



Article

Investigation of Essential Mineral Element Levels in Pregnant Women Residing in Rural Regions of Southern Uzbekistan

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Abstract: This study investigated the magnesium and iron content in the daily diets of pregnant women aged 21–34 years living in the Qashqadaryo region, as well as the concentrations of these minerals in their blood. According to the obtained results, the dietary magnesium intake of the participants was close to the recommended level in the first trimester (95.1%), while in the second and third trimesters it exceeded the recommended level by an average of 45.9–59.1%. In contrast, iron intake during the first to third trimesters averaged 52.8–80.04% of the recommended level. The serum magnesium concentration decreased compared to the normal reference range (0.75–1.25 mmol/L), showing an average reduction of 22.8% in the first trimester, 20.8% in the second trimester, and 14.4% in the third trimester. In contrast, blood iron levels differed: they were within the normal range in the first trimester (107.3%) but were reduced in the second and third trimesters by an average of 32.4% and 36.5%, respectively.

Keywords: Diet, Magnesium, Iron, Trimester, Blood Serum

1. Introduction

Proper nutrition for pregnant women involves not only adequate amounts of proteins, fats, and carbohydrates, along with vitamins, but also essential minerals. These minerals are crucial and irreplaceable components of a balanced diet. Consuming either too little or too much of these minerals in daily meals can negatively affect the health of both the mother and the developing fetus [1]. Consequently, the significance of minerals in the diets of pregnant women, as well as their biological roles in vital maternal and fetal processes, has recently become a topic of active research [2].

It should also be noted that many studies in this field have been carried out to explore methods for preventing or treating specific health conditions. For instance, iodine was studied in the mid-19th century due to its association with goiter, while iron and copper were examined because of their connection to anemia [3].

Minerals are integral components of the cell protoplasm and help maintain the osmotic pressure necessary for vital physiological processes. Additionally, they serve as structural elements for bones and teeth. The presence or deficiency of cations and anions in food also determines its alkalinity or acidity. The acid-base properties of foods are considered one of the key indicators of a healthy diet [4]. Therefore, an insufficient or excessive intake of minerals can disrupt chemical reactions that normally proceed with the participation of enzymes or hormones. Such disturbances may impair normal physiological processes and contribute to the development of various diseases [5].

Citation: Boymuratovna B. G. and Rakhmatillayevna R. D. Investigation Of Essential Mineral Element Levels In Pregnant Women Residing In Rural Regions Of Southern Uzbekistan. Central Asian Journal of Medical and Natural Science 2026, 7(2), 168-171.

Received: 12th Jan 2025
Revised: 28th Jan 2025
Accepted: 10th Feb 2026
Published: 23rd Feb 2026



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2. Materials and Methods

The study was conducted on 24 pregnant women aged 21–34 years residing in the Koson district of the Qashqadaryo region. Their dietary habits were assessed using a traditional questionnaire-based survey. The concentrations of the studied minerals (magnesium and iron) in the blood were determined using enzyme-linked immunosorbent assay (ELISA) [6]. All measurements were carried out with a modern biochemical analyzer, the MINDRAY BA-88A (WH-92109032, SHENZHEN MINDRAY BIO-MEDICAL ELECTRONICS CO., LTD, Mindray Building, Keji 12th Road South, High-Tech Industrial Park, Nshan, Shenzhen, 518057, P.R. China; Shanghai International Holding Corp. GmbH (Europe), Eiffestraße 80, 20537 Hamburg, Germany), manufactured on February 23, 2019 [7].

3. Results

The results of the assessment of mineral content in the daily diets of pregnant women are presented in Table 1, while their corresponding blood concentrations are shown in Table 2.

Table 1. The content of selected minerals in the daily diet of pregnant women

Indicators	Pregnancy Trimesters					
	1st Trimester		2nd Trimester		3rd Trimester	
	Recom mended	Observed	Recom mended	Observed	Recom mended	Observed
Magnesium, mg	300	285,3±6,1	300	437,8±48,5	300	477,39±55,2
Iron, mg	25	13,2±0,73	25	18,7±1,61	25	20,01±1,61

As shown in the table above, the amount of magnesium in the daily diets of the participants varied relative to the recommended intake. Specifically, in the first trimester, magnesium intake was 285.3 ± 6.1 mg, which corresponds to 95.1% of the recommended level. In the second trimester, the intake increased to 437.8 ± 48.5 mg, and in the third trimester to 477.39 ± 55.2 mg, representing average increases of 45.9% and 59.1% above the recommended levels, respectively [8]. These findings indicate that compared to the first trimester, participants consumed more magnesium-rich foods (such as pastries, legumes, dried fruits, etc.) during the second and third trimesters [9].

Furthermore, during the first trimester, many participants experienced severe morning sickness and various physiological changes, which affected their daily food consumption, leading to noticeable differences compared to the second and third trimesters. Such variations also influenced their daily dietary requirements [10].

A similar pattern was observed for iron intake. In the first trimester, the iron content in the diets of pregnant women aged 21–34 years was 13.2 ± 0.73 mg, corresponding to 52.8% of the recommended level. In the second and third trimesters, iron intake increased to 18.7 ± 1.61 mg and 20.01 ± 1.61 mg, respectively, which represents 74.8% and 80.04% of the recommended levels. These values indicate that iron intake across all three trimesters was, on average, 36.7% below the recommended level [11].

Assessment of Mineral Concentrations in Blood Serum

The determination of mineral concentrations in blood serum serves as an important indicator for objectively assessing the body's supply of these micronutrients. From this perspective, the concentrations of magnesium and iron in the blood serum of pregnant women were measured during the study Table 2 [12].

Table 2. Concentrations of Selected Minerals in the Blood Serum of Pregnant Women

Indicators	Pregnancy Trimesters					
	1st Trimester		2nd Trimester		3rd Trimester	
	Recom mended	Observed	Recommended	Observed	Recommended	Observed
Magnesium, mg	0,75-1,25	0,965±0,01 5	0,75-1,25	0,99±0,09	0,75-1,25	1,07±0,1
Iron, mg	9,0-30,0	32,2±0,005	9,0-30,0	20,3±4,2	9,0-30,0	19,06±0,89

According to the results, the serum magnesium concentration in the first trimester was 0.965 ± 0.015 mmol/L, which is 28.6% above the lower reference limit and 22.8% below the upper limit, corresponding to an average of 102.9% of the recommended range. In the second and third trimesters, magnesium levels increased to 0.99 ± 0.09 mmol/L and 1.07 ± 0.1 mmol/L, respectively, representing decreases of 20.8% and 14.4% relative to the upper reference limit [13].

For iron, the mean serum concentration in the first trimester was 32.2 ± 0.005 μ mol/L, corresponding to 107.3% of the upper recommended limit. In the second trimester, the concentration decreased to 20.3 ± 4.2 μ mol/L, and in the third trimester to 19.06 ± 0.89 μ mol/L, indicating reductions of approximately 32.4% and 36.5% relative to the upper limit. These findings suggest a relative iron deficiency in the later stages of pregnancy [14].

Such variations may also reflect physiological changes in the metabolism of mineral-related compounds in the maternal body, which can potentially lead to iron-related anemia in both the mother and the developing fetus [15].

4. Conclusion

It is evident that monitoring mineral intake and blood concentrations throughout pregnancy is essential for women living in rural areas. Regular assessment helps ensure that the physiological processes of both the mother and the fetus proceed normally during all trimesters.

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