THE COMPREHENSIVE REVIEW ON FAT SOLUBLE VITAMINS

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ABSTRACT

This review article deals with brief description of fat soluble vitamins with figures and tables showing statistical systematic data duly quoting the references wherever necessary. The word “soluble” actually means “able to be dissolved.” Whether a vitamin is classified as 'fat-soluble' or 'water-soluble' has to do with how the vitamin is absorbed, stored and removed from the body. Vitamins are tiny organic compounds with a huge impact on the health and well-being of the body. The body needs a small amount of fat soluble vitamins in regulate to stay in optimal health. Fat soluble vitamins play an important role in keeping the body healthy and functioning from immune system and muscle and heart function, easy flow and clotting of blood as well as eye health. They are dangerous to health and wellness—particularly reproductive health and wellness. Low-fat, no-fat and vegetarian diets are woefully lacking in fat soluble vitamins. However a diet based on traditional foods can naturally provide these vitamins. Science is still learning about many of the functions of vitamins. "Too much vitamin A, D, or K can lead to increased levels that are unhealthy and can cause serious health consequences. Diseased conditions leading to decreased fat absorption leads to decreased absorption of vitamins. The fat-soluble vitamins work most safely and effectively when obtained them from natural foods within the context of a diet rich in all their synergistic partners. If fat soluble vitamins are stored for lengthy time they generate threat for toxicity than water soluble vitamins and such situation even aggravated, provided they are consumed in excess. Vitamin products, above the legal limits are not considered food supplements and must be registered as prescription or non-prescription (over-the-counter drugs) due to their latent side effects. Vitamin A and E supplements do not provide health benefits for healthy individuals, as an alternative they may enhance transience, and it is held proved that beta-carotene supplements can be harmful to smokers.
INTRODUCTION

Vitamins are defined as organic substance required in small amount for the maintenance and growth of living organisms. Their deficiency may lead to certain specific diseases or symptoms which can be cured by the administration of that specific vitamin only. In the early 20th century the innovation of vitamins began. In 1906, the British Biochemist Sir Frederick Hopkins established that foods contain accessory factors in addition to proteins, carbohydrates, fats, minerals and water. The term vitamin was first discovered by Funk. Funk identified that the anti-beriberi substance in unpolished rice was an amine which is a type of nitrogen containing compound. He coined the term "vitamine" a combination word from vita and amine, meaning amine of life and considered that amines are vital for the life. However it was later found that all vitamins are either “nitrogen” or “amines” particularly in vitamin A. In 1912 Hopkins and Funk made a hypothesis according to which the deficiency of some vitamins could cause diseases such as beriberi and scurvy. In 1920, Drummond proposed to drop the final "e" consequently the word vitamines “e” was removed and termed as vitamins. It was later found that different vitamins have different chemical properties and advantages apart from harm if consumed in excess than what is required.[1]

Vitamin A maintains the right balance of these vitamins in the body is critical to excellent health and well-being the nature of being fat-soluble means that these vitamins are transported with fat and stored in the liver and fat tissue. Because they are stored, they can build up and become toxic when eaten in excessive amounts. This mostly occurs when taking single supplements of the fat-soluble vitamins rather than in foods rich in vitamins. Eating fat-free can lead to health problems can lead to vitamin deficiencies. When fat-soluble vitamins are ingested, they move from the mouth to the stomach to the small intestine. Their ability to dissolve in fat allows for their absorption: Fats are able to move across the cell walls of the small intestine and enter the body's general circulation.[2]

Deficiency in vitamin D can cause fragile, thin, or deformed bones and rickets in children and osteomalacia in adults. It having enough vitamin D in the diet, in addition to calcium, helps to prevent osteoporosis. Vitamin D isn’t actually in its working shape when it enters the body through sunlight, food, or supplements. In addition to obtain vitamin D from a few available natural and fortified foods, the body of course absorbs vitamin D from sunlight.[3]
Family unit of eight antioxidants and four tocopherols of vitamin E are alpha, beta, gamma and delta, and four tocotrienols are alpha, beta, gamma and delta out of which Alpha-tocopherols is the most active form. Vitamin E is the collective name for a group of 8 different chemicals that comprise diverse amounts of biological use. However, only alpha-tocopherols are indicated to cater the needs of the human body. Vitamin E found in the skin as a primary form and then total body enhancement. The release of vitamin E from food requires bile, digestive enzymes from the pancreas and intestinal tract, and incorporation into micelles. It is stored in the liver and adipose tissue. Its daily requirement is 15 µg per day.

Vitamin K is named for the German word “koagulation” because of its function in assisting blood clotting. In the twenty-first century its role in preventing calcification of the blood vessels and other soft tissues became clear. Vitamin K2, found in animal fats and fermented foods, in leafy greens and in much smaller quantities in most diets when compared to vitamin K1. Vitamin K1 more efficiently supports blood clotting, while vitamin K2 is also essential for building strong bones, preventing heart disease, and it plays a crucial part in other bodily processes as well. The biological role of vitamin K2 help to move calcium into the proper areas in the body, such as bones and teeth and also helps to remove calcium from arteries and soft tissues. Vitamin K2 activates proteins by adding carbon dioxide to them. In this production of CO2 by consuming carbohydrates, exercising, and maintaining correct level of thyroid status.

**Fat Soluble Vitamins**

**What are Fat-Soluble Vitamins?**

The fat-soluble vitamins, A, D, E, and K, are stored in the body for long periods of time and generally pose a greater risk for toxicity when consumed in excess than water-soluble vitamins. Eating a normal, well-balanced diet will not lead to toxicity in otherwise healthy individuals. However, taking vitamin supplements that contain mega doses of vitamins A, D, E and K may lead to toxicity. The body only needs small amounts of any vitamin.

While diseases caused by a lack of fat-soluble vitamins are rare in the United States, symptoms of mild deficiency can develop without adequate amounts of vitamins in the diet. Additionally, some health problems may decrease the absorption of fat, and in turn, decrease the absorption of vitamins A, D, E and K. Consult a medical professional about any potential health troubles that may interfere with vitamin absorption.
Classification of vitamins

**Vitamin A**

Vitamin A was the first fat-soluble vitamin to be identified; it is now recognized that there are several related compounds which have vitamin A activity, hence the name Vitamin A will be used. Three forms possess vitamin A activity in the body: retinol, retinal, and retinoic acid; collectively they are called the retinoids. There is interconversion between the first two forms, but once the acid has been formed it cannot be reconverted. In addition, there are provitamin A compounds, the carotenoids, which can be converted, with varying degrees of efficiency into retinol. The most important of these is 13-carotene.

The majority of vitamin A is stored in the liver and the size of the stores can be used to assess vitamin status. It is transported to its target sites attached to a specific retinol-binding protein (RBP), and a pre-albumin in the plasma. Retinol levels in the plasma are not a good indicator of vitamin status because of the normal size of liver stores; instead, lutein comprises 10-40% of plasma carotenoids and may be a useful marker of "green" intake. The different forms of vitamin A appear to have reverse function in the body. Between the many function of vitamin A, particularly important is its role in lymphocyte function and antibody response to infections. Children suffering from vitamin A deficiency are, therefore, more susceptible to infections, such as those of the respiratory and gastrointestinal tract, and measles. Furthermore, a severe infection may further deplete vitamin A and make the child more likely to die than a non deficient child with the same disease. There is a link between vitamin A and red blood cell formation, possibly involving the utilization of iron; anaemia is a frequent finding in vitamin A deficiency despite apparently adequate iron stores.
In recent years, the carotenoids have been found to have an important antioxidant role in quenching free radical reactions, particularly those involving singlet oxygen. This prevents a damaging chain reaction that could result in lipid per oxidation or damage to DNA, both of which have been postulated as being precursors of disease processes, leading to coronary heart disease and cancer, respectively. These properties have been attributed both to [3-carotene and lycopene (found especially in tomatoes).\cite{10}

Retinoids: chemical forms of preformed vitamin A Retinol, retinal, retinoic acid
- Carotenoids: yellow-orange pigments synthesized by plants and many microorganisms
- Some are vitamin A precursors converted to retinoids
- Example: beta-carotene, provitamin converted into vitamin A
- Sources: vitamin A in animal products (eggs, dairy), provitamin A in fruits and vegetables beta-carotene in orange, yellow, and dark green vegetables.
- Deficiency: xerophthalmia (night blindness progressing to permanent blindness), abnormal jaw bone growth in children, increased infections.
- Excess: nausea, vomiting, headache, dizziness, blurred vision, lack of muscle coordination, birth defects, liver damage, bone fractures; excess β-carotene can cause hypercarotenemia

**Deficiency**
If consumed food containing low quantity of required defined daily dose of vitamin A leading to liver disease, malabsorption due to the body fails to absorbs nutrients from food in small intestine causing celiac diseases, chronic liver, chronic pancreatitis, crones diseases etc., decreased mucus production, decreased resistance. Bacterial attack of the eye, conjunctival xerosis, Bigot's spots (white triangular plaques on conjunctiva), night blindness (nyctalopia),
follicular hyperkeratosis, poor growth, skin disorders, lack of growth and Hypervitaminosis can cause serious potential problems (like birth defects). Growth retardation caused by vitamin A deficiency. Vitamin A is also responsible for maintaining a normal surface of the eye (cornea) and deficiency leads to drying of the eye surface that condition called Xerophthalmia. This can lead to blue cloudiness of the eye followed by ulcer formation. In immunity, deficiency may lead to decreased resistance to infections and supplementation. If left untreated it leads to generation and ulceration of cornea called keratomalacia, ultimately resulting in blindness.

**Adverse effects**

Routine consumption of large amounts of vitamin A over a period can result in toxic symptoms such as liver damage, bone abnormalities, joint pain, alopecia, vomiting and skin desquamation. Hypervitaminosis (dermatitis-drying and redness of skin, decalcification and tenderness of long bones, weight loss, hair loss, enlargement of liver, joint pain, irritability-due to increased intracranial pressure) appears to be due to abnormal transport and distribution of vitamin A and retinoids caused by overloading of the plasma transport mechanisms. The smallest daily supplement associated with liver cirrhosis those have reported 7500 μg taken for 6 years. Very high single doses can also cause transient acute toxic symptoms that may include bulging fontanels in infants, headaches in older children and adults and vomiting, diarrhoea, loss of appetite and irritability in all age groups. Rarely does toxicity occur from ingestion of excess food sources of vitamin A and due to very frequent consumption of liver products. Toxicity from food sources of Provitamin A carotenoids not reported except for the cosmetic yellowing of skin and CNS effects like (headache, irritability, seizures, increased intracranial pressure), GIT effects (nausea and vomiting). Moreover, some of the toxicity effects like on the skin (desquamation-destruction and removal of squamous epithelial cells and on the eye (papilledema-swelling of optic disc/papilla, scotoma-a small area of absent vision in visual field, photophobia-an abnormal intolerance to light), teratogenic effects (craniofacial, urogenital, neural tube defects and musculoskeletal abnormalities). The over dose of vitamin A intake effects adversely on bone mineral density and fracture risk in perimenopausal women, Osteoporosis.

**Functions**

Retinoic acid is highly necessary for cellular differentiation, important for embryo development, gene expression. Retinoic acid influences production, structure and function of
epithelial cells and external passages or mucus forming cells within the body. The retinol is oxidized to its aldehyde and retinal which complexes with a molecule in the eye called opsin. Within the photoreceptor cells of the retina are the rods which detect small amounts of light and are specialized for motion. The cones that are specialized for color vision in bright light. The both rods and cones possess specialized outer segment disks that contain high amounts of rhodopsin and iodopsin respectively. When a photon of light hits the complex the retinal changes from the 11-cis form to the all-Trans form. These are initiating a chain of actions which results in the transmission of an impulse up to the optic nerve. These compounds are often referred to as the "Visual pigment".

Photoreceptor cells detect light and undergo a series of reactions which send signals to the brain where they are deciphered as a particular visual image. The important function of vitamin A involves retinoic acid, which acts as a hormone, and retinoic acid first binds to retinoic acid receptors. The receptors then interact with specific nucleotide sequences of DNA and the interaction directly affects gene expression and transcription which in turn control cellular expansion and body processes. For example epithelial cells depend on retinoic acid for structural and functional maintenance. Retinoic acid is especially important in heart, eye and lung and ear development, pigmentosa.\textsuperscript{[15]} Vitamin A is plays a key role in glycoprotein synthesis and once formed glycoproteins are important in multiple cellular processes including: communication, recognition, adhesion and aggregation. Retinoids are most commonly used in the treatment of skin diseases and the role of the retinoids in epithelial cell formation is very important in the treatment of skin cancer, acne and acne related diseases. Vitamin A also has antioxidant properties. However, β-carotene has been noted as having pro-oxidant properties. Vitamin A is known to help repair damaged tissue and therefore may be beneficial in counter action against free radical damage.

**Therapeutic uses:** Vitamin A is mainly used in the treatment of dermatological disease and lesions (due to suppression of keratin synthesis and secretion of mucous), Xerophthalmia, cold, warts, corns and calluses (skin infections), acne, psoriasis and persistent follicular hyperkeratosis of arms, night blindness, breast cancer\textsuperscript{[16]} and vision.

**Vitamin D**

Vitamin D plays a significant role in the body’s use of calcium and phosphorous. It works by increasing the amount of calcium absorbed from the small intestine, helping to form and maintain bones. Vitamin D benefits the body by playing a role in immunity and controlling
cell growth. Children especially need sufficient amounts of vitamin D to develop strong bones and healthy teeth.

**Food Sources for Vitamin D**

The primary food sources of vitamin D are milk and other dairy products prepared with vitamin D. Vitamin D is also found in oily fish (e.g., herring, salmon and sardines) as well as in cod liver oil. In addition to the vitamin D provided by food, we obtain vitamin D through our skin which produces vitamin D in response to sunlight.

**How much Vitamin D**

The Recommended Dietary Allowance (RDA) for vitamin D appears as micrograms (mcg) of cholecalciferol (vitamin D3) (Table 1). From 12 months to age fifty, the RDA is set at 15 mcg. Twenty mcg of cholecalciferol equals 800 International Units (IU), which is the recommendation for maintenance of healthy bone for adults over fifty. Table 1 lists additional recommendations for various life stages.

Exposure to ultraviolet light is required for the body to produce the active form of vitamin D. Ten to fifteen minutes of sunlight without sunscreen on the hands, arms and face, twice a week is sufficient to receive enough vitamin D. This can easily be obtained in the time spent riding a bike to work or taking a short walk. In order to reduce the risk for skin cancer one should apply sunscreen with an SPF of 15 or more, if time in the sun exceeds 10 to 15 minutes. [17]

**Vitamin D Deficiency**

Symptoms of vitamin D deficiency in growing children include rickets (long, soft bowed legs) and destruction of the back of the skull. Vitamin D deficiency in adults may result in osteomalacia (muscle and bone weakness), and osteoporosis (loss of bone mass).

In addition, those that live in inner cities, wear clothing that covers most of the skin, or live in northern climates where little sun is seen in the winter are also prone to vitamin D deficiency. Since most foods have very low vitamin D levels (unless they are enriched) a deficiency may be more likely to develop without sufficient exposure to sunlight. Adding fortified foods to the diet such as milk, and for adults including a supplement, are effective at ensuring adequate vitamin D intake and preventing low vitamin D levels.
Vitamin D deficiency has been associated with increased risk of common cancers, autoimmune diseases, hypertension, and infectious disease. In the absence of adequate sun exposure, at least 800 to 1,000 IU of vitamin D3 may be needed to reach the circulating level required to maximize vitamin D’s benefits.\[18\]

**Who is at Risk** — These populations may require extra vitamin D in the form of supplements or fortified foods:

- **Exclusively breast-fed infants:** Human milk only provides 25 IU of vitamin D per liter. All breast-fed and partially breast-fed infants should be given a vitamin D supplement of 400 IU/day.

- **Dark Skin:** Those with dark pigmented skin synthesize less vitamin D upon exposure to sunlight compared to those with light pigmented skin.

- **Elderly:** This population has a reduced ability to synthesize vitamin D upon exposure to sunlight, and is also more likely to stay indoors and wear sunscreen which blocks vitamin D synthesis.\[19\]

- **Covered and protected skin:** Those that cover all of their skin with clothing while outside, and those that wear sunscreen with an SPF factor of 8, block most of the synthesis of vitamin D from sunlight.

- **Disease:** Fat malabsorption syndromes, inflammatory bowel disease (IBD), and obesity are all known to result in a decreased ability to absorb and/or use vitamin D in fat stores.

**Too much Vitamin D**

The Tolerable Upper Intake Level (UL) for vitamin D is set at 100 mcg for people 9 years of age and older (Table 2). High doses of vitamin D supplements coupled with large amounts of fortified foods may cause accumulations in the liver and produce signs of poisoning. Signs of vitamin D toxicity include excess calcium in the blood, slowed mental and physical growth, decreased appetite, nausea and vomiting.

It is especially important that infants and young children do not consume excess amounts of vitamin D regularly, due to their small body size.
Types of vitamin D: So far 7 different types of vitamin D have been discovered, among which little information known about D5, D6 and D7. Infact in 7 different types of vitamin D only D1, D2 and D3 are important.

1. Vitamin D1 is a molecular compound containing lumisterol and calciferol in 1:1 ratio.
2. Vitamin D2 is ergocalciferol, derived from ergosterol.
3. Vitamin D3 is cholecalciferol and obtained form 7-dehydrocholesterol.
4. Vitamin D4 is obtained from 22-dihyroergocalciferol.
5. Vitamin D5 is sitocalciferol.[20]

Sources
Vitamin D is mostly obtained from natural sources and supplied through fortified food such as bread, breakfast cereal, margarine, oil spreads, milk, pastries, yogurt etc. that supplied with required amounts. Natural source include cod liver oil, catfish, eel, mackerel, salmon, sardines, tuna and mushrooms. Fungi and yeast also serve as sources of vitamin D as possess vitamin D precursor ergosterol. Vitamin D2 is of plant origin and commercially obtained by irradiation with UV light of ergosterol found in ergot and yeast. Therefore, ergosterol is called as the Provitamin. Vitamin D3 is obtained from animal sources only, by irradiation with UV light of a Provitamin. Table 4 shows RNI for vitamin D according to age group.[21]

Vitamin E: (Tocopherol)

What is Vitamin E
Vitamin E benefits the body by acting as an antioxidant, and protecting vitamins A and C, red blood cells, and essential fatty acids from destruction. Research from decades ago suggested that taking antioxidant supplements, vitamin E in particular, might help prevent heart disease and cancer. However, newer findings indicate that people who take antioxidant and vitamin E supplements are not better protected against heart disease and cancer than non-supplement users. Many studies show a link between regularly eating an antioxidant rich diet full of fruits and vegetables, and a lower risk for heart disease, cancer, and several other diseases. Essentially, recent research indicates that to receive the full benefits of antioxidants and phytonutrients in the diet, one should consume these compounds in the form of fruits and vegetables, not as supplements.[22]
Sources

Food Sources for Vitamin E

About 60 percent of vitamin E in the diet comes from vegetable oil (soybean, corn, cottonseed, and safflower). This also includes products made with vegetable oil (margarine and salad dressing). Vitamin E sources also include fruits and vegetables, grains, nuts (almonds and hazelnuts), seeds (sunflower) and fortified cereals.

Vitamin E can be found in fortified cereals, seeds and seed oils like sunflower and green leafy vegetables like spinach, turnip, tomato products, pumpkin, sweet potato, blue crab, rockfish, mangoes, asparagus, broccoli, papayas and their products. Liver of horses and cattle's found in high quantity and small quantities found in the muscles of heart, kidneys, placenta, eggs, mustard greens, turnip greens, chard, parsley, kale, olives, bell pepper, brussel sprouts, kiwi fruit and blue berries. It is also available in foods and also available in oils such as cooking oil, fish oil, multigrain apricots, mustard and poultry, cottonseed oil, soybean and hazelnuts, vegetable oils, corn, canola, sesame, peanut, rice bran, and palm oils, almond oil. It also can be had from legumes and whole grains, lentils, wheat, rice, northern beans, chickpeas, barley grass and oats. Wheat germ oil extracted from the germ of wheat, wheat germ oil has been using for a long time as a vitamin E supplement which offers a good combination of tocopherols.[23]

Functions

Being as an anti-oxidant vitamin E plays an important role to protect the body cells from the damage caused by free radicals which are highly reactive and destructive compounds formed due to oxidative deterioration (metabolism) of polyunsaturated fats. Factors contributing for free radical generation in the body include smoking and exposure to UV - radiations. Tocopherol performs a unique function and interrupts free radical chain reactions by capturing the free radicals which denotes antioxidant properties. The free hydroxyl group on the aromatic ring is responsible for the antioxidant properties. The hydrogen from this group is donating to the free radical resulting in a relatively stable free radical form of the vitamin. Vitamin E protects this oxygen rich blood from becoming filling with free radicals and the heart during sex which is also called sex vitamin. As a regulating cellular metabolism in the body including protein synthesis in muscles and protects vitamin C from oxidation and stabilizes of vitamin A.[24]
Deficiency
Deficiency of vitamin E causes heart disease, angina, cancer, multiple sclerosis, muscle weakness, diabetes, respiratory tract infections, neurological problems like Alzheimer’s disease, Parkinson’s diseases, poor nerve conduction in the body, cataracts, emphysema, high cholesterol, fibrocystic breast condition intermittent claudication, infertility, impotence, genital herpes, bedsores, leg cramps, muscle soreness, phlebitis, menopausal discomforts, HIV, osteoarthritis, chronic inflammatory diseases such as lupus, rheumatoid arthritis, low birth weight in infants.[25]

Adverse effects
Over doses may cause nausea, vomiting, diarrhoea. Individuals who are deficiency of vitamin K (people who are on blood thinners) should not be taken tocopherols. Supplements without proper medical examination, because of impending increased risk of haemorrhage. Some people may also get irritation or allergic reactions when vitamin E is applied to the skin. Possible side effects of vitamin E due to high doses include unusual bleeding or bruising, nausea, headaches and blurred vision.[26]

Vitamin K
What is Vitamin K
Vitamin K is naturally formed by the bacteria in the intestines, and plays an essential role in normal blood clotting, promoting bone health, and helping to produce proteins for blood, bones, and kidneys.

Food Sources for Vitamin K
Good food sources of vitamin K are green, leafy-vegetables such as turnip greens, spinach, cauliflower, cabbage and broccoli, and certain vegetables oils including soybean oil, cottonseed oil, canola oil and olive oil. Animal foods, in general, contain limited amounts of vitamin K.[27]

Vitamin K Deficiency
Without sufficient amounts of vitamin K, hemorrhaging can occur. Vitamin K deficiency may appear in infants, or in people who take anticoagulants, such as Coumadin (warfarin), or antibiotic drugs. Newborn babies lack the intestinal bacteria to produce vitamin K and need a supplement for the first week. Those on anticoagulant drugs (blood thinners) may become vitamin K deficient, but should not change their vitamin K intake without consulting a
physician. People taking antibiotics may lack vitamin K temporarily because intestinal bacteria are sometimes killed as a result of long-term use of antibiotics. Also, people with chronic diarrhea may have problems absorbing sufficient amounts of vitamin K through the intestine and should consult their physician to determine if supplementation is necessary.\[28\]

**Too much Vitamin K**

Although no Tolerable Upper Intake Level (UL) has been recognized for vitamin K, excessive amounts can cause the breakdown of red blood cells and liver damage. People taking blood-thinning drugs or anticoagulants should moderate their intake of foods with vitamin K, because excess vitamin K can alter blood clotting times. Large doses of vitamin K are not advised.\[29\]

**Summary**

Fat-soluble vitamins: A, D, E, and K — are stored in the body for long periods of time, and pose a better risk for toxicity than water-soluble vitamins. Fat-soluble vitamins are only needed in small amounts.

Beta carotene is an significant antioxidant that the body converts to Vitamin A, and it is found in a variety of fruits and vegetables.

Insufficient dietary consumption of vitamin D, along with limited sun exposure, makes vitamin D deficiency a growing public health concern.

Vitamin E benefits the body by acting as an antioxidant, and research indicates that it may offer a protective effect if obtained through a diet rich in fruits and vegetables, as opposed to a supplement or multivitamin.\[30\]

The bacteria in our gut produce vitamin K, and it is also found in green leafy vegetables.

**CONCLUSIONS**

Vitamins A, D, E, and K dissolve in organic solvents and used in correcting deficiency diseases and some used to treat non-deficiency diseases which are found in plant and animal sources. Sufficient intake of fat soluble vitamins is solely lacking among modern peoples—especially by comparison to traditional societies. Average intake of fat soluble vitamins like vitamin A, vitamin D, vitamin E and vitamin K is inadequate at best and dangerously low at worst even among health circles. Vitamins cannot be produced by the human bodies. They
must be eaten through food or as supplements and they help the body in using food by bringing about biochemical reactions so that life can be maintained. Most vitamins that are sold as food supplements cannot exceed a maximum daily dosage. Hence apt dosage of these fatty vitamins keep the body operating at its optimum capacity and too much quantity may destroy the health severely. Regulations that define limits of fat soluble vitamin dosages for the safe use as food supplements must be followed to preserve safety and to prevent side effects caused by overdose. Therefore it is felt imperative that public awareness need to be taken up in a big way frequently. As a incessant process through regular public meetings, group discussions, seminars, hoardings, cinema slides, placards, folk songs and stage shows relating to fat soluble vitamins, particularly in nook and corner country areas through governmental organisations of all departments, Non-governmental Organisations (N G O’s) corporate hospitals, enlightened village groups and the like.

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