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Effect of buck existence on some reproductive hormone levels during premating in Akkeçi goats

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Abstract: In this study, the effect of buck presence on serum progesterone, estrogen and FSH levels during the premating in 20 female Akkeçi goats was investigated. The goats were assigned to two groups as follows: control group (n = 10) and treatment group (n = 10). At the beginning of study, first blood samples (day 0) were taken from each goat kept isolated away from bucks at mating season. At day 13, female goats in treatment group were placed in a pen next to, that of bucks in order to provide buck effect. Second blood samples were taken from each does after two days following buck presence for treatment group. Seven days later, treatment and control groups were combined in the same pen, then one buck was introduced to herd in order to provide natural mating. Third blood sampling was performed after 2 days following group merging, last blood samples (4th) were taken from each goats on the 42th day. According to the result of statistical analysis, the effect of buck existence on the concentrations of progesterone, estrogen and FSH was not statistically significant ($p > 0.05$). In conclusion, buck existence did not affect observed hormone levels in Akkeçi goats during premating period.

Keywords: Goat, progesterone, estrogen, follicle stimulating hormone, buck effect

1. Introduction

Estrogen, progesterone and FSH hormones have an important role in reproductive physiology. It has been reported that estrogens are produced especially from ovarian follicles, corpus luteum and placenta [1]. It is also reported to be effective in the development of female characteristics [2]. Progesterone has been reported to be necessary for cervix, endometrium and uterus functions [3]. Rose et al. [4] reported that the determination of follicle-stimulating hormone was essential for elucidating reproductive physiology, regulating reproduction, diagnosis and treatment of reproductive disorders.

To know the physiological conditions of animals and environmental factors affecting these physiological conditions within the framework of reproductive endocrinology; it is important for the evaluation, control and in control sustainability of reproduction.

Some ruminant species, including sheep and goats, show seasonal estrus and with the domestication of these species, the seasonal breeding pattern seen in the wild has not changed, the aim is to ensure that the offspring are born during the most appropriate period of the year, usually in the spring [5].

The goat breed Akkeçi which were used in this study was a crossbreed (composed of 3/4 Saanen and 1/4 local Kilis breeds) genotype for milk production and as well as rusticity [6].

Regarding the breeding characteristics of goats, it has been reported that the beginning and length of the breeding season depends on factors such as the presence of males, latitude, climate, physiological stage, reproductive system, breed, but mainly on the photoperiod [7].

Detailed studies of pheromones in goats, sheep, cattle, pigs, insects and rodents have shown that male pheromones have a significant effect on reproductive activity in females [8]. In addition, it has been reported that in sheep and goats, the male effect is more than a pheromone-triggered response, and is a multifaceted process involving sociosexual signals provided by men [9].

Although exogenous hormone applications are generally used to control reproduction, it has also been reported that alternative approaches should be found [10]. It has been reported that hormonal applications using exogenous hormones and the application of goat effect, a natural method, were used in oestrus synchronization [11]. It has been observed that social relationships with other animals of their own species can affect reproductive processes in many species of animals [12]. In sheep and goats, both the male and the female effects, the response given after contact with the opposite sex is diverse and this

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may be due to the difference in the stimulus quality of the animal signaling the animal or the responsiveness of the target animal [13].

The aim of this study is to investigate the effect of buck presence on serum progesterone, estrogen and FSH levels in Akkeçi goats.

2. Material and method

2.1. Animal care

The experimental procedure was approved by Local Ethics Committee at Ankara University (Decision Number: 2017-21-170, Date: 18.10.2017).

2.2. Location, experimental animals and management

This study was carried out in the breeding season between September and November in the Animal Husbandry Station (39°57′43.2″ N, 32°51′58.1″ E) at the Ankara University, Faculty of Agriculture, Department of Animal Science. The study was conducted on 20 Akkeçi does (1.5–5.5 years old). The goats were kept isolated at a distance of 120 m from bucks 10 months before the study as visually, auditory, tactile and olfactory. They were housed in shaded pens during the experiment period. Animal density is on average 13 m^2/goat and they were not milked during experiment period. The goats were fed with concentrate feed (dry matter (DM, g kg^{-1}): 895, metabolizable energy (MJ kg^{-1} DM): 12.6, crude protein (g kg^{-1} DM): 163, ether extract (g kg^{-1} DM): 29.5, crude fiber (g kg^{-1} DM): 58, crude ash (g kg^{-1}): 66.5), alfalfa hay and wheat straw. Drinking water was always available for the goats.

2.3. Experimental groups and blood sampling

The goats were assigned to two groups as follows: 1) control group (n = 10) and treatment group (n = 10). Control and treatment groups (within themselves) were divided into two groups as nullipar (n = 5) and primipar-multipar (n = 5). During to the experiment, first blood samples (day 0, 26 September) were taken from each goat kept, isolated away from bucks at mating season. At day 13 (09 October), female goats in treatment group were placed in a pen next to that of bucks (3 Akkeçi goats and 2 Angora goat bucks) in order to provide buck effect. Thus, visual contact, touch, friction, odor and sound stimulation were allowed after transfer the experimental area but not mating. Second blood samples were taken from each goats after two days following buck presence (at day 15, 11 October) for treatment group. Seven days later (at day 20, 16 October), treatment and control groups were combined together, then one buck was introduced to herd in order to provide natural mating. This goat remained in the herd until the experiment was over. Third blood sampling was performed after 2 days following group merging (at day 22, 18 October), last blood samples (4th) were taken from each goats on the 42th day (07 November). Blood samples were regularly taken from the vena jugularis from goats using vacuum containers without anticoagulant (VACUETTE TUBE 8 mL Z Serum Sep Clot Activator) at 11:00 am on sampling days. The blood samples were centrifuged at 4000×g for 5 min, and the sera were stored at −20 °C until the analysis was carried out.

2.4. Hormone analysis

The analyses of hormones (progesterone, estrogen and FSH) in the blood serum were performed by enzyme immunoassay method (ELISA) in the Reproductive Biology and Animal Physiology Laboratory at Ankara University, Faculty of Agriculture, Department of Animal Science. The progesterone (YL Biont, Catalog Number: YLA0024GO, China), estrogen (YL Biont, Catalog Number: YLA0006GO, China) and FSH (YL Biont, Catalog Number: YLA0061GO, China) concentrations were determined using a commercial enzyme linked immunosorbent assay kits. The least detectable concentrations of the kits were 0.024 ng/mL, 0.093 ng/L and 0.028 mIU/mL for progesterone, estrogen and FSH, respectively.

2.5. Statistical analysis

The data obtained from the experiment were analyzed using repeated measures analysis of variance (ANOVA). Sources of variation were group (control and experimental groups), subgroups (nullipar and primipar-multipar groups), period (1st, 2nd, 3rd and 4th) and their interactions. Duncan test was used to determine different groups (transaction). The analyses were performed with IBM SPSS Statistics 20 program [14].

3. Results and discussion

3.1. Effect of buck existence on progesterone concentrations

The concentrations of progesterone in Akkeçi goats were shown in Table 1. As seen in Table 1, it was found that the effect of buck existence on the concentrations of progesterone was not statistically significant ($p > 0.05$) except for the general group where all experimental animals are evaluated together. It can be argued that this may be due to the fact that the experimental goats were in the breeding season. Also, it can be said that this situation is compatible when the studies conducted in the breeding season and anoestrus season are examined. Hawken et al. [15] reported that the male effect were implemented during the seasonal or lactational anestrus period and that high progesterone concentrations in the luteal period of estrus cycle were blocked the male effect in goats. Similarly, Moeini et al. [16] found that progesterone levels did not change in some groups due to male effect in the goats during the breeding season. In a study conducted in Pelibuey ewes, it was also reported that the male effect did not cause a significant difference in terms of progesterone

Table 1. Concentrations of progesterone (ng/mL) in Akkeçi goats in the groups during the experimental period.

Groups		Concentrations of progesterone at periods (ng/mL)			
		1st blood samples (day 0)	2nd blood samples (day 15)	3rd blood samples (day 22)	4th blood samples (day 42)
Control	Primipar-multipar (n = 5)	1.62 ± 0.49	1.25 ± 0.13	0.86 ± 0.28	1.67 ± 0.54
	Nullipar (n = 5)	2.64 ± 1.48	3.63 ± 1.17	1.87 ± 0.91	1.96 ± 0.73
	Total (n = 10)	2.13 ± 0.75	2.44 ± 0.68	1.37 ± 0.48	1.81 ± 0.43
Treatment	Primipar-multipar (n = 5)	2.46 ± 0.70	1.67 ± 0.80	0.77 ± 0.10	0.96 ± 0.09
	Nullipar (n = 5)	1.02 ± 0.15	1.09 ± 0.18	0.87 ± 0.22	1.11 ± 0.24
	Total (n = 10)	1.74 ± 0.41	1.38 ± 0.40	0.82 ± 0.11	1.04 ± 0.12
	General (n = 20)	1.94 ± 0.42^{A}	1.91 ± 0.40^{A}	1.09 ± 0.25^{B}	1.43 ± 0.24^{AB}

^{A,B}: Mean values within a row with different capital letters differ significantly ($p < 0.05$).

profiles in ewes in the estrus cycle [17]. In contrast to the studies conducted during the breeding season of goats, it was reported that the progesterone levels of the females were affected in the experiments about the male effect in the anoestrus season [18]. Ferreira-Silva et al. [19] reported that during the postpartum anoestrus periods of sheep, progesterone levels changed with the male effect. Also, Hulet et al. [20] reported that the ram effect did not have a significant effect on the ovulation rate in the does during the transitional season from anoestrus to breeding season. Additionally, statistical analysis showed a significant effect of period ($p < 0.05$) on progesterone concentrations. This situation can be attributed to the decrease in progesterone concentrations due to the regression of the corpus luteum in goats; it can also be thought to be caused by the increase in sample size by taking all groups into consideration together.

3.2. Effect of buck existence on estrogen concentrations

The estrogen concentrations in Akkeçi goats are shown in Table 2. As seen in Table 2, it was found that both male effect and period on the level of estrogen hormone was not statistically significant ($p > 0.05$). This is thought to be due to the fact that experimental goats were in the breeding season. In some of the studies carried out in similar field, it was reported that male effect is implemented only during seasonal or lactational anestrus period [15]. However, Ungerfeld et al. [21] were reported that the male effect in the breeding season did not lead to a significant difference ($p > 0.05$) between the control and treatment groups in terms of estradiol-17β concentrations. Additionally, Moeini et al. [16] were also reported that the estrogen levels of goats in the breeding season did not change due to the male effect. Also, Knight et al. [22] reported that the male effect did not cause a significant difference in estradiol-17β concentrations in female goats. Chemineau [23], on the other hand, reported that although cyclic goats come to oestrus with male effect, estrus distribution is different from expected uniformity. In contrast to the studies carried out during the breeding season, looking at the studies in the anoestrus season; it has been reported that the male effect affects ovulation in females in anoestrus season [24]. It can be said that the findings obtained in this study regarding estrogen concentrations were compatible with the literature.

3.3. Effect of buck existence on FSH concentrations

The concentrations of FSH in Akkeçi goats are shown in Table 3. As seen in Table 3, it was found that the male effect on the FSH concentrations was not significant ($p > 0.05$), while groups × subgroups × period interaction was significant ($p < 0.05$). This may be due to the fact that the experimental goats were in the breeding season and it can be said that the findings obtained were consistent with the literature. Thus, Hawken et al. [15] were reported that male effect is implemented only during seasonal or lactational

Table 2. Concentrations of estrogen (ng/L) in Akkeçi goats in the groups during the experimental period.

Groups		Concentrations of estrogen at periods (ng/L)			
		1st blood samples (day 0)	2nd blood samples (day 15)	3rd blood samples (day 22)	4th blood samples (day 42)
Control	Primipar-multipar (n = 5)	5.44 ± 1.56	5.28 ± 1.00	5.82 ± 1.57	8.62 ± 3.53
	Nullipar (n = 5)	12.60 ± 5.76	10.60 ± 4.63	8.36 ± 3.61	9.26 ± 2.49
	Total (n = 10)	9.02 ± 3.06	7.94 ± 2.40	7.09 ± 1.90	8.94 ± 2.04
Treatment	Primipar-multipar (n = 5)	8.27 ± 2.54	4.93 ± 0.82	5.07 ± 0.76	5.54 ± 1.62
	Nullipar (n = 5)	5.78 ± 0.58	4.24 ± 0.96	5.22 ± 0.62	2.53 ± 0.79
	Total (n = 10)	7.02 ± 1.30	4.59 ± 0.60	5.14 ± 0.46	4.03 ± 0.99
	General (n = 20)	8.02 ± 1.63	6.26 ± 1.27	6.12 ± 0.98	6.49 ± 1.24

Table 3. Concentrations of FSH (mIU/mL) in Akkeçi goats in the groups during the experimental period.

Groups		Concentrations of FSH at periods (mIU/mL)			
		1st blood samples (day 0)	2nd blood samples (day 15)	3rd blood samples (day 22)	4th blood samples (day 42)
Control	Primipar-multipar (n = 5)	1.12 ± 0.31 Aa_A	1.17 ± 0.21 Aa_A	1.43 ± 0.27 Aa_A	1.30 ± 0.42 Aa_A
	Nullipar (n = 5)	2.10 ± 0.76 Aa_A	1.33 ± 0.54 Ba_A	1.73 ± 0.75 ABa_A	1.53 ± 0.65 ABa_A
	Total (n = 10)	1.61 ± 0.42	1.25 ± 0.27	1.58 ± 0.38	1.42 ± 0.37
Treatment	Primipar-multipar (n = 5)	1.62 ± 0.51 Aa_A	0.89 ± 0.18 Ba_A	0.76 ± 0.07 Ba_A	0.91 ± 0.22 Ba_A
	Nullipar (n = 5)	1.00 ± 0.16 Aa_A	1.13 ± 0.30 Aa_A	0.81 ± 0.06 Aa_A	1.12 ± 0.23 Aa_A
	Total (n = 10)	1.31 ± 0.27	1.01 ± 0.17	0.79 ± 0.04	1.01 ± 0.15
	General (n = 20)	1.46 ± 0.25	1.13 ± 0.16	1.18 ± 0.21	1.22 ± 0.199

Capital letters was used to compare the periods in treatment × parity combination.
Small letters was used to compare the treatment in periods × parity combination.
Subscript capital letters was used to compare the parity in treatment × periods combination.

anestrus period. Also, Ungerfeld et al. [21] were reported that the male effect in the breeding season did not lead to a significant difference ($p > 0.05$) for FSH concentrations between the control and treatment groups in the breeding season. In this study, it can be argued that the differences in FSH levels are likely due to the presence of animals in different phases of the estrous cycle in groups. The studies conducted in the anoestrus period confirm this assumption

and Atkinson and Williamson [25] reported that the ram effect affects FSH levels in the anoestrus period. Similarly, Cohen-Tannoudji and Signoret [26] also reported that LH secretion was affected by the male effect during anoestrus period.

4. Conclusion

Although significant differences were expected on serum progesterone, estrogen and FSH levels between control and treatment groups, no statistically important difference was observed. In conclusion, buck existence did not affect significantly hormone levels in Akkeçi goats during premating period. In practice, buck effect is frequently used as a natural method for more synchronized heat appearance in goat herds. As reported in various studies, it has been observed that the male effect in goats does not have an important role in the breeding season, although it can have various effects outside the breeding season. Because, during the breeding season, as goats in a population can be found in different stages of estrous, the hormone levels of the individuals may differ from each other. Therefore, it can be thought that the male effect may not have a significant hormonal effect in every goat during the breeding season.

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