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Assessment of Serum Magnesium and sex-based differences in magnesium homeostasis's as the health and Quality of Life at among age groups Libyan population in Misurata, Libya 2025

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ABSTRACT: Context and Goal: Magnesium is vital for maintaining according to the WHO's "intrinsic capacity". Its levels are positively correlated with the assessment of personal health and quality of life, where the people with average and above-average supply of magnesium become clear have healthy better, compared to people with below-average magnesium status. So, the higher the magnesium levels, the better the quality of life and the health status, in conversely status. This study was aimed to assessment serum magnesium levels, and analyze sex-based differences in magnesium homeostasis, to assess the effectiveness of magnesium (Mg) and its correlation with quality of life. Material and methods': Cross-sectional study was conducted simultaneously in Qasr Ahmed Hospital - Misurata, the samples were collected from the adult Libyan population residing in Misurata city of Libya. to conduct the test, 617 A total of 617 individuals, comprised of 218 (35.33%) males and 399 (64.67%) females. Were 18 years of age or older, also the participants of young adult group, 14>17 years old (adolescents). Findings: The results manifest of (31.12 %) were marked Hypomagnesaemia level compared to (68.88 %) were have normal magnesium level. A comparison of the number of females with hypomagnesaemia was of (76.04 %) than (23.96 %) at males. Obvious increase rates of hypomagnesaemia at females with 14.06% in a range of (18-24) old, comparative in males by 5.21% in the same range of age. Also, an increase in magnesium deficiency rates with age at females, where the percentage reached 13.54% in age range > 65 old. Whereas, the prevalence deficiency levels of hypomagnesaemia of remaining constant between most age groups among males (25-34), (55-64) and (> 65 old) with 3.65 %. In conclusion: Recognizing sex-specific differences in magnesium metabolism is crucial for personalized nutrition and medical care because hormonal variations, life stages, and physiological differences between sexes lead to unique magnesium needs and impacts on health. Which emphasizes the importance of integrating biological gender in dietary recommendations.

Keywords: Serum Mg homeostasis; Essential electrolytes ; Quality of life; Hypomagnesaemia (HME); Gender differences magnesium.

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الملخص: هدفت هذه الدراسة إلى تقييم مستويات المغنيسيوم في مصل الدم وتحليل الفروق بين الجنسين في توازن المغنيسيوم وعلاقته بجودة الحياة، ظراً لأهمية المغنيسيوم في الحفاظ على "القدرة الجوهرية" للصحة وفقًا لتعريف منظمة الصحة العالمية، حيث ترتبط مستوياته ارتباطًا إيجابيًا بتعزيز الصحة العامة وجودة الحياة. أُجريت الدراسة المقطعية في مستشفى قصر أحمد بمدينة مصراتة – ليبيا، واشتملت على 617 مشاركًا من البالغين واليافعين، منهم 218 ذكورًا و399 إناثًا. أظهرت النتائج أن 31.12% من المشاركين يعانون من نقص المغنيسيوم، وكانت النسبة أعلى بشكل واضح بين الإناث 76.04%) مقارنة بالذكور (23.96%)، كما تبيّن وجود ارتفاع ملحوظ في معدلات النقص لدى الإناث في الفئات العمرية المبكرة والمتقدمة مقارنة الذكور الذين أظهرت معدلات نقص مستقرة نسبيًا عبر الفئات العمرية. تشير هذه النتائج إلى أهمية مراعاة الفروق البيولوجية بين الجنسين في تقييم لاحتياجات الغذائية ووضع استراتيجيات الرعاية الصحية، حيث تؤثر الاختلافات الهرمونية والفسيولوجية في ديناميكية المغنيسيوم وتوازن الجسم.

INTRODUCTION

Magnesium (Mg) has been recognized as essential electrolyte, ranks as the fourth most abundant cation in the human body, involved in ~80% of known metabolic functions. It is plays a crucial role in enzymatic activity, and significantly influences impacting cellular activity [1]. (Mg) is a cofactor for more than 300 enzyme systems, that regulate diverse biochemical reactions in the body, that very required for energy production, oxidative phosphorylation, glycolysis, and blood glucose control, blood pressure regulation [2]. It is plays a role in the active transport of calcium and potassium ions across cell membranes, a process that is important to nerve impulse conduction, muscular excitability, and normal heart rhythm [3]. Also, it serves as a more long-term regulatory element, and has a slight affects over the plasma (4). As well as, contributes to protein synthesis and the structural development of bone and is required for the synthesis of DNA, RNA [2]. Typical serum magnesium concentrations range from 1.46 to 2.68 mg/dL [3]. Hypomagnesemia is an electrolyte imbalance resulting from a serum magnesium concentration below 1.46 mg/dL in the bloodstream. Nonetheless, this condition usually shows no symptoms until the serum magnesium level falls below 1.2 mg/dL (0.5 mmol/L 1 [5]. Based on an epidemiological approach suggested an optimal hypomagnesemia cut-off value of < 0.85 mmol/L[6]. As magnesium directly affects various other electrolytes, including sodium, calcium, and potassium. So that, low magnesium levels may was secondary cause to renal and gastrointestinal casualties [3] .

Hypomagnesemia (HME) is defined as lower serum Mg levels but its reference values can vary greatly across different countries [6]. It is deem common in all hospitalized patients, has been associated especially in critically ill patients with coexisting electrolyte abnormalities [7,1]. Where found 60% of people do not meet the recommended daily intake (320 mg/day for women; 420 mg/day for men), in spite of importance of Mg for human health and quality life [6]. Hypomagnesemia related to cardiovascular complications, metabolic disturbances, neuromuscular dysfunctions, and increased morbidity [1]. Where leads to the activation of inflammation and increased concentrations of specific inflammatory markers, like C-reactive protein and tumor necrosis factor-α [8]. Further man, may cause severe and potentially fatal complications if not timely diagnosed and properly treated. So that, it associate with increased mortality [7].

Hypomagnesaemia can be caused by a number of diseases, including chronic illness, alcohol use disorder, gastrointestinal loss, renal loss [9,10]. The inadequate dietary intake or gastrointestinal absorption, loss through the gastrointestinal or renal system, most of the common causes of Mg deficiency, as pregnancy cases, where there is an increased requirement for Mg [11,6]. Mild tremors and widespread weakness are important indicators of hypomagnesemia, resulted by heart ischemia [8,9]. There are particulare Mg functions in women's health are well famous, like premenstrual syndrome, osteoporosis, cancer and menopause [12,6]. So, Mg deficiency is more frequent in women than men [12].

The likelihood of hypomagnesemia varies based on several factors across different healthcare environments. The prevalence reported in the general population ranges from 2.5% to 15%. In hospitalized individuals, it varies from 12% to 20%.[13,14]. The rate is even greater in critically ill patients, with an estimated 65% in a study.[14]. Management of patients with hypomagnesemia depends on kidney function status, symptom severity, and hemodynamic stability. In an acute hospital context, if a patient is hemodynamically unstable, 1 to 2 g of magnesium sulfate may be administered within approximately 15 minutes. As for symptomatic, severe hypomagnesemia in a stable individual, 1 to 2 grams of magnesium sulfate may be administered over a period of 1 hour[16]. The non-urgent replenishment of magnesium sulfate in an adult patient typically involves administering 4 to 8 g gradually over a period of 12 to 24 hours. In pediatric patients, the dosage is 25 to 50 mg/kg (not exceeding 2 g) [17].

Materials and Methods

Study design and population: This cross-sectional study is designed to assess deficiencies in serum magnesium levels in the period from March to June 2025. The samples were collected from the adult population residing in Misurata city of Libya. Participants were recruited from local community center (Qasr Ahmed Hospital). Inclusion criteria mandated that adults participants be 18 years of age or older and adolescents of 14 > 17 years old. **Data and samples collection:** The study was ethically cleared and approved by the ethics committee of the local community centers. In addition, Participants demographic data, such as age and gender, were documented at the time of specimen collection from each one. A total of 617 individuals, comprised of 218 (35.33%) males and 399 (64.67%) females. Approximately 2 mL of venous blood samples drawn by trained personnel under aseptic conditions after a fasting period. The blood was then centrifuged to separate the serum for analysis using a photometric technique on a Mindray BS-240 Pro chemistry analyzer. **Statistical Analysis:** The SPSS (version 26) computer analytic tool was used to analyze the data gathered in this study. The averages and standard deviations of serum magnesium percent levels were collected for the test groups.

Results

Assessment of prevalence rate of Hypomagnesaemia in study population:

A total of 617 samples underwent to magnesium blood test, to produce the results for this study as demonstrated in table (1), comprised of and 218 (35.33%) males and 399 (64.67%) females. The study sample was characterized by a significant gender imbalance. A substantially proportion of the volunteers were female compared to males. This disparity is a key factor to consider when interpreting the study's findings. Results clarify of 192 (31.12 %) were marked Hypomagnesaemia level compared to 425 (68.88 %) were have normal magnesium level. A comparison of the number of males and females with hypomagnesaemia, were 46 (23.96 %) man 146 (76.04 %) females. In contrast, Of 425 normally magnesium level, there were 172 (40.47 %) male and 253 (59.53 %) females.

Table (1): Prevalence rate of hypomagnesaemia level in study population of Misurata\ Libya

Magnesium Blood Test	Gender		Total
	Male	Females	
Hypomagnesaemia Level	46 (21.10 %)	146 (36.59 %)	192 (31.12 %)
Normal Magnesium Level	172 (78.90 %)	253 (63.41 %)	425 (68.88 %)
Total	218 (35.33 %)	399 (64.67%)	617 (100%)

Table (2) illustrated analyzing the age distribution, the highest number of participants in both groups fell within the 25 to 34-year age range, then 18 to 24-year, constituting 17.99% and 16.05 respectively in study population. Conversely, the age group of 14 to 17 years (Adolescents) had the lowest representation of both genders in study group by 8.90%. The finding, display the ages of the hypomagnesaemia cases, which is the main goal of the current study; the majority of them by 19.27% were in a range of (18-24) old, then (Ages> 65) old with (17.19 %). In contrast the age 45-54 years old exhibited the lowest markedly of hypomagnesaemia rate with 11.46 %, then the adolescents of age groups (14-17) old with 11.98 % at both gender.

Table. 2 : Assessment of Hypomagnesaemia among the age groups on study population

Age groups		Gender		Total	(%)
		M	F		
Age14 > 17years old (Adolescents)	Normal Magnesium Level	14	18	32	7.53 %
	Hypomagnesaemia Level	6 (3.13%)	17 (8.85%)	23	11.98 %
	Total	20	35	55	8.91 %
Age18-24years old	Normal Magnesium Level	26	36	62	14.59 %
	Hypomagnesaemia Level	10 (5.21%)	27 (14.06%)	37	19.27 %
	Total	36	63	99	16.05 %
Age25-34years old	Normal Magnesium Level	30	51	81	19.06 %
	Hypomagnesaemia Level	7 (3.65%)	21 (10.94%)	28	14.58 %
	Total	37	72	109	17.67 %

Age35-44years old		Normal Magnesium Level	18	37	55	12.94 %
		Hypomagnesaemia Level	4 (2.08%)	20 (10.42%)	24	12.50 %
	Total		22	57	79	12.80 %
Age45-54years old		Normal Magnesium Level	29	43	72	16.94 %
		Hypomagnesaemia Level	5 (2.60%)	17 (8.85%)	22	11.46 %
	Total		34	60	94	15.24 %
Age55-64years old		Normal Magnesium Level	33	35	68	16.00 %
		Hypomagnesaemia Level	7 (3.65%)	18 (9.38%)	25	13.02 %
	Total		40	53	93	15.07 %
Age> 65years old		Normal Magnesium Level	22	33	55	12.94 %
		Hypomagnesaemia Level	7 (3.65%)	26 (13.54%)	33	17.19 %
	Total		29	59	88	14.26 %

The results outlined in (Fig.1), offers the comparison of age groups of males and females with hypomagnesaemia. From of 192 cases obvious the incidences high for females with 14.06% in a range of (18-24) old, comparative in males by 5.21% in the same range of age. While the lowest of hypomagnesaemia rate, exhibited with 8.85 % at females in a range of (14-17) and (45-54) old, comparative at males by 2.08% a range of (35-44) old. As well as, notice an increase in magnesium deficiency rates with age, that evident in women, where the percentage reached 13.54% in age range > 65 old. Whereas, the prevalence deficiency levels of hypomagnesaemia of remaining constant between most age groups among males (25-34), (55-64) and (> 65 old) with 3.65 %.

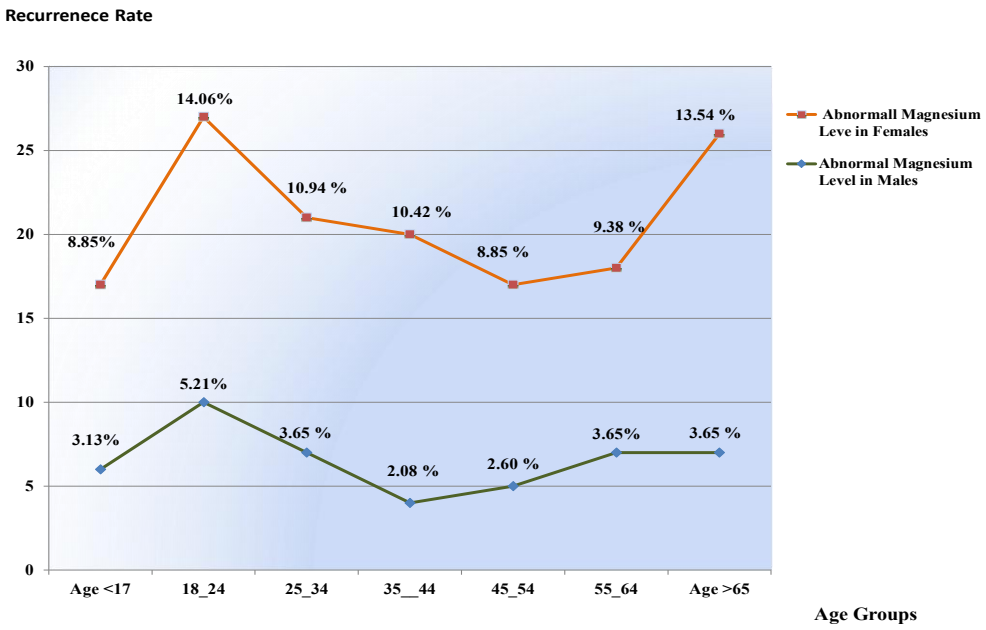

Figure 1 :The average age of Participants (males and females) of incidence with hpomagnesaemia.

DISCUSSION

Recently, in modern societies the health effects associated with magnesium deficiency have become apparent, non adequate of magnesium intake is common significantly, with average consumption often falling below the recommended level for whether among adolescents and adults [18]. Magnesium deficiency is markedly more frequently in women than in men [19]. This discrepancy may be partly regarded to estrogen's job in enhancing tissue magnesium utilization, resulting to hormonal fluctuations in women may influence and regulate magnesium homeostasis [20]. While subclinical magnesium deficiency is generally less common in men than in women, many men have inadequate magnesium, particularly older individuals and those with high physical activity levels as their increased activity levels can lead to higher magnesium demands [21]. Also, the consequences of Mg deficiency in aging individuals can be significant. Low Mg levels have been linked to a variety of age-related health issues, as insufficient dietary intake, poor absorption, increased loss through urine, osteoporosis, and muscle weakness, where the aging often brings about a total body Mg deficit [22].

The current investigation in tab.(1), looked distribution prevalence of hypomagnesaemia across different gender. There is 192 (31.12 %) have Hypomagnesaemia Level in population study. Of them 46 (23.96 %) man and 146 (76.04 %) females. Of the total the study population, was female have a higher prevalence rate of (HME) was by (36.59%) compared to males at (21,10%). A comparison of the number of males and females with hypomagnesaemia, this significantly agree with studies [18, 19 & 20], which concluded to overall, the females more likely with (HME), this is because magnesium plays a vital role in maintaining hormonal equilibrium and modulating inflammatory responses throughout the menstrual cycle. As well as, an increasing body of evidence suggests that magnesium deficiency significantly contributes to various physiological conditions across a woman's lifespan, posing substantial risks to health and overall quality of life [23].

As indicated in tab.(2) and (Fig.1) in this study; illustrated analyzing the age distribution, with comparison of age groups of males and females with hypomagnesaemia, the finding showed highest frequency of age groups with the hypomagnesaemia cases by (19.27%) in a range of (18-24) years old, where was percentage of (14.06%) in female contrast (5.21%) at male. Then (age> 65) old with (17.19 %). It agrees with what was published in a previous etude [24], that referred to the prevalence of subclinical magnesium deficiency ranges from 2.5% to 15% among generally healthy women and reaches approximately 20% in young women aged 18 to 22 years. Recent studies show magnesium plays a crucial role in the menstrual cycle and overall female health, where in the follicular phase, it helps regulate estrogen-driven inflammatory pathways, whereas contributes to muscle relaxation and electrolyte balance at the luteal phase, which can alleviate PMS symptoms like cramps and bloating. Magnesium also supports glucose homeostasis and neurotransmitter function, which is linked to mood stability [25].

Female's energy and nutritional requirements undergo significant changes throughout different life stages, driven by substantial hormonal fluctuations from puberty to reproductive age, through the

climacteric period, and into post menopause [26]. As female to approameach per menopause, the result this study showed hypomagnesaemia level (13.54%) in female, whereas (3.65%) at male, this agreement with [21], that referred the subclinical magnesium deficiency is generally less common in men than in women. Whereas, the prevalence deficiency levels of hypomagnesaemia of remaining constant between most age groups among males (25-34), (55-64) and (> 65 old) with 3.65 %.

Conclusion

Female's magnesium status is influenced by hormonal fluctuations, hormonal shifts in women, particularly estrogen, can alter magnesium absorption and utilization, making their status sensitive to life stages like puberty, pregnancy, and menopause. For men, lifestyle factors such as age and physical activity level play a larger role. Tailoring dietary guidelines and therapeutic strategies based on these sex-specific metabolic differences can significantly improve health outcomes and help manage chronic conditions like osteoporosis, cardiovascular disease, and metabolic disorders. Subclinical magnesium deficiency increases the risk of numerous types of cardiovascular disease, costs the healthcare costs and public health crisis.

Recommendation

- Important to account for individual characteristics such as age, gender, and lifestyle, to put approach aligns with gender-based nutrition. So, the one-size-fits-all strategy may not be sufficient to optimize magnesium intake.
- Emerging evidence suggests that magnesium Recommended needs may be higher in specific populations, recording to physiological states such as pregnancy, lactation, physical activity, age groups and aging.
- Recommended magnesium dietary for male allowance (RDA), is higher for them than for women. Due to differences in absorption, retention, and metabolic demands.

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