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Growth dynamics of the body weight index and anatomical parameters of the prostate of male rats during postnatal ontogenesis

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Abstract: The article is devoted to the development and growth of body weight and biometric indicators of the prostate of male rats during early and late postnatal ontogenesis. Based on the data obtained, the growth rates of body weight and organometric parameters of the rat prostate (mass, thickness, width, length) were established, the mass coefficient and the average daily weight gain were analyzed.

It has been reliably established that the change in body weight and weight of the prostate gland of male rats from the neonatal period to senile age is of a spasmodic nature. At the same time, the highest rate of body weight gain during the lactation period was detected on the 6th and 21st days of development. In the late postnatal period, the highest growth rate was noted in juvenile and young age. The greatest increase in prostate weight is observed in the interval from 3 to 9 months, the smallest - in individuals of 18 months of age.

The highest value of the average daily body weight gain was found in age groups throughout the suckling period, and then its decrease was noted up to senile age.

High indices of the organ mass coefficient were found in neonatal rat pups, and in the lactation period they are higher than in the age groups of late postnatal ontogenesis.

Keywords: rat prostate, postnatal ontogenesis, organometric parameters, mass coefficient

Introduction. Laboratory animals are the main biological link in the experiment system. The type of laboratory animals selected for conducting a biomedical scientific experiment, their anatomical and physiological features largely determine the actual results, and, consequently, the conclusions of the experimental work. In the process of conducting preclinical studies, when analyzing the data obtained, the main difficulty is the assessment of emerging shifts, their interpretation and comparison with the biological norm - the corresponding biometric indicators. It is this comparison that allows specialists to draw conclusions about the nature and degree of changes developing in the body under the influence of experimental conditions [1,3,7,8,11,14].

Since the mid-twentieth century, white rats have been in the first place in their use in experimental studies among laboratory animals [4,5,9,12,15].

An important point in conducting research is age, which is often determined by body weight. The change in body weight affects the physiological state of the body. Information about the body weight of white rats in postnatal ontogenesis is given in the works of a number of authors [2,6,10,13,16,17]. However, it should be noted that these data are contradictory and fragmentary. Most studies provide body weight indicators at a certain age of ontogenesis, and they do not show its growth and

development throughout postnatal ontogenesis. At the same time, in the literature available to us, we found no data concerning the development of organometric parameters of the prostate of rats during postnatal ontogenesis. All this determines the relevance of the study and provides for further studies.

The purpose of the study: To identify patterns of development and growth of body weight and organometric parameters of the prostate of rats during postnatal ontogenesis.

Material and methods of research:

The study was conducted on 161 white non-linear male rats from the newborn period to 18 months of age, the number of individuals in each age group ranged from 10 to 20. The animals were kept in a vivarium in compliance with a 12-hour lighting regime, with a standard diet and free access to water

Slaughtering of animals was carried out on 6,11,16,21 days, as well as by the end of 1, 3,6,9,12,18 months of life in the morning, on an empty stomach by means of instant decapitation under ether anesthesia. Before slaughter, the body weight of rats was measured. After opening the abdominal cavity, the prostate gland was immediately extracted in a wet state to avoid its drying out; mass, length, width, thickness were measured. The measurement of body weight of rats and prostate was carried out on electronic scales JW-1 (e = 0.02 g) by Acom Inc. (South Korea), length, width and thickness - with a millimeter tape. The calculation of mass coefficients was carried out according to the formula: MK = Organ mass (g) / body weight (g) x100%.

Mathematical processing was performed directly from the general Excel 7.0 data matrix using the capabilities of the STTGRAPH 5.1 program, the standard deviation and representativeness errors were determined.

Research results:

The study showed that newborn baby rats have a body weight ranging from 4.4 to 5.9 grams, an average of 5.16 ± 0.1 grams. On the 6th day of development, body weight varies from 10.0 to 11.9 grams, on average equal to 10.92 ± 0.12. Compared with the newborn period, this indicator increases by 1.1 times. The average daily body weight gain is 16.67%. In 11 day-old baby rats, the body weight ranges from 13.6 to 16.8 grams, on average equal to 14.54 ± 0.21 grams. The growth rate is 33.15%. The average daily weight gain is 20.0%. On the 16th day of development, the weight of rats varies from 14.6 to 18.4 grams, on average 16.24 ± 0.27 grams. The growth rate is 11.69%, the average daily weight gain is 20.0%. By the end of the lactation period, i.e. by day 21, the body weight ranges from 27.8-34.2 grams, on average equal to 30.4 ± 0.47 grams. The growth rate is 87.19%, the daily weight gain is 20%.In rats of the infantile period, i.e. by the first month of weight development, body weight ranges from 38.6 to 48.0 grams, on average - 42.78 ± 0.77. The growth rate is 40.72%, the average daily weight gain is 11.15. At the juvenile age (3 months of age) body weight varies from 104.1 to 117.1 grams, the average is 110.68 ± 1.2 grams. Compared to the previous age, body weight increases 1.6 times, daily weight gain is 1.66%. In 6-month-old rats, body weight ranges from 204.4 to 225.4 grams, with an average of 213.07 ± 1.72 grams. The body weight gain rate is 92.5%, the average daily gain is 1.1%. At the 9th month of life, body weight varies from 280.4 to

296.7 grams, on average -289.01 ± 1.5.The growth rate is 35.64%, the daily weight gain is 1.1%. By the first year of life, the weight of rats ranges from 303.4-325.4 grams, on average equal to 315.37 ± 2.38 grams. The growth rate is 9.12%, the average daily weight gain is 1.1%. To the senile period (18 months) the weight of rats varies from 318.7 to 351.4 grams, on average -335.08 ± 3.53 grams. The growth rate is 6.25%, the daily weight gain is 0.56%.

It was found that the prostate gland mass in rats at birth ranges from 0.05 to 0.10 grams, on average 0.08 ± 0.003 grams. At the same time, the mass coefficient is 1.55%. On the 6th day of development, the prostate weight is in the range of 0.08-0.12 grams, on average-0.10 ± 0.002. The growth rate is 25.0%, the mass coefficient is 0.92%. In 11 day-old rats, the prostate weight varies from 0.09 to 0.15 grams, on average equal to 0.13 ± 0.004 grams. The growth rate of the organ mass is 30.0%, the mass coefficient is 0.89%. On the 16th day of development, the prostate mass ranges from 0.11-0.17 grams, on average equal to 0.15 ± 0.004 grams. The growth rate is 15.4%, the mass coefficient is 0.92%.By the end of the suction period (21 days) the weight of the prostate gland is in the range of 0.16-0.22 grams, on average equal to 0.19 ± 0.004 grams. The growth rate is 26.7%, the mass coefficient is 0.63%. In rats of infantile age (1 month), the prostate mass varies from 0.17 to 0.28 grams, on average it is 0.24 ± 0.009 grams. The growth rate of the organ mass is 26.3%, the mass coefficient is 0.56%. At the 3rd month of development, i.e. at the juvenile age, the prostate weight ranges from 0.26-0.39 grams, on average - 0.34 ± 0.001 grams. The growth rate is 41.7%, the mass coefficient is 0.21%. In young rats of 6 months of age, the mass of the prostate gland is in the range from 0.31 to 0.83 grams, on average equal to 0.60 ± 0.04 grams. The growth rate is 76.5%, the mass coefficient is 0.28%. At the 9th month of development, the weight of the prostate varies from 0.66 to 1.09 grams, on average equal to 0.91 ± 0.04 grams.The growth rate of the organ mass is 51.7%, the mass coefficient is 0.31%. By the 1st year of life, the weight of the organ ranges from 0.86 to 1.34 grams, the average is 1.12 ± 0.05 grams. The growth rate is 23.1%, the mass coefficient is -0.36%. At the age of one and a half years, the prostate mass ranges from 0.96 to 1.65 grams, on average equal to 1.23 ± 0.07. Thegrowthrateis 9.8%, themasscoefficientis 0.37%.

The study showed that the thickness of the prostate gland in newborn baby rats varies within 1-2 mm, on average equal to 1.5 ± 0.07 mm. On the 6th day of development, the thickness also varies within 1-2 mm, averaging 1.9 ± 0.06 mm. The rate of increase in thickness is 26.7%. By day 11, the thickness of the organ is within 2-3 mm, on average 2.3 ± 0.07 mm.The growth rate is 21.1%. On the 16th day of development, the thickness of the prostate varies between 2-4 mm, with an average of 2.8 ± 0.14 mm. The growth rate of the thickness of the organ is 21.7%. By the end of the lactation period (21 days), the thickness of the prostate varies from 3 to 5 mm, averaging 3.6± 0.15 mm. The growth rate is 28.6%. In month-old rats, the thickness of the prostate gland is 4-5 mm, on average equal to 4.3 ± 0.08 mm. The growth rate of the thickness of the organ is 19.4%. At the 3rd month of development, the thickness of the prostate varies from 4 to 6 mm, on average equal to 5.0 ± 0.18 mm. In 6-month-old rats, the thickness of the prostate is in the range of 5-8 mm, on average 6.7 ± 0.25 mm. The growth rate is 34.0%. By the 9th month of development,

the thickness is 6-8 mm, on average 7.5 ± 0.18 mm. The growth rate is 11.9%. By the end of the 1st year of life, the thickness of the prostate varies from 6 to 9 mm, on average equal to 7.9 ± 0.32 mm. The growth rate is 23.1%.In rats at the 18th month of development, the thickness of the prostate gland varies between 7-10mm, on average equal to 8.4 ± 0.32 mm. Thegrowthrateis 9.8%.

It was found that the width of the prostate gland in newborn baby rats is within 2-3 mm, on average it is 2.17 ± 0.07 mm. On the 6th day of development, the width of the organ also varies within 2-3 mm, on average equal to 2.5 ± 0.06 mm. The growth rate is 15.2%. In 11-day-old rats, the prostate width ranges from 2 to 4 mm, on average - 3.1 ± 0.13 mm. The growth rate of the organ width is 24.0%. On the 16th day of development, the width of the prostate varies between 3-4 mm, on average 3.5 ± 0.07 mm.The growth rate is 12.9%. By the end of the suction period, i.e. by day 21, the width varies from 4 to 6 mm, on average equal to 4.6 ± 0.15 mm. The growth rate is 31.4%. In month-old rats, the width of the prostate gland is in the range of 4-7 mm, on average -5.3 ± 0.25 mm. The growth rate is 15.2%. At the 3rd month of development, the width of the organ ranges from 5 to 7 mm, on average equal to 6.2 ± 0.18. The growth rate is 17.0%. In 6-month-old rats, the width of the prostate varies between 7-10 mm, on average equal to 8.9 ± 0.25 mm. The growth rate is 43.5%. By the 9th month of development, the width of the prostate gland is in the range from 12 to 18 mm, on average 15.0 ± 0.55 mm. The growth rate of the organ width is 68.55%. In one-year-old rats, the width of the organ ranges from 14 to 18 mm, on average 16.1 ± 0.43 mm. The growth rate is 7.3%.At the 18th month of development, the width of the prostate varies from 16 to 20 mm, on average equal to 17.4 ± 0.43 mm. Thegrowthrateis 8.1%.

The study showed that the length of the prostate gland in rats at birth is within 3-4 mm, averaging 3.7 ± 0.07 mm. In rats on the 6th day of development, the length of the prostate varies between 4-5 mm, on average-4.6 ± 0.06 mm. The growth rate is 22.6%. On the 16th day of the development of baby rats, the length of the prostate gland varies from 5 to 7 mm, on average equal to 6.3 ± 0.14 mm. The growth rate of the organ length is 18.9%. By the end of the suction period, the length of the organ is in the range of 7-9 mm, on average-7.9 ± 0.15 mm. The growth rate is 25.4%. In monthly rats, the length of the prostate gland ranges from 8 to 10 mm, on average 9.0 ± 0.16 mm. The growth rate of length is 13.9%. At the 3rd month of development, the length of the organ varies from 8 to 11 mm.On average, it is equal to 10.1 ± 0.28 mm. The growth rate is 12.1%. In 6-month-old rats, the length of the prostate gland ranges from 10 to 15 mm, on average 13.0 ± 0.41 mm. The growth rate is 28.7%. At the 9th month of development, the length of the prostate varies from 11 to 16 mm, with an average of 14.1 ± 0.46 mm. The growth rate is 8.5%. In 12-month-old rats, the length of the prostate gland varies from 13 to 17 mm, on average -15.2 ± 0.43 mm. The growth rate is 7.8%. At the 18th month of development, the length of the prostate gland ranges from 14 to 18 mm, on average equal to 16.1 ± 0.43 mm. Thegrowthrateoftheorganlengthis 5.9%.

Conclusions:

The change in the body weight of male rats from the period of newborn to senile age is abrupt. At the same time, the highest growth rate during the lactation

period was revealed on the 6th and 21st days of development. In the late postnatal period, the highest growth rate was observed in juvenile and young age, after which there is a tendency to a gradual decrease in this indicator.

The greatest value of the average daily weight gain was revealed in the age groups throughout the suckling period, and later its decrease was noted up to senile age.

The weight of the prostate gland varies unevenly during postnatal ontogenesis. Its greatest growth is observed in the period from 3 to 9 months, the smallest - at the age of one and a half years.

The highest value of the mass coefficient of the organ was found in newborn rats, and the indicators of this coefficient in the lactation period are 2-4 times higher than in the age groups of late postnatal ontogenesis.

At all stages of postnatal ontogenesis, the length of the prostate is always greater than the width and thickness, and from the age of 9 months, the transverse size of the gland begins to prevail over the longitudinal and antero-posterior dimensions. The greatest increase in these indicators was noted by the end of the suckling period and in young rats of 6 and 9 months of age.

Thus, the process of development and growth of body mass indicators and anatomical parameters of the prostate of male rats during postnatal ontogenesis is uneven and depends on the age characteristics of the organ and the organism as a whole.

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