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ROLE OF CALCIUM FROM MINERAL WATERS DURING PREGNANCY

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Abstract

Mineral water is a good source of calcium, highly bioavailable and easily assimilated. Calcium represents the most abundant mineral in our organism. During pregnancy adequate calcium intake is of major importance for the health of both mother and fetus.

Daily consumption of hyposodic mineral waters, with a balanced content of calcium and magnesium, makes a valid support to supplement the diet and to achieve appropriate calcium dose.

Keywords: *Pregnancy, calcium, mineral water.*

Introduction

Drinking is a necessity but in some cases it is important to pay attention to the methods, the quantity and the quality of the ingested water. For a woman, pregnancy is a phase of change: her body changes to adapt to the child's growth. Firstly, the blood volume changes to ensure the placental vasculature. The amniotic fluid is made up of water. Therefore a correct hydration is important to ensure a correct maternal-fetal balance (Kovacs, 2005). The mother should drink about 1.5-2 liters of water per day and EFSA recommends an additional 300 mL of water and even more in the warmer months. Obviously, the intake of water with a controlled and bacteriological pure composition is recommended.

Water does not gain weight because it is free of calories. It also helps to promote intestinal transit and to counteract constipation and hemorrhoids. Furthermore adequate hydration counteracts the tendency to urinary infections and the appearance of muscle cramps.

Pregnancy and calcium

Pregnancy is a period of high calcium requirement. Calcium absorption and urinary calcium excretion are higher during pregnancy compared to other periods of life, due to increased glomerular filtration rate and hyperabsorption of calcium. Bone resorption and bone formation are increased, as indicated in several studies by bone turnover markers tests. Studies of pregnant women indicate that the fetal calcium demand is met largely by intestinal calcium absorption, which from early pregnancy onward more than doubles (Kovacs and Fuleihan, 2006).

Efforts to reach an adequate calcium intake are recommendable for all women with inadequate calcium intakes. During pregnancy, adaptive mechanisms are triggered regarding calcium homeostasis and mainly are observed an increase in calcium absorption in the intestine, a decrease in calcium losses in the kidney and an increase in bone resorption. These are adaptive mechanisms that serve to cope with the increase in demand for calcium. About 25-30 g of calcium are transferred from the mother to the fetus during pregnancy, particularly during the third trimester, when the fetus shows the need to strengthen its skeletal structure, ensuring proper development.

During pregnancy the calcium demand becomes about 1200 mg per day (LARN- rev. 2014) in order to ensure important physiological and nutritional functions both to the mother and the unborn child. Epidemiological studies indicate high percentage of pregnant women take only 50-70% of the recommended dose, with consequent depletion of calcium from their bones (Kovacs, 2005). When the levels of this mineral reach inadequate values, the mother's body increases its mobilization from the bones, keeping its blood level constant. This strategy predisposes to a series of pathologies such as osteopenia and osteoporosis, risk of pre-birth and low birth weight, risk of hypertension in pregnancy.

A very recent review indicated calcium supplementation might decrease the risk of preeclampsia and gestational hypertension. And results of subgroups analyses underline the protective effect of calcium supplementation. 27 studies, with 28 492 pregnant women were included. The results showed calcium supplement was associated with lower incidence of preeclampsia (RR 0.51, 95% CI: 0.40 to 0.64) and gestational hypertension (RR 0.70, 95% CI: 0.60 to 0.82) (Sun et al., 2019). Another article describes the results of a randomized, crossover trial of calcium supplementation on bone resorption among pregnant women. Thirty-one Mexican women at 25–35 weeks gestation participated in the study for 20 days. Each woman received a 1200 mg calcium supplement on 10 consecutive days and a multivitamin without calcium for 10 days. Urine samples were collected daily. Levels of cross-linked, N-telopeptides of type I collagen (NTX), a biomarker of bone resorption, were measured. 1200-mg calcium supplement during the third trimester of pregnancy reduces maternal bone resorption by an average of 13.6 nM BCE/mM creatinine (14%), as reflected by urinary NTX levels. These results suggest that calcium supplements reduce maternal skeletal-bone turnover during the third trimester of pregnancy (Janakiraman et al., 2003). As reported by Cullers and collaborators supplemental calcium provided during pregnancy may improve bone recovery postpartum in women consuming a typical US diet. This study assessed the effect of calcium supplementation during pregnancy on measures of changes in cortical and trabecular

bone from 16 weeks of pregnancy to 1 year postpartum. At baseline, the women consumed close to the calcium Dietary Reference Intake for pregnancy. Those receiving 1000 mg supplemental Ca have a 4–5% greater recovery of cortical and total bone density at aweight-bearing site postpartum. Thus, 1000 mg supplemental Ca/die during pregnancy may improve bone recovery during the first 12 months postpartum in women with calcium intakes averaging 700 mg/die (Cullers et al., 2019).

Calcium from mineral waters

Increased body calcium demand can be compensated by increasing the intake of this mineral with the diet (milk, dairy products, spinach, broccoli, cabbage). Diet is the main contributor to total calcium intake (Willemse et al., 2019; Guéguen and Pointillart, 2000). Among the various calcium-rich food sources, mineral waters with an adequate calcium content should also be taken into consideration. In fact waters with a good content of calcium and a low level of sodium contribute to providing an adequate percentage of calcium.

On the other hand, the sodium content in the water remains crucial. Since in pregnancy there is a tendency to introduce too much sodium with the diet and consequently there is a greater predisposition to water retention, it would be desirable to take a low amount of sodium with water.

Böhmer and coauthors in a study recall that calcium absorption factors in water are similar and, in some cases, even better than dairy products (Heaney et al., 2006; Dokkum et al., 1996; Greupner, 2017), especially if sodium is in small concentrations (Na^+ within 20 mg/L). Sodium can increase the elimination of urinary calcium and adversely affects its absorption capacity. There is a physiological correlation between calcium and sodium. Therefore people should choose water with a low sodium content because low-salt diets promote calcium absorption. Several studies have shown the limiting effect of sodium on calcium absorption at the cellular level (Lin et al., 2003). It has been estimated that about one gram of sodium causes the loss with urine of about 20 mg of calcium, considerably increasing the need for calcium to restore calcaemia. The pathophysiological mechanism at the base of hypercalciuria would be linked to the effect of sodium in the increase in plasma volume, which favors its filtration at renal level. Mineral water is a good source of calcium, highly bioavailable and easily assimilated. During pregnancy its consumption represents an important protective factor. Calcium is naturally abundant in mineral waters as caloric-free sources (Heaney and Dowell, 1994). Mineral waters with high calcium content (over 150 mg/L) and low sodium content (less than 20 mg/L) are excellent supplemental sources. Calcium of water is immediately bioavailable, as reported by many studies (Bacciottini et al., 2004; Winckel et al., 1997; Couzy et al., 1995). The bioavailability of calcium is related to the concentration of the ionized form at the duodenal level and the first loops of the jejunum, where it is absorbed by active and saturable transport mechanism (LARN- rev. 2014).

In most of the studied waters the counter-ion of calcium is bicarbonate, which is very important because at the same ingested calcium load, it can vary its bioavailability. In particular, in the last months of pregnancy, due to the increased need for calcium, it is recommended to take preferably bicarbonate-calcium water. The balance between calcium and magnesium is also important. Then high bicarbonate-calcium rich waters are preferable (Heaney, 2006).

Acqua Lete®

In this context, a habitual consumption of two liters of water Lete®, Italian mineral water, per day, thanks to its natural chemical balance with an adequate calcium content (310 mg/L), high bicarbonate content (930 mg/L) and a low sodium content (5.1 mg/L), provides about 630 mg of calcium, and represents a valuable aid for pregnant women to restore adequate levels of calcium.

Mineral water represents the most natural way to provide an adequate supply of calcium to our body. Moreover bicarbonates may neutralize acid secretion, accelerate gastric empting, provoke the release of gastric peptides. According to the classification of mineral waters under Fixed Residue Acqua Lete® has average mineralization (FR 890 mg/L). The content of sodium (Na^+) is less than 20 mg/L, suitable for low-sodium diets. Mineral water classification based on chemistry and related therapeutic effects (D.M. 29/12/2003) defines mineral

content. Water is bicarbonate when the content of bicarbonate (HCO_3^-) is higher than 600 mg/L. Moreover water possesses antinflammatory action, if is bicarbonate – alkaline, instead is able to facilitate digestive process and antispasmodic if it is bicarbonate – calcic. Acqua Lete® presents as a negative prevailing ion bicarbonate and as positive prevailing ion calcium (Ca^{2+}) is said water facies bicarbonate - calcic (Piazzese, 2015). During pregnancy this water can be considered a calcium diet source with adjuvant action. The presence of bicarbonates and CO_2 creates an acidic intestinal environment, positive for better calcium salts solubilisation and thus better calcium absorption.

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