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Original Research Article

Estimation of Serum Magnesium in Bronchial Asthma Patients of Tamil Nadu Population

Athira V. J.

Assistant Professor, Department of Biochemistry, Dhanalakshmi Srinivasan Medical College Siruvachur, Perambalur (district), Tamil Nadu-621113

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Corresponding Author: Dr. Athira V. J.
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Abstract:

Background: Magnesium has been shown to relax bronchial smooth muscle, causing bronchodialation for easy respiration. A deficiency or low level of magnesium is observed in bronchial asthma patients.

Method: 100 (one hundred) adult bronchial asthma patients and 100 (one hundred) healthy adult groups were studied and compared. In every patient, 2 ml of venous blood was collected to investigate serum magnesium, CBC, ESR, sputum for AFB, and Gram stain for S. mg. Were measured by the Elisa kit, chest x-rays were taken, and spirometry was measured to analyze PEFR, FEV, and ECG.

Results: The FEV1 in bronchial asthma patients was 44.80 (± 0.38) and 95.40 (± 1.26) in control; the t test was 37.6 and $p<0.001$. Serum magnesium in Bronchial asthma patients had 1.68 (± 0.13) and the control group had 2.25 (± 0.05); the t test was 5.38 and $p<0.41$ (p value was highly significant).

Conclusion: It is concluded that serum magnesium is considerably reduced in bronchial asthma patients. Hence, the administration of magnesium may relieve the bronchoconstriction and reduce the episodes of asthma attacks because the exact pathology of bronchial asthma is yet to be known.

Keywords: serum magnesium, bronchodialation, forced expiratory volume (FEV), Elisa Kit, chest x-ray.

Introduction

Serum Magnesium has been considered an adjunct therapy for severe and life threatening asthma exacerbations [1]. Magnesium induces bronchial smooth muscle relaxation in a dose-dependent manner by inhibiting calcium influx and into cytosol histamine release from most cells [2]. Magnesium is closely involved in numerous important biochemical reactions in the body, particularly those that entail the formation of ATP [3]. As a co-factor in over 30 intracellular enzymic reactions utilizing high-energy phosphate bonds, magnesium has been implicated in smooth muscle contraction. Magnesium has been shown to relax bronchial smooth muscle in vitro and bronchdialate asthmatic airways in vivo. Magnesium deficiency, either absolute or relative, may lead to increased excitability in the in the bronchial smooth muscle with a consequent bronchoconstriction [4]. Hence, an attempt was made to evaluate the relationship between non-specific bronchial reactivity and the level of magnesium, both at an intracellular level and in the serum, in asthmatic patients.

Material and Methods

100 (one hundred) patients regularly visited the biochemistry department of Dhanalakshmi Srinisvsan Medical College Hospital, Siruvaschir, Perambalur (district), Tamil Nadu-621113 were studied.

Inclusive Criteria: The patients were over 18 years old and clinically diagnosed with bronchial asthma, and they gave consent in writing. No asthma attack at least one week before the study was included in the study.

Exclusion Criteria: Patients who are smokers, pregnant, breast-feeding mothers, menopausal or postmenopausal, or have type II DM or bronchopulmonary malignancy. Immune-compromised patients were excluded from the study.

Method:

In the present study, 100 (one hundred) bronchial asthma patients are compared with a 100 (one hundred) (healthy) controlled group. The detailed history of every patient's occupation, duration of asthma, dietary habits, and previous medications were noted. A pulmonary function test was carried out using the spirometry peak expiration flow rate (PEFR), forced expiratory volume (FEV), and FEV/FVC of 25-75% recorded. 2 ml of venous blood was collected from each patient after taking

the necessary median cubital vein aseptic precautions. After collecting the blood sample, it was allowed to clot. After half an hour, the blood was centrifuged to separate the serum from the clot. After centrifugation, the serum was stored at minus 20^{O} C in FPP end or F tubes until analysis was done. Serum magnesium was measured using the spectro-photomeric method; other investigations included chest x-rays, complete blood count (CBC), ESR (erythrocyte sedimentation rate), electrocardiography, and sputum for AFB and Gram stains for each patient.

The duration of the study was from October 2022 to October 2023.

Statistical analysis: The body mass index, spirometric values, and serum magnesium levels were compared in bronchial asthma patients and a controlled group with a t test, and significant results were noted. The statistical analysis was carried out in SPSS software. The ratio of males and females was 2:1.

Observation and Results

Table 1: Comparison of Body Mass Index in the bronchial asthma patients and controlled groups: 25.52 (± 0.48) in the bronchial asthma patient and 26.40 (± 0.60) in the controlled group; t test was 11.4 and p<0.001 (p value is highly significant).

Table 2: Comparison of FEV_1 values in bronchial asthma patients and controlled groups: 44.80 (± 0.38) in bronchial asthma patients and 95.40 (± 1.26) in the controlled group; t test was 37.6 and p<0.001 (p value is highly significant).

Table 3: Comparison of serum magnesium levels in bronchial asthma patients and controlled groups: 1.68 (± 0.13) in bronchial asthma patients and 2.25 (± 0.05) in the controlled group; the t test was 5.38, and the (p value is highly significant (p<0.001).

Table 1: Comparison study of Body Mass Index (BMI) in Bronchial asthma patients and controlled group (Number of Patients: 200)

Parameter	Bronchial Asthma (100)	Controls (100)	t test	p value
BMI	25.52 (± 0.48)	26.40 (± 0.60)	11.4	P<0.001

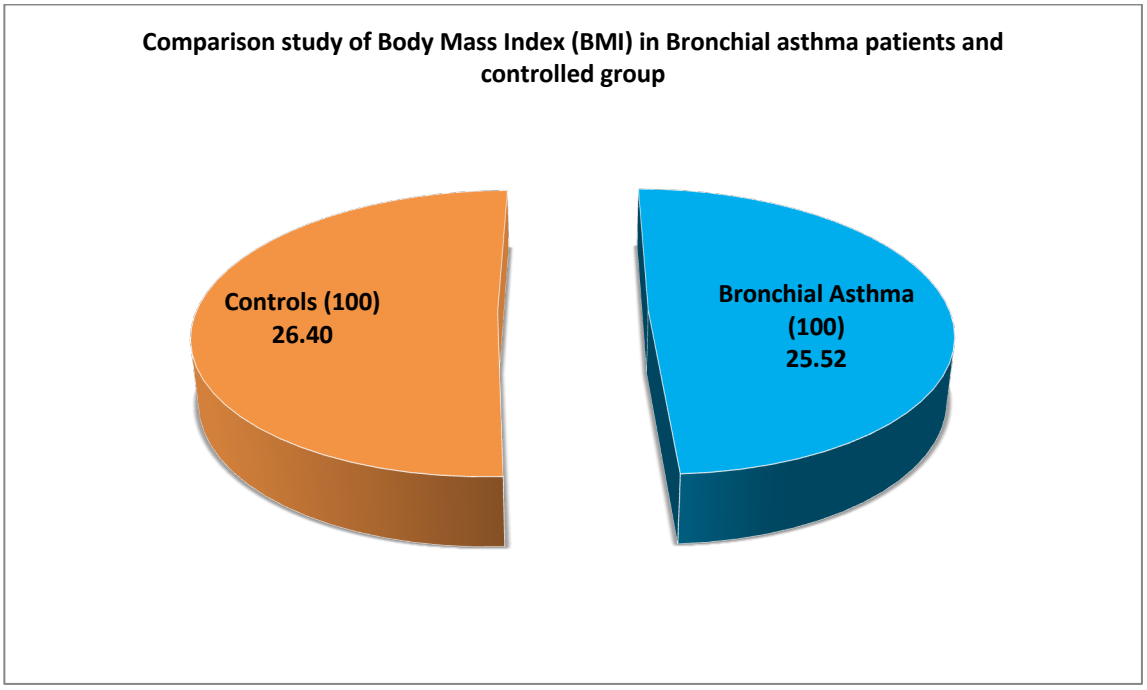

Figure 1: Comparison study of Body Mass Index (BMI) in Bronchial asthma patients and controlled group

Table 2: Comparison of FEV_1 values between Bronchial asthma patients and controlled group (Number of Patients: 200)

Parameter	Bronchial Asthma (100)	Controlled group (100)	t test	p value
FEV1	45.80 (± 0.38)	95.40 (± 1.26)	37.6	P<0.001

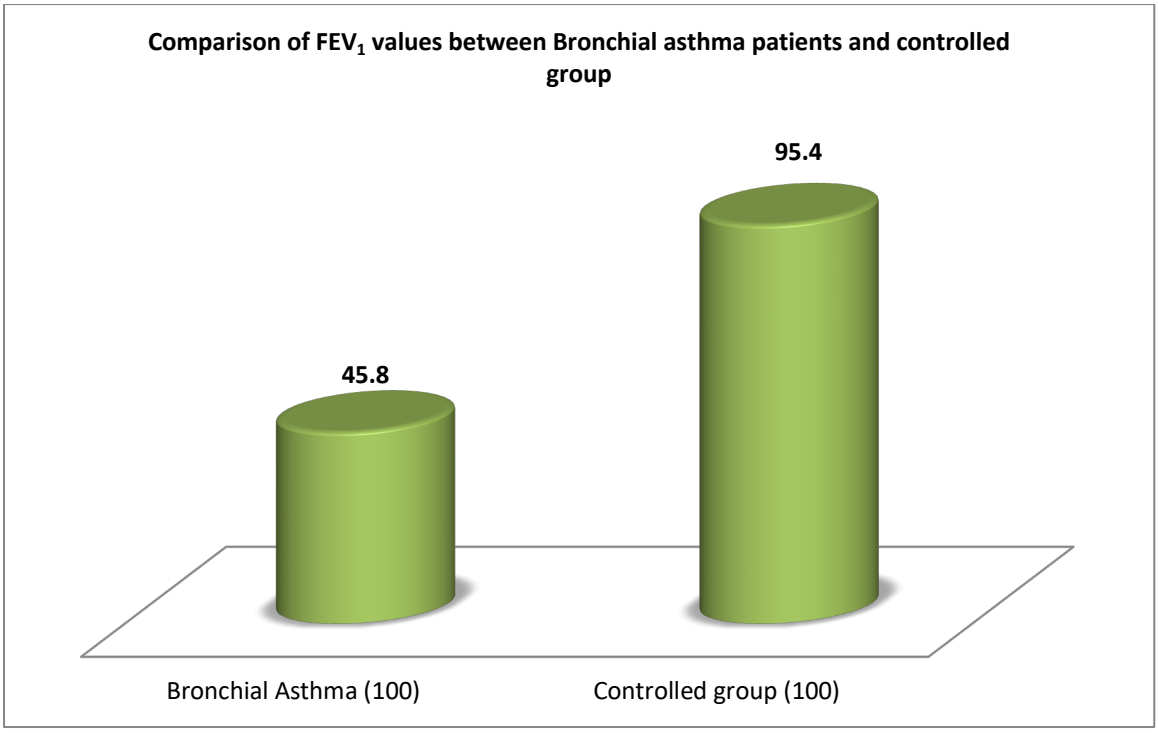

Figure 2: Comparison of FEV_1 values between Bronchial asthma patients and controlled group

Table 3: Comparison of Serum Magnesium values between Bronchial asthma patients and controlled group (Number of Patients: 200)

Particular	Bronchial Asthma (100)	Controlled group (100)	t test	p value
Serum magnum	1.68 (± 0.13)	2.25 (± 0.05)	5.38	P<0.001

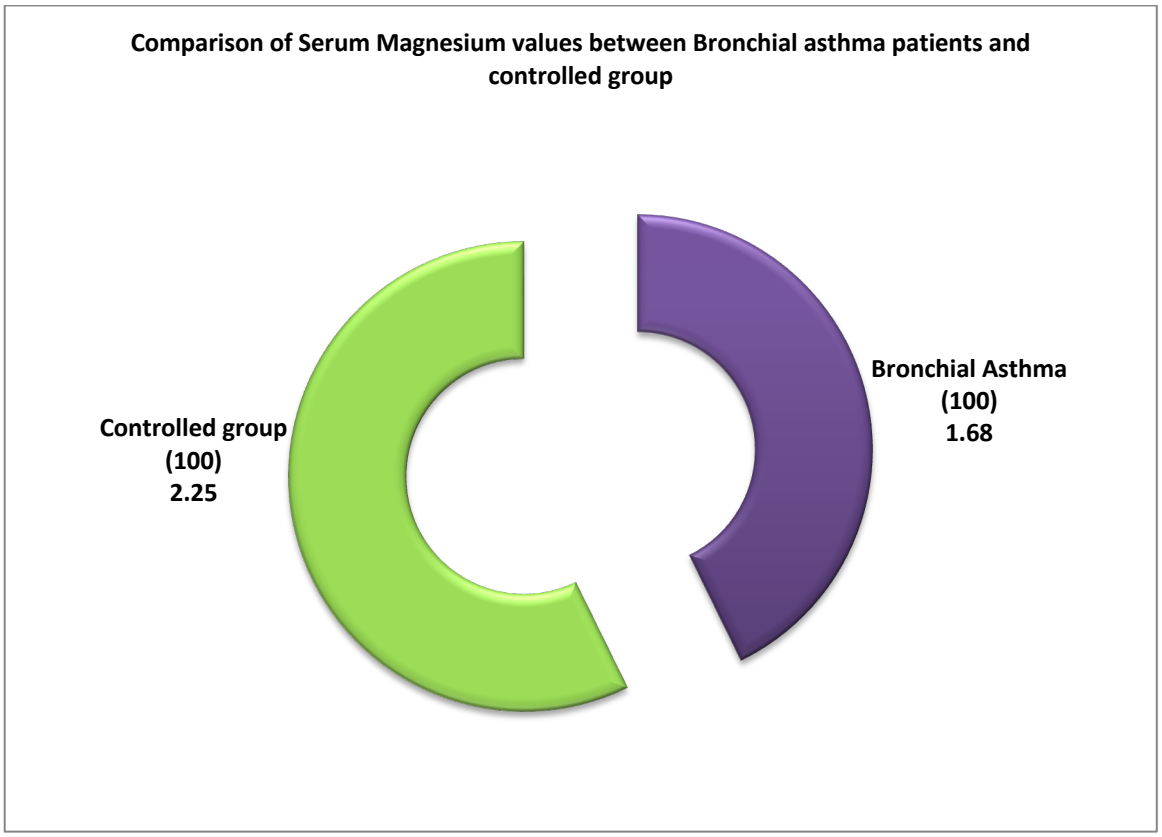

Figure 3: Comparison of Serum Magnesium values between Bronchial asthma patients and controlled group

Discussion

Present study of serum magnesium in bronchial asthma patients in the Tamil Nadu population. Out of two hundred, 100 adult bronchial asthma patients and 100 (healthy) controlled group was compared. The body mass index was 25.52 (± 0.48) in the bronchial asthma patients and 26.40 (± 0.60) in the controlled group; the t test was 11.4 and $p<0.001$ (Table 1). In comparison of FEV1 values in bronchial asthma patients, 45.80 (± 0.38) in asthma patients and 95.40 (± 1.26) in the controlled group, the t test was 37.6 and $p<0.001$ (Table 2). Comparison of serum magnesium values in bronchial asthma patients: 1.68 (± 0.13) and 2.25 (± 0.05) in the controlled group, the t test was 33.5 and $p<0.001$ (Table 3). These obtained values were more or less in agreement with previous studies [5,6].

Serum magnesium plays a vital role in the pathophysiology of allergic reactions, especially in bronchial asthma [7]. Contraction and dilation of myofibrillar proteins in smooth muscles of the bronchi are due to the phosphorylation and dephosphorylation processes, which include the enzymes myosin kinase and myosin phosphate. Myosin kinases are magnesium-dependent, and myosin phosphates are calcium-dependent enzymes. Since magnesium is involved in calcium transport across the cellular membrane, both enzymes are directly or indirectly influenced by magnesium (Serum Mg) level [8]. Hence, serum Mg plays a vital role in the contraction and dilatation of the muscles of the bronchial alveoli. Therefore, a reduction in serum mg level leads to hyperactivity in the bronchial alveoli.

Thus, there will be an aggravation of respiratory movement usually observed in bronchial asthma, and there will also be a reduced FEV1 level (Table 2, 3). It was proven that serum mg level 2 gm is ideal to treat bronchial asthma. Serum mg is also used as a tocolytic agent for preterm labor, given the I.V. route up to 4-6 g/dl, but continuous infusion may cause major toxicity when serum mg is at 9 gm/dl and above, causing loss of reflexes, blurred vision, lethargy muscle weakness, and pulmonary oedema [9]. In the case of hyper-magnesieumia levels, haemodialysis was done to prevent high risks to renal function.

Hence, nebulized Mg has proven more efficient to control or relive episodes of bronchial asthma than an adjacent dosage. Treatment of altered Mg++ status depends on the clinical setting and may include the addition of a potassium/mg++ sparing drug to an existing diuretic regimen.

Serum Mg is a cofactor in over 300 intracellular enzymatic reactions utilizing high-energy phosphate bounds. Magnesium has been implicated in smooth muscle contraction. Apart from relaxing bronchial smooth muscle, it has calcium channel blocking properties, inhibition of cholinergic neuromuscular transmission with decreased sensibility to the depolarizing action of acetylcholine, stabilizing the mast cells and T-lymphocytes [10], stimulation of nitric oxide, and prostacyclin.

Summary and Conclusion

The present study of serum Mg in bronchial asthma patients among the Tamil Nadu population is quite helpful to physicians in treating bronchial asthma with serum Mg as an adjacent dosage for relaxation of hyperactive bronchial alveoli. This study suggests there is a strong relationship between intracellular Mg levels and methacholine bronchial reactivity.

Hence, Mg level alterations may play a role in the pathogenesis of bronchial asthma. But this study demands further pathophysiological, genetic, bimolecular, and nutritional studies to shed more light on this subject because the exact intracellular action of serum magnesium on the smooth musculature of the bronchoalveoli is still unclear.

Limitation of study: Due to the tertiary location of the research center, the small number of patients, and the lack of the latest techniques, we have limited findings and results.

This research work has been approved by the ethical committee of the Dhanalakshmi Srinivasan Medical College hospital Siruvaschir, Perambalur (district), Tamil Nadu-621113

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