Pitot's spots in older children tend not to be responsive to vitamin A treatment, that is, the spots represent permanent lesions caused by earlier episodes of vitamin A depravation. More serious eye signs, such as corneal xerosis (X2) and corneal

ulceration (X3) are specific for vitamin A deficiency, but they are much less prevalent (<0.01%) in children suffering from vitamin A depletion.

• Biochemical assessment:

Vitamin A concentrations in the plasma, milk, or tear fluid are useful indicators of vitamin A status ***(Underwood and Olson, 1990)***.

• Serum vitamin A:

Serum vitamin A concentration can be used as an indicator of vitamin A status, although it is a less sensitive test than is the liver vitamin A concentration. The concentration of vitamin A in serum not falls until the stores of the vitamin in the liver have been depleted. One factor making serum vitamin A concentration a useful test is that it is affected only slightly by day-to-day variations in dietary vitamin A intake. A serum vitamin A concentration below 10μg/dl strongly suggests a state of vitamin A deficiency. However, serum vitamin A concentrations as high as 20μg/dl have occasionally been found in people whose liver vitamin A concentration has been less than 20μg/g and who are therefore almost certainly deficient in vitamin A ***(Underwood and Olson, 1990)***.

Table (V): Plasma vitamin A levels and vitamin A status *(Garrow et al, 1998)*.

Status	Plasma Vitamin A μ mol/L(μg/dl)	
Deficient	< 0. 35	(< 10)
Marginal	0. 35 – 0.70	(10 – 20)
Satisfactory	0.70 – 1.75	(20 – 50)
Excessive	1.75 – 3.5	(50 – 100)
Toxic	> 3.5	(> 100)

• Vitamin A concentration in Breast milk:

Vitamin A concentration in breast milk that are lower than 0.35 μmol/L (<10 μg/dl) indicate that the nursing child is at risk of vitamin A deficiency. Values higher than 0.7μmol/L (>20μg/dl) should provide adequate vitamin A for growth and development, whereas intermediate concentration (0.35 to 0.7 μmol/L) should cause concern ***(Olson, 1990)***.

• Liver vitamin A concentration:

The most sensitive indicator of vitamin A status is the measurement of vitamin A stores in the liver by analysis of a small piece of liver tissue removed by biopsy. This is not a feasible method for the evaluation of large numbers of people to obtain an estimate of vitamin A status of communities or populations. Liver vitamin A concentrations in excess of 20 μg/g of wet liver are considered to indicate a sufficiency of vitamin A in the body as a whole. Concentrations lower than 5μg/g of wet liver indicate that a person is at high risk of suffering the clinical consequences of vitamin A deficiency ***(Olson, 1990)***.

There are two tests, the RDR (relative dose response) and MRDR (modified relative dose response) in which the indirect assessment of liver reserves is made from a plasma assay. The basis for such tests is the finding that in the presence of vitamin A deficiency with diminished liver stores, apo RBP accumulates in the liver to several times its normal concentration ***(Flores et al, 1984)***.

The relative dose response test:

In the relative dose response test, a small amount of vitamin A is given by mouth or intravenously after a period of fasting, and the change in serum vitamin A concentration, that occurs in response to this dose is monitored over several hours before serum vitamin A returns to initial low levels. The difference between the fasting serum vitamin A concentration and the concentration 5 hours after the dose of vitamin A is divided by the fasting concentration to obtain a value known as the relative dose response. It can be expressed as a percentage value by multiplying the result of this calculation by 100. The relative dose response gives an accurate indication of the concentration of vitamin A in the liver. A relative dose response of 20% or more suggests that a person's liver vitamin A concentration is less than 20μg/g indicating that he or she is probably suffering from vitamin A deficiency.

• Histologcial assessment:

Conjunctival impression cytology (C/C):

This non-invasive test for sub clinical vitamin A deficiency is the detection by simple staining techniques of early histological changes in the bulbar conjunctiva, such as loss of goblet cell, the appearance of mucin lakes and xerotic changes in epithelial cells ***(Natadisastra et al, 1987)***. At present it is unclear how specific to vitamin A deficiency the changes are. In many places where widespread deficiency is suspected, chronic eye infections and local trauma from dust, smoke and ultraviolet light may lead to similar changes ***(Carlier et al, 1991)***.

Previous studies in India and Indonesia showed that conjunctival impression cytology test are a good indicator for detecting early xeropthalmia and subclinical vitamin A deficiency ***(Reddy et al, 1989)***. However, in a study in Guatemala, the conjunctival impression cytology (CIC) failed to detect subclinical vitamin A deficiency that was detected by other biochemical indicators. Most studies have been conducted with children > 3 years ***(Gadomski et al, 1989)***.

Another study in Bangladesh was conducted to compare (CIC) with relative dose response (RDR) test in detection of sub-clinical vitamin A deficiency, in 34 children aged < 3 years who had no clinical sings of vitamin A deficiency but who came from a population at high risk of vitamin A deficiency. The results suggest that the conjunctival impression cytology test has poor agreement with relative dose response test results in assessing vitamin A status in young children ***(Rahman et al, 1995)***.

- **Physiological assessment:**

Night blindness, caused by reduced concentration of rodopsin in the red cells of retina, is a common sign of vitamin A deficiency. A quantitative measurement of dark adaptation requires approximately 30 minutes, uses expensive equipment in a controlled ambient and is not appropriate for very young children. Thus, for survey procedures, interviews have been conducted with mothers of possible affected children; the time required for a child to recognize letters of animals under dim light after retinal bleaching, termed the vision-restoration time (VRT), and the time required to sort different colored disks in dim light after bleaching, termed the rapid dark-adaptation time (RDAT) have been determined ***(Underwood and Olson, 1990)***.

- **Dietary assessment:**

Because the intake of vitamin A-rich foods, such as liver, is infrequent, a 24 hours recall of dietary intake is useful in assessing the vitamin A status of a population but not of an individual. Well-constructed food-frequency questionnaires tend to provide more valid data about an individual's intake. Because the content of vitamin A and carotenoids can vary greatly in a given food, however, food composition tables provide at best a semi-quantitative estimate of vitamin A intake. The actual amounts of vitamin A and carotenoids in ingested foods can be measured, of course, but during the experimental period, individual usually must be constrained for a significant time in metabolic word. Nonetheless, a rapid procedure that is suitable for use in surveys in underdeveloped countries and provides an indication of risk in a preschool population has recently been developed and tested. Dietary data are therefore of greatest value in assessing the food habits of population at risk of vitamin A deficiency. Such information is essential in advising strategies for improving their nutritional well being ***(Underwood and Olson, 1990)***.

VITAMIN A DEFICIENCY

Symptoms of vitamin A Deficiency:

Full-blown picture of vitamin A deficiency includes:

- Retardation of mental and physical growth.
- Anemia with or without hepatospleenomegaly.
- Tendency of infection.
- Epithelial metaplasia:
  - Xerophthalmia, Keratomalacia and night blindness.
  - Pyuria and hematuria in the urinary tract.
  - Respiratory and gastrointestinal tract involvement.
  - Endocranial gynecomastia ***(Sillman et al, 1985)***.
- Hypogeusia reduced taste.
- Anorexia
- Later signs include bone growth failure, spermatogensis ***(Kaplan and Pesca, 1984)***.

The symptoms begin to appear once the liver's reserves of vitamin A have been used up. Symptoms of vitamin A deficiency can also appear as a result of deficiency of protein or zinc because of variety of proteins are involved in the transport and metabolism of vitamin A and zinc is required to mobilize vitamin A from the liver ***(Combs, 1992)***.

In general, the symptoms of vitamin A deficiency can result from the low dietary intakes, interference with the absorption or storage of the vitamin, or interference with the conversion of precursors into

vitamin A. Most of the symptoms reflect the vitamin's role in maintaining the health of epithelial cells, with eyes being particularly affected *(Olson, 1991)*.

Chemical deficiency signs:

The primary chemical signs of deficiency are reduction of plasma vitamin A. Because vitamin A in the liver can be inadequately mobilized and transport to target tissues, creating a true functional deficiency, serum vitamin A is currently believed to be the best available index of the functional status of health *(Kaplan and Pesca, 1984)*.

The chemical sign of vitamin A deficiency is reduction in its plasma level. Generally plasma retinol values below 10 μg/dl are associated with clinical symptoms *(Sommer et al, 1986)*.

Low level of retinol binding protein is also found in deficiency state.

As adequate level of plasma retinol usually indicates dietary and tissue adequacy, but low concentration dose not always indicate dietary deficiency. Zinc deficiency also lowers plasma retinol by retinol binding protein effect despite adequate liver retinol stores *(Kaplan and Pesca, 1984)*.

Vitamin A deficiency and ocular signs:

The only unequivocal clinical signs of deficiency in the human occur in the eye. These changes have been classified in five stages,

listed in order of increasing severity.

X0 Effect on the retina: poor dark adaptation.

X1 Effect on conjunctiva: xerosis (dryness) is detected by dullness with bright lighting of conjunctiva; it is often associated with Bitot's sport, as accumulation of foamy with debris and fatty material near the limits of the eye, especially laterally.

X2 Effect on cornea: xerosis along with superficial erosion.

X3 Effect on cornea: irreversible corneal ulceration.

X4 Effect on cornea: scarring and softening of the cornea *(Alpers et al, 1995)*.

The first symptom is night blindness. This is followed by damage to the cornea. The night blindness is reversible, but corneal damage involves dying of the conjunctiva, followed by the appearance of opaque white spot called Bitot's spots. The tendency toward drying of the eye is called xerosis. The ventual irreversible damage to the cornea, lens and consequent total blindness is part of the disease called xerophthalmia *(Brody, 1994)*.

Night blindness:

One of the earliest symptoms of vitamin A deficiency is night blindness *(Barltrop, 1992)*. At low intakes the liver reserves drop, followed by a drop in blood levels and subsequent drop in the level available in the retina of the eye, for formation of the visual pigment rhodopsin. This eventually shows up in a slow dark-adaptation time and finally night blindness.

Children with history of night blindness tend to have lower serum

retinol levels ***(Sommer, 1995)*** as well a higher risk of diarrhea, respiratory infection and mortality compared to children without night blindness ***(Sommer et al, 1984)***. The condition generally disappears within 24-48 hours after oral treatment with high-potency vitamin A ***(Sommer et al, 1993)***.

Xerophthalmia:

Xerophthalmia is the most common, specific, clinical manifestation of vitamin A deficiency. Xerophthalmia appears to be a public health problem, based on WHO minimum criteria (TableVI) in approximately 40 developing countries, located primarily in the peri-equatorial regions of the world ***(Sommer, 1995)***.

Table (VI): Criteria for assessing the public health significance of xerophthalmia and vitamin A deficiency among children less than 6 years of age (Sommer, 1995)

Criterion	Minimum prevalence (%)
Clinical	
Night blindness	1.0
Bitot spot	0.5
Corneal xerosis and/or Ulceration/Keratomalacia	0.01
Xerophthalmia – related Corneal scars	0.05
Biochemical	
Serum retinol (vitamin A) Less than 0.35 μ mol/l (10μg/dl)	5.0

Xerophalmia classification by ocular signs:

Night blindness (XN)
Conjunctival xerosis (X1A)

Bitot's spots (X1B)
Corneal xerosis (X2)
Corneal ulceration / keratomalacia < 1/3 corneal surface (X3A)
Corneal ulceration / keratomalacia ≥ 1/3 corneal surface (X3B)
Corneal scar (XS)
Xerophthalmic fundus (XF) ***(WHO/UNCIEF/IVACG, 1988)***.

VitaminA deficiency and infection:

Effect of vitamin A on susceptibility to infection is likely mediated by the vitamin's role in regulating epithelial and immune effected cell differentiation, function and integrity. Vitamin depleted animals show diffuse squamous metaplasia, kerotinization and / or losses of mucus secreting goblet and ciliated cells throughout the respiratory, gastro-intestinal and genito-urinary tracts and glandular ducts. Although data in humans are sparse, autopsy studies in the 1930s reported widespread epidermoid metaplasia in severely vitamin A-deficient, wasted children. These epithelial alterations occur independently of infection; however, such changes may increase the risk of pathogen colonization, invasion and infection ***(Semba, 1994).***

A synergism between vitamin A deficiency and infection also contributes to make matters worse. While children with mild xerophthalmia are more prone to infection, children who acquire infection are also more likely to become vitamin A-deficient. There can be several reasons for this: during acute infection dietary vitamin A intake and absorption may be poorer, hepatic mobilization may be impaired (as apart of acute phase response to infection), tissue utilization of retinol may increase and urinary excretion may increase many-fold. By decreasing available vitamin A, these action, in turn,

may further compromise innate and acquired resistance to infection *(Ross, 1992)*.

Semba et al, 1993 found that children with clinical vitamin A deficiency have underlying immune abnormalities in T-cell subsets and that those abnormalities are reversible with vitamin supplementation. Vitamin A deficiency is associated with selective loss of SD4 cells from lymph nodes and overall atrophy of the thymus, spleen and lymph nodes. Many disorders, especially infectious diseases are associated with low CD4/CD8 ratio and decreased proportions of SC4 cells, including infections with HIV. Epstein – Barr virus, measles and cytomegalovirus, candidiasis and phumonia *(Semba et al, 1993)*.

The importance of CD4 - T cells to a healthy immune response is shown in HIV infection, in which progressive loss of CD4 – Tcells is associated with infections and death, and in measles infection in developing countries, where low CD4 numbers have been associated with increase morbidity *(Kiepeila et al, 1987)*.

Human T-lymphocyte CD4 populations can be further divided into two major phenotypic and functional subsets, CD_{45} RA and CD_{45} Ro, which are thought to represent naïve and memory T-cell populations respectively, the CD8 populations have been similarly divided into naïve and memory phenotypes, but these have not been seen as well as have not been characterized *(Semba et al, 1993)*.

The CD4, CD_{45} Ro subset responds to soluble recall antigens, whereas the CD4 CD_{45} RA subset doses not. CD_{45} RA naïve and CD_{45} Ro memory T-cells seem to represent stages during maturation rather

than separate lineage. After T-cell activation, CD_{45} RA cells are thought to change phenotype to CD_{45} Ro, ***(Semba et al, 1993)***.

It was found that children with clinical vitamin A deficiency had lower proportion of circulating CD4 naïve T-cells than children without clinical vitamin A deficiency, ***(Semba et al, 1993)***.

Semba et al, (1993) found that vitamin supplementation had reversed the T-cell subset abnormalities associated with vitamin A deficiency 5 weeks later. Thus vitamin A status may be important for the differentiation of CD4 cells. Alternatively, vitamin A supplementation could affect lymphocyte circulation, but the possible mechanism is not clear. These findings support the notion that children with vitamin A deficiency have underlying immune abnormalities that can be corrected by vitamin A supplementation.

A deficiency of vitamin A injuries the epithelial tissues throughout the body and leads to a peculiar type of horny degeneration called keratinization. The epithelial cells form the outer layer of the skin and mucous membranes that line the mouth, digestive, respiratory and genitourinary tracts. Instead of being soft and moist, they became hard and dry. The skin, especially in the areas of the arms, legs, shoulders and lowers abdomen army, become rough, dry and scaly – a condition known as follicular hyperkeratosis or phyrnoderma (it looks like goose flesh); and bacteria have easy access to the mucous membranes, with the result that this is increased susceptibility to infections such as sinus trouble, sore throat and abscesses in the ears, mouth or salivary glands. Also, certain other troubles, non-infective in character, increase as the result of the damaged epithelium, including diarrhea, and the formation of kidney and bladder stones ***(Shenai et al, 1990)***.

Normally, vitamin A in the line form of holo –RBP (retinol-binding proteins diffuse into the dermis and epidermis from capillaries in the skin. On entering cells of the skin, retinol and its oxidation product, retinoic acid, are bound by CRBP and CRABP, respectively. Retinol is also oxidized to 3.4 didehydroretinol and both alcohol from long-chain fatty acyl esters in all layers of the skin ***(Torma and Vahlquist, 1990)***.

Under normal conditions, human keratinocytes synthesize keratins with molecular weights of 40.000 and 52.000 as well as may other. When vitamin A is absent, these "small" keratins are replaced by larger keratins (molecular weight $\geq$ 67.0) characteristic of stratum corneum. Retinoids stimulate basal cell proliferation but inhibit the transcription of several epidermal keratins ***(Fuch, 1990)***.

Vitamin A deficiency and iron:

In infants and laboratory animal, Vitamin A deficiency has been associated with increased concentrations of iron in the liver and spleen. It is also known that administering vitamin A to individuals with a vitamin A deficiency is followed by rise in serum iron levels. Increased saturation of transferrin and increased hemoglobin levels. The increase in the hemoglobin level occurs in children as few as 2 weeks after a single large oral dose of vitamin A. The speed of this response suggests that increased absorption of iron is not the main explanation for it ***(Bloem et al, 1990)***.

It is suggested that vitamin A deficiency may be associated with a failure to mobilize stored iron properly, although that may only be one of several ways in which vitamin A deficiency interferes with iron

metabolism. Other possibilities are that vitamin A deficiency could directly prevent normal differentiation of red blood cells or that infections brought on by impaired immunity of individuals with vitamin A deficiency could interfere with the normal functioning of bone marrow tissue responsible for generating red blood cells ***(Gunning et al, 1990)***.

VITAMIN A TOXICTY

Expression of the toxicity of any substance depends on the concentration of the toxic form at the target site. Occurrence of a threshold or greater concentration depends on dose incides and toxicokinetic processes. For substances such as vitamin A that tend to bioaccumulate (i.e. increase in concentration at each step in a food chain), the chronicity of exposure is crucial because of the slow metabolic clearance and the large storage capacity in certain tissue ***(Ariens and Simonis, 1982)***.

Vitamin A has a long biological half-life and bioaccumulates. The combination of relatively rapid absorption with slow clearance can produce acute toxicity after a sufficient high dose and chronic toxicity after prolonged intake of substantially smaller doses ***(Hathcock et al, 1990)***.

Hypervitaminosis A has been observed in both children and adults. The actual presentation of adverse symptoms varies with the dose and duration of exposure as well as with the age of the individual exposed ***(Hathcock et al, 1990)***. Listed in tables (VII) and (VII) are the signs and symptoms of vitamin A toxicity in humans ***(Bauernfeind, 1980; Miller and Hayes, 1982 and Olson, 1983)***.

Table (VII): Signs and symptoms of acute vitamin A toxicity *(Bauernfeind, 1980; & Miller and Hayes, 1982)*.

Children	Adult
Anorexia	Abdominal pain
Bulging fontanelles	Anorexia
Drowsiness	Blurred vision
Increased Inter-crenial	Drowsiness
Pressure	Headache
Irritability	Hypercalcemia
Vomiting	Irritability
	Muscle weakness
	Nausea, vomiting
	Peripheral neuritis
	Skin desquamation

Human and animal birth defect have been associated with the use of vitamin A analogue isotretinoin, are Accutane, for acne treatment during pregnancy ***(Mills et al, 1992, and Mitchell, 1992)***.

Numerous reports clearly establish the teratogenic ptoential of excessive intakes of vitamin A and related compounds in experimental animals ***(Rosa et al, 1986 and Reproductive tixcology center, 1986)***. Treatment of pregnant female experimental animals with excessive amount of vitamin A or one of its congeners, such as all-trans-retinoic acid or 13-cis retinoic acid, resulted in dermatically increased rates of fetal resorptions, still births, and birth of offspring with one or more characteristic defects. Despite animal vitamin A congener teratogenicity has been studied since 1954, striking human findings only arose in 1983 following isotretinoin (ITR) marketing for oral

treatment of severe acne. By November 1985, 44 outcomes with central nervous system (CNS), cardioarctic (CV) microtia, facial palsy, micrognathia, cleft palate, and /or thymic aplasia defects and 33 spontaneous abortions have been reported ***(Rosa et al, 1986)***.

Table (VIII): Some cases of chronic, low dose vitamin toxicity in children *(Carpenter et al, 1987)*.

Daily dose	Age and sex	Time	Symptoms	Other condition
IU/kg	Mo	Mo		
6338	31,M	5	Xerosis, cortical thickening in femur, high alkaline phosphatase, irritability	None
2361	26,M	6	Irritability, dermailis, some alopecia	Pica of paint chips
2700-3300	29,F	28	Irritability, photophobia, pseudoparesis, seborrheic plaques	None
1689	48,F	24	Pain in feet and ankles pailledema, dermatitis	None
3247	12,F	9	Irritability, vomiting	None
4086	30,M	12	Anorexia, ataxia, lethargy	Health food use

Vitamin A daily doses of higher than 8.000 IU for pregnant women are not necessary of good health, and are not recommended. Foods high in beta-carotene can provide the necessary amounts of vitamin A and in contrast to the synthetic analogues their use has not been associated with vitamin A toxicity or teratogenicity.

VITAMIN A AND RELATED HEALTH PROBLEMS

Vitamin A and Measles:

It was the first to suggest that vitamin A and D may have a protective effect during severe measles infection. Barclay et al, (1987), observed that high doses of vitamin A reduced the mortality rate from measles by half, especially among children younger than 2 years of age.

The etiology of depressed retinol concentration during acute measles has not been identified. Data from studies in animals suggest that the hepatic stores of vitamin A must be exhausted before the plasma retinol concentration falls ***(Barker, 1982)***.

It has been postulated from studies of humans in areas where clinically apparent vitamin A deficiency occurs that hyporetinemia during measles reflects rapid utilization of marginal hepatic stores ***(Barclay et al, 1987)***.

Reduced serum retinol concentration during acute measles may result from retinol binding protein (RBP) acting as a negative acute phase reactant ***(Frieden et al, 1992)***. A possible mechanism for this observation is the reduced synthesis of retinol binding-protein (RBP) messenger RNA in the liver, as demonstrated for albumin during

inflammatory reactions. Albumin is also reported at low levels during acute measles ***(Hussey and Klein, 1990)***. The retinol binding protein may be negative during acute pahse reactants as albumin and as a consequence of this, serum retinol may be reduced ***(Rosales and Kjolhede, 1992)***.

Children with low vitamin A level were more likely to have low measles specific antibody titers, and that children with low measles specific antibody titers had lower vitamin A levels than children with high measles specific antibody titers, among children with measles in New York city ***(Frieden et al, 1992)***.

Decreased levels of measles antibodies have been associated with increased measles mortality. Improvement in antibody production may explain deficiency of vitamin A therapy in the treatment of measles ***(Friedent et al, 1992)***.

Alternatively children with pre-existing malnutrition e.g. low prealbumin values may simply be more likely to have measles that is sever enough to warrant hospitalization or emergency department evaluation ***(Arrieta et al, 1992)***.

The world health organization recommended vitamin in A therapy for children with measles who live in communities with known vitamin A deficiency and in communities where the measles case ferairty rate is 17 or greater. Other studies suggest that this recommendation may need to be extended to all children younger than two years with sever measles ***(Frieden et al, 1992)***.

The dose of vitamin A recommended by WHO is 100.00 IU by

mouth for children younger than 12 months old and 200.00 IU for children 12 months or older. Vitamin A should be administered at the time of diagnosis and again 1 to 4 weeks later if any ocular symptoms of vitamin A deficiency are present ***(Butter et al, 1993)***.

Vitamin A and acute respiratory tract infection:

During the past decade, evidence has been obtained from several countries that children with marginal vitamin A deficiency are more susceptible to develop diarrhea and respiratory diseases than other children with sufficient vitamin A irrespective of their general nutritional status ***(Sommer et al, 1984, Milton et al, 1987, Bloem et al, 1991)***.

Vitamin A supplementation has been shown to reduce morbidity and mortality by 30-50% or more in preschool children ***(Sommer, 1986, Muhiala et al, 1988, Rahmathallah et al, 1990)***.

Large doses of vitamin A are recommended for both treatment of xerophthalmia and prohyloxis against, especially for infants and young children at risk for developing diarrhea and respiratory diseases ***(WHO, 1988)***.

The effect of vitamin A supplementation on the incidence of respiratory infection was investigated in Egypt by **Khalifa et al, 1984** in a randomized controlled clinical trial, at the allergy outpatient clinic of New Children Hospital. Cairo University and Imbaba General Hospital at Giza Governorate. One hundred and forty children aged 2-

6 years of age with a history of frequent respiratory illness were randomized in to 70 vitamin A supplemented (100.00 IU single dose) and 70 non-supplemented groups. Baseline characteristics of the two groups were similar. Blood hemoglobin and serum retinol level assessed at baseline and 30 days after vitamin A supplementation.

Respiratory symptoms were recorded monthly over a period of 6 month. Serum retinol and hemoglobin were significant elevated in the vitamin A supplemented group ($t = 14.4$, $P<0.001$) for serum retinol and $t = 2.9$. $p < 0.01$ for hemoglobin, while no change was observed in the non-supplemented group. Over the 6-month follow-up, the non-supplemented group showed 28.8% higher incidence of respiratory infections than the vitamin A supplemented group. The duration of antibiotic therapy was well significantly different between the two groups ($x^2 = 11.9$, $p < 0.01$). Children with a prior history of recurrent bronchitis or infection induced asthma benefited most from supplementation.

Neuzil et al, (1995) found that infants with respiratory syncytiol versus infection have low serum vitamin A levels. They treated 21 respiratory syncytial versus infected children with 12.500 to 25.000 IU of oral vitamin A. Vitamin A levels were normalized after 6 hours, and none of the children experienced vitamin A level toxicity or exacerbation of respiratory illness. They found that vitamin A treatment of previously healthy respiratory syncytial virus-infected infants at these doses was safe and well tolerated.

An observation study was conducted to determine the benefit of oral vitamin A supplementation for acute respiratory syncytial virus (RSV) infection. That study was carried out in urban teaching hospitals in

Chicago, USA. . Thirty-two-RSV-infected in patients (aged 2 to 58 months), 35 hospitalized children without respiratory infections (aged 2 to 19 months) and 39 healthy outpatients' controls (aged 2 to 67 months). The respiratory syncytial virus-infected group was randomized to receive a single dose of 100.000 IU oral vitamin A or placebo. Serum vitamin A and retinol binding protein (RBP) levels of participants and clinical indicators of severity such as days of hospitalization, oxygen use, intestive care, intubation, and a daily severity score. They concluded that serum vitamin A and retinol binding protein (RBP) levels were low in children hospitalized with respiratory-syncytial virus (RSV) infection and were lower in children admitted to the intensive care unit. Hospitalized control patients in intensive care also had lower levels than those treated on the ward. They observed no benefit from oral vitamin A supplementation for children hospitalized with respiratory-syncytial virus (RSV) infection ***(Quinlan and Hayani, 1996)***.

The impact of vitamin A supplementation on mortality of children 6 months to 5 years of age has been the subject of numerous studies in the past decade. Eight major randomized, placebo-controlled intervention trials were conducted in Asia and Africa. In six of these trials significant reductions in overall child mortality ranging from 19% to 54% occurred in the supplemented group ***(Sommer et al, 1986, Mubilal et al, 1988, Rahmathulla et al, 1990, West et al, 1991, Daulaire et al, 1992, Ghana VAST study Team, 1993)***. In the other two studies no effect was found ***(Vijayaraghavan et al, 1990, Herrera et al, 1992)***. Four independent meta-analysis were performed with data derived from these trials. The results of all four meta-analysis indicated average reductions in mortality of 23% ***(Beaton et al, 1993)***, 30% ***(Fawzi et al, 1993, Glaziou and Mackerras, 1993)***, and 34%

(Tonascia, 1993)..

The impact of large-dose vitamin A supplementation given at intervals of 4 months on child mortality and morbidity was examined according to the time interval since dosing, number of doses received previously, and time of year. Two double-blind, randomized, placebo-controlled trials of large doses of vitamin A administered at intervals of 4 months were conducted in adjacent populations in northern Ghana. It was concluded that there was no evidence that an interval between doses of less than 4 months would have a greater impact on sever morbidity or morbidity or mortality, and the effectiveness of supplementation did not vary by time of year ***(Ross et al, 1995)***.

Vitamin A and diarrhea:

There is clear evidence that decrease vitamin A absorption is associated with various infections; especially diarrhea, intestinal helminthrases and respiratory infection ***(West and Sommer, 1984)***. In addition, infection may decrease vitamin A intake owing to anorexia. In children whose dietary vitamin A intake is low and whose body stores are marginal it is possible that repeated respiratory or intestinal infections may precipitate vitamin A deficiency. It is widely believed, therefore, that diarrhea, especially repeated and prolonged diarrhea, is a risk factor for vitamin A deficiency in children ***(Feachem, 1987)***.

Stanton et al, (1980) showed an association between protracted diarrhea (> 14 days in past month) and prevelant night blindness with or without conjunctivol xerosis and/or Bitot's spots. On the other hand the reverse hypothesis (mild xerophthalmia as a risk factor for protracted diarrhea is also plausible).

In Egypt, **Kahlifa and his colleagues** conducted a study during 1987-1988 to investigate the protective action of vitamin A supplementation on frequency of diarrhea among infants and children in an urban area. The study was conducted in El-Zawya El-Hamra district in north Cairo. The number of children was around twenty-five thousands, 500 infants and children of them were randomly selected among those who attended the primary health care center for medical advice. In this study they depend on the rose bengal test (Rose bengal 1% solution eye drops for early detection of cases of conjunctival xerosis) 50.000 IU of vitamin A was injected IM for young child (less than 6 months) and 100.000 IU for older children. The injections were repeated after 6 months. From the results they concluded that vitamin A deficiency in unprivileged urban locality is around the value of 20% based on rose Bengal eye stain while the dietary estimation is much more. Also they concluded that stunted targets are more to nutritional disorders and infectious problems including diarrhea. Their susceptibility to vitamin A deficiency should be expected ***(Khalifa et al, 1988)***.

In 1993, a study was conducted to determine the impact of large dose vitamin A supplementation on childhood diarrhea, respiratory disease and growth. One hundred and Seventy-two 0.5-3.0 year old children in a mountainous area of northern Hebei Province of China were randomly assigned to a vitamin A supplementation group (n=98) or a control group (n = 74) for a 1 year double – blind study. Capsules containing 200.000 IU vitamin A and 40 IU vitamin E were given to the children in the experimental group 3 and 9 months after baseline examination. During the 12 month study period, there was a significant reduction in the incidence of diarrhea ($P< 0.01$) and

respiratory disease (P< 0.01) in the children of the experimental group compared to the control. Risk of diarrhea and respiratory disease was respectively 2.5 and 3.4 times higher in the control children. Serum retinol and IgA levels of the treatment group were significantly higher than that of control group (P< 0.01) 7 weeks after first supplementation. There was no significant difference in saliva level between groups. No significant differences in growth were recorded. It was concluded that supplementation with large doses of vitamin A decrease the incidence and severely of diarrhea and respiratory disease in these children, possibly through enhanced activity of immune system, but had no effect on growth over 1 year ***(Lie et al, 1993)***.

To assess the impact of vitamin A (200.000 IU) supplementation on morbidity from acute respiratory tract infections and diarrhea, a double-blind placebo controlled trial involving 900 children aged 12-60 months attending a local health facility for acute diarrhea of less than seven days duration, was carried out in an urban slum area in New Delhi, India. They found that the incidence and average number of days spent with acute lower respiratory tract infections were similar in the vitamin A supplementation and placebo groups. Among children aged 23 months or less there was significant reduction in the incidence of measles. The incidence of diarrhea was also similar in two groups. There was a 36% reduction in the mean daily prevalence of diarrhea associated with fever in the vitamin A supplementated children older than 23 months. The conclusions from the results were consistent with a lack of impact on acute lower respiratory tract related mortality after vitamin A supplementation noted in other trails and a possible reduction in the severity of diarrhea ***(Bhandari et al, 1994)***.

To investigate the effect of vitamin A supplementation on diarrhea

and acute lower-respiratory-tract infections (ALRI) in children from northeaster Brazil a randomized, double-blind, placebo-controlled trial was conducted, 1240 children aged 6-48 months were assigned vitamin A or placebo every 4 months for one year. They were followed up at home three times a week, and data about the occurrence and severity of diarrhea and acute lower respiratory tract infection (ALRI) were collected. Any child with cough and respiratory rate above 40 breath per minute was significantly lower in the vitamin -A- supplemented group than in the placebo group. The benefit of supplementation was greater as regards sever episodes of diarrhea; the incidence was 20% lower in the vitamin A group than in placebo group. With the standard definition of diarrhea (> or = 3 liquid or semi-liquid stools in 24h) the effect of vitamin A on mean daily prevalence did not reach significant, but as the definition of diarrhea was made more stringent (increase number of stools per day), a significant benefit become apparent, reaching for diarrhea with 6 or more liquid or semi-liquid stools in 24h a 23% lower prevalence. They found no effect of vitamin A supplementation on the incidence of acute lower respiratory tract infection (ALRI). The reduction in severity of diarrhea may be the most important factor in the lowering of mortality of vitamin A supplementation ***(Barrelo et al, 1994)***.

A study conducted in Sudan (1995) by Fawzi and his colleagues to examine the relationship of dietary vitamin A intake and the incidence of diarrhea and respiratory infection among Sudanese children between the ages of 6 months and 6 years. Total dietary vitamin A intake was strongly and inversely associated with the risk of diarrhea, they also observed a strong inverse association with the risk of having cough and fever. On the other hand, they noted a significant positive association of dietary vitamin A intake and the incidence of cough

alone, a sign that may be associated with a healthy respiratory epithelium. Vitamin A intake was also negatively associated with the risk of measles. These data emphasize the importance of adequate dietary vitamin A intake to protect the health of children in developing countries *(Fawzi et al, 1995)*.

Vitamin A and aneamia:

Aneamia and inadequate dietary intake of vitamin A are two of the most common findings of nutrition surveys carried out in developing countries. These epidemiological findings were the stimulus that caused to re-evaluate, nutrition-survey data from which they established a significant correlation between blood levels of vitamin A and hemoglobin among non-pregnant, non lactating women *(Hodeges et al, 1978)*.

Mejia et al, (1977) found a similar relationship for central American Children above 5 years of age but not for younger children. The data obtained from the children showed a parallel increase in hemoglobin and serum iron with increasing blood levels of vitamin A. Prospective studies of vitamin A supplementation in children reported from India *(Mohanram et al, 1987)*, Guatemala and Indonesia record post-supplementation improvement in hematopoietic indices *(Mejia and Arroyave, 1982)*.

Vitamin A status in Egyptian rural children and its relationship to anemia was studied in 271 children aged 6-12 years from Beni-Magdol and El-Fateh primary schools of Giza Governorate. Both sexes were represented. The study carried out within two scholastic years; 158 children were studied in 1985. The work comprised clinical

assessment of vitamin A, qualitative assessment using Rose Bengal technique, estimation of blood vitamin A and hemoglobin to study of prevalence of vitamin A deficiency and the factor influencing its incidence. The study showed positive association of anemia with low deficient levels of serum vitamin A, the relationship however disappeared at high serum vitamin A level ***(El-Shamy et al, 1989)***.

In Egypt, **EL-Naggar and Hussein (1982)** who showed positive significant correlation between plasma retinol and hemoglobin level among 63 rural pupils previously reported similar findings.

Another studies in Egypt by **El-Ghorab and his colleagues** were carried out during **1992** and **1994** to determine vitamin A and its relation to iron status of preschool and school age children. The children were selected from two locations namely Awladi orphanage at Maadi and Emam-El-Shafie area. Out of the total sample studied 57% were males and 43% were females. Age ranged from 3 to < 12 years. Venous blood samples were obtained to assess vitamin A (Serum retinol). It was found that vitamin A deficiency was prevalent among 34% of the total sample investigated; and the highest prevalence was in Emam-El-Shefie schoolers. Mild vitamin A deficiency was found among 50.4% of the total sample. Low vitamin A and vitamin A deficiency affected 94.5% of anemic iron deficient children versus 71.4% of the iron deficient children without anemia, 81.4% of the normal children and 75% of the anemic children without iron deficiency. The highest percentage of vitamin A deficiency was found in the anemic-iron deficient groups. The mild vitamin A deficiency was prevalent among 49.3% of the anemic-iron deficient children. The results also showed that there was a statistical significant positive correlation between serum retinol and three hematological parameters

namely serum iron, transferrin saturation and hemoglobin ***(El-Ghorab et al, 1994)***.

The national survey for assessment of vitamin A status in Egypt (1995) showed significant increase of anemia prevalence among vitamin A deficiency (VAD) mothers. However, there is no significant relation between vitamin A deficiency (VAD) and anemia among children. Anemia is prevalent among 25.2% of children, 26% of pregnant mothers and 14.8% of non pregnant mothers with an improvement during the period 1978-1995. However, it is still a public health problem ***(Nutriton Institute in collaboration with UNICEF, 1995)***.

Vitmain A and protein-calorie malnutrition (DCM):

There is a large body of work showing that a deficiency of protein can limit output of vitamin A from the liver. A diet, containing protein but devoid of vitamin A rise the retinol, retinol-binding protein (RBP) and prealbumin in the serum malnourished children. Liver biopsy showed that this only happens when the liver contains some vitamin A and serum level falls again after depletion of the store ***(Ingenbleek et al, 1975)***.

Studies in Egypt by **Zaklama et al, (1972)** showed that a fair proportion with either kawashorkori (KWO) marasmus had considerable vitamin A in their liver but abnormal low serum levels.

In another study 16 children with both clinical vitamin A deficiency and protein-caloric malnutrition were given 100.000 IU of water miscible vitamin A intramuscularly on the day after admission to

hospital but they showed no increase in retinol-binding protein (RBP) in the following 24 hours. This is because the synthesis of hepatic retinol-binding protein (RBP) is impaired in PCM ***(Pirie and Anbunathan, 1981)***.

A recent study was conducted to determine the prevalence of protein-calorie malnutrition (PCM), ocular diseases, and vitamin A deficiency in preschool children select at random in a rural zone of the groundnut belt of senegal. The prevalence of protein-calorie malnutrition (PCM) was 37.1% with a majority of sutnting, and prevalence of hypovitaminosis A was estimated to be 11.4% by using impression cytology. Furthermore, 19.4% of the children might be defined at risk of deficiency. The prevalence of Bitot's spots was equal to 0.2%. A problem of protein-calorie malnutrition (PCM) associated with health-endangering vitamin A deficiency existed ***(Carlier et al, 1991)***.

TREATMENT OF VITAMIN A DEFICIENCY

Children with any stage of xeropthalmia should be treated with vitamin A accoridng to WHO guidelines 200.000 IU vitamin A orally on presentation, the following day and whenever possible, 1-4 weeks later (infants 6-12 months receive a half dose and infants < 6 months one-quarter the dose, following the same schedule). Broad-spectrum antibiotic therapy can reduce the risk of secondary infection in children with corneal involvement. Concurrent infections and worm infestation should also be treated with appropriate antibiotics and antihelminthics, respectively; patients with diarndoea should receive oral rehydration therapy ***(Sommer, 1995)***. The mother or guardian should be advised to feed properly prepared vitamin A-rich foods (either preformed or provitamin A) to her children to prevent recurrent (in the patient) or initial (in siblings) xerophthalmia and reduce their risk or severe infection. Children should consume any one of the following to meet their daily vitamin A requirements: ½ cup of cooked, dark green leaves, ¼ cup of a cooked , medium-sized carrot, 2 tablespoons of yellow sweet potato or ripe papaya, half of a ripe mango. Perhaps on a weekly basis, any of the following, highly protective foods should be given: a cooked egg, 15-30g of cooked liver, 15-30g cheese, or 4-6 oz of milk ***(Sommer and west, 1995)***.

In addition, children with persistent diarrhea, dysentery or acute respiratory infection especially in the presence of wasting malnutrition,

should be treated with a single 200.000 IU oral of vitamin A (repeat doses can be safely given as frequently as every 4 months). Children with sever, protein-energy malnutrition, cases of measles in areas of known vitamin A deficiency or sever, complicated cases of measles irrespective of where they occur, should be given a full treatment regimen of vitamin A (Table IX). Dietary counseling should be given whether or not the child has xerophthalmia ***(Sommer, 1995)***.

Table (IX): Treatment schedule for xerophthalmia

TIMING	DOSAGE [a]
Immediately upon diagnosis (b)	110 mg retinyl palmitate or GGmg retinyl acetate (200.000 IU) by mouth.
Next day	110 mg retinyl palmitate or GG mg retinyl acetate (200.000 IU) by mouth.
Within 1-4 weeks; whenever clinical deterioration occurs; every 2-1 weeks in the presence of persistent kwashiorkor	110 mg retinyl palmitate or GG mg retinyl acetate (200.000 IU) by mouth

a) Children 6-11 months of age should receive only half the dose shown in this table, and children less than 6 months one quarter of the dose.

b) Intra muscular injection of 55mg water-miscible retinyl palmitate (100.00 IU) is substituted in rare instances when children with severe stomatitis cannot swallow, in case of persistent vomiting or if severe malabsorption (as in cystic fibrosis) prevents an adequate response *(Sommer, 1995)*.

The goal of prevention is to insure an adequate vitamin A intake and status of high-risk groups. Three complementary approaches can help achieve this goal: dietary diversification; food fortification with vitamin A; and periodic supplementation of high-risk groups with high-potency vitamin A ***(Sommer and West, 1995)***.

Dietary diversification:

Vitamin A deficiency prevention has a rational dietary solution, increase the intake of local food sources of both performed retinyl esters and provitamin A carotenoids to levels that at least exceed minimal requirements and preferably approach recommended daily intakes. The food and Agriculture Organization of the United Nations has set these levels (termed 'basal' and 'safe') at 200UG and 450 U, retinol equivalents per day, respectively, for healthy, pre-school-aged children (1-6 years). These levels can largely be achieved in children by consuming vitamin A rich foods in amounts specified under "Treatment" ***(Sommer and West, 1995)***.

Food fortification:

One of the main strategies to prevent and eliminate vitamin A deficiency is the addition of nutrients to foods and accessory food items. Provided that reasonable evidence of need for the added nutrients exists in a population, fortification is described as an effective, economical, flexible and socially acceptable method of increasing the nutrient intake, contributing to improved nutrition status and health ***(Cervinskas and Lotfi, 1996)***.

Several countries in which vitamin A deficiency is common have food fortification programs to add vitamin A to a commercially processed staple food. In Central America the addition of vitamin A to a national sugar has had a favorable impact on vitamin A status of whole population, especially preschool children ***(Arroyave et al, 1989)***.

In the Philippines and Indonesia monosodium glutamate is widely consumed as a flavor-enhance or Pilot projects have shown fortification of monosodium glutamate to improve vitamin A status and decrease xerophthalmia ***(Muhilal et al, 1988)***.

In the latter part of the 1980's the Food and Nutrition Research Institute (FNRI) sought to develop the fortification of rice with iron and vitamin A. It assumed that if fortification can address more than one nutritional problem the net benefits would out-weight the cost. In spite of extensive trials with two different pre-mixes, the FNRI was unable to solve the problem of excessive vitamin A loss during storage and cooking ***(Bacos, 1994)***.

Supplementation:

Supplementation can be an effective intervention for the improvement of vitamin A status in deficient population. However, supplementation should be progressively phased out as soon as micronutrients – rich food- based strategies enable adequate consumption of vitamin A ***(Cervinskas and Lotfi, 1996)***.

Periodic distribution of an oral, high-potency vitamin A supplement is currently the most direct and widely adopted way to improve vitamin A status, prevent xerophthalmia and reduce associated mortality in preschool children 6months of age and older. Supplements are normally supplied to countries through UNICEF (~ 125 million in 1993 alone) as small, elatinous capsules containing 200.000IU vitamin A.

Periodic megadose vitamin A supplementation in the form of

capsule, syrup or multiple dispenser 200.000IU (66.000ug) has been delivered at 4-6 monthly intervals to high-risk preschool children or by universal distribution to preschool children and lactating mothers ***(WHO/UNICEF/IVACG, 1988)***.

India has a program that provides each child under 5 years of age with a single dose of 100.000 IU (30.000 RE) of vitamin A in oil dropped directly onto the tongue every 6 months by a health professional. This has produced an impressive reduction in the incidence of vitamin A deficiency. Unfortunately, however, this program, because of difficulties in administering it within such a large population spread ever a large area misses about 35% of children. An earlier program in India based on the administration of vitamin A in tablet form was considerably less successful ***(Rahmathullah et al, 1990)***.

Vitamin A supplementation programs have been used in Indonesia, the Philippines and Africa, where they have resulted in moderate reductions in child mortality and dramatic decreases in the incidence of night and xerophalomia. Public health workers have used the following schedule for preventing xerophthalamia and increasing the liver's reserves of vitamin A. Oral retinyl palmitate (110mg) retinyl acetate (66mg), or injected retinyl palmitate (55mg) are administered on each of two successive days, and once a few weeks later if symptoms are not relieved ***(Underwood, 1990)***.

The World Health Organization recommended vitamin A supplementation for children with measles in areas where vitamin A deficiency was a recognized problem and the measles related mortality rate was 1% or more ***(Arrieta et al, 1992)***. The dose recommended

was 200.00IU by mouth at the diagnosis of measles (100.000IU for children below 1 year of age) repeated 24 hours later and again in 4 weeks if clinical signs of vitamin A deficiency were still present *(Arrieta et al, 1992)*.

Nutrition education and communications:

Nutrition education is an essential element in any strategy to reduce vitamin a deficiency this includes promoting increased consumption of vitamin A rich foods, suggesting new preparation techniques or food combinations, motivating and teaching people ways of growing or preserving nutritious food locally, motivating acceptance of vitamin A capsules and promoting purchase and use of vitamin A – fortified foods. Effective nutrition education is based on a clear understanding of the learner's perspective and tailored to the local situation, combining mass media and effective inter-personal communications as appropriate; it encompasses both centrally planned activities and local, community initiatives. The communication component of vitamin A or other development encompasses nutrition education aimed at behavior – change among mothers and families, advocacy with policy makers and program support communications to strengthen services and counselling *(Cervinskas and Lotfi, 1996)*.

There can be little doubt that this is really what is required. Vitamin A deficiency is nearly always 'poverty in the midst of plenty'- vegetable sources of vitamin abound but are not being incorporated into the diet of the young child, due to lack of knowledge of mothers. Nutrition education, together with practical advice and help with growing cheap, nutritious vegetables.

Promotion of breast-feeding:

Breast milk is virtually the only source of vitamin A in the first few months for many infants and often continues to be one of the most important sources through age 2. Without breast milk, newborns can maintain optimal vitamin A nutriture for nor more than few weeks. Although vitamin A rations in human milk are dependent on the mother's vitamin A status, vitamin A deficiency is rare among breast feeding infants, even in parts or world where vitamin A deficiency is endemic. Promotion of exclusive breast-feeding for 4-6 months and continued breast-feeding with complementary foods there after should form part of any dietary intervention to improve vitamin A ***(Cervinskas and Lotfi, 1996)***.

VITAMIN A STATUS IN EGYPT

The global momentum for eliminating morbidity and mortality resulting from vitamin A deficiency (VAD) has significantly increased in the last decade. At the 1990 World Summit for Children in New York, heads of states and government from 123 countries signed the World Declaration on the survival, protection and development of children. Among several components of declaration virtual elimination of vitamin A deficiency and its consequences before the year 2000 was stated. Thus it was agreed that all countries should identify whether or not they have a problem of vitamin A deficiency and in which parts of the country the problem exists.

Also the **International Conference of Nutrition , "ICN" 1992,** attended by delegated of 159 countries, both in the declaration and the plan of action, the importance of elimination of vitamin A deficiency.

There are three major types of indicators which can be used to estimate the prevalence of vitamin A deficiency in a population; biochemical indicators which determine the concentration of vitamin A in the body (vitamin A in serum and breast milk), clinical and physiological indicators which assess the clinical consequences of vitamin A deficiency (VAD), night blindness and eye signs of Xerophtalmia, and estimates of the adequacy of dietary intake of the vitamin ***(Sommer, 1993)***.

Dietary intake in young children and surveys of the prevalence of xerophthalmia has been done in almost developing countries. Based on available information WHO and UNCIEF have completed a list of countries at risk of vitamin A deficiency ***(WHO/UNICEF, 1994)***.

The recent survey of vitamin A assessment in Egypt run by the Nutrition Institute in collaboration with UNICEF (1995), there was no available data determining whether vitamin A deficiency is a public health problem or not. According to the **ARE National Nutrition Survey (1978)**, only four of nearly 10.000 deficiency preschool children were found to have Bitot's spot and vitamin A deficiency and that was considered not a public health problem in Egypt, if compared with the prevalence less than 0.5% which is the cut-off point for considering vitamin A deficiency VAD a public health problem.

A longitudinal study in a rural community in lower Egypt (1985-1987) revealed that vitamin A intake covers about 65% of recommended dietary allowances "RDA" in spring while not exceeding 35% in other seasons, feasts and fasts for target members of the family ***(CRSP, 1987)***. The collected data included social and economic information, as was biodemographic data, beside breast feeding status of children less than 2 years of age. Anthropometric measurements (weight, length/height) and clinical examination for eye signs of vitamin A deficiency were done for all children and their mothers, while goiter detection was done for all mothers and only children aged 3-6 years old. Morbidity load for children during the month preceding the surveys day was done including vomiting, diarrhea or both, upper respiratory tract infections, lower respiratory tract infection and fever of unknown origin.

Dietary assessment for all the children was 19.7%, for both sexes were affected to the same degree and without age influence. About 75% of the studied subjects were found to receive less than 60% of RDA of vitamin A.

A recent study was carried out by the **Nutrition Institute in Collaboration with UNICEF** (1995) on a total sample of 1629 mother child pair in five geographical area representing the metropolitan (Cairo), Coastal, Alexandria, Canal Zone (Suez), Lower Egypt (Gharbia) and Upper Egypt (Quena). From each area two districts were investigated (clinically and biochemically) including an urban and rural location. In each 6 to 72 months children and their mothers from the catchment area of two PHC facilities were examined clinically and biochemcially.

50% subsample of their mothers was done using frequency method and 24 hours recall food frequency was done for children more than 2 years of age.


MATERIALS
AND
METHODS

MATERIAL AND METHODS

I- Subjects of Study:

Three hundred children aged 2-5 years of both sexes with history of recurrent attacks of diarrhea and respiratory tract infection were recruited from the health center outpatient clinic in Badrashin City in Giza Governorate. Three hundred children were recruited randomly according to the list of registration. All the children at the beginning of the study were selected free from diarrhea diseases and respiratory tract infections. Then 120 children were excluded because some mothers refused to take blood samples from their children; others refused to give their children vitamin A capsules (200.000 I.U.), and some mothers refused to complete the follow-up protocol for further six months. The rest of the children (180) completed the study till the end. This study was intiated in Feberuary 1996 & vitamin A was given in Mars 1996. The children were followed up from April till September 1996.

II- Plan of the study:

Three phases were included in the study:-

A- Base line data

B- Intervention trial

C- Follow up study

A- Base line data:-

The following information were collected from the mother of each child at the first visit:-

1-Social and Demographic Background:

a- Birth order

b- Family size

c- Mother and father education

d- Smoking status

e- Mother job and father job

f- Past history: Detailed child history was taken from his mother. The child's mother was inquired about:

- Vaccination: of the child (Polio, DPT, measles)
- Respiratory illness of the child (respiratory disease was defined by history of clinically significant respiratory complaint accompanied by fever such as: respiratory difficulties, cough, running nose, and type of treatment taken during illness (antibiotics, antitussive, expectorants, corticosteroid), the frequency and the duration of the drug.
- Diarrhea affection of the child, (diarrhea was defined as a history of four or more loose stools per day), the presence of any parasite and any treatment taken for diarrhea (frequency, duration).
- Dietery history by 24 hours food recall and history of breast feeding & weaning.

2- Clinical examination:

Every child was subjected to a thorough clinical examination. The clinical sheet is included in the appendix.

3- Anthropometric measurements included the following:

A- Weight: was taken with light clothing: It was measured to the nearest 0.1 kg using an adult weight scale carefully calibrated with a known weight.

B- Height: was recorded in centimeters without shoes. It was measured to the nearest 0.1cm using metallic stand measuring scale for heights. The equipment was tested from time to time for accuracy.

C- Mid-Upper Arm Circumference: The measurement was taken on the left arm, midway between the tip of the acromion and olecranon process. The mid point was located by extending a metallic measurement tape between the two landmarks and then estimating the midpoint. The circumference was measured to the nearest 0.1cm.

D- Triceps Skin fold Thickness: Skinfold was measured by using Holtain Caliper ***(Weiner and Lowei, 1969)***, the skinfold was picked up between the thumb and Forefinger and the caliper jaws was applied at the exact level. After two seconds the measurement was read. The caplier was removed and then applied again for 30 seconds. Another reading was recorded. The average of two readings was taken. Triceps skin fold is a convenient site and is considered to be representative of the fat of the entire body. The measurement was taken over the triceps muscle at the back of the left arm midway between the olecranon

processes with the skinfold parallel to the longitudinal axis of the upper-arm ***(Tanner and White house, 1975)***.

4- Biochemical and laboratory methods:

For biochemical determinations, Five mls venous blood sample was obtained from each child. Since vitamin A and its precursor carotenoids in biological specimens are labile substances they required special handling to avoid loss prior to analysis. For this reason specific and general precautions were taken to minimize potential extrinsic sources of errors. Along the work the following precautions were taken in consideration:-

1- Avoiding oxidation of vitamin A:

This was avoided during collection of the samples by keeping the samples in: an ice-box and by using clean disposable tubes to avoid contamination with trace metals as iron and copper.

2- Avoiding exposure to light:

Exposure to light destroys vitamin A and carotenoids due to structural phtotrans formations. Direct exposure to sunlight was avoided during collection of the samples by covering the tube and the rack with aluminum foil.

3- Avoiding hemolyisis:

Hemolysis of the blood sample was avoided in this work since it resulted in erroneous results.

After collection of the blood samples, the covered tubes were transferred to the lab., where the serum was separated by centrifugation at 1000xg for 10 minutes. The sera were kept at -20°c until analysis. Repeated freezing and thawing and

exposure of serum samples to light were avoided during the work. In each serum sample the following parameters were determined:-

- Vitamin A
- Retinol binding protein
- Immunoglobulin IgG, IgM and IgA
- Zinc

A- Determination Of Serum Vitamin A

The method used in this work is micro vitamin A determination method that was developed by **Neeld and Pearson (1963)**. In this method triflouro-acefic acid (TFA) was used as the chromogenic agent. The advantage of this chromogen is that is does not exhibit the turbidity or film-forming properties of antimony trichloride in the presence of moisture. In this method complete extraction of vitamin A and carotene into an organic solvent (petrolium ether) will occur only after complete precipitation of protein by addition of alcohol in appropriate ratio (approx. 1:1). An aqueous solution too concentrated in ethanol will inhibits the extraction of vitamin A into the organic solvent phase. The carotene concentration was determined by measuring the absorption of the extract at 450mm. Following evaporation of the solvent, vitamin A was dissolved in chloroform and was determined by reading the intensity of the blue color developed after addition of tri fluoro-acetic acid chloroform reagent at two time points. A correction was made for the concentration of total carotenoids. Since carotenoids, when present in high amounts, contribute to the intensity of blue color.

B- Determination of Retinol Binding Protein (RBP)

Retinol-binding protein (RBP) was determined by radial immuno diffusion procedure of **Mancini et al (1965)**.

In this procedure retinol-binding protein (RBP) as protein antigen was allowed to diffuse from the sample placed in a small cylindrical well into a thin layer of gel containing monospecific antiserum. When the concentration of the spreading antigen falls appreciably below that of the uniformly distributed specific antibodies, the two interact to form a precipitate in the form of holo or ring around the well which marks the end point of their reaction.

The area of the ring was directly related to the concentration of diffusing antigen from the sample. By running solution of known concentration alongside with samples on each layer of gel, it was possible to prepare a calibration curve from which unknowns were evaluated. The diameter of the rings in two directions at right angles was measured using radial immun-diffusion magnifying system.

C- Determination of Serum Immunoglobulins (IGg, IGM, IGA)

The radiaol immunodiffusion technique was used for the determination of serum IgA, IgG snf IgM.

Nor-Partigen IgA plate was used for determination of the serum immunoglobulin A concentration. The assessment range was 0.42-6.34 g/L Behring. Nor-partigen IgG plate was used for determination of the serum immunoglobulin G concentration. The assay range was

2.5-37.7 g/L Behring. Nor Partigen IgM plate was used for determination of serum IgM concentration. The assay range was 0.32-4.83 g/L Behring. Each plate contained monospecific antiserum in a ready -for use- agarose gel layer

All the plates were put in vicinity of deep freeze compartment of the refrigerator. They were stored in the original unopened state at +2°c to +8°c and were protected from freezing.

The main principle of the method is that the human serum provided from the children reacts with the specific antiserum present in the NOR-Partigen plate producing single radial immunodiffusion precipitate. The diameter of the obtained precipitate differs according to the serum immunoglobulin concentration.

The stored serum was taken out of the fridge few hours before starting the laboratory study in order to allow serum thawing. The serum of the children was subjected to a dilution of (1:1 or 1:2) using isotonic saline solution. The dilution was done to avoid getting a precipitate diameter outside the assay range of the kits.

The reaction between NOR-Partigen and studied serum resulted in precipitate rings. Measurements of the precipitate ring diameter were taken twice. The first assessment was done 18 hours after filling the wells of each plate. The obtained first reading helps in early diagnosis. The second assessment should be done after attainment of the diffusion end point. The second evaluation for NOR-Partigen IgA and NOR-Partigen Ig plates was done two days after filling the wells, the second evaluation, for IgM was taken five days from filling the wells. The diameter of the precipitate ring was measured using a

special scaled magnifying lens in millimeters. The scaled lens is called Peak Scale Lupe 7x(made in Japan). It is scaled from 0 up to 20 millimeters

Reading in millimeters was used to sort out the comparable immunoglobulin concentration in g/L Behring from special tales supplied with the kits. The accuracy of the result was checked by comparing them with the results of the control serum supplied with the specific NOR-Partigen plate.

D- Determination of Serum Zinc

Serum was diluted in a ratio of 1:4 with de-ionized water and was measured using the Atomic Absorption meter Zeiss, Model PMQ3, at a wave length 214nm. With each bunch of samples, a standard curve was set up from 0.200 mg/ml and was measured along with the samples.

Values for zinc in each sample were calculated from their corresponding standard curves and the final concentration ug/100 ml serum was calculated as follows:

Concentration / Sample X dilution factor x 100
(from the standard curve) = Ug zinc / 100ml serum

5- Determination of Dietary consumption pattern:

This was investigated by:

a- 24-Hour recall procedure:

the mothers were the respondents since the children were young. For the recall, subjects list the foods they have ingested by a certain period of time, usually the preceding 24 hr. This assessment can be done relatively quickly, although the actual will depend on the level of details required.

Peters, et al (1994), reported that a disadvantage of this method is the problem of errors of memory. The reliability of recall among individuals may differ depending on other relevant characteristics such as socioeconomic status or health status.

A single 24 hour, recall is not adequate for measurement of an idividual's usual diet, although mean intake of a group can be estimated with one 24 hour recall per individual ***(Byens, et al, 1983)***.

b- Food Frequency Questionnaires:

In this method, the respondent (mother) is presented with list of foods rich in vitamin A and asked how often the child eats them. The individual respondent portion size of each food is not ascertained, but nutrients are estimated by multiplying reported frequency by the amount of the nutrient in a "standard" portion of each food. This method is useful in identifying individuals at the extremes of the nutrient intake distribution, and it can be used in large-scale studies. Advantages of this method include the fact that it is expensive to code, can be made to be self-administered and/or machine-readable, and may be more representative of individual intake than a few days of diet records. However, its validity is highly dependent on the correct selection of the foods on the list, and on the choice of the correct

portion size and nutrient content assumptions for each food. Furthermore, the method relies on the respondent's description of her child diet and also is limited in its ability to assess accurately the nutrient intake of child with dietary patterns markedly different from the food.

c- Intervention trial:

180 children included in the study were randomly distributed into two matched groups or an individual basis according to their baseline data of age, sex, weight, height, and vitamin A status. One group of children received massive dose of vitamin A (200.00 I.U.), oral. The other group of children served as control. The capsule nipple was snipped off and the contents (200.00 I.U. vitamin A) were squeezed into child's mouth.

After one month blood sample was taken again for vitamin A' with the same precautions that were taken with the first blood sample as done before.

d- Follow up study:

The mother was asked to come once per month for six months. The child was examined, and the mother was asked about any diarrhea attack, and respiratory tract infection during this period. The data were recorded at each visit for a period of 6 months.

STATISTICAL ANALYSIS

The statistical analysis was done using an IBM compatible computer and STATISTICA for MS Windows 98 statistical package.

Statistical Tests:

Descriptive statistics was presented as means ± standard deviations and number and percentage (frequency distributions).

Analytical tests used included unpaired student test (two sided) for comparing two groups. Analysis of variance (F test) for comparing more than 2 groups.

Chi square test for contingency table analysis.

Correlation analysis was also preformed whenever appropriate.

Signifcance level:

Significance level of 0.05 and 0.01 was used throughout all statistical tests within this study.

Tabulation and Graphical Presentation:

Tabulation and graphical presentation was also done according to Knapp and Miller (1992).


RESULTS

RESULTS

Our study group includes 180 children aged 2-5years. The children data are shown in the appendix. They include anthropometric measurement, biochemical analysis and follow-up data.

Tables and Figures:-

Table (1a):

Shows the mean value ± SD of the serum vitamin A base line (Ug/dl) of the studied children according to the different age groups (1st group from 2-<3, n=43, the 2nd group 3-<4, n=55 and the 3rd group 4-<5, n=81). The mean value ± SD of serum vitamin A in the 1st group 26.4 ± 7.21 and range from 12.0 to 41.0 and in the 3rd age group 27.4 ± 6.8 and the range 42.6. No significant difference had been found between all groups.

Fig (1):

Shows frequency distribution histogram of serum vitamin A level for the whole group of the children (n=180).

Table (1b):

Demonstrates the mean value ± SD serum retinol binding protein (RBP) base line (mg/dl) of the whole studied children according to different age groups (1st group 2-<3, n=43, 2nd group 3-<4, n=55 and 3rd group 4-<5, n=81). The mean value ± SD serum RBP in the 1st group 2.5 ± 0.9, range 1.1-4.5 2nd group 2.3 ± 1.0, range 1.1-4.5 and in the 3rd group 2.4 ± 0.93, range 1.1-4.5. No significant difference had been found between all age groups

Fig (2):

Demonstrate frequency distribution histogram of Retinol. Binding protein (RBP) for the whole group of chidren (n=180).

Table (1c):

Presents the mean value ± SD of serum zinc level base line (Ug/dl) of the whole studied group children according to different age groups (1st group 2-<3, n=43, 2nd group 3-<4, n=55 and the 3rd group 4-<5, n=81). The mean value ± SD of serum zinc in the 1st group 86.3 ± 25.1, range 8.5-169.4, in the 2nd group 79.6 ± 19.3 range51.0-133.6 and in the 3rd group 48.9 ± 18.2, range 51.1-120.3. No significant difference had been found between all age groups.

Fig (3):

Presents the frequency distribution histogram of serum zinc level for the whole group of the chidren (n=180).

Table (2a):

Shows the mean value ± SD of serum vitamin A base line (Ug/dl) of both the un-supplemented group and the supplemented group in the three age groups. In the un-supplemented group the mean value ±SD in the 1st group (age 2-<3, n=21) 26.4 ± 6.8, in the 2nd group (age 3-<4, n=26) 26.4 ± 6.8, and in the 3rd group (age 4-<5, n=42) 27.5 ± 6.5. In the supplement group the mean value ± SD in the 1st group (n=22) 26.4 ± 7.6, in the 2nd group (n=29) 24.9 ± 6.3, and in the 3rd group (n=39) 27.2 ± 7.13. No significant difference was found between the un-supplemented, and the supplemented groups at the three age groups as regard base line serum vitamin A.

Table (2b):

Demonstrates the mean value ± SD of the base line of serum retinol binding protein (RBP mg/dl) in both un-supplemented and supplemented group according to the three age group. In the un-supplemented group the mean value ± SD of serum RBP in the 1st group (n=13) 2.7 ± 0.9, in the 2nd group (n=14) 2.5 ± 1.1 and in the 3rd

group (n=25) 3.1 ± 1.2. In the supplemented group the mean value ± SD of Serum RBP in the 1st group (n=16) 2.3 ± 0.9, in the 2nd group (n=23) 2.3 ± 1.0 and in the 3rd group (n=33) 2.3 ± 0.6. No significant difference was found between un-supplemented and supplemented group in all groups.

Table (2c):

Shows the mean value ± SD of serum zinc level base line (Ug/dl) in the un-supplemented and the supplemented group in the three age group of the study in the un-supplemented group the mean value ± SD of serum zinc in the 1st group (n=14) 86.0 ± 19.00 and the 2nd group (n=15) 86.2 ± 23.7 and in the 3rd group (n=28) 85.7 ± 17.3. In the supplemented group the mean value ± SD of serum zinc in the 1st group (n=18) 26.6 ± 29.9, in the 2nd group (n=23) 75.3-15.00 and in the 3rd group (n=28) 84.1 ± 19.3. No significant difference had been found between the un-supplemented and the supplemented groups for all the age groups of the study.

Table (3):

Shows significant difference in the serum zinc level and retinol binding protein (RBP) between different levels of serum vitamin A. We classify serum vitamin A level into two groups according to WHO, 1982: the 1st group serum vitamin A $\leq$ 20 Ug/dl and the 2nd group

serum vitamin A > 20 Ug/dl . The P value for serum zinc P=0.000 and t value = -4.5 and for retinol binding protein P=0.00000, and t value = -5.39.

Table (1a): Serum vitamin A base line of the studied children according to different age groups.

Age in year	Groups	Serum vit. A ug/dL	Group	P-Value
		Mean ± S.D		
2-<3 (n= 43)	1	26.46 ± 7.21	1 vs 2	N.S
Range		12.0 – 44.0		
3- <4 (n= 55)	2	25.66 ± 6.58	2 vs 3	N.S
Range		12.4 – 41.0		
4- <5 (n= 81)	3	27.41 ± 6.86	1 vs 3	N.S
Range		12.2 – 42.0		

N.S = No significant difference.

Table (1b): Serum retinol binding protein (RBP) base line of the studied children according to different age groups.

Age in year	Groups	Serum RBP mg/dL	Group	P-value
		Mean ± S.D		
2-<3 (n= 43)	1	2.51 ± 0.93	1 vs 2	N.S
Range		1.1 - 4.5		
3- <4 (n= 55)	2	2.38 ± 1.08	1 vs 3	N.S
Range		1.1 - 4.5		
4- <5 (n= 81)	3	2.46 ± 0.93	2 vs 3	N.S
Range		1.1 - 4.5		

N.S = No significant difference

Fig (1)

Fig. (1) : Frequency distribution histogram of serum vitamin A level for the whole group of children (n=180)

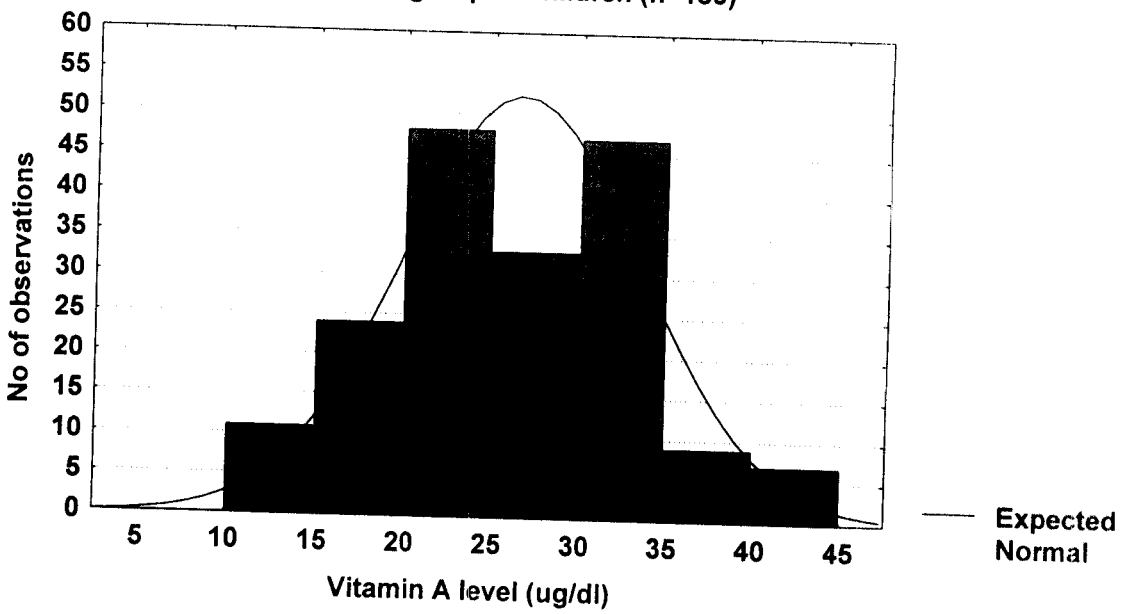


Fig (2)

ig. (2) : Frequency distribution histogram of Retinol Binding Protein (RBP) for the whole group of children (n=180)

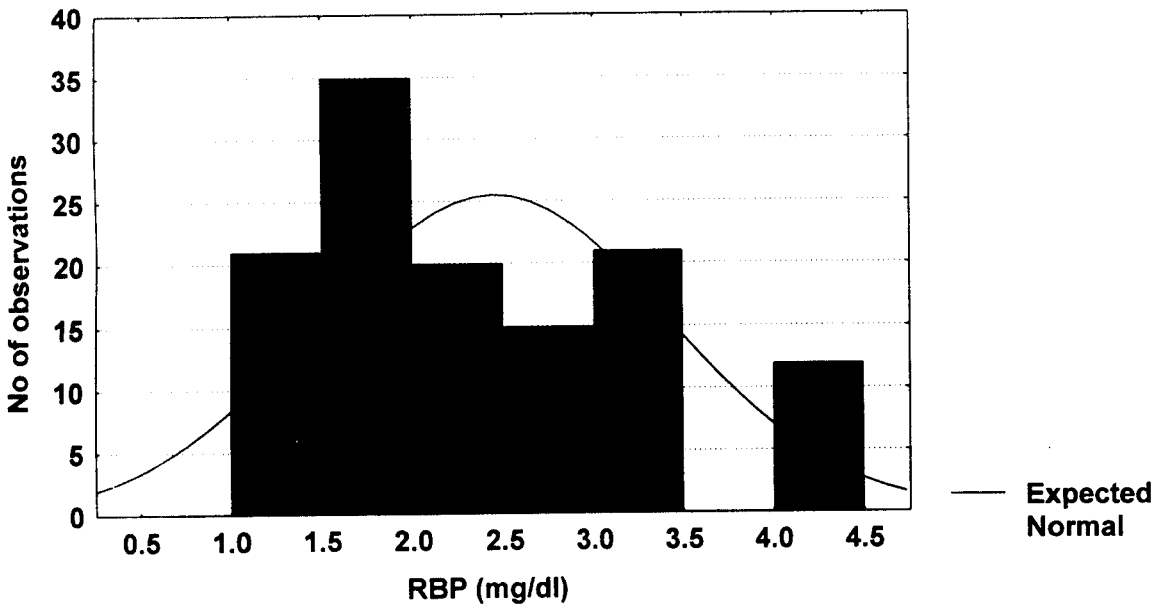


Table (1c): Serum Zinc base line of the studied children according to different age groups.

Age in year	Groups	Serum zinc level ug/dL	Group	P-value
		Mean ± S.D		
2-<3 (n= 43)	1	86.37 ± 25.14	1 vs 2	N.S
Range		48.5 – 169.4		
3- <4 (n= 55)	2	79.62 ± 19.39	1 vs 3	N.S
Range		51.0 – 133.6		
4- <5 (n= 81)	3	48.98 ± 18.23	2 vs 3	N.S
Range		51.1 – 120.3		

N.S. = no significant difference.

Table (2a): Serum vitamin A base line level (mean ±S.D) of both Un-supplemented and supplemented groups by age.

Age in Year	Serum vit. A ug/dL						t-value	P-value
	n.	Un-supplemented		n.	Supplemented			
		Mean	± S.D		Mean	± S.D		
2-<3	21	26.46	6.88	22	26.47	7.68	0.004	N.S
3- <4	26	26.49	6.82	29	24.93	6.37	0.87	N.S
4- <5	42	27.58	6.57	39	27.22	7.13	0.23	N.S

N.S = No significant difference

Table (2b): Serum retrnel binding protein (RBP) base line level (mean ±SD) of both vitamin A un-supplemented and supplemented groups by age.

Age inYear	Serum RBP mg/dL						t-value	P-value
	n.	Un-supplemented		n.	Supplemented			
		Mean	± S.D		Mean	± S.D		
2- <3	13	2.73	0.96	16	2.32	0.90	1.21	NS
3- <4	14	2.51	1.14	23	2.30	1.06	0.55	NS
4- <5	25	3.19	1.19	33	2.38	0.68	0.74	NS

N.S = No significant difference

Fig (3)

Fig. (3) : Frequency distribution histogram of serum Zinc level for the whole group of children (n=180)

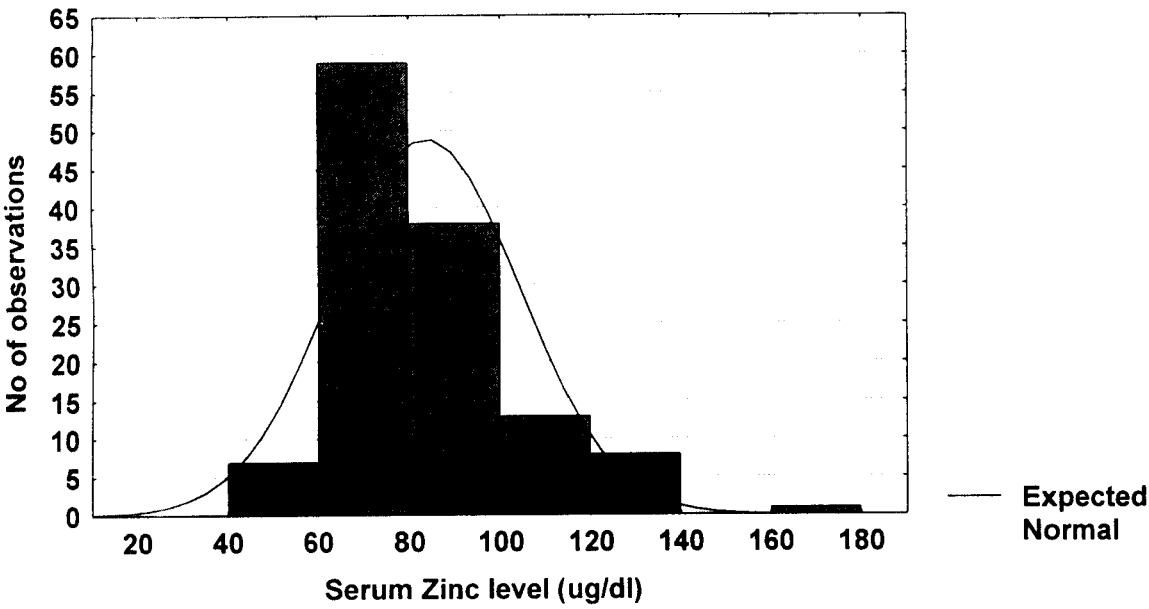


Table (2c): Serum zinc base line level (mean ±SD) of both vitamin A un-supplemented and supplemented groups by age

Age in Year	Serum zinc ug/dL						t-valuc	P-valuc
	n.	Un-supplemented		n.	Supplemented			
		Mean	± S.D		Mean	± S.D		
2-<3	14	86.02	19.09	18	86.63	29.96	0.07	NS
3- <4	15	86.20	23.72	23	75.33	15.04	1.73	NS
4- <5	28	85.79	17.33	28	84.17	19.38	0.33	NS

N.S = No significant difference

Table (3): Mean serum zinc and RBP levels at vitamin A level ≤ 20 ug/dL and > 20 ug/dL in the whole group according to WHO (1982).

Variable	Vit. A ≤ 20		Vit. A >20		t-value	p-value
	Mean	± S.D	Mean	± S.D		
Zinc	67.37	9.41	87.37	20.60	4.53	0.0001
R.B.P	1.64	0.73	2.67	0.91	5.39	0.0001

Table (4):

Shows the anthropometric classification used in this study for evaluation of growth and nutritional status according to percentile values described by **Frishancho, 1993**. From these, we have five categories applied to the evaluation of growth and nutrition status. Based upon measures of the linear growth (child's height) children are classified upon whether they fall into one of these as either short, below average, average, above average, or tall depending whether they fall into one of these five categories. The weight is similar classified: low weight, below average, average, above average and heavy weight.

Table (5):

Demonstrate the mean ± SD and range of the weight in kg, height in cm, weight for age percentile (WAP), weight for age Z-score, height for age percentile, and height for age Z-score according to base line data of the three age group.

Table (6):

Shows the mean value ± SD of the growth status of the children based on weight for age percentile (WAP). The mean value of WAP in category I (low weight) 2.5 ± 1.24 and number of the children =23 (12.7%), in category II (below average) 9.8 ± 2.9 and number = 30

(21.7%), in the category III (average) 40.76 ± 21.2 and the number =113 (62.8%) and in category IV (above average) 88.9 ±2.99 and number =5 (2.80%). There is no children in category V (fat) in our study.

Table (7):

Represents the mean value ± SD of the growth status of the children based on height for age percentile (HAP). The mean value of HAP in category I (short) 1.7 ± 1.3 and the number of the children = 38(21.1%), category II (below average) 9.09 ± 2.7 and n = 28 (13.9%), in category III (average) 45.5 ± 21.3 and n = 100(55.5%) in category IV (above average) 88.7 ± 2.5 and the number = 13(7.2%) and in category V (tall) 98.9 ± 2.1 and n = 4.

Table (8):

Showed the relationship between extremely low nutrient intake (<50% of RDA) specific nutrients and the incidence of shortness and low weight of the studied subjects. **Sempseon et al, 1995**, indicate that children who consume <50% of RDAs (recommended Dietary Allowance) are considered as extremely low nutrient intake. So the table showed that 71% short children had <50% of their RDA from vitamin A while the percent was 60% and 55% incase of zinc and

vitamin C intake. The same trend was noticed with low weight children in spite of the percentage were less than that with height.

Table (9):

Represented correlation coefficient between serum vitamin A at base line and the anthropometic measurement (HAP-WAP-WHP-BMI) were significantly positively correlated to vitamin A where P value were <0.01, <0001, <0003 respectively while HAP show no significant correlation.

Table (10):

Shows the mean value ± SD of the different biochemical indices (RBP,VIT A, ZINC, IgA, IgM, IgG) for children who are $<5^{th}$ percentile of height for age (HAP). The mean value of RBP of short children (HAP) 2.54 ± 0.8, (n=29), of vitamin A 28.4 ± 6.7, (n=38). For zinc 85.7 ± 16.7 and (n=26) for IgA 124.7 ± 22.3, (n=16), for IgM 106.6 ± 23.3, (n=16) and finally for IgG 10.7 ± 3.16 and (n=16).

Table (11):

Demonstrates mean value ± SD of the different biochemical indices for children had <5 percentile of weight for age (WAP). The mean

value of serum RBP for low weight children 2.66 ± 0.9 and n=16, mean value for serum vitamin A 26.5 ± 7.2 and n=23, mean value for zinc 81.1 ± 16.9 and n=18, the mean value for IgA 119.1 ± 18.8 and n=11, for IgM 109.5 ± 23.7, n=11, for IgG 10.30 ± 2.3 and n=11.

Table (4): Anthropometric classification for evaluation of growth and nutritional status.

Growth status	Percentile	Growth – status	Weight status
Category I	0.0 to 5.0	Short	Low weight
Category II	5.1 to 15.0	Below average	Below average
Category III	15.1 to 85.0	Average	Average
Category IV	85.1 to 95.0	Above average	Above average
Category V	95.1 to 100.0	Tall	Heavy weight

Table (5): Weight and height base line data according to the different age groups.

Age in year	n.	Wt. (kg)	WAZ	WAP	Ht. (Lm)	HAZ	HAP
2- < 3	43	12.07±1.6	0.61 ± 1.02	34.9 ± 27.1	89.16±5.11	0.46±1.23	40.22±31.6
range		10.0 - 16	-2.9-1.22	0.19-88.9	79.0-100	3.25-1.94	0.06-97.41
3- < 4	55	14.1±1.58	0.66±86	30.32±25.3	96.83±5.81	0.42±1.37	38.49±34.2
range		11.0-19.0	-2.24-1.13	1.25-87	87-108	2.7-3.3	0.0-99.8
4 - < 5	82	16.58±2.01	0.72±0.82	28.36±24.4	101.4±11.5	0.39±1.08	31.53±27.6
range		13.0-21.0	-2.17-1.50	1.48-93.3	102-113	-3.62-2.31	.02-98.95

WAZ	Weight for age Z score
WAP	Weight for age percentile
Z score	Standard's mean value – value of subjects / standard deviation of standard
HAZ	Height for age Z score
HAP	Height for age percent

Table (6): Growth status of children based on weight for age percentile (WAP).

	WAP			
	Mean	± S.D	No.	%
Category I(low weight)	2.52	1.24	23	12.70
Category II (below average)	9.86	2.95	39	21.70
Category III (average)	40.76	21.2	113	62.80
Category IV (above average)	88.94	2.99	5	2.80

Table (7): Growth status of children based on height for age percentities HAP.

Growth status	Number	HAP Mean ± S.D	%
Category I (short)	38	1.77 ± 1.3	21.1
Category II (below average)	25	9.09 ± 2.7	13.9
Category III (average)	100	45.5 ± 21.3	55.55
Category IV (above average)	13	88.7 ± 2.5	7.20
Category V (Tall)	4	98.9 ± 1.13	2.20

Table (8): Number and percentage of children that were short and low weight who consumed < 50% of recommended dietary allowance.

Nutrient	Short HAP < 5^{th} (n= 38)		Low weight WAP < 5^{th} (n=23)	
	No.	%	No.	%
Energy	5	13.2	3	13.0
Vitamin A	27	71.1	13	56.5
Vitamin C	21	55.3	10	43.8
Vitamin E	9	23.7	5	21.7
Iron	9	23.7	7	30.4
Zinc	23	60.5	12	52.2

Table (9): Correlation coefficient between serum vitamin A as dependent value and anthropometric measurements represented as percentiles.

Percentiles	Correlation coefficient (r value)	p-value
HAP	-0.05	NS
WAP	0.17	< 0.01
WHP	0.22	< 0.001
BMI	0.21	< 0.003

BMI:Body mass index (Weight / Height)

Table (10): Mean ± SD of different biochemical indices for children below 5th percentile of height for age.

Indices	Short children (HAP) Mean ± SD
RBP (n= 29)	2.54 ± 0.85
Vit. A (n= 38)	28.4 ± 6.75
Zinc (n= 26)	85.73 ± 16.28
IGA (n= 16)	124.7 ± 22.39
IGM (n= 16)	106.6 ± 23.34
IGG (n= 16)	10.73 ± 3.16

Table (11): Mean ± SD of different biochemical indices for low weight children (< 5th percentile of weight for age)

Indices	Low weight children (WAP) Mean ± SD
RBP (n= 16)	2.66 ± 0.96
Vit. A (n= 23)	26.55 ± 7.21
Zinc (n= 18)	81.17 ± 16.92
IGA (n= 11)	119.1 ± 18.82
IGM (n= 11)	109.5 ± 23.72
IGG (n= 11)	10.30 ± 2.36

Table (12a):

Shows the mean value ± SD, range of serum IgA of the whole group according to the three age groups of the study. The mean value of serum IgA in the 1st group n=18,120.5 ± 18.3, range from 96.0 to 150.0, in the 2nd group n=22, 119.2 ± 24.8, range 80-69 and in the 3rd group n=25, 122.3 ± 25.2, range 80.0-175.8. No significant difference had been found between all groups.

Table (12b):

Demonstrates the mean value, ± SD range of serum 1gM for the whole children according to the age three group of the study. The mean value of serum IgM in the 1st group 112.4 ± 20.0 range 80.2 – 149.0, in the 2nd group 120 ± 21.7, range 80.2-149.0 and in the 3rd age group 101.2 ± 23.1, range 80.2-149.0. No significant difference had been found between all groups.

Table (12c):

Shows the mean value ± SD is the range of serum IgG in the whole children according to the three age groups of the study. The mean value of serum IgG in the 1st group 11.0 ± 3.1, range 3.70-12.2, in the 2nd group 11.6 ± 3.3, range 3.7-16.3 and in the 3rd group 10.3 ± 3.0,

range from 3.7 to 16.4. No significant difference had been found between all age groups.

Table (13a):

Shows the mean value ± SD of serum IgA in un-supplemented and supplemented group in the mean age groups of the study. The mean value of serum vitamin A in un-supplemented group, in the 1st group n=10, 117.2 ± 19.6, in the 2nd groups n=10, 113.6 ± 26.9, and in the 3rd group n=12, 110.5 ± 24.3. In the supplemented group the mean value of serum IgA in the 1st group n=8, 124.7 ± 17 in the 2nd group n=12, 119.7 ± 24.8 and the 3rd group n=13, 133.7 ± 21.3. No significant difference had been found in serum IgA between the un-supplemented and the supplemented groups in the three age groups of the study.

Table (13b):

Demonstrated the mean value ± SD of serum level of IgM in the un-supplemented and supplemented groups in the three age groups of the study. In un-supplemented the mean value of serum IgM in the 1st age group 118 ± 21.4, in the 2nd group 118.6 ± 23 and in the 3rd group 99.2 ± 23.5. In the supplemented group the mean value in the 1st group 105.3 ± 17.2, in the 2nd group 117.7 ± 19 and in the 3rd group 103.1 ± 23.6. No significant difference had been found in serum IgM between

the un-supplemented group and the supplemented group at the three age groups of the study.

Table (13c):

Demonstrates the mean value of ± SDthe base line of serum IgG in the un-supplemented group and the supplemented group in the three age group of the study. In un-supplemented group the mean value of serum IgG in the 1st group 12.1 ± 2.1, in the 2nd group 12.6 ± 20 and in the 3rd group 10.9 ± 3.1. In the supplemented group the mean value of serum IgG in the 1st group 9.6 ± 3.7, in the 2nd group 10.7 ± 3.9 and in the 3rd group 9.8 ± 3.0. No significant difference had been found in serum IgG between the unsupplemented group and the supplemented group in the three age groups.

Table (14):

Represent the mean value ± SD of serum immunoglobulin IgA in mg/dL (n=65), IgM in mg/dL , (n=65) and IgG in mg/dL (n=65) in vitamin A un-supplemented group and supplemented group (Because the kits of immuno globulin are expensive only 65 of the studied children were analyzed). In the un-supplemented group the mean value of IgA = 5.1 ± 23.0, IgM 106.2 ± 23.5 and IgG 11.9 ± 2.5 in supplemented group the mean value of serum IgA 126.6 ± 21.7 IgM 109.5 ± 21.0 and serum IgG 10.1 ± 3.4. No significant difference

found in serum IgM between un-supplemented and supplemented group. There were statistically difference in serum IgA (P.04) and serum IgG (P.02) between un-supplemented and supplemented group.

Table (15):

Shows the mean value ± SD of serum IgG, IgM, IgA at vitamin A level ≤ 20 µg/dL and at level > 20 µg/dL. At vitamin A level ≤ 20 µg/dL the mean value of IgG 11.3 ± 3.5, IgM 119.5 ± 25.8 and IgA 109.2 ± 20.9. At vitamin A level > 20µg/dL the mean value IgG 10.8 ± 3.0, IgM 121 ± 22.7 and IgA 107.3 ± 22.6. There was no significant difference in serum IgG, IgM, IgA at vitamin A level ≥ 20 Mg/dL and vitamin A lvel > 20 µ g/dL.

Table (16):

Demonstrated the mean value ± SD of serum vitamin A in both vitamin A un-supplemented group and supplemented group before supplementation and 30 days (one month) after supplementation. The mean value of serum vitamin A level at base line before supplementation in un-supplemented group 26.99 ± 6.6 in supplemented group 26.3 ± 6.9. There was no significant difference between both groups. The mean value of serum vitamin A level after supplementation (for 30 days) in un-supplemented groups 26.6 ± 6.7 and in supplemented group 29.4 ± 5.7. The difference was statistically

significant in serum vitamin A level after supplementation between both groups (P 0.005). The difference was also statistically difference in serum vitamin A level in supplemented group before and after supplementation (P < 0 .001) and there was no significant difference in serum vitamin A level in the un-supplemented group before and after supplementation.

Table (12a): Statistical analysis for differences between mean serum immunoglobulin IgA levels by age groups.

	Group	Serum IgA g/L		Comparison between groups	P-Value
		Mean	± S.D		
2- <3 (n= 18) range	1	120.55 96.0-150.0	18.36	1 VS 2	N.S
3- <4 (n= 22) range	2	119.21 80.0-169.0	24.82	1 VS 3	N.S
4- <5 (n= 25) range	3	122.54 80.0-175.8	25.26	1 VS 3	N.S

Table (12b): Statistical analysis for differences between mean serum immunoglobulin IgM levels by age groups.

	Group	Serum IgM g/L		Comparison between groups	P-Value
		Mean	± S.D		
2- <3 (n= 18) range	1	112.41 80.2-149.0	20.22	1 VS 2	N.S
3- <4 (n= 22) range	2	120.82 80.2-149.0	21.77	1 VS 3	N.S
4- <5 (n= 25) range	3	101.24 80.2-149.0	23.19	1 VS 3	N.S

Table (12c): Statistical analysis for differences between mean serum immunoglobulin IgG levels by age groups.

	Group	Serum IgG g/L		Comparison between groups	P-Value
		Mean	± S.D		
2- <3 (n= 18) range	1	11.04 3.70-14.2	3.15	1 VS 2	N.S
3- <4 (n= 22) range	2	11.64 3.7-16.3	3.34	1 VS 3	N.S
4- <5 (n= 25) range	3	10.37 3.7-16.4	3.06	2 VS 3	N.S

Table (13a): Mean ±SD serum immunoglobulin IgA for both vitamin A un-supplemented and supplemented groups by age.

Groups	Serum IgA mg/dL						t-value	P-Value
	n.	Un-supplemented		n.	Supplemented			
		Mean	± S.D		Mean	± S.D		
2- <3	10	117.20	19.60	8	124.7	17.00	0.86	N.S
3- <4	10	118.60	26.94	12	119.7	24.87	0.10	N.S
4- <5	12	110.50	24.33	13	133.7	21.34	2.54	0.02

Table (13b): Mean ±SD serum immunoglobulin IgM for both vitamin A un-supplemented and supplemented groups by age.

Groups	Serum IgM mg/dL						t-value	P-Value
	n.	Un-supplemented		n.	Supplemented			
		Mean	± S.D		Mean	± S.D		
2- <3	10	118.09	21.47	8	105.3	17.24	-1.37	N.S
3- <4	12	102.90	23.07	12	117.7	19.00	1.65	N.S
4- <5	12	99.24	23.54	12	103.1	23.68	0.41	N.S

Table (13c): Mean SD serum immunoglobulin IgG for both vitamin A un-supplemented and upplemented groups by age.

Groups	Serum IgG g/L						t-value	P-Value
	n.	Un-supplemented		n.	Supplemented			
		Mean	± S.D		Mean	± S.D		
2-<3	10	12.15	2.14	8	9.66	3.79	1.76	NS
3- <4	10	12.67	2.09	12	10.71	3.96	1.47	NS
4- <5	12	10.98	3.14	13	9.82	3.01	0.94	NS

Table (14): Base line data of serum immunoglobulins (IgM, IgG, IgA) for both vitamin A un-supplemented and supplemented groups (n= 64).

	IgM mg/dl (n= 65)		IgA mg/dl (n=65)		IgG g/L (n= 65)	
	Mean	± S.D	Mean	± S.D	Mean	± S.D
Vit. A un-supp. Group	106.28	23.51	115.1	23.09	11.90	2.59
Vit. A supp. Group	109.57	21.09	126.6	21.72	10.14	3.43
t-value	0.60		2.08		2.34	
p-value	NS		0.04		0.02	

Table (15): Mean ± S.D of serum immunglubulin levels according to vitamin A deficient (≤20 ug/dl) and normal vitamin A (> 20 ug/dL) children.

Immunglobulin type	Vitamin A level ≤20 ug/dl		Vitamin A level >20 ug/dl		t-value	P-Value
	Mean	± S.D	Mean	± S.D		
IgG	11.32	3.59	10.87	3.09	0.18	NS
IgM	119.54	25.8	121.1	22.7	0.04	NS
IgA	109.25	20.97	107.3	22.62	0.07	NS

Table (16): Mean serum vitamin A levels before and one month after supplementation for both vitamin A un-supplemented and supplemented groups.

	Serum vit. A ug/dL							
	n.	Un-supplemented		n.	Supplemented		t-value	P-Value
		Mean	± S.D		Mean	± S.D		
Base line before suppl.	89	26.99	6.67	94	26.30	6.99	-0.68	N.S
30 days after suppl.	75	26.62	6.70	86	29.40	5.71	2.85	0.05
t-value p-level	0.55 N.S			8.54 0.001				

Table (17):

Represents the mean ± SD nutrient intake for children. Since they were different age group calculate the adequacy of this intake as its relative RDA. From the table the mean adequacy of energy intake was 73% of the RDA, and there was wide range of the adequacy (30-147.1). As regards to vitamin A the mean adequacy intake was 79% (± 132.0) ranged from 0.2- 683% and for vitamin C 66.6% (± 83) ranged from (0.0-591.8), vitamin E 78.0% (± 47) ranged from (16.2-364.7), iron 68.0 ± 30.5 ranged from (17.4 – 181.1), zinc 50.0 ± 18.3 range from (13.9 – 97.8) and for copper 91.6 ± 24.5 range (86.7 – 168.1).

Table (18):

Shows the percentage of the children with daily intake <50% of recommended dietary allowance from the table, more than 50% of the

children had <50% of their RDA from vitamin A, vitamin C and zinc. Meanwhile one third of the children had <50% of their iron requirement. At the same time the percentage was 27% for vitamin E.

Table (19):

Demonstrate the mean (± SD) of the base line dietary intake per 24 hours for both vitamin A un-supplemented and supplemented groups. No significant difference had been found in base line dietary intake for 24 hours between un-supplemented and supplemented groups except for fat and vitamin C there was significant difference between both groups where the P value for fat = 0.001 and for vitamin C = 0.003.

Table (20):

Shows the mean (± SD) of percent of recommended dietary allowance (RDA) for 24 hour intake of both vitamin A un-supplemented and supplemented groups. There were no significant difference in the percent of RDA for 24 hour intake between un-supplemented group and supplemented group except for Vit.C and Vit.E where p value = 0.003 for Vit.C and p value =-0.03 for Vit.E.

Table (21, 22):

According to WHO, FAO recommendate the consumption pattern of any person is equal to more than three time per week from identified

rich sources, the child or the person suppose to have vitamin A deficiency.

As regards to the frequency of consumption table 21 showed that 51% of our sample consumed milk and carrots and tomatoes three or more than three times per week. Leafy vegetables were consumed by 60% of the children three times or more per week. Highly consumption was for oils and butter as they are used for cooking. In order to elaberate more about relationship between this consumption pattern and vitamin A level in the serum of the children, showed in table 22 results no significant difference between the pattern in all food items except for milk and energy ($P < 0.01$ and $P < 0.03$ respectively).

Table (23):

Presents correlation coefficient between serum vitamin A at base line and the nutrient intake for the whole children. From the table the nutrient intake were positive correlated with serum vitamin A level.

Table (24):

Shows correlation coefficient between serum vitamin A level and nutrient intake as percentage of recommended dietary allowance (RDA). From the table the nutrient intake as % of RDA were positive

significantly correlated to serum vitamin A except for energy, protein and vitamin E.

Fig (4):

Represents positive correlation coefficient between serum vitamin A level µg/dL and serum retinol-binding protein (RBP) mg/dL r=0.59.

Fig (5):

Shows positive correlation coeffecient between serum vitamin A µg/dL and serum Zinc level µg/dL r= 0.56

Fig (6):

Demonstrates positive correlation coefficient between serum retinol binding protein (RBP) (mg/dL) and serum Zinc level µg/dLg where r=0.52.

Fig (7):

Shows correlation coefficient between vitamin A intake and carotene intake where r =0.94

Table (17): Dietary in take per 24 hour for the investigated subject and its relation to RDA.

Nutrients	Intake	% RDA
	Mean ± S.D Range	Mean ± S.D Range
Energy (kcal)	1083.6 ± 376.5 442.8 – 2116.4	73.0 ± 24.7 29.7 – 147.4
Total protein (gm)	36.9 ± 13.9 12.9 – 76.8	197.7 ± 73.5 74.2 – 430.4
Carbohydrate (gm)	182.2 ± 69.2 61.33 – 352.4	
Total Fat. (gm)	24.2 ± 12.8 6.8 – 74.7	
Vit. A (R-E)	317.2 ± 528.3 1.6 – 2935.7	79.0 ± 132.0 -2 – 683
Carotene (mg)	156.9 ± 364.2 0.00 – 2863.7	
Vit. C (mg)	28.0 ± 35.3 0.0 – 266.3	66.6 ± 83.0 0.0 – 591.8
Vit. E (mg)	4.96 ± 3.1 1.1 – 25.5	78.0 ± 47.5 16.1 – 364.7
Iron (mg)	6.8 ± 3.1 11.7 – 18.1	68.0 ± 30.5 17.4 – 181.1
Zinc (mg)	5.0 ± 1.8 1.4 – 9.8	50.0 ± 18.3 13.9 – 97.8
Copper (mg)	0.9 ± 0.3 0.2 – 2.0	91.6 ± 24.5 26.7 – 168.1

Table (18): Percentage of children with Daily intake < 50% recommended dietary allowances

Nutruent	Number	% of total number
Energy	30	16.7
Vitamin A	122	67.7
Vitamin C	103	57.2
Vitamin E	49	27.2
Iron	56	31.1
Zinc	100	55.6

Table (19): Statistical difference between base line dietary intake per 24 hours for both vitamin A un-supplemented and supplemented groups.

Nutrient	Un-supplemented		Supplemented		t-value	P-Value
	Mean	± S.D	Mean	± S.D		
Energy (kcal)	1070	385	1095	370	0.44	NS
Total protein (gm)	38.0	14.60	35.80	13.20	1.08	NS
Carbohydrate (gm)	185.2	69.63	179.2	69.04	0.58	NS
Total fat (gm)	20.10	9.40	28.30	14.40	4.60	0.001
Vitamin A (I.U)	1989.1	3199.9	2223.1	4450.6	0.40	NS
Vitamin A (R.E)	347.0	600.9	287.4	445.6	0.80	NS
Carotine (mg)	125.8	253.9	188.1	447.6	1.10	NS
Vitamin C (mg)	22.10	27.7	33.90	40.90	2.30	0.03
Vitamin E (mg)	4.97	3.45	4.94	2.65	0.07	NS
Iron (mg)	7.20	3.20	6.40	2.80	1.80	NS
Zinc (mg)	5.10	1.90	4.90	1.80	0.80	NS
Copper (mg)	0.90	0.30	0.90	0.30	0.04	NS

I U = international unit
R E = retinal equivalent

Table (20): Percent of RDA for 24 hours intake of both vitamin A un-supplemented and supplemented groups.

Nutrients	Un-supplemented		Supplemented		t-value	P-Value
	Mean	± S.D	Mean	± S.D		
Energy (kcal)	72.79	24.18	73.18	25.35	0.104	NS
Total protein (gm)	207.5	75.80	187.9	70.20	1.80	NS
Vitamin C (mg)	53.08	65.53	80.09	95.95	2.205	0.003
Vitamin E (mg)	78.75	52.72	77.26	41.90	0.210	0.03
Zinc (mg)	51.15	18.12	48.87	17.88	0.832	NS
Iron (mg)	72.08	32.13	64.03	28.44	7.778	NS
Copper (mg)	92.41	25.46	90.74	23.62	0.454	NS

Table (21): Numbers and percentage of children that consumed food items rich in vitamin A.

Food items	Frequency of consumption			
	<3 times / week		≥ 3 times /week	
	No.	%	No.	%
Milk	93	51.70	87	8.30
Eggs	177	98.30	3	1.70
Meat	176	97.80	4	2.20
Leafy vegetables	72	40.00	108	60.0
Oil sand butter	8	5.00	171	95.0
Sweet potatoes	177	98.30	3	1.70
Carrot and tomatoes	93	51.70	87	48.30

Table (22): Serum vitamin A levels related to frequency of consumption of food items rich in vitamin A.

Nutrient	Serum vit. A ug/dL				P-value
	< 3 times consumption		≥ 3 times consumption		
	Mean	± S.D	Mean	± S.D	
Milk	24.90	6.10	27.9	7.3	< 0.01
Eggs	21.30	5.90	18.9	4.8	< 0.03
Meat	26.90	6.60	26.9	4.9	NS
Leafy vegetables	27.50	6.20	26.3	7.0	NS
Sweet potatoes	27.70	5.60	31.5	7.7	NS
Carrots and	26.20	6.90	27.0	6.7	NS
tomatoes	26.30	8.60	26.5	7.0	NS
Oil – butter					

Table (23): Correlation cooficient between serum vitamin A level and nutrient intake (n= 178).

Nutruent	Serum vit. A ug/dL	p-value
Energy	0.18	< 0.01
Total protein	0.14	N.S
Carbohydrate	0.21	< 0.001
Total fat	0.05	N.S
Vitamin A (RE)	0.89	<0.0001
Vitamin A	0.06	N.S
Carotein	0.95	< 0.0001
Vitamin C	0.28	< 0.003
Vitamin E	0.15	< 0.01
Iron	0.31	< 0.001
Zinc	0.21	< 0.003
Copper	0.30	< 0.001

Table (24): Correlation coefficient between serum vitamin A level and nutrient intake variables as percentage of RDA

Nutruent	Serum vit. A	p-value
Energy	0.14	N.S
Protein	0.08	N.S
Vitamin A	0.89	< 0.0001
Vitamin C	0.28	< 0.003
Vitamin E	0.13	N.S
Iron	0.31	< 0.001
Zinc	0.21	< 0.003
Copper	0.21	< 0.003

RDA: Recommended Dietary Allwance

Fig (4)

(4) : Correlation coeffecient between serum vit A level and serum RBP lev

R_B_P = .26307 + .08284 * VIT_A_B

Correlation: r = .59121

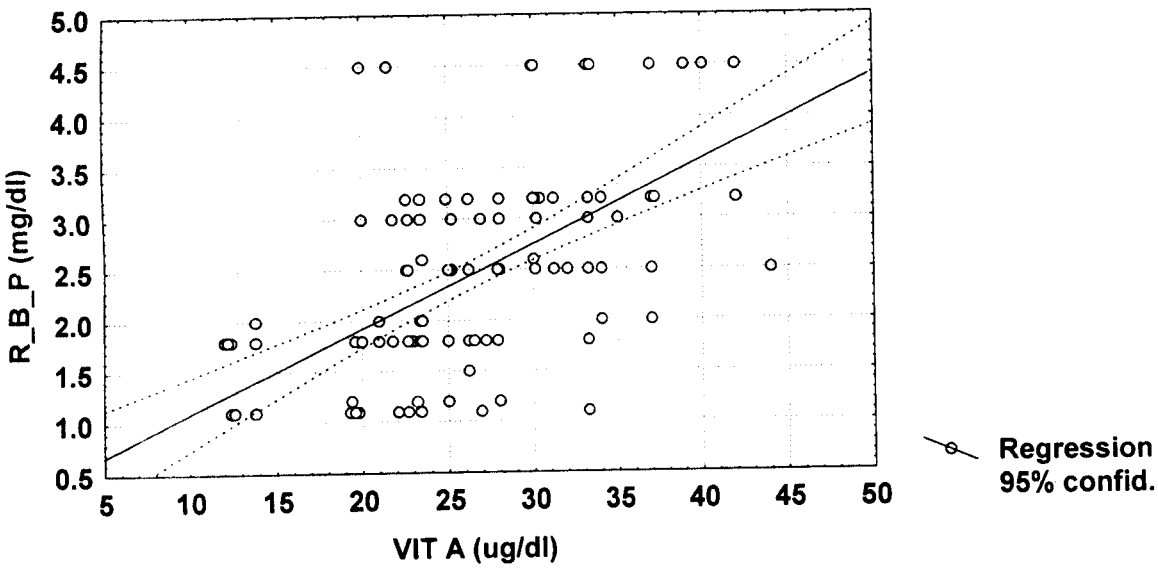


Fig (5)

(5) : Correlation coefficient between serum vitamin A and serum Zinc leve

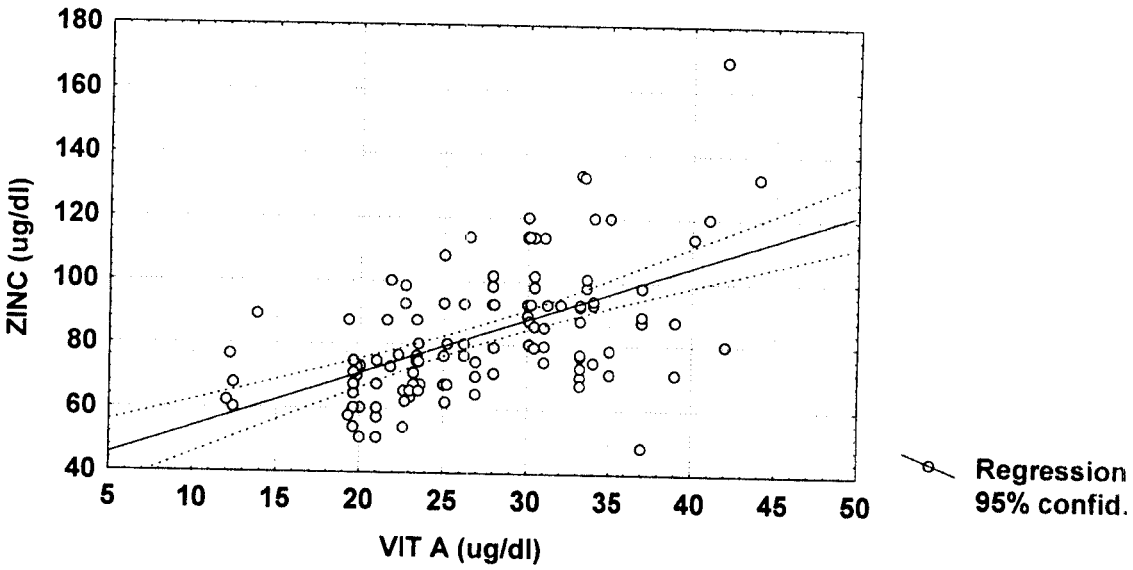


Fig (6)

(6) Correlation coeffecient between serum RBP level and serum zinc level

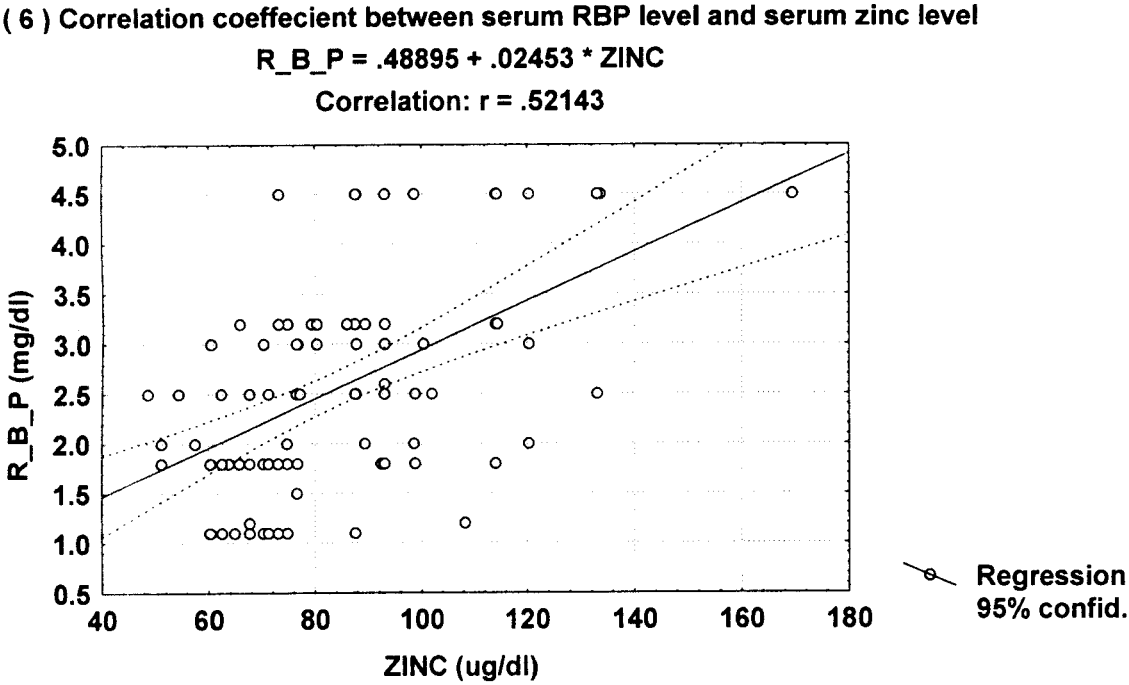


Fig (7)

Fig. (7) Correlation coeffecient between vit. A intake and Carroten

CARO = -30.72 + .08910 * VITAIU

Correlation: r = .94599

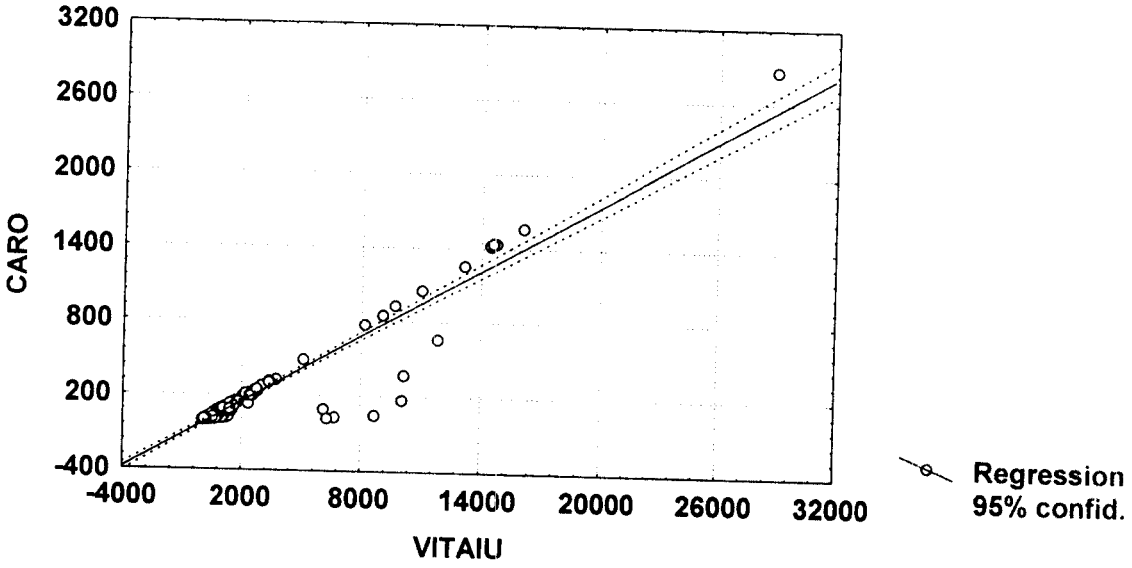


Table (25):

Shows the frequency of the diarrhea attacks for six months of follow-up after supplementation of 200.000IU oral dose of vitamin A in the supplemented group (n=90) and un-supplemented group (n=90). In the supplemented group, in the 1st month 2.7% of children have diarrhea, in the 2nd month 4.5% have diarrhea, in the 3rd month 3.6% have diarrhea, in the 4th month 4.5% have diarrhea, in the 5th month 4.5% have diarrhea and in the 6th month 6.3% have diarrhea. In the un-supplemented group the % of children which have diarrhea is as follow in the 1st month 9%, in the 2nd month 9.9%, in the 3rd month 7.2%, in the 4th month 6.3%, in the 5th month 5.4% and in the 6th month 9.9%.

Fig (8):

Shows the frequency of diarrhea attacks for six months after supplementation with 200.000IU oral dose of vitamin A.

Table (26):

Presents the frequency of the respiratory tract infection for 6 months of follow-up after supplementation of 200.000IU oral dose of vitamin A in the supplemented and un-supplemented group. In the supplemented group the % of children which have respiratory tract infection during the 6 months are as follow: in the 1st month 4.5%, in

the 2nd month 2.7%, in the 3rd month 4.5%, in the 4th month 3.6%, in the 5th month 7.2% and in the 6th month 6.3%. In the un-supplemented group, the % of the children which have respiratory tract infection are as follow: in the 1st month 9.9%, in the 2nd month 7.2%, in the 3rd month 10.8%, in the 4th month 8.1%, in the 5th month 11.7% and in the 6th month 10.8%.

Fig (9):

Shows the frequency of respiratory tract infection attacks for six months after supplementation with 200.000IU oral dose of vitamin A.

Table (27):

Presents the frequency of diarrhea according to the level of serum vitamin A level ≤ 20 Ug/dl or > 20 Ug/dl. In children with serum vitamin A level ≤ 20Ug/dl 55.5% of them have diarrhea and 44.4% have no diarrhea. In children with serum vitamin A level > 20 Ug/dl 46.5% of them have diarrhea and 53.4% have no diarrhea.

Table (28):

Shows the frequency of respiratory tract infection according to the level of vitamin A at the base line ≤ 20 Ug/dL or > 20 Ug/dl. In children with serum vitamin A ≤ 20 Ug/dL 55.5% of them have

respiratory tract infection and 44.4% have no respiratory tract infection. In children with serum vitamin A >20 Mg/dL 52.7% have respiratory tract infection and 47.2% have no respiratory tract infection.

Table (25): Frequency of diarrhea attacks for 6 months after supplementation with 200.000 I.U single oral dose f vitamin A.

Group	Month 1		Month 2		Month 3		Month 4		Month 5		Month 6		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Supplemented (n= 90)	3	2.7	5	4.5	4	3.6	5	4.5	5	4.5	7	6.3	29	26.1
Un-supplemented (n= 90)	10	9	11	9.9	8	7.2	7	6.3	6	5.4	11	9.9	53	47.7

Table (26): Frequency of respiratory infection attackes for 6 months after supplementation with 200.000 I.U oral dose of vitamin A

Group	Month 1		Month 2		Month 3		Month 4		Month 5		Month 6		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Supplemented (n= 90)	5	4.5	3	2.7	5	4.5	4	3.6	8	7.2	7	6.3	32	28.8
Un-supplemented (n= 90)	10	9.9	8	7.2	12	10.8	9	8.1	13	11.7	12	10.8	64	57.6

Table (27): Frequency of diarrhea according to serum vitamin A level.

Vitamin A level (ug/dl)	Diarrhea		No. diarrhea		Total
	No.	%	No.	%	
≤ 20	20	55.56	16	44.44	36
> 20	67	46.53	77	53.47	144
Total	87	100	93	100	180
Chi^2 p-value	0.093 N.S				

N.S = No significant difference

Table (28): Frequency of respiratory tract infection according to serum vitamin A level.

Vitamin A level (ug/dl)	Respiratory tract infection		No respiratory tract infection	Total	
	No.	%	No.	%	
≤ 20	20	55.56	16	44.44	36
> 20	76	52.78	68	47.22	144
Total	96	100	84	100	180
Chi^2 p-value	0.089 N.S				

N.S = No significant difference

Fig (8)

Fig (8): Frequency of diarrhea attacks for 6 months after unsupplementation with 200,000 IU oral dose of vitamin A

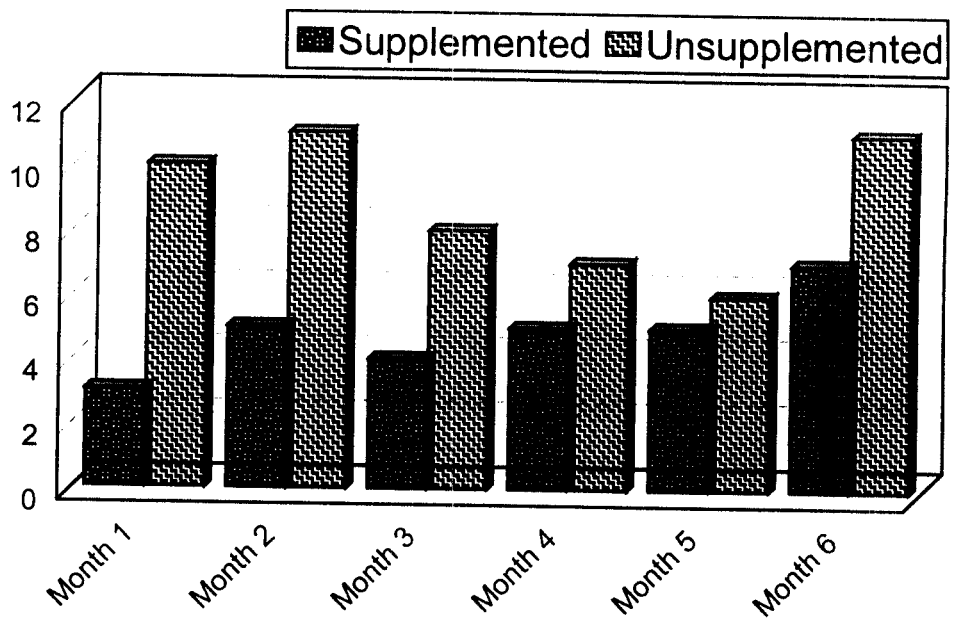
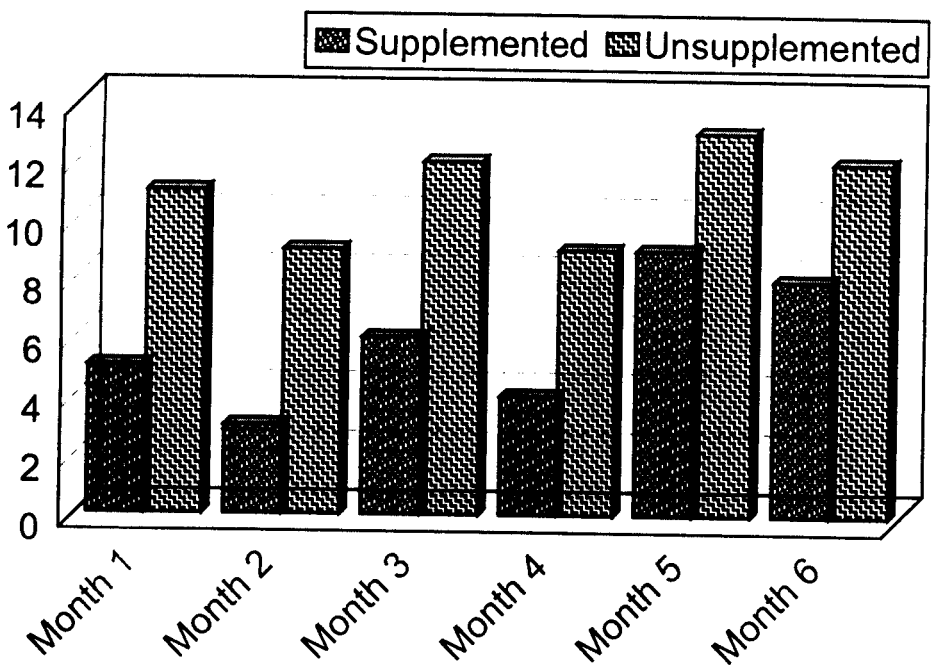
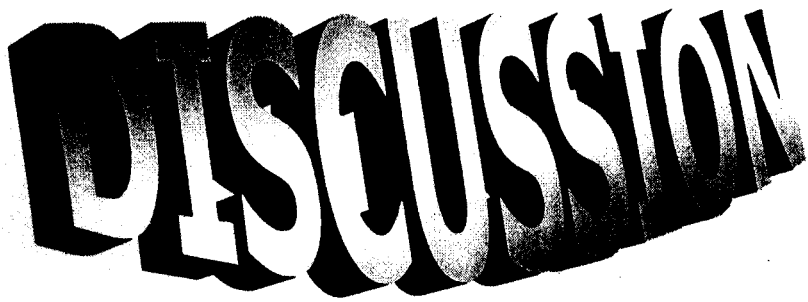


Fig (9)

Fig (9): Frequency of respiratory tract infections attacks for 6 months after unsupplementation with 200,000 IU oral dose of vitamin A




DISCUSSION

DISCUSSION

Vitamin A is stored in the liver, it is transported to target tissues by two carrier protein, retinol binding protein (RBP) and transthyretin (TTR) which require zinc for their synthesis ***(Dijkhuizen, 1998)***. The metabolic availability of vitamin A is thus dependent upon adequate supplies of protein and zinc. Supplementation with high dose of vitamin A to preschool children without taking into account their protein and zinc status, may have a little value in the primary prevention of infectious disease.

Accordingly this study was designed to investigate serum vitamin A level, zinc and retinol-binding protein, in a group of pre-school children of age 2-5 years before being supplemented orally with 200.000IU vitamin A. Two of the major consequences of vitamin A deficiency are growth retardation and increase susceptibility to infection. For this reason, in this study, growth measurements as well as serum levels for IgG, IgM, and IgA were done among the base line data of the children.

In this study, 300 children aged 2-5 years were recruited according to the list of restoration from the out patient clinic of Badrashin City Health Center in Giza Governorate. One hundred and twenty children were excluded from the study due to the following reasons: -

- Some mothers refused blood sampling.
- Some children were severely anemic and some were severely malnourished. Both groups were given the proper treatment.

Guidelines for different vitamin A control programs directed towards improving the vitamin A status of a population were given by the International Vitamin A consultative Group ***(IVACG, 1990)***. Periodic massive dose programs have appeared to be feasible control measure. According to WHO (1988), 30-50% of a 200.000 IU dose of vitamin A is stored by the body, and the protection period for a growing child has been calculated to be about 500 days. Oral dosing with 200.000 IU of retinyl palmitate in oil once every 6 months was recommended and considered the optimum regime for reducing the incidence of ocular lesions and caused no serious acute hyper-vitaminosis symptoms ***(Sommer, 1986)***.

As regard to the safety of use of vitamin A prophylaxis , nausea, vomiting and headache have been reported in several percent of children taking part in large dose program (30, 60 mg vitamin A dialydose). Severe vomiting (1.2%) was limited to children given 60mg vitamin A; symptoms lasted for almost no longer than 12-24 hours.

In this study we chose to give the children the vitamin A massive dose (200.000IU) by oral root, every child was given 4 capsules containing 50.000 IU of vitamin A in oil ***(El-Kahira pharmaceutical co, Egypt)***, the capsule was snipped by a sterile needle and contents were expressed into the child's mouth by the pediatriation or the nurse of the health care unit to be sure that the child has got the supplement properly. We preferred the oral root because it is less harmful to the child, than the water miscible parental preparation which are more costly and less readily available than the oral preparation, their administration required syringes, needles as well.

In this study, we observed children for symptoms of nausea, vomiting and headache, fortunately no one got any of these symptoms. The rest of the children (180) were divided into two groups, age and sex matching. One group was assigned unsupplemented and the other group was assigned vitamin A supplemented. Each child of the two groups was subjected to base line data that included anthropometric measurements, dietary history and blood sampling. Each child of the supplemented group was given orally 200.000IU vitamin A according to the regulation of WHO ***(WHO, 1988)***.

Base line data of the children: -

Children of this study (n=180) were categorized by age into 3 groups, group 1 from 2-<3 years n=43 group 2 from 3-<4 n=55, and group 3 from 4-5 years, n=82. Each of the three groups was subdivided into two other subgroups, one is supplemented with vitamin A and the other was not supplemented.

A-Biochemical Results:-

In this study serum vitamin A was measured in alcohol form i.e. retinol. In human serum 80-90% of vitamin A is present in the alcohol form, i.e. the active form and the rest is in the ester form. Serum retinol concentration remains fairly constant, while the ester form rises with the administration of vitamin A ***(Barker, 1982)***. The mean serum vitamin A level among each of the three age groups was 26.46 , 25.66 and 27.41 respectively (Table 19). No statistical significant differences were shown between the levels of the three age groups. The mean serum vitamin A levels of the three groups were within the normal

range. Frequency distribution histogram of serum vitamin A level for the whole number of children studied showed normal distribution and ranged between 10-45 ug/dl (Fig. 1). The pediatric reference intervals of the 2.5-97.5 cnetiles for serum vitamin A, for children within this age period were 20.05-51.56 Ug/dl ***(Kasr et al, 1997)***. That is some of the values of our children were below the 2.5 centile for the reference range.

Similar to our finding, no correlation was previously shown between serum vitamin A level and age and sex of the "Egyptian children in the study of ***(Quttb et al, 1995)***. Our mean vitamin A levels are however lower than those shown for school age children in Thailand (30.28 ± 8.86 Ug/dl) and in US (36.0±|.57 Ug/dl) ***(Udomkesmalee et al, 1990)***.

Serum retinol concentration > 20ug/dl) is considered necessary to maintain normal body function ***(Sommer, 1982 and Olson, 1989)***. For this reason a cut-off level of 20Ug/dl is considered critical, below which, a person is considered at risk for vitamin A deficiency. In this study, number of children who had serum vitamin A ≤ 20 Ug/dl was 36 i.e. 20% of the total number of children were deficient in both supplemented group and in unsupplenmented groups.

Our mean levels are comparable to those shown **Mokter et al (1998)** in preschool children in Morocco, 1998). The authors showed that 40.6 of the children had retinol < 20 Ug/dl and 3.1% of them had serum retinol < 10 Ug/dl. Similarly, in Beishifu Town in China, 33.6% of children had serum vitamin A below 20 Ug/dl and 8.1% of the children had a level below 10 Ug/dl ***(Wang lin, 1998)***. In an Egyptian study on 500 infants and children from semi-urban locality in Cairo, prevalence

of vitamin A deficiency based on response to 1% Rose Bengal eye stain was 19.7 ***(Khalifa et al, 1992)***. This prevalence is almost similar to the prevalence of children with serum vitamin A level ,20mg that was shown in this study.

Retinol binding protein (RBP) is a possible surrogate for serum retinol since this protein transports "biologically active" form. An unknown percentage (15-20%) is not associated with retinol ***(Neal E. Craft, 1998)***.

In this study RBP was measured among the base line data for both supplemented and unspplemented groups. Mean levels at all age groups were within the normal range with no statistical differences between the groups (Tables 1b and 2b). Frequency distribution histogram for retinol-binding protein for the whole age group showed normal distribution and that serum RBP level ranged between 1.1 and 4.5 mg/dl (Fig 2). The reference 2.5 and 97.5 centiles for retinol-binding protein (RBP) for health preschool children aged 9-62 months in Sydney, Australia, were 1.4 and 3.6 mg/dl respectively ***(Kar el al, 1997)***. In our study, children with serum Retinol-binding protein (RBP) level $\leq$1.5 mg/dl were 22 at all age groups .

In this study a positive significant correlation between serum RBP and serum retinol level was shown with r=0.56 (Fig. 4). Similar strong correlation between these two parameters has been previously shown. Accordingly, from these studies 0.7 Umol/L retinol (i.e. 20 Ug/dl) was shown to be equivalent to 2.1 mg/dl RBP ***(Rosales, 1999)***. This means that serum vitamin A cut-off was taken as 20mg/dl below which the individual is considered at risk for vitamin A deficiency, RBP $\leq$2.1

mg/dl level will accordingly be as well considered at risk for deficiency. In this study, the number of children with serum vitamin A level below 20Ug/dl were 36, RBP mean serum level of those children was 12.64 mg/dl as compared with 2.67 mg/dl for the children with serum vitamin A level >20 Ug/dl. Difference between the two means for RBP was statistically highly significant (P<0.000) (Table 3). In a study done on South Africa children with pulmonary tuberculosis low level of RBP were as well shown to a be associated with low serum vitamin A level ***(Hanekom et al, 1997)***.

All these studies augment the suggestion of Rosales 1999, that plasma RBP can be used as a simple and accurate surrogate measure for retinol. Measurment of RBP by immuno-diffusion is simple, and is specific for only one protein.

Tronthyretin (TTR) is another carrier protein for retinol together with RBP. Both proteins require zinc for their synthesis. Data are accumulating that support the hypothesis that inadequate zinc nutriture will result in an impairment of vitamin utilization ***(Udmok Ermalae et al, 1990)***. Therefore in this study serum zinc level was measured along with vitamin A. Mean serum zinc level of both the unsupplemented and supplemented groups was within the normal range for all age groups. Frequency distribution histogram of serum zinc level for the whole group of the children showed normal distribution (Fig. 3). The level ranged between 40-180Ug/dl. The reference intervals for serum zinc level for healthy preschool children aged 9-62 months based on the 2.5 and 97.5 centiles are 58.8 and 124.2 micrograms /dl respectively ***(Karr et al, 1997)***. It the 2.5 centile level (i.e. 58.8 Ug/dl) for zinc is taken as the cut off. Our results show that of the children of

this study were zinc deficient. Children with mean serum vitamin A level ≤ 20mg/dl showed mean serum zinc level of 67.4 Ug/dl as compared to 87.4 Ug/dl, for children with vitamin A level > 20 Ug/dl. The difference between the two groups was highly significant ($P < 0.000$). This finding denotes that children who are deficient for vitamin A are also at risk for zinc deficiency.

Correlation coefficient between serum vitamin A level in this study and zinc level was significantly positive with r value = 0.55 and $P < 0.000$ (Fig. 5).

Similar positive significant correlation was as well shown between serum RBP level and serum zinc with r-value = 0.52 and p level 0.000 (Fig. 6).

These data indicate the strong relationship between the three variables retinol, RBP and zinc and demonstrate the importance of the availability of these nutrients together in order to maximize the benefit of vitamin A supplementation . This will be taken into consideration in future supplementation programs.

B- Anthropometric Measurements:-

Growth status of the children in this study was assessed by measuring weight and height and by relating these measurements to the international reference standards by using the anthro soft ware program. Accordingly weight / age Z-score (WAZ) and Height per age Z-score (HAZ) were calculated, weight/age percentiles and Height/age

percentiles were calculated. Results showed that mean levels of WAZ, HAZ, WAP and HAP were within normal range all age groups. Catigorization of WAP and HAP was done according to the classification shown in table (4) that was published by **Frisanchs, 1993** for the evaluation of growth and nutritional status. According to this classification 12.7% of the children were low weight for age, 21.7% were below the average weight 21.1% were short and 13.90% were below the average. By investigating the intake of the short children, 71.1% of them, had vitamin A intake < 50% of the RDA (recommended dietary intake) and 60.5% of them had zinc intake < 50% of the RDA. For the low weight children 56.5% and 52.2% of them had <50% of the RDA for vitamin and zinc respectively. **Sampson et al, 1995** indicated that children who consumed < 50% of RDAs are considered at extremely low nutrient intake ***(Sampson et al, 1995)***.

No significant differences were as well shown in this study between serum levels of each of the retinol, RBP and zinc in short and low weight children as compared to those with normal growth. Apparently, deficiencies in these biochemical parameters have no impact on the abnormalities shown in growth of some of these children. This was as well shown in the study of **Quttb et al (1995)** that showed no relationship between vitamin A level and weight of the children.

C-Dietary Intake Assessment: -

In this study relationship of vitamin A status of the children as assessed biochemical to different nutrients intake was studied. The 24 hour recall procedure as well as the frequency of intake of food items rich in vitamin A were used for data collection. All the foods consumed by children were converted to its relative nutrients by using software FNIP (Food and Nutrient Intake program).

The mean vitamin A intake estimated for our children was 291 Retinol Equivalent (RE) for those with inadequate serum retinol (≤20 Ug/dl) compared with 323 with adequate serum retinol level (>20 Ug/dl).

Molla et al 1993 estimated vitamin A intake for the Pakistani pre-school children (6-60 months) results revealed the intake was 362 (Retinol Equivalents R.E.) versus 431 RE for the inadequate and adequate serum retinol group.

Khalil et al, 1996 in Egypt found that the mean vitamin A intake for pre-school children was 321 RE for children with low and deficient plasma retinol levels (≤20Ug/dl) compared to 369 RE in the group with adequate serum retinol level (>20 Ug/dl).

The mean retinol equivalent for all the children was 317 ± 528 and for zinc intake was 5.0 ± 1.183 mg 24 hours. The mean levels represent 79 ± 132% RDA for retinol and 50 ± 18.3% RDA for zinc.

If we compare these results with the results of the National survey conducted by the Nutritional Institute with collaboration with UNICEF (1995), it was found that 50% of the children in the National survey get less than 100% of RDA of vitamin A versus 86.7% in our study, and those who had < 75% of their RDAs were 40.6% versus 82.2% in National survey and in our study respectively.

This study agreed with the results of a previous one that conducted in an urban slum in Cairo, on preschool children suffering from diarrhea, where they found that 75% of the children were receiving <60% of their RDA for vitamin A (for our results it was found that 75% of the studied children had < 60% of their RDA from vitamin A). **Khalil et al, 1996** found that 75-80% of the preschool children in one of the villages in Giza Governorate consumed vitamin A below the minimum daily requirements. Mean while **Harrison et al, 1997** on their national survey about household food security found that 40% of the preschool children had less than 50% of their RDA for vitamin A, while in our study the percentage was 67.7%.

Frequency of consumption of food groups of rich sources of vitamin A was as well studies. Results showed that more than 25% (40-50%) of the children consumed leafy vegetables as cooked and fresh vegetables as carrot, tomatoes less than 3 times per week, this agreed with results of the national survey, 1995.

More than 95% of the children consumed eggs and meat less than 3 times per week, but the situation for milk is somewhat different since 50% of the children consumed milk less than 3 times per week. According to WHO/UNICEF (1994) reduced milk consumption is

considered a high-risk ecological factor for vitamin A deficiency. This was reflected on serum vitamin A level where there was significant difference ($P< 0.01$) between those who consumed milk for equal to or more than 3 times per week and those who consumed less than that. As to sweet potatoes and carrots, serum vitamin A was higher with higher consumption of these foods, but differences were not significant. This agreed with the study conducted in Bangladesh 1996 by **Hussain and Kvale** to study socioeconomic conditions, demographic factors, use of vitamin A capsules and dietary practices in relation to the risk of low serum vitamin A. The authors found that the level of serum vitamin A was strongly related to age and consumption of β-carotene rich food.

In other study conducted in Panama by **Cabllero et al 1996** on prevalence of vitamin A deficiency in pre-school children, their results showed that high risk of inadequate dietary vitamin A intake closely paralleled low serum retinol levels, especially the highest prevalence of inadequate intake was found in the western region, especially among Indian groups .

A positive correlation was found between serum vitamin A and intake of vitamin A ($r=0.89$ $P<0.000$) where as the same phenomena was found as regards to carotene intake ***(Nimsakul, 1994)***. This result agreed with that of **Khalil et al 1996** and **Caballero et al, 1996**.

No correlation was found between total fat intake and serum vitamin A, this was not the case with Khalil et al, 1996 where the correlation was poor ($r = 0.20$).

D- Immunoglbulins Status of the Children:-

Previous studies have indicated a direct effect of vitamin A status clearly affects immune function and may lead to impaired immune competence ***(Wieringa, 1998)***. In this study immune status of the children was assessed by measuring serum levels of each of the immunoglobulins IgG, IgM and IgA in some of the children among base line data. When the supplementation started both the supplemented and unsupplemented children were monthly clinically followed for the next 6 months after supplementation. During this period the number of the episodes of diarrhea attack as well as respiratory infection attacks were determined in both groups. Results of this study showed that the mean serum levels of each the IgA, IgM and IgG were within the normal values at all age group. No significant differences were shown between immunoglobulins levels at each of the age group.

No significant differences were as well shown between the mean levels of the immunoglobulines of the two groups (supplemented and unsupplemented), before the supplementation program started. Correlation coefficients between serum vitamin A level and each of the immunoglobulins levels were also not significant. Immunoglobulins levels of the short (HAP < 1.77) and the low weight children (WAP < 2.52) were within the normal range thus indicating no impact of the nutritional status of the children on the immunoglobulin levels.

E- Supplementation Trial and Morbidity Follow up:-

Supplementation with vitamin A is according in this study by giving

oral dose of 200.000 IU to each child. After 30 days of giving the supplement, retinol serum level was predetermined in both the supplemented and the unsupplemented groups. In the supplemented group mean serum retinol level was significantly increased by 11.9% while in the unsupplemented group, the retinol level was almost the same.

Non of the children had serum retinol $\leq$ 20 Ug/dl after the supplementation. Previous similar trials with 200.000IU oral dose given to children from 1 - 5 years showed that plasma retinol level was improved after 3 and 6 months from the start but 8% of the children were still deficient with serum retinol level < 10 Ug/dl ***(Kartasamita et al, 1995)***. Another study in china showed that supplementation of children under 3 years of age with large dose of vitamin A (200.000 IU) increased significantly serum vitamin A and IgA levels of the studied children above those of the controls.

Other studies from Nigeria have shown by giving two doses of 200.000 IU with three weeks interval, got 83% recovery from night blindness ***(Uzodinma, et al, 1983)***. Another approach was done in India in which red palm oil was given to children (4g/child/day) for a period of one year with the inclusion of vitamin A rich food in the meals. In this study 12.45 – 14.54 Ug/dl raised mean level of serum retinol by the end of the year ***(Devadas et al, 1988)***.

Previous studies showed that vitamin A supplementation to children, resulted in a significant increase in immunoglobulin G subclasses ***(Coutsoudies et al, 1992 and Samba et al, 1994)***. Other indicators for

immune status such as interlukin 2 and plasma complements values were however unaffected by vitamin A supplementation. These findings show that the pathways of vitamin A activity in decreasing morbidity and mortality are partly found on selective immunopotentiation. Morbidity study was done for 6 months after supplementation. The results showed that 25/90 (27.8%) of the vitamin A supplemented children had diarrhea episodes as compared with 53/90 (58.9%) for the children of the unsupplemented group. For respiratory infection, 28/90 (1.1%) of the vitamin A supplemented group had respiratory episodes as compared with 48/90 (53.3%) respiratory episodes for the unsupplemented group. These findings therefore demonstrate the impact of vitamin A supplementation on morbidity since the supplemented group significantly showed lower number of episodes of diarrhea and respiratory infection (R) as compared to the unsupplemented one.

Results of this study also showed that 23% of the diarrheal children had vitamin A $\leq$ 20 Ug/dl as compared with 17.2% in the nondiarrheal ones. The difference was not significant (table 27). Similarly 20.8% of the children with respiratory tract infection had serum vitamin A $\leq$ 20 Ug/dl as compared with 19.0% in the uninfected ones (table 28) and the difference was not significant.

In previous studies different types of supplementation programs were conducted aiming to reduce the episodes of infectious diseases among children as diarrhea, respiratory infection, pneumonia and measles. Some of the studies showed that single large dose of vitamin A supplementation did not have benificial effect on the incidence of diarrhea and respiratory infection (RI) ***(Kartoesasmita et al, 1995;***

Rahman et al, 1996 and Nacut et al 1997). The authors also added that a large proportion of the infants remained vitamin A deficient over after supplementation due to the frequent respiratory tract infections. Another study suggested that the efficiency of one dose of vitamin A in oil to prevent measles complications was not as effective as two 200.000 IU dose of water miscible ***(Rosales et al, 1996)***.

In India, in two studies supplementation of children under 6 years with large dose of vitamin A, showed no statistically significant difference in the incidence of diarrhea episodes or respiratory infection (RI) however there was a significant difference in the duration of the diarrhea episodes ***(Brswas et al, 1994 and Bhandari et al, 1994)***.

In Brazil a study on 1240 children aged 6-48 months showed that supplementation with large dose reduced the incidence of diarrhea episodes by 20% in the vitamin A supplemented group than that of the placebo group ***(Barrate et al, 1994)***. Other authors in Bengaldesh suggested that vitamin A can be given safety during diarrhea illness to augment hepatic reserves and possibly provide a beneficial effect regard to subsequent episodes of diarrhea and other infections ***(Hennign et al, 1992)***.

Despite these contradiction in the results of vitamin A supplementation and despite the wide variations in the strategies offered for supplementation, the value of vitamin A as an "anti-infective" therapy in controlled clinical trials and the recent studies provided compelling scientific evidence for the use of vitamin A supplementation as an important public health intervention .


CLUSION
AND

CONCLUSION & RECOMMENDATION

The present study shows that serum vitamin A increase after supplementation of oral dose of 200.00IU of vitamin A.

Also vitamin A supplementation improved morbidity of the children, concerning the diarrhea and respiratory infection, only 26.1% have diarrhea, 28% have respiratory tract infections, in comparison to 47.7% and 57.6% respectively in un-supplemented group.

We recommend the following:

A- **Periodic vitamin A supplementation** especially for vulnerable groups.

- Just post natal, as increasing concentration of serum vitamin A will increase vitamin A concentration in the milk as breast feeding must should be continued untill the age of 2 years.
- Infant, below one year should be given vitamin A every six month in a dose of 100.000 IU. Now the Ministry of Health give vitamin A in the schedule of immunization with vaccine of measles at nine month, for the age above one year we give vitamin A in a dose of 200.000 IU up to 2 years.
- Pre school children should have 200.000IU vitamin A orally every six-month, we recommend oral rout because it is cheaper

and easy.

B- **Food fortification:** Vitamin A can be added to powdered milk or any other baby formula. Minerals and other vitamins can be considered.

C- Nutritional Education through:

- Pediatrician: maternal and child health personel to educate: the mother, the school teacher especially of kinder garden about rich sources of vitamin A and the importance of green leafy vegetables.

- Mass media: to let the mother know the complication of respiratory tract infection and diarrhea, and the importance of their children to eat food rich in vitamin A which decrease the incidence of diarrhea attacks and respiratory tract infection.

SUMMARY

SUMMARY

Nutritional status is an important concept that often to be misunderstood. Vitamin A is an organic dietary constituent for life, health and growth. Vitamin A is essential for a number of physiological process, normal growth, cellular differentiation, gene expression, maintour of body epithelial tissue and immune function, vitamin A was termed "The anti-infective vitamin". Vitamin A helps the body to resist infection. It helps to keep the entire cell on the surface of body healthy, so that it is difficult for microorganism to enter the body. These body surfaces include the skin, inside the mouth the cells that line the gut, and the cells that line respiratory tract. When there is vitamin A deficiency immunity is depressed and mucus production is decreased. So that the bacteria can stick more easily to respiratory mucosa. Because of this event mild vitamin A deficiency may increase susceptibility to respiratory disease. Thus vitamin A level are associated with increase mortality and severity of morbidity of gastro-intestinal disease. So it is very important that not only the severe cases of hypovitaminosis A be diagnosed for immediate treatment, but also the marginal cases of vitamin A deficiency be diagnosed early as possible, so that appropriate preventive measures are implemented.

Vitamin A in blood consists almost of retinol bound to its specific serum carrier protein-retinol-binding protein (RBP). Plasma retinol levels are used, as an indicator of vitamin A status in human when direct liver analysis is not possible by autopsy or biopsy. The cut off of

plasma vitamin A concentration is 20 Ug/dl, below, which a deficiency state is considered.

Fat, protein, zinc and vitamin E help the body to absorb or use vitamin A. Humans, animals, birds and fish store vitamin A in their liver.

The aim of this work:-

1. To estimate vitamin A in children aged 2-5 years.
2. To find out the morbidity status of the children especially for respiratory infection and diarrhea diseases.
3. To estimate their nutrient intake.
4. To implant an intervention trial for part of those children.
5. Finally to find out the impact of this intervention.

In our study we measure; serum at the base line: Serum vitamin A, RBP, zinc and immunoglobuline IgA, IgM, IgG of 180 children. Then we gave vitamin A orally in a dose of 200.000IU for 90 child only. After 30 days we measure vitamin A another time for the whole children. After that the whole children are followed up for 6 months after supplementation of vitamin A for the attacks of diarrhea and respiratory tract infection.

We found that:-

1. The serum vitamin level increase after 30 days of supplementation of vitamin A in the supplemented group, and there is no elevation of serum vitamin A in un-supplemented group.

2. The level of serum RBP, and serum zinc is affected according to the level of serum vitamin A, they are higher when serum vitamin A > 20 Ug/dl than when serum vitamin A ≤ 20 Ug/dl.

Also, from follow-up of the children for six months after supplementation of vitamin A for the attacks of diarrhea and respiratory tract infection, we found that the attacks of diarrhea and respiratory tract infection are less in children with vitamin A supplementation than un-supplemented children.

Also, the attacks of diarrhea and respiratory tract infection in supplemented group are less in the first months of follow-up and become increase by the end of the months of the follow-up of the study.

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APPENDIX

Name:

Date:

Age:

Sex: Male Female

Adress:

Birth Order:

Family Size:

Mother Education:

Father Education:

Smoking Status:

Mother Job: Father Job:

Past History:

1-Vaccination: DPT: Measls:

2-Respiratory Infection:

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Any Treatment: Antibiotics:

For How Long: Frequency:

Antitussive:

Expectorants:

Corticosteroids:

Any Other Treatment:

3-Diarrhoea:

-Any Parasites:

-Any Other Treatment:

Examination:

*Clinical Examination:

-Head & Neck:

-Chest:

-Heart:

-Abdomen:

-U.L. L.L.

*Anthropometric Measurments:

-Weight:

-Hieght:

-Mid Upper Arm Circumferance:

-Triceps Skin Fold thickness:

Check List

Butter

Ghee

Egg; whole

Egg yolk

Kidney

Bstrema

Chicken

Milk Full Cream

Milk Half Cream

Cheese

Cerelac

Riri

Carrots

Mango

Beach

Gauava

Orange

Dates

Vegetables:

خبيزة
ملوخية
فجل
جرجير
خس
فلفل أخضر
ورق عنب
كرات

24 hour recall

Date of interview	Day	Month	Year
Child's Name	Sex	Male	Female
Age	In months		

Meals	Food items	Quantity
Breakfast		
Snack		
Lunch		
Snack		
Dinner		

Remarks

NO_	AGE	AGE_C	SEX	WT__KG_	HT__CM_	MAC_CM_
1.00	4.0000	3-4	F	15.00	98.00	15.00
2.00	4.2000	4-5	M	15.00	10.20	13.00
3.00	4.0000	3-4	F	15.00	96.00	14.00
4.00	2.6000	2-3	M	10.00	79.00	13.50
5.00	4.2000	4-5	F	14.00	99.00	14.50
6.00	2.7000	2-3	M	15.00	88.00	16.00
7.00	2.8000	2-3	F	12.00	84.00	14.50
8.00	5.0000	4-5	M	20.00	105.00	17.00
9.00	3.1000	3-4	M	12.00	90.00	14.00
10.00	3.2000	3-4	M	14.00	100.00	15.00
11.00	3.6000	3-4	M	13.00	88.00	13.00
12.00	4.6000	4-5	F	18.00	104.00	15.00
13.00	4.6000	4-5	F	19.00	95.00	19.00
14.00	4.3000	4-5	M	17.00	93.00	16.00
15.00	3.3000	3-4	M	14.00	90.00	14.00
16.00	2.9000	2-3	F	14.00	86.00	16.00
17.00	3.6000	3-4	F	14.00	88.00	15.50
18.00	3.6000	3-4	F	15.00	98.00	15.50
19.00	4.8000	4-5	M	19.00	107.00	16.00
20.00	4.6000	4-5	M	17.00	104.00	15.00
21.00	2.6000	2-3	F	12.00	82.00	14.00
22.00	4.2000	4-5	F	13.00	87.00	13.00
23.00	3.1000	3-4	F	12.00	87.00	14.50
24.00	3.0000	2-3	F	16.00	93.00	16.00
25.00	5.2000	4-5	M	21.00	110.00	14.00
26.00	2.9000	2-3	M	16.00	99.00	18.00
28.00	4.1000	4-5	F	15.00	98.00	15.00
29.00	4.0000	3-4	M	14.50	102.00	13.00
30.00	4.0000	3-4	F	15.00	96.00	14.00
31.00	2.6000	2-3	M	10.00	79.00	13.00
32.00	3.9000	3-4	F	14.00	99.00	14.50
33.00	4.9000	4-5	M	15.00	104.00	14.00
34.00	4.1000	4-5	F	14.00	97.00	15.00
35.00	3.0000	2-3	F	13.00	95.00	17.00
38.00	3.2000	3-4	M	14.00	100.00	15.00
39.00	4.6000	4-5	F	16.00	98.00	19.00
40.00	5.0000	4-5	M	19.00	112.00	14.00
41.00	5.0000	4-5	F	17.00	112.00	15.00
42.00	4.9000	4-5	F	21.00	109.00	17.00
43.00	4.2000	4-5	M	15.00	95.00	15.00
44.00	3.4000	3-4	F	11.00	94.00	14.00
45.00	4.0000	3-4	F	14.00	96.00	15.00
46.00	2.6000	2-3	M	10.50	81.00	13.00
47.00	4.0000	3-4	M	19.00	108.00	19.00
48.00	2.8000	2-3	M	10.50	89.00	13.00
50.00	3.8000	3-4	F	11.50	93.00	14.50
51.00	4.3000	4-5	M	15.00	95.00	16.00

T_S_F_MI	D_NO_	R_NO_	VIT__A_B	VIT_AB_C	VIT__A_3	ZINC
5.50		2	19.60 <=20		21.50	60.20
4.80		2	34.00 >20			93.00
5.00			30.00 >20		32.00	114.00
6.00		1	30.40 >20		31.80	101.90
5.00			28.00 >20		29.50	
7.00	1	1	33.20 >20			70.20
9.50		1	25.20 >20		28.20	
10.00			20.00 <=20		24.80	51.10
9.00	1	1	12.40 <=20		21.00	60.30
4.20		1	35.00 >20		38.10	78.50
4.00		1	21.00 >20		26.00	67.60
4.00			20.00 <=20		23.00	60.30
4.00	1	1	33.20 >20		35.00	76.70
5.20		1	30.40 >20		32.60	98.50
7.00	1	1	34.00 >20		38.00	74.80
8.50			19.60 <=20		24.00	54.30
7.40			21.00 >20		23.30	57.40
8.30	1		30.00 >20		34.70	89.40
6.50		1	33.20 >20		31.50	87.80
5.50			35.00 >20		36.00	120.30
4.90	1		37.00 >20		36.90	87.50
4.50			42.00 >20			80.30
4.20		1	39.00 >20		41.00	87.80
5.90	1		42.00 >20		41.20	169.40
5.90		2	34.00 >20			74.70
6.10	1	1	44.00 >20		40.00	133.00
5.50			23.00 >20		24.00	63.70
4.80		2	25.00 >20			67.60
5.00			19.60 <=20		23.00	64.80
4.80		1	30.00 >20		30.80	93.00
5.00			28.00 >20		31.20	71.20
6.00	2	1	33.20 >20		36.20	
8.00			25.20 >20		28.20	67.60
8.00			12.00 <=20		20.10	62.40
4.20	1		19.60 <=20		22.30	67.60
4.30	1		37.00 >20		36.70	98.50
5.00			20.00 <=20		24.20	60.30
5.10			25.10 >20		28.20	62.20
6.10			41.00 >20		40.00	120.30
6.00			34.00 >20		33.50	120.30
6.00	1	1	23.70 >20			
4.90			22.70 >20		26.20	62.40
6.00			23.60 >20		28.40	67.60
7.00			37.00 >20		33.60	
5.00			19.60 <=20		24.20	60.30
5.30	2	2	23.20 >20		33.00	
5.80			23.40 >20		30.20	

R_B_P	IGG	IGA	IGM	GROUP
1.10	3.70	132.00	130.00	Vit. A S
2.50	8.40	126.00	80.20	Vit. A S
3.20	6.40	99.80	130.00	Vit. A S
	11.20	132.00	96.80	Vit. A S
1.20	13.40	144.00	101.30	Vit. A S
3.00	12.80	100.20	126.00	Vit. A S
2.50	3.70	124.00	96.80	Vit. A S
1.80	8.40	150.00	80.20	Vit. A S
1.10	13.40	99.00	101.30	Vit. A S
	11.20	132.10	124.60	Vit. A S
1.80	14.80	132.00	130.00	Vit. A S
1.80	12.70	124.00	149.00	Vit. A S
3.00	11.20	175.80	101.30	Vit. A S
	6.40	150.00	80.20	Vit. A S
3.20	12.80	80.00	130.00	Vit. A S
	13.80	150.00	96.80	Vit. A S
2.00	6.30	99.00	126.00	Vit. A S
3.20	6.40	169.00	80.80	Vit. A S
2.50	3.70	132.00	130.00	Vit. A S
3.00	13.40	132.00	96.30	Vit. A S
3.20	13.80	130.00	124.60	Vit. A S
3.20	8.40	96.80	130.00	Vit. A S
4.50	14.80	144.00	80.60	Vit. A S
4.50	7.20	99.80	80.60	Vit. A S
3.20	8.70	99.00	90.80	Vit. A S
2.50	8.40	132.00	124.60	Vit. A S
1.80	8.40	132.00	80.20	Vit. A S
	14.80	126.80	130.00	Vit. A S
1.10	11.20	124.00	124.60	Vit. A S
2.60	6.40	130.00	96.30	Vit. A S
2.50	12.80	99.00	124.60	Vit. A S
3.00	13.40	126.00	130.00	Vit. A S
2.50	11.20	150.00	90.80	Vit. A S
1.80				Vit. A S
1.10				Vit. A S
2.00				Vit. A S
3.00				Vit. A S
2.50				Vit. A S
				Vit. A S
2.00				Vit. A S
				Vit. A S
1.10				Vit. A S
				Vit. A S
				Vit. A S
1.80				Vit. A S
				Vit. A S
2.00				Vit. A S

52.00	3.1000	3-4	F	16.00	105.00	15.00
53.00	2.6000	2-3	M	12.00	88.00	14.50
54.00	4.3000	4-5	F	15.00	101.00	15.00
55.00	4.8000	4-5	M	16.00	98.00	15.00
56.00	2.6000	2-3	F	10.00	85.00	13.00
57.00	4.1000	4-5	F	14.00	102.00	14.50
58.00	4.0000	3-4	M	15.00	107.00	13.50
59.00	3.1000	3-4	F	15.50	102.00	15.00
60.00	4.5000	4-5	M	21.00	112.00	15.00
61.00	2.4000	2-3	M	10.00	89.00	13.50
62.00	5.0000	4-5	M	17.00	111.00	16.50
63.00	3.8000	3-4	F	12.00	91.00	15.00
64.00	3.6000	3-4	M	13.00	89.00	13.50
65.00	3.0000	2-3	M	14.00	100.00	15.00
66.00	4.2000	4-5	F	14.00	99.00	14.50
67.00	3.2000	3-4	M	14.00	100.00	15.00
68.00	4.0000	3-4	F	15.50	104.00	16.00
69.00	2.6000	2-3	M	11.00	90.00	13.50
70.00	4.3000	4-5	M	17.00	96.00	16.00
71.00	4.9000	4-5	M	18.00	103.00	14.50
72.00	2.8000	2-3	F	12.50	89.00	14.50
73.00	4.8000	4-5	M	19.00	104.00	16.00
74.00	3.2000	3-4	F	14.00	100.00	15.00
75.00	3.0000	2-3	F	13.00	95.00	17.00
76.00	5.0000	4-5	F	17.00	112.00	16.00
77.00	2.6000	2-3	M	14.00	92.00	14.50
78.00	4.1000	4-5	M	15.50	100.00	14.00
79.00	4.0000	3-4	F	14.00	98.00	14.00
80.00	3.9000	3-4	M	13.50	96.00	14.80
81.00	4.1000	4-5	F	14.50	97.00	16.00
82.00	4.9000	4-5	M	16.00	104.00	14.00
83.00	2.6000	2-3	M	11.50	90.00	14.50
84.00	5.0000	4-5	M	20.00	105.00	17.00
85.00	3.3000	3-4	M	14.00	91.00	14.50
86.00	4.8000	4-5	F	19.00	107.00	15.50
87.00	3.2000	3-4	F	12.00	87.00	14.50
88.00	4.8000	4-5	M	19.00	107.00	16.00
89.00	4.3000	4-5	F	15.00	101.00	15.50
90.00	2.7000	2-3	F	11.00	92.00	13.00
91.00	4.9000	4-5	M	21.00	108.00	16.50
92.00	2.3000	2-3	M	11.50	91.00	13.50
93.00	4.3000	4-5	F	15.00	100.00	15.50
94.00	4.1000	4-5	M	18.00	109.00	16.00
1.00	4.2000	4-5	F	15.50	98.00	15.00
2.00	4.0000	3-4	M	14.50	102.00	13.00
3.00	2.6000	2-3	M	11.00	82.00	13.50
4.00	4.3000	4-5	M	15.00	101.00	15.00
5.00	2.4000	2-3	F	13.00	89.00	14.50

6.10			33.20 >20	36.40	73.00
4.80			26.20 >20	25.90	80.30
6.10			23.40 >20	28.00	
7.00	1		31.20 >20	42.00	
5.00	1		30.20 >20	34.80	
5.20			21.80 >20	30.20	100.30
4.70			21.60 >20	34.50	87.60
6.90	1		25.00 >20	33.00	76.50
5.50			30.10 >20	31.30	87.60
5.00	2	1	22.60 >20	28.40	54.30
5.10			23.50 >20	26.80	
5.80			26.20 >20	29.40	76.60
4.00	1	1	13.80 <=20	20.80	
4.20			19.30 <=20	22.30	87.60
5.00			25.00 >20	28.00	108.20
4.20		1	22.70 >20	30.20	98.70
5.80	1		23.40 >20	31.20	76.50
6.00		1	27.90 >20	31.40	101.90
5.30			26.90 >20	28.20	70.20
5.80		1	33.20 >20	34.00	92.40
6.50			19.40 <=20	21.20	
6.50			12.60 <=20	19.40	
4.20	1		21.00 >20	22.20	51.10
4.80	1		20.00 <=20	24.40	
5.20			30.40 >20	32.50	86.00
4.80			26.90 >20	28.10	70.20
5.20			23.40 >20	26.50	
5.00		2	27.90 >20	28.10	98.70
5.10			19.80 <=20	23.40	70.20
8.00			12.40 <=20		67.80
6.10	1		33.60 >20	40.80	98.50
5.10	1	1	23.20 >20	28.60	71.20
8.50			22.10 >20	24.20	
7.10	1	1	22.70 >20	24.80	
5.90			32.00 >20	34.00	93.00
4.20			24.90 >20	30.80	
5.90	1		23.40 >20	24.20	74.80
6.30	1		22.30 >20		76.70
4.90			26.50 >20	28.60	114.00
6.30			22.60 >20	22.10	65.70
4.90	1		23.50 >20	28.00	80.30
6.30			26.20 >20	28.10	
8.10			13.80 <=20	21.00	
5.50	1	1	23.40 >20	28.00	
4.80	2	1	19.60 <=20	21.00	71.20
4.90		1	26.20 >20	28.20	93.00
6.10	1		33.20 >20	34.00	67.60
5.20			37.00 >20	35.00	48.50

3.20				Vit. A S
				Vit. A S
3.20				Vit. A S
3.20				Vit. A S
3.20				Vit. A S
3.00				Vit. A S
4.50				Vit. A S
2.50				Vit. A S
2.50				Vit. A S
2.50				Vit. A S
2.60				Vit. A S
1.50				Vit. A S
1.10				Vit. A S
1.10				Vit. A S
1.20				Vit. A S
1.80				Vit. A S
3.00				Vit. A S
2.50				Vit. A S
3.00				Vit. A S
1.80				Vit. A S
1.21				Vit. A S
1.10				Vit. A S
2.00				Vit. A S
1.80				Vit. A S
3.20				Vit. A S
1.10				Vit. A S
1.80				Vit. A S
2.50				Vit. A S
1.80				Vit. A S
				Vit. A S
				Vit. A S
				Vit. A S
1.10				Vit. A S
				Vit. A S
2.50				Vit. A S
3.20				Vit. A S
1.80				Vit. A S
				Vit. A S
1.80				Vit. A S
3.20				Vit. A S
				Vit. A S
2.50				Vit. A S
				Vit. A S
1.10	13.40	132.00	80.20	Non. sup
1.80	12.80	150.00	101.30	Non. sup
2.50	11.20	96.00	130.00	Non. sup
1.10	12.80	130.00	80.20	Non. sup
2.50	13.80	130.00	149.00	Non. sup

6.00	4.6000 4-5	M	16.00	101.00	16.00
7.00	4.0000 3-4	M	14.00	100.00	13.00
8.00	4.4000 4-5	F	16.00	99.00	15.00
9.00	4.4000 4-5	F	16.00	100.00	15.00
10.00	2.7000 2-3	F	12.00	94.00	13.50
11.00	3.2000 3-4	F	15.50	104.00	14.50
12.00	4.5000 4-5	F	15.00	96.00	15.00
13.00	4.8000 4-5	M	19.00	104.00	15.50
14.00	2.4000 2-3	F	11.00	88.00	13.50
15.00	4.3000 4-5	M	14.50	98.00	15.50
16.00	4.0000 3-4	F	14.00	100.00	14.00
17.00	4.3000 4-5	M	15.50	103.00	13.00
18.00	3.9000 3-4	F	12.50	96.00	15.00
19.00	3.8000 3-4	M	15.00	101.00	14.50
20.00	2.7000 2-3	F	10.50	88.00	15.50
21.00	4.0000 3-4	M	15.00	103.00	16.00
22.00	4.4000 4-5	M	19.00	107.00	15.50
23.00	2.9000 2-3	M	11.00	92.00	13.50
24.00	3.1000 3-4	F	12.00	88.00	14.50
25.00	2.8000 2-3	M	11.00	90.00	14.00
26.00	4.0000 3-4	M	19.00	108.00	19.00
27.00	5.1000 4-5	M	18.00	106.00	16.00
28.00	2.6000 2-3	M	10.50	83.00	13.50
29.00	2.4000 2-3	F	11.50	92.00	14.00
30.00	4.8000 4-5	M	15.00	97.00	15.50
31.00	3.6000 3-4	F	11.50	96.00	14.50
32.00	2.8000 2-3	M	12.00	93.00	14.00
33.00	4.2000 4-5	M	15.50	94.00	15.00
34.00	2.5000 2-3	F	11.00	88.00	13.50
35.00	4.1000 4-5	F	14.50	97.00	16.00
36.00	4.4000 4-5	M	20.00	100.00	17.00
37.00	4.3000 4-5	M	16.00	106.00	15.00
38.00	4.1000 4-5	F	15.50	102.00	14.00
39.00	5.0000 4-5	M	20.00	113.00	15.50
40.00	3.1000 3-4	F	16.00	103.00	14.50
41.00	4.3000 4-5	F	15.00	102.00	15.50
42.00	4.1000 4-5	F	14.00	106.00	17.50
43.00	5.0000 4-5	F	18.00	110.00	16.00
44.00	4.8000 4-5	M	16.00	106.00	16.00
45.00	3.9000 3-4	M	12.50	98.00	15.00
46.00	4.9000 4-5	F	15.50	100.00	18.00
47.00	4.1000 4-5	F	14.50	96.00	15.50
48.00	4.8000 4-5	M	20.00	108.00	16.50
49.00	5.0000 4-5	F	17.50	113.00	16.00
50.00	3.9000 3-4	F	14.00	96.00	15.00
51.00	2.5000 2-3	F	11.00	92.00	14.00
52.00	3.1000 3-4	M	12.00	88.00	15.00
53.00	4.6000 4-5	M	15.00	103.00	15.00

5.80	1	1	23.40 >20	20.00	
4.90		3	22.70 >20	19.60	93.00
6.40	1		34.00 >20	33.20	
6.10	1	2	23.20 >20	25.20	67.60
5.10			27.20 >20	28.00	
5.10	1		41.00 >20	38.20	
7.00	1	1	37.00 >20	33.20	89.40
5.80	1	1	31.00 >20	30.00	74.80
4.90			28.00 >20	30.00	79.30
5.90	1		30.00 >20	28.90	120.30
5.30		1	19.60 <=20		
4.80	1		25.00 >20	24.80	
5.60	2	1	23.00 >20	21.00	65.70
6.30	1	1	33.20 >20	33.40	133.60
4.80		2	31.00 >20	32.30	85.70
5.20	1	1	25.20 >20	27.10	80.30
6.10			26.20 >20	24.10	
5.30			33.20 >20	30.40	
4.40			25.20 >20	24.10	
5.10	1	1	20.00 <=20	12.80	73.20
6.80	2	1	31.00 >20	32.00	114.00
5.30			19.60 <=20	18.10	67.60
5.90	1	1	19.30 <=20		57.80
4.90	1		33.20 >20	30.20	93.00
7.10	1	1	25.00 >20	23.50	
6.00	1	2	31.20 >20		93.00
5.00	1	1	22.70 >20	21.80	
5.90			33.20 >20	31.80	77.20
5.20			23.40 >20	24.60	87.80
6.20			26.90 >20	25.80	74.70
8.10			25.00 >20	27.50	93.20
5.10	1		30.10 >20	29.60	80.30
4.90	1		26.20 >20		
5.20	1	3	19.60 <=20	18.60	67.60
6.80	1	1	22.70 >20		
6.10			19.40 <=20	16.80	
6.30			30.40 >20	32.20	
5.30			26.90 >20	25.00	64.80
7.00	1	1	27.90 >20	28.20	93.00
5.30	1		19.80 <=20		73.00
4.80			12.40 <=20	14.00	
6.10	2	1	33.60 >20		101.20
5.80	1	2	26.50 >20	28.10	
6.20	1	1	23.50 >20	25.20	74.70
6.10			13.80 <=20	16.80	
5.30	2	2	30.00 >20		93.00
4.80	2		37.20 >20	38.00	
6.10	2	1	40.10 >20	39.20	114.00

	14.20	132.00	101.30	Non. sup
2.50	12.80	132.00	80.20	Non. sup
	6.40	124.00	126.00	Non. sup
1.20	11.20	124.00	80.80	Non. sup
1.80	13.40	96.00	130.00	Non. sup
	14.80	98.00	80.60	Non. sup
3.20	8.40	102.00	80.60	Non. sup
	11.20	80.00	90.80	Non. sup
3.20	12.70	150.00	124.60	Non. sup
4.50	8.40	80.00	130.30	Non. sup
	16.30	86.00	101.30	Non. sup
	16.40	150.00	80.20	Non. sup
	8.70	150.00	149.00	Non. sup
4.50	11.20	132.00	124.60	Non. sup
	12.80	124.00	90.80	Non. sup
3.00	13.20	96.00	96.40	Non. sup
3.20	13.40	96.00	101.30	Non. sup
	8.40	130.00	80.20	Non. sup
	13.80	132.00	124.60	Non. sup
4.50	13.80	96.00	130.30	Non. sup
	11.20	80.00	90.80	Non. sup
	7.20	80.00	90.20	Non. sup
	14.20	124.00	96.80	Non. sup
	8.40	96.00	124.60	Non. sup
1.80	8.70	96.00	149.00	Non. sup
2.50	12.80	130.00	80.20	Non. sup
3.00	12.80	130.00	124.60	Non. sup
2.50				Non. sup
3.00				Non. sup
				Non. sup
				Non. sup
3.20				Non. sup
1.80				Non. sup
1.80				Non. sup
				Non. sup
				Non. sup
				Non. sup
				Non. sup
1.80				Non. sup
1.10				Non. sup
				Non. sup
				Non. sup
1.80				Non. sup
2.00				Non. sup
1.80				Non. sup
4.50				Non. sup
3.20				Non. sup
4.50				Non. sup

54.00	3.8000 3-4	F	14.00	100.00	14.50
55.00	3.2000 3-4	F	15.00	99.00	15.00
56.00	5.0000 4-5	M	18.00	104.00	16.00
57.00	2.6000 2-3	M	11.00	90.00	13.50
58.00	3.6000 3-4	M	14.50	93.00	15.00
59.00	4.4000 4-5	M	16.50	98.00	16.00
60.00	2.8000 2-3	M	13.00	85.00	15.00
61.00	4.1000 4-5	F	16.00	109.00	16.00
62.00	2.9000 2-3	F	14.00	88.00	16.00
63.00	4.8000 4-5	F	16.00	102.00	15.00
64.00	2.6000 2-3	F	11.50	92.00	14.50
65.00	3.2000 3-4	M	14.00	100.00	15.00
66.00	4.8000 4-5	F	18.00	106.00	15.00
67.00	3.6000 3-4	M	15.00	92.00	15.00
68.00	4.2000 4-5	F	15.00	99.00	17.00
69.00	4.8000 4-5	M	18.00	104.00	15.50
70.00	4.9000 4-5	M	14.50	101.00	15.00
71.00	3.6000 3-4	F	13.00	89.00	14.50
72.00	2.5000 2-3	F	12.00	84.00	13.50
73.00	3.2000 3-4	F	13.50	87.00	14.00
74.00	3.0000 2-3	F	12.50	94.00	14.50
75.00	2.8000 2-3	M	15.00	99.00	16.00
76.00	4.9000 4-5	F	16.00	103.00	15.00
77.00	3.9000 3-4	M	14.00	95.00	15.00
78.00	4.1000 4-5	F	16.00	100.00	15.00
79.00	3.1000 3-4	F	15.50	105.00	14.00
80.00	5.0000 4-5	M	17.00	112.00	16.00
81.00	4.2000 4-5	F	15.50	100.00	15.00
82.00	4.3000 4-5	F	15.00	96.00	15.50
83.00	3.9000 3-4	M	16.00	95.00	16.00
84.00	2.8000 2-3	M	11.00	82.00	14.00
85.00	5.0000 4-5	F	16.00	110.00	16.50
86.00	2.4000 2-3	M	14.00	93.00	14.00
87.00	4.1000 4-5	M	15.00	100.00	14.50
88.00	4.8000 4-5	M	14.50	100.00	13.50
89.00	4.0000 3-4	F	14.50	96.00	13.00
90.00	3.8000 3-4	F	13.50	99.00	14.00

5.10	1	2	33.40 >20	38.00	133.00
4.40	1	1	28.00 >20	23.40	93.00
7.40	1	2	33.20 >20		67.60
5.80			12.40 <=20	14.60	
6.80	1	1	19.60 <=20	20.10	71.20
5.20			20.00 <=20	18.20	
6.30	1	2	30.00 >20	31.20	114.30
6.30			35.00 >20	33.20	71.20
	1	1	34.00 >20		94.20
6.30	1	1	30.40 >20	28.00	79.30
5.40	1	2	21.00 >20	20.40	74.80
4.20			25.20 >20	26.20	
5.60	1	1	19.60 <=20	20.00	
6.30			30.00 >20	31.20	
8.00		1	33.20 >20		93.00
6.10			30.40 >20	30.80	114.00
5.60			37.00 >20		98.50
4.90		3	30.40 >20	36.20	
4.30			34.00 >20		120.30
4.60	1	1	39.00 >20	33.60	71.20
6.10	2	1	21.00 >20	19.60	
5.40	1	1	33.20 >20	37.00	
5.90			12.20 <=20	16.20	76.70
5.30			19.60 <=20	18.90	74.80
5.60	1	1	40.10 >20	41.10	114.00
4.80	2	1	21.00 >20		60.30
6.10	1		<=20		
5.20	1		31.00 >20	28.90	79.80
7.70	1		30.20 >20	32.80	93.00
5.10		1	23.50 >20	26.20	65.70
5.10	1	1	13.80 <=20	16.20	89.40
5.40	1		21.80 >20	20.20	73.00
5.10		2	25.00 >20	26.00	
5.40			21.60 >20	19.20	
5.90			30.10 >20	28.10	114.20
7.30		3	22.60 >20	21.40	
4.90	2	1	31.20 >20	30.20	

4.50	Non. sup
3.00	Non. sup
2.50	Non. sup
1.80	Non. sup
1.10	Non. sup
1.80	Non. sup
3.20	Non. sup
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3.00	Non. sup
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2.00	Non. sup
1.80	Non. sup
	Non. sup
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4.50	Non. sup
	Non. sup
	Non. sup

IDC	SEX	AG	AGE_C	SAMP	WT	HT	VITA	ENG
1.00	2.00	48.00	3-4	Supplem	15.00	98.00	19.60	917.40
2.00	1.00	48.00	4-5	Supplem	15.50	102.00	34.00	1268.20
3.00	2.00	48.00	3-4	Supplem	15.00	96.00	30.00	1608.00
4.00	1.00	30.00	2-3	Supplem	10.00	79.00	30.40	807.20
5.00	2.00	48.00	4-5	Supplem	14.00	99.00	28.00	1608.60
6.00	1.00	31.00	2-3	Supplem	15.00	88.00	33.20	827.50
7.00	2.00	32.00	2-3	Supplem	12.00	84.00	25.20	964.40
8.00	1.00	60.00	4-5	Supplem	20.00	105.00	20.00	1908.50
9.00	1.00	36.00	3-4	Supplem	12.00	90.00	12.40	650.20
10.00	1.00	36.00	3-4	Supplem	14.00	100.00	35.00	916.00
11.00	1.00	42.00	3-4	Supplem	13.00	88.00	21.00	1400.00
12.00	2.00	54.00	4-5	Supplem	18.00	109.00	20.00	1752.30
13.00	2.00	54.00	4-5	Supplem	19.00	95.00	33.20	1136.60
14.00	1.00	48.00	4-5	Supplem	17.00	93.00	30.40	1001.30
15.00	1.00	36.00	3-4	Supplem	14.00	90.00	34.00	1256.40
16.00	2.00	29.00	2-3	Supplem	14.00	86.00	19.60	471.60
17.00	2.00	36.00	3-4	Supplem	14.00	88.00	21.00	1115.70
18.00	2.00	42.00	3-4	Supplem	15.00	98.00	30.00	690.80
19.00	2.00	56.00	4-5	Supplem	19.00	107.00	33.20	1351.60
20.00	1.00	52.00	4-5	Supplem	17.00	109.00	35.00	1213.60
21.00	2.00	30.00	2-3	Supplem	12.00	82.00	37.00	843.30
22.00	2.00	48.00	4-5	Supplem	13.00	87.00	42.00	980.50
23.00	2.00	36.00	3-4	Supplem	12.00	87.00	39.00	645.00
24.00	2.00	36.00	2-3	Supplem	16.00	93.00	42.00	626.30
25.00	1.00	60.00	4-5	Supplem	21.00	110.00	34.00	613.80
26.00	1.00	48.00	2-3	Supplem	16.00	99.00	44.00	971.10
28.00	1.00	60.00	4-5	Supplem	15.00	98.00	23.00	1188.60
29.00	1.00	30.00	3-4	Supplem	14.50	102.00	25.00	1072.80
30.00	1.00	30.00	3-4	Supplem	15.00	96.00	19.60	1425.10
31.00	1.00	36.00	2-3	Supplem	10.00	97.00	30.00	967.70
32.00	2.00	60.00	3-4	Supplem	14.00	99.00	28.00	1522.60
33.00	1.00	57.00	4-5	Supplem	15.00	104.00	33.20	1447.10
34.00	2.00	48.00	4-5	Supplem	14.00	97.00	25.20	1450.50
35.00	2.00	36.00	2-3	Supplem	13.00	95.00	12.00	876.90
38.00	2.00	48.00	3-4	Supplem	14.00	100.00	19.60	704.50
39.00	1.00	60.00	4-5	Supplem	16.00	98.00	37.00	778.90
40.00	1.00	60.00	4-5	Supplem	19.00	112.00	20.00	688.90
41.00	2.00	60.00	4-5	Supplem	17.00	112.00	25.10	1136.60
42.00	2.00	60.00	4-5	Supplem	21.00	109.00	41.00	1059.70
43.00	1.00	48.00	4-5	Supplem	15.00	95.00	34.00	1130.80
44.00	2.00	36.00	3-4	Supplem	11.00	94.00	23.70	679.50
45.00	2.00	48.00	3-4	Supplem	14.00	96.00	22.70	1218.90
46.00	1.00	30.00	2-3	Supplem	10.50	81.00	23.60	1301.60
47.00	1.00	48.00	3-4	Supplem	19.00	108.00	37.00	1381.00
48.00	1.00	24.00	2-3	Supplem	10.50	89.00	19.60	795.60
50.00	1.00	30.00	3-4	Supplem	11.50	93.00	23.20	1396.90
51.00	1.00	48.00	4-5	Supplem	15.00	95.00	23.40	1156.40
52.00	2.00	36.00	3-4	Supplem	16.00	105.00	33.20	1237.80
53.00	1.00	30.00	2-3	Supplem	12.00	88.00	26.20	826.20
55.00	2.00	54.00	4-5	Supplem	16.00	108.00	23.20	1304.30

TPRO	CAR	TFAT	VITAIU	VITARE	CARO	VITC	VITE	IRN
31.88	134.67	28.58	14459.00	1494.00	1421.90	5.45	4.11	4.85
45.22	157.66	53.31	2289.60	316.40	171.30	34.45	6.93	7.27
38.96	234.19	59.52	1145.90	221.70	63.60	19.13	7.05	6.82
20.34	126.07	26.47	669.30	73.90	64.70	111.87	4.37	3.10
45.67	301.96	28.55	624.40	150.60	24.90	5.53	5.22	13.98
30.23	121.85	25.21	419.30	86.00	19.00	13.03	3.75	4.77
36.77	133.17	33.06	557.70	98.70	35.10	3.70	4.65	6.04
59.07	252.60	74.70	1267.10	288.10	21.30	24.47	4.49	5.61
18.26	136.38	7.48	723.00	74.10	74.10	191.51	3.84	3.36
29.28	172.85	14.78	14731.90	1539.60	1444.10	85.24	3.31	6.99
49.70	227.02	35.60	433.00	75.40	26.90	17.21	4.18	9.08
59.59	299.95	40.48	14424.80	1463.60	1432.00	22.00	5.47	11.65
37.15	175.24	36.07	1406.10	160.00	131.30	34.17	10.51	9.41
30.67	158.69	29.59	1829.30	289.40	145.10	48.13	10.46	7.39
34.09	174.11	48.67	2324.90	443.90	131.80	17.07	4.15	4.44
15.01	74.89	12.89	532.20	141.30	7.60	0.05	1.57	2.18
31.97	178.16	29.83	1155.60	213.60	49.80	15.42	3.93	2.49
25.68	91.75	26.12	386.90	93.80	16.10	9.55	2.46	4.52
32.84	262.22	19.61	660.70	108.80	45.70	58.88	5.17	5.25
36.01	233.44	19.92	556.70	80.80	44.00	81.36	4.59	6.28
23.48	112.00	34.54	434.20	87.40	23.50	8.04	5.38	3.37
34.89	169.55	20.74	1020.20	212.90	53.10	24.59	3.49	6.69
23.67	118.96	9.50	451.50	92.80	21.30	15.59	2.32	4.66
23.61	110.02	11.85	668.80	100.00	50.10	23.24	4.21	4.80
23.12	104.75	13.35	1264.90	200.60	96.10	34.99	2.26	5.33
26.64	206.00	10.07	664.30	96.20	53.10	122.93	2.83	5.44
44.78	188.37	28.59	1215.70	181.60	18.10	41.46	3.63	7.58
40.54	143.71	36.43	1414.80	278.40	60.00	11.30	2.10	3.48
42.87	204.76	52.90	924.40	203.50	24.10	21.58	3.84	7.36
20.52	185.09	17.99	14592.80	1482.10	1449.00	97.05	6.08	3.74
44.57	223.00	55.08	1147.80	262.80	29.50	19.16	3.98	8.29
64.29	186.60	51.64	1342.00	269.30	30.10	7.40	4.63	7.00
60.64	197.04	47.15	936.50	200.00	39.00	14.77	7.24	8.10
17.67	100.04	46.46	340.40	84.80	8.70	6.13	7.06	3.46
35.97	61.33	35.49	1519.30	274.80	77.20	21.02	2.01	2.86
20.91	120.20	26.68	1051.40	169.10	76.50	37.40	3.49	5.11
25.64	101.12	21.92	736.90	99.10	60.30	14.98	2.81	4.65
37.20	206.55	23.18	706.30	126.90	42.50	57.81	3.84	7.14
35.11	154.77	35.51	1011.50	221.20	33.20	26.03	1.92	4.30
31.11	162.01	42.46	437.80	79.90	26.30	30.38	7.04	6.15
16.24	. 90.61	29.81	442.30	98.80	18.90	20.60	1.57	2.97
38.11	227.95	22.71	638.30	108.60	41.20	57.67	3.79	7.57
31.33	243.21	23.22	14549.80	1480.50	1445.40	85.45	7.53	5.23
29.92	240.01	34.44	28876.00	2935.70	2863.70	91.22	8.35	5.48
27.91	134.84	17.41	340.60	86.20	13.10	0.71	3.47	5.63
36.16	223.56	38.65	888.10	141.80	52.50	109.69	7.22	2.69
33.32	154.39	48.13	1343.40	259.70	70.40	24.48	4.69	6.41
36.13	171.61	48.46	1343.40	259.70	70.40	24.48	4.87	7.00
24.50	131.72	24.41	628.40	152.00	21.80	14.11	3.24	4.60
21.44	93.49	9.56	719.60	142.40	40.20	15.52	1.91	4.28

ZNC	COP	RENG	RPRO	RARE	RVITC	RVITE	RIRN	RZNC
4.49	0.80	51.00	132.81	346.20	12.11	58.74	48.49	44.91
5.90	1.26	70.50	188.44	69.00	76.56	98.95	72.73	59.04
5.47	1.36	89.30	162.33	46.50	42.52	100.67	68.17	54.72
3.17	0.70	62.10	127.14	21.20	279.68	72.79	30.97	31.69
6.86	1.55	89.40	190.29	31.00	12.28	74.59	139.84	68.57
4.41	0.66	63.70	188.95	22.30	32.57	62.52	47.74	44.12
4.63	0.84	74.20	229.80	26.10	9.26	77.49	60.36	46.31
7.27	0.79	106.00	246.11	58.30	54.39	64.17	56.15	72.65
2.54	0.67	50.00	114.11	21.60	478.78	64.01	33.60	25.43
4.10	0.74	70.50	182.99	445.10	213.11	55.21	69.91	41.03
6.71	1.09	107.70	310.60	20.00	43.02	69.71	90.82	67.11
8.63	1.36	97.40	248.30	340.50	48.89	78.09	116.51	86.28
5.43	1.23	63.10	154.81	36.40	75.94	150.18	94.09	54.25
4.94	1.11	55.60	127.77	62.70	106.96	149.49	73.93	49.42
4.50	0.84	96.60	213.08	116.50	42.68	69.11	44.38	44.98
1.57	0.19	36.30	93.81	35.60	0.11	26.09	21.75	15.74
3.70	0.43	85.80	199.80	55.50	38.54	65.47	24.91	37.01
4.27	0.58	53.10	160.50	24.10	23.88	41.06	45.17	42.71
5.06	0.90	75.10	136.82	23.30	130.85	73.83	52.53	50.55
4.50	0.91	67.40	150.04	17.60	180.79	65.58	62.77	45.04
3.21	0.89	64.90	146.74	22.80	20.11	89.68	33.69	32.08
5.24	0.91	54.50	145.37	44.40	54.64	49.79	66.88	52.42
3.02	0.59	49.60	147.96	24.10	38.98	38.59	46.58	30.20
3.33	0.66	48.20	147.54	27.10	58.11	70.24	48.03	33.34
3.23	0.54	34.10	96.33	43.30	77.75	32.29	53.31	32.30
3.77	0.81	54.00	110.99	21.00	273.17	40.41	54.44	37.74
6.70	0.88	66.00	186.59	36.90	92.13	51.81	75.75	67.02
4.63	0.43	82.50	253.38	72.10	28.24	34.92	34.83	46.28
5.82	0.94	109.60	267.95	51.90	53.94	63.99	73.56	58.23
2.98	0.91	74.40	128.25	430.90	242.63	101.37	37.41	29.83
6.10	1.03	84.60	185.71	53.50	42.58	56.85	82.86	60.95
7.85	0.89	80.40	267.87	54.90	16.44	66.17	69.98	78.48
6.51	1.01	80.60	252.67	41.30	32.82	103.36	80.98	65.14
1.98	0.58	67.50	110.46	21.60	15.32	117.58	34.60	19.80
3.37	0.32	39.10	149.89	57.50	46.72	28.74	28.57	33.71
3.91	0.81	43.30	87.13	36.40	83.12	49.87	51.13	39.12
3.59	0.50	38.30	106.85	21.80	33.29	40.15	46.46	35.87
4.43	0.86	63.10	154.99	26.80	128.47	54.78	71.36	44.27
4.87	0.63	58.90	146.29	45.30	57.85	27.36	42.95	48.71
3.99	0.74	62.80	129.61	16.90	67.51	100.58	61.53	39.91
1.95	0.38	52.30	101.52	25.50	51.50	26.12	29.69	19.46
4.74	0.93	67.70	158.79	23.10	128.16	54.07	75.72	47.41
4.89	0.89	100.10	195.80	430.40	213.63	125.51	52.28	48.88
4.03	1.07	76.70	124.68	682.60	202.72	119.26	54.77	40.29
3.84	0.78	61.20	174.47	22.10	1.77	57.79	56.29	38.43
4.91	0.81	107.50	225.97	37.60	274.23	120.33	26.86	49.11
4.85	0.87	64.20	138.85	54.30	54.39	66.96	64.06	48.47
5.28	0.94	95.20	225.80	67.90	61.19	81.21	70.03	52.78
4.07	0.71	63.60	153.11	38.90	35.28	53.95	45.99	40.66
2.92	0.41	29.70	89.33	29.80	34.49	27.28	42.82	29.20

RCOP	PROP	CARP	FATP	AGE	OILBUT	EGGS	MEAT	MILK
79.62	13.90	58.72	28.04	48.00	4.00	0.00	1.00	0.00
100.00	14.26	49.73	37.83	48.00	4.00	0.00	3.00	0.00
100.00	9.69	58.26	33.32	48.00	5.00	0.00	1.00	0.00
100.00	10.08	62.48	29.52	30.00	6.00	0.00	1.00	1.00
103.15	11.36	75.09	15.98	48.00	5.00	0.00	2.00	1.00
93.69	14.61	58.90	27.41	31.00	3.00	0.00	1.00	0.00
100.00	15.25	55.23	30.85	32.00	4.00	0.00	1.00	0.00
78.82	12.38	52.94	35.23	60.00	4.00	0.00	1.00	7.00
96.10	11.23	83.90	10.35	36.00	2.00	0.00	2.00	1.00
100.00	12.79	75.49	14.52	36.00	1.00	0.00	1.00	7.00
109.01	14.20	64.86	22.89	42.00	4.00	0.00	1.00	1.00
100.00	13.60	68.47	20.79	54.00	1.00	0.00	1.00	0.00
100.00	13.08	61.67	28.56	54.00	5.00	0.00	1.00	3.00
100.00	12.25	63.39	26.60	48.00	3.00	0.00	1.00	0.00
100.00	10.85	55.43	34.86	36.00	3.00	0.00	1.00	2.00
26.72	12.73	63.52	24.60	29.00	4.00	0.00	0.00	7.00
61.50	11.46	63.88	24.06	36.00	3.00	0.00	1.00	7.00
83.07	14.87	53.13	34.04	42.00	4.00	1.00	2.00	7.00
90.20	9.72	77.60	13.06	56.00	3.00	0.00	1.00	7.00
90.73	11.87	76.94	14.78	52.00	4.00	0.00	1.00	7.00
100.00	11.14	53.13	36.86	30.00	4.00	0.00	1.00	4.00
90.75	14.23	69.17	19.04	48.00	3.00	0.00	0.00	1.00
84.49	14.68	73.77	13.25	36.00	3.00	0.00	0.00	3.00
93.60	15.08	70.27	17.03	36.00	4.00	0.00	1.00	7.00
54.24	15.07	68.27	19.57	60.00	4.00	1.00	1.00	0.00
80.77	10.97	84.85	9.34	48.00	4.00	1.00	1.00	7.00
88.10	15.07	63.39	21.65	60.00	3.00	0.00	0.00	0.00
61.79	15.12	53.58	30.56	30.00	3.00	0.00	0.00	7.00
100.00	12.03	57.47	33.41	30.00	4.00	0.00	1.00	1.00
100.00	8.48	76.51	16.73	36.00	4.00	0.00	0.00	1.00
100.00	11.71	58.58	32.56	60.00	5.00	0.00	1.00	0.00
89.12	17.77	51.58	32.12	57.00	5.00	0.00	1.00	3.00
100.00	16.72	54.34	29.26	48.00	4.00	1.00	2.00	7.00
82.69	8.06	45.63	47.68	36.00	5.00	0.00	1.00	1.00
31.59	20.43	34.82	45.33	48.00	7.00	0.00	1.00	2.00
80.55	10.74	61.73	30.83	60.00	7.00	0.00	1.00	1.00
50.00	14.89	58.71	28.64	60.00	7.00	0.00	1.00	3.00
86.27	13.09	72.69	18.36	60.00	7.00	0.00	1.00	7.00
63.14	13.25	58.42	30.16	60.00	4.00	0.00	0.00	3.00
74.41	11.00	57.31	33.79	48.00	3.00	0.00	1.00	1.00
54.24	9.56	53.34	39.48	36.00	3.00	1.00	0.00	3.00
92.84	12.51	74.80	16.77	48.00	3.00	0.00	0.00	3.00
100.00	9.63	74.74	16.06	30.00	4.00	0.00	0.00	0.00
100.00	8.67	69.52	22.44	48.00	5.00	0.00	1.00	3.00
100.00	14.04	67.80	19.69	24.00	4.00	0.00	0.00	1.00
100.00	10.35	64.02	24.90	30.00	5.00	1.00	1.00	4.00
87.06	11.53	53.40	37.46	48.00	7.00	0.00	0.00	3.00
100.00	11.67	55.46	35.24	36.00	3.00	0.00	0.00	3.00
100.00	11.86	63.77	26.59	30.00	3.00	0.00	1.00	0.00

FRUIT	LEAVVEG	CARTOM	SWEETP(	HAZ	HAP	HAM	WAZ	WAP
7.00	3.00	3.00	1.00	-0.90	18.49	96.43	-0.56	28.63
0.00	2.00	3.00	0.00	-0.22	41.19	99.08	-0.63	26.48
0.00	4.00	1.00	0.00	-1.39	8.21	94.46	-0.56	28.63
0.00	1.00	2.00	0.00	-3.25	0.06	87.36	-2.54	0.56
0.00	4.00	3.00	2.00	-0.65	25.80	97.41	-1.15	12.45
0.00	1.00	2.00	0.00	-0.90	18.48	96.49	0.74	77.04
7.00	4.00	4.00	0.00	-1.95	2.53	92.31	-1.01	15.63
0.00	7.00	4.00	0.00	-1.07	14.18	95.52	0.55	70.92
0.00	4.00	2.00	0.00	-1.29	9.82	94.82	-1.64	5.02
0.00	2.00	3.00	4.00	1.34	90.92	105.35	-0.39	34.79
0.00	4.00	1.00	0.00	-2.73	0.31	88.82	-1.52	6.45
0.00	4.00	1.00	0.00	0.93	82.40	103.73	0.46	67.84
2.00	3.00	4.00	0.00	-2.39	0.84	90.40	0.85	80.32
0.00	4.00	3.00	1.00	-2.33	0.98	90.34	0.15	55.94
2.00	4.00	3.00	0.00	-1.29	9.82	94.82	-0.39	34.79
2.00	5.00	2.00	0.00	-0.77	21.99	96.99	0.70	75.94
4.00	3.00	3.00	1.00	-1.59	5.59	93.71	-0.07	47.18
4.00	4.00	3.00	1.00	0.02	50.65	100.07	-0.04	48.26
4.00	3.00	1.00	1.00	0.19	57.45	100.76	0.72	76.52
8.00	3.00	3.00	0.00	0.83	79.56	103.44	-0.18	42.82
2.00	7.00	3.00	0.00	-2.13	1.65	91.66	-0.77	22.18
2.00	3.00	4.00	0.00	-3.62	0.02	85.61	-1.74	4.09
8.00	1.00	3.00	0.00	-1.86	3.15	92.64	-1.43	7.68
2.00	3.00	3.00	0.00	-0.25	40.32	99.03	0.97	83.43
3.00	3.00	1.00	0.00	0.02	50.64	100.07	0.97	83.30
5.00	1.00	2.00	0.00	-0.93	17.70	96.16	-0.37	35.74
0.00	2.00	1.00	0.00	-2.60	0.47	89.15	-1.74	4.13
0.00	0.00	1.00	0.00	3.29	99.80	112.79	0.57	71.43
4.00	4.00	3.00	0.00	1.58	94.33	106.16	0.85	80.35
1.00	3.00	2.00	0.00	0.55	70.79	102.19	-2.90	0.19
4.00	4.00	4.00	0.00	-2.12	1.69	91.34	-1.90	2.90
2.00	3.00	3.00	0.00	-0.94	17.26	96.06	-1.54	6.18
5.00	3.00	2.00	0.00	-1.14	12.63	95.45	-1.15	12.45
5.00	3.00	3.00	0.00	0.29	61.54	101.16	-0.75	22.70
4.00	4.00	3.00	0.00	-0.40	34.36	98.40	-1.15	12.45
5.00	1.00	2.00	0.00	-2.60	0.47	89.15	-1.26	10.32
5.00	3.00	3.00	0.00	0.45	67.41	101.89	0.14	55.40
5.00	3.00	5.00	0.00	0.82	79.37	103.34	-0.34	36.54
5.00	3.00	3.00	0.00	0.14	55.57	100.57	1.20	88.46
5.00	2.00	1.00	0.00	-1.87	3.11	92.28	-0.89	18.62
5.00	7.00	3.00	0.00	0.02	50.95	100.09	-2.10	1.76
5.00	7.00	2.00	0.00	-1.39	8.21	94.46	-1.15	12.45
5.00	1.00	1.00	0.00	-2.68	0.37	89.57	-2.17	1.48
5.00	2.00	2.00	1.00	1.19	88.22	104.91	1.13	87.00
5.00	1.00	3.00	0.00	1.07	85.79	103.98	-1.64	5.07
5.00	1.00	3.00	0.00	0.73	76.73	102.84	-1.45	7.29
3.00	4.00	2.00	0.00	-1.87	3.11	92.28	-0.89	18.62
4.00	3.00	1.00	0.00	2.99	99.80	111.81	0.97	83.43
3.00	1.00	2.00	0.00	-0.69	24.47	97.31	-1.09	13.70
6.00	0.00	1.00	0.00	-0.58	28.21	97.70	-0.79	21.44

WAM	WHZ	WHP	WHM	FLAG	BMI	DIARRH	DIARR_C	RESP
93.99	0.09	53.71	101.00	0.00	15.6200	2.0	Diarr	
92.85	-0.56	28.89	95.15	0.00	14.9000	2.0	Diarr	
93.99	0.42	66.23	104.53	0.00	16.2800		No Diarr	
73.98	-0.77	21.95	92.65	0.00	16.0200	1.0	Diarr	
87.72	-0.83	20.29	92.67	0.00	14.2800		No Diarr	
109.44	1.51	93.43	117.20	0.00	19.3700	1.0	Diarr	
89.55	0.28	60.99	103.25	0.00	17.0100	1.0	Diarr	
107.10	1.77	96.20	116.69	0.00	18.1400		No Diarr	
82.05	-1.08	13.96	90.49	0.00	14.8100	1.0	Diarr	
95.73	-1.27	10.16	88.90	0.00	14.0000	1.0	Diarr	
82.92	0.14	55.49	101.57	0.00	16.7900	1.0	Diarr	
107.07	0.04	51.54	100.42	0.00	15.1500		No Diarr	
113.02	3.19	99.80	134.71	0.00	21.0500	1.0	Diarr	
101.83	2.06	98.04	121.65	0.00	19.6600	1.0	Diarr	
95.73	0.51	69.33	105.57	0.00	17.2800	1.0	Diarr	
109.10	1.42	92.15	116.20	0.00	18.9300		No Diarr	
99.26	1.08	85.93	112.15	0.00	18.0800		No Diarr	
99.54	0.09	53.71	101.00	0.00	15.6200	1.0	Diarr	
111.15	0.90	81.72	109.68	0.00	16.6000		No Diarr	
97.94	-0.85	19.80	92.67	0.00	14.3100		No Diarr	
92.12	0.60	72.51	107.10	0.00	17.8500	1.0	Diarr	
81.46	0.53	70.12	106.00	0.00	17.1800		No Diarr	
85.08	-0.24	40.43	97.84	0.00	15.8500		No Diarr	
113.44	1.59	94.42	117.43	0.00	18.5000	1.0	Diarr	
112.46	1.31	90.55	112.54	0.00	17.3600		No Diarr	
95.84	0.34	63.42	103.34	0.00	16.3200	2.0	Diarr	
80.33	-0.17	43.34	98.54	0.00	15.6200		No Diarr	2.0
107.27	-1.26	10.37	89.01	0.00	13.9400		No Diarr	2.0
110.97	0.19	57.69	101.95	0.00	16.2800		No Diarr	
68.38	-3.80	0.01	66.82	0.00	10.6300		No Diarr	1.0
79.25	-0.83	20.29	92.67	0.00	14.2800	2.0	Diarr	
82.51	-1.26	10.34	89.01	0.00	13.8700		No Diarr	1.0
87.72	-0.47	32.07	95.90	0.00	14.8800		No Diarr	
92.17	-0.89	18.64	92.17	0.00	14.4000	1.0	Diarr	
87.72	-1.01	15.66	91.09	0.00	14.0000	1.0	Diarr	
85.68	0.52	69.83	105.11	0.00	16.6600		No Diarr	
101.75	-0.19	42.57	98.40	0.00	15.1500	1.0	Diarr	
96.24	-1.14	12.64	90.06	0.00	13.5500		No Diarr	
118.88	1.60	94.51	117.15	0.00	17.6800		No Diarr	
89.85	0.36	64.20	103.71	0.00	16.6200		No Diarr	
77.99	-2.35	0.93	79.35	0.00	12.4500	1.0	Diarr	1.0
87.72	-0.28	39.09	97.57	0.00	15.1900		No Diarr	
77.68	-0.70	24.10	93.48	0.00	16.0000		No Diarr	
113.81	0.57	71.46	105.35	0.00	16.2900		No Diarr	
85.07	-2.20	1.38	80.59	0.00	13.2600		No Diarr	
85.07	-2.02	2.15	82.30	0.00	13.3000		No Diarr	2.0
89.85	0.36	64.20	103.71	0.00	16.6200		No Diarr	
113.44	-0.50	30.84	95.57	0.00	14.5100		No Diarr	
88.77	-0.71	24.02	93.76	0.00	15.5000		No Diarr	

RESP_C	VIT_AB	VIT_A_C
Resp Dis	19.6	<=20
Resp Dis	34.0	>20
Resp Dis	30.0	>20
Resp Dis	30.4	>20
Resp Dis	28.0	>20
Resp Dis	33.2	>20
Resp Dis	25.2	>20
Resp Dis	20.0	<=20
Resp Dis	12.4	<=20
Resp Dis	35.0	>20
Resp Dis	21.0	>20
Resp Dis	20.0	<=20
Resp Dis	33.2	>20
Resp Dis	30.4	>20
Resp Dis	34.0	>20
Resp Dis	19.6	<=20
Resp Dis	21.0	>20
Resp Dis	30.0	>20
Resp Dis	33.2	>20
Resp Dis	35.0	>20
Resp Dis	37.0	>20
Resp Dis	42.0	>20
Resp Dis	39.0	>20
Resp Dis	42.0	>20
Resp Dis	34.0	>20
Resp Dis	44.0	>20
Resp Dis	23.0	>20
Resp Dis	25.0	>20
Resp Dis	19.6	<=20
No R.D.	30.0	>20
Resp Dis	28.0	>20
No R.D.	33.2	>20
Resp Dis	25.2	>20
Resp Dis	12.0	<=20
Resp Dis	19.6	<=20
Resp Dis	37.0	>20
Resp Dis	20.0	<=20
Resp Dis	25.1	>20
Resp Dis	41.0	>20
Resp Dis	34.0	>20
Resp Dis	23.7	>20
No R.D.	22.7	>20
No R.D.	23.6	>20
No R.D.	37.0	>20
No R.D.	19.6	<=20
Resp Dis	23.2	>20
No R.D.	23.4	>20
No R.D.	33.2	>20
No R.D.	26.2	>20
No R.D.	23.2	>20

61.00	1.00	28.00 2-3	Supplem	10.00	89.00	22.60	840.50
62.00	1.00	60.00 4-5	Supplem	17.00	111.00	23.50	594.20
1.00	2.00	50.00 3-4	No Supl	15.50	98.00	23.40	1787.10
2.00	2.00	44.00 3-4	Supplem	12.00	91.00	26.20	1745.50
3.00	1.00	42.00 2-3	Supplem	13.00	89.00	13.80	714.70
6.00	1.00	36.00 4-5	Supplem	14.00	100.00	19.30	1709.50
9.00	2.00	50.00 3-4	Supplem	14.00	99.00	25.00	1055.20
10.00	1.00	48.00 3-4	No Supl	14.50	102.00	19.60	1615.10
11.00	1.00	38.00 2-3	Supplem	14.00	100.00	22.70	1472.00
12.00	1.00	30.00 4-5	No Supl	11.00	82.00	26.20	1601.00
15.00	1.00	51.00 4-5	No Supl	15.00	101.00	33.20	803.20
19.00	2.00	28.00 2-3	No Supl	13.00	89.00	37.00	1917.40
23.00	1.00	54.00 4-5	No Supl	16.00	101.00	23.40	1141.90
26.00	1.00	48.00 3-4	No Supl	14.00	100.00	22.70	1551.00
33.00	2.00	52.00 2-3	No Supl	16.00	99.00	34.00	1600.60
34.00	2.00	52.00 4-5	No Supl	16.00	100.00	23.20	1142.90
36.00	2.00	31.00 2-3	No Supl	12.00	94.00	27.20	1888.90
38.00	2.00	38.00 4-5	No Supl	15.50	104.00	41.00	935.00
41.00	2.00	48.00 3-4	Supplem	15.50	104.00	23.40	1915.90
44.00	2.00	53.00 3-4	No Supl	15.00	96.00	37.00	1232.40
51.00	1.00	56.00 4-5	No Supl	19.00	104.00	31.00	1435.10
54.00	1.00	30.00 4-5	Supplem	11.00	90.00	27.90	1307.80
55.00	1.00	51.00 2-3	Supplem	17.00	96.00	26.90	1426.50
56.00	2.00	28.00 4-5	No Supl	11.00	88.00	28.00	1810.20
57.00	1.00	51.00 3-4	No Supl	14.50	98.00	30.00	1541.00
58.00	2.00	48.00 4-5	No Supl	14.00	100.00	19.60	1178.50
59.00	1.00	57.00 3-4	Supplem	18.00	103.00	33.20	1606.70
61.00	1.00	51.00 4-5	No Supl	15.50	103.00	25.00	1866.00
69.00	2.00	45.00 4-5	No Supl	12.50	96.00	23.00	1110.10
72.00	1.00	44.00 2-3	No Supl	15.00	101.00	33.20	1419.10
75.00	2.00	32.00 4-5	Supplem	12.50	84.00	19.40	860.20
77.00	1.00	56.00 2-3	Supplem	19.00	104.00	12.60	1538.30
78.00	2.00	38.00 4-5	Supplem	14.00	100.00	21.00	1402.40
79.00	2.00	36.00 4-5	Supplem	13.00	95.00	20.00	1229.00
83.00	2.00	31.00 4-5	No Supl	10.50	88.00	31.00	1034.50
87.00	1.00	48.00 3-4	No Supl	15.00	103.00	25.20	1719.70
89.00	2.00	60.00 2-3	Supplem	17.00	112.00	30.40	1689.70
103.00	1.00	52.00 4-5	No Supl	19.00	107.00	26.20	553.70
104.00	1.00	30.00 2-3	Supplem	14.00	92.00	26.90	708.00
105.00	1.00	33.00 4-5	No Supl	11.00	92.00	33.20	612.20
108.00	2.00	37.00 3-4	No Supl	12.00	88.00	25.20	872.50
109.00	1.00	49.00 4-5	Supplem	15.50	100.00	23.40	493.20
110.00	1.00	32.00 4-5	No Supl	11.00	90.00	20.00	619.60
111.00	2.00	48.00 2-3	Supplem	14.00	98.00	27.90	444.00
113.00	1.00	48.00 3-4	No Supl	19.00	108.00	31.00	837.60
116.00	1.00	61.00 4-5	No Supl	18.00	106.00	19.60	1165.00
117.00	1.00	30.00 4-5	No Supl	10.50	83.00	19.30	1225.40
118.00	2.00	28.00 2-3	No Supl	11.50	92.00	33.20	1165.70
119.00	1.00	52.00 4-5	No Supl	15.00	97.00	25.00	871.90
121.00	2.00	42.00 3-4	No Supl	11.50	14.50	31.20	680.60
122.00	1.00	40.00 4-5	Supplem	13.50	96.00	19.80	990.10

25.26	142.60	19.37	857.70	146.00	54.60	42.37	5.11	4.23
22.79	112.34	8.05	855.30	100.10	79.20	29.43	2.61	5.31
66.73	326.33	28.47	3704.30	452.00	329.70	6.09	6.60	15.12
58.22	352.35	18.36	2051.10	225.70	197.80	266.32	6.46	12.59
33.87	122.90	11.35	479.00	94.40	24.60	7.20	2.81	6.65
51.53	311.78	32.57	285.20	82.40	1.70	15.65	4.07	12.24
38.83	200.32	13.17	212.00	49.20	7.20	6.73	4.70	7.35
61.78	299.44	24.35	9669.00	1040.00	931.30	78.19	4.96	15.98
51.29	262.31	27.40	317.90	85.60	5.00	11.14	4.43	9.84
66.25	281.72	27.85	13151.50	1421.50	1262.30	13.28	4.27	18.11
28.36	126.66	21.76	10062.30	2704.50	173.90	75.42	5.39	9.69
62.70	352.38	30.68	11865.90	2236.90	662.10	50.16	10.20	14.96
47.13	191.73	21.61	6654.70	1933.90	31.40	13.09	4.53	10.03
49.60	264.01	32.35	519.20	81.30	37.20	3.78	7.31	7.30
53.88	295.25	24.56	1386.40	222.60	95.60	20.65	2.67	13.90
31.39	183.14	31.75	98.90	24.40	2.40	0.48	5.43	4.53
76.78	312.55	35.04	696.50	158.60	24.40	1.47	8.03	8.58
31.88	150.84	23.08	136.30	13.60	13.60	3.75	5.43	5.21
50.41	287.82	62.94	2548.50	362.40	201.80	33.76	9.79	10.44
48.78	191.96	31.11	568.90	111.70	29.10	3.05	3.25	7.42
53.30	249.19	29.95	1445.30	189.00	122.40	26.97	6.65	10.05
36.47	229.22	29.32	2342.60	266.40	218.30	52.38	6.88	7.57
36.23	281.56	21.75	2167.30	225.50	213.10	57.74	7.57	7.94
53.58	326.10	36.44	1175.20	167.90	93.20	31.89	9.23	10.94
68.87	258.00	29.55	1241.00	204.50	83.70	22.22	7.82	11.45
50.16	187.22	27.46	368.40	93.60	8.60	3.75	11.98	9.07
63.83	306.02	21.21	9061.00	1011.80	852.40	64.96	4.13	13.03
70.68	337.47	29.44	2625.60	306.70	240.40	58.49	9.17	11.18
41.94	188.93	24.30	5071.30	543.70	488.70	20.55	5.37	10.49
36.20	258.39	30.29	1678.30	201.00	151.00	39.93	7.81	9.93
29.69	124.36	29.18	1138.10	256.30	42.10	23.91	6.08	5.03
53.48	241.58	43.23	2628.10	350.50	222.90	47.91	5.36	8.69
58.15	251.44	20.08	887.00	110.90	77.10	19.71	6.09	7.90
53.38	188.70	32.02	627.80	71.20	58.30	18.20	18.93	8.92
32.77	195.64	17.83	2543.10	322.30	219.90	54.18	5.53	7.13
69.67	323.20	21.94	3359.60	376.40	315.60	63.94	8.00	13.24
58.60	304.49	28.55	2794.40	370.70	234.00	49.14	8.55	9.45
17.87	84.14	15.13	165.80	49.90	0.00	0.00	3.00	1.91
30.15	123.24	11.71	532.30	148.50	4.90	1.43	2.75	4.98
25.10	111.21	8.91	459.30	68.10	34.80	10.26	2.94	5.14
27.75	172.81	9.65	16064.60	1677.70	1570.70	17.67	6.02	6.75
18.84	86.22	10.02	1156.30	159.10	92.80	66.75	3.25	3.53
21.13	120.06	7.53	144.20	41.50	0.90	2.70	2.51	4.31
14.59	78.48	9.24	77.00	9.40	6.80	4.13	2.52	3.23
27.37	138.21	20.28	698.30	195.30	13.70	1.39	1.79	4.39
37.09	229.64	13.20	2383.90	314.20	198.90	49.04	3.60	6.99
44.10	244.13	11.75	922.00	96.50	90.30	63.65	4.53	9.63
44.23	231.23	9.81	651.80	102.10	46.10	9.70	3.25	8.65
29.37	139.39	22.24	77.00	9.40	6.80	1.47	3.76	4.68
25.96	120.90	11.92	242.80	59.30	6.80	1.47	2.93	5.23
63.81	82.21	43.61	1010.70	273.30	12.60	12.79	3.29	4.25

3.56	0.83	64.70	157.86	38.80	105.92	85.25	42.30	35.58
3.47	0.62	33.00	94.97	22.70	65.40	37.34	53.07	34.69
9.71	1.54	99.30	278.03	101.40	13.54	94.29	151.17	97.05
8.30	1.58	97.00	242.56	51.70	591.81	92.30	125.89	82.99
4.34	0.67	55.00	211.71	24.60	17.99	46.81	66.47	43.43
7.04	1.38	131.50	322.06	20.70	39.12	67.87	122.36	70.42
5.22	0.90	81.20	242.66	12.60	16.82	78.36	73.50	52.17
9.18	1.68	124.20	386.11	298.80	195.47	82.63	159.80	91.79
6.88	1.10	113.20	320.59	21.60	27.85	73.89	98.36	68.84
9.52	1.80	88.90	276.03	326.40	29.51	61.05	181.11	95.17
5.17	0.81	61.80	177.26	683.40	188.55	89.83	96.87	51.68
9.78	1.79	106.50	261.27	469.50	111.47	145.69	149.56	97.83
5.99	0.98	87.80	294.55	484.80	32.73	75.48	100.28	59.87
6.25	0.96	119.30	309.98	21.90	9.46	121.86	72.99	62.46
6.42	1.55	88.90	224.52	47.70	45.88	38.09	139.00	64.18
5.59	0.75	87.90	196.18	6.20	1.19	90.57	45.27	55.94
8.04	1.09	104.90	319.91	32.50	3.27	114.65	85.77	80.40
4.70	0.66	71.90	199.23	4.00	9.36	90.53	52.12	47.03
7.47	1.44	147.40	315.04	99.00	84.39	163.13	104.41	74.69
7.02	0.83	68.50	203.26	23.30	6.77	46.37	74.17	70.24
7.75	1.24	110.40	333.12	52.30	67.42	110.90	100.52	77.45
5.60	1.02	100.60	227.96	75.70	130.95	114.63	75.71	56.01
5.69	1.25	109.70	226.46	65.30	144.35	126.08	79.40	56.95
8.26	1.44	139.20	334.89	45.90	79.71	153.92	109.37	82.58
8.35	1.49	118.50	430.43	54.60	55.55	130.31	114.53	83.46
5.47	0.95	90.70	313.50	23.80	9.37	199.61	90.68	54.73
8.33	1.42	89.30	265.95	230.80	144.35	58.97	130.29	83.28
9.29	1.45	103.70	294.50	69.40	129.97	131.01	111.82	92.92
6.06	1.35	85.40	262.11	156.30	51.36	89.52	104.90	60.58
5.72	1.37	109.20	226.27	56.60	99.83	130.11	99.34	57.20
3.99	0.71	66.20	185.54	65.80	59.77	101.30	50.26	39.91
8.46	1.16	118.30	334.28	96.90	119.76	89.41	86.86	84.61
6.24	1.22	107.90	363.45	30.90	49.27	101.52	79.02	62.36
6.56	1.28	94.50	333.62	20.20	45.49	315.46	89.19	65.63
4.76	0.72	57.50	136.55	71.80	120.39	78.97	71.32	47.57
8.97	1.44	95.50	290.27	85.80	142.10	114.34	132.43	89.70
7.34	1.32	130.00	366.25	102.40	122.85	142.55	94.53	73.44
2.51	0.26	42.60	111.72	12.50	0.00	49.97	19.14	25.11
4.19	0.54	54.50	188.45	37.30	3.57	45.80	49.77	41.93
3.58	0.59	47.10	156.87	18.50	25.65	49.01	51.36	35.84
4.09	0.81	67.10	173.41	484.90	44.18	100.39	67.47	40.93
2.56	0.40	37.90	117.73	43.60	166.87	54.13	35.29	25.64
3.18	0.51	47.70	132.09	10.40	6.75	41.81	43.13	31.82
2.17	0.40	34.20	91.21	2.60	10.32	42.01	32.28	21.68
3.51	0.52	64.40	171.05	49.40	3.46	29.89	43.95	35.08
5.60	0.90	64.70	154.54	69.50	108.99	51.47	69.92	56.01
6.54	1.14	94.30	275.63	27.90	159.13	75.49	96.34	65.38
6.37	0.99	89.70	276.43	27.40	24.24	54.24	86.46	63.72
4.48	0.56	67.10	183.56	2.60	3.68	62.68	46.75	44.80
3.65	0.53	37.80	108.16	12.10	3.27	41.83	52.34	36.53

100.00	12.02	67.87	20.74	28.00	3.00	0.00	0.00	1.00
62.44	15.34	75.62	12.20	60.00	4.00	4.00	0.00	1.00
102.83	14.94	73.04	14.34	48.00	4.00	0.00	1.00	0.00
105.28	13.34	80.75	9.46	48.00	4.00	0.00	3.00	0.00
96.22	18.96	68.78	14.29	24.00	5.00	0.00	1.00	0.00
137.81	12.06	72.95	17.15	42.00	6.00	0.00	1.00	1.00
100.00	14.72	75.94	11.23	36.00	5.00	0.00	2.00	1.00
168.07	15.30	74.16	13.57	36.00	3.00	0.00	1.00	0.00
110.37	13.94	71.28	16.75	36.00	4.00	0.00	1.00	0.00
120.28	16.55	70.39	15.66	48.00	4.00	0.00	1.00	7.00
100.00	14.12	63.08	24.38	24.00	2.00	0.00	2.00	1.00
119.36	13.08	73.51	14.40	48.00	1.00	0.00	1.00	7.00
100.00	16.51	67.16	17.03	24.00	4.00	0.00	1.00	1.00
100.00	12.79	68.09	18.77	36.00	1.00	0.00	1.00	0.00
103.47	13.47	73.78	13.81	48.00	5.00	0.00	1.00	3.00
100.00	10.99	64.10	25.00	18.00	3.00	0.00	1.00	0.00
100.00	16.26	66.18	16.69	50.00	3.00	0.00	1.00	2.00
94.66	13.64	64.53	22.22	14.00	4.00	0.00	0.00	7.00
144.05	10.52	60.09	29.57	26.00	3.00	0.00	1.00	7.00
82.94	15.83	62.30	22.72	48.00	4.00	1.00	2.00	7.00
123.79	14.86	69.45	18.78	24.00	3.00	0.00	1.00	7.00
102.03	11.16	70.11	20.18	18.00	4.00	0.00	1.00	7.00
124.81	10.16	78.95	13.72	30.00	4.00	0.00	1.00	4.00
143.73	11.84	72.06	18.12	22.00	3.00	0.00	0.00	1.00
148.96	17.88	66.97	17.26	30.00	3.00	0.00	0.00	3.00
100.00	17.03	63.55	20.97	24.00	4.00	0.00	1.00	7.00
100.00	15.89	76.18	11.88	48.00	4.00	1.00	1.00	0.00
100.00	15.15	72.34	14.20	60.00	4.00	1.00	1.00	7.00
134.73	15.11	68.08	19.70	36.00	3.00	0.00	0.00	0.00
137.04	10.20	72.83	19.21	46.00	3.00	0.00	0.00	7.00
100.00	13.80	57.83	30.53	18.00	4.00	0.00	1.00	1.00
115.88	13.91	62.82	25.29	40.00	4.00	0.00	0.00	1.00
121.74	16.59	71.72	12.89	42.00	5.00	0.00	1.00	0.00
128.08	17.37	61.41	23.45	27.00	5.00	0.00	1.00	3.00
71.55	12.67	75.65	15.52	48.00	4.00	1.00	2.00	7.00
100.00	16.20	75.18	11.48	48.00	5.00	0.00	1.00	1.00
132.14	13.87	72.08	15.21	36.00	7.00	0.00	1.00	2.00
37.64	12.91	60.79	24.60	24.00	7.00	0.00	1.00	1.00
76.36	17.04	69.63	14.89	24.00	7.00	0.00	1.00	3.00
83.56	16.40	72.67	13.10	18.00	7.00	0.00	1.00	7.00
100.00	12.72	79.23	9.96	18.00	4.00	0.00	0.00	3.00
57.43	15.28	69.92	18.28	36.00	3.00	0.00	1.00	1.00
72.79	13.64	77.50	10.94	24.00	3.00	1.00	0.00	3.00
57.51	13.15	70.71	18.74	36.00	3.00	0.00	0.00	3.00
73.50	13.07	66.01	21.80	36.00	4.00	0.00	0.00	0.00
90.41	12.73	78.85	10.20	48.00	5.00	0.00	1.00	3.00
113.67	14.40	79.69	8.63	38.00	4.00	0.00	0.00	1.00
100.00	15.18	79.34	7.57	36.00	5.00	1.00	1.00	4.00
79.90	13.47	63.95	22.96	36.00	7.00	0.00	0.00	3.00
52.68	15.26	71.06	15.76	48.00	3.00	0.00	0.00	3.00
42.55	25.78	33.21	39.64	60.00	3.00	0.00	1.00	0.00

3.00	1.00	2.00	0.00	0.04	51.63	100.16	-2.40	0.82
3.00	4.00	3.00	0.00	0.23	59.23	100.98	-0.79	21.45
7.00	3.00	3.00	1.00	-1.17	12.07	95.33	-0.43	33.37
0.00	2.00	3.00	0.00	-2.08	1.88	91.73	-2.07	1.92
0.00	4.00	1.00	0.00	-2.49	0.64	89.83	-1.52	6.45
0.00	1.00	2.00	0.00	1.34	90.92	105.35	-0.39	34.79
0.00	4.00	3.00	2.00	-0.93	17.69	96.30	-1.29	9.79
0.00	1.00	2.00	0.00	-0.22	41.19	99.08	-1.16	12.40
7.00	4.00	4.00	0.00	0.94	82.66	103.80	-0.59	27.69
0.00	7.00	4.00	0.00	-2.40	0.83	90.68	-1.81	3.48
0.00	4.00	2.00	0.00	-0.87	19.25	96.39	-1.12	13.14
0.00	2.00	3.00	4.00	0.33	62.99	101.29	0.23	58.97
0.00	4.00	1.00	0.00	-1.25	10.55	94.79	-0.84	20.09
0.00	4.00	1.00	0.00	-0.69	24.44	97.14	-1.42	7.80
2.00	3.00	4.00	0.00	-1.19	11.67	95.24	-0.30	38.26
0.00	4.00	3.00	1.00	-0.95	17.08	96.20	-0.30	38.26
2.00	4.00	3.00	0.00	1.06	85.60	104.17	-0.89	18.64
2.00	5.00	2.00	0.00	2.31	98.95	109.13	0.52	70.01
4.00	3.00	3.00	1.00	0.59	72.15	102.33	-0.27	39.35
4.00	4.00	3.00	1.00	-2.04	2.09	91.85	-0.93	17.55
4.00	3.00	1.00	1.00	-0.82	20.50	96.56	0.43	66.76
8.00	3.00	3.00	0.00	-0.12	45.11	99.52	-1.81	3.48
2.00	7.00	3.00	0.00	-2.02	2.18	91.62	-0.10	46.08
2.00	3.00	4.00	0.00	0.04	51.58	100.15	-1.27	10.21
8.00	1.00	3.00	0.00	-1.56	5.96	93.53	-1.38	8.46
2.00	3.00	3.00	0.00	-0.40	34.36	98.40	-1.15	12.45
3.00	3.00	1.00	0.00	-1.17	12.19	95.13	-0.09	46.52
5.00	1.00	2.00	0.00	-0.41	34.11	98.30	-0.86	19.37
0.00	2.00	1.00	0.00	-0.96	16.80	96.17	-1.84	3.32
0.00	0.00	1.00	0.00	0.15	55.78	100.60	-0.56	28.67
4.00	4.00	3.00	0.00	-1.95	2.53	92.31	-0.65	25.81
1.00	3.00	2.00	0.00	-0.82	20.50	96.56	0.43	66.76
4.00	4.00	4.00	0.00	1.25	89.40	104.94	-0.29	38.66
2.00	3.00	3.00	0.00	0.29	61.54	101.16	-0.75	22.70
5.00	3.00	2.00	0.00	-0.63	26.39	97.52	-1.99	2.32
5.00	3.00	3.00	0.00	0.01	50.48	100.05	-0.89	18.62
4.00	4.00	3.00	0.00	0.82	79.37	103.34	-0.34	36.54
5.00	1.00	2.00	0.00	0.37	64.42	101.54	0.76	77.74
5.00	3.00	3.00	0.00	0.45	67.21	101.73	0.28	60.95
5.00	3.00	5.00	0.00	-0.20	42.24	99.23	-2.05	2.00
5.00	3.00	3.00	0.00	-1.76	3.90	93.01	-1.52	6.43
5.00	2.00	1.00	0.00	-0.83	20.30	96.56	-0.71	23.92
5.00	7.00	3.00	0.00	-0.54	29.36	97.86	-1.98	2.40
5.00	7.00	2.00	0.00	-0.90	18.49	96.43	-1.15	12.45
5.00	1.00	1.00	0.00	1.19	88.22	104.91	1.13	87.00
5.00	2.00	2.00	1.00	-0.97	16.67	95.96	-0.39	34.72
5.00	1.00	3.00	0.00	-2.11	1.74	91.78	-2.17	1.48
5.00	1.00	3.00	0.00	1.21	88.64	104.71	-0.88	18.91
3.00	4.00	2.00	0.00	-1.91	2.80	92.05	-1.19	11.65
4.00	3.00	1.00	0.00		0.00	14.81	-2.24	1.25
3.00	1.00	2.00	0.00	-0.43	33.19	98.23	-1.07	14.24

76.14	-2.64	0.42	76.75	0.00	12.6200	2.0	Diarr	
91.04	-1.22	11.20	89.56	0.00	13.8000		No Diarr	1.0
95.41	0.41	65.75	104.37	0.00	16.1400		No Diarr	
78.06	-1.00	15.81	91.19	0.00	14.4900	1.0	Diarr	
82.92	-0.03	48.99	99.78	0.00	16.4100		No Diarr	1.0
95.73	-1.27	10.16	88.90	0.00	14.0000		No Diarr	
86.18	-0.83	20.29	92.67	0.00	14.2800		No Diarr	
86.86	-1.26	10.37	89.01	0.00	13.9400	1.0	Diarr	1.0
93.45	-1.27	10.16	88.90	0.00	14.0000		No Diarr	
81.37	-0.43	33.35	96.05	0.00	16.3600		No Diarr	1.0
87.25	-0.73	23.33	93.65	0.00	14.7000		No Diarr	
102.89	0.21	58.19	102.31	0.00	16.4100		No Diarr	1.0
90.46	-0.01	49.52	99.89	0.00	15.6800		No Diarr	
83.86	-1.27	10.16	88.90	0.00	14.0000	1.0	Diarr	
96.80	0.55	70.86	105.90	0.00	16.3200	1.0	Diarr	
96.80	0.38	64.90	104.10	0.00	16.0000		No Diarr	
90.80	-1.53	6.29	86.56	0.00	13.5800		No Diarr	
107.36	-0.66	25.55	94.18	0.00	14.3300		No Diarr	
97.12	-0.66	25.55	94.18	0.00	14.3300		No Diarr	2.0
89.98	0.42	66.23	104.53	0.00	16.2800		No Diarr	
105.46	1.35	91.20	112.75	0.00	17.5700		No Diarr	
81.37	-1.94	2.62	82.95	0.00	13.5800	1.0	Diarr	
98.88	1.54	93.88	115.54	0.00	18.4500	1.0	Diarr	1.0
87.06	-1.34	8.99	88.11	0.00	14.2000		No Diarr	
84.34	-0.54	29.32	95.25	0.00	15.1000	1.0	Diarr	1.0
87.72	-1.01	15.66	91.09	0.00	14.0000		No Diarr	
99.01	0.91	81.96	108.64	0.00	16.9700		No Diarr	
90.16	-0.74	22.96	93.55	0.00	14.6100	1.0	Diarr	
80.53	-1.47	7.14	87.11	0.00	13.5600	1.0	Diarr	
93.63	-0.73	23.33	93.65	0.00	14.7000		No Diarr	
93.28	0.65	74.17	107.55	0.00	17.7200		No Diarr	
105.46	1.35	91.20	112.75	0.00	17.5700	1.0	Diarr	
96.97	-1.01	15.66	91.09	0.00	14.0000		No Diarr	
92.17	-0.89	18.64	92.17	0.00	14.4000		No Diarr	
79.45	-1.79	3.65	84.11	0.00	13.5600	1.0	Diarr	1.0
89.85	-1.09	13.86	90.53	0.00	14.1400	2.0	Diarr	1.0
96.24	-1.14	12.64	90.06	0.00	13.5500		No Diarr	1.0
109.46	0.76	77.64	107.16	0.00	16.6000	1.0	Diarr	
103.57	0.18	57.21	101.94	0.00	16.5400		No Diarr	
78.13	-2.27	1.15	80.09	0.00	13.0000	1.0	Diarr	1.0
84.08	-0.44	33.09	96.12	0.00	15.5000		No Diarr	3.0
91.93	-0.18	42.84	98.42	0.00	15.5000	1.0	Diarr	
79.17	-1.94	2.62	82.95	0.00	13.5800	1.0	Diarr	2.0
87.72	-0.65	25.77	94.27	0.00	14.5800		No Diarr	
113.81	0.57	71.46	105.35	0.00	16.2900	1.0	Diarr	
95.55	0.35	63.55	103.26	0.00	16.0200	1.0	Diarr	1.0
77.68	-1.11	13.45	89.95	0.00	15.2400	1.0	Diarr	1.0
91.02	-1.61	5.39	85.88	0.00	13.5900		No Diarr	
86.42	0.02	50.91	100.23	0.00	15.9400	1.0	Diarr	
76.31				3.00			No Diarr	1.0
88.05	-0.94	17.26	91.76	0.00	14.6500	1.0	Diarr	

No R.D.	22.6 >20
Resp Dis	23.5 >20
No R.D.	26.2 >20
No R.D.	13.8 <=20
Resp Dis	19.3 <=20
No R.D.	25.0 >20
No R.D.	22.7 >20
Resp Dis	23.4 >20
No R.D.	27.9 >20
Resp Dis	26.9 >20
No R.D.	33.2 >20
Resp Dis	19.4 <=20
No R.D.	12.6 <=20
No R.D.	21.0 >20
No R.D.	20.0 <=20
No R.D.	30.4 >20
No R.D.	26.9 >20
No R.D.	23.4 >20
Resp Dis	27.9 >20
No R.D.	19.8 <=20
No R.D.	12.4 <=20
No R.D.	33.6 >20
Resp Dis	23.2 >20
No R.D.	22.1 >20
Resp Dis	22.7 >20
No R.D.	32.0 >20
No R.D.	24.9 >20
No R.D.	23.4 >20
No R.D.	22.3 >20
No R.D.	26.5 >20
No R.D.	22.6 >20
No R.D.	23.5 >20
No R.D.	26.2 >20
No R.D.	13.8 <=20
Resp Dis	23.4 >20
Resp Dis	19.6 <=20
Resp Dis	26.2 >20
No R.D.	33.2 >20
No R.D.	37.0 >20
Resp Dis	23.4 >20
Resp Dis	22.7 >20
No R.D.	34.0 >20
Resp Dis	23.2 >20
No R.D.	27.2 >20
No R.D.	41.0 >20
Resp Dis	37.0 >20
Resp Dis	31.0 >20
No R.D.	28.0 >20
No R.D.	30.0 >20
Resp Dis	19.6 <=20
No R.D.	25.0 >20

152.00	1.00	51.00 3-4	No Supl	16.00	106.00	30.10	2116.40
153.00	2.00	49.00 2-3	No Supl	15.50	102.00	26.20	1219.90
154.00	1.00	60.00 3-4	No Supl	20.00	113.00	19.60	1402.60
155.00	1.00	57.00 4-5	Supplem	16.00	104.00	33.60	1104.10
156.00	2.00	47.00 2-3	No Supl	16.00	103.50	22.70	937.00
157.00	2.00	51.00 2-3	No Supl	15.00	102.00	19.40	1127.30
159.00	1.00	30.00 4-5	Supplem	11.50	90.00	23.20	1326.50
162.00	2.00	58.00 3-4	No Supl	19.00	106.50	30.40	1350.50
163.00	2.00	60.00 2-3	No Supl	18.00	110.50	26.90	1211.10
164.00	1.00	56.00 4-5	No Supl	16.00	106.00	27.90	1393.10
167.00	1.00	60.00 2-3	Supplem	20.00	105.00	22.10	1682.30
168.00	1.00	45.00 4-5	No Supl	12.50	98.00	19.80	1312.70
169.00	1.00	39.00 4-5	Supplem	14.00	91.00	22.70	1498.90
177.00	2.00	57.00 4-5	No Supl	15.50	100.00	12.40	1407.20
178.00	2.00	49.00 4-5	No Supl	14.50	96.00	33.60	806.90
179.00	1.00	56.00 4-5	No Supl	20.00	108.00	26.50	1042.40
181.00	2.00	56.00 3-4	Supplem	19.00	107.00	32.00	1034.20
182.00	2.00	60.00 4-5	No Supl	17.50	113.00	23.50	1243.30
186.00	2.00	45.00 4-5	No Supl	14.00	96.00	13.80	1125.90
187.00	2.00	29.00 4-5	No Supl	11.00	92.00	30.00	1178.80
194.00	2.00	38.00 4-5	Supplem	12.00	87.00	24.90	849.80
195.00	1.00	56.00 3-4	Supplem	19.00	107.00	23.40	912.60
204.00	1.00	37.00 4-5	No Supl	12.00	88.00	37.20	1435.10
205.00	1.00	54.00 4-5	No Supl	15.00	103.00	40.10	820.70
206.00	2.00	51.00 4-5	Supplem	15.00	101.00	22.20	1193.30
207.00	2.00	31.00 4-5	Supplem	11.00	92.00	26.50	1521.00
208.00	2.00	44.00 3-4	No Supl	14.00	100.00	33.40	684.50
209.00	1.00	57.00 2-3	Supplem	21.00	108.00	22.60	1292.50
211.00	2.00	38.00 3-4	No Supl	15.00	99.00	28.00	708.00
212.00	1.00	60.00 4-5	No Supl	18.00	104.00	33.20	994.90
215.00	1.00	30.00 3-4	No Supl	11.00	90.00	12.40	874.70
221.00	1.00	27.00 3-4	Supplem	11.50	91.00	23.50	696.90
222.00	2.00	51.00 4-5	Supplem	15.00	100.00	26.20	547.30
223.00	1.00	42.00 2-3	No Supl	14.50	93.00	19.60	923.80
227.00	1.00	53.00 3-4	No Supl	16.50	98.00	20.00	894.10
231.00	1.00	32.00 4-5	No Supl	13.00	85.00	30.00	1262.90
233.00	2.00	59.00 2-3	No Supl	16.00	109.00	35.00	836.40
234.00	2.00	33.00 4-5	No Supl	14.00	88.00	34.00	915.50
241.00	2.00	52.00 2-3	No Supl	16.00	102.00	30.40	442.80
251.00	1.00	59.00 4-5	Supplem	18.00	109.00	13.80	747.00
252.00	1.00	30.00 2-3	No Supl	11.50	92.00	21.00	649.80
254.00	1.00	38.00 3-4	No Supl	14.00	100.00	25.20	1280.00
255.00	2.00	56.00 4-5	No Supl	18.00	106.00	19.60	1966.90
259.00	1.00	44.00 3-4	No Supl	15.00	92.00	30.00	966.00
260.00	2.00	50.00 4-5	No Supl	15.00	99.00	33.20	768.20
262.00	1.00	56.00 4-5	No Supl	18.00	104.00	30.40	1017.00
263.00	1.00	57.00 4-5	No Supl	14.50	101.00	37.00	800.20
265.00	2.00	42.00 3-4	No Supl	13.00	89.00	30.40	877.90
266.00	2.00	29.00 2-3	No Supl	12.00	84.00	34.00	698.60
267.00	2.00	38.00 3-4	No Supl	13.50	87.00	39.00	793.90
269.00	2.00	38.00 2-3	No Supl	12.00	84.00	23.80	685.20

63.00	346.38	58.66	156.40	20.80	13.20	5.11	25.53	11.11
41.50	195.48	31.38	1029.90	269.80	19.70	1.49	6.69	7.20
54.49	275.36	11.88	335.10	57.50	21.20	1.33	3.64	8.13
40.32	202.74	18.32	247.70	28.40	22.90	6.19	3.69	7.93
32.21	186.82	7.46	313.40	76.30	8.90	0.39	1.97	4.45
37.21	233.44	6.88	24.70	6.20	0.70	0.00	2.84	6.63
45.03	263.55	13.67	735.20	85.80	67.20	17.47	4.50	9.92
48.14	249.64	20.99	554.90	102.80	31.90	2.99	4.55	8.67
51.21	190.19	29.07	2459.50	377.50	199.20	70.69	5.79	8.54
37.62	265.73	20.59	561.80	82.20	42.60	41.51	6.48	6.75
65.77	285.36	36.86	11009.30	1189.60	1056.90	12.17	14.60	17.76
49.49	258.44	12.33	202.70	40.60	10.20	1.61	4.16	9.15
42.41	290.52	20.17	826.70	161.40	42.80	15.09	3.69	7.17
47.68	230.60	34.43	1580.50	191.30	141.70	23.06	9.61	9.68
24.81	150.31	14.08	1077.30	156.00	92.00	31.71	3.90	5.34
37.19	199.97	13.60	1596.20	183.30	147.90	37.46	5.14	7.62
28.95	166.55	30.08	1814.10	275.30	147.90	50.55	5.10	8.60
37.72	247.64	14.53	515.00	94.80	29.00	29.87	3.74	7.94
40.30	217.28	15.75	2975.90	338.10	277.70	59.52	5.35	8.78
46.50	192.82	28.44	8155.20	894.40	776.20	39.44	5.50	11.40
32.66	157.40	12.77	782.30	79.40	77.80	17.97	4.15	6.81
33.63	165.36	15.08	456.10	50.00	43.00	11.02	3.96	6.34
52.04	230.40	34.28	529.10	117.70	20.70	4.81	7.64	8.15
20.21	145.14	20.00	806.80	140.60	55.70	30.13	4.86	4.02
34.30	227.67	18.42	360.20	87.60	10.30	0.71	5.37	9.36
52.64	276.73	26.98	177.10	23.30	15.70	7.07	6.47	9.92
31.30	127.44	6.81	526.20	56.30	50.80	3.80	2.89	5.69
42.33	229.43	24.24	93.60	12.40	8.00	3.70	6.98	7.54
25.24	131.15	10.49	6102.00	1638.80	95.90	36.53	2.90	6.88
33.61	165.45	22.47	115.90	17.10	8.80	13.13	3.87	5.34
30.28	147.88	18.57	6279.80	1843.00	20.40	17.53	4.79	7.61
30.92	102.12	20.07	3348.20	390.60	307.00	23.31	4.51	5.91
19.19	91.84	10.85	192.20	57.20	0.30	0.06	3.27	2.10
56.36	125.52	21.43	382.20	102.40	5.10	0.02	2.54	5.40
24.95	163.56	18.01	1182.00	140.00	108.70	26.11	6.27	5.99
33.22	231.44	27.70	2748.90	336.80	250.40	116.32	8.42	9.38
39.91	146.74	11.78	685.20	127.30	38.20	15.54	2.79	5.67
31.64	126.20	32.78	1513.00	230.90	122.10	47.36	4.25	4.66
22.59	64.58	10.99	8678.70	2512.80	49.40	36.91	2.86	7.16
24.70	138.13	12.14	88.60	8.90	8.90	2.30	3.73	5.12
28.11	112.39	10.47	1087.80	149.80	87.80	147.96	2.72	3.88
49.39	215.81	27.26	315.40	52.30	21.20	10.39	4.09	8.37
24.91	142.16	9.64	961.20	177.20	55.70	63.70	2.63	5.68
36.23	151.40	24.95	226.80	29.30	19.20	0.71	5.31	5.86
27.69	152.32	8.23	1098.90	127.50	101.50	65.04	2.80	6.16
28.43	194.53	13.10	156.60	29.80	8.60	1.42	3.93	4.60
17.81	147.39	18.65	158.60	33.40	8.20	0.23	2.62	4.04
26.71	123.14	32.05	814.40	186.50	28.90	1.88	13.44	4.92
17.22	100.06	28.98	312.60	81.60	5.10	1.65	2.92	3.38
26.11	143.79	15.65	1420.50	160.20	132.90	30.68	2.89	4.65
12.93	91.85	27.72	628.60	152.40	18.40	0.41	4.96	2.16

7.61	1.28	117.60	262.48	4.60	11.35	364.74	111.13	76.14
5.28	0.93	67.80	172.93	54.60	3.32	95.56	72.04	52.76
6.28	1.13	77.90	227.02	12.20	2.96	51.99	81.28	62.78
5.50	0.97	61.30	167.98	6.40	13.76	52.68	79.28	54.97
3.49	0.53	52.10	134.23	15.50	0.86	28.09	44.51	34.94
4.97	0.80	62.60	155.03	1.30	0.00	40.52	66.29	49.66
6.77	1.15	102.00	281.43	24.30	43.68	75.02	99.17	67.69
5.90	0.95	103.90	300.91	27.00	7.47	75.88	86.66	59.03
6.75	0.95	67.30	213.37	82.10	157.08	82.67	85.36	67.51
5.17	1.24	107.20	235.15	22.30	103.77	108.05	67.45	51.73
9.78	2.01	93.50	274.02	273.10	27.05	208.63	177.62	97.81
6.56	1.02	101.00	309.29	10.60	4.02	69.29	91.53	65.64
5.78	1.07	115.30	265.06	42.10	37.73	61.56	71.72	57.83
6.38	1.21	78.20	198.68	43.00	51.25	137.28	96.79	63.78
3.62	0.62	62.10	155.03	42.80	79.28	64.92	53.38	36.15
5.36	0.93	57.90	154.97	41.60	83.24	73.37	76.25	53.57
4.49	1.14	79.60	180.96	75.00	126.36	84.96	85.99	44.94
5.75	1.32	95.60	235.76	24.90	74.68	62.33	79.42	57.54
5.81	0.97	86.60	251.86	96.10	148.80	89.18	87.82	58.10
6.41	1.34	90.70	290.63	255.90	98.60	91.71	113.99	64.11
4.69	0.79	65.40	204.13	23.10	44.91	69.21	68.05	46.94
4.39	0.90	70.20	210.20	14.30	27.56	65.98	63.43	43.87
7.09	1.04	79.70	216.83	24.20	10.69	109.08	81.51	70.87
3.01	0.83	63.10	126.31	37.50	75.32	81.01	40.16	30.10
5.03	1.24	91.80	214.39	22.30	1.78	89.46	93.57	50.28
8.54	1.36	84.50	219.33	5.20	15.70	92.44	99.20	85.35
3.98	0.64	52.70	195.62	16.20	9.51	48.18	56.92	39.83
6.51	1.07	99.40	264.54	3.40	9.24	116.35	75.39	65.08
3.93	0.71	54.50	157.75	413.70	91.33	48.29	68.77	39.30
4.56	0.73	76.50	210.08	4.60	32.82	64.52	53.44	45.57
4.38	0.94	67.30	189.27	461.60	43.83	79.78	76.10	43.78
3.64	0.82	53.60	193.28	110.40	58.29	75.20	59.05	36.42
2.17	0.30	42.10	119.97	14.30	0.14	54.42	20.98	21.74
5.27	0.62	51.30	234.82	20.70	0.03	36.29	53.95	52.70
3.90	0.82	68.80	155.92	39.50	65.28	104.44	59.90	39.02
5.34	1.30	97.10	207.63	94.60	290.80	140.36	93.75	53.35
5.80	0.68	64.30	249.43	33.40	38.84	46.52	56.69	57.98
3.51	0.70	70.40	197.74	62.80	118.40	70.85	46.56	35.13
3.73	0.62	34.10	141.22	630.30	92.28	47.69	71.62	37.25
3.64	0.82	57.50	154.35	2.60	5.75	62.18	51.19	36.36
3.19	0.55	36.10	117.12	32.90	328.79	38.89	38.75	31.92
7.14	0.98	98.50	308.69	13.90	25.97	68.08	83.72	71.44
3.44	0.64	40.90	103.78	37.30	141.56	37.54	56.80	34.38
3.71	1.25	74.30	226.47	8.10	1.77	88.43	58.55	37.05
4.20	0.77	59.10	173.05	36.10	162.59	46.69	61.63	41.99
3.67	0.68	56.50	118.48	6.20	3.16	56.10	46.00	36.74
2.99	0.67	44.50	74.20	7.00	0.52	37.47	40.38	29.90
3.88	0.96	67.50	166.93	47.80	4.70	224.03	49.17	38.77
3.18	0.52	53.70	107.64	20.60	4.12	48.58	33.82	31.82
3.41	0.62	61.10	163.17	45.60	76.70	48.21	46.51	34.13
1.39	0.26	51.20	80.83	38.90	1.02	82.74	21.55	13.90

100.00	11.91	65.47	24.94	54.00	3.00	0.00	0.00	1.00
93.12	13.61	64.10	23.15	60.00	3.00	0.00	0.00	1.00
100.00	15.54	78.53	7.62	48.00	4.00	4.00	0.00	1.00
97.11	14.61	73.45	14.94	48.00	4.00	0.00	1.00	0.00
52.65	13.75	79.75	7.17	60.00	4.00	0.00	3.00	0.00
80.31	13.20	82.83	5.50	60.00	5.00	0.00	1.00	0.00
115.19	13.58	79.47	9.28	24.00	6.00	0.00	1.00	1.00
100.00	14.26	73.94	13.99	24.00	5.00	0.00	2.00	1.00
94.47	16.91	62.82	21.60	48.00	3.00	0.00	1.00	0.00
124.18	10.80	76.30	13.30	24.00	4.00	0.00	1.00	0.00
134.01	15.64	67.85	19.72	48.00	4.00	0.00	1.00	7.00
101.99	15.08	78.75	8.45	36.00	2.00	0.00	2.00	1.00
107.33	11.32	77.53	12.11	36.00	1.00	0.00	1.00	7.00
100.00	13.55	65.55	22.02	60.00	4.00	0.00	1.00	1.00
89.14	12.30	74.51	15.70	19.00	1.00	0.00	1.00	0.00
92.84	14.27	76.73	11.74	60.00	5.00	0.00	1.00	3.00
113.98	11.20	64.42	26.18	24.00	3.00	0.00	1.00	0.00
132.36	12.14	79.67	10.52	42.00	3.00	0.00	1.00	2.00
100.00	14.32	77.19	12.59	18.00	4.00	0.00	0.00	7.00
134.40	15.78	65.43	21.71	24.00	3.00	0.00	1.00	7.00
100.00	15.37	74.09	13.52	24.00	4.00	1.00	2.00	7.00
100.00	14.74	72.47	14.88	24.00	3.00	0.00	1.00	7.00
100.00	14.50	64.22	21.50	60.00	4.00	0.00	1.00	7.00
100.00	9.85	70.74	21.93	20.00	4.00	0.00	1.00	4.00
123.52	11.50	76.31	13.89	25.00	3.00	0.00	0.00	1.00
100.00	13.84	72.78	15.97	60.00	3.00	0.00	0.00	3.00
90.91	18.29	74.47	8.95	36.00	4.00	0.00	1.00	7.00
107.37	13.10	71.00	16.88	21.00	4.00	1.00	1.00	0.00
100.00	14.26	74.09	13.33	27.00	4.00	1.00	1.00	7.00
100.00	13.52	66.52	20.33	31.00	3.00	0.00	0.00	0.00
100.00	13.85	67.62	19.11	18.00	3.00	0.00	0.00	7.00
100.00	17.75	58.61	25.92	18.00	4.00	0.00	1.00	1.00
42.91	14.03	67.12	17.84	16.00	4.00	0.00	0.00	1.00
61.58	24.40	54.35	20.88	54.00	5.00	0.00	1.00	0.00
100.00	11.16	73.17	18.13	36.00	5.00	0.00	1.00	3.00
130.00	10.52	73.30	19.74	30.00	4.00	1.00	2.00	7.00
97.53	19.09	70.17	12.68	18.00	5.00	0.00	1.00	1.00
100.00	13.82	55.14	32.23	21.00	7.00	0.00	1.00	2.00
88.37	20.41	58.34	22.34	18.00	7.00	0.00	1.00	1.00
100.00	13.22	73.97	14.62	20.00	7.00	0.00	1.00	3.00
55.12	17.30	69.19	14.50	48.00	7.00	0.00	1.00	7.00
100.00	15.43	67.44	19.17	32.00	4.00	0.00	0.00	3.00
64.03	13.52	77.17	11.78	48.00	3.00	0.00	1.00	1.00
124.53	15.01	62.69	23.25	38.00	3.00	1.00	0.00	3.00
100.00	14.42	79.31	9.65	24.00	3.00	0.00	0.00	3.00
68.55	11.18	76.51	11.59	48.00	4.00	0.00	0.00	0.00
67.25	8.90	73.67	20.98	48.00	5.00	0.00	1.00	3.00
100.00	12.17	56.10	32.86	12.00	4.00	0.00	0.00	1.00
74.40	9.86	57.29	37.34	18.00	5.00	1.00	1.00	4.00
87.82	13.15	72.45	17.74	36.00	7.00	0.00	0.00	3.00

2.00	1.00	1.00	0.00	0.28	61.01	101.16	-0.61	27.13
3.00	1.00	2.00	0.00	-0.05	47.86	99.79	-0.35	36.28
3.00	4.00	3.00	0.00	0.67	74.82	102.80	0.55	70.92
7.00	3.00	3.00	1.00	-0.94	17.26	96.06	-1.06	14.55
0.00	2.00	3.00	0.00	0.62	73.08	102.44	0.08	53.17
0.00	4.00	1.00	0.00	-0.33	36.91	98.67	-0.79	21.44
0.00	1.00	2.00	0.00	-0.12	45.11	99.52	-1.45	7.29
0.00	4.00	3.00	2.00	-0.18	42.73	99.26	0.60	72.54
0.00	1.00	2.00	0.00	0.48	68.43	101.96	0.12	54.80
7.00	4.00	4.00	0.00	-0.38	35.24	98.42	-0.98	16.24
0.00	7.00	4.00	0.00	-1.07	14.18	95.52	0.55	70.92
0.00	4.00	2.00	0.00	-0.73	23.18	96.98	-2.01	2.22
0.00	2.00	3.00	4.00	-1.53	6.24	93.78	-0.69	24.62
0.00	4.00	1.00	0.00	-1.57	5.88	93.68	-0.93	17.65
0.00	4.00	1.00	0.00	-1.53	6.34	93.92	-0.93	17.54
2.00	3.00	4.00	0.00	0.07	52.64	100.28	0.87	80.88
0.00	4.00	3.00	1.00	0.19	57.45	100.76	0.72	76.52
2.00	4.00	3.00	0.00	1.05	85.22	104.26	-0.09	46.60
2.00	5.00	2.00	0.00	-0.96	16.80	96.17	-0.92	17.77
4.00	3.00	3.00	1.00	0.96	83.17	103.76	-1.39	8.15
4.00	4.00	3.00	1.00	-2.20	1.41	91.29	-1.61	5.39
4.00	3.00	1.00	1.00	-0.16	43.79	99.35	0.43	66.76
8.00	3.00	3.00	0.00	-1.98	2.37	92.02	-1.72	4.25
2.00	7.00	3.00	0.00	-0.80	21.17	96.66	-1.34	9.09
2.00	3.00	4.00	0.00	-0.58	28.21	97.70	-0.79	21.44
8.00	1.00	3.00	0.00	0.50	69.08	101.96	-1.62	5.21
2.00	3.00	3.00	0.00	0.20	58.07	100.81	-0.84	19.96
3.00	3.00	1.00	0.00	-0.06	47.64	99.75	1.22	88.95
5.00	1.00	2.00	0.00	0.98	83.71	103.89	0.28	60.95
0.00	2.00	1.00	0.00	-1.29	9.86	94.61	-0.32	37.51
0.00	0.00	1.00	0.00	-0.12	45.11	99.52	-1.81	3.48
4.00	4.00	3.00	0.00	0.88	80.96	103.34	-1.14	12.73
1.00	3.00	2.00	0.00	-0.82	20.64	96.73	-0.79	21.44
4.00	4.00	4.00	0.00	-1.50	6.67	93.86	-0.67	25.21
2.00	3.00	3.00	0.00	-1.81	3.54	92.48	-0.51	30.41
5.00	3.00	2.00	0.00	-1.92	2.72	92.43	-0.61	27.07
5.00	3.00	3.00	0.00	0.26	60.44	101.08	-0.80	21.30
4.00	4.00	3.00	0.00	-1.04	15.02	95.92	0.23	59.03
5.00	1.00	2.00	0.00	-0.47	31.92	98.12	-0.30	38.26
5.00	3.00	3.00	0.00	-0.08	46.69	99.65	-0.24	40.42
5.00	3.00	5.00	0.00	0.45	67.21	101.73	-1.45	7.29
5.00	3.00	3.00	0.00	0.94	82.66	103.80	-0.59	27.69
5.00	2.00	1.00	0.00	-0.05	48.16	99.81	0.34	63.45
5.00	7.00	3.00	0.00	-2.04	2.08	91.63	-0.56	28.67
5.00	7.00	2.00	0.00	-0.93	17.69	96.30	-0.72	23.65
5.00	1.00	1.00	0.00	-0.82	20.50	96.56	-0.01	49.69
5.00	2.00	2.00	1.00	-1.61	5.39	93.29	-1.78	3.74
5.00	1.00	3.00	0.00	-2.30	1.08	90.88	-1.30	9.68
5.00	1.00	3.00	0.00	-1.35	8.83	94.73	-0.63	26.31
3.00	4.00	2.00	0.00	-2.20	1.41	91.29	-0.62	26.82
4.00	3.00	1.00	0.00	0.02	50.95	100.09	-1.09	13.83

306.00	2.00	50.00 4-5	No Supl	15.50	100.00	31.00	984.30
307.00	2.00	51.00 4-5	No Supl	15.00	96.00	30.20	743.30
309.00	1.00	45.00 3-4	No Supl	16.00	95.00	23.50	956.00
311.00	1.00	32.00 2-3	No Supl	11.00	82.00	13.80	836.50
312.00	2.00	60.00 4-5	No Supl	16.00	110.00	21.80	464.90
315.00	1.00	28.00 2-3	No Supl	14.00	93.00	25.00	866.50
331.00	1.00	49.00 4-5	No Supl	15.00	100.00	21.60	1437.00
332.00	1.00	56.00 4-5	No Supl	14.50	100.00	30.10	1025.20
335.00	2.00	48.00 3-4	No Supl	14.50	96.00	22.60	484.10
337.00	2.00	44.00 3-4	No Supl	13.50	99.00	31.20	495.30

35.90	174.34	18.18	1074.10	153.90	92.80	31.71	5.54	8.18
38.52	119.19	13.17	618.00	169.50	6.40	1.44	2.06	4.02
48.08	150.77	18.65	1399.70	258.10	88.40	30.31	3.71	5.81
37.21	125.77	21.93	770.40	163.90	32.30	3.97	3.99	5.85
17.20	76.10	10.37	489.90	122.10	12.20	0.57	2.15	2.62
35.66	146.82	16.23	704.60	182.10	11.80	1.48	1.89	4.08
63.54	222.17	35.04	538.30	113.00	24.30	9.69	16.40	10.42
45.67	180.21	15.16	10138.40	2307.30	371.60	53.87	3.99	10.27
21.17	78.29	10.49	204.00	53.80	3.90	2.30	3.15	3.98
20.14	81.72	10.99	72.70	7.40	7.40	4.07	3.58	4.20

5.71	0.98	54.70	149.57	33.90	70.47	79.11	81.80	57.06
3.75	0.42	41.30	160.48	34.10	3.21	29.46	40.24	37.50
4.68	0.62	73.50	300.47	68.20	75.78	61.89	58.11	46.75
4.39	0.70	64.30	232.59	42.30	9.91	66.42	58.47	43.91
1.89	0.26	35.80	107.49	31.00	1.41	35.76	26.16	18.85
3.63	0.45	66.70	222.89	46.00	3.69	31.51	40.78	36.28
6.55	1.09	110.50	397.10	29.30	24.22	273.41	104.21	65.53
6.32	0.89	78.90	285.43	592.30	134.67	66.53	102.75	63.15
2.91	0.48	37.20	132.32	13.60	5.75	52.42	39.77	29.08
2.94	0.57	38.10	125.85	2.10	10.18	59.73	42.00	29.35

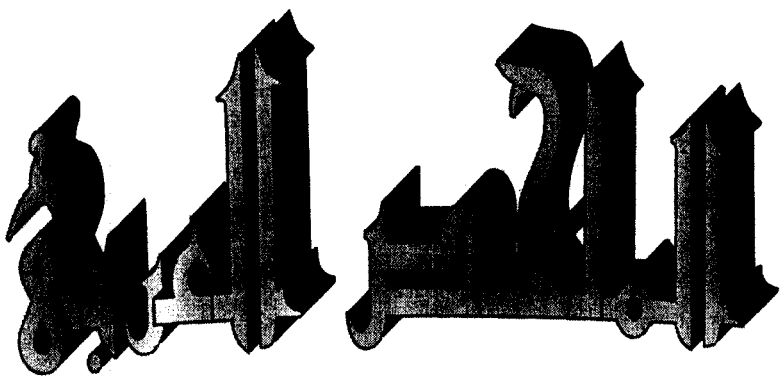
97.80	14.59	70.85	16.63	54.00	4.00	0.00	1.00	7.00
42.12	20.73	64.14	15.95	48.00	3.00	0.00	0.00	1.00
88.46	20.12	63.09	17.56	24.00	3.00	0.00	0.00	1.00
99.45	17.80	60.14	23.60	36.00	4.00	4.00	0.00	1.00
36.86	14.80	65.47	20.08	18.00	4.00	0.00	1.00	0.00
64.03	16.46	67.78	16.85	12.00	4.00	0.00	3.00	0.00
109.22	17.69	61.84	21.94	24.00	5.00	0.00	1.00	0.00
100.00	17.82	70.31	13.31	24.00	6.00	0.00	1.00	1.00
68.40	17.49	64.69	19.50	24.00	5.00	0.00	2.00	1.00
82.06	16.26	66.00	19.96	36.00	3.00	0.00	1.00	0.00

3.00	0.00	2.00	0.00	-0.68	24.72	97.27	-0.43	33.37
2.00	1.00	1.00	0.00	-1.79	3.69	92.86	-0.79	21.44
3.00	1.00	2.00	0.00	-1.45	7.30	94.01	-0.10	45.88
3.00	4.00	3.00	0.00	-2.75	0.30	89.16	-1.98	2.40
7.00	3.00	3.00	1.00	0.37	64.30	101.49	-0.86	19.45
0.00	2.00	3.00	0.00	1.21	88.76	104.66	0.51	69.34
0.00	4.00	1.00	0.00	-0.83	20.30	96.56	-0.97	16.62
0.00	1.00	2.00	0.00	-1.71	4.33	92.85	-1.72	4.30
0.00	4.00	3.00	2.00	-1.39	8.21	94.46	-0.86	19.53
0.00	1.00	2.00	0.00	-0.05	47.98	99.80	-1.15	12.50

95.41	0.08	53.16	100.85	0.00	15.5000	1.0 Diarr	
91.53	0.42	66.23	104.53	0.00	16.2800	1.0 Diarr	
98.83	1.04	85.12	110.62	0.00	17.7300	No Diarr	1.0
79.17	-0.43	33.35	96.05	0.00	16.3600	1.0 Diarr	1.0
90.58	-1.40	8.06	87.74	0.00	13.2200	1.0 Diarr	
106.59	0.02	50.71	100.19	0.00	16.1900	No Diarr	2.0
88.96	-0.54	29.30	95.25	0.00	15.0000	No Diarr	
80.48	-0.91	18.18	92.07	0.00	14.5000	No Diarr	
90.86	0.10	53.86	101.05	0.00	15.7300	No Diarr	3.0
87.82	-1.21	11.38	89.36	0.00	13.7700	2.0 Diarr	1.0

No R.D.	31.0	>20
No R.D.	30.2	>20
Resp Dis	23.5	>20
Resp Dis	13.8	<=20
No R.D.	21.8	>20
Resp Dis	25.0	>20
No R.D.	21.6	>20
No R.D.	30.1	>20
Resp Dis	22.6	>20
Resp Dis	31.2	>20


ARABIC
SUMMER


البصر الحديد

الملخص العربي

يعتبر فيتامين (أ) من العناصر الغذائية العضوية الهامة لسلامة الصحة و النمو و الحياة، فهو هام في العديد من العمليات الفسيولوجية مثل الرؤية و النمو و تخليق الخلايا و قدرة الجينات على التعديل و الحفاظ على أنسجة الجسم الظهارية و الوظائف المناعية و لذلك فهو يلقب بالفيتامين المضاد للعدوى لانه يساعد الجسم على مقاومة العدوى و يحافظ على حيوية الخلايا السطحية للجسم مما يمنع اختراقها بواسطة الكائنات الدقيقة.

يوجد فيتامين (أ) فى دم الأنسان في صورة " الرتينول " محمولا على بروتين خاص به و هو " البوتين حامل الرتينول" و تعتبر نسبة فيتامين (أ) في الدم مقياسا لمستوى فيتامين (أ) بالجسم حينما يصعب قياس نسبة الفيتامين في الكبد الذي يحتوي على ٩٠ % من النسبة الكلية بالجسم و يصبح مستوى فيتامين (أ) بالدم منخفضا ان قلت نسبته عن ٢٠ ميكروجرام/١٠٠سم مكعب من بلازما الدم.

الهدف من هذه الرسالة تقييم حالة فيتامين (أ) في الأطفال من سن ٢-٥ سنوات و رسم محاولة تداخلية بواسطة فيتامين (أ) لهؤلاء الأطفال و معرفة نتيجة هذه المحاولة في تقليل الحالة المرضيةمن أمراض الجهاز التنفسي و الاسهال. في هذه الدراسةتم قياس معدل فيتامين (أ) في الدم و البروتين حامل الريتينول و الزنك و الأجسام المضادة النوعية (أ) (ب) ، (ج) في ١٨٠ طفل ثم تم اعطاء جرعة تساوي مائتي ألف وحدة دوليةمن فيتامين (أ) عن طريق الفم لتسعين طفل و بعد ثلاثون يوما تم قياس مستوى فيتامين (أ) مرة أخرى لكل الأطفال ثم جرت متابعة جميع الأطفال لمدة ستة أشهر لمعرفة حالات الاصابة بالاسهال و الأمراض التنفسية.

تبين أن مستوى فيتامين (أ) في الدم قد ارتفع في المجموعة التي اعطيت فيتامين (أ) بعد ثلاثون يوما من الاضافة بينما تبقى المستوى بدون ارتفاع في المجموعة التي لم تتناول الفيتامين. كذلك فان مستوى البروتين الحامل للريتينول بالدم و مستوى الزنك قد تأثر طبقا لمستوى قيتامين (أ) بالدم " أعلى اذا كان مستوى فيتامين (أ) أكثر من ٢٠

ميكروجرام/١٠٠سم مكعب عن الحالات الأخرى و الذي مستوى فيتامين (أ) يساوي أو أقل من ٢٠ ميكروجرام/١٠٠سم مكعب ". كذلك فانه بعد متابعة الأطفال لمدة ستة أشهر من اعطاء جرعة فيتامين (أ) عن طريق الفم تبين أن الاصابة بالاسهال و أمراض الجهاز التنفسي أصبحت أقل في الأطفال الذين أعطوا فيتامين (أ).

مستخلص الرسالة

عنوان الرسالة : التجربة التداخلية لتحسين حالة فيتامين أ في الأطفال من سن ٢-٥ سنوات.

تهدف هذه الدراسة لتحسين حالة فيتامين أ في الأطفال و تقليل الحالة المرضية بالنسبة لأمراض الجهاز التنفسي و الاسهال. ١٨٠ طفل استمروا في هذه الدراسة من المترددين على المركز الصحي بالبدرشين بالجيزة. و قد تم قياس نسبة فيتامين أ و الزنك و الرتينول حامل البروتين و الاجسام المضادة للمناعة. ثم أعطي ٢٠٠,٠٠٠ وحدة دولية من فيتامين أ عن طريق الفم الى ٩٠ طفل. و بعد شهر تم قياس نسبة فيتامين أ و تم متابعة الأطفال لمدة ٦ شهور بعد ذلك.

تبين أرتفاع نسبة فيتامين أ في الدم في المجموعة التي أعطيت فيتامين أ كما قلت نسبة الاصابة بالأسهال و أمراض الجهاز التنفسي في الأطفال الذين أعطوا فيتامين أ.

الكلمات المفتاحية:

طب الأطفال – الطعام الغني بفيتامين أ – الأسهال – أمراض الجهاز التنفسي – نسبة فيتامين أ و الزنك و الرتينول حامل البروتين بالدم.

جامعة عين شمس
معهد الدراسات العليا للطفولة
قسم الدراسات الطبية

شكر

أشكر السادة الأساتذة الذين قاموا بالاشراف
و هم:
١ – أ.د. سهير ابراهيم سالم.
٢ – د. مجدي كرم الدين.
٣ – د. عبلة جلال خليفة.

ثم الأشخاص الذين تعاونوا معي في البحث
و هم:
١ – أ.د. سنية وهبة.
٢ – أ.د. سلوي الحسيني.

و كذلك الهيئات الآتية:
١ – المركز القومي للبحوث.
٢ – معهد الدراسات العليا للطفولة.

جامعة عين شمس

الكلية : معهد الدراسات العليا للطفولة

صفحة العنوان :

أسم الطالبة : سمر محمد المأمون سالم.

الدرجة : دكتوراه.

القسم التابع له : الدراسات الطبية.

أسم الكلية : معهد الدراسات العليا للطفولة.

الجامعة : عين شمس.

سنة التخرج : ٢٠٠٠ .

سنة المنح : ٢٠٠٠ .

شروط عامة:

يوضع شعار الجامعة على الغلاف الخارجي.

جامعة عين شمس

الكلية:

رسالة ماجستير / دكتوراه:

أسم الطالبة : سمر محمد المأمون سالم.

عنوان الرسالة : التجربة التداخلية لتحسين حالة فيتامين أ في الأطفال من سن ٢-٥ سنوات.

أسم الدرجة : (ماجستير / دكتوراه).

لجنة الاشراف:

١ – الاسم/ أ.د. سهير ابراهيم سالم. ٢ – الوظيفة/ أستاذ الكيمياء الحيوية المركز القومي للبحوث.

١ – الاسم / د. مجدي كرم الدين. ٢- الوظيفة/ أستاذ مساعد طب الأطفال- معهد الدراسات العليا للطفولة.

١ – الاسم/ د. عبلة جلال خليفة. ٢– الوظيفة/ أستاذ مساعد طب الأطفال – المركز القومي للبحوث.

تاريخ البحث :٢١/٢/١٩٩٢

الدراسات العليا :

ختم الاجازة : / ٢٠٠٠ أجيزت الرسالة بتاريخ ٢/ ١/ ٢٠٠٠

موافق عليه
١٧ / ٢ / ٢٠٠٠

موافق عليه من الجامعة

معهد الدراسات العليا للطفولة
جامعة عين شمس

التجربة التداخلية لتحسين حالة فيتامين أ في الأطفال من سن ٢-٥ سنوات

بحث مقدم توطئة للحصول على درجة دكتوراه الفلسفة
من معهد الدراسات العليا للطفولة (القسم الطبي) - جامعة عين شمس

مقدم من
الطبيبة / سمر محمد المأمون سالم
ماجستير طب الأطفال - جامعة القاهرة

تحت أشراف

أ.د. سهير إبراهيم سالم
أستاذ الكيمياء الحيوية
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