INFLUENCE OF INOSITOLHEXAPHOSPHORIC ACID (PHYTIC ACID) ON THE DISTRIBUTION AND THE EXCRETION OF MAGNESIUM IN RAT TISSUES

V.P. KOTSAKI-KOVATSI*, L. KOVATSI, TH. KIRIAKIDIS, AND G. KOEHLER-SAMOUILIDOU. Lab. of Biochemistry and Toxicology and *Lab. of Pharmacology, Faculty of Veterinary Medicine, Aristotle University, Thessaloniki 54006, Macedonia, Greece.

1. Summary

In the present investigation, the effect of the administration of phytic acid on magnesium (Mg) concentrations in rat tissues was studied. The animals were divided into three groups: Group A (received a diet supplemented with 2% phytic acid), group B (received a diet supplemented with 10% phytic acid) and group C (control). At the end of the experiment, the animals were sacrificed and the concentration of magnesium was determined in several tissues.

Phytic acid significantly increased Mg concentration in the duodenum and the ovary of the animals of both groups. Magnesium concentration was also increased in the heart, liver, jejunum and blood of the animals of group B as well as in the lung, adrenals and spleen of the animals of group A.

On the other hand, the lung and stomach magnesium concentrations of the animals of group B as well as the colon and hair magnesium concentrations of the animals of group A were decreased. Magnesium excretion through feces was significantly decreased in the animals of both groups, while the excretion through urine was only decreased in the animals of group B. No significant changes were observed in the brain, ocular tissue, kidney, uterus and thigh bone concentrations of magnesium.

In conclusion, the administration of phytic acid can produce translocation and/or elimination of magnesium in several tissues of rats.

Keywords: Magnesium, rats, phytic acid.

2. Introduction

Phytic acid is present in many plants, constituting 1 to 5% of the weight of many cereals and legumes. Its molecular structure makes possible the formation of complexes with several elements in vitro and we believe that the same can happen in...
vivo. Similar hypotheses have been made and experimentally confirmed with other drugs [1,2,3]. Concern about the presence of phytic acid in the diet, arises from evidence that it decreases the bioavailability of many essential minerals by interacting with multivalent cations to form complexes. These complexes appear to be responsible for the decreased bioavailability of the complexed minerals [4-6].

The aim of the present study was to investigate the effect of phytic acid on the concentration of Mg in several rat tissues, based on the facts that phytic acid is a strong calcium binding agent [7,8] and that its molecular structure makes possible the formation of complexes with other elements both in vitro and in vivo.

3. Material and methods

Twenty four female Wistar rats, six months old, weighing 200-250 g were used. The animals were housed in polypropylene cages, maintained at 22-24°C, with lighting conditions of 12h of light and 12h of darkness.

We divided our animals into three groups A, B and C (8 animals in each group). The animals of group C (control) received nothing. They were provided daily with water and a balanced, pelleted diet ad libitum. The metal content of the diet was as follows: 12 g Ca/kg, 50 mg Zn/kg, 7 mg Cu/kg, 50 mg Mg/kg. The animals of group A received a diet supplemented with 2% phytic acid for 4 weeks. The animals of group B at first received a diet supplemented with 2% phytic acid for 8 weeks and then a diet supplemented with 10% phytic acid for another 4 weeks. Phytic acid was purchased from Aldrich, as a syrupy, aqueous solution 40% per wt.

At the end of the experiment, the animals were kept in metabolic cages for 24h in order to collect urine and feces. Urine and feces were collected in glass tubes and stored at -20°C until analysis. The next day the animals were sacrificed. Immediately after death, blood was collected directly from the heart, through cardiac puncture, using heparinized syringes. Brain, ocular tissue, heart, lung, liver, spleen, kidney, adrenals, ovaries, uterus, a portion of the stomach, duodenum, jejunum, colon, thigh bone and about 2 g of hair from the neck were removed. The tissues were blotted dry, weighed and kept frozen (-20°C) until further analysis. For the determination of the Mg concentrations in the tissues, blood, urine and feces, flame atomic absorption spectroscopy was used. Student’s t-test was used for statistical analysis with p<0.05 being considered significant.

4. Results and Discussion

In tables 1 and 2, we present the results of phytic acid administration on the concentration of Mg in the examined tissues, hair, blood, urine and feces. Mg concentrations in the duodenum and in the ovary were significantly increased in the animals of both groups (p<0.05). Magnesium concentration was also significantly