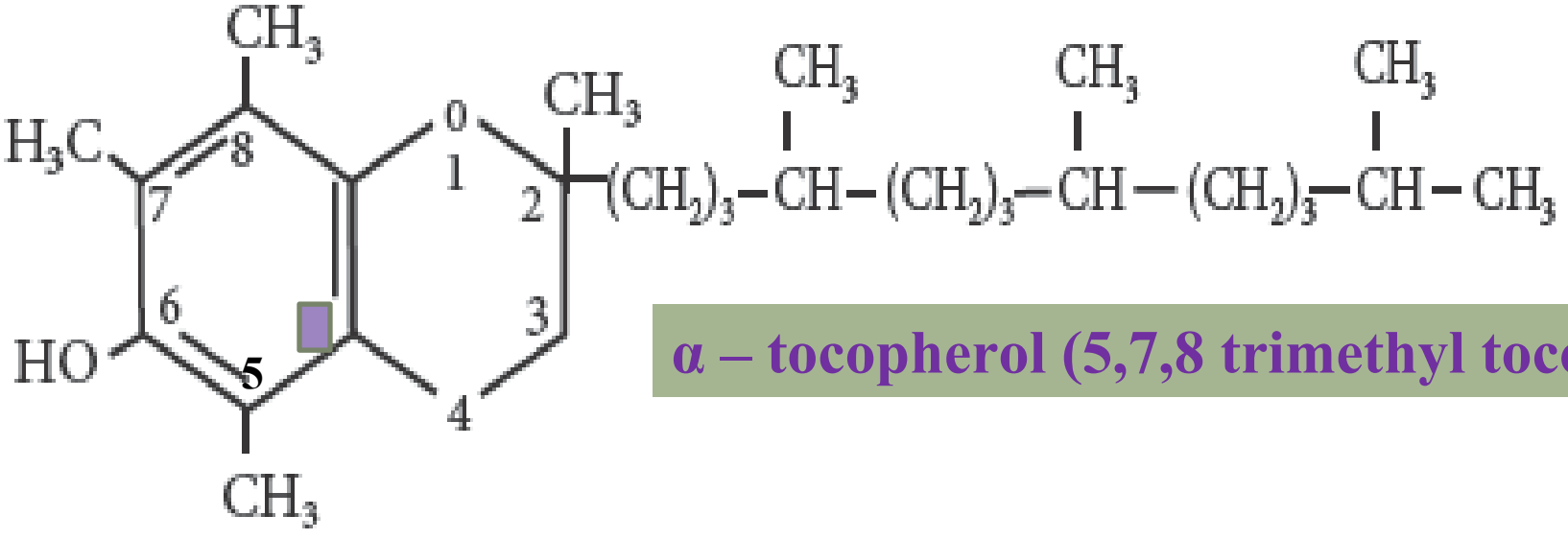
INTRODUCTION

- Vitamin E is chemically known as tocopherol (Greek: tokos=childbirth, pherin =to bear and ol=alcohol)
- anti-infertility Vitamin
- Infertile animal + vitamin E ⟹ conception of animal
- Vitamin E is lipid soluble antioxidants in cell membranes, and is important in maintaining the fluidity of cell membranes.
- Structure of Vitamin E was elucidated by Paul Karr (Noble prize-1937)

CHEMISTRY

Vitamin E a name given to a group of Tocopherols and Tocotrienols



α – tocopherol (5,7,8 trimethyl tocol)

Structure of ♋-tocopherol (various tocopherols differ in the substitution of methyl groups on chromanol nucleus).

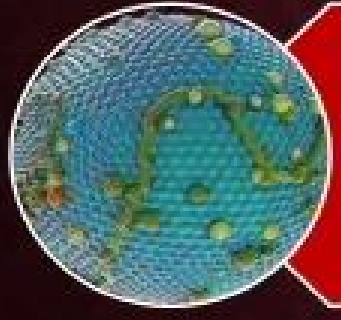
- Chemically it is a substituted hydroxychromane derivative or methylated tocols
- 8 derivatives of Tocopherols identified as α,β,γ,δ Tocopherol etc. out of which α-tocopherol is most active physiologically.
- **OH group** of Tocol is responsible for antioxidant property of Vitamin E
- Tocotrienols have 1-50% activity of activity of Tocopherols

ABSORPTION, TRANSPORT AND STORAGE

- It is absorbed along with other fats and needs the help of bile salts.
- Tocopherol is absorbed and transported as chylo microns.
- In the liver, it is incorporated into lipoproteins (VLDL and LDL) and transported
- It is stored in adipose tissue, liver and muscle.
- During catabolism, the chromane ring and side chain may be oxidized and excreted in bile after conjugation with glucuronic acid

Don’t forget

- Dietary vitamin E is absorbed in the duodenum along with lipids.



It is transported to the liver through chylomicron.

Stored in Liver and adipose tissue

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TISSUE DISTRIBUTION

- All cell membranes including mitochondrial membrane and endoplasmic membrane.
- Retina is specially rich in vitamin E.
- Plasma levels are 0.5 -1 mg/dl

BIOCHEMICAL ROLE

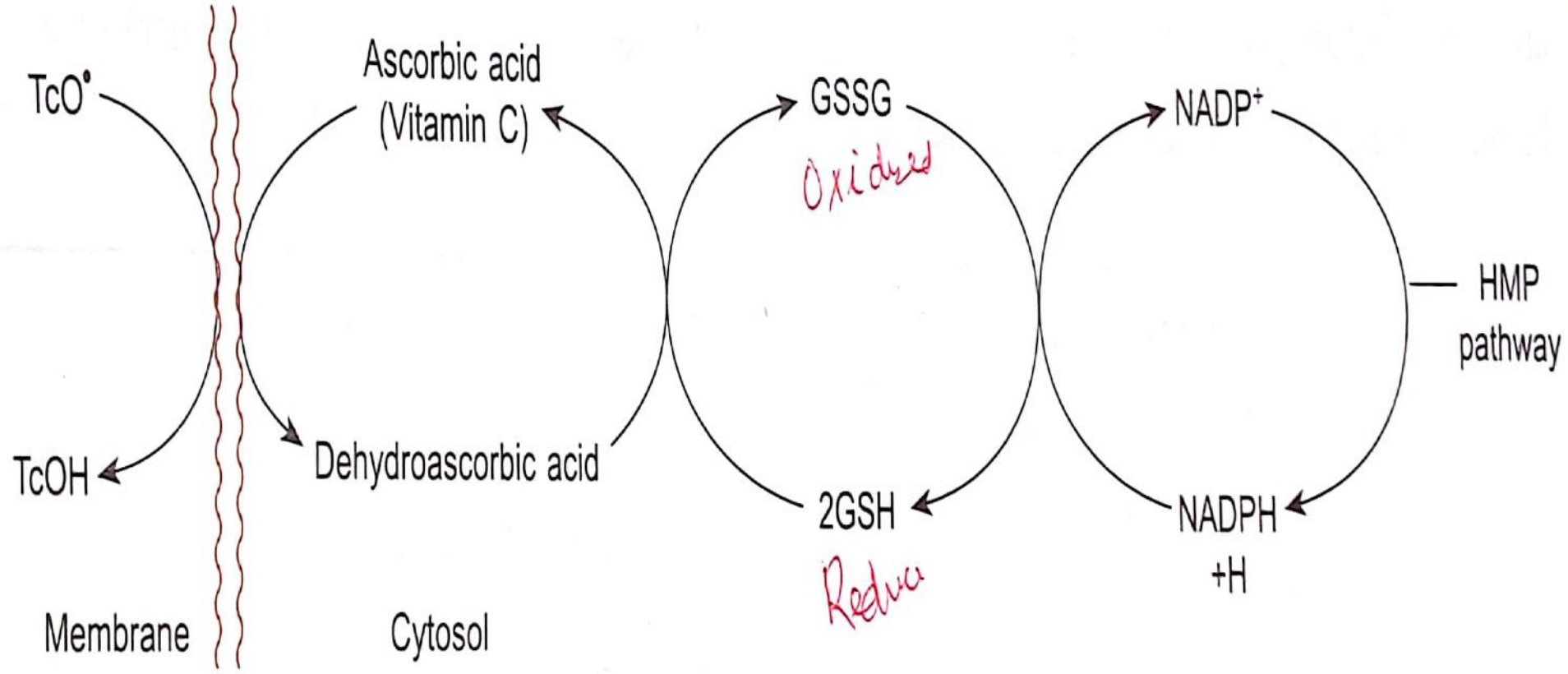
A. Antioxidant Role

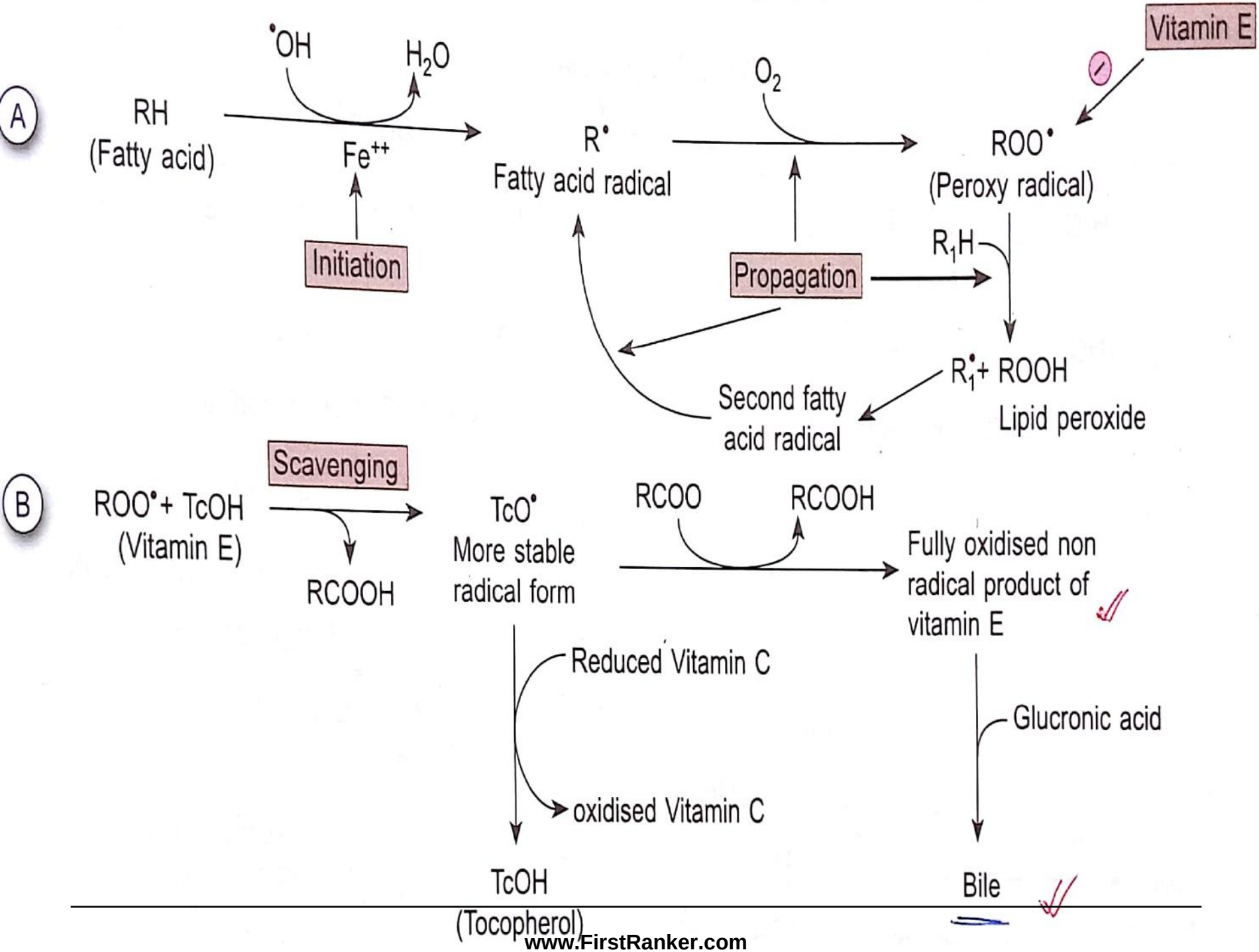
- It is a potent natural antioxidant vitamin.
- It is a chain breaking and peroxyl-radical scavenging antioxidant
- It protects most lipophilic molecule susceptible to oxidant injury like PUFA, and phospholipid having PUFA, present in cell membranes, lipoproteins, RBC, mitochondrial membrane, retina etc.

- It acts as an antioxidants by donating a hydrogen radical $H^{\cdot}$ and terminating the chain reaction of fatty acid peroxidation.
- Vitamin E itself becomes phenoxy radical which is relatively more stable.
- Its further fate is two fold:

1. It is reduced by vitamin C back to original form. The oxidized vitamin C is maintained in reduced form through glutathione and NADPH via the HMP pathway.

- The phenoxy radical may undergo a series of rearrangement involving oxidation of chromane ring and side chain. This is then conjugated with glucuronic acid and excreted.

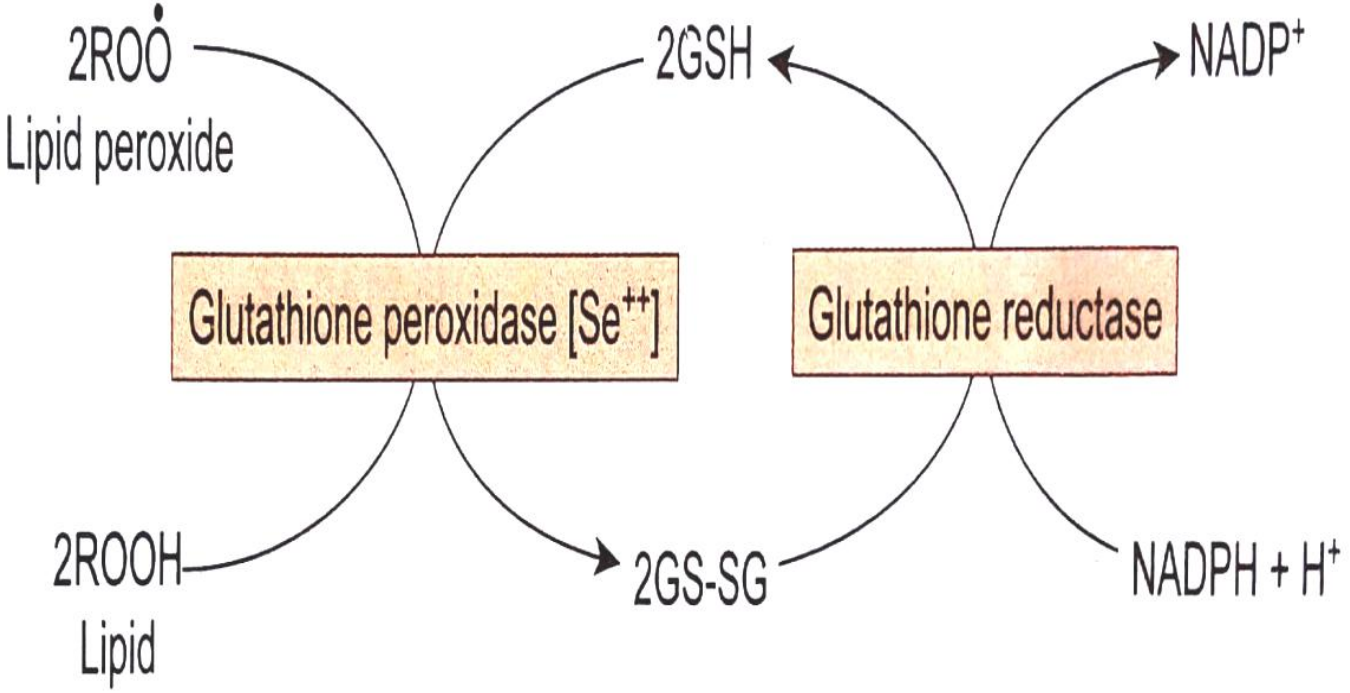




2.Synergistic action with glutathione peroxidase and sparing of selenium

- Lipid peroxides produced by oxidation of lipids are neutralized by glutathione peroxidase as a second line of defence.
- vitamin E acts synergistically with Selenium which is a cofactor of antioxidant enzyme Glutathione peroxidase that destroys free radicals .
- Vitamin E can spare requirement of Selenium ,and vice versa.

Reduction of lipid peroxide by glutathione peroxidase



3. Anti – atherogenic effect:

- Oxidation of LDL is an initial and critical event in the development of atherosclerosis. Vitamin E is known to prevent this oxidation. Hence, vitamin E has anti atherogenic role .

4. Ant sterility role

- Prevents sterility and closely associated with reproductive functions
- maintains germinal epithelium of gonads
- Anti sterility role in humans is doubtful.

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5. Maintaining the structural and functional integrity of cells and organs. In that sense, it is said to have anti – aging effect.
6. It protects the RBC from hemolysis by oxidizing agents (e.g. H2O2) and thus helps in maintaining RBC membrane integrity.
7. Enhances activity of δ aminolaevulinic acid (ALA) synthase and ALA dehydratase
   ⇨ Enhances heme synthesis
8. Required for cellular respiration through electron transport chain (stabilizes coenzyme Q)

9. Vitamin E encourages skin healing and reducing scarring effect after injuries such as burn- extensive use in skin creams and lotions.
10. It is required for proper storage of creatine in skeletal muscle
11. .It protects the liver from toxic compounds such as carbontetrachloride
12. It works in association with vitamin A,C and beta-carotene, to delay the onset of cataract
13. It is said to be beneficial in Alzheimers disease, skin disorders, cancers
14. Trace amount of vitamin E (hydroquinone),Gallic acid and alpha naphthol are added in commercial preparation of fat and oils to prevent oxidative rancidity

Vitamin E Deficiency

- Blood levels:

levels below 5 µg/ml are suggestive of vitamin E deficiency.

- Causes :

1. Dietary deficiency
2. Obstructive jaundice
3. Patients with cystic fibrosis & chronic liver diseases
4. Malabsorption syndrome
5. Hypolipoproteinemia
6. Very low birth weight infants

Manifestation of vitamin E Deficiency

1. Anaemia due to RBC hemolysis because of the increased membrane fragility.
2. Neurological deficiency such as delayed milestone in premature infant, i.e. late start of standing, walking, crawling
3. Degenaration of post. Spinal column tract and spinocerebellar tract causing decreased vibration sense, demyelination of nerves, cerebellar ataxia

Manifestation of vitamin E Deficiency

4 . Retinal pigmentation degeneration

5. Retrolental fibroplasia (RLF):a neuropathy observed in premature infants with low birth weight due to poor placental transfer of Vitamin E .

6. Muscular weakness & creatinuria.

Symptoms of Vitamin E Deficiency

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Premature Aging

Varicose Veins

Acne

RDA

- Adults - 8 -10 mg/day
- Pregnancy & Lactation - 10 - 15 mg/day
- 15 mg of vitamin E is equivalent to 33 IU
- Pharmacological dose is 200-400 IU/day

Sources of Vitamin E


Olive Oil


Coconut Oil


Sunflower Oil


Broccoli


Kale


Spinach


Avocado


Almonds


Peanuts

Hypervitaminosis E

- Hypervitaminosis E : toxicity at doses above 1000 IU
- No toxic effects observed = LEAST TOXIC fat soluble vitamin
- Tendency of hemorrhage.
- Neurological symptoms.

"Vitamin in search of a disease".

Clinical use of vitamin E

1. Fibrocystic breast diseases
2. Intermittent claudication (episodes of tingling, numbness and pain in the legs due to ischemia).
3. Patients at high risk of free radical –mediated injury (prescribed along with other antioxidants)

STAY HOME STAY SAFE