

Characteristics of Postnatal Ontogenetic Changes in Small Oval Follicles of the Thyroid Gland in Hissar Sheep from Regions with Different Levels of Iodine Deficiency

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Abstract: The dynamics of changes in the morphometric dimensions of the histological structures of the thyroid gland in sheep raised under natural conditions with varying levels of iodine deficiency were investigated during postnatal ontogenesis. It was found that the absolute diameter of small oval follicles in the right and left lobes of the thyroid gland in sheep from the Kashkadarya and Fergana regions decreased stepwise from the first 3 days to 60 months of postnatal ontogenesis. In addition, it was established that at all studied stages after 3 months of postnatal development, the absolute diameter of small oval follicles in sheep raised in the Fergana region was higher than that observed in sheep from the Kashkadarya region.

Keywords: Hissar sheep, endocrine system, thyroid gland, right lobe, left lobe, small oval follicle, postnatal ontogenesis, iodine deficiency, growth coefficient, morphometric parameters, absolute values.

Introduction

The productive characteristics of animals depend not only on feeding, housing, and management technologies, as well as on the genotype of the organism, but also on the functional activity of the endocrine system.

According to research data, slight changes in the topography of the thyroid gland have been identified in Kulunda sheep, namely, asymmetrical arrangement of the glandular lobes located in the region of the first 4–6 tracheal rings, between the esophagus and the sternothyroid muscle [1].

It has been observed that the height of the follicular epithelium changes proportionally to the diameter of the follicles. Researchers have established that the height of the follicular epithelium is higher in rodents compared to carnivores, whereas in lagomorphs it is relatively lower [2].

The thyroid gland of sheep belongs to the mixed follicular type, as medium-sized follicles predominate. According to research data, the average diameter and height of thyroid follicles in sheep range from **90.2–106.3 μm** and **43.44–44.0 μm** , respectively. In contrast, the thyroid gland of cattle is characterized by larger follicular diameters and also belongs to the mixed type, containing both small and large follicles [3].

Scientific studies have shown that the hypofunctional state of the thyroid gland in sheep is characterized by flattened epithelium, markedly elongated follicles, dense colloid with strong staining properties, the presence of resorption vacuoles, and the absence of the Brown index. It has also been established that C-cells are very rare in the thyroid gland of adult sheep and completely absent in lambs [4, 5, 6].

Materials and Methods

The scientific research was conducted on the thyroid glands of Hissar sheep raised under the conditions of the Fergana and Kashkadarya regions. For the study, thyroid glands were collected from animals at the following stages of postnatal development: 3 days, 3, 6, 12, 18, 24, and 60 months of age.

Conventional morphological methods were used to measure the histological structures of the thyroid glands.

All numerical data obtained as a result of the scientific investigations were subjected to mathematical processing according to the method proposed by Ye.K. Merkureva.

To determine the age-related dynamics of changes in the morphometric parameters of the thyroid glands, the growth coefficient was calculated using the formula $K = \frac{V_t}{V_0}$ developed by K.B.

Svechin:

K – growth coefficient;

V_t – absolute value of the thyroid gland parameter in adult animals;

V_0 – initial value of the thyroid gland parameter.

Mathematical and statistical analysis was performed using Student's t -test and Fisher's criteria with the aid of Microsoft Excel spreadsheet software.

Results and Discussion

As a result of the study, it was established that the morphometric dimensions of the histological structures of the thyroid gland in Hissar sheep raised under iodine-deficient conditions exhibit specific dynamics of change at different physiological stages of postnatal ontogenesis.

The absolute diameter of small oval follicles in the **right lobe of the thyroid gland** of sheep raised under the conditions of the Kashkadarya region was $388.0 \pm 8.29 \mu\text{m}$ at the first 3 days of postnatal ontogenesis. By 3 months, this value decreased to $327.0 \pm 6.64 \mu\text{m}$ ($K = 0.85$; $p < 0.02$), and by 6 months to $253.0 \pm 6.86 \mu\text{m}$ ($K = 0.77$; $p < 0.03$). At subsequent stages of development, this decreasing trend continued without marked deviations, amounting to $264.8 \pm 6.67 \mu\text{m}$ at 12 months ($K = 1.05$; $p < 0.03$), $233.0 \pm 5.38 \mu\text{m}$ at 18 months ($K = 0.88$; $p < 0.03$), $197.0 \pm 5.06 \mu\text{m}$ at 24 months ($K = 0.85$; $p < 0.03$), and $178.0 \pm 4.91 \mu\text{m}$ at 60 months ($K = 0.90$; $p < 0.03$). The growth coefficient of the absolute diameter of small oval follicles in the right thyroid lobe over the period from 3 days to 60 months of postnatal development was **0.46**.

The absolute diameter of small oval follicles in the **right lobe of the thyroid gland** of **male Hissar sheep** raised in the Kashkadarya region decreased from $385.0 \pm 8.3 \mu\text{m}$ at 3 days to $324.0 \pm 6.8 \mu\text{m}$ at 3 months ($K = 0.84$; $p < 0.02$), and further to $246.0 \pm 7.0 \mu\text{m}$ at 6 months ($K = 0.76$). Up to 18 months, no pronounced changes were observed, with values of $215.0 \pm 7.0 \mu\text{m}$ at 12 months ($K = 0.94$; $p < 0.04$) and $221.0 \pm 8.0 \mu\text{m}$ at 18 months ($K = 1.03$). At later stages, the parameter decreased to $177.0 \pm 5.0 \mu\text{m}$ at 24 months ($K = 0.80$) and $163.0 \pm 5.0 \mu\text{m}$ at 60 months ($K = 0.92$). The overall growth coefficient from 3 days to 60 months was **0.42**.

The absolute diameter of small oval follicles in the **right lobe of the thyroid gland** of Hissar sheep raised in the Fergana region showed no significant changes from 3 days to 6 months of postnatal development, amounting to $393.0 \pm 9.2 \mu\text{m}$ at 3 days, $386.2 \pm 9.0 \mu\text{m}$ at 3 months ($K = 0.98$; $p < 0.02$), and $371.0 \pm 9.0 \mu\text{m}$ at 6 months ($K = 0.96$; $p < 0.02$). By 12 months, this indicator decreased to $311.0 \pm 7.2 \mu\text{m}$ ($K = 0.84$). At 18 months, the value remained almost unchanged ($309.0 \pm 10.7 \mu\text{m}$; $K = 0.99$; $p < 0.02$), followed by a sharp decrease at 24 months ($205.6 \pm 5.3 \mu\text{m}$; $K = 0.67$) and a subsequent increase at 60 months to $241.0 \pm 6.4 \mu\text{m}$ ($K = 1.17$; $p < 0.03$). The growth coefficient over the studied period was **0.61**.

In **male Hissar sheep** raised under the conditions of the Fergana region, the absolute diameter of small oval follicles in the right thyroid lobe gradually decreased from $392.0 \pm 9.2 \mu\text{m}$ at 3 months to $385.0 \pm 9.0 \mu\text{m}$ ($K = 0.98$; $p < 0.03$), $363.0 \pm 9.0 \mu\text{m}$ at 6 months ($K = 0.94$; $p < 0.03$), and $261.0 \pm 7.0 \mu\text{m}$ at 12 months ($K = 0.72$). At 18 months, the value remained almost unchanged ($288.0 \pm 10.0 \mu\text{m}$; $K = 1.10$), then decreased to $185.0 \pm 5.0 \mu\text{m}$ at 24 months ($K = 0.64$), and increased to $224.0 \pm 6.0 \mu\text{m}$ at 60 months ($K = 1.21$; $p < 0.03$). The overall growth coefficient was **0.61**.

The absolute diameter of small oval follicles in the **left lobe of the thyroid gland** of **female sheep** raised in the Kashkadarya region was $374.0 \pm 9.80 \mu\text{m}$ at 3 days of postnatal development. This value decreased to $321.0 \pm 14.02 \mu\text{m}$ at 3 months ($K = 0.86$; $p < 0.02$) and $264.0 \pm 5.56 \mu\text{m}$ at 6 months ($K = 0.82$). At 12 months, a slight increase was observed ($278.6 \pm 5.84 \mu\text{m}$; $K = 1.06$). From 18 months onward, a gradual decrease continued, reaching $227.0 \pm 5.56 \mu\text{m}$ ($K = 0.81$) at 18 months, $190.0 \pm 5.56 \mu\text{m}$ ($K = 0.84$; $p < 0.03$) at 24 months, and $186.0 \pm 5.56 \mu\text{m}$ ($K = 0.98$; $p < 0.03$) at 60 months. The growth coefficient over the entire period was **0.50**.

The absolute diameter of small oval follicles in the **left lobe of the thyroid gland** of **male Hissar sheep** raised in the Kashkadarya region decreased stepwise from $373.0 \pm 9.8 \mu\text{m}$ at 3 days to $320.0 \pm 14.0 \mu\text{m}$ at 3 months ($K = 0.86$), $259.0 \pm 6.0 \mu\text{m}$ at 6 months ($K = 0.81$), $228.0 \pm 6.0 \mu\text{m}$ at 12 months ($K = 0.88$), $206.0 \pm 6.0 \mu\text{m}$ at 18 months ($K = 0.91$), and $169.0 \pm 6.0 \mu\text{m}$ at 24 months ($K = 0.82$). At 60 months, this value remained almost unchanged ($170.0 \pm 6.0 \mu\text{m}$). The overall growth coefficient was **0.46**.

In sheep raised under the conditions of the Fergana region, the absolute diameter of small oval follicles in the **left thyroid lobe** increased from $390.0 \pm 9.7 \mu\text{m}$ at 3 days to $396.0 \pm 13.8 \mu\text{m}$ at 3 months ($K = 1.02$; $p < 0.03$), then decreased to $308.0 \pm 7.2 \mu\text{m}$ at 6 months ($K = 0.78$). Up to 18 months, no significant changes were observed, with values of $294.0 \pm 7.2 \mu\text{m}$ at 12 months ($K = 0.95$) and $306.0 \pm 7.2 \mu\text{m}$ at 18 months ($K = 1.04$; $p < 0.04$). At 24 months, a sharp decrease

occurred ($207.0 \pm 5.4 \mu\text{m}$; $K = 0.68$), followed by an increase at 60 months to $256.0 \pm 5.7 \mu\text{m}$ ($K = 1.24$; $p < 0.02$). The growth coefficient over the studied period was **0.66**.

The absolute diameter of small oval follicles in the **left lobe of the thyroid gland** of male sheep raised in the Fergana region increased from $389.0 \pm 10.1 \mu\text{m}$ at 3 days to $395.0 \pm 13.8 \mu\text{m}$ at 3 months ($K = 1.02$), then gradually decreased without marked deviations up to 12 months, measuring $301.0 \pm 6.0 \mu\text{m}$ ($K = 0.76$) at 6 months and $242.0 \pm 7.0 \mu\text{m}$ ($K = 0.80$) at 12 months. At 18 months, a slight increase was observed ($284.0 \pm 7.0 \mu\text{m}$; $K = 1.17$; $p < 0.03$), followed by a decrease at 24 months ($185.0 \pm 6.0 \mu\text{m}$; $K = 0.65$) and a subsequent increase at 60 months to $239.0 \pm 6.0 \mu\text{m}$ ($K = 1.29$; $p < 0.02$). The overall growth coefficient from 3 days to 60 months was **0.61**.

Conclusion

- It was established that the absolute diameter of small oval follicles in both the **right and left lobes of the thyroid gland** in sheep raised in the **Kashkadarya and Fergana regions** decreased stepwise from **3 days to 60 months** of postnatal ontogenesis.
- At all investigated stages after **3 months of postnatal development**, the absolute diameter of small oval follicles in sheep raised in the **Fergana region** was higher than that observed in sheep from the **Kashkadarya region**.

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