Comprehensive clinical and biochemical diagnosis of hypomicroelementosis in the saaneni white german improved goats acclimatized in biogeochemical conditions of the Astrakhan Region

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ABSTRACT
The study of trace elements in recent years has reached a new comprehensive clinical and biochemical level of diagnosis of the latent form of hypomicroelementoses. About this in the literature, there are serious studies performed on various productive animals, including farm birds. Of particular importance are these data when transporting animals from one biogeochemical region to another, and their acclimatization. The work shows the data from a study of a large complex of physiological and biochemical blood parameters in Saanen white German improved goats imported to the Astrakhan region from the “reference” chernozem region (Krasnodar Territory), where, due to the optimal level of trace elements in the main components of terrestrial ecosystems (soil, water, various types of plants and plant foods) endemic pathologies are not observed, including hypomicroelementoses. The studied clinical parameters (body temperature, pulse rate, the number of respiratory movements per minute) in Saanen white German improved goats acclimatizing in the Astrakhan region were determined by generally accepted methods and they were within the range of normative and published data. The content of trace elements in biological samples was determined by the atomic absorption method. The main changes were revealed during the biochemical analysis of the blood of the studied goats, which indicate the presence in the Saanen white German improved goats of a latent (asymptomatic) form of the combined (Se, I, Co) hypomicroelementosis, which was accompanied by a decrease in the integrative functions of milk productivity and reproduction of the studied ruminants.

INTRODUCTION
Being a mobile medium in the body, the blood reacts very quickly and subtly even to the smallest geochemical irritations (changes) of the environment that cause pathological changes (a hidden form of hypomicroelementosis, etc.), especially in the processes of peroxidation, metabolic and hematopoiesis reactions in the productive body animals (Cantor et al., 1978; Chandra et al., 2008).

Comprehensive diagnostic studies of hypomicroelementosis in dairy Saanen white German improved goats imported to the Astrakhan region from the Krasnodar chernozem “reference” region, where
Table 1: Biochemical blood parameters of the studied goats in the biogeochemical conditions of the Astrakhan region

| Indicators                        | Saanen white german improved goats |
|----------------------------------|-----------------------------------|
| Total protein, g/L               | 58,94±4,09                        |
| Total lipids, g/L                | 4,35±0,18                         |
| Total calcium, mmol/L            | 7,45±0,14                         |
| Inorganic phosphorus, mmol/L     | 1,02±0,02                         |
| Selenium, mcg/L                  | 0,027±0,004                       |
| Cobalt, mg/L                     | 1,22±0,08                         |
| Iodine, mg/L                     | 0,21±0,006                        |
| Alkaline reserve, vol.% CO2      | 41,2±2,31                         |
| Glucose, mmol/L                  | 4,97±0,33                         |
| Vitamin A, μmol/L                | 0,65±0,003                        |
| Vitamin C, μmol/L                | 0,023±0,001                       |
| Vitamin E, μmol/L                | 4,7±0,03                          |

Trace elements are found in soil, water, plants in optimal quantities, were not carried out, although animals acclimatized in the Lower Volga region sharply reduced milk production and reproduction functions (Chung and Maines, 1981; Corrie, 1996). Earlier in the Astrakhan region, low levels of selenium, iodine, and cobalt were found in soil, water, plants, plant feed, and organs and tissues of cattle and omnivores (Craven et al., 1997; Odorico et al., 2000).

The aim of our work was a diagnostic study of the latent form of combined (Se, I, Co) hypomicroelementosis with the help of a comprehensive study of general clinical indicators and hematological status of imported and adapting Saanen white German improved goats in the biogeochemical conditions of the Lower Volga (Astrakhan region).

MATERIALS AND METHODS

Studies were conducted from 2015 to 2019 at the departments of veterinary medicine and veterinary-sanitary examination of Astrakhan State University and on the basis of peasant farms in the Astrakhan region. The material for the diagnostic study was blood, adapting Saanen white German improved goats imported from the "reference" chernozem Prikubansky district of the Krasnodar Territory, where endemic diseases, including hypomicroelementosis, are not recorded. In addition, general clinical indicators were determined in the goats under study: body temperature, pulse rate and the number of respiratory movements per minute.

Trace elements were determined by the atomic absorption method on a CHITAHI 180-50 spectrophotometer (Japan). The results were processed statistically using the mathematical analysis software package, Microsoft Excel 97 Pro, Statistika.

RESULTS AND DISCUSSION

We found that the number of red blood cells, white blood cells and the white blood cell count of the Saanen German white improved goats were within the physiological norm for this animal species.

Comparing the blood biochemical parameters obtained by us with the literary ones, it can be argued that the level of protein, total lipids, selenium, iodine, cobalt, total calcium, inorganic phosphorus, alkaline reserve, as well as the content of antioxidant vitamins E, A, C and B₁₂ (Table 1) are the physiological norm for small ruminants (Hansen and Deguchi, 1996).

It should be noted that the blood glucose level of the studied goats was higher than the physiological norm for this animal species, which indicates the presence of hypomicroelementosis in the studied animals. This is consistent with data from other researchers and occurs against the background of a positive correlation \( r = +0.68 \) of low levels of selenium, iodine, and cobalt in soils, water, plants, and plant feeds previously established in the Astrakhan region (Gaitan and Dunn, 1992; Georgopoulos et al., 2003).

At the same time, general clinical indicators for acclimatized Saanen white German improved goats, such as body temperature \( (39.2±2.16 \) degrees Celsius), pulse rate \( (78±4.8 \) per minute) and respiratory rate \( (145±2.7 \) per minute) did not go beyond the physiological norm (Harrison et al., 1984; Kendall et al., 2000).
Therefore, it is precisely the changes in the physiological and biochemical parameters of the studied goats that are in the biogeochemical conditions of Astrakhan that allow using the complex diagnostics method to establish the negative effect of low levels of I, Se, and Co on the organism of acclimatized Saanen white German improved goats, i.e., the presence of they have hypomicroelementosis, which prolongs a decrease in milk productivity and animal reproduction function by 20–40%, as we indicated earlier (Chirico and Halliwell, 1993).

CONCLUSIONS

A comprehensive clinical, physiological, and biochemical analysis allows us to diagnose the latent form of hypomicroelementosis in the Saanen white German improved goats brought to the Astrakhan region, which probably have not yet fully adapted to the low levels of selenium, iodine, and cobalt in the environment and vegetable feed and animals negatively respond to a low level of deficient trace elements in the biogeochemical conditions of the Lower Volga region, including Astrakhan region.

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