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The Effect of Hypokinesia on the Reproductive Outcomes of Pregnant Rabbits and the Biometric Parameters of Their Offspring

Abstract

The effect of hypokinesia on blood parameters during various stages of pregnancy in pregnant rabbits was investigated. Hypokinesia acts as an adverse extreme factor negatively affecting the course and outcome of pregnancy in pregnant rabbits, leading to resorption of the fertilized egg or embryo, as well as the birth of offspring with reduced viability and miscarriage. Pregnant rabbits subjected to hypokinesia during different prenatal developmental stages (embryonic, fetal, and late fetal periods) experienced stress conditions that impacted the blood parameters, body weight, and survival rates of their offspring. Hypokinesia during pregnancy results in fetal developmental delay and causes a 47% reduction in reproductive capacity when imposed during the embryonic stage. Movement restriction negatively influences the quality of life of both the mother and the fetus, weakening oxygen transport systems and potentially impairing placental blood circulation. Therefore, investigating prenatal hypokinesia is highly relevant. The main objective of this study is to examine the reproductive capacity and dynamic changes in biometric indicators before and after hypokinesia exposure in both intact and hypokinesia-exposed pregnant rabbits at various prenatal developmental stages.

Keywords: *ontogenesis, hypokinesia, reproduction, biometric indicators*

Introduction

Restriction of physical activity leads to morphofunctional alterations in vital systems and affects cellular genetics (Zaripova et al., 2014). In the 20th century, among various ecological factors emerging due to scientific and technological progress, reduced physical activity in humans — *hypokinesia* — and muscle function weakening — *hypodynamia* — have become prominent. Their negative effects manifest throughout all stages of ontogenesis, including the embryonic development period (Kovalenko & Gurovski, 1980; Shchedrina, 1989).

Evidence in the literature indicates that hypokinesia, particularly when prolonged, manifests in the functioning of the central nervous system as well as in the mechanisms involved in the formation and regulation of its fundamental processes (Mahmudova, 2018). Studying the impact of limited physical activity (*hypokinesia*) on the organism remains a pressing issue in physiology. Movement restriction induces morphofunctional changes in vital systems and affects the genetic apparatus of cells (Dolganova, 2008; Kozlovskaya, 2003; Tkachenko, 2011).

The most pronounced changes during hypokinesia occur in the musculoskeletal system, with restricted muscle activity being a key feature of hypokinetic syndrome. Research shows that 15 days of hypokinesia in mice reduces motor activity by 66.7%, 30 days by 78.9%, and 45 days by 91.4%.

Research

Hypokinesia during pregnancy disrupts mother–fetus interactions, resulting in changes in the number and survival dynamics of the offspring. Although predicting the future child's health is challenging, it is possible to prevent negative influences of some external and internal factors on the developing fetus and mitigate their consequences (Shirochenko, 2003).

Long-term studies conducted under the supervision of A. G. Gaziyev in the "Environmental Factors and Development of Analyzers" Laboratory at the Institute of Physiology named after academician A. Garayev have shown that the impact of factors such as chronic hypoxia, hypokinesia,

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and electromagnetic radiation during critical periods of embryonic development leads to significant developmental delays and increased mortality rates among newborn rats.

The findings of this study can be used for direct and indirect analysis of functional changes in the brain of offspring born to mothers exposed to hypokinesia during pregnancy, especially during later postnatal developmental stages. Given that prolonged maternal hypokinesia during gestation can affect the formation of fetal or embryonic brain structures and its effects may persist postnatally, these factors must be considered in the study of the neurophysiological and neurobiochemical aspects of hypokinesia.

The results obtained are of considerable clinical and biomedical importance in analyzing functional changes arising from prolonged limited movement conditions in sedentary pregnant women and their offspring.

Materials and Methods

Experiments were conducted using pregnant rabbits of the *Chinchilla* breed, newborn kits, and 30-day-old kits. The effects of hypokinesia on the biometric parameters of newborn and 30-day-old kits, as well as on the reproductive capacity of pregnant rabbits and the survival rate of offspring, were studied. For each stage of pregnancy, 8–10 female rabbits were used.

The gestation period for rabbits lasts 28–30 days. Adult rabbits measure 43–58 cm in length and weigh between 950 and 1350 grams. Animals were kept in dry, heated rooms with good natural and artificial lighting. Male and female rabbits were housed separately during pregnancy.

All pregnant rabbits were divided into two groups: control and experimental. The control group was maintained under normal vivarium conditions, while the experimental group was subjected to hypokinesia at different stages of pregnancy. To create hypokinesia conditions, specially sized cages were designed to allow the pregnant rabbits to sit only, restricting movement.

According to E. A. Kovalenko and N. N. Gurovski (1980), one of the methods to induce hypokinesia in experimental studies is housing small animals in spatially and volumetrically reduced cages. Blood samples (1–1.5 ml) were collected from the ear veins of pregnant rabbits in both control and experimental groups for analysis. This procedure is considered non-invasive and minimally traumatic, complying with bioethical standards.

All experiments were conducted in accordance with the European Union International Convention (November 13, 1987, Strasbourg) and animal welfare principles.

Conclusion

In the initial phase of the study, reproductive capacity was assessed in control and experimental groups exposed to prenatal hypokinesia at all three stages of pregnancy. In the control group, one rabbit produced an average of 7–8 offspring, with 67 kits born from 10 rabbits, of which 3 died. In contrast, hypokinetic rabbits produced an average of 4–5 kits each. During the embryonic stage, 10 rabbits were mated, 7 gave birth, yielding 32 kits, with 11 mortalities. This indicates a 47% reduction in reproductive capacity due to hypokinesia during the embryonic stage. During the fetal and late fetal stages, 7–8 rabbits out of 10 gave birth, producing 49 kits with 13 mortalities and 52 kits with 7 mortalities, respectively. Body weights of newborn kits were as follows: control group — 67 ± 9.544 g; kits born to mothers subjected to hypokinesia during the embryonic stage — 49.8 ± 2.867 g; fetal stage — 51.6 ± 4.05 g; late fetal stage — 46.2 ± 3.19 g. For 30-day-old kits, weights were: control — 651.2 ± 40 g; embryonic stage hypokinesia — 421.6 ± 76.0 g; fetal stage — 527.8 ± 81 g; late fetal stage — 302.4 ± 30 g

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Table 1. Biometric parameters of newborn and 30-day-old rabbits under conditions of hypokinesia during various periods of prenatal development.

№	Kontrol (gr)	Embrionic period (gr)	Pre-fetal period (gr)	Fetal period (gr)
New born	67±9,544	49,8±2,867	51,6±4,05	46,2±3,19
30 days	651,2±40,0	421,6±76,0	527,8±81,6	302,4±30,0

Discussion of Results

The changes in hemoglobin and platelet counts during various stages of pregnancy caused by the influence of the *hypokinesia* factor exert a negative impact on pregnancy and its progression. These alterations contribute to the disruption of reproductive functions (Hamidova, 2025).

Based on the obtained results, it can be concluded that the number of offspring significantly decreased during the early stages of pregnancy (E0–E10, embryonic period) in pregnant rabbits exposed to *hypokinesia*. The overall data from the experimental groups demonstrated a 47% reduction in offspring number compared to the control groups.

Specifically, the several-fold increase in platelet count during this period adversely affects the course of pregnancy, leading to resorption of the fertilized egg or embryo and the birth of offspring with reduced viability. Additionally, the research revealed that among the critical periods of pregnancy, the fetal period (E10–E20) is the most resilient to the destructive effects of the *hypokinesia* factor. During this stage, significant changes in hemoglobin and platelet levels were not observed.

Regarding the changes occurring during the late fetal period, an increase in platelet count may raise the risk of infarction and stroke in the heart and cerebral vessels.

Based on our study, it can be asserted that *hypokinesia* negatively influences the reproductive capacity of pregnant rabbits. Evidence from previous studies investigating the effects of prenatal *hypokinesia* demonstrated significant deviations in physiological indicators of the newborn offspring as a consequence of maternal *hypokinesia* during pregnancy (Ağayeva, 2019).

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