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ORIGINAL ARTICLE

Estimating the levels of some vitamins, ions and minerals in elderly and young individuals-A comparative study

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Abstract

Essential elements, ions, and vitamins are pivotal in maintaining human health and influencing diverse physiological processes. However, various factors, including inadequate dietary intake, underlying health conditions, and lifestyle choices, can lead to deficiencies in these vital nutrients. Understanding the importance of these micronutrients and the factors contributing to their deficiency is critical for promoting overall well-being and guiding effective preventive measures. This study aimed to measure the levels of vitamins E and D, sodium and calcium ions, and the elements selenium, magnesium, and copper. Ninety samples were collected from young and elderly people, including 40 samples from young people and 50 samples from elderly people, ranging in age from 20 to 60 years. 5 milliliters of venous blood were drawn to obtain serum and used for the above measurements. The results of this study showed an increase in the level of vitamin D and E among young people compared to the elderly at a probability level of greater than or equal to ($P \leq 0.05$). Sodium showed a significant increase at the probability level of ($P \leq 0.01$), where its level in the elderly was higher than in the young group. As for calcium, it showed an increase at the level of probability ($P \leq 0.01$), where its level in the elderly group was higher than its level in the young group. As for the levels of selenium, copper, and magnesium, their levels showed a significant decrease in the elderly group compared to young people at the probability level ($P \leq 0.01$).

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1. Introduction

Proper nutrition is a vital aspect of human health that significantly contributes to overall well-being at every stage of life. The intricate relationship between minerals, vitamins, and ions within the body is a crucial element of nutrition. While these essential nutrients are necessary for individuals of all age groups, it is important to acknowledge that the nutritional needs and utilization of minerals, vitamins, and ions undergo significant changes as individual's progress from youth to old age. Recognizing these age-related distinctions is crucial in tailoring dietary recommendations and healthcare strategies to improve health outcomes in both young and elderly populations. The journey of nutrition begins in infancy, where young bodies require crucial nutrients such as calcium, iron, and a range of vitamins for healthy bone development, a strong immune system, and overall vitality [1].

The choices made during this period can have long-lasting effects on health. However, as individuals enter the elderly phase of life, they face a unique set of nutritional challenges. The aging process is often accompanied by physiological changes that affect the metabolism, absorption, and utilization

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of minerals, vitamins, and ions. These changes can increase the vulnerability to specific deficiencies and chronic diseases [2]. For example, older individuals may experience reduced efficiency in absorbing vital nutrients like vitamin B12, which is necessary for nerve function and red blood cell production [3]. Additionally, preserving adequate bone density and cognitive function becomes a top priority, requiring a focus on nutrients such as calcium and vitamin D [4, 5]. In addition to minerals and vitamins, ions play a critical role in various physiological processes. Charged particles like sodium, potassium, calcium, and magnesium are involved in functions like blood pressure regulation, muscle contraction, and nerve signaling [6, 7]. With advancing age, changes in ion regulation become more relevant. Electrolyte imbalances, such as hyponatremia (low sodium levels) or hypokalemia (low potassium levels), can be more common among the elderly and may have implications for cardiovascular and muscle health. Consequently, managing ion balance becomes a crucial consideration in caring for older populations. Understanding the age-related complexities of mineral, vitamin, and ion metabolism holds paramount significance for several reasons. Firstly, it allows for the development of targeted dietary interventions and supplementation strategies that address the specific needs of elderly individuals, thereby preventing deficiencies and reducing the risk of age-related health conditions. Secondly, this understanding enables healthcare professionals to provide more effective guidance across all age groups. Whether it involves educating parents about their children's nutritional requirements or helping elderly patients optimize their nutrient intake, having a nuanced grasp of age-related nutritional needs proves invaluable [8].

1.1 Vitamin D

Vitamin D is a well-known fat-soluble vitamin that plays a diverse role in human health. While it is primarily recognized for its importance in calcium absorption and bone health, vitamin D is also involved in various physiological processes. It can be produced by the skin when exposed to sunlight or obtained through foods and supplements. In addition to its role in bone health, vitamin D has gained attention for potential benefits in immune system function, mood regulation, and cardiovascular health [9]. However, vitamin D deficiency is a global health issue, with many individuals having insufficient levels due to factors such as limited sun exposure and dietary choices [10]. Severe deficiency can lead to conditions like rickets in children and osteoporosis in adults. Ongoing research indicates that maintaining vitamin D levels may have positive effects on overall health, which continues to be an area of exploration [11, 12].

1.2 Vitamin E

Vitamin E is a renowned fat-soluble vitamin with powerful antioxidant properties. It consists of a group of compounds called tocopherols and tocotrienols, which play a vital role in protecting cells from oxidative damage caused by free radicals. Vitamin E is essential for maintaining the integrity of cell membranes and DNA, making it an important nutrient. It can be found in a variety of foods such as nuts, seeds, vegetable oils, and leafy greens. In addition to preserving cell health, the antioxidant activity of vitamin E also supports the immune system and may have benefits for cardiovascular health.
Although vitamin E deficiency is rare, it can lead to symptoms including muscle weakness and neurological issues. As an important antioxidant, vitamin E continues to be an area of research to explore its potential in promoting overall health and reducing the risk of chronic diseases [13-15]**.**

1.3 Sodium Ion (Na+)

Sodium ions (Na+) are essential electrolytes that have a significant impact on various physiological processes. These ions are primarily present in extracellular fluids and play a vital role in maintaining proper fluid balance, regulating blood pressure, and facilitating nerve function. Sodium ions are involved in transmitting electrical signals in nerve cells and supporting muscle contractions [16]. The body maintains sodium balance through intricate mechanisms that include the kidneys, adrenal glands, and hormonal factors like aldosterone. Imbalances in sodium levels can lead to health problems such as hypertension and edema. Having a comprehensive understanding of sodium ion regulation is essential for overall health maintenance [17].

1.4 Calcium Ion (Ca^+)

Calcium ions play a crucial role in numerous vital processes within the human body, serving as essential signaling molecules. Alongside their well-recognized involvement in bone health, calcium ions are integral to muscle contractions, neurotransmitter release, blood clotting, and cellular communication. Acting as secondary messengers, they facilitate the translation of signals from outside the cell to appropriate intracellular responses [18]. Maintaining optimal calcium ion balance is vital for normal physiological function, and the body achieves this equilibrium through the actions of hormones such as parathyroid hormone (PTH) and calcitonin, as well as vitamin D. Disruptions in calcium regulation can give rise to conditions such as osteoporosis, muscle disorders, and impaired cardiac function [19,20]. Recognizing the intricate role of calcium ions in cellular signaling and overall health highlights their importance in maintaining the proper functioning of various physiological systems.

1.5 Selenium (Se^+)

Selenium is a vital trace element that plays a critical role in human health. It is an essential component of key selenoproteins that have diverse functions, including antioxidant defense, thyroid hormone metabolism, and immune system regulation. The significance of selenium in human physiology and health is supported by relevant scientific literature. One of the primary roles of selenium is its

function as a cofactor for selenoproteins such as glutathione peroxidases (GPx) and thioredoxin reductases (TrxR). These enzymes are crucial for the body's antioxidant defense system, protecting cells from oxidative damage caused by reactive oxygen species (ROS). Selenium deficiency can result in reduced activity of these selenoproteins, increasing the risk of oxidative stress-related diseases [21]. Selenium is also involved in thyroid hormone metabolism through selenoproteins like deiodinases. These enzymes regulate the conversion of the inactive thyroid hormone thyroxine (T4) to the active form triiodothyronine (T3). Inadequate selenium levels can impair thyroid function, highlighting the importance of selenium in maintaining proper thyroid hormone levels [22]. These proteins play a role in modulating the immune response. Selenium deficiency can compromise immune function, increasing susceptibility to infections [23, 24]. Studies have shown that selenium status is associated with various health outcomes. For example, research has explored the potential protective effects of selenium against certain cancers. Selenium supplementation has been investigated for its role in reducing the risk of prostate, lung, and colorectal cancers [25, 26, 27]. It is important to note that selenium exhibits a U-shaped relationship with health, where both deficiency and excess can be detrimental. While selenium deficiency is linked to various health issues, excessive selenium intake can lead to selenosis, characterized by symptoms such as hair and nail loss, gastrointestinal problems, and neurological abnormalities. Selenium is an essential trace element with significant implications for human health. Its roles in antioxidant defense, thyroid hormone metabolism, and immune function underscore its importance. Adequate selenium intake is crucial for maintaining overall health, and ongoing research continues to explore its potential benefits and optimal dietary recommendations [28].

1.6 Copper (Cu^{+})

Copper (Cu) is a vital micronutrient that plays a pivotal role in numerous physiological processes within the human body. It acts as a cofactor for various enzymes, participating in functions such as energy production, antioxidant defense, and connective tissue formation. Copper's importance in human health is supported by scientific literature. One of copper's primary roles is its involvement as a cofactor for enzymes related to energy production. For example, cytochrome c oxidase, a copper-containing enzyme, plays a crucial role in the electron transport chain, which generates adenosine triphosphate (ATP), the body's main energy source [29]. Inadequate copper levels can impair ATP production, possibly leading to symptoms of fatigue and weakness. Copper also serves as a cofactor for superoxide dismutase (SOD), an antioxidant enzyme essential for neutralizing damaging reactive oxygen species (ROS) in the body [29]. Insufficient copper levels can compromise the body's ability to combat oxidative stress, potentially contributing to cellular damage and various health issues. Another significant function of copper is its involvement in connective tissue formation, including collagen and elastin. Copper-dependent enzymes play a role in cross-linking collagen fibers, which are necessary for the strength and integrity of tissues such as skin, blood vessels, and bones [30]. Copper deficiency can impair connective tissue formation and lead to conditions such as joint problems and skin abnormalities. Copper is also crucial for maintaining a healthy nervous system. Copper-dependent enzymes participate in neurotransmitter synthesis, including norepinephrine and dopamine [31]. Copper deficiency may impact neurotransmitter balance and function, potentially contributing to neurological symptoms. Scientific research has explored the consequences of copper imbalance on human health. Both copper deficiency and excess can have adverse effects. Copper deficiency can occur in conditions like Menkes disease, a genetic disorder affecting copper absorption [32]. Copper is an essential micronutrient with diverse roles in human health. Its involvement in energy production, antioxidant defense, connective tissue formation, and neurological function highlights its significance. Maintaining an appropriate copper balance is crucial for overall health, and ongoing research continues to uncover its role in various physiological processes [33].

1.7 Magnesium(Mg)

Magnesium is a vital mineral that plays a crucial role in numerous physiological processes in the human body. It is involved in over 300 enzymatic reactions, making it essential for functions such as energy production, muscle contraction, nerve transmission, and bone health. Magnesium is a cofactor for enzymes involved in ATP synthesis, the body's primary source of energy [34]. A deficiency in magnesium can lead to fatigue and weakness due to impaired ATP production. Additionally, magnesium is essential for muscle function, including muscle contraction and relaxation [35]. It regulates calcium ions in muscle cells, influencing muscle contractions. Inadequate magnesium levels can result in muscle cramps, spasms, and impaired muscle function. Magnesium plays a vital role in nerve transmission and neuromuscular coordination by regulating neurotransmitter release and receptor sensitivity [36]. A deficiency in magnesium can contribute to neurological symptoms such as numbness, tingling, and muscle tremors. Furthermore, magnesium is crucial for bone health as it is a key component of hydroxyapatite, the mineral complex that provides strength and density to bones [37]. Inadequate magnesium levels can weaken bone structure and increase the risk of osteoporosis. Studies have also explored the implications of magnesium deficiency, linking it to an increased risk of cardiovascular diseases such as hypertension and arrhythmias [38]. Additionally, research has examined the potential benefits of magnesium supplementation in managing conditions like type II diabetes. Maintaining an adequate magnesium intake through a balanced diet or supplementation is crucial for overall health, and ongoing research continues to investigate its role in human health [39].

2. Material and Methods

2.1 Study Design

In this cross-sectional study conducted in Tikrit city, data was collected from 90 individuals between the ages of 20-60 years. The participants were divided into two main groups: 50 samples from the elderly and 40 from young individuals. For specimen collection (5ml), disposable plastic syringes were used to draw venous blood from young and elderly individuals. After coagulation, serum was separated by centrifugation for (10) minutes at (6000) rmp. Serum was obtained and stored at (-20°C) in small windproof tubes with a capacity of 1.5mL until analysis. The measurement of these components was performed using a ready-made kit provided by Biolabo, a company based in France.

Table 1: The used tools and material in our study.

N	Tools and material	Company
1.	Disposable syringes	Türkiye
2.	Micropipette	Japan
3.	Disposable tips	Spain
4.	Plane tubes	France
5.	Test tubes	China
6.	Bottle washing water	China

Table 2: Used apparatus in our study.

N	Apparatus	Company
1.	Centrifuge	Germany-Dupont
2.	Incubator	Türkiye – Elektromag
3.	Ultra Violet & Visible Spectrophotometer	Cecil Instrument Limited. USA

3. Results and Discussion

The table presents the average values and standard errors for Vitamin D, Vitamin E, Sodium, and Calcium levels in two distinct groups: Elders and Young individuals. Statistical significance is indicated with *(P≤ 0.05) and **(P≤ 0.01). In terms of Vitamin D levels (measured in ng/ml), the Young group shows significantly higher levels (61.90 ± 6.9) compared to the Elders group (30.13 ± 4.13) (P≤0.05). A study conducted by Bouillon concluded that aging is associated with changes in skin structure and function, leading to decreased efficiency in synthesizing Vitamin D from sunlight. This physiological change may contribute to lower Vitamin D levels in older individuals [40]. For Vitamin E levels (measured in mg/100ml), although the Young group has a slightly higher average (0.95 ± 0.46) compared to the Elders group (0.633 ± 0.15), this difference is not statistically significant (P≤0.05). Researcher Meydani conducted that the prevalence of chronic diseases increases with age, and certain conditions may affect Vitamin E status. For example, individuals with chronic diseases such as diabetes or cardiovascular disease may have altered Vitamin E metabolism and utilization [41]. Regarding Sodium levels (measured in mmol/L), the Elders group has significantly higher levels (587.33 ± 9.75) when compared to the Young group (156.38 ± 13.11) (P≤0.01). Previous study by Morley et al. concluded that older individuals may be more prone to dehydration, which can lead to relative sodium concentration in the blood. This can happen due to reduced thirst perception or other factors [42]. Lastly, Calcium levels (measured in mg/dl) show a significant difference, with the Elders group (11.298 ± 0.126) having higher levels than the Young group (9.228 ± 0.127) (P≤0.01). Aging is associated with changes in bone density and turnover. While bone resorption may increase, leading to higher calcium release, bone formation may decrease, impacting overall calcium balance as conducted by Siebel [43]. The provided data shows the mean values with standard errors for Selenium (ppb), Copper (µg/dl), and Magnesium (mg/dl) levels in two groups: Elders and Young individuals. The significance levels, denoted by **(P≤ 0.01), indicate statistical significance.

Table 3: Comparison between young and old individuals in Vitamin E, Vitamin D, Sodium and Calcium.

Group	Mean ± SE			
	Vitamin D*	Vitamin E*	Sodium**	Calcium**
	mg/ml	mg/100ml	mmol/L	mg/dl
Elders	30.13±4.13	0.633±0.15	587.33±9.75	11.298±0.126
Young	61.90±6.9	0.95±0.46	156.38±13.11	9.228 ±0.127
**(P≤ 0.01)		*(P≤ 0.05)		

Table 4: Comparison between young and old individuals in Selenium, Copper and Magnesium

Group	Mean ± SE		
	Selenium** ppb	Copper** µg/dl	Magnesium** mg/dl
Elders	49.490±1.330	12.95±0.34	1.610±0.028
Young	92.885±1.690	23.917±1.78	2.235±0.040
**(P≤ 0.01)			

In terms of Selenium levels (ppb), there is a notable difference between the two groups. The Young group (mean: 92.885 ± 1.690 ppb) has significantly higher Selenium levels compared to the Elders group (mean: 49.490±1.330 ppb) at a significance level of P≤0.01. Study by Rayman said that Age-related changes in gastrointestinal function can affect the absorption of nutrients, including selenium. Reduced efficiency in nutrient absorption may contribute to lower selenium levels in older individuals [44]. For Copper levels (µg/dl), the Young group (mean: 23.917 ± 1.78 µg/dl) shows significantly higher Copper levels compared to the Elders group (mean: 12.95 ± 0.34 µg/dl) at a significance level of P≤0.01. Changes in dietary habits with age, such as reduced food intake or altered food choices, can impact copper intake. Dietary factors play a crucial role in determining copper status which was conducted by researcher Turnlund [45]. In terms of Magnesium levels (mg/dl), there is a substantial difference between the two groups. The Young group (mean: 2.235 ± 0.040 mg/dl) exhibits significantly higher Magnesium levels compared to the Elders group (mean: 1.610 ± 0.028 mg/dl) at a significance level of P≤0.01. Study conducted by Veronese et al. concluded

that certain health conditions common in aging, such as diabetes or gastrointestinal disorders, and medications may impact magnesium metabolism. Chronic diseases and medications can affect magnesium absorption, excretion, and utilization [46].

4. Conclusions

This research highlights the following key findings:

- An increase in the level of vitamin D and E among young people compared to the elderly at a probability level of greater than or equal to ($P \leq 0.05$).
- Sodium showed a significant increase at the probability level of ($P \leq 0.01$), where its level in the elderly was higher than the level in the young group
- Calcium, it showed and increase at the level of probability ($P \leq 0.01$), where its level in the elderly group was higher than its level in the young group.
- The levels of selenium, copper, and magnesium, their levels showed a significant decrease in the elderly group compared to young people at the probability level ($P \leq 0.01$).

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