



KINGDOM OF SAUDI ARABIA
Ministry of Higher Education
JAZAN UNIVERSITY
FACULTY of APPLIED MEDICAL SCIENCES
Clinical Nutrition Dep.
2nd Year
Second Semester

المحاضرة الأربعة عشر

advanced Nutrition

دكتورة منة مكي

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لا أحد ينس من السبوي

The Basic principles of micro nutrition

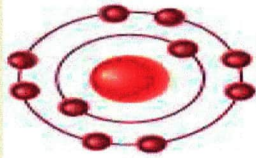
In the first half of the 20th century nutritional research has focused on:

- The discovery of vitamins and description of classic vitamins and minerals deficiency such as **scurvy** and **rickets**.
- Prevention vitamins and minerals deficiency by their fortifying foods : as example enriched grain with vitamin B and iron, table salt with iodine ,water with floured and milk with vitamin A & D.
- However, there is a high prevalence of iron and folic acid deficiency among women, Vitamin D and calcium among older adults.

MAJOR ROLES OF VITAMINS

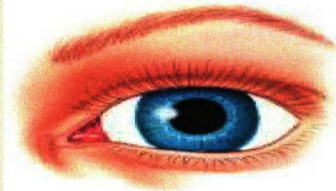
Antioxidants

Vitamin E
Vitamin C



Vision

Vitamin A



Bone health

✓ Vitamin D
✓ Vitamin K



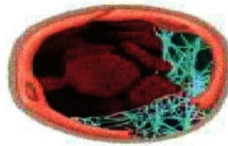
Coenzymes

The 8 B-vitamins



Blood clotting

Vitamin K



مساعد
على تكدس عوامل
التخثر

- Micronutrients term refers to: Vitamins, minerals, trace elements, amino acids and essential fatty acids.
- These substances found in very small amounts in the diets (mg Mg (milligram or microgram level)).
- Micronutrients have a significant health effects beyond prevention of deficiency diseases, it preserve a good health and treatment diseases.

Micronutrients include

- vitamins
- Minerals
- trace elements
- aa
- FA

Functions

prevention
of deficiency
dz

preserve
good health

treat
dz

45 - ضررها

- Must be supplied in
diets

لأن body can't synthesize them.

- Approximately 45 essential micronutrients are needed for life and must be presented in diets because they cannot be synthesized in the human body.

Micronutrients are basic components of every body cells.

- They serve as chemical messengers , building blocks and enzyme .
- Micronutrients are metabolized, broken down and excreted, so they must be replaced quickly because most of them are not storied in the body.

Mechanism of action.

- Micronutrients can prevent and treat diseases by:

- First way, eliminating chronic deficiency resulting from low intake in the diets, and body reserve depletion. If the deficiency was severe, clear symptoms appear quickly over a period of week .
- Specific and localized tissue deficiency of vitamins my occur despite adequate level in the blood and other tissues, as example , localized deficiency of folate, vitamin E and A in bronco-pulmonary of smokers may increase the risk of cancer.

Why micronutrients must be replaced quickly ?

① Micronutrients are Metabolized and brokedown then excreted ..

② Micronutrient are not stored in the body .

تكمّلوا مخازن الجسم الميكروبيوتيك عن طريق الغذاء في كل يوم
وذلك في السنين قليلة ..

مثلاً /
↓ Folic Acid } in bronchopulmonary
↓ vit. E } tissues of
↓ vit. A } smokers
↓
lung cancer

• Mechanism of action.

- Second way, micronutrients can prevent diseases by enhancing healthy pathways of cell metabolism as example supplementing dietary calcium intake during adolescence and adult hood reduce turnover of bones and promote minerals deposition into the Skelton. This can help in maintenance the bone density and reduce the risk of osteoporosis and bone fractures in later life .

Ⓟ

ex. Ca supplements ↓ turnover of bones

- promote Mineral deposition into skeleton
- Maintains bone density and ↓ osteoporosis.

ب

- Many trace elements are essential cofactors in enzyme system, and boosting intake stimulates activity of the enzymes, as example selenium is an essential component of glutathione peroxides enzyme so increase selenium intake stimulate the enzyme and reduce oxidative stress.

↓ oxidative stress

- Greater intake of certain micronutrients than those in usual diets have many beneficial and new actions that are not apparent in lower doses

as example:

الجرعة العادية لها مفعولها
الجرعة الزائدة (الكبيرة) لها مفعول آخر

مثال ①

niacin → ↑ Energy Production

dose 10-100 times

↓
niacin will influence
lipid Metabolism

↓ LDL

↓ TG

↑ HDL

وبالتالي → high dose of niacin
is recommended
as 1st line tx of
hyperlipidemia.

- Niacin is a component of nicotinamide adenine dinucleotide (NAD⁺), plays an important role in energy production in the cells. At doses 10 to 100 times higher niacin begins to influence lipid metabolism in the liver, resulting in lowering low density lipoprotein (LDL) cholesterol and triglycerides in the blood, and increasing high density lipoprotein cholesterol, therefore high dose of niacin is recommended as first line for hyperlipidemia therapy.

- Normal dietary intake of folic acid needed for red blood cells growth and prevents anemia, two or four times of normal doses during early pregnancy provide protection against birth defect by 25 – 50%.
- Higher dose of vitamin E at level of 150- 200 mg/day than the normal dose 8 -10 mg/day reduce the risk of coronary heart disease by 40% in adult men and women, while at level of 200 – 400mg/day can help protect the lungs from the oxidative stress of air pollution the level of 800 mg may enhance the immune response and increase the body ability to fight infection.

2 U₂ FA is needed for RBCs growth, prevents anemia.

2 -4 times of normal doses during early pregnancy → protection against birth defect by 20-50%.

13 U₂ vit. E * normal dose 8-10 mg/day

* at level 800 mg
→ Enhance immune response, ↑ body ability to fight infection.

* at high dose 150 – 200 mg/day
→ ↓ risk of coronary heart disease

* at high dose 200 – 400 mg/day
→ protect lung from oxidative stress of air pollution.

- Classical and newer role of micronutrients

Micronutrients	Classical role	Newer role
Niacin	Coenzyme in energy metabolism	Reduce blood LDL cholesterol
Folic acid	Hematopoiesis	Prevention of birth defect
Vitamin E	Growth and reproduction	Antioxidant, immune function
Vitamin B6	Coenzyme in protein metabolism	Immune function
Iron	Hematopoiesis	Mental function, Immune system

#

الاختلاف في الحاجة للمغذيات

Variability in micronutrients requirements among individual

- Each individual has a distinctive nutrients needs, while the list of nutrients needed by all of by all human may be the same, the respective amount needed are necessarily not the same of all individuals.

- ①
- For example 2 mg / day of vitamin B6 is adequate for a good health in most people, yet some individuals with inherited defects in vitamin B6 metabolism needed up to 30 – 100 times than adequate level.

الاغذية مثل فيتامين ب6

انهم يحتاجون B6

كمية 30 - 100 ضعف

من الكمية التي يحتاجها الناس العاديين

Factors affecting variability in micronutrients requirements among individuals

1. Genetic differences
2. Pregnancy and breast feeding
3. Illness, infection, or surgery
4. Smoking
5. Drug-nutrition interaction

العوامل التي تؤثر
على الاحتياجات الغذائية
للحاجة للمواد الغذائية

- ② • Some women need 4 to 5 folds of calcium requirements.
- ③ • Life style may affect vitamins requirements as example, a smokers need two or three times of Vitamin C than nonsmokers.

المخاض يحتاج فيتامين سي

2-3 مرات

الغذاء

Factors affecting variability in micronutrients requirements among individuals

6. Psychological and emotional stress الضغط النفسي
7. Growth during childhood and adolescence
8. Exposure to environmental pollutants التعرض لمواد التلوث البيئية
9. Activity and exercise
10. Regular alcohol or caffeine intake

Toxicity of micronutrients

- Vitamin, minerals and trace elements like all substances, can be toxic in sufficient high amount.
- Toxicity has been reported for vitamin A, D, K, B6, niacin and many of other minerals or trace elements.
- Many of the vitamins have a large therapeutic ^{index} incidence and free from adverse effect at doses of 10 to 20 times of normal requirements, as example calcium channel blocker can be used to treat high blood pressure, but it may increase the risk of sudden cardiac risk.

✓ large TI

↓
حاجب الأدرينالين ..

Dietary micronutrients

- In the developed countries many peoples suffer from micronutrients deficiency, however they are eating enough foods.
- That because they are over supplied with food rich in fat, protein, sugars, salt and under supplied with complex carbohydrates, fibers, vitamins, and minerals.
- Dietary surveys found that micronutrients deficiencies are widespread among USA and Western Europe peoples as follows

Common dietary deficiencies of micronutrients in the USA and Western Europe

USA	Western Europe
Vitamin B6	Vitamin B6
Folic acid	Folic acid
Vitamin A	Vitamin A
Vitamin C	Vitamin C
Vitamin D	Vitamin D
	Thiamin
	Riboflavin
Calcium	Calcium
Iron	Iron
Magnesium	
zinc	
	Iodin

Why many people suffer from M.N. deficiency despite eating enough foods ?

السبب
 They are over supplied with food rich
 in
 fat
 protein
 sugars
 Salt
 and under supplied with
 complex carb.
 fibers
 vit.
 Minerals .

• Causes of micronutrients deficiencies

- ✓ Modern processing (refining) and storage of foods depletes vitamins and minerals, معالجة الطعام تقلل من مغذياته

As example bran free (white) flour contain only 15% of vitamin E, 15% of vitamin B6 and less than 1% of chromium found whole wheat flour.

Potato chips have almost none of fiber and vitamin C but have high sodium and fat content

Many frozen vegetables lose nearly 50% of vitamin B6 content

مزايدة
للمعرفة

الزراعة المكثفة تقتل المعادن في التربة

- ✓ Modern intensive agriculture methods deplete the soil of minerals and trace elements
- ✓ The wrong choice of diets by the people
- ✓ Polluted environments increase micronutrients requirements
- ✓ Caffeine, tobacco, alcohol and drugs interfere with micronutrients absorption and utilization

البقرة / الكحول / الأدوية

تقلل من امتصاص المواد الغذائية الرئيسية

Loss of micronutrients during food processing and preparation

Food	Method	micronutrients	Loss(%)
Chicken	Deep frozen	Thiamin, riboflavin, niacin	20-40
Fish	Canned	B vitamins	70
Milk	Pasteurization	Thiamin, B6, float	5-10
Milk	Sterilization	B6, float, B12	35-90
Beef	Roasted	Thiamin, B6, panthothenic acid	35-60

Loss of micronutrients during food processing and preparation

Food	Method	micronutrients	Loss(%)
Pulses (bean, pea)	Boiling	Copper, iron, zinc ,vitamin B	15-50
Strawberries	Deep frozen	Vitamin C	20-45
Vegetables	Boling	Thiamin, riboflavin, float, Vitamin C, carotenoids	30-75
Vegetables	Steaming	Thiamin, float, vitamin C	30-40
Vegetables(spinach, cabbage, leeks)	Boiling	Magnesium, zinc, calcium	25-40
Vegetables	Boling and canning	Vitamin A	20-30
White rice	Boiling	Thiamin, riboflavin, B6	50
Whole-wheat pasta	Boling	Iron, Magnesium,	25-40
Plant oils	Heat refining	Vitamin E	50-70