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Effect of buck's body weight on some reproductive parameters and it's relation with sexual behaviour

K.H. Sultan, W.Kh. Ahmed and A.R. Mohamed

Department of Animal Production, College of Agriculture and Forestry, University of Mosul, Mosul, Iraq

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Correspondence:
K.H. Sultan
dr.khalid.h@uomosul.edu.iq

Abstract

This study aims to investigate the relation of body weight with testicular parameters, sexual behavior and sex hormones. The study was conducted within two months, August and September. Eighteen native black bucks were randomly assigned to three groups (n=6) according to their body weights, 30-35, 36-40 and 41-45 kg. All animals were reared under a semi-intensive system. The analysis of data revealed direct correlation of testicular parameters as scrotal circumference, right and left testicular length and volume with the body weight . The results at August show that the bucks body weight when increased, many sexual behaviors improve significantly as attempted mounts, snuffing, flehmen response, time for 1st mating and time for 1st jump. As for sexual behavior at September, the attempted mounts, snuffing, flehmen response, number of mating, time for 1st mating and time for 1st jump, improve significantly in the bucks with heavy weight as compared to low weight bucks. Also, the number of mating (ejaculation) is better numerically at September compared to August. For the effect of buck's body weight on sexual hormones, testosterone concentration increases significantly at both, August and September as body weight increased, and conversely, both LH and estrogen levels are reduced as body weight increases . In conclusion, the current study reveals that there is a direct relation between the local buck's body weight and most of the testicular parameters, sexual behavior and sexual hormones activity.

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Introduction

Livestock is an important source of income (1), as it is one of the most important natural resources that support the state's economy, as sheep and goats are a vital source for the production of meat, milk, and wool (2). According to statistics from AOAD (3), the number of goats in Iraq reached roughly 1.328.800 heads in 2019, and the number of goats in Mosul is much less than that of sheep (4). Numerous studies have attempted to increase goat productivity by enhancing reproductive performance using hormonal, nutritional, and management tools (5). Goats stand out for their exceptional ability to adapt to harsh and diverse environmental conditions, as well as their capacity to take advantage of low-value food and graze in poor regions. Because of these crucial traits, they do not compete with humans for food, consequently, their breeding spreads throughout the world (6). It is widespread in several nations, particularly among small breeders, because it doesn't require a lot of resources, advanced methods, or costly feed (7). Also, the quick sexual maturation and the small size make dealing with them easier at the family level (8). Body weight affects the attaining of puberty and sexual maturity and reflected on the semen quality (9). Likewise, body size (weight) and lasts size may be used as a tool for measuring reproduction performance (10), and testis size is a good measure that indirectly enhances reproductivity (11). In a study Gemeda and Workalemahu (12) on three breeds of Ethiopian goats, it is revealed that greater body weight breed (Long-eared Somali goats) has greater scrotal testicular

parameters. Among the factors that increase the reproductive efficiency of males are the semen quality and sexual behavior, which are affected by many factors as breed, season and testicular size (13). Sexual behavior as libido (sexual desire) was related to some behavior forms as detection of ewes in estrus, mating and courtship behavior (14). It was varying among males and it affects reproduction (15). The current study aims were to evaluate the impact of buck's body weight on testicular parameters and its relation with sexual behavior and sexual hormones.

Materials and methods

Ethical approve

Under the number UM.VET.2022.040 and with the date of July 3, 2022, the study and sample collection were carried out with the agreement of the ethical and animal welfare committee of the College of Veterinary Medicine, University of Mosul.

Experimental animals

The study was carried out in a private field in Baibukht, a village to the northeast of Mosul, Iraq, on August - September, 2022. Eighteen local bucks (mean body weight 37.50± 1.22 kg) were divided into three pens (n=6 per pen) in semi-open barns and fed concentrate meals. The feed and water were admitted ad libitum with daily grazing for about 3-4 hours.

Body weights and experimental design

Eighteen Local bucks were randomly divided into three groups (n=6), according to their body weight (BW), mean BW: 30-35 kg, 36-40 kg and 41-45 kg for the 1st, 2nd and 3rd groups, respectively. The bucks were healthy and under continuous veterinary care throughout the experiment.

Testicular measurements

Scrotal circumference (SC) measured using a graded cm tape around the widest area of the testes. The length of each testis and the right and left testes lengths (RLT, LTL) were measured between the upper and lower poles of testes using the calipers. The volume of both testes (TV) was calculated according to the equation of El-Zelaky *et al.* (16). Testes volume (cm^3) = 0.0396 × average testis length × (scrotal circumference)3. All the measurements were done at the end of the study.

Sexual behavior

The sexual behavior of bucks was tested at the end of August and September, when 3 local doses were stimulated by intramuscular injection of estradiol benzoate 1 ml (2mg/ml) repeated after 2 days, and the sexual behavior test was conducted the next day in the morning. After the estrus-stimulating dose, placing them in a 4×5 m pen, the bucks were individually inserted into the dose pen, and the buck's behavior was monitored from outside the pen for a period of time, that is 20 minutes, which was used to evaluate sexual behavior parameters, according to Kridli *et al.* (17). The sexual behavior parameters include: attempted mounts, snuffing, flehmen response, number of jumps for 1st mating, time for 1st mating (min.), time for 1st jump (sec) and number of mating (ejaculation).

Sex hormones determination

At the end of August and September, blood samples were collected from jugular vein of each buck in a plain tube. The serum was isolated using the centrifuge (3000 rpm) for 15 minutes. The serum was stored at - 20 ºC till analysis. The serum was used to determine the testosterone and the luteinizing hormones using ELISA kits (Lake Forest, USA).

Statistical analysis

One-way ANOVA analysis was used for the data by the SAS program (18), and the Duncan multiple range test was applied for the significant F value to determine if there were statistically significant differences between the means.

Results

Table 1 revealed that SC, RTL, and LTL were significantly (P≤0.05) increased with the increase in bucks' weight, the values of SC: 28.25 and 29.21 cm, RTL: 15.18 and 15.50 cm, and LTL: 14.06 and 14.60 cm in T2 group and T3 group, respectively, as compared to T1 values: 26.88cm, 14.11 cm and 13.15 cm, respectively (P≤0.05). TV values were significantly higher in T3 group 481 cm^3 as compared to T1: 400 cm^3 and T2: 417 cm^3.

Table 2 revealed the effect of body weight on sexual behavior of bucks at August. The increase in body weight was accompanied with a significant decrease in the number of attempts to mount:4.33 as compared to T1:6.33 and T2:5.83, and in snuffing: 3.66 as compared to T1: 6.00 and in flehmen response: 5.00 as compared to T1: 6.66 and T2: 6.16, and in time for 1st mating: 5.00 minutes as compared to T1: 7.50 minutes, and T2:6.16 minutes, and in time for 1st jump: 33.50 seconds as compared to T1; 54.16 seconds, and T2: 38.16 seconds (P≤0.05). The number of jumping for 1st mating and number of mating were not affected among the three groups.

On the other hand, the effect of buck's body weight on sexual behavior parameters on September was shown in table 3, attempts to mount: 4.00 and time for 1st mating: 3.00 min and time for 1st jump: 28.16 sec. in T3 were significantly reduced as compared to T1: 5.33, 6.00 min. and 51.33 sec., respectively. Whereas snuffing was 7.50, flehmen response: 8.33 and number of mating: 2.00 were significantly higher in T3 as compared to T1:6.16, 7.33 and 1.00, respectively at (P≤0.05). Meanwhile the number of jumping for 1st mating was not affected by body weight.

During August and September, the data showed that testosterone values are directly proportionate with buck body weights, while the LH and estrogen values are inversely proportionate with buck body weights. Testosterone values were significantly higher in T3 during August (6.19 ng/ml) compared to T1 and T2 (5.28 and 5.64 ng/ml), respectively.

Figure 1 (A, B and C), revealed the effect of body weight on sexual hormone values and also in T3 during September (6.80 ng/ml) as compared to T1 and T2 (5.72 and 6.18 ng/ml), respectively, at P 0.05. In terms of LH values, the bucks with lower body weight (T1) had significantly higher LH values (3.92 and 4.18 ng/ml) in August and September, compared to the T2 group bucks with middle body weight (3.55 and 3.79 ng/ml), and the T3 group bucks with high body weight (3.13 and 3.41 ng/ml) in August and September ($P \leq 0.05$). During August, estrogen levels were significantly lower in T3 (63.25 pg/ml) as compared to T1 and T2 (78025 and 74.77 pg/ml), respectively. Also, estrogen levels were significantly lower in T3 (58.62 pg/ml) as compared to T2 (69.65 pg/ml) and T1 (74.45 pg/ml); bucks in T1 had significantly higher estrogen levels than T2.

Table 1: The effect of body weight changes on some testicular parameters in the studied bucks

Measurements	Treatments		
	T1	T2	T3
Body weight (Kg)	33.37 ± 0.64^{c}	37.92 ± 0.75^{b}	44.21 ± 0.35^{a}
Scrotal circumference (cm)	26.88 ± 0.26^{b}	28.25 ± 0.48^{a}	29.21 ± 0.33^{a}
Right testicular length (cm)	14.11 ± 0.20^{b}	15.18 ± 0.17^{a}	15.50 ± 0.18^{a}
Left testicular length (cm)	13.15 ± 0.24^{b}	14.06 ± 0.15^{a}	14.60 ± 0.17^{a}
Testicular volume (cm^3)	400.33 ± 3.46^{b}	417.50 ± 7.38^{b}	481.17 ± 10.09^{a}

Different letters in the same row indicate significant differences at $P \leq 0.05$.

Table 2: The effect of body weight on the buck sexuality at August and September

Measurements	August			September		
	T1	T2	T3	T1	T2	T3
Attempted mounts	6.33 ± 0.42^{a}	5.83 ± 0.30^{a}	4.33 ± 0.33^{b}	5.33 ± 0.33^{a}	4.66 ± 0.42^{ab}	4.00 ± 0.25^{b}
Snuffing	6.00 ± 0.36^{a}	4.66 ± 0.33^{b}	3.66 ± 0.33^{b}	6.16 ± 0.47^{b}	6.83 ± 0.30^{ab}	7.50 ± 0.42^{a}
Flehmen response	6.66 ± 0.33^{a}	6.16 ± 0.30^{a}	5.00 ± 0.25^{b}	7.33 ± 0.33^{b}	7.66 ± 0.21^{ab}	8.33 ± 0.33^{a}
Number of jumping for 1st mating	3.16 ± 0.30^{a}	3.33 ± 0.21^{a}	2.83 ± 0.30^{a}	3.33 ± 0.33^{a}	3.00 ± 0.25^{a}	2.66 ± 0.33^{a}
Number of matting (ejaculation)	0.83 ± 0.16^{a}	1.00 ± 0.25^{a}	1.16 ± 0.16^{a}	1.00 ± 0.25^{b}	1.33 ± 0.21^{ab}	2.00 ± 0.25^{a}
Time for 1st mating (min.)	7.50 ± 0.42^{a}	6.16 ± 0.30^{b}	5.00 ± 0.25^{c}	6.00 ± 0.57^{a}	4.50 ± 0.42^{b}	3.00 ± 0.25^{c}
Time for 1st jump (sec.)	54.16 ± 1.64^{a}	38.16 ± 0.94^{b}	33.50 ± 0.84^{c}	51.33 ± 0.61^{a}	36.66 ± 0.66^{b}	28.16 ± 0.60^{c}

Different letters in the same row indicate significant differences at $P \leq 0.05$.

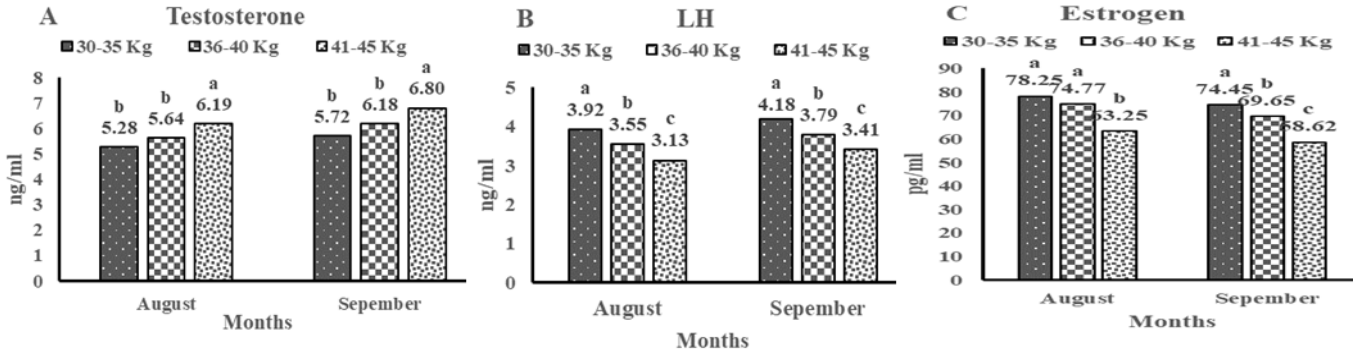

Figure 1: The effect of body weight on the buck serum sexual hormones levels at August and September.

Discussion

The data obtained in this study are inconsistent with the findings of Sultan (19) in his study on Awassi rams, reporting that the increase in body weight resulted in an improvement in SC, RTL and LTL, due to the positive correlation between body weight of rams and testes parameters (20). Mickelsen *et al.* (21) and Mekasha *et al.* (22), showed that SC was affected by many factors including breeds, season, nutrition and body weight, as well as,

Gemeda and Workalemahu (12) reported a positive correlation between testicular traits and body weight of Ethiopian goat breeds.

The results of the current study relating to sexual behavior are in agreement with the results of Elaref *et al.* (23), reporting a significant increase in sexual behavior parameters (snuffing, flehmen, foreleg kicking and mount attempts). Also, Zarkawi and Al-Daker (24) revealed that the heaviest Sohagi ram lambs reach the puberty earlier than medium and low weight rams. With regard to the results of body weight effect on testosterone level, it is clear that bucks of 35-40 and 40-45 kg body weight have higher concentration of testosterone especially at September. Bezerra *et al.* (25) also recorded a positive correlation between testosterone and testes circumferences, which was reflected in the improvement of sexual behavior (26). Elaref *et al.* (23) pointed out that the relation between body weight, testes growth and testosterone level are important factors influencing the attainment of puberty (27). The increase in testosterone level supports the submission of Bitto *et al.* (28), in a study on west African Dwarf bucks, which indicated that the testosterone level was on peak at July, August and September, and the superiority of pubertal buck's testosterone levels was not related to the population of leydig cells, but it is probably due to the increased receptor capacity for gonadotropin that usually accompanies the attainment of puberty. Oloye *et al.* (29) showed that the increase in testosterone level subjected a negative feedback effect on LH synthesis and release at the anterior pituitary gland and that the testosterone has a negative feedback effect on the hypothalamus (arcuate and preoptic nuclei), leading to a reduction in GnRH release, which in turn reduces LH release from the anterior pituitary, indicating that reproductive performance is related to animal sexual disorders (30). The finding of the current study agrees with the finding of Oloye *et al.* (29), who revealed that local buck sexual behavior was favored in summer and autumn and the increase of sexual activity was attributed to the increased testosterone level during the months of summer and autumn, especially at August, September and October. It is also related to the enhancement of sexual behavior, spermatogenesis and the secondary sex characteristics (29). The anterior pituitary gland and hypothalamus get direct negative feedback as testosterone levels rise, according to Recabarren *et al.* (31). Because testosterone reduces the release of gonadotropin releasing hormone (GnRH) in the arcuate and preoptic nuclei of the hypothalamus, less GnRH is released into the hypothalamo-pituitary portal system, which causes the anterior pituitary to release less luteinizing hormone (LH).

Conclusion

The current study findings conclude that the body weight and the season had an impact on the testicular characteristics, sexual behavior, and sex hormones of local bucks. Better sexual behavior was evident in heavier buck, which will certainly enhance reproductive efficiency. Therefore, it might be suggested that body weight is one of the most important and determining elements influencing the onset of puberty in goats. Breeders must pay attention to this in order to produce more goats by achieving the best qualities of puberty at a younger age with a sufficient weight of local bucks.

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Conflict of interest

The authors declare no conflict of interest.

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تأثير وزن الجسم لذكور الماعز في بعض المقاييس التناسلية وعلاقتها بالسلوك الجنسي

خالد حساني سلطان، وسيم خالد احمد وعمار رائد محمد

قسم الإنتاج الحيواني، كلية الزراعة والغابات، جامعة الموصل، الموصل، العراق

الخلاصة

تهدف هذه الدراسة إلى التحري عن العلاقة بين وزن الجسم لذكور الماعز وقياسات الخصية والسلوك الجنسي والهرمونات الجنسية. استغرقت الدراسة مدة شهرين هما آب وأيلول. وربيت جميع الحيوانات وفق النظام شبه المكثف. إذ قسم ثمانية عشر ذكراً من ذكور الماعز الأسود المحلي بشكل عشوائي إلى ثلاث مجموعات (٦/ مجموعة) حسب وزن الجسم، ٣٠-٣٥ و٣٦-٤٠ و٤١-٤٥ كغم. ومن خلال تحليل البيانات تبين وجود ارتباط بين قياسات الخصية مثل محيط كيس الصفن وطول الخصيتين اليمنى واليسرى وحجمهما مع وزن الجسم. كذلك، أظهرت النتائج في شهر آب أنه بزيادة وزن الجسم لذكور الماعز، فإن العديد من صفات السلوك الجنسي تتحسن كثيراً مثل محاولة القفز وعدد مرات الشم والوقت اللازم لأول تلقيح والوقت لأول قفزة، بينما تتحسن صفات السلوك الجنسي في شهر أيلول لصفات محاولة القفز وعدد مرات الشم وعدد مرات التلقيح والوقت لأول قفزة لذكور الماعز ذات الوزن الثقيل مقارنة بالأوزان الخفيفة. كما أن عدد التلقيحات الناجحة في شهر أيلول تكون أفضل حسابياً مقارنة بشهر آب. وارتفع معنويا تركيز هرمون التستوستيرون في هذين الشهرين مع زيادة وزن الجسم، وعلى العكس من ذلك، فقد انخفض معنويا تركيز الهرمون اللوتيني والأستروجين مع زيادة وزن الجسم. بشكل عام، بينت الدراسة الحالية وجود علاقة مباشرة بين وزن الجسم ومعظم قياسات الخصية والسلوك الجنسي ونشاط الهرمونات الجنسية لذكور الماعز المحلي.