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# Effects of hypokinesia and radiation on body weight

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***Abstract*---**It has been morphologically proven that the enzymes of the digestive glands are incorporated into the blood from acinocytes through the basolateral membrane. The ratio of these mechanisms depends on the functional state of the digestive glands and small intestine, the permeability of their histohematological barrier, the pressure in the excretory tract, and the level of their blood supply. The aim of the study was to study the effects of limited mobility and radiation on the body weight of animals of different ages in the experiment.

***Keywords*---**Atsinocyte, rat, incretion, hydrolytic enzymes, radiation.

## Introduction

It has been morphologically proven that digestive gland enzymes are incorporated into the blood from acinocytes through the basolateral membrane (Permyakov, Podolsky, Titova, 1973). The transport of hydrolytic enzymes and their zymogens into the blood is carried out by several mechanisms: incretion from the small intestinal cavity, degraded acinocytes, glandular secretory pathways, and


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acinocytes. The ratio of these mechanisms depends on the functional state of the digestive glands and small intestine, the permeability of their histohematological barrier, the magnitude of the pressure in the excretory tract, the level of their blood supply (Korotko, 2011). The aim of the study was to study the effects of limited mobility and radiation on the body weight of animals of different ages in the experiment. Our results are reflected in Tables 1.1-1.9.

**Materials and Methods**

Table 1.1 below shows the effect of persistence of hypokinesia on body weight of young rats. Our results showed that no changes in body weight were observed after 1 day in the control group rats. After 3 days, it was found that the absolute number of control groups increased by 18% compared to the initial state, while no change in weight was observed. In the following days, it was found that the weight of control group rats increased by up to 20% compared to the initial condition at 60 days of age. In experimental animals, however, this indicator, i.e. body weight, remained the same at the beginning and end of the experiment. From these results, it can be concluded that, first, as a result of limited movement as a stressor, they had a negative impact on the growth of the animals in the experiment, and they stopped growing. Second, hypokinesia results in increased proteolysis enzymes in skeletal muscle and skeletal muscle atrophy as a result of increased activity of proteolytic enzymes such as calpain and proteosomes in the muscles.

Table 1.1
Effect of duration of hypokinesia on body weight of young rats (M ± m)

| Observation days | Control group | Experimental group | D difference | t according to the standard Student | t is the actual result | P reliability level |
|---|---|---|---|---|---|---|
| 1- day | 94 ±4 | 104 ±5 | 10 | 2.23 | 1.56 | - |
| 3- day | 105 ±6 | 97 ±5 | 8 | 2.23 | 1.02 | - |
| 10- day | 112 ±5 | 93.3 ±3 | 18.7 | 2.23 | 3.2 | 0.01 |
| 20- day | 111 ±4 | 96 ±6 | 15 | 2.23 | 2.08 | - |
| 30- day | 106 ±4 | 88 ±4 | 18 | 3.17 | 3.18 | 0.01 |
| 60- day | 110 ±5 | 87±4 | 23 | 3.17 | 3.59 | 0.01 |

Note: Dehydration also occurs in the body under the influence of hypokinesia. This means that with the increase in the duration of the experiment, the change in body weight due to muscle atrophy and dehydration caused by hypokinesia is not noticeable, that is, the growth and development of experimental rats lags far behind those in the control group. In this table *P<0,05; **P<0,01; n=6.

In our subsequent experiments, the effect of hypokinesia on body weight in mature rats was studied (Table 1.2). The results showed that the change in body weight of the rats in the mature control group was similar to that of the young, but slightly different. Weight gain in the control rats of the mature rats was significant from day 20 onwards. In the 20- to 60-day period, the control group rats were found to have gained 13–14% weight gain compared to the baseline condition (Table 1.2).

The experimental group reported a significant decrease in body weight in rats at 20 days of hypokinesia relative to the initial state, and at other intervals, the experimental rats' body weight remained unchanged in the initial state. The results obtained in older rats were markedly different from those in young and mature rats. In older control group rats, as in mature rats, body weight gain was observed from day 20 onwards.

Table 1.2
Effect of hypokinesia duration on body weight of mature rats (M ± m)

| Observation days | Control group | Experimental group | D difference | t according to the standard Student | t is the actual result | P reliability level |
|---|---|---|---|---|---|---|
| 1-day | 197±4 | 189 ±6 | 8 | 4.59 | 1.1 | - |
| 3- day | 160 ±6 | 150 ±5 | 10 | 2.23 | 1.28 | - |
| 10- day | 176 ±5 | 185 ±5 | -9 | 2.23 | 1.27 | - |
| 20- day | 181 ±6 | 171 ±6 | 10 | 2.23 | 1.17 | - |
| 30- day | 196 ±6 | 174 ±4 | 22 | 2.23 | 3.05 | 0.05 |
| 60- day | 201 ±5 | 184 ±5 | 17 | 2.23 | 2.40 | 0.05 |

Note: Hence, the longer the hypokinesia persists, the more the growth and development of the experimental mature rats lag behind those of the control group. In this table *P<0,05; **P<0,01; n=6.

Depending on the duration of the follow-up period, body weight was found to increase by 7–11% compared to the initial condition (Table 1.3). In the elderly rats in the experimental group, body weight was found to be reduced by 10–20% from day 3 to day 30 of hypokinesia. In the 60-day hypokinesia alone (Table 1.3), body weight remained at baseline, but was found to be significantly behind in growth and development compared to the control group.

Under the influence of weightlessness and hypokinesia, a new "metabolic stereotype" is formed in animals (rabbits, rats) - energy exchange changes from "carbohydrate" to "fat" (Smirnov, 1990), liposynthesis increases, fat stores and tissue triglycerides decrease, fats are used as the main energy source. The body's antioxidant system is weakened. Such changes are observed not only in hypokinesia and weightlessness, but in all stressful situations. In addition, the activity of tissue enzymes and hormones in protein metabolism also changes. Negative nitrogen balance is observed (Kovalenko, Gurovsky, 1980). Tissue protein synthesis decreases, their breakdown increases, and as a result, internal organs and muscle mass decrease.

Table 1.3
Effect of hypokinesia duration on body weight in elderly rats (M ± m)

| Observation days | Control group | Experience Group | D difference | t according to the | t is the actual | P reliability level |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | standard Student | result | |
| 1-day | 94 ±4 | 104 ±5 | 10 | 2.23 | 1.56 | - |
| 3- day | 105 ±6 | 97 ±5 | 8 | 2.23 | 1.02 | - |
| 10- day | 112 ±5 | 93.3 ±3 | 18.7 | 2.23 | 3.2 | 0.01 |
| 20- day | 111 ±4 | 96 ±6 | 15 | 2.23 | 2.08 | - |
| 30- day | 106 ±4 | 88 ±4 | 18 | 3.17 | 3.18 | 0.01 |
| 60- day | 110 ±5 | 87±4 | 23 | 3.17 | 3.59 | 0.01 |

Note: In older animals, atrophy caused by hypokinesia resulted in a decrease in body weight even more than before, as their growth and developmental intensity was much lower. In this table *P<0,05; **P<0,01; n=6.

**Results and Discussions**

Our results confirm these cited literature data and determine that these changes are related to the age of the animals in the experiment. Due to the high intensity of growth and development in young and mature animals, the weight of the animals remained in the initial state under the influence of hypokinesia.

**Effects of radiation on body weight in rats of different ages**

In the experiments, rats of different ages were irradiated with gamma at a dose of 4 Gr relative to body weight once in an unrestricted range of motion, and after a certain period of time, their weight was compared with baseline and control group performance.

Table 1.4
Effect of radiation on body weight of young rats (M ± m)

| Observation days | Control group | Experience Group | D difference | t according to the standard Student | t is the actual result | P reliability level |
|---|---|---|---|---|---|---|
| 1-day | 96 ±4 | 103 ±5 | -7 | 2.23 | 1.09 | - |
| 3- day | 117 ±5 | 94 ±3 | 23 | 3.17 | 3.96 | 0.01 |
| 10- day | 117 ±5 | 94 ±3 | 23 | 3.17 | 3.96 | 0.01 |
| 20- day | 119 ±4 | 96 ±6 | 23 | 3.17 | 3.96 | 0.01 |
| 30- day | 120 ±4 | 90 ±4 | 30 | 3.17 | 3.75 | 0.01 |
| 60- day | 120 ±5 | 88±4 | 32 | 4.59 | 6.98 | 0.001 |

Note: The effect of radiation on the weight of young rats was reflected. In the control group, rat weight was observed to increase in percentage from day 3 onwards. The control group rat weight increased by 19% on day 3 of the experiment, 32% on day 20, 33% on day 30, and 30% on day 60 compared to the first day. In this table *P<0,05; **P<0,01; n=6.

In experimental, i.e., irradiated rats, weight remained the same throughout our observations. This means that irradiation has a negative effect on the growth and development of rats. In irradiated rats, body weight remained unchanged from the initial state, i.e., the growth and development of the organism was stopped, because the active radicals formed in the organism under the influence of radiation disrupt enzymatic processes and decrease macroergic compounds in the cell. Radiation disruption of cell division as a result of radiation depends on the radiation dose, mitosis is temporarily stopped at small doses of radiation, and completely stopped at large doses.

Table 1.5
Effect of radiation on body weight of mature rats (M ± m)

| Кузатув кунлари | Control group | Experience Group | D difference | t according to the standard Student | t is the actual result | P reliability level |
|---|---|---|---|---|---|---|
| 1-day | 187 ±4 | 179 ±3 | 8 | 2.23 | 0.81 | - |
| 3- day | 199 ±5 | 176 ±7 | 23 | 2.23 | 3.02 | 0.05 |
| 10- day | 210 ±5 | 199 ±9 | 11 | 2.23 | 1.06 | - |
| 20- day | 219 ±6 | 203 ±8 | 16 | 2.23 | 1.6 | - |
| 30- day | 206 ±6 | 181 ±9 | 25 | 2.23 | 2.31 | 0.05 |
| 60- day | 204±5 | 165±7 | 39 | 3.17 | 4.53 | 0.01 |

Note: Our results in mature rats showed that control group rats gained weight reliably from 20 days of age. They found that their weight increased by 9% at 20 days, 13% at 30 days, and 15% at 60 days as the observation period increased. In this table *P<0,05; **P<0,01; n=6.

Table 1.6
Effects of radiation on body weight in elderly rats (M ± m)

| Observation days | Control group | Experience Group | D difference | t according to the standard Student | t is the actual result | P reliability level |
|---|---|---|---|---|---|---|
| 1-day | 266±6 | 281±7 | -15 | 2.23 | 1.63 | - |
| 3- day | 281±6 | 256±7 | 25 | 2.23 | 2.71 | 0.05 |
| 10- day | 293±6 | 246±9 | 47 | 3.17 | 4.35 | 0.01 |
| 20- day | 309 ±6 | 240± 8 | 69 | 4.59 | 6.9 | 0.001 |
| 30- day | 285±5 | 209±5 | 76 | 4.59 | 10.74 | 0.001 |
| 60- day | 284±6 | 240±6 | 81 | 4.59 | 9.55 | 0.001 |

Note: Our results in older rats showed that in the control group, their weight increased by 7% after 20 days, by 11% at 30 days, and by 9% at 60 days. After irradiation, older rats lost weight by 10% at 3 days, 16% at 10 days, 17% at 20 days, 20% at 30 days, and 19% at 60 days compared to the first day. In this table *P<0,05; **P<0,01; n=6.

## Conclusion

Radiation γ-radiation has led to the development of the pathogenesis of atherosclerosis, tumors, asthma, arthritis, diseases of the cardiovascular system and diseases associated with the structure and function of hepatocytes by increasing the formation of active forms of oxygen (free radicals) in the tissue cells of biological organisms. Studies have shown an increase in the concentration of LPO products in the tissues of various organs of rats under the influence of γ-radiation using a gamma device "Teragam" (So60) (Czech Republic), a sharp change in the activity of some enzymes.

Simultaneously, under the combined influence of two stressors, namely radiation and hypokinesia, it was observed that young and mature rats stopped growth and development, i.e., their performance remained in the initial state at all times. In older rats, weight gain was found to be associated with a combination of these factors. The following conclusions can be drawn from our results:

1. The weight of rats increases due to growth and development depending on the duration of observation in the control group.
2. The growth and development of experimental rats will remain at their initial state as a result of the negative effects of hypokinesia and radiation, while in older rats it will be even lower.
3. The results obtained when the two stressors are combined in combination with hypokinesia and gamma radiation are similar to their separate effects, which means that their separate effects are sufficient to cause changes in the body.

Thus, while irradiation has a different effect on rats of different ages, while young and mature rats have stopped growing and developing, there has been a gradual weight loss after irradiation in older rats, which may be the result of dystrophic processes in their bodies.

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