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Effect of Breed, Feed, Housing, Age and Parity on Serum Trace Elements Levels in Goats

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ABSTRACT

The present study aimed to investigate factors affecting the level of manganese, selenium, iron and zinc in the serum of brood goats. Total of 134 clinically healthy and non-pregnant does were assigned for this study. Does were classified according to breed, feeding, housing system, age, and parity. The animals in different groups were bled and sera were analyzed for trace elements using Flam Emission Atomic Absorption. Breed affected levels of manganese (P=0.02) and zinc (P=0.01). Does supplemented with pelleted food with barseem had higher serum manganese (P=0.001) and zinc (P=0.05) levels than other feeding groups. Selenium (P=0.001) was higher in the serum of does in mixed houses than those sheltered in closed or open system. Older does had lower serum selenium (P=0.01) and iron (P=0.001) than younger ones. It can be concluded that breed, feeding type, housing system, age and parity could affect the level of serum trace elements in breeding does.

Key words: Animal Husbandry, Age Groups, Risk factors, Nutrition.

INTRODUCTION

On formulation of ration for certain category of breeding animals, it is of utmost importance to provide the necessary requirements of trace elements required for optimum production and reproduction of animals (Grace and Knowles 2012). In this regard, several factors governing this calculation should be considered (Nawito et al. 2015). These factors should be justified for certain species and for a specific breed to obtain a good performance from these animals (Makhlouf et al. 2020). Innate immunity, enzymatic wear and tear, oxidant: antioxidant balance, tissue growth and biosynthesis are all biological processes fueled by trace elements and necessitate their contribution to work properly (Vázquez-Armijo et al. 2011; Abdel-Saeed and Salem 2019). It has been reported that age and number of previous births should be accountable on supplementing trace elements for these animals (Shivakumara and Siddaraju 2019). The aim of this study was to investigate the effect of the breed, feeding type, housing, age and parity on the serum level of four crucial trace elements [zinc (Zn), manganese (Mn), iron (Fe) and selenium (Se)] of breeding goats in Qassim region, Saudi Arabia.

MATERIALS AND METHODS

Ethical Approval

Animal Care and Welfare Committee, Deanship of Scientific Research, Qassim University, Kingdom of Saudi Arabia approved this study vide code # 213177.

Animals

Total of 134 goats from 15 flocks, averaged 2.75 years age and 48.87kg weight, average body condition score 3.25 (Sharma et al. 2018) in Qassim region, central Saudi Arabia were used in this study. They were fed on diets formulated to meet the requirements of 50kg maintenance doe (NRC 2007) and drinking water *ad libitum*. Does were classified according to breed, feeding, housing, age and parity Table 1.

Clinical Examination

The animals were examined clinically for general health condition and thriftiness. For the gynecological

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examination, transrectal/transabdominal ultrasonography using a 5 MHz probe (Eickemeyer, Tuttlingen, Germany) was carried out on the context of routine examination of the goat flocks in the region. Only healthy, sound and non-pregnant does were used in the present study.

Blood Sampling

Blood was collected from the jugular vein of all studied does. At each sample time, 5mL of blood was placed in plain tubes to obtain serum. The serum samples were separated by centrifugation for 15min at 3000xg and were immediately stored at -20°C till the time of estimation.

Estimation of Trace Elements in Serum

Flame emission atomic absorption was used to estimate serum levels of Mn, Se, Fe and Zn after samples digested using HClO4-HNO3 mixture (Pompilio et al. 2021).

Statistical Analysis

The data were presented in mean±SE, and statistical analysis was carried out using the SPSS program, version 25 (SPSS Inc., Chicago, IL, USA, 2017). Data were analyzed by the GLM procedures for the effect of different factors on the serum concentration trace elements in does. Significance was set at $P<0.05$.

RESULTS AND DISCUSSION

Serum trace elements levels in different groups are shown in Table 1. Results showed that goat breed affected significantly the level of Mn (P=0.02) and Zn (P=0.01). An animal's genotype largely determines its energy and protein requirements (Sahlu et al. 2004), therefore, trace element requirements are also expected to differ among genotypes. The current study showed that Ardi and Damascus does had a distinct profile of serum trace elements compared with other breeds. Recently, Ali et al. (2020) reported that both breeds are likely more adaptable to the intensive system of breeding and harsh condition in central Saudi Arabia. Goat breeds other than these two breeds were less tolerable to deficiency in trace elements in Saudi Arabia (Shawaf et al. 2021).

Mn (P=0.007) and Se (P=0.001) were higher in the serum of does housed in mixed houses than those sheltered in pens or in open system. Older does had significantly lower serum Mn (P=0.05), Se (P=0.01) and Fe (P=0.001) than younger ones. Nulli- and primiparous does had higher serum Mn (P=0.001), Se (P=0.009) and Fe (P=0.001) levels compared with pluriparous does. There was a significant interaction between age and parity on the level of Mn (r=-0.23, P=0.007) and Zn (r=-0.3, P=0.01). Older does had a lower Mn, Se and Fe level than younger ones. Consequently, pluriparous does had lower Mn, Se and Fe serum levels compared with nulli- or primiparous does. The level of trace elements is undoutedly influenced by age and parity (Gürdoğan et al. 2006). Accordingly, levels of serum Se, Fe and Zn were lower in older and multiparous does. There is a strong evidence that maternal stores of minerals deplete with age and repeated pregnancies and the fact that most minerals decrease in older females is irrefutable (Ugwuja et al. 2015). The higher demand of nutrition during pregnancy and associated increase in metabolic processes including mobilization of the trace elements from the maternal tissue to the circulation during pregnancy probably cause this drop after parturition (Kumar et al. 2011).

Does supplemented with pelleted food added to barseem had higher serum Mn (P=0.001) and Zn (P=0.05) levels. Does fed on forages (barseem only or barseem and barley) had lower serum Mn and Zn levels. While forages are rich in trace elements, the type of soil in which they grow determines their composition and content. These elements may affect the amount even detected in the green substance and seeds of a crop based on their concentration in soil and availability in plants (Hill and Shannon 2019). A short rainy season, excessive soil salinity and saline underground water in Qassim region (Al-Turki et al. 2020) may be the major factors influencing trace minerals contents in the domestic forages.

Table 1: The effect of breed, feeding, housing on the level of serum manganese (Mn), Selenium (Se), iron (Fe) and Zinc (Zn) of does

Parameters		n	Mn (µmol/L)	Se (µmol/L)	Fe (µmol/L)	Zn (µmol/L)
Breed	Ardi	44	5.98±0.56a	0.32±0.03a	18.01±4.98a	6.10±1.13a
	Damascus	36	7.21±0.18a	0.95±0.04a	15.83±2.42a	5.40±0.29a
	Balady	31	1.96±0.69b	0.47±0.15a	11.93±1.33a	3.98±0.86b
	Hybrid	23	1.45±0.62b	1.01±0.67a	6.63±0.67a	3.47±0.57b
Feeding	Barseem	38	2.83±0.65a	0.38±0.05a	22.00±8.18a	6.47±1.51a
	Barseem+pellets	67	5.15±0.87b	0.75±0.13a	15.57±1.99b	9.50±2.16b
	Barseem+barely	29	1.46±0.20a	0.54±0.24a	10.41±1.15b	3.23±0.24a
Housing	Open	31	1.24±0.09a	0.07±0.34a	9.00±1.32a	2.07±3.90a
	Mixed	46	5.87±0.57b	1.22±0.18b	11.79±3.93a	6.02±2.04a
	Closed	57	1.73±0.39a	0.45±0.12a	12.81±4.09a	5.03±1.41a
Age	<2 Y	14	3.54±0.46a	0.97±0.28a	14.98±5.61a	6.18±1.65a
	2-3 Y	16	1.97±0.78b	0.62±0.24b	14.36±4.80a	5.52±1.93a
	3-4 Y	48	2.59±0.54b	0.38±0.17b	9.76±2.24a	2.13±2.81a
	>4 y	56	1.71±0.89b	0.35±0.14b	5.70±1.16b	3.65±3.18a
Parity	Nullipara	12	4.83±1.85a	0.89±0.32a	13.08±2.37a	7.54±3.52a
	Primipara	51	3.11±0.71b	0.49±0.09b	25.81±6.67b	7.96±2.12a
	2 parities	43	1.87±0.58c	0.38±0.11b	10.49±1.19a	3.61±0.31b
	≥3 parities	28	2.74±0.76b	0.25±0.04b	8.52±1.33a	5.05±0.92a

Values (mean±SE) with the same superscript letter in the same column are not significantly different. Statistical significance was set at $P<0.05$.

Animals housed in closed pens had lower serum Mn and Se values than those managed in open and mixed management system. It is generally accepted that breeders and their knowledge of animal health solely determine the quantity and quality of feed provided to their animals (Shivakumara and Siddaraju 2019). In Qassim region, the majority of the studied animals belong to small stockholders (Ali et al. 2020). Few farms base their livestock feeding decisions on institutional data. It can be concluded that the level of trace elements in breeding goats is affected by breed, housing system, type of feeding, age and parity.

Conclusion

Based on the results of the present study, it is recommended that on formulating ration for breeding goats, factors affecting the level of trace elements should not be overlooked.

Authors Contribution

Derar Derar: Conceptualization, Methodology, Software; Ahmed Ali.: Data curation, Writing- Original draft preparation. Tariq Al-Mundarij: Visualization, Investigation. Essam Abdel-Moneim: Supervision. Tamim Alhassun: Software, Validation.

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