

**“HYPOMAGNESEMIA IN ALCOHOL DEPENDENT POPULATION
FROM THE LOWER SOCIO-ECONOMIC BACKGROUND WHO
WERE CONSUMING ILLICIT LIQUOR AND ATTENDING THE DE-
ADDICTION CENTER”**

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Article Received on
06 April 2015,

Revised on 29 April 2015,
Accepted on 24 May 2015

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ABSTRACT

Background: Magnesium is intimately involved in over 300 enzymatic reactions, particularly in processes involving the formation and utilization of ATP. It is also a known fact that alcoholism is associated with hypomagnesemia. The present study aims to determine the significance of routine serum magnesium determination in alcoholic patients consuming illicit liquor from lower socio-economic background attending deaddiction centre. Patients and Methods: We determined serum magnesium, sodium and potassium concentrations in 200 chronic alcoholic patients consuming illicit liquor from lower socio-economic background admitted to the deaddiction centre, and compared the results to those of 158 healthy nonalcoholic controls. Results: Serum magnesium levels were significantly decreased in

alcoholic patients compared to healthy nonalcoholic controls. There were also increased activities of SGOT, SGPT and gamma-glutamyl transferase in alcoholics. **Conclusions:** The results of our study showed hypomagnesemia in chronic alcoholic subjects. Hypomagnesemia may be due to the increased oxidative stress and might be a risk factor in the progression of fatty liver to steatohepatitis. The results of the present investigation support the practice of routine magnesium administration to chronic alcoholics.

KEYWORDS: Hypomagnesemia, Alcohol, Illicit Liquor.

1. INTRODUCTION

The association of humans with alcohol is from times immemorial. Alcohol permeates, pleases and plagues the world. The social evil, despite its ill effects, has lot of charm and attracts the society. Alcoholism can lead to various medical complications, like perturbed alcohol metabolism, liver cirrhosis and hormonal changes associated with pancreatitis, osteoporosis, immune impairment and impaired fertility.^[1]

Alcohol abuse may result in a wide range of electrolyte and acid-base disorders, including hypophosphatemia, hypomagnesemia, hypocalcemia, hypokalemia, metabolic acidosis, and respiratory alkalosis.^[2] The role of the kidney in the pathogenesis of these disturbances is obscure. Hypomagnesemia is a common entity occurring in up to 12% of hospitalized patients.^[3] The incidence rises to high as 60 to 65% in patients in intensive care settings in which nutrition, diuretics, hypoalbuminemia, and aminoglycosides may play important roles.^[4, 5, 6] Hypomagnesemia is common in alcoholic patients admitted to the hospital; in one study, the prevalence was found to be as high as 30%.^[7]

Excessive urinary excretion of magnesium occurred in 18 of the 38 patients with hypomagnesemia. The defect in urinary excretion appears to reflect alcohol-induced tubular dysfunction that is reversible within 4 weeks of abstinence.^[8]

This effect is modest, and is not alone. Other factors also contribute to hypomagnesemia in these patients, including dietary deficiency, acute pancreatitis, and diarrhea. Therefore, the present study is aimed to investigate the effect of alcohol consumption on serum magnesium levels in alcohol dependent patients.

2. MATERIALS AND METHODS

This study was carried out after getting clearance from Institutional Ethical Review Committee, Grant Medical College & Sir J .J. Groups of Hospitals, Byculla, Mumbai. Patients were selected according to the following flow chart (Figure-1).

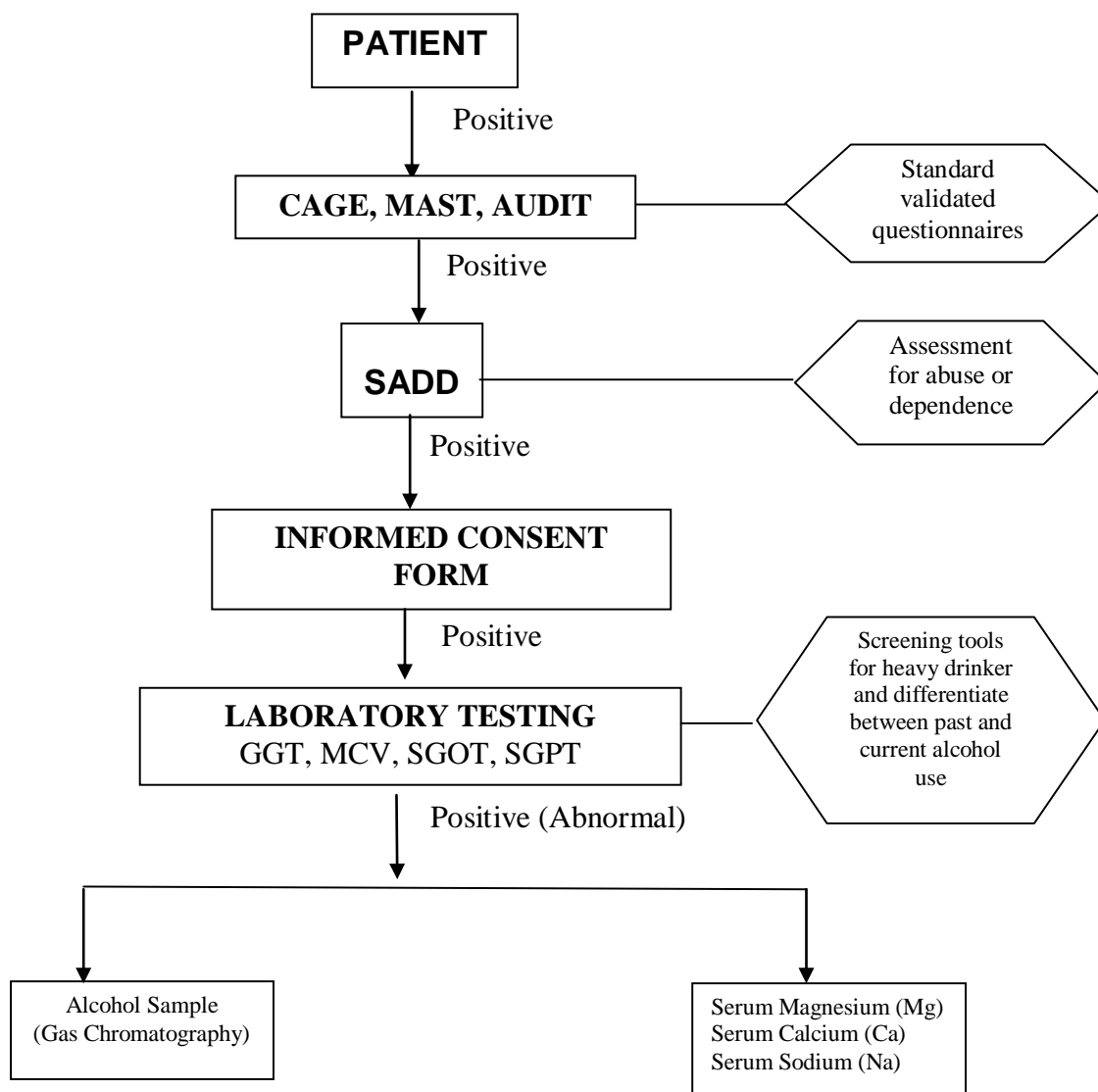


Figure 1: Flow Chart for Screening and Diagnosis of Alcoholism.

In the present study, attempts were made to design a discrimination procedure to separate alcoholics from controls and patients with non-alcoholic hepatic diseases using a combination of the most promising test. The most powerful discrimination model was constructed with the batteries of screening instruments for detecting alcohol problems. We used tests like CAGE [9, 10, 11], Michigan Alcohol Screening Test (MAST)^[12, 13] Alcohol Use Disorder Identification Test (AUDIT)^[14, 15] and Severity of Alcohol Use Disorder Data (SADD).^[16] Patients between 25 and 45 years of age, willing to participate in the study and with no history of undergoing long term medical intervention for various medical conditions like cancer, diabetes, advanced alcoholic liver disease, acute respiratory distress (ARD), chronic renal failure (CRF), cardiovascular disease (CVD) and any other serious medical, surgical, neurological conditions were included in the study. The patients were matched for age, sex and socio economic status with

normal controls (n=158) who were participating in the screening programme. These controls were, to the best of our knowledge healthy and had no reason to consult their local doctors during the preceding 12 months. Further their nutritional anthropometry (age independent anthropometric indices) was evaluated by the Rao's method.^[17]

Excessive smokers evaluated according to Fagerstrom test for nicotine dependence with score more than 15 were excluded.^[18, 19, 20] People with history of substance abuse such as cannabis, nicotine, opium and other psychotropic substances were also not considered. Patients taking vitamins, antioxidants or any other significant supplements, Patients with Immunocompromise and acute infectious state, and Patients with acute psychotic state, were excluded from the study.

A dietary survey of study population was conducted by oral questionnaire method to assess per day consumption of calories, fats and protein. The daily food intake was recorded on a presented proforma and the values were computed from standard chart of "Recommended Dietary Allowances for Indians"^[21, 22] and by estimating dietary antioxidant vitamins in the blood of study population.

Within 24 hours of admission and overnight fasting conditions a total of 10ml of venous blood sample was collected. Serum was separated by centrifuging at 2500 rpm for 7 minutes at room temperature and was used for estimation of Serum γ -Glutamyl Transferase (GGT), Serum glutamic-oxalacetic transaminases (SGOT) and Serum glutamic-pyruvic transaminases (SGPT). Serum magnesium was estimated by kit method manufactured by Bio Assay Systems Quanti ChromTM using the Magnesium Assay Kit (DIMG-250) involving a Quantitative Colorimetric Magnesium Determination at 500 nm. Serum Calcium was estimated by kit method manufactured by Asritha in-vitro diagnostic reagents. The determination of sodium in serum was performed by kit method by Asritha invitro diagnostic reagents.

3. ANALYSIS

All spectrophotometric readings were taken on Shimadzu UV-160A, UV-Visible Recording Spectrophotometer. All the samples were run in duplicate, and were statistically assessed using Student's t-Test^[23] (with the aid of statistical software MINITAB, and ONE-WAY ANOVA). The results obtained were expressed as Mean \pm Standard deviation (SD).

4. RESULTS

GGT, MCV, SGOT and SGPT estimation showed significantly increased values as compared to the control group (Table 1). Serum magnesium, serum calcium (Ca) and serum sodium (Na) values in alcoholic patients consuming illicit liquor was significantly decreased as compared to their healthy controls (Table 1). Further our correlation study (Table- 2) revealed a significant negative correlation between serum GGT levels and serum Mg, serum (Ca) and serum Na concentrations in alcoholic patients.

Table 1: Parametric data of serum magnesium (Mg), serum calcium (Ca) and serum sodium (Na), (Mean \pm SD) of the controls and alcoholic patients attending deaddiction centre from lower socioeconomic backgrounds consuming illicit liquor.

PARAMETERS	GROUPS	RESULTS
Age(years)	Control	38.38 \pm 4.3
	Alcoholic Patients	37.40 \pm 5.6
Alcohol intake (g/day)	Control	NIL
	Alcoholic Patients	110.8 \pm 8.4
Anthropometric Index [@]	Control	0.20 \pm 0.03
	Alcoholic Patients	0.14 \pm 0.011
GGT(11-50 U/I at 37°C for Men)	Control	20.51 \pm 6.7
	Alcoholic Patients	141.21 \pm 5.8*
MCV(82-98 FL)	Control	91.04 \pm 6.4
	Alcoholic Patients	122.3 \pm 4.1*
SGOT(0-40 IU/L)	Control	23.50 \pm 6.5
	Alcoholic Patients	76.80 \pm 2.1*
SGPT(0-40 IU/L)	Control	17.90 \pm 1.8
	Alcoholic Patients	55.09 \pm 2.9*
Serum Magnesium (Mg) (mg/dL)	Control	1.82 \pm 0.19
	Alcoholic Patients	0.44 \pm 0.09 *
Serum Calcium (Ca) (mg/dl)	Control	9.7 \pm 0.6
	Alcoholic Patients	6.6 \pm 1.4*
Serum Sodium (Na) (mmol/L)	Control	143 \pm 9.3
	Alcoholic Patients	128 \pm 8.4*

- All values are expressed as MEAN \pm SD.
- * P<0.001

Table 2: Correlation between biochemical parameters in alcoholic patients (r values)

PARAMETERS MEAN \pm SD	Serum Magnesium	Serum Calcium	Serum Sodium
GGT	-0.76*	- 0.82*	- 0.79*

- * P<0.001

5. DISCUSSION

The aim of our study was to determine the possible pathophysiologic mechanisms of hypomagnesemia in alcoholic patients especially in Indian alcoholic population consuming illicit liquor from lower socio-economic background. From the data obtained in alcoholic patients it is evident that, there is a statistically significant increase in classical biological markers of chronic alcoholism like serum GGT and erythrocyte MCV, and liver function markers such as SGOT and SGPT compared to their non alcoholic healthy controls. Our results also show significant decrease of serum (Mg), serum (Ca) and serum (Na) concentrations in alcoholic subjects consuming illicit liquor from lower socio-economic status.

Our alcohol dependent study population consuming illicit liquor belongs to lower socioeconomic group^[22], and they live in slum or skid road side in metropolitan city like Mumbai. They are averse to hardworking, illiterate and live in poverty; they are careless and ignorant about their health, hygiene and nutrition. Our study population was very fond of liquor, and had penchant for locally made liquor known as "Hath Bhatti". This selected alcoholic population was grossly under-nourished compared to their age, and sex matched non-alcoholic controls. It will be worthwhile to mention that in these poor communities with severe alcohol dependence the inadequate diet is due to financial constraints, as all their earnings are utilized in alcohol intoxication and gambling. All these factors are expected to have multifarious adverse effects on health. The present study evaluates the effect of chronic alcohol intake population belonging to lower socio-economic status on serum (Mg), serum (Ca) and serum (Na) concentrations.

People with alcoholism represent the second largest group of people with hypomagnesemia. This is due in part to the inherent effects of alcohol on magnesium homeostasis and in part to the consequences of the poor diet typical of alcohol abusers. Acutely, alcohol increases urinary magnesium excretion by as much as 260% above baseline values; this occurs within minutes of ingestion or parenteral administration. With chronic alcohol intake, body stores of magnesium become depleted. Reasons include inadequate intake, starvation ketosis, vomiting and diarrhea, and urinary excretion. In advanced alcoholism, however, urinary magnesium excretion may decline in response to reduced intake and depleted stores. Among the effects of chronic alcoholism are a negative magnesium balance, decreased plasma levels of magnesium, decreased magnesium concentration in cerebrospinal fluid and in muscle

biopsies, and the development of a magnesium-responsive hypocalcemia.^[24] Magnesium deficiency has long been recognized in alcoholism^[25]; it can be secondary to low intake, malabsorption, and, if cirrhosis develops, secondary aldosteronism.^[26]

Our results consistently match the findings of Stasyukinene et al (2004) were they have evaluated hypomagnesemia rate in patients with chronic alcoholism with alcohol withdrawal syndrome. They found that hypomagnesemia occurred significantly more frequently in patients with severe alcohol withdrawal syndrome. A case study of alcoholic dementia by Motohiro Tsuji et al (2008) revealed hypomagnesemia, hypocalcemia and a low level of serum parathyroid hormone in the biochemical examination of blood sample of patient with chronic alcohol intake. Findings of Elisaf M et al (1995) states that hypomagnesemia is the most common electrolyte abnormality observed in alcoholic patients, as a result of various pathophysiologic mechanisms. Sergio DeMarchi et al (1993) found that transient defects in renal tubular function are common in patients with chronic alcoholism and may contribute to their abnormalities of serum electrolyte especially hypomagnesemia. Pintar et al (1965) suggested that the vessel wall edema of alcoholic cardiomyopathic patients might have resulted from hypomagnesemia. Magnesium deficiency is thought to be contributory to alcoholic cardiomyopathy according to a study of the cardiac lesions by Heggtveit HA (1962), who observed that the coronary arterioles of magnesium-deficient rats were edematous. Intravenous infusion of 20% ethanol into rats also caused significant swelling of the capillary endothelial cells.^[33]

In conclusion, hypomagnesemia is the most common electrolyte abnormality observed in our study population. This can be due to various pathophysiologic mechanisms and further reflects poor nutritional status which indicates that, although not essential, malnutrition along with severe alcohol intoxication appears to precede the development of hypomagnesemia. Further trials of magnesium supplementation need to be investigated in alcoholic patients suffering from hypomagnesemia to analyze whether magnesium supplementation could restore the magnesium deficiency in these patients.

Accompanying Sheet

What is already known about this topic?

Extensive research has been carried out in past on Hypomagnesemia and alcoholism especially outside India both human and animals. However scant attention is given to Indian alcoholic population especially the alcohol dependent population consuming illicit liquor

belonging to lower socioeconomic group who live in slum or skid road side in metropolitan city like Mumbai. They are averse to hardworking, illiterate and live in poverty; they are careless and ignorant about their health, hygiene and nutrition. This population, which resides in slum areas for example dharavi in our study population are very fond of liquor, they have penchant for locally made liquor known as “Hath Bhatti”. This selected alcoholic population is grossly under-nourished compared with their age, sex matched non-alcoholic control. It will be worthwhile to mention that in these poor communities with severe alcohol dependence the inadequate diet is due to financial constraints, as all their earnings are utilized in alcohol intoxication and gambling, all these factors should have multifarious adverse effects on health including electrolyte balance. This is presently recognized as one of the important determinants of ageing process and numerous diseases.

What this study adds?

To the best of our knowledge the present study is a maiden effort to evaluate the effects of chronic alcohol intake especially illicit liquor on the electrolyte status like Magnesium, Calcium and Sodium of alcoholics consuming illicit liquor and who are not aware of the importance of balance diet, nutritional values and its requirement in daily life, due to illiteracy, influence of alcohol and financial constraints.

Suggestions for further development

In future, we intend to perform a trial, to better understand the effects of supplementation of these trace elements in alcohol dependent patients attending deaddiction centre from lower socioeconomic status consuming illicit liquor. Whether it can further restore the blood electrolyte imbalance caused due to alcohol intoxication is to be seen. Here follow the titles of the figure and table attached.

CONFLICT OF INTEREST: No competing financial interests exist.

ACKNOWLEDGEMENTS: We would like to acknowledge all the member's from our laboratory.

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