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The Effect of Oral Magnesium Supplements on Lipid Profile and Oxidative Stress in Adult Albino Female Rats

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Abstract

The present study was designed to show the effect of magnesium on lipid profile and oxidative stress. The present study used 30 adult albino female rats that distributed to following groups (each group consist 6 rats); control group received ad libidium, second group administrated magnesium (orally, 35.7mg /kg) for eight weeks, third group administrated magnesium (orally, 71.4mg /kg) for eight weeks, fourth group (pregnant rats) administrated magnesium (orally, 35.7mg /kg) for eight weeks, fifth group (pregnant rats) administrated magnesium (orally, 71.4mg /kg) for eight weeks, and then killed. The results showed high significant increased ($P < 0.05$) in levels of lipid profile (total cholesterol, total glyceride, high density lipid (HDL), low density lipid (LDL) very low density lipid (VLDL)), especially in pregnant female rats (third and fifth groups) compared with control group. On the other hand, the results showed significant changes ($P < 0.05$) in levels of malondialdehyde (MDA), *Superoxide dismutase* (*SOD*) and catalase especially in pregnant female rats (third and fifth groups) compared with control group. It was concluded that the prolong using and overdose of magnesium lead to elevated the lipid profile and oxidative stress in rats especially in pregnant female rats.

Keywords: *Magnesium; Lipid profile; Oxidative stress.*

Introduction

Magnesium (Mg2+) has several functions in the human body. It acts as a cofactor for more than 300 enzymes, regulating a number of fundamental functions such as muscle contraction, neuromuscular conduction, glycemic control, myocardial contraction, and blood pressure [1]. Intracellular Mg stores are found in high concentration in mitochondria [2], where this element plays a pivotal role in the synthesis of ATP (adenosine triphosphate) from ADP (adenosine diphosphate) and inorganic phosphate [3]. About 60% of the magnesium is present in bone, of which 30% is exchangeable and functions as a reservoir to stabilize the serum concentration. About 20% is found in skeletal muscle, 19% in other soft tissues and less than 1% in the extracellular fluid [4]. Magnesium levels in the blood are higher than 1.1 mmol in general hyperglycemia which can be clinically observable in patients with nausea, vomiting, lethargy, headaches. When magnesium reach above 3.0 mmol, it may cause acute cardiac disorders such as low blood pressure, lengthening of QRS, PR and QT intervals. Excessive hyperglycemia can lead to coma, stunting, and death by cardiac arrest [5-8]. So, the aim of study is detecting the toxicity effect of Hypermagnesemia in female adult rats.

Materials & Methods

Animal model

30 adult female rats (Rattuss norwegicus), (wt: 240-280 with age: 4-6 Mon) obtained from Veterinary college/Baghdad, and kept on standard pellet diet and water for two weeks before experiment.

Experimental design

30 adult female rats were used and distributed in five groups (six rats in each group) as following and administrated orally:

Control group received normal saline and normal diet for seven days.

Second group administrated magnesium (orally,

35.7mg /kg) for eight weeks, and then killed.

third group administrated magnesium (orally, 71.4mg /kg) for eight weeks, and then killed.

Fourth group (pregnant rats) administrated magnesium (orally, 35.7mg /kg) for eight weeks, and then killed.

Fifth group (pregnant rats) administrated magnesium (orally, 71.4mg /kg) for eight weeks, and then killed.

Prepare of blood solution

5 ml of blood collected by cardiac puncture under anesthesia and put in test tubes. Then using centrifugation 5000 cycle/min for 15 min. Sera were taken and stored by deep freezing to estimate the biochemical measurement.

Measurements

Lipid profile

Total cholesterol and triglyceride were measured by technique according to the instructions of manufacturer company kit (Randox) [9].

Oxidative Stress and Antioxidant Parameters

MDA (malonedialdehyied) was measured based on the colorimetric reaction with thiobarbituric acid (TBA) using spectrophotometer [10]. SOD and Catalase was measured by using the procedure of Biovision-USA kits.

Statistical Analysis

Data of study were analyzed by using a statistical program known as Minitab. data Means were compared using Duncan's Multiple Range test. Probability levels of more than 0.05 were regarded as statistically non-significant, whereas values less than 0.05 were considered as significant [11].

Results

Lipid profile

Lipid profile (TC, TG, HDL, LDL and VLDL) in second and fourth groups show significant changes ($P < 0.05$) compared with control group. While, Lipid profile in third and fifth groups (pregnant rats) show high significant changes ($P < 0.05$) compared with control group as shown in table (1).

Table (1): levels of lipid profile in all groups

Parameters Groups	S.Cholesterol mmol/L	S. Triglyceride mmol/L	HLDL mmol/L	LDL mmol/L	VLDL mmol/L
Control group	2.15 ± 0.34 b	1.29 ± 0.27 b	1.07 ± 0.23 b	0.82 ± 0.50 a	0.26 ± 0.05 b
Second group	2.47 ± 0.23 b	2.19 ± 0.81 b	1.20 ± 0.18 b	0.84 ± 0.18 a	0.44 ± 0.16 b
Third group	2.66 ± 0.59 b	2.09 ± 0.43 a	1.23 ± 0.19 b	1.01 ± 0.61 a	0.42 ± 0.09 a
Fourth group	3.45 ± 0.92 a	1.89 ± 0.33 a	2.19 ± 0.05 a	1.09 ± 0.77 a	0.38 ± 0.07 a
Fifth group	3.78 ± 1.01 a	2.11 ± 0.28 a	2.16 ± 0.16 a	1.40 ± 0.32 a	0.42 ± 0.06 a

Oxidative stress and antioxidants

MDA, SOD and catalase in second and fourth groups show non-significant changes ($P < 0.05$) compared with control group. Also, MDA, SOD and catalase in third and fifth groups (pregnant rats) show non-significant changes ($P < 0.05$) compared with control group as shown in table (2).

Table (2): levels of MDA, SOD and catalase in all groups

Parameters Groups	Malondialdehyde µmol/L	SOD mmol/l	S. catalase U/L
Control group	1.79 ± 0.39 a	147.40 ± 7.3 a	126.60 ± 13.28 a
Second group	2.30 ± 0.63 a	187.20 ± 55.93 a	118.00 ± 14.46 a
Third group	1.85 ± 0.35 a	194.20 ± 53.4 a	119.60 ± 14.31 a
Fourth group	2.43 ± 0.63 a	153.20 ± 29.138 a	122.60 ± 14.83 a
Fifth group	1.98 ± 0.35 a	155.80 ± 26.58 a	124.20 ± 14.70 a

Discussion

The results of present study show significant changes in lipid profiles and oxidative stress. Hypermagnesemia has often been described with the use of magnesium containing cathartics for treatment of drug overdose, in patients taking magnesium-containing cathartics and antacids for therapeutic purposes [12]. Arpaci et al referred in their study there was no correlation between magnesium level and levels of cholesterol, LDL and triglycerides [13], that is not agreement with results of the present study. On the other hand, Philips et al, referred that hypermag-nesiumia lead to necrosis and collapse of liver parenchyma, perivenular hepatocellular and canalicular cholestasis with mild macrovesicular steatosis [14], that explain the increased the levels of lipid profile in the present study. About oxidative stress in this study. The present results show non-significant changes between groups that administrated with magnesium and control group. Same findings reported by Barbagallo et al. who established a strong, direct correlation between RBC Mg levels and GSH/ GSSG concentration (circulating reduced/ oxidized glutathione) [15]. In another study, a negative correlation between Mg levels and OS stress markers (plasma superoxide anions and malondialdehyde) was observed in groups of the population chronically exposed to stress [16]. Interestingly, no correlation between Mg intake and antioxidant capacity has been found among Korean adults [17].

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

Conflict of Interest: The authors declare that they have no conflict of interest.

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