VITAMINS, MINERALS

VITAMIN D

B12

PHOSPORUS

CALCIUM

VITAMIN E

NIACIN

VITAMIN A

IRON

FLUORIDE

FOLATE

ZINC

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MSc.in Biochemistry and molecular biology

Vitamins Facts

- **Vitamins are essential organic nutrients, required in small amounts.**
- **They cannot be synthesized by the body. Must be obtained by outside sources like diet, rumen bacteria & sun.**

Vitamins Facts

- **Required for growth, maintenance, reproduction and lactation.**
- **Vitamins deficiencies lead to disease.**
- **Most vitamins enzymatically transformed to function as co-enzymes.**

Classes of Vitamins

1.Water Soluble Vitamins:

Not stored in tissues, must have constant supply

Examples

B Family, Folic Acid, C

2.Fat Soluble Vitamins:

Stored in tissues

Examples

A

D

E

K

1. Water-Soluble Vitamins

Water soluble vitamin: are vitamins that cannot be stored in the tissues.

- **Must be provided regularly as deficiencies can develop in a short time.**

1.Water-Soluble Vitamins

- Vitamins Bs and C
- Eight B vitamins:
- Thiamin (B-1)
- Riboflavin (B-2)
- Niacin, Nicotinic acid (B-3)
- Pantothenic acid (B-5)
- Pyridoxine, Pyridoxal, (B-6)
- Biotin(B-7)
- Folic acid, Folate (B-9)
- Cobalamin (B-12)

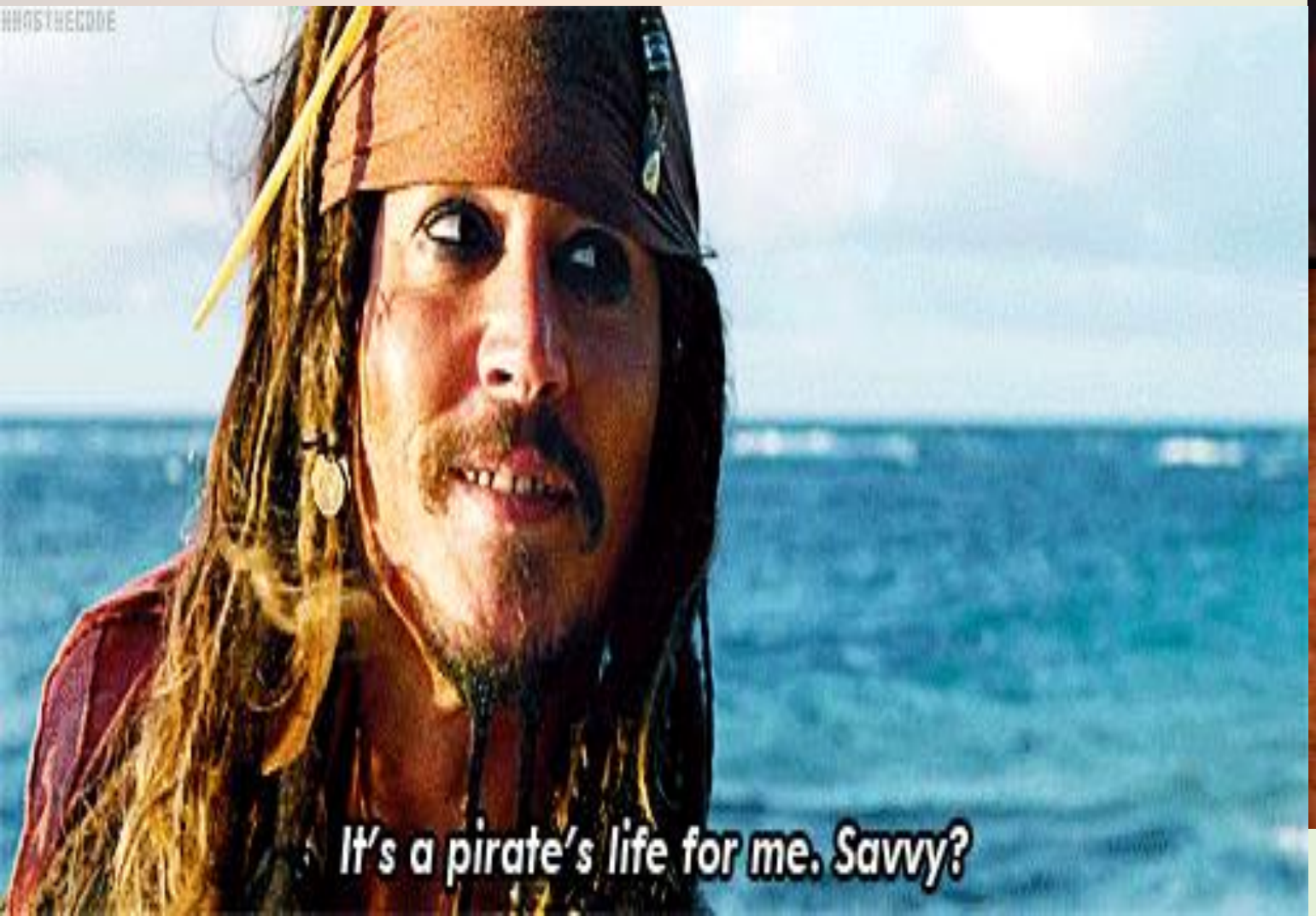
- Active co-enzyme
- Vit C no coenzyme
- TPP
- FMN& FAD
- NADP- NADPH
- Coenzyme A
- Pyridoxal phosphate
- Biocytin
- Tetrahydrofolate
- Cynocobalamin converted → Methylcobalamin/ Adenosylcobalamin

VITAMIN	FUNCTION	FOOD SOURCES	DEFICIENCIES	TOXICITIES
★ **C** ***Ascorbic Acid*** (Water Soluble)	**-Maintains connective tissues** **-Antioxidant.** Absorption of Iron Protects body against infection	-Citrus fruits	**-Scurvy** (spots on the skin, poor wound healing & bleeding gums)	-Kidney stones
VITAMIN	**FUNCTION**	**FOOD SOURCES**	**DEFICIENCIES**	**TOXICITIES**
B1 ***Thiamine*** (Water Soluble)	-COENZYME! -Used to convert carbohydrates to energy **-Nerve function**	-Milk -Bran -Whole grains -Poultry -Fish -Dried Beans	**-Beriberi** (Swelling in legs, sore muscles, stiffness and weakness)	-None

Scurvy

Swollen and Bleeding Gums







Spots on Skin

BERIBERI DISEASE

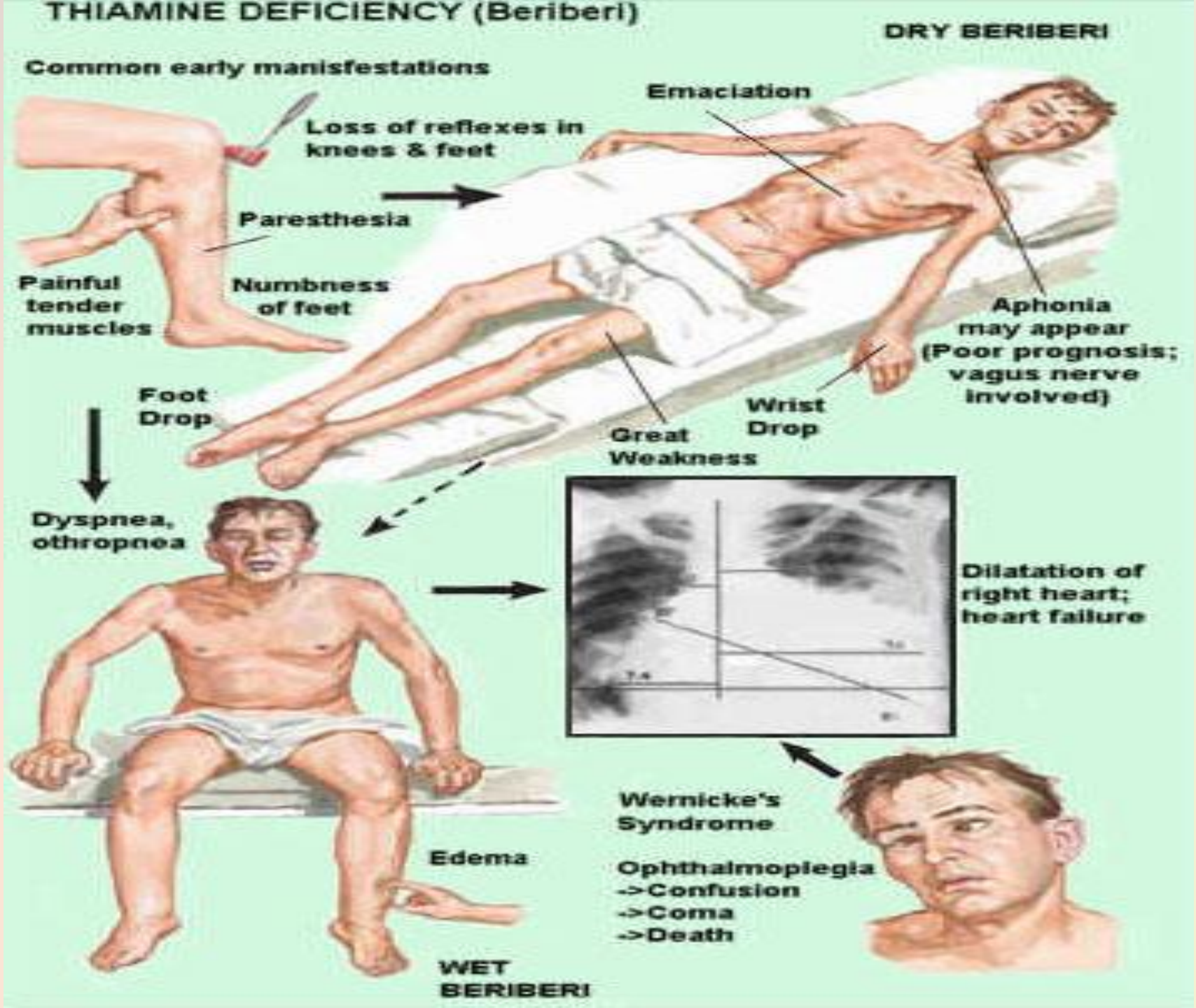
A DISEASE CAUSED BY A LACK OF VITAMIN B1

Beriberi








THIAMINE DEFICIENCY (Beriberi)
DRY BERIBERI
Common early manisfestations
Loss of reflexes in knees & feet
Paresthesia
Painful tender muscles
Numbness of feet
Emaciation
Aphonia may appear (Poor prognosis; vagus nerve involved)
Foot Drop
Wrist Drop
Great Weakness
Dyspnea, othropnea
Dilatation of right heart; heart failure
Edema
WET BERIBERI
Wernicke's Syndrome
Ophthalmoplegia
->Confusion
->Coma
->Death

VITAMIN	FUNCTION	FOOD SOURCES	DEFICIENCIES	TOXICITIES
B2 *Riboflavin* (Water Soluble)	- **Electron carrier in oxidation reduction reactions** -Promotes growth -Used for energy production	-Milk products -Green leafy vegetables	-Premature aging -Cracks in the corner of mouth .Dry, scaly skin -Inflammation of tongue and mouth	-None
VITAMIN	**FUNCTION**	**FOOD SOURCES**	**DEFICIENCIES**	**TOXICITIES**
★ **B3** *Niacin* (Water Soluble)	**Hydrogen carrier in oxidation reduction reactions** -Used for energy production Lowering plasma cholesterol	-Milk -Eggs -Meat, fish, poultry -Whole grains -Enriched grains	**Pellagra** (4 D disease) -Dermatitis -Diarrhea -Dementia -Death	-None

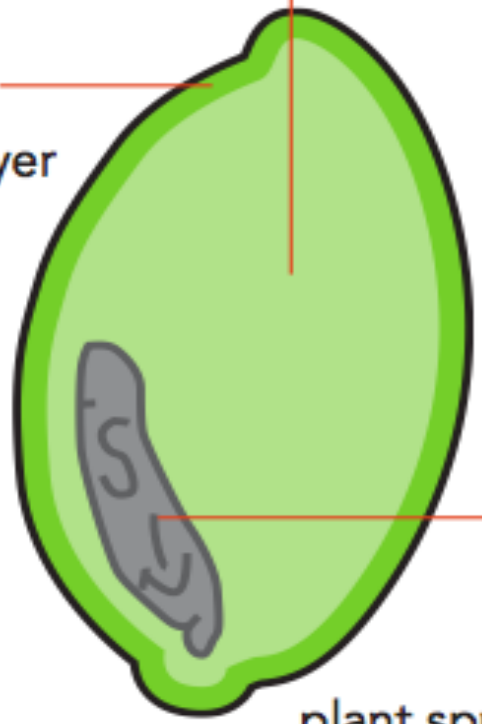
THE Whole Grain Kernel

Endosperm

The bulk of the kernel that contains small amounts of vitamins and minerals. Refined grains contain mostly endosperm.

Bran

This outer layer of the grain kernel is rich in fiber.



Germ

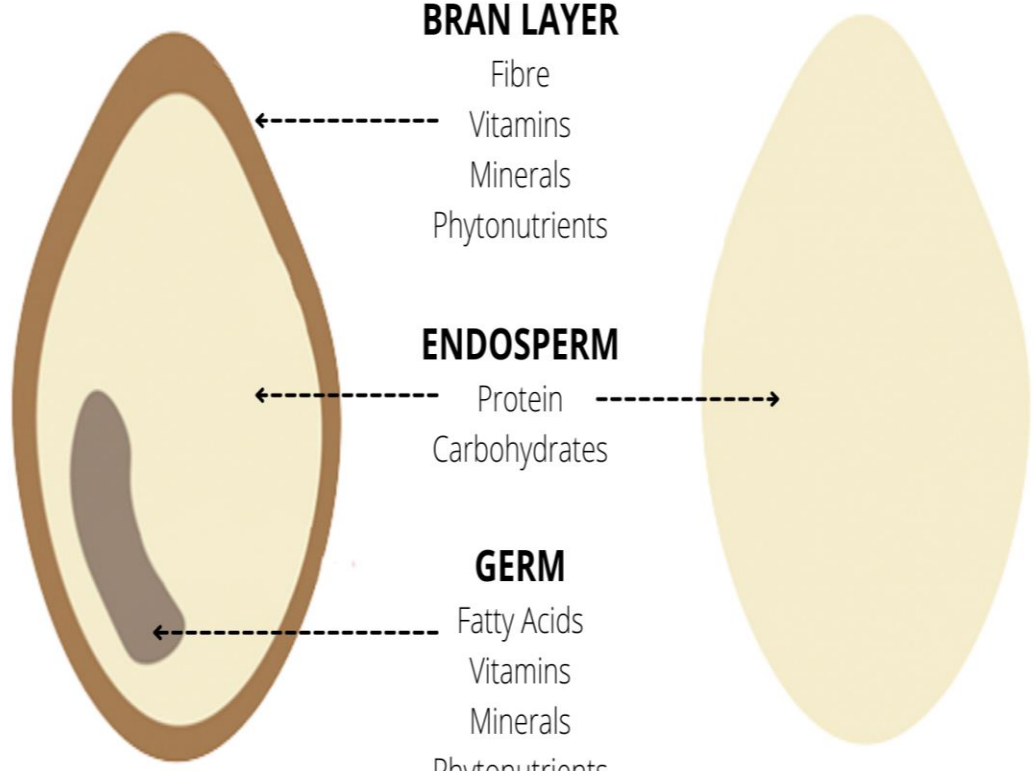
This inner layer is where a new plant sprouts. The germ is rich in nutrients.

"100%" whole grain uses all 3 parts

WHOLE GRAINS VS REFINED GRAINS

A WHOLE GRAIN IS A FOOD THAT CONTAINS ALL THREE PARTS OF THE GRAIN IN THEIR ORIGINAL PROPORTIONS.

WHOLE GRAIN *REFINED GRAIN*



Vitamin B2 deficiency



Glossitis



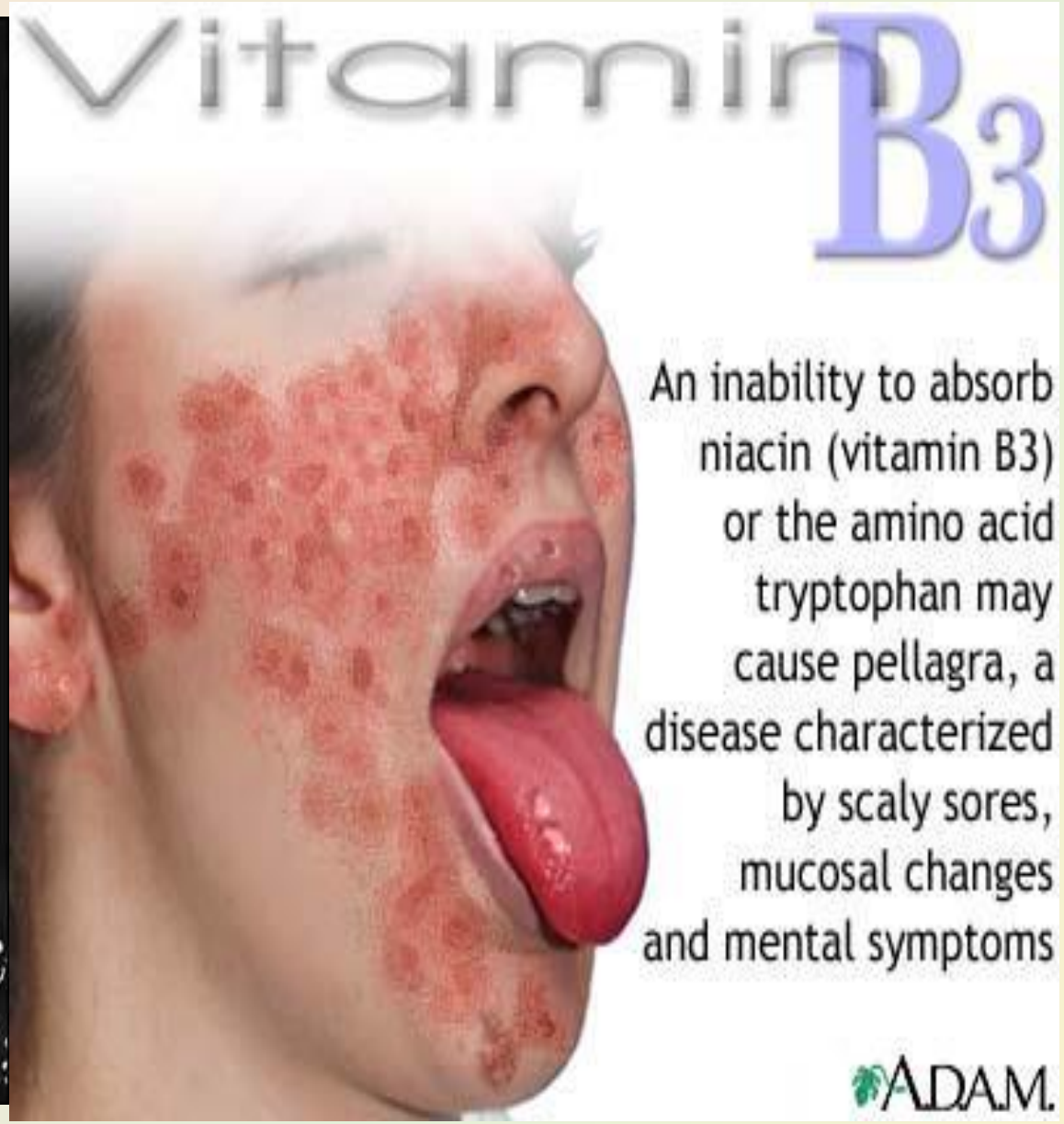
Cheilosis



Itching and burning eyes

Pellagra




Vitamin B3
An inability to absorb niacin (vitamin B3) or the amino acid tryptophan may cause pellagra, a disease characterized by scaly sores, mucosal changes and mental symptoms
A.D.A.M.

VITAMIN	FUNCTION	FOOD SOURCES	DEFICIENCIES	TOXICITIES
Folate **B9** *Folic Acid or Folicin*	**-Red blood cell formation** **Synthesis of DNA** & nonessential amino acids **-Cell division**	-Leafy green vegetables -Legumes -Seeds	- **Spina bifida** in infants **-Anemia (Megaloblastic)** -Heartburn -Diarrhea	-None
VITAMIN	**FUNCTION**	**FOOD SOURCES**	**DEFICIENCIES**	**TOXICITIES**
B6 ***Pyridoxine*** (Water Soluble)	**-Synthesis of heme** **-Protein & Nucleic acid metabolism** -Carbohydrate & lipids metabolism	-Green leafy vegetables -Animal protein	**Sideroblastic Anemia** -Abnormal brain wave pattern -Irritability	-None

Spina Bifida

- The spinal cord begins to develop within the first 28 days of pregnancy. Since folate makes new cells
- It is vital that the mother's body already has a supply of folate in her system to prevent this tragic condition.



VITAMIN	FUNCTION	FOOD SOURCES	DEFICIENCIES	TOXICITIES
B12 ***Cobalamin*** (Water Soluble)	**-Synthesis of DNA** Tetrahydrofolate **(hemopoiesis)** **-Myelin sheath**	-Animal foods	**Anemia** **(Megaloblastic)** -Fatigue **-Neurological problems**	-Water retention



Pantothenic Acid (Vit B5)

- Formed from β-alanine and pantoic acid
- **Function of Co-enzyme A:** **acts in the transfer of acyl groups** in the synthesis of carbohydrates, lipids & heme.
- **Deficiencies** are rare
- **Foods:** Almost any food, plant-based or animal-based

Biotin
(Vit B7)

- **Cofactor: Biocytin**
- **Function: acts as coenzyme for carboxylase enzymes (CO2 fixation), Regulation of cell cycle**
- **Can be synthesized by intestinal bacteria**
- **Deficiencies: prolonged use of antibiotics**

	Fat soluble vitamins	*Water soluble vitamins*
Solubility in fat	Soluble	Not soluble
Water solubility	Not soluble	Soluble
Absorption	Along with lipids Requires bile salts	*Absorption simple
Carrier proteins	Present	*No carrier proteins
Storage	Stored in liver	*No storage
Excretion	Not excreted	Excreted
Deficiency	Manifests only when stores are depleted	*Manifests rapidly as there is no storage
Toxicity	Hypervitaminosis may result	Unlikely, since excess is excreted
Treatment of deficiency	Single large doses may prevent deficiency	Regular dietary supply is required
Major vitamins	A, D, E and K	B and C
*Vitamin B_{12} is an exception.		


Thank you!