



TOPIC: EFFECTS OF VARIOUS FACTORS ON THE ORGANISM DURING THE LACTATION PERIOD AND ITS ADAPTIVE CAPACITIES

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Abstract. During the lactation period, a woman's body is significantly influenced by nutrition, stress, environmental factors, hormonal changes, as well as other external and internal influences. In this period, the body faces increased energy demand, milk synthesis, and metabolic load. This article analyzes the effects of various factors on the maternal organism during lactation, milk production processes, hormonal and metabolic adaptations, as well as the body's adaptive capabilities. The results of the study show that positive factors (balanced nutrition, stress management, and favorable environmental conditions) support lactation and strengthen the health of both mother and child. Negative factors, on the other hand, may reduce the quantity and quality of breast milk and lead to fatigue and metabolic disorders in the maternal organism. The body's adaptive mechanisms (metabolic reorganization, hormonal regulation, and immune response) help it adjust to high physiological demands.

Keywords: lactation period, breastfeeding, maternal organism, adaptive capacity, metabolic adaptation, hormonal influence.

Introduction. The lactation period is a unique and complex physiological stage in a woman's life, which represents not only a continuation of reproductive function but also a phase characterized by deep integration and adaptive processes among multiple body systems. During this period, the maternal organism mobilizes its morphological, physiological, and biochemical resources to ensure the nutrition, growth, and development of the newborn. Therefore, lactation is considered a biologically high-energy-demanding process with complex regulatory mechanisms. In the postpartum period, significant hormonal changes occur in the female body. In particular, the hormone prolactin stimulates milk synthesis, while oxytocin is responsible for the milk ejection reflex. A decrease in estrogen and progesterone levels creates favorable conditions for the initiation of lactation. This hormonal restructuring is regulated by the hypothalamic-pituitary system and is closely connected with the central nervous system. As a result, not only the activity of the mammary glands changes, but also the overall metabolism, water-salt balance, immune response, and even the psycho-emotional state of the woman.

During lactation, energy metabolism is significantly redirected. The maternal organism actively utilizes fat reserves to meet energy demands, leading to changes in body composition. At the same time, protein synthesis and the metabolism of vitamins and minerals are intensified, as they are essential for ensuring the adequate quantity and quality of breast milk. The immune system also becomes more active, contributing to the protection of both mother and child. In addition, behavioral changes are observed during lactation, including an increased protective and caregiving instinct toward the infant, which is an evolutionarily developed adaptive mechanism.

In modern conditions, the range of factors affecting the maternal organism during lactation has significantly expanded. Improper and unbalanced nutrition, physical inactivity or excessive physical load, chronic psycho-emotional stress, environmental pollution (including harmful



substances and heavy metals in the atmosphere), socio-economic difficulties, and late reproductive age childbirth all directly or indirectly influence the lactation process. Furthermore, certain somatic and endocrine diseases may limit the adaptive capacity of the maternal organism. Under such conditions, the adaptive capacity of the organism - its ability to adjust to external and internal influences - becomes particularly important. Through adaptive mechanisms, the body optimizes energy expenditure, maintains homeostasis, adjusts milk composition to the infant's age and needs, and strives to protect maternal health at the maximum level. These processes occur through the coordinated interaction of neuro-hormonal, metabolic, and immune mechanisms. However, adaptive capacity is not unlimited. Prolonged or intense exposure to negative factors may disrupt compensatory mechanisms of the body. This can lead to conditions such as hypogalactia (insufficient milk production), chronic fatigue syndrome, metabolic disorders, rapid changes in body weight, decreased immunity, and postpartum depression. As a result, not only maternal health but also the optimal nutrition and development of the infant may be compromised.

In this regard, a comprehensive study of factors affecting the maternal organism during lactation and a detailed analysis of adaptive mechanisms are of both scientific and practical importance. The aim of this article is to systematically investigate the effects of various biological, social, and environmental factors on the maternal organism during lactation, to determine its adaptive capacities, and to develop scientifically based preventive and practical recommendations. The results of this study may contribute to improving breastfeeding support strategies within healthcare systems, pediatric practice, and social policy frameworks.

Literature Review. Scientific studies devoted to the physiology of the lactation period and the organism's adaptive mechanisms have significantly expanded over the past decades, contributing to a deeper understanding of the multifaceted biological nature of this process. Research conducted by both international and local scientists has explored various aspects of lactation, including hormonal regulation, metabolic adaptation, immunological adjustments, and psycho-emotional factors. Classical studies on the physiological basis of lactation, such as those by Sauer (1987) and other authors, have provided detailed analyses of the neuro-hormonal mechanisms regulating mammary gland activity. According to their findings, a sharp decrease in progesterone levels following placental expulsion after childbirth activates the lactogenic effect of prolactin, which stimulates milk synthesis. Oxytocin, in turn, regulates the milk ejection reflex, ensuring the efficiency of lactation. These processes are controlled by the hypothalamic-pituitary system and are closely connected with the central nervous system.

Neville and colleagues (2001) further classified lactogenesis into two main stages—lactogenesis I (preparation of the mammary glands during pregnancy) and lactogenesis II (onset of active milk production after childbirth)—and provided molecular and physiological explanations for these stages. This classification remains one of the key theoretical foundations of modern lactation physiology. Metabolic adaptation has become a central focus of contemporary research. Studies by Anhê et al. (2022) have demonstrated that during lactation, the maternal organism undergoes a significant reorganization of energy metabolism, including active mobilization of adipose tissue and increased hepatic gluconeogenesis. These adaptations ensure the supply of energy and substrates necessary for milk synthesis and contribute to the physiological normalization of body weight in the postpartum period. Additionally, changes in



insulin sensitivity and lipid metabolism are recognized as important components of lactational metabolic adaptation.

The influence of psycho-emotional factors and stress on lactation has also been widely investigated. Lee et al. (2016) showed that chronic stress leads to a reduction in prolactin secretion and suppression of the oxytocin reflex, thereby impairing milk production. At the same time, breastfeeding itself has been shown to reduce cortisol levels through the action of prolactin and oxytocin, functioning as a natural “anti-stress” mechanism. In the international literature, a broader range of factors affecting lactation has been highlighted. Studies by Golan et al. (2020) and Hasiec et al. (2018) have identified genetic factors, dietary composition, and environmental conditions as significant determinants of both the quantity and quality of breast milk. In particular, the concept of “maternal energy metabolism adaptation” is increasingly recognized as an important direction in modern biomedical research. In Central Asia and Uzbekistan, research has mainly focused on practical and clinical aspects of breastfeeding, emphasizing its medical and pediatric significance. Materials from the Ministry of Health of Uzbekistan (2024) highlight the benefits of breastfeeding for maternal health, including improved stress resistance, normalization of metabolic processes, and the natural contraceptive effect. However, there is still a lack of comprehensive local studies addressing the adaptive capacity of the maternal organism in the context of environmental factors, urbanization, and social stress.

Overall, the literature review indicates that while individual aspects of lactation have been sufficiently studied, the complex and interrelated effects of various factors—especially considering regional characteristics—remain insufficiently explored. Addressing this scientific gap is one of the main objectives of the present study.

Results and Discussion. A comprehensive analysis of the maternal organism’s responses to various factors during the lactation period and its adaptive capacities allows for the formulation of several important scientific conclusions. This period should not be regarded as a simple physiological state, but rather as a highly integrated stage of systemic adaptation in the human body. Firstly, metabolic adaptation is one of the key and most effective mechanisms of the lactation period. To meet the high energy demands of milk production, the maternal organism actively mobilizes fat reserves, enhances gluconeogenesis, and prioritizes energy distribution toward lactation processes. Under optimal nutritional conditions, this mechanism contributes to the physiological restoration of body weight. However, in cases of insufficient or unbalanced nutrition, adaptive capacity becomes limited, catabolic processes dominate, and this may lead to a decline in milk quality as well as deterioration of the mother’s general health status. Secondly, hormonal regulation represents a highly delicate and balanced system. The optimal secretion of prolactin and oxytocin ensures successful lactation. At the same time, these hormones directly influence the psycho-emotional state of the mother. Chronic stress, sleep deprivation, and psychological pressure may disrupt the functioning of the hypothalamic-pituitary system, resulting in impaired lactation. Nevertheless, breastfeeding itself acts as a natural neuroendocrine stress-reducing mechanism, which represents one of its important beneficial effects.

Thirdly, environmental and external factors are becoming increasingly significant in modern conditions. Air pollution, heavy metals, and other toxic substances may enter the maternal organism and, to some extent, pass into breast milk. Although detoxification systems and immune adaptations partially compensate for these effects, their capacity is limited. This issue is



particularly relevant in highly urbanized areas where environmental burden continues to increase. Fourthly, social and lifestyle factors also significantly influence adaptive processes. In the context of Uzbekistan, a diet dominated by carbohydrates with insufficient intake of proteins and micronutrients, as well as the high household workload placed on women, may hinder recovery and adaptation processes. This, in turn, directly affects the efficiency of lactation. The obtained scientific data indicate that the lactation period should be viewed not only as a stage of infant nutrition, but also as a large-scale physiological “reorganization” of the maternal organism. Successful lactation not only ensures optimal infant development but also has long-term positive effects on maternal health, including a reduced risk of cardiovascular diseases, type 2 diabetes, and certain oncological conditions. At the same time, adaptive mechanisms are not unlimited, and negative factors of modern lifestyle can significantly weaken them. Chronic stress, improper nutrition, low or excessive physical activity, and environmental problems contribute to the development of hypogalactia, chronic fatigue syndrome, and postpartum depression in many lactating women. These conditions arise when the organism’s adaptive capacity is not adequately supported.

Although the adaptive capacity of the maternal organism during lactation is high, it requires effective management and support. Balanced nutrition, psychological support, a healthy lifestyle, and environmental safety can significantly improve the health outcomes of both mother and child. Therefore, the development of national and regional recommendations in this field remains an important scientific and practical task.

Conclusion. In conclusion, the lactation period is a unique biological stage in a woman’s life characterized by highly coordinated, complex physiological and metabolic adaptations. During this period, the maternal organism activates extensive adaptive mechanisms to ensure milk synthesis, reorganize energy metabolism, and maintain hormonal balance. As a result, almost all body systems—including the endocrine, metabolic, immune, and nervous systems—function as an integrated physiological unit. The analysis shows that lactation efficiency is a multifactorial process directly influenced by key determinants such as nutritional status, psycho-emotional state, environmental conditions, and hormonal balance. A balanced and adequate diet, a stable psychological environment, and a healthy lifestyle support the adaptive capacity of the organism, optimize milk production, and contribute to the improvement of both maternal and child health. At the same time, modern lifestyle-related negative factors—chronic stress, improper or unbalanced nutrition, increased environmental burden, and social pressure—place excessive strain on adaptive mechanisms. Under such conditions, the disruption of regulatory systems may lead to the development of hypogalactia, metabolic disorders, chronic fatigue syndrome, and postpartum depression. These conditions negatively affect not only maternal health but also the optimal nutrition and development of the infant. The results of this study confirm that the adaptive capacity of the organism is realized through the coordinated interaction of metabolic reorganization, hormonal regulation, and immune response mechanisms. However, these capacities are limited, and prolonged exposure to adverse factors reduces their efficiency, leading to compensatory failure. Therefore, a preventive approach in managing the lactation period is of particular importance. An effective approach to supporting lactation requires a comprehensive strategy that includes rational nutrition, psychological support, optimal physical activity, and ensuring hygienic and environmental safety. Scientifically based recommendations developed on this basis are essential not only for protecting maternal health but also for ensuring the development of a healthy generation.



The findings of this study contribute to a deeper understanding of the physiology of lactation and adaptive mechanisms and may serve as a scientific basis for improving breastfeeding support strategies within healthcare systems.

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