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Some of the Morphological Indicators of Laboratory Rats after Administration of Microelement Preparation

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Abstract

The article deals with the investigation of the effect of Sedimin (Sediminum) preparation on bodyweight parameters and macro-morphological indicators of internal secretion and endoexocrine glands of male and female outbred rats under the conditions of subacute experiment. It is shown that at intramuscular administration of Sedimin to laboratory male rats at a dose of 0.25 ml per animal on the 1st and 5th day of the experiment does not cause significant changes in macromorphology of thymus, supramental capsules and seminal glands, while similar doses of preparation administrated to female rats significantly affected the studied parameters of thyroid gland and thymus.

Keywords: Laboratory Rats, Minor Constituents, Seminal Glands, Supramental Capsules, Thymus, Thyroid Gland

1. Introduction

Currently medical and veterinary practice is enriched by a variety of preparations for the correction of immune status, enhancement of growth and development and increasing productivity of animals[1–3]. A composition of applied preparations is often of chemical origin; therefore, the biological availability of constituent components is low, as well as the consequences of their introduction into the human body, when consuming animal products, are unpredictable[4,5].

One of the contemporary methods of increasing the efficiency of livestock production and improving its quality is preventive and curative use of preparations, comprising of components, which are easily digestible and environmentally non-harmful to humans and animals[6–8].

The Sedimin is an example of such inexpensive domestically produced preparation. Use of this preparation, according to the manufacturers, eliminates insufficiency of iron, iodine and selenium that causes white-muscle disease and degeneration of liver. The preparation normalizes metabolism, accelerates the growth and development of animals, increases body's resistance against various diseases and improves the general condition of animal.

The thyroid gland is an indispensable link in the endocrine system of the body[9,10]. In addition, to ensure its normal performance, thyroid gland needs the elements that are not always available in sufficient quantities from food. These include iodine, selenium and iron[11–14]. Sedimin is the preparation, which can comprehensively solve the problem of micronutrient deficiency.

The role of selenium in the body is still debated by specialists[15]. Nevertheless, it is believed that its deficiency reduces the immune response, while surplus of selenium manifests some toxic effects[15–17].

The study of biological preparations through the use of laboratory animals makes it possible to track macro- and micromorphological changes in tissues and organs and to get an idea about the mechanisms of their effects on the processes dynamics at the system, organ, cellular and

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subcellular levels that is very important when developing effective prevention methods, as well as preventing an overdosage of preparations when prescribing to productive animals, since the administration of the preparation to animal during even a short period can significantly affect the subsequent development of the organism[1–22].

The aim of the present research is to study the effect of the Sedimin preparation on bodyweight and macro-morphological indicators of the internal secretion and endoexocrine glands condition in laboratory rats at short-term administration of the preparation into the body.

2. Materials and Methods

The experiment was performed on 26 healthy outbred rats (13 males and 13 females). All animals were kept in standard conditions of vivarium. Feeding was carried out in accordance with the norms of feeding laboratory animals with free access to water (the order of Ministry of Health of the USSR No.163 dated 10.03.1966).

To investigate the effect of the preparation under study on bodyweight parameters and macro-morphological condition of the endocrine glands of rats, an experiment was conducted for a period of 2 weeks. Visual inspection of the pelage and skin status, visible mucous membranes and lymphatic glands was carried out on the 1st day of the experiment.

The studied Sedimin preparation (aqueous mixture of iodine and selenium compounds, produced in Pushchino, Russia, the certificate of state registration of drugs for animals No. PVR-2-3.6/01651) was injected intramuscularly to the rats of the 2 experimental group (5 male animals) in a dose of 0.25 ml per each animal on the 1st and 5th day of the experiment.

At the same time the male animals of the control group 1 (8 animals) were subjected to intramuscular injection of saline solution.

The studied preparation was injected at a dose of 0.25 ml to each experimental female rat (5 animals of experimental group 4) on the 1st and 5th day of the experiment. Female rats of the control group 3 (8 animals) were subjected to injection of saline solution in equivalent doses according to the same scheme.

To study the background morphological parameters, 3 male and 3 female rats were devitalized from each control group on the 1st day of the experiment. On the 14th day (the end of the experiment) all the animals were sacrificed.

On the 1st day of observation and at the end of the experiment, visual observation of the experimental animals was carried out, as well as their bodyweight parameters (weight, body length and tail length) were measured.

Animals were sacrificed by decapitation under ether anesthesia. Further, thyroid gland, thymus, supramental capsules and seminal glands were removed for subsequent studies: To determine their absolute mass and the weighting factor (the ratio between the organ's mass (mg) and the rat's total body mass).

Statistical analysis was performed using Microsoft Excel 2007 applied programs package. Verification of the hypothesis of normality of distribution was carried out using the criteria of. Verification of the hypothesis of equality of group means of all the quantitative characters was performed using non-parametric criterion of Wilcoxon-Mann-Whitney. Average values of indicators are presented as M±s (where M – is the mean value, s – is the standard deviation). Estimation of the statistical significance of differences between mean values was carried out at the critical level $p = 0.05$.

3. Results and Discussion

Weight of male rates at the beginning of the experiment was within the range from 149.96 to 187.67 g. At the time of sacrifice the male rats of the control group weighted 166.76±29.54 g, while the weight of the rats from the experimental group 2 was 172.91±3.21 g ($P>0.05$). Similar indicators for female rats were: 149.60–159.45; 159.29±2.69 and 156.89±2.13 g, respectively.

The body length of the control male rats over the observation period increased by an average of 0.90±1.34 cm, while of the control female rats – by 0.64±0.46 cm; in experimental male rats – by 1.30±0.50 and experimental female rats – by 0.76±0.28 cm ($P>0.05$).

At that, the length of the tail of both male and female rats during the observation period did not change significantly and ranged from 14.21±0.82 to 16.12±0.41 cm (males, $P>0.05$) and from 13.25±1.10 to 14.48±0.46 cm (females, $P>0.05$).

The visceras of rats from both the control and experimental groups had the structure corresponding to a normal anatomical condition. No inflammatory

and degenerative changes were found during the visual inspection. The muscle tissues were staining into brown color at the sites of injection of Sedimin preparation.

The absolute mass of the thyroid gland in male rats of the control group at the time of completion of the observations amounted to 22.20±1.90 mg. In animals of the group 2, subjected to injections of Sedimin preparation, this indicator was greater by 33.2% (P<0.05).

The absolute mass of thyroid gland in female rats of the group 4 at the time of completion of the observations was by 10.3% greater than that in the animals of the control group, and by 10.9 % greater than in male rats at a given period of observation (P<0.05).

At that, the values of the weighting factor of the studied organ in control male and female rats at the beginning of the experiment were 0.14±0.03 and 0.15±0.01 mg/g, respectively (P>0.05), while at the time of completion of observations, these indicators in male rats of intact group amounted to 22.20±1.90, while in animals of experimental group – 0.19±0.02 mg/g (P<0.05) and in female rats – 0.21±0.01 and 0.23±0.02 mg/g, respectively (P>0.05).

The increase in the absolute mass of the thymus in control male rats during the observation period was of 3.50±1.77 mg. At that, the absolute mass of the thymus gland in animals of the group 2 at the time of completion of the experiment was by 3.07% greater as compared with the animals of the control group (P>0.05). The weighting factor of the studied organ at the time of completion of observations in male rats of the control group amounted to 1.50±0.34 mg/g that is by 0.6% greater than in the experimental group 2 (P>0.05).

The absolute mass of the thymus in control female rats at the beginning of the experiment was 233.88±7.58 – 236.59±7.74 mg. At the time of completion of observations this indicator in animals of group 3 was by 6.4% greater as compared with the rats of group 4 (P<0.05). The weighting factor of the tested organ at the time of completion of observations in female rats of the control group was 1.60±0.09 mg/g, that is greater than in the rats of experimental group 3 by 5.1%.

Absolute mass of supramental capsules in control male rats at the beginning of the experiment was 35.34±1.71 mg, while by the end of the observation increased by 13.3% (P>0.05). The weight of the supramental capsules in animals of the group 2 at the time of completion of observations was 36.70±9.74 mg (P>0.05). It is noted that the weighting factor of the studied gland in male rats from the beginning of observations to their end increased insignificantly up to the values of 0.21±0.06 – 0.23±0.09 mg/g (P>0.05).

The weight of supramental capsules in female rats of the experimental group at the time of completion of observations was just 2.6% less than that in the control animals (P>0.05). The difference in the weighting factor of this organ was insignificant as well.

The absolute mass of both seminal glands in all tested animals during the observation period varied within the range of 2.10±0.13 – 2.62±0.20 g. At that, short-term administration of the Sedimin preparation did not have significant effect on the mass of seminal glands.

It was revealed that the weighting factor of the seminal glands during the observation period had no significant difference in the animals of various groups and varied within the range 13.5±1.2-13.9±4.7 – 15.4±3.3-15.8±0.5 mg/g (P>0.05).

4. Conclusion

When comparing male rats of the control group with the rats subjected to administration of Sedimin preparation, it was revealed that the overall pattern of changes in indicators of growth, the absolute mass and weighting factors of the studied internal secretion and endoexocrine glands testifies animal's response to the simulated animal welfare. It should be noted also, that intramuscular injection of Sedimin preparation to laboratory male rats at a dose of 0.25 ml on the 1st and 5th day of life under the conditions of subacute experiment did not cause significant changes in macro-morphology of thymus, supramental capsules and seminal glands, in contrast to the thyroid gland.

When comparing the effect of investigated preparation on male and female laboratory rats, it was revealed that the Sedimin preparation has the most significant effect on the weighting factors of the thyroid gland and thymus of female rats, as compared with male rats.

Thus, the obtained data indicate that thyroid gland and thymus are the organs, quickly reacting to the administration into the organism of minor constituents that is consistent with data obtained by other researchers[21].

At that, it should be noted that the absence of frank macro-morphological changes in body organs does not exclude changes at the cellular and subcellular levels, by virtue whereof our experiments will be continued for a more thorough analysis of structural changes in the studied glands.

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6. References

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