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Calcium's Role in Child Growth and Development and It's Complications

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ABSTRACT

Calcium (Ca) is an important mineral used to build and maintain the skeletal system. Calcium is the body's most vital mineral. Bone and teeth contain calcium, phosphorus, and the rest of the body's calcium. This mineral aids in the creation of bones and teeth, blood coagulation and muscle contraction as well as nerve transmission and cell metabolism.

Calcium deficiency in children causes physical and mental growth problems, as well as the development of Rashitisme, a kind of osteoporosis. This disorder is characterised by deformed bones, big joints, and mobility issues. Calcium shortage in adults produces osteomalacia, which causes hollow and brittle bones due to a reduction in calcium density in the bones.

Vitamin D deficiency causes bone mineralization difficulties and severe muscle cramping. Calcium is required for bone and tooth development, blood coagulation, muscle contraction, nerve transmission, and cell metabolism, say the researchers.

This study concluded that calcium causes bone strength. Children's meals should include enough calcium to prevent osteoporosis in adults. A new scientific barrier has been published, as well as the importance of calcium's function in the body and the repercussions of its deficiency on children's growth and development.

Keywords- Calcium, deficiency, Child Growth, Complications, cell metabolism

I. INTRODUCTION

To exist, all living things need nourishment. Food is required for the body's energy requirements, as well as the operation of numerous organs and systems, growth and development, the provision and maintenance of body heat, and each of the critical activities. Food plays a vital part in living healthier and maintaining complete physical health, and nutrition is one of the variables impacting public health and economic success in human civilizations today. It is crucial. Nutrients are the smallest components that make up human meals. Carbohydrates, fats or lipids, and proteins, which are three sources of energy and have a structural and biological function, are the six categories of nutrients involved in the formation of food. Vitamins, minerals, and water are all nutrients, but they are not energising. Instead, they are protective nutrients that play an important role in biochemical interactions. There are two types of minerals that are necessary for human health.

Micro elements and macro elements are the two types of elements. Sodium, potassium, sulphur, magnesium, and iron are examples of high-consumption elements, whereas cobalt, tin, selenium, fluorine, and iodine are examples of low-consumption elements. About 99% of calcium is released into the bones, with the remaining 1% going into other organs and fluids. In youngsters, calcium insufficiency creates soft bones. Children's soft bones develop firm bones as they absorb calcium. Rashitisme is the term for bone softening. Adults with a calcium deficit develop osteoporosis. Calcium is necessary for developing children, pregnant women, and nursing mothers.

II. IMPORTANCE AND CALCIUM'S ROLE IN THE BODY

Calcium is one of the most essential mineral components of diet, since it is necessary for the body's skeletal structure to be built and maintained. The most

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significant mineral in the body is calcium. The body's calcium is found in bone and teeth, with the balance in soft tissues and extracellular fluid. Calcium is used by the body for:

A) Bone and tooth structure:

The density of minerals within bones determines their strength and durability. The cleaner and stronger the bone is, the greater the density of minerals and mineral crystals within it. Calcium and phosphorus compounds make up the majority of bone crystals.

When a developing bone lacks adequate calcium and other minerals, it becomes weak or brittle, and osteoporosis develops over time.

B) Blood coagulation:

Calcium is required for blood to clot or coagulate. Its main function is to aid in the conversion of prothrombin and fibrin.

C) Muscle contraction:

During contraction, calcium is required for the production of muscle proteins (actin and myosin). If blood calcium levels are low, muscles will be unable to relax after a contraction, resulting in a general contraction of the body muscles. Calcium modulates vascular wall muscle and blood pressure when consumed in sufficient amounts.

D) Nerve current transmission:

Calcium is required for appropriate nerve current transmission and the release of nerve piles. Another cause of widespread muscular contraction is a lack of neurotransmission caused by calcium insufficiency.

E) Cell metabolism:

Calcium is necessary for cellular metabolism and the synthesis of specific proteins in the cell that help enzymes work more efficiently. Calcium is required for the body's glycogen synthesis (3: 67-68)

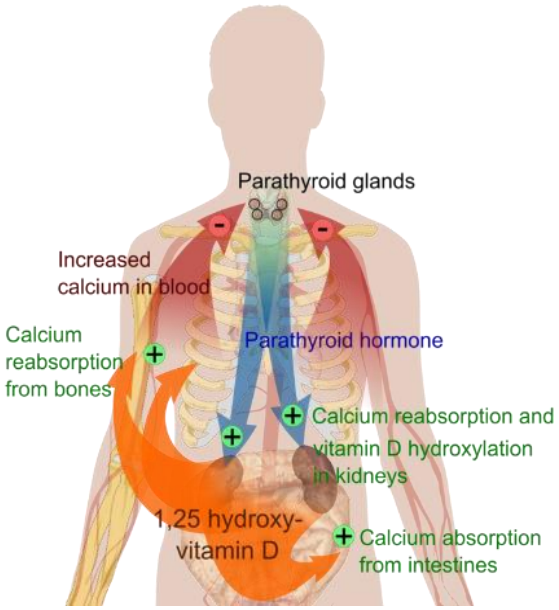

Figure 1: Calcium regulation

III. CALCIUM ABSORPTION

Calcium absorption occurs mostly in the upper section of the small intestine, where the pH is lower and more conducive to calcium absorption. The first and most important component that aids calcium absorption is the body's demand. The body can absorb and utilise 20 to 40% of the calcium received in diet. When the body requires more calcium; calcium consumption rises as you develop, get pregnant, and nurse.

A number of variables lead to improved calcium absorption, including:

1. The quantity of vitamin D in the intestines is enough.
2. A adequate supply of vitamin C and certain amino acids
3. The presence of lactose, or milk sugar, in the intestines, which promotes the development of certain microscopic organisms. This action also increases calcium absorption by altering the pH of the intestines.

To receive adequate calcium from food, you not only need to consume enough calcium-rich foods, but you also need vitamin D, vitamin C, and some carbs in your body. As a result, lowering any of the foregoing components or the presence of certain acids in the pelvis, such as oxalic acid, which is combined with calcium, reduces calcium absorption. Alternatively, when stomach acid levels fall with ageing, calcium absorption decreases (6: 149).

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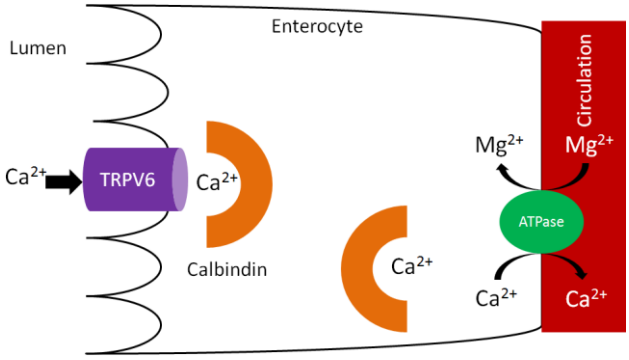

Figure 2: Calcium absorption

IV. FOOD SOURCES AND DAILY REQUIREMENT

Calcium is abundant in milk and its products. After milk and its products, the finest sources of calcium are fruits and vegetables, grains and legumes, fish or poultry meat, eggs, turnips, and almonds.

Calcium intake should be about 800 mg per day, with an additional 400 mg given for development, puberty, pregnancy, and breastfeeding.

Complications of calcium deficiency

Children and adults develop osteoporosis as a result of calcium shortage. Calcium insufficiency is often linked to vitamin D deficiency, resulting in bone mineralization issues and severe muscular cramps.

Cramps that don't react to calcium might be caused by a magnesium deficiency, which can lead to heart failure.

The bones release 99 percent of calcium, whereas other organs and internal bodily fluids release 10%. In youngsters, calcium insufficiency creates soft bones. Children's soft bones develop firm bones as they absorb calcium. Rashitisme is the term for bone softening. Adults with a calcium deficit develop osteoporosis. Calcium is especially important for developing children, pregnant women, and breastfeeding mothers.

Calcium and trace element deficiency syndromes have developed as a result of the use of comprehensive intravenous feeding in individuals with past digestive issues. Because mineralization occurs in the cartilaginous matrix, alterations in the bones of children are typical due to calcium insufficiency, and cartilage development is normal (2: 78-79).

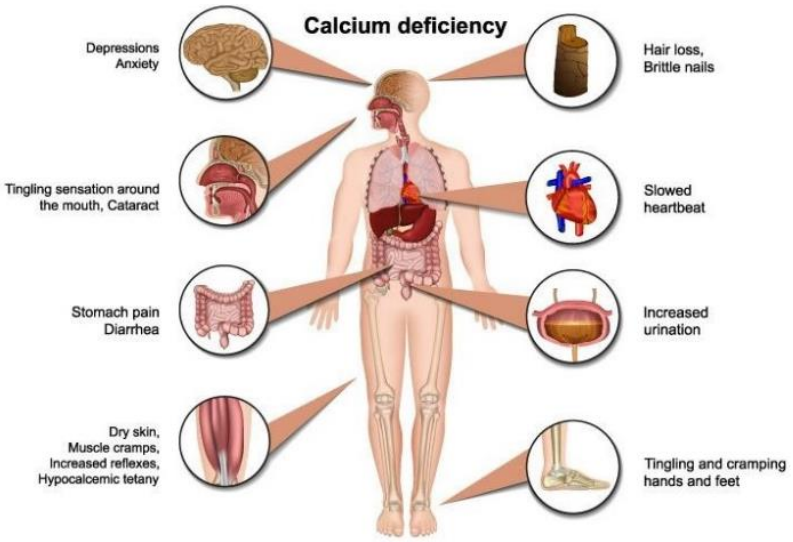

Figure 3: Calcium deficiency

Vitamin D

One of the vitamins dissolved in the uterus is vitamin D. Milk, egg yolks, animal livers, particularly those from aquatic species, and fish oil all contain this vitamin. Keep in mind that the human body produces vitamin D. Cholicalciferol is a vitamin generated from cholesterol molecules in the human skin as a consequence of UV light from the sun.

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Complications of vitamin D deficiency

Vitamin D deficiency in children produces rashitisme, which creates crooked and crooked bones, particularly long bones.

As the condition proceeds, calcium is released from bone tissue and the quantity of calcium in the bone diminishes, causing the bones to weaken and distort. In young children, this problem is more severe. According to studies, 54.5 percent of youngsters who are deficient in vitamin D suffer dental decay within eight months. Only 7% of such youngsters did not respond to vitamin D treatment; the remainder completely healed. In youngsters, vitamin D deficiency leads the spine to flex and break bones on its own, exposing the body to microbial diseases. Chest infections, TB, and pertussis are common among these youngsters. Adults with a vitamin D deficiency develop osteomalacia. This illness results in bone fractures and weakening of the pelvic floor muscles. Larger skulls, stunted development, and enlarged joints are all symptoms of this condition. Breastfeeding mothers and children with this condition need more vitamin D.

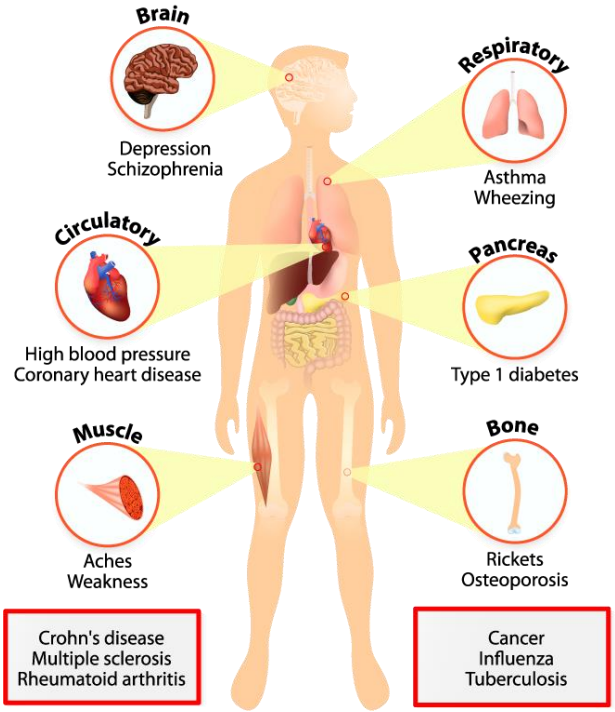

Figure 4: Vitamin D deficiency

Side effects of increased vitamin D in the body

Excessive vitamin D consumption results in adverse effects such as excessive brotherhood, dislike, great weariness, the presence of albumin in the urine, and elevated calcium and phosphorus in the blood. Itchy skin, muscular weakness, anorexia, weight loss, and rage are all common symptoms (4: 77-78).

Vitamin C

Vitamin C, also known as ascorbic acid, is a water-soluble vitamin with a daily need of 3 to 5 milligrammes per kilogramme of body weight. This number rises dramatically in children. Vitamin C is important for capillary development and nourishment, as well as the following activities in the body:

1. Collagen Production: Collagen is a protein that acts as a cement between epithelial tissue cells and is required for the development of interstitial material in teeth, bones, cartilage, skin, and capillary walls. Vitamin C is required for the production of teeth and bones, bone bonding, wound healing, and wound health.
2. Aiding immune system function: Vitamin C boosts the body's resilience to bacterial harm and toxins.
3. Aids iron absorption: Vitamin C aids iron absorption by converting ferric iron to a more absorbable form.

Important food sources of vitamin C

Foodstuffs (berries, clover, lettuce) Vitamin C is found in fruits, particularly those with a sour flavour (oranges, sour lemons, pomegranates), as well as animal organs and products (adrenal glands, brain, pituitary gland, and milk). (pages 140-141)

V. THE HUMAN SKELETAL SYSTEM

To sit, stand, lift weights, and breathe, humans need the skeletal system. It is difficult to depend on the body, form it, protect the tissues and internal organs, develop the capacity to move, store minerals, and manufacture blood without the skeleton.

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In Greek, the word skeleton implies "dry," but bone is a living substance that can develop and mend itself after an injury. Bones and auxiliary connective tissue including cartilage, ligaments, and tendons make up the skeletal system. Although certain portions of the body are hard, cartilage is more resilient than bone and provides the following functions:

Model cartilage is provided for the development of bones throughout pregnancy and infancy. It covers the bones and offers a smooth surface to avoid bone friction during puberty. Frames may also be found in several structures, such as the nose, outer ear, domes, and town hall. Citation and comments are provided. Cartilage is the most elastic and shock-absorbing structure in the human body, thanks to its superb matrix.

Ligaments and tendons have a lot of collagen filaments in their extracellular matrix, which makes them rigid like wire ropes. Collagen and minerals like calcium and phosphite make up the extracellular matrix of bone, which is analogous to hard concrete. Collagen strands that look like ropes, like iron rods in concrete, help to reinforce bone. Bone strength and density are determined by the minerals in the matrix. The majority of the minerals in the bone are hydroxyapatite crystals, which are calcium phosphate crystals (1: 168-169).

Cartilage

There are two types of cartilage growth and development: a) Interstitial growth and development, in which cartilage cells inside the voids separate the intercellular material. First, new cells appear at the same time as emptiness, then cartilage expands as interstitial matter separates, and b) Appositional Growth, in which cartilage cells from the Perichondrium class grow together. It is brought up by them.

VI. CARTILAGE NUTRITION

The cartilage is supplied by diffusion and lacks blood arteries, lymphatic vessels, and nerve fibres. The liquid transports the needed elements to the intercellular channels, where they permeate the cells. This fluid emanates from the perichondrium's arteries. It's obvious: cells close to the pericardium consume nutrients quickly, while feeding cells farther away from the pericardium is more challenging, particularly if calcium cartilage has accumulated in the matrix. Chondrocytes) do not reach their destination and perish. It should be mentioned that Proteoglycans are responsible for roughly 75% of the water in cartilage and play a crucial role in the movement of fluids, electrolytes, and nutrients through the matrix.

Cartilage repair

Because mature cartilage cells lose their capacity to proliferate, if cartilage tissue is damaged, cartilage cells will not be able to restore it. The perichondrium's action is responsible for restoration. That is, the perichondrium proliferates and heals the injured region, resulting in rounded fibroblasts, malformed chondrocytes, and cartilaginous interstitial as the interstitial material. It shifts because it is impossible to replace all of the cartilage in situations when a considerable portion of it has been lost, the injured region will be filled with connected tissue (131: 8-132).

Cartilage transformations

The following are the changes in cartilage:

A. The cartilage loses its transparency.
B. There is a decrease in the amount of cartilage cells.
C. The colour of C. Bina al-Hajravi fades.

It may include fine silk strands, such as cartilage. It weakens the matrix and may possibly induce cartilage perforation as a result of this occurrence. Calcium is present in cartilage under normal conditions. Citrus cells, particularly calcium-phosphate and calcium-carbonate cells, concentrate in the gap between cartilage cells in certain situations. These reserves begin near the cell and progressively expand to span the full space between the cells. The diffusion and penetration of nutrients into the chondrocytes is impeded when the space between cells is entirely filled by calcium, resulting in cell death (2: 170-172).

Effects of nutrients on cartilage growth

Dietary issues, particularly a lack of protein, minerals, and vitamins, result in visible cartilage abnormalities. When an experimental animal is fed a protein-free or vitamin A-free diet for an extended period of time, the thickness of the pineal cartilage quickly reduces. Furthermore, when vitamin C is eliminated from an animal's food, the matrix material is depleted, and alterations in the animal's cells occur. Vitamin D deficiency inhibits calcium and phosphorus absorption. The cartilage cells continue to grow in this situation, but calcium does not precipitate. As a consequence, the growing bones flex and take on aberrant forms beneath the weight of the body.

VII. THE ROLE AND IMPORTANCE OF CARTILAGE IN BONE FORMATION

Participation in ossification is one of cartilage's most essential activities. Cartilage creates the earliest model of the future bone near the foetus, with cartilage being generated initially, then eliminated and replaced by bone tissue. In reality, the size and form of bones are determined by cartilage.

The cartilaginous plates between the vertebrae of the spine operate as a shock absorber, lowering the strength of the heartbeat (5: 22-23).

Bone remodelling

Changes in blood calcium levels, muscular strain on the skeleton, and gravity all influence bone regeneration. Bone regeneration includes the removal of old bone by osteoclasts and the formation of new bone

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by osteoblasts in all bones. Bone regeneration is responsible for bone form changes, stress adaptation, bone regeneration, and calcium ion control in bodily fluids. As new bone is consumed by osteoblasts on the inner surface of the bone in the core area, the length and diameter of a long bone grows. As a result, the thickness of the dense bone that surrounds the core hollow diminishes as the diameter of the bone rises. The bone would grow extraordinarily thick and heavy if the size of the core cavity did not expand with the overall increase in bone size. Calcium is mostly obtained from bones. Many physiological activities of the body need blood calcium levels to be within a small range in order to operate normally. Calcium leaves the bone marrow when blood calcium levels drop, and calcium builds up in the bones when adequate calcium is absorbed via eating. This calcium exchange is regulated by the hormones.

Calcium buildup causes the bones to stiffen and develop prickly lumps, preventing them from performing their regular duties. Too little bone formation or too much calcium loss weakens the bones, making them more prone to breaking. When bones shatter, blood vessels in the bone are also injured, which complicates bone recovery. At the location of the damage, blood flows and a clot develops, and three days after the blood vessels break, nearby cells and tissues begin to penetrate the clot. Some of these cells form a connective tissue network between the shattered bone fragments that binds them together and fills the gap between them. In the retina, other cells create cartilage islands. The callus is the region of tissue regrowth between two damaged bones. Osteoblasts enter the callus and begin the process of creating spongy bones. Four to six weeks following the fracture, the production of cancellous bone is complete. Moving the bones at this stage is risky because it might damage or thin the new matrix. Following that, the spongy bone progressively shifts and gives way to thick bone, completing the process of bone regeneration. It might take months for a fractured bone to heal completely. If the broken portion heals completely, it will be stronger than the rest of the bones (7: 116-117).

VIII. CONCLUSION

Calcium is the most significant mineral element in human and animal bodies, and it is one of the most important mineral components of diet. It is required for creating and maintaining skeleton and skeletal bones. The bones and teeth contain 99 percent of the calcium in the body, along with phosphorus, while the remainder is contained in soft tissues and foreign cell fluids.

Calcium is involved in bone and tooth formation, blood clotting, muscular contraction, nerve transmission, and cell metabolism in the human body. Calcium deficiency in children causes physical and mental growth problems, as well as the development of Rashitisme, a kind of osteoporosis. This disorder is characterised by deformed bones, big joints, and mobility issues.

Calcium shortage in adults produces osteomalacia, which causes hollow and brittle bones due to a reduction in calcium density in the bones.

Factors like having enough vitamin D in the intestines, having enough vitamin C and certain amino acids in the food, and having enough lactose or milk sugar in the diet, which allows some tiny organisms to proliferate and adjust the pH of the intestines, all aid with calcium absorption. They are beneficial. Calcium is abundant in milk and its products. After milk and its products, the finest sources of calcium are fruits and vegetables, grains and legumes, fish or poultry meat, eggs, turnips, and almonds.

Calcium intake should be about 800 mg per day, with an additional 400 mg given for development, puberty, pregnancy, and breastfeeding.

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