Ethological and clinical reactions of dairy goats under the conditions of the extreme continental climate of the Lower Volga

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Abstract. The research study was devoted to the adaptive properties of dairy goats that were imported from the Netherlands (Saanen breed) and Germany (Anglo-Nubian breed) and were adapting to the new conditions of the extremely continental climate of the Lower Volga region. The adaptive properties of the goats were assessed with respect to ethological and clinical indicators, taking into account the season of the year. The daily behavior of goats in conditions of year-round zero grazing was as follows: the standing time of the animals ranged from 242.6 to 248.5 minutes and amounted to 16.85 and 17.26%; the lying down time lasted for 258.5 and 262.4 minutes or 17.95 and 18.22%; the motor activity made 370.6 and 373.4 minutes or 25.74 and 25.93%; and the night rest was recorded for 486.0 and 490.0 minutes or 33.75 and 34.03%. A significance was established in favor of Anglo-Nubian goats in terms of the feeding time for 12.7 minutes (P<0.05) and ruminating time while standing for 5.8 minutes (P<0.05). Saanen goats significantly (P<0.05) exceeded Anglo-Nubian goats in terms of day-time sleep, contact with other animals, and milking. The maximum body temperature in both groups was noted in the summer period at an ambient temperature of from +23 to +34 °C, i.e. 39.4-39.9 °C for Saanen breed and 39.4-39.7 °C for Anglo-Nubian breed. The minimum indices were established in the winter period at the air temperature range from -10 to -16 °C, namely, 39.0-39.3 for Saanen goats and 38.6-38.8 °C for Anglo-Nubian ones. In the autumn-spring period, the body temperature indices of both Saanen and Anglo-Nubian goats were higher than in winter and lower than in summer.

1. Introduction
Currently in Russia, there are 768 thousand dairy goats that are represented by 4 breeds, namely, Zaanen, Alpine, Nubian, and Mursiano-Granadina. The main factors, constraining the development of the dairy goat breeding, are a weak domestic breeding base for dairy production, a shortage of goats for creating new farms in agricultural enterprises, a lack of assessment standards and forms of breeding records, and negative veterinary regionalization consequences that pre-vent the spread of breeding animals and genetic material throughout the country [1].
Considerably changed living conditions of imported animals during their movement from their temperate climate zones to areas with a sharply continental climate cause metabolic disorders due to the discrepancy between the level of feeding and keeping and the level of inherent genetic productivity.

In recent years, scientists have devoted their works to ecological and biological aspects of sheep and goats under acclimatization (Khadykov V.P., Mushaev S.G., Dorzhiev S.I., Prozorovsky V.M., Baltuev S.I., Zhamyanov B.V., Novopashina S.I. et al., Gorlov I.F., and others) [2, 3, 4, 5, 6].

The purpose of our research was to study the ethological and clinical reac-tions of Saanen and Anglo-Nubian goats in the extreme continental climate of the Lower Volga region.

2. Methods and materials
Ethological and clinical indicators of dairy goats of the Saanen and Anglo-Nubian breeds, adapting to the conditions of the sharply continental climate, were studied at ECOPRODUCT, OOO located in the Svetloyarsk district of the Volgograd region.

To conduct the research, there were formed 2 groups of experimental goats, 10 heads each, i.e. the Saanen breed of the Netherlands selection and the Anglo-Nubian breed of the German selection. Ethological and clinical parameters were checked on 5 goats in each group.

Ethological parameters of the daily behavior cycle of the experimental goats were determined according to the Velikzhanin’s timing method [7] based on visual observations.

Clinical studies took into account general conditions of the animals, i.e. the body temperature, pulse rate, and respiration by seasons. The body temperature was determined rectally with an ordinary thermometer, the pulse rate corresponded to the number of heart beats per minute on the femoral artery, the number of respiratory movements per minute was counted by the chest’s inhalation acts when the animals were in a calm state. The feeding and keeping conditions were the same for the experimental goats. The rations were compiled with the detailed norms developed by Kalashnikov et al. [8].

The digital material of the research was biometrically processed according to the Plokhinsky method [9], using the Microsoft Office software package and determining the Student criterion at three significance levels. The significance thresholds were * P<0.05; ** P<0.01; and *** P<0.001.

3. Results and discussion
The issue of animals’ behavior is of great importance for the technology of their keeping, as well as time and frequency of feeding goats, in order to increase their productivity. The behavior of imported goats served as an indicator of their adaptation to the environment and changing climatic and technological conditions. One of the essential signs of imported goats, adapting to the harsh continental climate of the Lower Volga region, was the animals’ behavior that was ex-pressed in the duration of the daily cycle and the frequency of feeding, ruminating, lying down, and motor activity (table 1).

Table 1. The daily behavior rhythm of goats during the year-round stall keeping (n=5, \( \Sigma n=10 \)).

| Parameter                        | Breed               |
|----------------------------------|---------------------|
|                                  | Saanen             | Anglo-Nubian       |
| Stand in total, min.             | 242.6±3.13         | 248.5±3.14         |
| incl. feed intake                | 145.6±2.70         | 158.3±2.82*        |
| ruminating                       | 42.7±1.52          | 48.5±1.83*         |
| Lie down in total, min.          | 258.5±3.14         | 262.4±3.62         |
| incl. ruminating                 | 154.8±2.06         | 157.4±2.04         |
| Move in total, min.              | 373.4±4.13         | 370.6±4.23         |
| Drink in total, min.             | 10.6±1.12          | 11.4±1.14          |
| Total daytime sleep, min.        | 30.2±1.33*         | 24.8±1.37          |
| Urinate and defecate, min.       | 8.6±1.06           | 9.3±1.03           |
| Contact in total, min.           | 16.6±1.10*         | 12.8±1.13          |
| Milking and preparation to it     | 13.5±0.71*         | 10.2±0.82          |
| Night rest, min.                 | 486.0±2.10         | 490.0±1.84         |
| Total time, min.                 | 1440               | 1440               |
The daily behavior of goats in conditions of year-round zero grazing keeping was as follows: the standing time of animals ranged from 242.6 to 248.5 minutes and made 16.85 and 17.26%; the duration of lying down was 258.5 and 262.4 minutes or 17.95 and 18.22%; the motor activity lasted for 370.6 and 373.4 minutes or 25.74 and 25.93%; and the night rest took 486.0 and 490.0 minutes or 33.75 and 34.03%. A significant was established in favor of Anglo-Nubian goats in terms of feeding for 12.7 minutes (P<0.05) and standing ruminating for 5.8 minutes (P<0.05). Saanen goats significantly (P<0.05) exceeded Anglo-Nubian goats in terms of the daytime sleep, contact with other animals, and milking.

The significance in the standing time was 2.43% in favor of the Anglo-Nubian breed. Moreover, the feed intake of 12.7 minutes or 8.72% (P<0.05) was established to be significant, so was ruminating for 5.8 minutes or 13.58% (P<0.05).

In terms of the lying down time, the significance was 1.5% and in terms of the lying ruminating, it was 1.67% in favor of Anglo-Nubian goats.

The motor activity of Saanen goats was 373.4 minutes, which was longer by 0.75% than that of Anglo-Nubian goats.

The drinking time parameter was not significant. The daytime sleep of Saanen goats was 30.2 minutes, which was significantly higher (P<0.05) by 5.4 minutes or 21.77% in comparison with the goats of the Anglo-Nubian breed.

Due to higher milk yield, the Saanen goats spent 13.5 minutes for the preparation and milking, which was significantly (P<0.05) higher by 3.3 minutes than the Anglo-Nubian goats did.

We studied the clinical adaptation indicators of the experimental goats by the seasons of the year and by the time of the day (table 2).

| Season | Day time, hours | Air t, °C | Body t, °C | Saanen, n=9 | Anglo-Nubian, n=10 |
|--------|----------------|-----------|------------|-------------|-------------------|
| Winter |                |           |            |             |                   |
| 9-00   | -10            | 39.0      | 18         | 71          | 38.7              |
| 14-00  | -16            | 39.3      | 20         | 73          | 38.8              |
| 19-00  | -14            | 39.1      | 19         | 72          | 38.6              |
| 9-00   | +9             | 39.5      | 20         | 82          | 39.2              |
| Spring |                |           |            |             |                   |
| 14-00  | +19            | 39.6      | 22         | 84          | 39.4              |
| 19-00  | +12            | 39.3      | 21         | 81          | 39.0              |
| 9-00   | +23            | 39.4      | 22         | 83          | 39.4              |
| Summer |                |           |            |             |                   |
| 14-00  | +34            | 39.9      | 24         | 85          | 39.7              |
| 19-00  | +27            | 39.6      | 23         | 84          | 39.5              |
| 9-00   | +18            | 39.3      | 19         | 73          | 38.5              |
| Autumn |                |           |            |             |                   |
| 14-00  | +22            | 39.6      | 21         | 79          | 38.8              |
| 19-00  | +20            | 39.5      | 20         | 77          | 38.6              |

Our data indicated that all clinical parameters of the experimental goats were within the physiological norm.

The maximum body temperature of goats was noted in both groups in the summer period at an ambient temperature of +23 - +34 °C, i.e. 39.4-39.9 °C for Saanen goats and 39.4-39.7 °C for Anglo-Nubian ones. The minimum indices were recorded in winter at the air temperature range from -10 to -16 °C, namely, 39.0 - 39.3 for Saanen goats and 38.6-38.8 °C for Anglo-Nubian ones. In the autumn-
spring period, the body temperature indices were higher than in winter and lower than in summer for both Saanen and Anglo-Nubian goats.

In general, the body temperature of the Anglo-Nubian goats was lower than that of the Saanen goats in all seasons of the year, which indicated the former being better adapted to habitat conditions.

4. Conclusion
Thus, the ethological reactions of the imported Saanen and Anglo-Nubian goats were characterized by a more pronounced feeding behavior with a relatively low motor activity due to zero grazing. All seasonal changes in clinical parameters of the experimental goats were within the physiological norm.

The complex of ethological and clinical indicators made it possible to conclude that, the goats of the Saanen and Anglo-Nubian breeds imported from abroad showed rather high adaptive qualities in the new sharply continental conditions of the Lower Volga region

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