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REVIEW ARTICLE

The relationship between diet and serum iron, copper, and selenium levels and mood levels in young adults

Genç yetişkin bireylerde diyet ve serum demir, selenyum, bakır seviyesinin, duygu durum düzeyi ile ilişkisi

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Abstract

Nutritional habits and serum iron, selenium, and copper levels have significant effects on mood in young adults. Nutrition is a determining factor not only in meeting an individual's physiological needs but also in maintaining mental health. Trace elements such as iron, selenium, and copper play critical roles in neurotransmitter synthesis, oxidative stress regulation, and central nervous system function. Literature has shown that deficiencies in these elements may be associated with depression, anxiety, and mood disorders. In this context, ensuring a balanced diet and adequate micronutrient intake are crucial for maintaining mental health. This review emphasizes the multidimensional nature of the relationship between nutrition and mood in young adults, and that regular monitoring of micronutrient levels and encouraging healthy eating habits can be a preventative approach.

Keywords: Mood, nutrition, minerals.

Özet

Genç yetişkinlerde beslenme alışkanlıkları ile serum demir, selenyum ve bakır düzeylerinin duygu durumu üzerinde önemli etkileri bulunmaktadır. Beslenme, bireyin yalnızca fizyolojik ihtiyaçlarının karşılanmasında değil, aynı zamanda ruh sağlığının korunmasında da belirleyici bir faktördür. Demir, selenyum ve bakır gibi eser elementler; nörotransmitter sentezi, oksidatif stresin düzenlenmesi ve merkezi sinir sistemi fonksiyonlarında kritik roller üstlenmektedir. Literatürde, bu elementlerin yetersizliğinin depresyon, anksiyete ve duygu durum bozuklukları ile ilişkili olabileceği gösterilmiştir. Bu bağlamda, dengeli beslenmenin sağlanması ve mikro besin ögelerinin yeterli düzeyde alınması, ruh sağlığının korunması açısından önem arz etmektedir. Bu derlemede, genç yetişkinlerde beslenme ve duygu durumu arasındaki ilişkinin çok boyutlu olduğu, mikro besinlerin düzeyinin düzenli izlenmesinin ve sağlıklı beslenme alışkanlıklarının teşvik edilmesinin koruyucu bir yaklaşım olabileceği üzerinde durulmuştur.

Anahtar Kelimeler: Duygu durumu, beslenme, mineraller.

INTRODUCTION

Nutritional status and serum levels in young adults may be directly related to mood. The metabolic and neurobiological roles of trace elements such as iron, copper, and selenium are particularly important in terms of their effects on neurotransmitter synthesis, antioxidant defense, nerve transmission, and stress responses (1,3). The main objective of this study is to conceptualize the relationship between iron, selenium, and copper levels in young adults in terms of diet and serum levels and depressive symptoms and to evaluate existing epidemiological data (4,5).

Nutrition is defined as the intake of organic and inorganic nutrients in a specific order necessary for the organism to sustain life, maintain health, and develop. These elements, which are essential for the human body, consist of carbohydrates, proteins, fats, vitamins, and minerals (1,4). It is expected that the foods consumed through nutrition not only meet daily energy needs but also contribute to healthy aging and have the potential to extend life span.

Individuals' nutritional habits vary according to their life stages. While family, friends, and social interactions play an important role in the formation and maintenance of eating behaviors in young adulthood, television, social media, the internet, and other digital communication tools are seen to be more influential during college years.

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Adolescents, in particular, may experience difficulties in choosing healthy foods (2,3). Failure to manage this transition period properly can lead to unhealthy eating behaviors, an increased tendency to consume ready-made and processed foods, and associated weight changes (4). In addition, insufficient time allocated to nutrition, stress factors, and emotional fluctuations also increase the risk of obesity and chronic diseases (4,5).

Obesity, recognized as one of the most significant nutritional disorders today, tends to persist into adulthood when it begins in youth (6). Inadequate or excessive consumption of macronutrients during this period plays a significant role in the development of chronic health problems such as obesity, cardiovascular diseases, and cancer in later life (7). University students are a group that is more vulnerable to these risks due to their lifestyle characteristics. Living away from family control, turning to low-quality and cheap foods due to limited budgets, lack of physical activity, and environmental stress factors can lead to weight gain in students (8,9).

NUTRITIONAL INFLUENCES ON MOOD AND EMOTIONAL WELL-BEING

The Relationship Between Nutrition And Emotional State

The relationship between nutrition and emotional state is quite complex and bidirectional. Individuals' mental states can determine the foods they consume, and the foods they eat can also affect their moods. Overeating is a commonly observed response during stressful periods, and most studies report that individuals change their diets when they are stressed (10). The term "comfort food," which has entered our everyday language in recent years, refers to traditional foods believed to soothe negative emotions and enhance positive ones. These types of foods are usually rich in both carbohydrates and fat and are easy to prepare. Although they provide quick relief in times of stress, it is noted that refined carbohydrate and sugar consumption can negatively affect the stress response along with blood sugar fluctuations (11).

The effect of nutrition on mood can also work in the opposite direction; that is, it has been suggested that certain foods can make individuals more resilient to stress. For example, high daily fruit and vegetable consumption has been associated with a more positive mood (12-14).

The role of nutrition in preventing chronic diseases such as cardiovascular disease, diabetes, obesity, or cancer has long been recognized. However, the use of nutrition to support mental function and protect mental health is a relatively new approach called "nutritional psychiatry" (15,16). Historically, the effect of food on mood has also been considered; in the Middle Ages, it was assumed that some foods (e.g., eggs, pomegranates, apples) increased sexual desire, while others calmed the person or improved their mood (15).

Effects Of Emotions On Eating Behavior

There are differing views on how emotions affect eating behavior. Some studies show that negative emotional states increase food intake and that sadness, in particular, triggers eating behavior more strongly than happiness (17). In contrast, another study conducted with healthy individuals of normal body weight reported that positive emotions may also have an appetite-increasing effect (18).

Positive emotional states are generally associated with individuals meeting their basic needs, their ability to adapt to their environment, regulate their emotions, and be effective in social relationships. Emotions such as happiness, joy, pride, optimism, and gratitude fall into this category, while negative emotions are more related to unmet needs, obstacles to achieving goals, losses, threatening situations, and dysfunctional cognitions. Sadness, anger, unhappiness, anxiety, guilt, loneliness, fear, and stress fall within this category (18).

Eating behavior in response to negative emotions is generally accepted as a psychological coping mechanism. However, it has been suggested that individuals who have difficulty identifying or perceiving their emotions may experience binge eating episodes. Individuals who cannot express their emotions in sufficient detail may show a tendency to avoid these emotions by directing their attention to food when they feel unable to cope with their negative experiences (19-21). Another explanation for the relationship between stress and eating behavior is the "masking hypothesis." According to this hypothesis,

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individuals try to suppress negative emotions through eating behavior rather than coping with them. This is because coping with the discomfort resulting from overeating is perceived as easier than dealing with more severe sources of stress (22).

THE RELATIONSHIP BETWEEN CERTAIN MINERALS AND MOOD LEVELS

Iron Mineral

Iron is an essential element involved in DNA synthesis, cellular metabolism, protein and hormone production, and neurotransmitter synthesis. It is particularly critical for brain development, cell differentiation, and nervous system functions (23). Iron deficiency may contribute to the development of mood disorders by disrupting the synthesis of neurotransmitters such as dopamine and serotonin (22-24).

Studies examining the relationship between major depressive disorder and iron metabolism have revealed that low serum transferrin and ferritin levels are associated with depression (24,26). Furthermore, it has been reported that biometals generally play a supporting role in mood disorders, particularly in individuals with abnormal iron metabolism, where the incidence of depression is increased (28). However, some studies have found no significant relationship between hemoglobin levels and depression (27-29).

It has been reported that the prevalence of iron deficiency anemia is higher in individuals with psychiatric disorders (30). Fatigue, lethargy, and behavioral changes associated with anemia can mimic depressive disorder; furthermore, it has been reported that depressive symptoms decrease even without improvement in hematological parameters following iron supplementation (31). Similarly, Baune and colleagues (2006) reported that depression and somatic symptom complaints were more common in the anemia group (32). Semiz and colleagues (2011) reported that sleep quality, anxiety, and depression scores were worse in anemic patients compared to healthy individuals (33). A large-scale study conducted in Japan showed that the prevalence of depression was higher in individuals with iron deficiency anemia and that K6 test scores were significantly higher compared to the control group (34). Similarly, research conducted by Li and colleagues (2014) on 14,834 adults in the US found that zinc, iron, copper, and selenium intake was negatively associated with depression; adequate intake of these elements may have a protective effect (35).

It has also been reported that mild to moderate iron deficiency, particularly observed in young women, has negative effects on motivation, emotional functioning, and physical endurance (36). This condition is linked to biochemical changes in the central nervous system. Consequently, iron deficiency can lead not only to hematological but also to neuropsychiatric consequences. Therefore, considering iron levels in the assessment of depression is important in early diagnosis and treatment approaches (37,38).

Copper Mineral

Copper is an essential trace element that plays a role in the regulation of serotonergic, noradrenergic, dopaminergic, glutamatergic, and GABAergic systems in the central nervous system (39). The absorption of dietary copper varies depending on its chemical form, gastrointestinal absorption disorders, and competition with antagonist minerals such as zinc and iron (40). The blood-brain barrier facilitates the transport of copper from the circulation to the nervous tissue, while the blood-cerebrospinal fluid barrier is involved in maintaining homeostasis. Therefore, copper deficiency or excess can directly affect the development and function of the nervous system (41,42).

Copper is found in the structure of antioxidant enzymes such as superoxide dismutase, which are involved in oxidative stress processes, and functions as an electron donor in many metalloenzymes. Therefore, it is critically important in neurotransmitter synthesis, receptor functions, and synaptic transmission (41,43). Clinical studies suggest that blood copper levels may be a potential biomarker for depression. A large-scale study by (2014) reported that copper and selenium intake in US adults was associated with depression (44). Similarly, low copper intake was found to increase the risk of depression in Korean young adult (39). Kamath (2019) noted in his study that copper levels were higher in individuals with mild depression compared to the control group (45).

Turk J Clin Res. 2025;1(2):138-143
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The reasons for increased copper levels include excessive intake, deficiencies in liver copper metabolism, or stress-induced biochemical changes (46). There is strong evidence that imbalances in copper metabolism may be related to the pathophysiology of depression. Both copper deficiency and excess can contribute to the emergence of depressive symptoms by affecting neurotransmitter functions in the central nervous system. Therefore, copper may be considered a potential biomarker in the diagnosis and treatment of depression (43).

Selenium Mineral

Selenium is an essential trace element for human health and is found in the body mostly in the form of selenocysteine. The biological functions of selenium are carried out directly through selenoproteins. Among these proteins, glutathione peroxidase (Gpx), thioredoxin reductase, and iodothyronine deiodinases play a decisive role in antioxidant defense, thyroid hormone metabolism, and cellular redox balance (45-48). Selenium's role in reducing oxidative stress is considered critical, particularly for neurological health.

Selenium deficiency has been associated with impaired immune function, thyroid disorders, and neurological symptoms. This is considered an important mechanism in the pathophysiology of neuropsychiatric disorders, particularly depression (50).

Studies examining the relationship between depression and selenium suggest that selenium may act as both a protective and risk-determining factor. Selenium's reduction of free radical damage through glutathione peroxidase activity, its protection of neuronal structural integrity, and its support of neurotransmitter metabolism are thought to be the fundamental biological mechanisms underlying its potential antidepressant effect (49,50). Indeed, it has been reported that depressive symptoms are more common in individuals with low selenium intake, while adequate or high intake reduces the risk of depression (46). Pregnancy and the postpartum period are particularly critical periods in terms of selenium. The decrease in maternal plasma selenium levels as pregnancy progresses is explained by fetal requirements and placental transfer (47,48). This situation may be decisive for both the mother's mental health and the fetus's neurological development. One study showed that adequate selenium intake throughout pregnancy reduced the risk of postpartum depression (50,51). However, the biological effects of selenium may vary among individuals. Age, gender, genetic polymorphisms, and current selenium levels are factors that determine this variability (44). It should also be noted that selenium has a narrow therapeutic range. Inadequate intake can lead to cognitive impairment and mental health problems, while excessive intake can cause gastrointestinal diseases, hair and nail disorders, nerve damage, and toxicity symptoms (45). Therefore, the daily selenium requirement has been determined according to different standards between countries: 55 µg in the US, 50–70 µg in Europe, and 70 µg in Turkey (46,47).

In conclusion, selenium stands out as a critical micronutrient in both the prevention of depression and the understanding of its pathophysiology due to its effects on antioxidant defense, neurotransmitter regulation, and thyroid function. However, it should be noted that it is not the sole determinant in preventing depression, but rather plays a role in interaction with genetic, environmental, and psychosocial factors. In this context, selenium is considered both a protective micronutrient and a potential biomarker for depression (49-51).

CONCLUSION

This review examined the relationship between dietary and serum levels of micronutrients such as iron, selenium, and copper and mood in young adults. Findings in the literature indicate that iron and selenium deficiencies, in particular, are associated with depressive symptoms, fatigue, and decreased cognitive performance, while copper imbalance may contribute to mood fluctuations. This highlights that micronutrients are critical not only for physiological functions but also for mental health. Young adulthood is a period when lifelong psychological health is shaped and dietary habits become established. Therefore, supporting adequate and balanced micronutrient intake is considered a protective strategy for preventing mood disorders and maintaining mental well-being. While current data is promising, more prospective studies and randomized controlled trials are needed to clarify the causal relationship.

Turk J Clin Res. 2025;1(2):138-143
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Turk J Clin Res. 2025;1(2):138-143
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