

DETERMINATION OF THE SERUM MAGNESIUM AND ITS INTERFERENCES

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Abstract

The minerals are nutritive substances that are found in the food ration and in the body, in the form of anorganic and organic compounds. Although the mineral substances in the body represent only 4 – 5 % of the body's weight, they are indispensable for the maintaining of the health condition. In the body the mineral substances meet important functions, biochemical and physiological. In the body some minerals are found in larger quantities, bearing the denomination of macro minerals. In this category we can include the mineral substances that include the elements: Calcium, Phosphorus, Sodium, Potassium, Chlorine and Magnesium.

Keywords: Magnesium, minerals, biochemistry

INTRODUCTION

The Magnesium is an element that, although is found in small proportion in the body (0,05% of the total weight of the body), presents a great importance from the structural and functional point of view.

70% of the total quantity of Magnesium of the human body (approx. 14g) is found in the composition of the bones together with Ca and P and the rest is distributed in soft tissues (especially in the muscles of the skeleton) and in different fluids. Approximately 1% is found in the plasma, 25% being related to the proteins, the rest remaining under the ionized form Mg^{2+} . In the erythrocytes the quantity of Mg is considerable, approx. 5.2 mEq/L. Regarding the cellular distribution of the Magnesium, the majority is found in mitochondria and nucleus. Beside his plastic role of component of the bones and of the soft tissues, Mg meets numerous functional roles among which is that of activator of some enzymes, over 300 enzymes involved in the metabolism of the carbohydrates, the synthesis of the proteins and nucleic acids, the most known being Na^+/K^+ ATPaza. Together with the ions Na^+ , K^+ and Ca^{2+} , the Magnesium regulates the excitability of the neuro muscles and the mechanism of the coagulation.

The actions of the Calcium and Magnesium are tightly connected between them, the deficit of one of these elements influencing significantly the metabolism of the other (the Magnesium is necessary for the intestinal absorption and for the metabolism of the Calcium). In the muscular cell the Magnesium acts as an antagonist of the Calcium. The deficit of Magnesium will generate the mobilization of the Calcium from the bones, being possible the appearance of the abnormal calcifications on the level of the aorta and kidney. For this reason it is recommended to be considered the level of the Calcium when it is evaluated the level of the Magnesium. Also, hypomagnesemia is associated with the hypopotassemia in 60% of the cases.

From the clinical point of view, the deficit of Magnesium determines neuro muscular affections (weakness of the muscles, tremble, tetany and convulsions), and on the level of the heart it can generate arithmias.

MATERIAL AND METHODS

In order to accomplish the objectives proposes was used a prospective study.

It is followed the study of the behavior of the serum Mg, the study concerns the correcting of an eventual deficit of Magnesium.

Preparing the patient – àjeun before the meal, at least 4 hours.

Harvested specimen – venous blood with the following recommendations:

- the harvesting will be made in the sleeping position, because in orthostatic position the level of the serum Magnesium increases with 4%²;
- it will be avoided the venous stasis with the tourniquet;
- it will not be used gloves with talcum powder (contains Magnesium stearate; the gloves are washed with water jet, without soap or detergents).

Recipient of harvesting – vacutainer without anticoagulant with /without separating gel.

Necessary processing after the harvesting – is centrifuged the sample and is separated the serum as soon as possible; is analyzed immediately; if this is not possible, is stored the serum at temperatures between 2-8 °C or is refrigerated (-18 °C).

Volume of the sample – minimum 1 mL serum.

Causes of rejection of the sample – hemolysis specimen.

Stability of the sample – separated serum is stable: 7 days at room temperature; 7 days at 4-8 °C; a month at -20 °C.

Method of work – spectrophotometric (colorimetric)

RESULTS AND DISCUSSIONS

Table 1

The values of reference reported to the age

<i>Age</i>	<i>Values (mg/dL)</i>
Newborn	1.5-2.2
5 months – 6 years	1.7-2.3
6-12 years	1.7-2.1
12-20 years	1.7-2.2
Adult (2-60 years)	1.6-2.6
6-90 years	1.6-2.4
>90 years	1.7-2.3

Normally 95% of the quantity of Magnesium that is filtered on the glomerular level is reabsorbed tubulated, especially in the ascendant portion of the loop of Henle. The excretion of Magnesium controls the serum level of this element and is dependent on the diet, on the other part being submitted, together with that of the Calcium, to the effects of the parathyroid hormone; the increase of the Calcium reabsorption leads to the competitive inhibition of the Magnesium absorption. Hyperkalemia, hypophosphatemia and acidosis are among the inhibitors of the tubular reabsorption of Magnesium. When the kidney function is decreased, the Magnesium is retained determining the increase of serum level.

From the point of view of frequency it is the fourth mineral from the body; also, it is the most frequently clinically ignored. A third of the extracellular Magnesium is related to the serum albumin. For this reason the serum concentration is not a faithful indicator of the total deposits of Magnesium.

The Magnesium is necessary for the function of some enzymes and hormones; it is necessary, also for the transport of Sodium, Potassium and Calcium inside and outside the cells. For that matter, when there is a hypomagnesemia, it is possible the correction of the intracellular deficit of Potassium. It is important also in the stabilization of the excitable membranes and is useful in the therapy of the atrial and ventricular arrhythmias.

It represents the increase of the serum level over the normal limits of 1,3-2.2mEq/L. The Magnesium balance is influenced by many of the factors that control the Calcium balance. Moreover, it is influenced also by the factors that

regulate the Potassium balance. As a consequence the Magnesium balance is in tight correlation with the Potassium and Calcium balances.

The most frequently met cause of hypermagnesemia is the renal failure; other causes can be: iatrogenic (by the overdose of Magnesium), visceral perforation with continuing the food input, utilization of laxatives/antacids that include Magnesium (an important cause in elder persons).

Neurologic symptoms in case of hypermagnesemia: muscle weakness, paralysis, ataxia, dizziness and confusion. The gastrointestinal symptoms: vomit and nausea. Moderate hypermagnesemia can produce vasodilatation and the severe one hypotension. The extremely high serum levels lead to the dejection of the conscience, bradycardia, hypoventilation and cardiac arrest.

Clinically, it is more frequent than hypermagnesemia. Defined as serum level under the normal value of 1,3-2,2mEq/L, hypomagnesemia is, usually, the result of the decrease of the absorption or the increase of the losses, renal or digestive (diarrhea). Dysfunctions of the parathyroid hormones and some medicine (ex. pentamidine, diuretic, alcohol) can also produce hypomagnesemia. Women that lactate have a high risk to develop hypomagnesemia.

The main signs of hypomagnesemia are the neurologic ones, although some studies found a relation between the neurologic effects and the cardiac ones of the Magnesium. Hypomagnesemia interferes with the effects of the parathyroid hormones, the result being hypocalcemia. It can produce also hypokaliemia.

CONCLUSIONS

In the conditions associated with Magnesium deficit the values of urinary Magnesium are reduced before the serum ones. The serum levels of Magnesium can remain normal, even in the presence of a depletion of up to 20% of the total reserves of the body.

The hemolysis interferes by the emission of Mg from erythrocytes, generating false increased results. The bilirubin can determined false decreased results.

The decrease of the urinary Magnesium suggest a deficit of Magnesium and if the loss is the renal cause, the urinary Magnesium is increased.

High blood alcohol level determines the increase of urinary Magnesium. The presence of the blood in the urine increases the urinary Magnesium.

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