

Some biochemical parameters in the blood of grazing German improved fawn goats from Istria, Croatia

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ABSTRACT

Concentrations of glucose, cholesterol, triglycerides, total proteins and albumin in the blood of goats have been investigated. The tested herd contained 80 clinically healthy goats aged between 6 months and ten years, kept and fed extensively. Relative hypoglycaemia, hypocholesterolemia and hypotriglyceridemia were detected and are attributed to energetically insufficient nutrition in terms of the lactation level. The concentration of total proteins and albumin were within physiological range.

Key words: glucose, cholesterol, triglycerides, total proteins, albumin, goat

Introduction

The available literature related to the field of metabolism in goats is rather scarce, and only a few authors have looked into this problem. Some of them tested the concentration of biochemical indicators exclusively in healthy goats and did not observe any aberrations from the physiological values (BARAKAT and EL-GUINDI, 1967; VARMA, 1967; RIDOUX, 1981; LLOYD, 1982; BENNIS et al., 1991; NAZIFI et al., 1999). Others investigated healthy goats and presented biochemical indicators in relation to age, sex, breed, reproduction cycle, season of the year, influence of stress, and maintenance

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conditions. These indicators were then compared to analogue values in other animal species, as well as to those of humans (BARLET et al., 1971; CASTRO et al., 1977; CASTRO et al., 1977a; BOSS and WANNER, 1977; BOGIN et al., 1981; PUGLIESE et al., 1982; VRZGULA et al., 1985; WOJCIK et al., 1986; DEL PALACIO, 1987; GRABKOWSKI and RUTKOWIAK, 1989; JOSHUA and ABA-ADULUGBA, 1990; VAN NIEKERK et al., 1990; ŽUBČIĆ, 1997). Furthermore, the changes in biochemical indicators in the blood of goats as a result of certain, usually parasitary, but also metabolic, diseases were investigated by FETCHER (1982), PINSENT and COTTOM (1987), JOVANOVIĆ et al. (1989), KALU et al. (1989), GRUNWALDT et al. (1990), MCDUGALL et al. (1991), and AHMED et al. (1992).

This work is designed to contribute to the understanding of potential basic metabolic disorders at the sub-clinical level by observing changes in concentration of glucose, cholesterol, triglycerides, total proteins and albumin in the blood of goats. A herd of goats was kept extensively, with only a minor influence of breeders on their production. As there have been no systematic analyses of biochemical indicators in goats carried out in Croatia, this work is aimed at determining those indicators and comparing them to values obtained by other authors.

Materials and methods

The study was conducted on a herd of 80 German improved fawn goats (Bunte Deutsche Edelziege, BDE) aged between 6 months and 10 years, on the Haber farm in Istria, near Rovinj, and the Limski kanal fjord. Goats were kept extensively and spent about 8 hours a day on pasture. They browsed and grazed on a rocky and grassy area (approx. 30%), meadows (20%), in vineyards during winter (10%) and in macchia (40%). The ratio between grazing and browsing was 2:1. Goats were fed hay only until the eighth day following kidding. They occasionally received bone meal or blocks of iodine-treated salt, together with some other minerals. Water was provided from the public water-supply. During the night goats stayed under shelters fenced with hay bales. They were milked morning and evening. Their annual production ranged between 400 l and 800 l of milk per goat. Animals kid late in winter or at the beginning of spring and

on average they produce 2.1 kids a year. Old goats died of natural causes and are milk almost until the end of their lives. Dehelminthization was varied out twice a year by administering Iverctin solution and Nilsan pills (Pliva, Zagreb, Croatia). Kids were occasionally given shots of vitamins A, D₃ and E and oligoelement of selenium. Coprologic tests have been carried out using the flotation method and strongylide-type eggs, as well as *Coccidia* oocysts, have been found in the collective samples in younger animals, while in older ones only strongylide-type eggs have been detected. The intensity of invasion was of low level. No antibodies to causative agents of brucellosis, Q-fever, leptospirosis and listeriosis were detected. While taking samples for laboratory tests, standard clinical assessments of goats were also done. No signs of any infectious disease or mastitis have been observed.

The blood samples needed for testing were taken from v. jugularis, and for technical reasons always late in the afternoon. Samples were taken in glass tubes, coagulated at room temperature, centrifuged for 10 minutes at 1,500 g. and stored at +4 °C.

Serum samples were tested at the Central Laboratory of a City Hospital in Villach, Austria. Glucose level was determined using the glucosis-dehydrogenase method (Merck and Co, Inc., Rahway, N.J., U.S.A.). Cholesterol and triglycerides levels were determined by the enzymatic test (Boehringer, Mannheim GmbH, Mannheim, Germany). Total proteins level was determined using the biuret method, and the albumin level by means of brom-cresol verdure (Roche, Nuttley, New York, U.S.A.) on Cobas Bio and Cobas Mira biochemical auto-analyzers (Roche, Nuttley, New York, U.S.A.). All obtained data were then statistically analyzed (arithmetic mean, standard deviation, 2.5% and 97.5% percentiles, concentration correlation between biochemical indicators and the age of animal) by means of statistic software program (SAS User's guide: Statistics. Version 6.1, 1989; Cary, North Carolina, USA).

Results

The results obtained for tested biochemical indicators compared to those of other authors, are shown in Table 1, as well as the data related to

arithmetic mean, one standard deviation (sd), 2.5% and 97.5 percentile. The results obtained for each biochemical parameter indicate that the material is well balanced and suitable for statistical analysis. In other words, the distribution of results is in accordance with the Gaussian curve.

Table 1. Review of obtained results of biochemical indicators analysed in our study compared to those of other authors

	Glucose mmol/L Mean \pm s d min - max	Cholesterol mmol/L Mean \pm s d min - max	Triglycerides mmol/L Mean \pm s d min - max	T. proteins g/L Mean \pm s d min - max	Albumin g/L Mean \pm s d min - max
Our study	2.1 \pm 0.55 1.1 – 3.0 *	1.74 \pm 0.08 0.07 – 0.36 *	0.17 \pm 0.08 0.07 – 0.36 *	74.8 \pm 9.4 56.0 – 90.0 *	33.0 \pm 6.1 18.9 – 44.5 *
BARAKAT and EL-GUINDI (1967)	3.1 \pm 0.4 2.2 – 4.0	6.2 \pm 0.6 4.9 – 7.9	-	65.6 \pm 4.2 51.6 – 75.8	-
CASTRO et al. (1977; 1977a)	3.9 \pm 0.6	-	-	73.0 \pm 7.0	32.0 \pm 6.0
BOGIN et al. (1981)	3.2 \pm 0.3	2.1 \pm 0.5	-	74.0 \pm 2.0	40 \pm 1.8
LLOYD (1982)	2.2 - 3.3	-	-	60 – 78.5	32.5 - 49
PUGLIESE et al. (1982)	2.9 \pm 0.6 2.0 – 4.3	1.7 \pm 0.3 1.22 – 2.36	0.30 \pm 0.09 0.15 – 0.54	74.6 \pm 6.0 59.4 – 96.6	31.8 \pm 6.0 20.6 – 45.9
WOJCIK et al. (1986)	2.4 – 3.1 \pm 0.1 – 0.2 **	2.9 – 3.4 \pm 0.3 – 0.5 **	-	58.4 – 70.8 \pm 3.0 – 5.2 **	-
PALACIO (1987)	2.5 – 3.0 \pm 0.04 – 0.06 ***	-	-	80.2 – 88.1 \pm 0.3 – 0.6 ***	40.6 – 50.0 \pm 0.3 – 0.5 ***
JOVANOVIĆ et al. (1989)	3.1 \pm 0.3 2.3 – 3.8	2.6 \pm 0.7 0.9 – 2.9	-	76.7 \pm 6.8 52.3 – 99.4	20.3 \pm 2.9 15.0 – 28.6
McDOUGALL et al. (1991)	3.4 \pm 0.5 2.0 – 4.8	-	-	78.0 \pm 6.0 62.0 – 89.0	29.0 \pm 2.0 21.0 – 33.0

* Shown as percentiles (2.5% - 97.5%), not min-max values

** Mean \pm sd incorporating four different groups (correlating to the seasons of the year)

*** Mean \pm sd incorporating seven different groups (correlating to geographic areas in Spain)

Discussion

The investigation of basic biochemical indicators contributes to the knowledge of metabolic profiles in extensively kept and fed goats and their possible disorders, whether of a latent or clinical nature.

The concentrations of glucose determined in this research are to some extent lower than in those detected by other authors. Thus, the mean value of glycaemia of 2.1 mmol/L, determined in this study is lower than physiological concentration obtained by BARAKAT and EL-GUINDI (1967),

CASTRO et al. (1977), LLOYD (1982), PUGLIESE et al. (1982), JOVANOVIĆ et al. (1989), and McDOUGALL et al. (1991). In those papers the mean concentrations of glucose in a herd range between 2.2 and 3.9 mmol/L. In the study of WOJCIK et al. (1986) and DEL PALACIO (1987) the mean concentration in certain seasons of the year and in different geographic areas amounted to 2.4 mmol/L, which is a somewhat higher mean concentration than that observed in our study. GRABKOWSKI and RUTKOWIAK (1989) also determined a somewhat lower mean value of glucose (2.4 mmol/L). JANA et al. (1991) registered mean values of 2.4 mmol/L and 2.0 mmol/L at the initial stage of pregnancy and in the last pregnancy trimester, respectively, and goats were reared under an extensive management system. Given that the goats included in our study were healthy, it is our belief that one of the important causes of hypoglycaemia could be found in the extensive method of feeding. Moreover, blood was taken from animals during the summer season, when the herbal covering in the Istrian karst is meager, despite which the goats were giving fairly large quantities of milk. This could be an additional reason for the values that are lower than the physiological ones, observed by other authors. Also, we have established that the glucose level decreases with the ageing of goats, which is in accordance with the results obtained by BOGIN et al. (1981).

With regard to the concentrations of cholesterol in the blood of goats, they are comparably lower than those determined by other authors (BARAKAT and EL-GUINDI, 1967; WOJCIK et al., 1986; JOVANOVIĆ et al., 1989). However, they are slightly lower than those stated in the work by BOGIN et al. (1981), whereas they are in agreement with the results obtained by PUGLIESE et al. (1982). In our opinion this is due to the circumstances of feeding conditions, i.e. relative under-nutrition of goats in relation to the degree of milking capacity. We could compare the concentration of triglycerides in blood only to that observed by PUGLIESE et al. (1982). They are lower in our research for the same reasons as those related to concentration of cholesterol.

With regard to the concentration of total proteins in the blood serum, our results are in agreement with those obtained by the majority of authors (CASTRO et al., 1977a; BOGIN et al., 1981; PUGLIESE et al., 1982; VRZGULA et al., 1985; JOVANOVIĆ et al., 1989; McDOUGALL et al., 1991). Results for albumins

are mainly within well-known physiological limits, although they are inclined to the lower physiological values rather than those that are higher, stated by CASTRO et al. (1977a), PUGLIESE et al. (1982) and McDOUGALL et al. (1991).

Conclusions

Sub-clinical hypoglycaemia is present in German improved fawn goats kept under extensive conditions and fed exclusively on pasture. It is most probably caused by under-nutrition closely connected with lactation capacity. Concentrations of cholesterol and triglycerides which are below the physiological level are in accordance with the above conclusion. Protein and albumin concentrations vary within physiological limits. The obtained results indicate that the investigated herd showed certain changes in terms of metabolic disorders of a sub-clinical nature, primarily due to a relative shortage of energetic substances in the food. This conclusion is in agreement with the specific intention of the breeder to keep and feed his goats strictly extensively and on karst terrains and to keep them alive as long as possible, with optimal lactation ranging between 400 to 800 litres of milk per year.

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SAŽETAK

Određivana je koncentracija glukoze, ukupnog kolesterola, triglicerida, ukupnih bjelančevina i albumina u krvi 80 klinički zdravih koza u dobi od šest mjeseci do deset godina držanih i hranjenih ekstenzivno. Utvrđena je relativna hipoglikemija, hipokolesterolemija i hipotrigliceridemija što se pripisuje energetske nedostatnoj hranidbi s obzirom na stupanj laktacije. Koncentracija ukupnih bjelančevina i albumina kreću se u fiziološkom rasponu.

Ključne riječi: glukoza, kolesterol, trigliceridi, ukupne bjelančevine, albumini, koza
