Effects Of Drinking Desalinated Seawater On The Formation And Growth Of Bones Of Children

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Aim of the work

The aim of this study is:

To assess the effect of drinking desalinated seawater on the formation and growth of children's bones through: studying their bone mineral density (BMD) by the use of a quantitative ultrasound machine (QUS), and evaluating their bone turnover and bone metabolism through studying their serum alkaline phosphatase, serum calcium, serum phosphorus and serum magnesium.

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Introduction

It is anticipated that by the year 2025 water resources of Egypt will drop approaching the water poverty limit. The future strategy is based on enhancing the use of non-conventional sources including desalination ***(El- Kady and El-Shibini, 2001).***

Desalinated water is produced mainly by distillation, deionisation and membrane filtration (reverse osmosis or nanofiltration). It is commonly further treated by adding chemical constituents such as calcium carbonate or limestone to improve their taste and reduce their aggressiveness ***(Kozisek, 2004).***

Reverse osmosis filters remove 65–95% of fluoride, and distillation filters remove all fluoride ***(Hobson et al., 2007).***

The U.S. Centers for Disease Control listed water fluoridation as one of the ten great public health achievements of the 20th century ***(CDC, 1999).***

The effect of fluoridation on bone mineral density and rates of fracture is inconsistent ***(Kathy et al., 2000).***

Some studies have reported a protective effect of fluoride on fracture ***(WHO, 2006).***

Little is known of fluoride's effects, if any, on normal childhood bone development at lower levels, including from community water fluoridation. Few studies have related fluoride to childhood bone measures ***(Steven, 2009).***

Review of literature

Chapter 1

Bone mineral density

Composition of Bone:

Bone is not a uniformly solid material, but rather has some spaces between its hard elements. Compact (cortical) bone the hard outer layer of bones is composed of compact bone tissue, so-called due to its minimal gaps and spaces. Its porosity is 5-30%. This tissue gives bones their smooth, white, and solid appearance, and accounts for 80% of the total bone mass of an adult skeleton. Compact bone may also be referred to as dense bone. Trabecular (Cancellous) bone Filling the interior of the bone is the trabecular bone tissue (an open cell porous network also called cancellous or spongy bone), which is composed of a network of rod- and plate-like elements that make the overall organ lighter and allow room for blood vessels and marrow. Trabecular bone accounts for the remaining 20% of total bone mass but has nearly ten times the surface area of compact bone. Its porosity is 30-90%. If for any reason there is an alteration in the strain to which the cancellous is subjected, there is a

rearrangement of the trabeculae. The microscopic difference between compact and cancellous bone is that compact bone consists of haversian sites and osteons, while cancellous bones do not. Also, bone surrounds blood in the compact bone, while blood surrounds bone in the cancellous bone ***(Hall, Susan. Basic Biomechanics, Fifth Edition, Pg. 88).***

Bone is composed of 70% mineral (cells and bone matrix without organic constitutes) and 30% organic constitutes**.** ***(Soames, 1998)***

(A) Cells:

Cells occupy 2% of the organic matrix of bone and are responsible for formation, resorption and maintenance of the remodeling cycle, and include:

1- Osteoprogerinator cells.
2- Osteoblasts.
3- Osteocytes.
4- Osteoclasts.

(Soames, 1998)

(B) Matrix

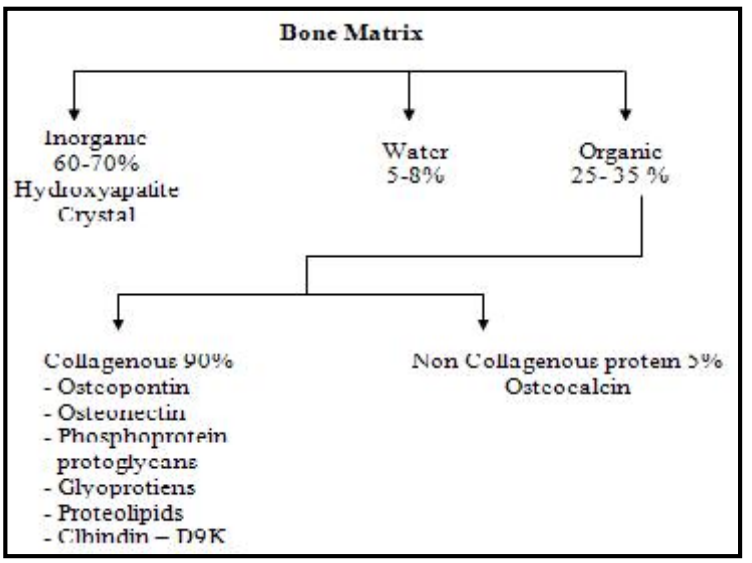

Fig. (1): Composition of bone matrix ***(Kelly et al., 1997)***

Bone Turnover

Bone is a living, growing tissue that turns over at a rate of about 10% a year. It is made up largely of collagen, and crystals of calcium and phosphate, a mineralized complex that hardens the framework bone strong yet flexible enough to bear weight and to withstand stress ***(Raisz et al.,* 2003).**