Productive qualities of nanny-goats of the Orenburg downy breed depending on various types of diets

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Abstract. The article shows the positive effect of different types of diets on the milk and downy productivity of Orenburg nanny-goats. In order to increase production and improve its quality, it is proved that it is necessary to use hay concentrate (43.6% coarse, 33.4% concentrates, 23.0% juicy) and hay (53.6% coarse, 23.4% concentrates and 23.0% juicy) type. This type of feeding allows you to increase the fleece of down, respectively by 6.63 and 12.80%, while reducing the cost of feed (feed units) by 1 kg of gain - 7.37%, by 1 kg of down - by 6.61 and 18.43%, the cost of 1 kg of down, respectively - by 6.53 and 16.55%.

1. Introduction
The development of downy goat breeding, in a market economy, is impossible without the development of new technologies and improvement of existing ones for feeding age-sex groups of goats, including downy nanny-goats of the Orenburg breed [1, 2]. This problem is especially relevant for the winter stable keeping in the South Ural region (Orenburg region), where nanny-goats of this unique breed live in a sharply continental climate [3, 4].

To obtain a high average annual growth rate of down production, with a simultaneous improvement in the quality indicators of products, it is necessary to provide pregnant and lactating nanny-goats with biologically complete, normalized feeding, taking into account their physiological state [5,6]. Thus, the quality of forage of winter-stable keeping has not been fully studied. There are almost no data characterizing forage of winter-stable keeping, taking into account different soil and climatic zones of their distribution, feeding norms for this period are not improved, including the level of total and protein nutrition. All this testifies the need to study a number of issues on optimizing diets for fruit-bearing and lactating nanny-goats and their analysis in order to increase the efficiency of production of downy goat breeding products.
2. Materials and methods
For the study, 90 nanny-goats were selected according to the principle of pairs-analogs, taking into account live weight, body condition and age. The experimental animals, in accordance with the developed experimental scheme, were divided into three groups: control, experimental I and II, 30 animals each. The service to animals and experimental studies were carried out in accordance with the instructions and recommendations of the Order of the Ministry of Health of the USSR dated July 27, 1978 No. 701 "On amendments to the order of the Ministry of Health of the USSR dated 12.08.77 No. 755" and "The Guide for Care and Use of Laboratory Animals "(National Academy Press, Washington, DC 1996).

In order to identify the effectiveness of using diets with different ratios of coarse, juicy and concentrated feeds in the feeding of Orenburg nanny-goats in JSC "Donskoye" of the Orenburg region, scientific and physiological studies were carried out.

The main period of the experiment lasted 204 days and covered the first and second half of pregnancy, the first half of lactation. The main difference between the groups of goats (control, I and II was in feeding various types of rations. Control goats received a hay-silage-concentrate ration (33.3% coarse, 33.4% concentrates, 33.3% juicy), I experimental - a hay-concentrate (43.6% coarse, 33.4% concentrates, 23.0% juicy) and II experimental - hay type of ration (53.6% coarse, 23.4% concentrates and 23.0% juicy).

Down productivity of each experimental animal was determined during the fleece time of the nanny-goats. When determining the down productivity of the experimental goats, the qualitative indicators of down were studied: natural and true length of down fibers and outer hair, thickness of down fibers, weight content of down and wool, weight fraction of down. The content of down and outer hair was determined by the weight method, the thickness - on a lanameter according to the VIZh method (1958). The natural length of the down was determined with a ruler according to the VIZH method (1958), with an accuracy of 0.1 cm, the true length - according to samples taken with a special fork.

The milk production of nanny-goats was determined by weighing the goatlings before and after feeding on two adjacent days at the age of 15, 30, 45 and 60 days. The nutritional value and chemical composition of milk were determined by the method of P.T. Lebedev and A.T. Usovich (1969).

Hematological studies. To determine the morphological and biochemical parameters of blood at the beginning and at the end of the experiment, blood was taken from the jugular vein of three animals from each group for research. In the blood, the number of erythrocytes and leukocytes in the Goryaev chamber, the hemoglobin content according to Sali was determined, the total protein content in the blood serum was determined by refractometric according to Robertson, total nitrogen - by the Kjeldahl method, residual nitrogen - by calorimetry.

To clarify the effect of different types of feeding on the digestibility of nutrients in the diet, the balance of nitrogen, calcium and phosphorus, balance experiments were carried out at different periods of the physiological state of nanny-goats according to the generally accepted method (A.I. Ovsyannikov, 1976; A.P. Kalashnikov et al., 1987).

Statistical processing. The significance of differences was checked using the Mann-Whitney U test. Significance level (P) was considered to be less or equal - 0.05, 0.01, 0.001. The data obtained were processed using the” Statistica 10.0” software package (“Stat Soft Inc.”, USA).

3. Results
The down productivity of the test nanny-goats was studied, which was taken into account from each individual experimental animal during hackling of the goats. The quality parameters took into account the existing classification of down.
Table 1. Fleece and quality of down in experimental nanny-goats ($\overline{X} \pm S\overline{X}$)

| Indicator                        | Group         |
|----------------------------------|---------------|
|                                  | control      | experimental 1 | experimental 2 |
| Down fleece, g / head            | 337.0±17.74  | 358.00±13.18   | 397.0±29.53   |
| Natural length, cm               | 6.3±0.65     | 6.40±0.51      | 6.40±0.28     |
| True length, cm                  | 6.90±0.61    | 7.40±0.57      | 7.60±0.53     |
| Outer hair length, cm            | 8.30±0.63    | 8.40±0.30      | 9.00±0.72     |
| Down thickness, mkm              | 16.60±0.68   | 16.30±0.95     | 16.70±0.69    |
| Weight content of down, %        | 52.20±0.71   | 52.30±0.36     | 52.20±0.57    |
| Mass fraction of down, %         | 87.40±0.89   | 89.30±1.68     | 88.6±1.12     |

The fleece of the down in the II experimental group was more than in the control - by 17.80% and in the first experimental - by 10.89%, in turn, the latter exceeded the control ones - by 6.23%, with better indicators of the quality of the down. So, we found that the fineness of the down of animals of the experimental group I was less than in the control - by 1.81% and 2.39% in comparison with the experimental group II. At the same time, the fineness of the down of animals in the control and experimental groups was practically the same (16.6-16.7 microns). Feeding with hay and hay-concentrate diets helps increase the length of the down.

Certain differences were established not only in the value of milk productivity, but also in the qualitative parameters of the milk of the experimental nanny-goats.

Table 2. Milk yield of goats by lactation periods, kg ($\overline{X} \pm S\overline{X}$)

| Indicator                        | Group         |
|----------------------------------|---------------|
|                                  | control      | experimental 1 | experimental 2 |
| Lactation period (days)          |              |               |               |
| 15                               | 1.01±0.029   | 1.04±0.041    | 1.03±0.103    |
| 30                               | 1.12±0.052   | 1.12±0.107    | 1.18±0.081    |
| 45                               | 1.10±0.141   | 0.96±0.034    | 1.12±0.068*   |
| 60                               | 1.03±0.044   | 1.07±0.057    | 1.09±0.101    |
| On average for the first half of |              |               |               |
| lactation                        | 1.06±0.062   | 1.05±0.057    | 1.11±0.086    |

* P≤0.05

These data show that in the first 15 days of lactation, animals of the experimental groups I and II exceeded the control nanny-goats in milk yield by 2.97 and 1.98%, respectively. It was found that by the 45th day of lactation in all compared groups there was a decrease in the milk yield of goats: in the control group - by 1.79%, in experimental I - by 14.29%, in experimental II - by 5.08%. The study of the milk yield of goats by the 60th day of lactation showed a decrease in milk yield only in the control and II experimental groups, respectively by 6.36 and 2.68%, and an increase (by 11.46%) in the I
experimental group of nanny-goats. In general, for the first half of lactation, the milk yield of nanny-goats in the experimental group II was higher than in the control group and the experimental group I. For normal growth and intensive development of kids, the biological and chemical properties of milk, its nutritional value, are of great importance, bearing in mind that in the first month of life, the main source of nutrients for them is the milk of nanny-goats. In this regard, we have studied the chemical composition and calculated the nutritional value of the milk of experimental goats (Table 3). The results obtained indicate some differences between the groups in terms of the studied indicators.

| Indicator             | Group          |
|----------------------|---------------|
|                      | control      | experimental 1 | experimental 2 |
| Fat, %               | 3.91±0.243   | 4.12±0.087     | 4.10±0.257     |
| Protein, %           | 5.56±0.152   | 5.73±0.096     | 5.52±0.174     |
| Sugar, %             | 4.19±0.098   | 4.48±0.102*    | 4.50±0.120*    |
| SOMO, %              | 10.08±0.288  | 9.62±0.063     | 10.24±0.129*** |
| Calcium, mg          | 186.00±2.28* | 179.60±0.970   | 194.20±3.84*** |
| Phosphorus, mg%      | 96.40±2.140  | 92.70±3.200    | 102.70±2.97*   |
| Nutritional value of 1 kg, kcal | 770.00±12.51 | 802.00±11.28 | 783.00±13.75 |
| Nutritional value of the average daily amount from one nanny-goat, kcal | 816.00±16.37 | 842.00±28.73 | 869.00±19.82* |

* P≤0.05; ** P≤0.01; *** P≤0.001

It should be noted that, in terms of the content of SOMO, calcium and phosphorus, the milk of animals of the I experimental group was inferior not only to the milk of animals of the II experimental group, but also to the milk of nanny-goats of the control group, respectively by 0.46%; by 0.40 (P≤0.05), and by 3.70 mg%.

The use of hay-concentrate and hay types in feeding nanny-goats made it possible to increase the caloric content of not only one kilogram, but also of the average daily amount of milk. Thus, the nutritional value of one kilogram of nanny-goat milk in experimental group I was 802 kcal, which is by 4.16% more than in the control group and by 2.43% more in comparison with the milk of nanny-goats from experimental group II. At the same time, it was found that the caloric content of the milk of nanny-goats of the experimental group II exceeded the caloric content of the milk of their contemporaries from the control group by 1.69%.

At the same time, in terms of the total nutritional value of the average daily amount of extracted milk, experimental groups I and II surpassed the control nanny-goats by 3.19 and 6.49%, respectively (P≤0.05). The nanny-goats of the experimental group I were inferior to animals from the experimental group II in terms of this indicator - 3.21%.

The quality of the nanny-goat's milk had a positive impact on the growth and development of the newborn goatlings. So, if at birth the live weight of the goatlings in all groups was practically the same, then at the age of 60 days it was the highest in the goatlings of group II (11.1 kg versus 10.9 kg
in the first and 10.2 kg in the group II), because of higher average daily gains in live weight - by 3.91 and 12.71%.

Thus, the researches carried out showed that the best results were achieved in experimental groups I and II, which indicates the need to use hay and hay-concentrate types in feeding nanny-goats of the Orenburg breed.

4. Discussion
The studies carried out revealed the advantages of feeding pregnant and suckling nanny-goats with diets based on roughage (hay) in comparison with traditional multicomponent diets [7.8].

Different types of feeding also influenced the down production of the test nanny-goats. The superiority of animals fed with hay diets was established in comparison with others in terms of the amount of down per head and its quality characteristics. In the second experimental group, the nanny-goats that received roughage, the fleece of down was on average 397 g per head, or 17.80% and 10.89% higher than in the control and I experimental groups, respectively.

A significant difference in the level of down productivity in the test nanny-goats can be explained by the better biological value of diets, including good quality hay, optimal content of digestible protein and minerals, which have a positive effect on the use of nutrients in the diets [9.10].

The use of different types of diets in the feeding nanny-goats influenced the milk production of downy nanny-goats, as well as the growth and development of their goatlings. It is consistent with the previous researches [11].

5. Conclusion
Summarizing the materials of the results obtained, we can conclude that the use of hay-type diet in feeding nanny-goats of the Orenburg downy breed contributes, both during pregnancy and lactation, to a better use of nutrients, their digestibility, ensures efficient use of energy for products, and, as a result, an increase in down and milk productivity.

References
[1] Goetsch A L 2016 Invited review: Current areas of research of feeding practices for lactating goats Prof Anim Sci. 32 725-35 doi:10.15232/pas.2016-01541
[2] Goetsch A L 2019 Recent research of feeding practices and the nutrition of lactating dairy goats J Appl Anim Res. 47 103-14 doi:10.1080/09712119.2019.1580585
[3] Petrov N I 2016 A toolkit for creating a herd of white Orenburg downy goats, providing increased productivity and improved quality indicators of down (Orenburg: Press Agency)
[4] Petrov N I 2018 Especially productive white Orenburg goats Agrarian Reporter of South-East 1(18) 36-9
[5] Goetsch A L, Detweiler G, Sahlu T, Puchala R and Dawson L J 2001 Dairy goat performance with different dietary concentrate levels in late lactation Small Rumin Res. 41 117–25
[6] Sahlu T, Goetsch A L, Luo J, et al. 2004 Nutrient requirements of goats: developed equations, other considerations and future research to improve them Small Rumin Res. 53 191–219
[7] Manousidis T, Parissi Z M, Kyriazopoulos A P, Malesios C, Koutroubas S D and Abas Z 2018 Relationships among nutritive value of selected forages, diet composition and milk quality in goats grazing in a Mediterranean woody rangeland Livest Sci. 218 8–19 doi:10.1016/j.livsci.2018.10.002
[8] Goetsch A L 2019 Recent research of feeding practices and the nutrition of lactating dairy goats J Appl Anim Res. 47 103–14 doi:10.1080/09712119.2019.1580585
[9] Jørgensen GH M, Andersen I L and Bue K E 2007 Feed intake and social interactions in dairy goats-The effects of feeding space and type of roughage Appl Anim Behav Sci. 107 239–51
[10] Egea Á V, Bakker M L, Allegretti L I, et al. 2019 Seasonal changes in feed intake, diet digestibility and diet composition by lactating and non-lactating goats browsing in a semi-
arid rangeland of Argentina *Grass Forage Sci.* **74** 115–28 doi:10.1111/gfs.12393

[11] Fedele V, Claps S, Rubino R, Calandrelli M and Pilla A M 2002 Effect of free-choice and traditional feeding systems on goat feeding behaviour and intake *Livest Prod Sci.* **74** 19–31 doi:10.1016/S0301-6226(01)00285-8