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A STUDY OF THE RELATIONSHIP BETWEEN SERUM MAGNESIUM LEVELS AND HEIGHT IN YOUNG PEOPLE OF GROWING AGE

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ABSTRACT

Magnesium (Mg) is an essential mineral involved in many body processes including enzymatic reactions, protein and nucleic acid synthesis, and energy production. Although Mg deficiency can lead to a variety of health problems, it can also affect growth in young people. The aim of this study was to investigate the relationship between serum Mg levels and height in young people aged 12 to 17 years. A total of 177 students from schools in Latakia, Syria, participated in this study. Demographic data, height, parental height, and serum Mg levels were measured. Expected height at age 18 was calculated using a mathematical formula based on the height of the parents. The difference between expected height and actual height at current age was then compared with serum Mg levels. We found that the mean of serum Mg level was 1.77 mg/dl. We also demonstrated a significant correlation between the difference between expected and actual height in young people and serum Mg concentration (Pearson correlation = 0.168*, P = 0.026). Our study reported a significant correlation between serum Mg levels and height in young people. We suggest that regular monitoring of Mg levels may provide valuable insights into potential underlying physiological mechanisms for aging-related issues.

KEYWORDS: Magnesium, growth hormone, insulin-like growth factor, height.

1. INTRODUCTION

Magnesium (Mg) is an essential mineral that plays an important role in various physiological processes in the human body.[1,2] It is involved in more than 300 enzymatic reactions, helping to synthesize proteins, nucleic acids, and energy.[3] Furthermore, Mg plays an important role in muscle and nerve function, blood glucose regulation, and blood pressure control.[3,4]

However, Mg deficiency can lead to muscle cramps, fatigue, and cardiovascular complications.[5] Conversely, proper intake of Mg is associated with many health benefits, including improved bone health, reduced risk of type 2 diabetes, and cognitive function.[5,6]

Previous studies have shown that Mg deficiency causes delayed aging and may affect the secretion of growth hormone (GH) and insulin-like growth factors (IGF-1).[7]

While growth hormone levels are undoubtedly important in the pursuit of growth and development, focusing on them alone can neglect other important health factors.[8] Managing Mg levels provides a comprehensive and useful approach in providing valuable insights into general health conditions, and facilitates the diagnosis of potential early health problems.[9]

Despite the importance of Mg in growth and development, the relationship between serum Mg levels and height in young and older adults remains poorly defined. Therefore, the aim of this study was to investigate the relationship between serum Mg concentration and height in young people.

2. MATERIALS AND METHODS

2.1. Study design and data collection

Our study was conducted at Tishreen Hospital in Syria from 1 January 2022 to 30 December 2023. 177 school students participated from various schools in Latakia, Syria after obtaining their consent and their parent's approval.

Including criteria were: age from 12 to 17 years, healthy, and have no chronic diseases.

Demographic information (age and gender), height, and parent's height were also registered. Moreover, laboratory test included Mg serum concentrations were measured.

In general, children may have unique genetic abilities for growth, so we relied on calculating the differences between expected and actual height rather than actual height which provides an understanding of the growth patterns and more individualized assessment.

For this issue, the expected height of a child at the age of 18 years was calculated according to the mathematical law[10]:

For boys: $\text{Expected height at the age of 18} = \left(\frac{\text{mother's height} + \text{father's height} + 13}{2}\right)$

For girls: $\text{Expected height at the age of 18} = \left(\frac{\text{mother's height} + \text{father's height} - 13}{2}\right)$

Then, we used this value to measure the expected heights at the current age using 'distance' charts[10], and we compared differences between the expected and actual height at the current age with Mg serum concentrations.

This study was approved by the bioethics committee at Tishreen University No. 21 dated 3/8/2021.

2.2. Statistical analysis

Data was analyzed using the Statistical Package for Social Sciences (SPSS) version 26. The correlation was measured using the Pearson correlation coefficient. variables showing P-values <0.05 were considered statistically significant.

3. RESULTS

3.1. Population characteristics

A total of 177 school children were enrolled in our study, of which 39 children (22%) were males and 138 were females (78%) (Figure 1). The mean age of all children was 15.08 years.

The heights ranged from 138 to 190 centimeters (cm), while Mg concentrations ranged from 0.9 to 3 mg/dl, with a mean of 1.77 and a standard deviation of 0.35. Other quantitative variables included in our study are presented in table 1.

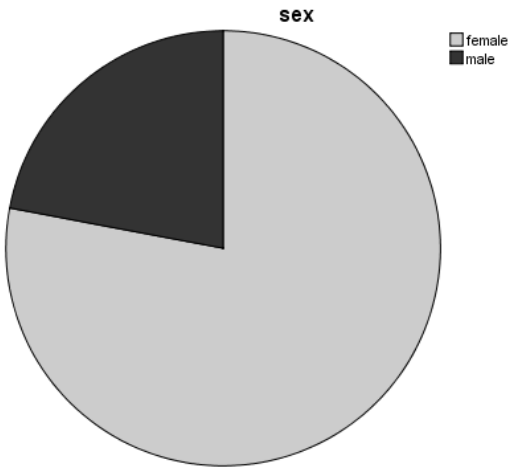

Figure 1: Sex Distribution in The Study Sample.

Table 1: Descriptive statistics of the quantitative variables included in our study.

	Minimum	Maximum	Mean	Std. Deviation
Age (years)	12	17	15.08	0.99
Tall (cm)	138	190	160.58	7.48
Father's tall (cm)	160	200	174.02	6.98
Mother's tall (cm)	145	177	161.92	6.29
Expected tall at 18 (cm)	148	189	164.31	7.53
Current expected tall (cm)	136	186.5	161.41	7.38
Magnesium (mg/dl)	0.9	3	1.77	0.35

The most frequent age among the students was 15 years old (76/177) followed by 16 years old (43/177) as shown in table 2 and figure 2.

Table 2: Age Distribution in The Study Sample.

Age (years)	Frequency	Percent (%)
12	4	2.3
13	1	.6
14	40	22.6
15	76	42.9
16	43	24.3
17	13	7.3

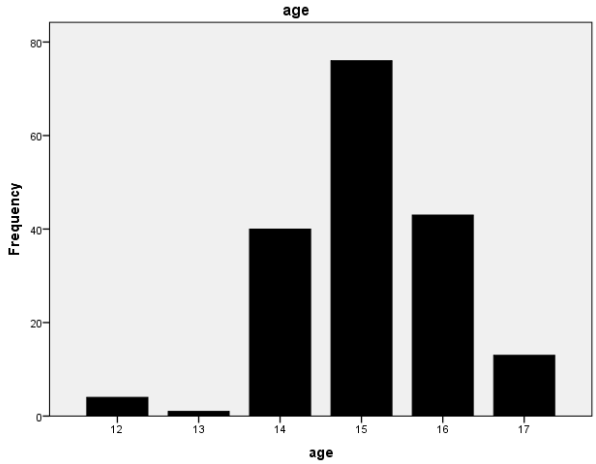

Figure 2: Age Distribution in the Study Sample.

3.2. Correlation between magnesium and height

We investigated the effect of Mg serum levels on the differences between the expected and actual height at the current age.

As shown in table 3 and figure 3, there was a significant correlation between the two variables (Pearson Correlation = .168*, P= .026).

Table 3: Correlation between Mg levels and the differences between the expected and actual height at the current age.

		Difference between actual tall and current expected tall
Mg	Pearson Correlation	.168*
	Sig. (2-tailed)	.026
	N	177

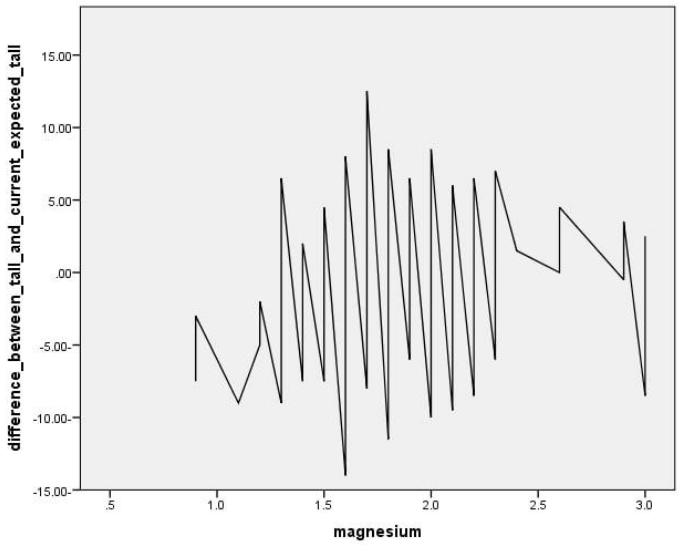

Figure 3: Correlation Between Mg Levels and the Differences Between the Expected and Actual Height at the Current Age.

4. DISCUSSION

In this study, we investigated the relationship between Mg serum levels and height in children. Indeed, monitoring children's height is important for several reasons, including assessing growth and development, identifying potential health issues, and providing guidance on appropriate interventions.[11]

The significant association observed between serum Mg levels and the difference between the expected and actual tall at the current age suggests a potential role for Mg in growth and development in young people. This result is consistent with previous studies that have emphasized the importance of Mg in bone health and growth development, in which it has been linked to its importance in the synthesis of osteoclast proteins and parathyroid hormone regulation.[12,13]

For instance, research was done by J E Sojka *et al*, in which they investigated the association between Mg intake and bone mineral density in adults and children, they found that taking Mg affects bone turnover and mineral density.[14]

Another study was done by Dørup I *et al*[15], has shown that Mg plays a role in controlling IGF-1 levels, which is essential for growth and development.[16,17]

It's worth mentioning that IGF-1 is a key mediator of GH maturation and is primarily synthesized in the liver in response to GH stimulation.[18] Mg plays an important role in the activation of enzymes involved in IGF-1 synthesis and bioavailability.[18] As a result, Mg deficiency can therefore lead to decreased levels of IGF-1, which is critical for normal growth and development.

Moreover, Mg is involved in various cellular signaling pathways that regulate GH secretion and IGF-1 action.[19] We hypothesize that low Mg levels may disrupt these pathways, leading to impaired GH secretion and decreased sensitivity to IGF-1.

Mg is also involved in energy production and metabolism, which is essential for young people's growth and development.[20] Furthermore, Low Mg can increase oxidative stress and inflammation, which can further impair GH secretion and reduce IGF-1 bioavailability.[21]

All these reasons mentioned above could explain our findings. However, understanding the relationship between Mg levels and abnormal growth may have important implications for clinical practice. Monitoring Mg levels in young people with aging issues may provide valuable insights into potential underlying physiological mechanisms and inform targeted interventions so the way.

Our study has several strengths. Firstly, monitoring Mg levels is a relatively simple and cost-effective procedure compared to measuring growth hormone levels, often requiring complicated and expensive diagnostic tests.[22] This provides young people with an accessible and useful alternative to routine health screening.

Secondly, early detection of Mg deficiency through routine monitoring allows for timely interventions, such as dietary changes or supplements, that can aid growth and development. This early intervention approach can prevent potential aging-related complications and improve long-term health outcomes.

Given the potential confounding factors and the need for further detailed studies to understand causality, it is important to interpret these findings carefully. Future research should focus on the specific pathways of Mg influence growth and development by elucidating.

5. CONCLUSION

In this study, we propose the importance of Mg in young people's growth. We found that there was a significant correlation between Mg serum levels and the differences between the expected and actual height at the current age. We also suggest that adequate levels of Mg are essential for optimal growth and development, especially in young people.

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