THE EFFECT OF SELENIUM-CONTAINING DRUGS ON HORMONE SYNTHESIS

Mehmonov Alisher Zafarovich, Suponova Xolida Suxrobovna Students of Samarkand State Medical University.

Scientific advisor: Jalilova Dildora Murotovna Assistant of Samarkand State Medical University. Samarkand, Uzbekistan

Annotation: Selenium, an essential trace element, has garnered significant attention for its role in hormone synthesis, specifically in thyroid hormone metabolism and immune function. Its deficiency has been linked to various autoimmune thyroid disorders, exacerbating conditions such as hypothyroidism and hyperthyroidism, as outlined in recent studies that highlight the crucial relationship between selenium levels and thyroid function (Varghese C et al., 2025). Furthermore, selenium-containing drugs and their bioinorganic complexes demonstrate promising therapeutic potential in modulating hormone synthesis and action, as indicated by their multifunctional properties observed in various biochemical pathways (Kumar S et al., 2025). The intricacies of selenium metabolism necessitate a comprehensive understanding of how dietary sources and bioreductive processes translate selenium into biological activities . This exploration is essential for elucidating the mechanisms by which selenium influences hormone synthesis, thereby contributing to the management of thyroid-related disorders and improving patient health outcomes.

Keywords: selenium content, reproductive hormone, selenium metabolism, actors affecting thyroid.

ВЛИЯНИЕ СЕЛЕНСОДЕРЖАЩИХ ПРЕПАРАТОВ НА СИНТЕЗ ГОРМОНОВ

Мехмонов Алишер Зафарович, Супонова Холида Сухробовна Студенты Самаркандского государственного медицинского университета.

Научный руководитель: Жалилова Дилдора Муротовна Самаркандского государственного медицинского университета. Самарканд, Узбекистан.

Аннотация: Селен, важный микроэлемент, привлек значительное внимание своей ролью в синтезе гормонов, в частности в метаболизме гормонов щитовидной железы и иммунной функции. Его дефицит был связан с различными аутоиммунными заболеваниями щитовидной железы, усугубляя такие состояния, как гипотиреоз и гипертиреоз, как указано в недавних исследованиях, которые подчеркивают важную связь между уровнями селена и функцией щитовидной железы (Varghese C et al., 2025). Кроме того, препараты, содержащие селен, и их бионеорганические комплексы демонстрируют многообещающий терапевтический потенциал в модуляции синтеза и действия гормонов, о чем свидетельствуют их многофункциональные свойства, наблюдаемые в различных биохимических путях (Kumar S et al., 2025). Сложности метаболизма селена требуют всестороннего понимания того, как пищевые источники и биоредуктивные процессы переводят селен в биологическую активность. Это исследование имеет важное значение для выяснения механизмов, посредством которых селен влияет на синтез гормонов, тем самым способствуя лечению заболеваний, связанных с щитовидной железой, и улучшению результатов лечения пациентов.

Ключевые слова: содержание селена, репродуктивный гормон, метаболизм селена, факторы, влияющие на щитовидную железу.

Selenium (Se) is an essential trace element recognized for its critical biological significance, particularly in the synthesis of important selenoproteins that play vital roles in antioxidant defense and hormone regulation. These selenoproteins, which include glutathione peroxidases and thioredoxin reductases, are crucial for cellular protection against oxidative damage and may influence thyroid function and hormone metabolism. Selenium acts as a cofactor in various biochemical processes, enhancing immune

responses and modulating thyroid hormone synthesis by facilitating the conversion of thyroxine (T4) to its biologically active form, triiodothyronine (T3) (Shahidin et al., 2025). Deficiencies in selenium can lead to various health issues, including impaired immune function and altered hormone levels, underscoring its importance in maintaining hormonal balance and overall health (Alharbi HO et al., 2025). The intricate interactions between selenium and hormone synthesis illustrate the elements multifaceted role in biological systems, necessitating further research to fully understand its therapeutic potential. The metabolic processes of selenium in the body are elegantly represented in , elucidating its pathway and significance in human physiology. The introduction of selenium-containing drugs has garnered significant attention due to their multifaceted roles in biological systems, particularly concerning hormone synthesis. Selenium, an essential trace element, plays a crucial role in metabolic pathways, including the synthesis of thyroid hormones, which are vital for regulating metabolism and growth. Notably, selenium facilitates the activity of selenoproteins, such as glutathione peroxidases, which protect thyroid cells from oxidative damage. Selenium-containing compounds have also shown promise in cancer therapy, influencing the expression of genes involved in hormone synthesis and metabolism, thus presenting potential applications in treating hormone-related cancers (Liu P et al., 2025). Furthermore, the unique properties of selenium nanoparticles, which exhibit significant antioxidative effects, indicate their therapeutic potential, particularly in modulating inflammatory responses that can disrupt hormone balance (Kumar S et al., 2025). The intricate interplay between selenium compounds and endocrine function underscores the necessity for further research in this domain, paving the way for innovative selenium-based therapeutics.

Understanding hormone synthesis in relation to selenium is crucial, given seleniums role as an essential trace element involved in various metabolic pathways, including thyroid hormone metabolism and the antioxidant defense system. As highlighted by the effects of selenium-containing drugs, their impact on hormone synthesis can provide insights into therapeutic applications for endocrine disorders and metabolic syndromes. Research has indicated that selenium facilitates the production of selenoproteins, which are integral for proper hormonal function by influencing redox processes within cells (Kumar S et al., 2025). Furthermore, the modulation of thyroid hormone activity by selenium suggests a direct relationship between selenium availability and hormone synthesis. Such interactions underscore the importance of studying seleniums multifaceted role in endocrine health, particularly as it relates to the development of interventions for diseases linked to hormone imbalances (Badalyan K et al., 2025). Selenium plays a crucial role in regulating steroid hormone synthesis, primarily through its involvement in selenoprotein production, which impacts various biochemical pathways akin to steroidogenesis. By mediating antioxidant defenses, selenium may influence the activity of steroidogenic enzymes responsible for synthesizing key hormones, including androgens and corticosteroids. This interplay underscores the significance of selenoproteins, which exert their biological functions through selenoproteins, which contain the amino acid selenocysteine "Selenium is an essential micronutrient in mammals, but is also recognized as toxic in excess. Selenium exerts its biological functions through selenoproteins, which contain the amino acid selenocysteine." (Selenium in Biology).

The interaction of selenium with hormone receptors is a critical facet of understanding how selenium-containing drugs influence hormone synthesis. Selenium, a vital trace element, is intricately linked to the functioning of the thyroid gland, where it acts as a cofactor for the three thyroid hormone deiodinases, which “activate and then deactivate various thyroid hormones and their metabolites” "Selenium also plays a role in the functioning of the thyroid gland. It participates as a cofactor for the three thyroid hormone deiodinases. These enzymes activate and then deactivate various thyroid hormones and their metabolites." (Selenium in Biology). This catalytic activity underscores seleniums role not only in hormone activation but also in signaling pathways that regulate numerous hormonal activities. The clinical applications of selenium-containing drugs have garnered considerable attention due to their multifaceted roles in hormone synthesis, particularly regarding thyroid function. Selenium is crucial for the production of selenoproteins, which are integral to the synthesis and metabolism of thyroid hormones, highlighting its significance in endocrine health. Research indicates that selenium supplementation can ameliorate thyroid dysfunction, particularly in autoimmune conditions such as Graves disease and Hashimotos thyroiditis, where selenoenzymes contribute to antioxidant defense and modulate immune responses (Liu P et al., 2025). Furthermore, selenium has demonstrated therapeutic efficacy in cancer treatment, displaying anticancer properties that may synergistically enhance hormone receptor interactions (Kumar S et al., 2025). This pharmacological potential underscores the importance of selenium in not only bolstering hormonal health but also in

extending the therapeutic repertoire for hormonal cancers. The biochemical pathways involved in seleniums action are further elucidated in , which emphasizes environmental influences on thyroid function and the relevance of selenium as a protective agent. Selenium plays a pivotal role in regulating reproductive hormone levels, serving as an essential micronutrient in reproductive health. Research indicates that both selenium deficiency and excess can significantly impact fertility, particularly in relation to sperm quality and hormonal balance. For instance, seleniums involvement in the synthesis of selenoproteins is crucial for the optimal functioning of the endocrine system, which directly influences hormone production and regulation. As noted, Abnormally high or low levels of dietary selenium can have an adverse effect on sperm quality, with a consequent lowering of fertility. This delicate balance underscores seleniums dual role as both a protective and regulatory agent in reproductive health. Moreover, the interplay between selenium intake and reproductive hormones highlights the need for further investigation into selenium-containing drugs to harness their therapeutic potential in addressing reproductive dysfunctions. The biochemical processes involved in selenium metabolism are detailed in , illustrating the intricate relationship between nutrient intake and hormone synthesis. Seleniums role in managing metabolic syndrome is increasingly recognized, particularly through its influence on hormone synthesis and antioxidant defense mechanisms. This trace element is vital for synthesizing selenoproteins, which play essential roles in regulating metabolic processes and inflammation. Research indicates that Selenium supplementation has been shown to improve insulin sensitivity and reduce markers of inflammation in individuals with metabolic syndrome. As metabolic syndrome is often characterized by insulin resistance, the antioxidant properties of selenium may help mitigate oxidative stress associated with metabolic dysregulation. Moreover, the bioavailability and absorption of organic forms of selenium, like selenomethionine, enhance its health benefits when incorporated into functional foods, as noted in recent studies (Shahidin et al., 2025). These findings underscore the potential of selenium-containing interventions to alter the metabolic landscape, making it a promising candidate for clinical applications targeting metabolic syndrome (Terracina S et al., 2025).

While selenium-containing drugs can provide benefits for hormone synthesis, they do carry potential risks and side effects that warrant careful consideration. High doses of selenium can lead to selenosis, characterized by symptoms such as gastrointestinal distress, hair loss, and nerve damage, demonstrating the fine line between therapeutic and toxic levels. Additionally, selenium has been implicated in disrupting thyroid hormone synthesis and exacerbating autoimmune thyroid conditions, as highlighted by evidence that excessive selenium intake may disturb the intricate balance required for proper hormonal function (Si D et al., 2025). Furthermore, the oxidative stress associated with selenium metabolism can negatively impact cellular processes, particularly in organs like the thyroid (Long Y et al., 2025). The relationship between selenium and various environmental pollutants underscores the need for an integrated approach in evaluating its supplementation. Thus, understanding these risks is crucial in leveraging selenium’s therapeutic potential while minimizing harm.

The relationship between selenium intake and hormone synthesis is complex, especially given the potential toxicity associated with excessive consumption of this essential micronutrient. While selenium plays a critical role in the synthesis of thyroid hormones and the function of selenoproteins, it is important to note that selenium is an essential micronutrient for animals, though it is toxic in large doses "Selenium is an essential micronutrient for animals, though it is toxic in large doses." (Selenium in biology). Exceeding the Tolerable Upper Intake Level of 400 micrograms per day can lead to selenosis, a condition characterized by gastrointestinal distress, hair loss, and neurological damage (Shahidin et al., 2025). Furthermore, environmental factors, including pollutants such as heavy metals, can exacerbate selenium toxicity by altering its metabolic pathways and interactions within the body. Overall, careful regulation of selenium intake is essential to harness its beneficial effects on hormone synthesis while mitigating the risk of toxicity.

Selenium deficiency has profound implications for hormone synthesis, particularly concerning thyroid hormones, which are critical for metabolic regulation and overall health. Low selenium levels can disrupt selenoprotein production, impairing enzymatic functions essential for deiodination processes that convert inactive thyroid hormone (T4) into its active form (T3) (Nahed F Fahmy et al., 2025). This deficiency not only reduces hormone synthesis but also exacerbates oxidative stress, leading to further thyroid dysfunction and contributing to conditions such as hypothyroidism (Kumar S et al., 2025). Additionally, seleniums role extends to supporting reproductive health, where deficiency can hinder the synthesis of estrogen and testosterone, impacting fertility (Tatiana M Motovilova et al., 2025). Given these multifaceted effects,

strategies to address selenium deficiency through supplementation or selenium-containing drugs are critical for improving hormone production and cellular function, ultimately enhancing overall hormonal balance and health (Liu P et al., 2025). The processes associated with seleniums influence on hormone synthesis are visually represented in related diagrams, such as, which outlines the metabolic pathways involved.

Selenium plays a crucial role in hormone synthesis, particularly in the production and regulation of thyroid hormones. Research indicates that selenium is integral to the activity of selenoproteins, which are essential for maintaining thyroid function and preventing oxidative stress in thyroid cells. Key findings suggest that a deficiency in selenium can impair the synthesis of thyroid hormones, leading to disorders such as hypothyroidism and autoimmune thyroiditis. Furthermore, seleniums interaction with thyroid-stimulating hormone (TSH) influences not only hormone production but also overall metabolic function, making its adequate intake vital for endocrine health. The image effectively illustrates the metabolic pathways related to selenium utilization in hormone synthesis, emphasizing the biochemical mechanisms through which selenium impacts thyroid function.

The exploration of selenium-containing drugs has significant implications for both future research and clinical practices, particularly in understanding hormone synthesis. Given the established role of selenium in enhancing selenoprotein production, which in turn influences hormone regulation, further investigations into dosage, form, and delivery mechanisms of selenium-based therapies are crucial . Clinical trials should aim to ascertain optimal selenium formulations that maximize therapeutic outcomes while minimizing potential toxicity. Moreover, insights into the metabolic pathways highlighted in the diagram of selenium metabolism and selenoprotein synthesis could pave the way for personalized medicine approaches, tailoring treatment based on individual metabolic profiles. Additionally, examining the interplay between selenium and environmental factors affecting thyroid health, as depicted in , may shed light on broader public health implications, indicating a necessary cross-disciplinary approach to mitigate risks associated with selenium deficiency (Malavolta M et al., 2018-11-13). Ultimately, integrating such findings could enhance the efficacy of hormonal therapies and offer new avenues for managing related disorders (Malavolta M et al., 2018-11-13).

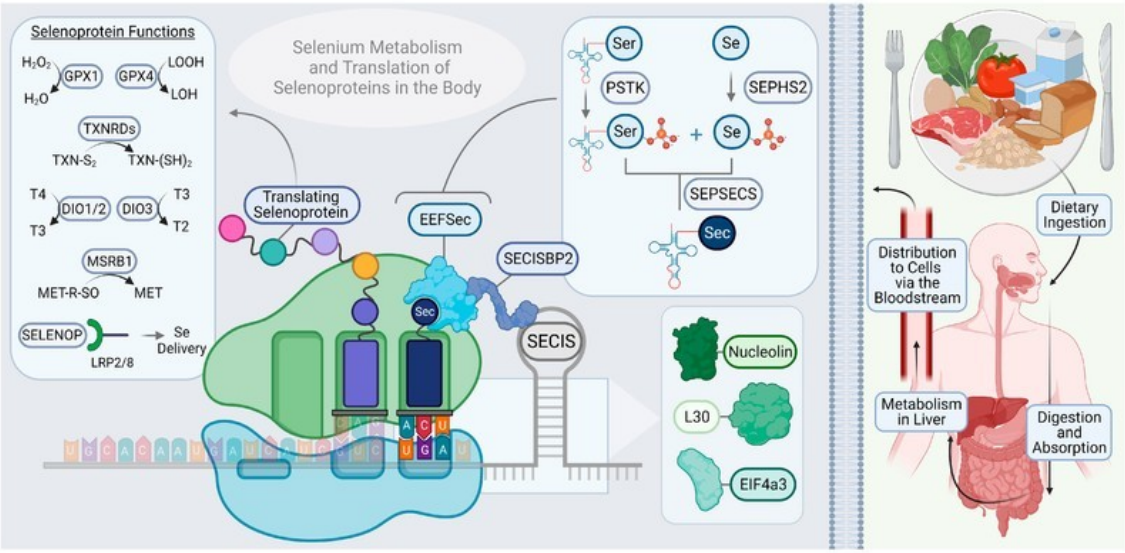

Image1. Selenium Metabolism and Selenoprotein Translation in the Human Body

In evaluating the balance of selenium use in medicine, it is essential to recognize both its therapeutic potential and the risks associated with excess intake. Selenium plays a critical role in hormone synthesis, particularly in thyroid function, where it supports the production of selenoproteins that are vital for antioxidant defense and metabolic regulation. However, the relationship between selenium supplementation and clinical outcomes remains complex. While low selenium status has been linked to various disorders, including thyroid dysfunction, excessive selenium can lead to toxicity and adverse health effects.

References

1. Ceema Varghese, B. Vijayalakshmi, Vergis Paul, JK Mukkadan, KC Thresiamma (2025) Serum Selenium Status in Autoimmune Thyroid Disorders: A Case-control Study. JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH. doi: https://www.semanticscholar.org/paper/63c914406ee47ad77f43d6672c0cf56f64ba7fad
2. Sanjeev Kumar, Naresh Kumar (2025) Synthesis, Characterization of Trinuclear Containing Se (II) Donar Group of Ni (II) Complexes. International Journal of Scientific Research in Science and Technology. doi: https://www.semanticscholar.org/paper/db85e0b4ee01bd9a19b00d8db3a37b2b28ae8b97
3. Juliana West, Maggie Li, Sabrina Wong, G. H. Le, K. Teopiz, Kyle Valentino, Christine E. Dri, et al. (2025) Are Glucagon-Like Peptide-1 (GLP-1) Receptor Agonists Central Nervous System (CNS) Penetrant: A Narrative Review.. Neurology and therapy. doi: https://www.semanticscholar.org/paper/c0a6d4f158902fd84ce0f7c0d4e31032b15877cb
4. Ali Tunç, Ilkin Muradov, C. Sulu, Mehmet Umut Çapar, P. Kadıoğlu (2025) P-47 A CASE OF SPONTANEOUS REMISSION AFTER METYRAPONE IN CUSHING'S DISEASE. Volume(3). JCEM Case Reports. doi: https://www.semanticscholar.org/paper/24f58bb1224dd5640f02acbfa0e2985a4b13baac
5. Peixin Liu, Xiaodong Liu, Zihao Wu, Kui Shen, Zhaofeng Li, Xiaowei Li, Qifeng Wu, et al. (2025) Size effect-based improved antioxidant activity of selenium nanoparticles regulating Anti-PI3K-mTOR and Ras-MEK pathways for treating spinal cord injury to avoid hormone shock-induced immunosuppression. Volume(23). Journal of Nanobiotechnology. doi: https://www.semanticscholar.org/paper/cb2566743f4ef1d71f5819fdce0eccae3c46d7ec
6. Sanjeev Kumar, Naresh Kumar (2025) Synthesis, Characterization of Trinuclear Containing Se (II) Donar Group of Ni (II) Complexes. International Journal of Scientific Research in Science and Technology. doi: https://www.semanticscholar.org/paper/db85e0b4ee01bd9a19b00d8db3a37b2b28ae8b97
7. Tatiana M. Motovilova, L. Z. Sirotina, Oksana I. Trifonova, Irina A. Kruglova, A.D. Varnavskaya, Kseniia V. Kazakova (2025) Non-hormonal therapies for vulvovaginal atrophy: Clinical cases. Gynecology. doi: https://www.semanticscholar.org/paper/f85570802f5657fad16f489b2097a0fd426577fe
8. Nahed F Fahmy, Marwa Mahmoud Abdel-Kareem, Heba A. Ahmed, M. Helmy, E. Mahmoud (2025) Evaluation of the antibacterial and antibiofilm effect of mycosynthesized silver and selenium nanoparticles and their synergistic effect with antibiotics on nosocomial bacteria. Volume(24). Microbial Cell Factories. doi: https://www.semanticscholar.org/paper/116648a137b50bad607dd1f5678161e4928d2e1b
9. Sanjeev Kumar, Naresh Kumar (2025) Synthesis, Characterization of Trinuclear Containing Se (II) Donar Group of Ni (II) Complexes. International Journal of Scientific Research in Science and Technology. doi: https://www.semanticscholar.org/paper/db85e0b4ee01bd9a19b00d8db3a37b2b28ae8b97
10. Xiaoqiong Li, Kejiang Wang, Jiaxin Liu, Yan Li (2025) A comprehensive analysis to reveal the underlying molecular mechanisms of natural killer cell in thyroid carcinoma based on single-cell RNA sequencing data. Volume(16). Discover Oncology. doi: https://www.semanticscholar.org/paper/95cb359c4c88006db65f7331e3683593b8475237