Let's Excel Together

CANADIAN ACADEMY OF SPORTS NUTRITION

Lecture 58:

Minerals

Part 1

Copyright Protection:

Minerals To Be Discussed:

- Calcium
- Chromium
- Iodine

Calcium:

- Calcium is the most abundant and essential mineral in the body.
- It constitutes approximately 1.5 – 2% of the total body weight.
- About 98% of calcium is in the bones, 1% in the teeth, and 1% in other tissues and blood circulation.
- A normal calcium level is important for an optimal health.

Absorption and Blood Level of Calcium:

- **Total calcium concentration in the blood is 2.2 – 2.6 mmol/dl (8.5 – 10.5 mg/dl).**

- **Out of that amount, about 50% is in ionized form and the rest is bound to proteins or complexed with phosphate, citrate, sulfate or other anions.**

- **Despite large changes in daily dietary calcium intake, the daily net calcium absorption from the intestine is relatively constant, which is 5 – 7.5 mmol (200 – 400 mg) per day.**

- **Approximately 8 – 10 grams of calcium is filtered by the kidneys every day, of which about 97 – 98% is reabsorbed and only 2 – 3% appears in the urine.**

Factors that increase the absorption of calcium:

- a) Vitamin D.
- b) Vitamin A.
- c) Vitamin C.
- d) Exercise.
- e) Enough protein.
- f) Amino acids: lysine and glycine.

Factors that decrease the absorption of calcium:

- a) Vitamin D deficiency.
- b) Stress.
- c) Lack of exercise.
- d) Excessive protein intake.
- e) High fat intake.
- f) High phosphorous intake.
- g) Decreased stomach acid.
- h) Oxalate rich foods (such as spinach, Swiss chard, rhubarb, and beet greens).
- i) Phytate rich foods (grains and legumes).
- j) Pancreatic insufficiency.
- k) Biliary insufficiency.

Food Sources of Calcium:

Foods	Serving Size	Calcium (mg)
Swiss cheese	2 oz	540
Cheddar cheese	2 oz	410
Other cheeses	2 oz	350 - 400
Yogurt	1 cup	400
Sardines	3 oz	340
Milk	1 cup	300
Collard greens	1 cup	270
Spinach	1 cup	250
Salmon	3 oz	230

Dairy products are the best food sources of calcium.

Image: Copyright©Depositphotos.com/Ingrid Balabanova

Functions and Benefits of Calcium:

- a) Muscle contraction.
- b) Heart function.
- c) Development of bones and teeth.
- d) Acid – base balance.
- e) Nervous system function.
- f) Production of neurotransmitters.
- g) Blood clotting.
- h) Regulating blood pressure.

The following conditions may benefit from calcium supplementation:

- a) Osteoporosis.
- b) Hyperkalemia (increased blood level of potassium): calcium is given intravenously.
- c) Pregnancy – induced hypertension.
- d) Rickets.
- e) Osteomalacia.
- f) Premenstrual syndrome (PMS).
- g) Painful menstruation (dysmenorrhea).

- **h) Celiac disease.**
- **i) Weight management.**
- **j) Colon cancer.**
- **k) Peptic ulcer (as calcium carbonate).**
- **l) Migraine.**
- **m) Malabsorption syndromes.**

Daily Needs and Dosage:

Age Groups	Daily need (mg/day)
0 – 6 months	210
7 – 12 months	270
1 – 3 years old	500
4 – 8 years old	800
9 – 19 years old	1300
20 – 50 years old	1000
51 – 70 years old (women)	1200
51 – 70 years old (men)	1000
Over 70 years old	1000
Postmenopausal	1500
Pregnancy and breastfeeding, under 18 years	1300
Pregnancy and breastfeeding, over 18 years	1000

- **Calcium supplements are available as carbonate, citrate, lactate, and gluconate in the forms of 500 mg, 600 mg, and 1000 mg. When taking orally, they have different rates of absorption.**

Types of Calcium	Rate of Absorption
Carbonate	40%
Citrate	21%
Lactate	13%
Gluconate	9%

Side Effects and Interactions:

- **Calcium is considered safe in recommended doses.**
- **However, higher doses of calcium could cause minor gastrointestinal disturbances, such as constipation, bloating, belching, and gas.**
- **Excessive intake of alcohol, protein, caffeine, sodium, and phosphorous increases calcium loss though urine.**

Calcium supplementation <u>should be avoided</u> in the following conditions:

- a) Prostate cancer.
- b) Kidney stone, oxalate type.
- c) Hyperparathyroidism.
- d) Chronic renal failure.

Calcium – Drugs Interactions:

Calcium decreases their absorptions:

Bisphosphonates (alendronate, etidronate)

Levothyroxine

Quinolones

Tetracyclines

They decrease calcium levels in the body:

Anti - Epileptics (phenytoin, phenobarbitol)

Cholestyramine

Corticosteroids

Loop Diuretics (furosmide, bumetanide)

They increase calcium levels in the body:

Antiestrogens

Thiazides

Chromium:

- **Chromium is an essential trace mineral that plays an important role in regulating blood sugar and metabolism of carbohydrates and fats.**
- **Chromium helps carbohydrates move into the cells by making them more sensitive to insulin.**
- **It is a part of glucose tolerance factor (GTF) and enhances function of insulin.**

Food Sources and Absorption:

- **Chromium is found in the body in the organic active form in the trivalent state (as a part of GTF) or bound to beta globulin protein.**

- **There are approximately 6 – 10 mg of chromium stored in the body especially in the muscles, adipose tissues, skin, brain, kidneys, and testicles.**

- **Brewer`s yeast is the best food source of chromium.**

- **Other sources are beef, liver, eggs, chicken, whole wheat, wheat germ, potatoes (especially skin), green pepper, banana, and apple.**

- **Unfortunately, the absorption of chromium is poor. Only up to 3% of chromium in foods is absorbed and most of it is eliminated through stools.**

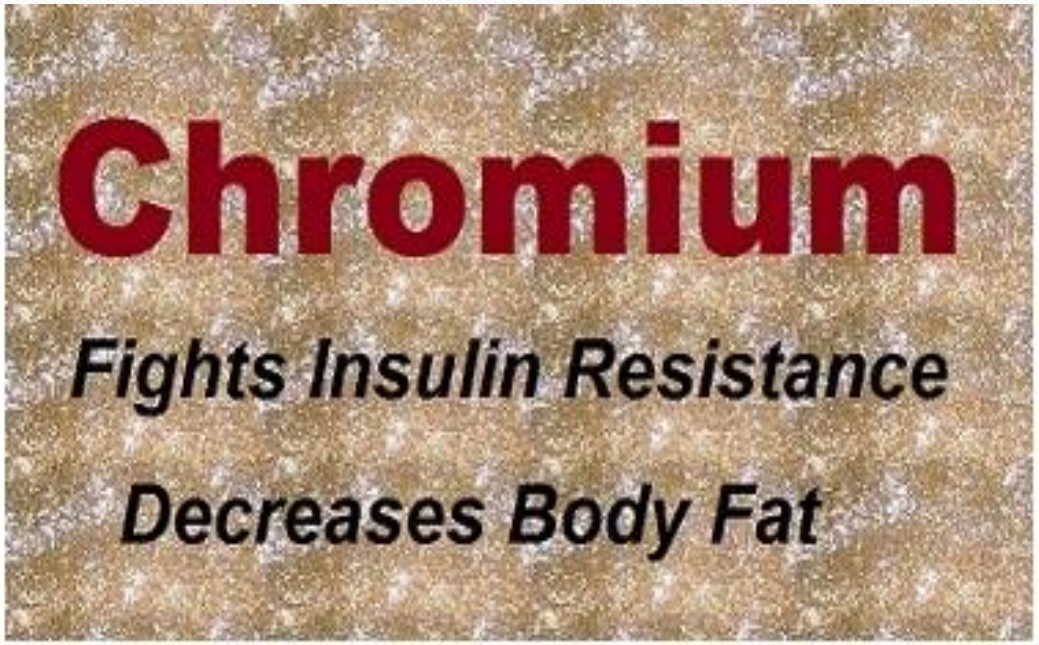
- **Tissue levels of chromium and its absorption decline by age, increasing propensity to develop diabetes.**

Athletic Benefits of Chromium:

- **Chromium enhances sensitivity of the cells to insulin, leading to an increase in the cellular uptake of amino acids, a boost in enhancing lean body mass, and an increase in metabolic rate.**

- **When taken during the "*anabolic window*" (within 30 minutes after exercise), chromium shows anabolic – like activity by enhancing insulin function followed by transporting amino acids into the cells to synthesize protein.**

- **Decreased levels of chromium in the body may lower blood levels of DHEA (dehydroepiandrosterone), which is a pro-hormone to produce testosterone.**



Potential athletic benefits of chromium are:

- a) Enhances lean body mass.
- b) Decreases body fat.
- c) May help change body composition.
- d) Improves protein synthesis.
- e) Enhances exercise capacity and delays exhaustion time in a prolonged exercise session when taking along with carbohydrates.
- f) May act as a testosterone booster.
- g) May enhance uptake of creatine by the muscles.

Non – Athletic Benefits of Chromium:

Chromium may be beneficial in the following conditions:

- **a) Diabetes type II.**
- **b) Insulin resistance.**
- **c) Weight management.**
- **d) Obesity.**
- **e) Polycystic ovarian syndrome (PCOS).**
- **f) High LDL cholesterol and triglyceride levels.**
- **g) Hypoglycemia.**

- **h) Craving for carbohydrates.**
- **i) Atherosclerosis.**
- **j) Glaucoma.**
- **k) Depression.**
- **l) Reversing CLA paradox.**

Dosage and Side Effects:

- **Chromium is a part of many multivitamins. However, it is also available in several forms, including chromium polynicotinate, chromium acetate, chromium citrate, chromium histidinate, chromium picolinate, chromium chloride, and glucose tolerance factor chromium (GTF).**

- **Chromium picolinate and chromium polynicotinate are the most popular ones.**

- **The daily recommended dietary allowances (RDAs) of chromium for adults are:**
- **Men: 30 – 35 mcg.**
- **Women: 20 – 25 mcg.**

- **Commercially, it is available in the forms of 200 mcg, 400 mcg, 500 mcg, and 600 mcg.**

- **Depending on the condition for which chromium is used, daily intake is 200 – 1000 mcg in divided doses.**

Chromium is considered safe for most adults when taking low doses.

However, higher doses consumers may experience:

- **Lightheaded.**
- **Skin irritation.**
- **Headaches.**
- **Dizziness.**
- **Nausea.**
- **Mood changes**.

Interactions:

- a) **Insulin and anti – diabetic medications**: chromium increases their effects.

- b) **Levothyroxine:** chromium decreases its absorption, and they should be taken 3 – 4 hours apart.

- c) **NSAIDs** (Nonsteroidal anti-inflammatory drugs), such as Ibuprofen (Advil), indomethacin (Indocin), naproxen, diclofenac, piroxicam and aspirin. These medications may increase blood levels of chromium.

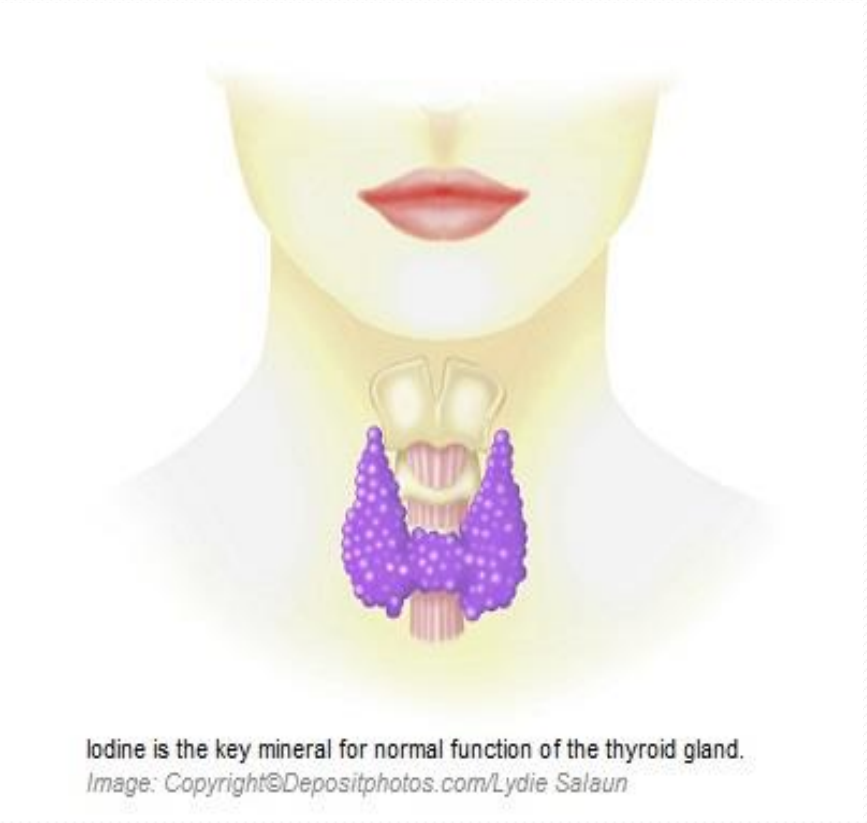
- **d) Corticosteroids: they may lower chromium level.**

- **e) Calcium carbonate – containing antacids, nexium, and omeprazole: they lower chromium absorption and they should be taken 2 – 4 hours apart.**

Iodine:

- **Iodine is an important trace mineral needed for normal functioning of the thyroid gland and active body metabolism.**

- **Known also as "thyroid mineral", it is an essential nutrient for production of thyroid hormones (T4 and T3).**



Iodine is the key mineral for normal function of the thyroid gland.
Image: Copyright©Depositphotos.com/Lydie Salaun

- **T3 and T4 are required for body metabolism, energy production, normal growth and development, protein synthesis, reproduction, normal growth of skin, and hair and nails.**

Food Sources and Absorption of Iodine:

- **Iodine rich foods are fish (especially cod and haddock), shellfish, kelp, seaweed, egg yolk, soy nuts, beans, milk, yogurt and cottage cheese.**

- **Iodized salt contains about 76 mcg of iodine per one gram of salt or 380 mcg per one teaspoon.**

- **Dietary iodine is absorbed well from the stomach into the blood stream.**

- **Ingested iodine is bound to proteins in the blood particularly albumin. Approximately 30% of iodine enters into the thyroid gland, and the rest is excreted in the urine.**

- **A person has an average of 15 – 20 mg of iodine in the body with the highest concentration in the thyroid gland (about 70% - 80%). The rest is in the muscles, skin, bones, and blood.**

- **Isothiocyanates are sulfur-containing phytonutrients found in some foods.**

- **They interfere with the absorption of iodine. These foods are called "goitrogens".**

- **Isothyocyanates are found in arugula, Bok Choy, broccoli, Brussels sprout, cabbage, cauliflower, collards, gai-lan, kale, kohlrabi, leek, mustard greens, peanuts, radish, soy beans, soy, spinach, turnip, turnip greens, and watercress.**

Benefits of Iodine:

- a) Hypothyroidism (low function thyroid).
- b) Goiter.
- c) Fibrocystic disease of breast.
- d) Hyperthyroidism (at very higher doses).
- e) Oral mucositis (inflammation of mouth due to chemotherapy or radiation therapy). Iodine mouth rinse may help reduce inflammation.
- f) Vaginitis (topical application).
- g) Wound disinfection (topical application).
- h) Radiation exposure.

Dosage and Side Effects:

- **The recommended daily allowance (RDA) for iodine in adults is 150 mcg.**
- **The RDAs for women during pregnancy and breastfeeding are 220 mcg and 290 mcg, respectively.**
- **The tolerable upper intake level for iodine in adults is 1100 mcg per day.**

- **Iodine deficiency may manifest as goiter, low function thyroid, and cretinism (childhood hypothyroidism).**

- **Side effects of iodine occur at extremely higher doses (iodine toxicity), which manifests as thyroid dysfunction and acne – like skin eruptions.**

Image: Copyright©Depositphotos.com/Andrejs Pidjass

- **Most people do not need supplementing with iodine, as they get enough from iodized salts.**
- **The usual dosage of iodine is 150 mcg per day.**
- **It is available as potassium iodide (500 mcg per pill), kelp extract (providing 150 mcg per serving), liquid (150 mcg per one tablespoon), and oral drop 4% (250 mcg per drop).**
- **It may come in different formulations and you would need to adjust your daily intake to 150 – 300 mcg.**

Interactions:

- a) **Anti –thyroid medications** (propylthiouracil, carbimazole, and methimazole): they may lower the effectiveness of iodine.
- b) **Lithium:** it may reduce the absorption of iodine.
- c) **Sulfonamides:** they reduce iodine absorption.
- d) **Amiodarone:** it may raise iodine levels dramatically.

Homework:

- **1) Describe the factors that decrease the absorption of calcium.**

- **2) Describe how chromium could be beneficial in weight management and sports.**