



ANALYSIS OF THE DEPENDENCE OF MILK PRODUCTIVITY OF HISSAR EWES ON THEIR AGE AND NUTRITION

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Abstract. This article provides a scientific analysis of how the milk-yield indicators of Hissar ewes depend on their age and level of nutrition. During the study, ewes aged 1.5 to 6 years were observed in separate groups, and the lactation period, gross milk yield, daily milk yield, and milk fat content were determined for each group. In addition, changes in milk yield under three different feeding levels (low, medium, and high) were investigated. The results showed that the maximum milk yield was observed in the group of 4–5-year-old ewes, and that an increase in the feeding level significantly improved milk yield ($p < 0.01$). The study is of practical importance for developing recommendations on the effective use of the Hissar breed for dairy purposes.

Keywords: *Hissar sheep, ewe, milk yield, lactation period, milk fat content, feeding level, age effect, zootechnics, sheep farming.*

1. Introduction

The Hissar breed is one of the most widespread native sheep breeds in Central Asia, particularly in Uzbekistan and Tajikistan, and is raised mainly for meat and fat production. In recent years, however, increasing attention has been paid to the milk-production potential of this breed.



The milk of Hissar ewes differs from that of other breeds in its high fat content (6.8–7.0%) and biological completeness. Owing to this property, it can be used as a value-added product in local agriculture. The milk yield of ewes depends on several factors — heredity, age, physiological state, season, and feeding conditions.

Among these, the effects of age and feeding level deserve separate study because of their practical importance. A review of the available literature shows that the comprehensive study of the milk yield of Hissar ewes in relation to age and feeding factors remains an insufficiently investigated problem in the animal science of Uzbekistan.

The main aim of this study is to comparatively analyze the milk-yield indicators of Hissar ewes across age groups and feeding levels, and to identify the factors that most strongly affect milk yield. The practical recommendations developed on the basis of the results will serve as important guidance for farmers and livestock specialists engaged in Hissar sheep farming in introducing a rational feeding system.

2. Literature Review

There are many breeds of meat-and-fat-tailed sheep in the world, and the Hissar breed is one of their finest representatives. The Hissar fat-tailed breed — the largest in the world — was created over many years through folk selection by the labor of generations of local livestock breeders.

P.F. Kiyatkin (1968) reported that at the “Kommuna” state farm in the Parkent district, local Hissar ewes were crossed with Lincoln rams to obtain satisfactory crossbred offspring; in the final stage these were interbred to form a purpose-oriented group of sheep named the Parkent sheep.

G. Mamedov (1969) and T. Safargaliyev (1986), monitoring the growth and development of animals, concluded on the basis of their results that the growth and development of lambs depend on the age, milk yield, and fertility of the ewes.

Ro‘ziboev N.R. and Shayusupov B.B. (2019) reported that, by combining three distinct hereditary lines — the local fat-tailed sheep of the East (also referred to in the literature as the Uzbek fat-tailed breed), the fine-wooled sheep of the lower west (North Caucasus), and the meat-type Lincoln breed of England — and through long-term, continuous selection together with “within-line” breeding of half-fine-wooled sheep possessing a high growth rate, a relatively large body, and vital vigor, the



Akhangaran and Parkent types of meat-and-wool sheep, and subsequently a breed group of meat-and-wool sheep, were created.

According to the authors, growth is expressed by changes in the weight, volume, or number of all living organisms, including farm animals, whereas development represents qualitative changes in the functional forms and relationships of a living organism. Accordingly, the growth and development of all living organisms constitute their vital process.

3. Materials and Methods

The study was carried out during 2025–2026 at the “Bobotog‘ suri” breeding LLC located in the Qumqo‘rg‘on district of the Surxondaryo region. A total of 100 Hissar ewes aged 1.5 to 6 years were selected as the object of study. The ewes were divided into six groups by age and into three groups by feeding level:

- 1.5–2 years (20 head) — ewes that had lambed for the first time;
- 2–3 years (10 head) and 3–4 years (20 head);
- 4–5 years (30 head) — the period of maximum productivity;
- 5–6 years (10 head) and over 6 years (10 head).

The following research methods were used:

- *Milking method*: individual milking was performed once every 10 days, and daily and periodic milk volumes were recorded;
- *Milk fat content*: determined with a Gerber butyrometer (GOST 5867-90);
- *Feed accounting*: the feed offered and refused was weighed daily; feed units (FU) and crude protein were recorded systematically;
- *Lactation period*: the number of days from lambing until cessation of milking;
- *Statistical analysis*: one-way and two-way ANOVA and Pearson correlation analysis in SPSS 26.0 ($p < 0.05$).

The feeding rations were formulated according to the norms of the Ministry of Agriculture of Uzbekistan. Milk samples were taken on days 30, 60, 90, and 120 of lactation.

4. Results and Discussion



The study results were systematized and analyzed in three main directions: the relationship between ewe age and milk yield; the relationship between feeding level and milk-yield indicators; and the combined effect of age and feeding factors.

Table 1. Milk-yield indicators of Hissar ewes by age group

Age (years)	No. of head	Lactation (days)	Gross milk (L)	Daily milk (L)	Fat content (%)
1.5–2	28	148	92.4	0.62	6.8
2–3	35	156	118.6	0.76	7.1
3–4	40	162	147.2	0.91	7.4
4–5	38	168	162.8	0.97	7.6
5–6	32	165	158.4	0.96	7.5
6+	24	154	134.1	0.87	7.2
Average	—	159	135.6	0.85	7.3

The analysis of Table 1 shows that milk yield in Hissar ewes exhibits considerable age-dependent variation. The lowest milk yield was recorded in the 1.5–2-year-old group (gross milk 92.4 L, daily 0.62 L), since at this age the lactation system is not yet fully developed. Milk yield rises sharply from the 3–4-year group and peaks at 4–5 years (gross milk 162.8 L, daily milk 0.97 L). Although a slight decline is observed in the 5–6-year group, the indicators remain high (158.4 L). In ewes over 6 years of age, milk yield decreases markedly (134.1 L). Milk fat content ranged from 6.8 to 7.6% across all groups, increasing slightly with age.

Table 2. Relationship between feeding level and milk-yield indicators

Feeding level	FU/day	Crude protein (g)	Lactation (days)	Gross milk (L)	Daily milk (L)
Low (<0.9 FU)	0.82	98	138	96.4	0.70
Medium (0.9–1.2 FU)	1.05	132	158	142.6	0.90
High (>1.2 FU)	1.28	168	171	176.3	1.03
Average	1.05	133	156	138.4	0.88

According to Table 2, an increase in the feeding level has a direct positive effect on milk yield. In the low-feeding group (0.82 FU/day), gross milk was 96.4 L and



daily milk 0.70 L, whereas in the high-feeding group (1.28 FU/day) these reached 176.3 L and 1.03 L, respectively. The lactation period also depends on the feeding level: 138 days in the low group and 171 days in the high group. This difference of 33 days is of considerable economic significance. An adequate supply of crude protein (168 g/day) plays a special role in maximizing milk productivity.

Table 3. Combined effect of age and feeding level on gross milk yield (L)

Age (years)	Low feeding (L)	Medium feeding (L)	High feeding (L)	Difference (L)
1.5–2	74.2	90.8	112.4	+38.2
2–3	96.1	118.3	142.6	+46.5
3–4	118.4	146.9	176.3	+57.9
4–5	128.6	161.4	196.8	+68.2
5–6	124.1	156.8	190.4	+66.3
6+	106.3	132.7	162.9	+56.6
Average	107.9	134.5	163.6	+55.7

Table 3 clearly demonstrates the combined effect of age and nutrition. In every age group, raising the feeding level from low to high significantly increased milk volume. The greatest absolute gain was observed in the 4–5-year group: improving nutrition raised milk volume from 128.6 L to 196.8 L, i.e., by +68.2 L. On average, raising the feeding level to high made it possible to obtain 55.7 L more milk per ewe per year. In the youngest group (1.5–2 years) and the oldest group (over 6 years), nutrition also had a positive effect (+38.2 and +56.6 L, respectively). These results demonstrate the synergistic effect of the age and feeding factors.

Pearson correlation analysis revealed a moderately strong positive correlation between ewe age and milk yield ($r=0.74$, $p<0.01$) and a strong positive correlation between feeding level and gross milk yield ($r=0.88$, $p<0.01$). Two-way ANOVA confirmed that the effects of both factors were statistically highly significant ($p<0.01$).

The study results were compared with data obtained for other breeds by foreign researchers — Okorusha et al. (2018) and Perez and Martinez (2020). The occurrence of maximum milk yield at 4–5 years in the Hissar breed and the high correlational effect of nutrition are fully consistent with these foreign studies.



5. Conclusions and Recommendations

On the basis of the conducted study, the following main conclusions were drawn:

- In Hissar ewes, milk yield varies with age, with the maximum recorded at 4–5 years (gross milk 162.8 L, daily 0.97 L); after 6 years, milk yield begins to decline.
- The lactation period is also age-dependent: 4–5-year-old ewes, with a lactation of about 168 days, surpassed all other groups.
- The combined, synergistic effect of the age and feeding factors was most pronounced in the 4–5-year group (a gain of +68.2 L).
- Increasing the feeding level significantly and reliably improves milk yield in all age groups ($p < 0.01$). Accordingly, a high feeding level (> 1.2 FU/day with about 168 g of crude protein) is recommended, especially for ewes aged 3–5 years, in order to use the dairy potential of the Hissar breed most effectively.

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