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Original Article

Serum magnesium levels in liver cirrhosis patients and healthy controls: An investigation

Ajanta Beniwal[1], Rati Mathur[1], Bhumika Pareek[1], Durva Garg[2], T Ilanchezhian[3,*]

[1]Department of Biochemistry, Sawai Man Singh Medical College, JNL Marg Jaipur-302004, India
[2]Department of Biochemistry, Sarder Patel Medical College, Bikaner, Rajasthan 334001, India
[4]Department of Biochemistry, ACPM Medical College, Dhule – Maharashtra - 424001, India

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*Corresponding author:
T. Ilanchezhian, Assistant Professor, Department of Biochemistry, ACPM Medical College, Dhule – Maharashtra - 424001, India

ABSTRACT

Background: *Liver cirrhosis is an escalating health issue, and the death rate associated with this illness is fast rising among both males and females. In the initial stages, cirrhosis typically does not produce noticeable signs or symptoms. However, as liver function declines, many indications and symptoms become evident, such as fatigue, nausea, unintentional weight loss, jaundice, gastrointestinal bleeding, severe itching, and swelling in the legs and abdomen. Liver illnesses are significantly influenced by micronutrients. Magnesium is the second most prevalent ion found within cells and the fourth most prevalent positively charged ion in the body.*

Objective: *This study aimed to analyze the connection between magnesium levels and the severity of liver cirrhosis and its consequences. The significance of trace elements, such as magnesium, in the etiology of liver cirrhosis is not yet fully known.*

Materials and Methods: *This study was a hospital-based case-control observational study. The study was carried out in the Central Lab, Department of Biochemistry, SMS Medical College & associated Hospitals in Jaipur. This study included 92 patients diagnosed with liver cirrhosis and a sample size of 92 healthy controls.*

Result: *The average serum magnesium levels of the patients (1.13 ± 0.21) are lower than those of the controls (2.07 ± 0.27).*

Conclusion: *The study revealed a statistically significant drop in magnesium levels in liver cirrhotic patients compared to the control group. Utilizing these uncomplicated and economical biochemical parameters may serve as biomarkers for the early diagnosis of liver cirrhosis and aid in the identification of people with this condition.*

Keywords: *Magnesium (Mg); Liver Cirrhosis; Non-alcoholic fatty liver disease (NAFLD); Alcoholic liver disease.*

Introduction

Liver cirrhosis is an escalating health issue, and the death rate associated with this illness is fast rising in both males and females [1]. Hepatic fibrosis is a pathological disease characterized by the substitution of normal, healthy liver tissue with fibrous tissue. Fibrosis replaces healthy liver tissue, obstructing blood flow and impairing liver function [2]. Liver cirrhosis is the last phase of several liver illnesses, and is distinguished by the disintegration of liver structure, fibrosis, and the development of

regenerating nodules [3]. Cirrhosis is a long-term liver disorder characterized by widespread damage and regeneration of liver cells, leading to an overall increase in connective tissue and disruption of the normal structure of the liver lobes. In the first stages, cirrhosis typically does not produce noticeable signs or symptoms. However, as the liver's functionality declines, several indications and symptoms begin to manifest. These include exhaustion, nausea, unintentional weight loss, jaundice, gastrointestinal bleeding, severe itching, and swelling in the legs and abdomen [4].

While it is possible for certain individuals with cirrhosis to live for an extended period of time, their overall outlook is often unfavourable. Additional factors that can lead to cirrhosis include persistent infection with hepatitis B and D viruses, autoimmune hepatitis, genetic conditions such as α1-antitrypsin deficiency, Wilson disease, hemochromatosis, and galactosemia, non-alcoholic steatohepatitis, obstruction of the bile ducts, exposure to certain medicines, poisons, and infections. The primary etiologies of liver cirrhosis and cancer include nonalcoholic fatty liver disease (NAFLD), alcoholic liver disease, and hepatitis B and C infection [5].

Liver problems are greatly influenced by micronutrients. Magnesium is the second most prevalent ion found inside cells and the fourth most prevalent positively charged ion in the body. It has a broad distribution throughout the body and is found in several compartments, including the nucleus, cytoplasm, mitochondria, and endoplasmic reticulum [6,7]. Roughly 50% of the overall magnesium content in the body is found in soft tissue, while the remaining 50% is located in bone. The concentration of magnesium in the blood is less than 1% of the total amount of magnesium in the body. However, most of our experimental data is derived from the analysis of magnesium levels in serum and red blood cells.

Hepatic metabolism also leads to the inactivation of some hormones. This deficiency leads to elevated levels of aldosterone, growth hormone, and glucagon in the bloodstream, which ultimately promotes the outflow of magnesium in urine [8].

Magnesium is a crucial cofactor that plays a significant role in metabolic activity. The kidneys serve as the primary regulatory site for magnesium, facilitating its absorption, filtration, and secretion. Each additional 100 mg of magnesium consumed is linked to a 49% reduction in the likelihood of death caused by any liver condition [9].

The precise understanding of the function of trace elements, such as magnesium, in the development of liver cirrhosis and its associated consequences is currently lacking [10]. This study aimed to analyze the correlation between magnesium levels and the degree of liver cirrhosis in individuals.

Materials and Methods

This study was a hospital-based case-control observational study. The study was carried out in the Central Lab, Department of Biochemistry, SMS Medical College & associated Hospitals in Jaipur. This study included a total of 92 patients diagnosed with liver cirrhosis, as well as 92 healthy individuals who served as controls. The serum levels of magnesium were evaluated in both the patients and controls groups. The venous blood sample will be taken using aseptic techniques after a fasting period of 12 to 14 hours and stored in simple vials. A simple vial kept undisturbed for a duration of 20 to 30 minutes. Next, the samples were subjected to centrifugation at a speed of 3000 revolutions per minute for a duration of 10 minutes in order to separate the serum. The Serum Magnesium levels were determined using the Calmagite – EGTA Colorimetric technique.

Result

Table 1: Comparison of mean s. magnesium levels between liver cirrhosis patients and controls.

Test/ Parameters	Controls (n=92)	Cases (n=92)	P-value
Serum Magnesium (mg/dl)	2.07 ± 0.27	1.13 ± 0.21	< 0.01 (S)

In the above table, it is shown that the mean serum magnesium levels of cases (1.13 ± 0.21) are lower as compared to controls (2.07 ± 0.27). However, P-value is significant (<0.01).

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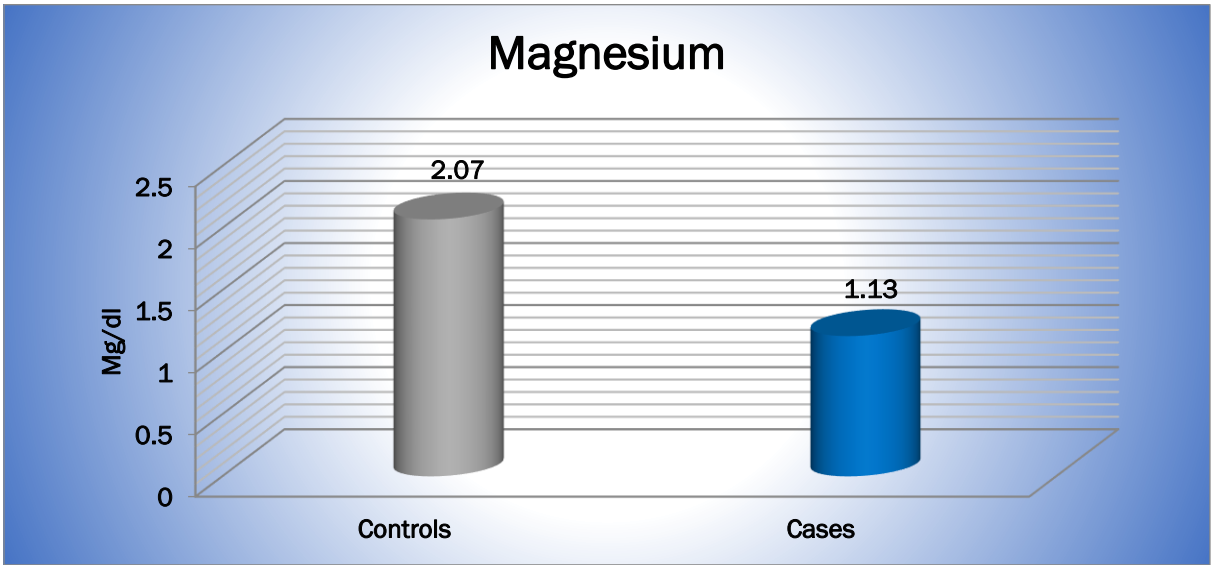

Figure 1: Comparison of mean s. magnesium levels between liver cirrhosis patients and controls.

Discussion

Magnesium is essential in maintaining insulin action, insulin-mediated glucose absorption, and vascular tone. Reduced levels of magnesium are linked to reduced ability to process glucose and a higher likelihood of developing type Π diabetes mellitus. The existing knowledge on the presence of serum magnesium deficit in women with PCOS and its possible correlation with hyperglycemia levels is still uncertain.

The average blood magnesium levels in individuals with PCOS (1.88 ± 0.21 mg/dl) are lower than those in the control group (2.09 ± 0.27 mg/dl), and this difference is statistically significant ($p<0.001$). Additionally, our investigation revealed a noteworthy inverse relationship between fasting blood glucose levels and serum magnesium levels.

The study conducted by Kauffman RP et al. found no correlation between magnesium levels and age, BMI, waist circumference, glycemic levels, blood pressure, or lipid levels in reproductive-age women with PCOS [11]. Shariffi et al. conducted cross-sectional research including 103 patients with polycystic ovary syndrome (PCOS). The study found that individuals with magnesium (Mg) deficiency had a 19-fold increased chance of developing PCOS compared to those with normal levels of Mg in their blood ($P \leq 0.0001$) [12]. This study demonstrates a recognized connection between low levels of ionized magnesium ($Mg2+$) in the blood and a high ratio of ionized calcium to magnesium. This connection is associated with insulin resistance, cardiovascular issues, diabetes mellitus, and hypertension.

Conclusion

The objective of this study was to investigate the serum magnesium levels in individuals with liver cirrhosis and compare them to a control group, as well as to determine any association between the two. The study demonstrated a statistically significant drop in magnesium levels in individuals with liver cirrhosis compared to the control group. The utilization of these uncomplicated and economical biochemical parameters may serve as biomarkers for the timely identification of liver cirrhosis and aid in the recognition of patients afflicted with this condition.

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Conflict of Interest

None declared.

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