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THE RELATIONSHIP BETWEEN TESTOSTERONE LEVELS AND METHODS OF MANAGEMENT IN BUCKS

(With 4 Tables and 2 Plates)

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العلاقة بين مستوى هرمون التستستيرون وطرق الرعاية في ذكور الماعز

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تمت الدراسة علي هرمون التستستيرون لإختبار و تقييم تأثير تطبيق بعض ممارسات الرعاية وما يصاحبه من ظهور سلوكيات معينة علي ذكور الماعز. في موسم التزاوج يزيد مستوى هرمون التستستيرون زيادة معنوية عن موسم عدم التزاوج و لكن لم يظهر أي فرق معنوي في مستوى هرمون التستستيرون بين الذكر السائد و الذكور المتحية. و نتيجة لهذا فقد ظهرت علامات الرغبة الجنسية في كل الذكور (السائد و المتحني) بغير الالتفات إلى تأثير الهيكل الاجتماعي. ومن خلال هذه الدراسة فقد لوحظ أن وجود الذكر السائد بين الذكور المتحية في المحيط الجنسي (بجوار أو بداخل حظيرة الإناث) قد نتج عنه غياب وفتاع النشاطات الجنسية (الجماع) لكل الذكور (السائد و المتحني). وقد وجد أن مستوى هرمون التستستيرون يقل معنويًا عندما تم عزل الذكور عن الإناث عزلا كاملا و لكن عندما تعرض الذكور للمؤثرات المختلفة في وجوده في المحيط الجنسي بالقرب من الإناث بدون الدخول عليهم (الشم / السمع / رؤية الإناث) نتج عنه زيادة معنوية في مستوى هرمون التستستيرون و أيضا لوحظ زيادة معنوية في مستوى هرمون التستستيرون عندما تم الالتقاء المباشر فرديا لكل ذكر علي حدة بالإناث. و لكن لم نجد أي اختلاف معنوي في مستوى الهرمون بين الحالتين السابقتين. ومن خلال هذا البحث قد تم دراسة التأثير السمي علي ذكور الماعز من خلال إعادة سماع أصوات مسجلة أثناء التزاوج بين الذكور مع الإناث في فترات سابقة وقد لوحظ بعد سماع هذه الأصوات الجنسية بأن مستوى هرمون التستستيرون زاد زيادة معنوية و هذه الزيادة يصاحبها ظهور رغبات جنسية متأججة مما أدت إلى ظهور بعض حالات الشذوذ الجنسي. و حتى نستطيع أن نتجنب ظهور حالات الشذوذ الجنسي بين ذكور الماعز و الذي قد يؤدي إلى الإنهالك الجنسي ينصح بعدم الإفراط لتعرض ذكور الماعز لمؤثرات جنسية زائدة عن الحد لإظهار الرغبات الجنسية لأنه قد اكتشف أن ذكور الماعز مثارة جنسيا بطبيعة حالها.

SUMMARY

This study was carried out to investigate the levels of testosterone in response to some management practices and behavior in bucks. The means of testosterone level (ng/ml) in bucks during the breeding season were significantly higher. There was no significant difference in testosterone levels between both dominant and subordinates. The signs of sexual desire were existed in bucks irrespective of their social ranks. The presence of a dominant with the subordinates in a pen of females resulted in absence of actual sexual activities for all. Testosterone levels decreased significantly during complete isolation of bucks away from females. The olfactory, auditory and visual communication with a female pen had resulted in significant increase in the testosterone levels. After individual and physical admission of bucks (all means of communication), testosterone level increased also significantly than that during complete isolation. On the other hand, testosterone levels in bucks after the physical contact with females were not higher than during their presence in the breeding context without physical contact. There was a significant increase in testosterone levels after applying of the inductive auditory stimuli. This increase was coincided with radical changes in the sexual behavioral activities of bucks. Our results indicated that all means of over sexual stimulation were detrimental and should be prohibited in bucks, as they are naturally sexually excited. The previous practice will inevitably prevent the common sexual behavioral aberrations in bucks.

Key words: Dominance control, Sexual behaviour, Testosterone and Bucks.

INTRODUCTION

Understanding of endocrinology is basic to reproductive behavior. In several mammalian species photoperiodic variation is a major environmental cues synchronizing reproductive function with season (Petitclerc *et al.*, 1988). This will result in stimulation of both spermatogenesis and testosterone production by testis (Ortavant, 1956; Lincoln, 1976). The increased androgen secretion stimulates the accessory glands of reproduction (Amir and Volcani, 1965) and affects aggressive and sexual behavior (Lees, 1965). The breeding season in Italian goat began in August, reached its peak during September,

decreased during October (Debenedette *et al.*, 1982). The breeding period of sheep in Egypt starts from August till October (Mohamed *et al.*, 2002). In rams there was no evidence of spectators (subordinates) psychological inhibition of the sexual behavior with the presence of a dominant (Lindsay *et al.*, 1976). Meanwhile in goat, loss of dominance control over satellite males resulted in breeding by the subordinates (Geist, 1971). Therefore intense homosexual activity among satellite males (subordinates) was observed clearly in goats (Shank, 1972). The peak of testosterone levels of mature dominant male bucks (deer) was significantly higher than those of mature subordinates (Karel *et al.*, 1987). The levels of LH and consequently the testosterone secretion in the rams increased after exposure of rams to estrous ewes (Haynes and Haresign, 1987). On the other hand, testosterone levels increased significantly in male camels after hearing of a couple during mating (El-Nassan *et al.*, 1995).

As a matter of fact, the relationship between testosterone hormone and behavior in goats is still a point of speculation. Up till now, the fluctuations in testosterone hormone in response to management practices and stimulation in goat are not covered. Accordingly, this study was made to clarify the following points:

1. Testosterone levels in bucks during breeding and non-breeding periods.
2. Testosterone levels and their relationships to the social structure among bucks.
3. Fluctuations in testosterone levels in bucks with different means of communications.
4. The impact of auditory stimuli on testosterone levels in bucks.

MATERIALS and METHODS

This study was done at the farm of the Faculty of Agriculture, Suez Canal University, Ismailia Governarate, Egypt.

Animal used:

A total of 10 apparently healthy bucks and 50 adult female goats were used. A social rank was determined for each buck according to Maha *et al.* (2000).

Housing and feeding:

Bucks were housed in a separate yard, which ensured the olfactory, auditory and visual communications with the flock of female goats (Haupt and Wolski, 1982) except during studying the effect of complete isolation of bucks away from females. However, to investigate

the effect of dominance control, a dominant and subordinates were left in the same yard with females. Each buck was given 0.49 Km concentrate mixture, 0.67 Kg of hay and rice straw ad libitum per day (Morrison, 1957). Water was available ad libitum to animals throughout the day.

Blood sampling technique:

Blood samples were collected by repeated vein-puncture from ten bucks every other day and the blood was left to flow freely into dry and clean centrifuge tubes without anti-coagulant and left to clot at a room temperature for 2 hours, then centrifuged at 3000 r.p.m., for 20 minutes. The clear non-haemolysied serum were transferred carefully to clean, dry rubber stopper and labeled glass vials. Finally, serum samples were stored at -20 °C until analysis. Levels of testosterone were measured by radioimmunoassay technique using kit obtained from DiaSorin co. catalogue No./ REF.:CA- 1558. The analysis was carried out according to Royer *et al.* (1984). Blood samples were taken from all bucks for analysis of testosterone according to the following protocol.

- 1- Ten blood samples (one from each buck) were taken during breeding and non-breeding periods.
 - 2- To investigate the relationship between the social structure and testosterone level, blood samples were taken from a dominant and subordinates during breeding and non-breeding periods.
 - 3- To investigate the effect of isolation and degrees of communication on the testosterone level. Blood samples were taken during the following:
 - Complete isolation from the female pens (lack of all means of communication).
 - Relocation of bucks nearby the female pen (olfactory, auditory and visual communication).
 - After the individual and physical admission of each buck with a female pen.
- The above mentioned order was followed according to (Khalil, 2002).
- 4- To test the role of auditory stimuli on the sexual behavior and testosterone level in bucks, an experiment was designed as following:
 - Males and females were left together in a separate yard.
 - A tape recorder was prepared, using a cassette recorder to record the sounds emitted from both male and female during copulation.
 - These sounds were presented to both males and females through playing back of a cassette.

- Blood samples were collected for testosterone analysis before and after hearing. The behavioral activities in response to hearing were also recorded.

Statistical analysis:

Statistical analysis were done according to Sendcore and Cochran (1980).

RESULTS and DISCUSSION

Table 1: Means (\pm) of testosterone levels (ng/ml) in bucks during breeding and non-breeding periods.

Season	Testosterone levels (ng/ml)
Non-Breeding	05.70 \pm 1.9
Breeding	12.18 \pm 1.4**

** Highly significant difference at $P \leq 0.01$

The means of testosterone level (ng/ml) in bucks during breeding were significantly higher than that of non-breeding period (Table,1). A higher level of testosterone was coincided with appearance of the behavioral activities relevant to the breeding context. As a matter of fact, a significant increase in testosterone level may be attributed to the effect of the season (change in photoperiod, which affects reproduction). Therefore, this will result in releasing of LH and FSH, resulting in stimulation of both spermatogenesis and testosterone production by the testis. The latter explanation agrees with Pelletier & Ortavant (1964, 1975). Nevertheless, the male sex hormone lowered the threshold of stimulation required to elicit aggression (Knight, 1973).

Table 2: Means (\pm) of testosterone levels (ng/ml) in both dominant and subordinate bucks.

Social rank	Testosterone level (ng/ml)
Dominant	15.33 \pm 0.33
Subordinates	12.18 \pm 1.40

There was no significant difference between the testosterone level in both dominant and subordinates (Table,2). The sexual desire was not repressed in subordinates during the presence of a dominant. Accordingly, the signs of desire were existed irrespective of a social rank. This may give a reason for a non-significant difference between

the testosterone level in both dominant and subordinates. Moreover, the presence of a dominant with the subordinates in the same pen of females resulted in absence of actual sexual activities for all.

A dominant buck was watching the subordinates trying to keep them away from the females. The situation may be exaggerated to the point of waste ejaculation without mounting (Plate, 1). On the other hand, subordinates were waiting for a chance to satisfy their aroused desire through getting access near the females (loss of dominance control). The above mentioned finding and observation were consistent to Shank (1972). Accordingly, it is imperative to enable males from the individual access to the female's pen. The later recommendation will avoid engagement of males with each other.

Table 3: Means (\pm) of testosterone levels (ng/ml) during absence and presence of communications with a female herd.

Buck treatment	Testosterone level (ng/ml)
1- Complete isolation from a female pen	2.52 \pm 1.55**
2- Presence in the breeding context (complete communication but physical)	13.66 \pm 0.33
3- After physical contact and copulation	15.1 \pm 0.4

L.S.D_{0.005} = 3.28

During complete isolation of bucks from a female pen i.e. lack of all means of communications, testosterone levels decreased significantly (Table 3). As matter of fact, olfactory, auditory and visual communications with a female's pen had resulted in significant increase in the testosterone level. Nevertheless, this increase may be attributed to the presence of bucks within the media of females which in turn enable them from receiving the reproductive mediators (Rosa *et al.*, 2000). After individual and physical admission of bucks (all means of communication), testosterone levels increased also significantly than during complete isolation. On the other hand, testosterone levels were not higher than during the presence of bucks in the breeding context without physical contact. The non-significant increase in testosterone levels may be attributed to the fact that the subordinates were highly excited even without admission to the female pen. Verily, the exposure of bucks to estrous female goat can increase the level of LH and consequently the testosterone secretion in the bucks (Hayness and Haresign, 1987).

Table 4: Means (\pm) of testosterone levels (ng/ml) and coincided behavioral changes in bucks before & after applying of inductive auditory stimuli.

Condition	Testosterone levels (ng/ml)	Behavioral characteristic after Applying of stimuli	
		Male	Female
Before applying stimuli	7.25 \pm 0.85**	1-Protrusion of penis. 2- Snorting. 3- Striking and pawing of a forelimb against the ground. 4-Erection. 5- Attention and looking toward the female. 6- Ejaculation.	1- Wagging of tail 2- Keeping close from a male 3- Firm stances near the male 4- Arching of back and presenting her vulva to the male
After applying stimuli	15.25 \pm 0.43		

** Highly significant difference at $P < 0.01$

There was a significant increase in testosterone levels after applying of the inductive auditory stimuli (table,4). Such increase in testosterone levels may be due to the release of LH in response to hearing of a tape, which resulted in higher secretion of testosterone. The obtained results agree with that mentioned by Tembroke (1963) and Fraser (1964).

Subordinates shared the above mentioned behavioral signs in response to the auditory stimuli. Moreover, they were highly excited which resulted finally in appearance of homosexuality (plate, 2). The appearance of aberrant sexual behavior among subordinates may be attributed to the effect of the exaggerated sexual desire (Khalil,2002). To sum up, all means of over sexual stimulation should be prohibited in bucks, as they are naturally sexually excited. This will inevitably prevent the common sexual behavioral aberrations in bucks.

REFERENCES

- Amir, D. and Volcani, R. (1965):* Seasonal fluctuations in the sexual activity of Awassi, German Mutton, Corriedale, Border Leicester and Dorset Horn ram -Seasonal changes in semen volume and its fructose and citric acid concentrations. *J. Agr. Sci., Camb.* 64, 115-120.

- Debenedette, A.; Lucarion, A. and Malifati, A. (1982):* Induction of synchronized estrous in goats following the introduction of males after a period of separation (buck effect). *Attidella Soc. Ital. Della Sci. Vet.* 36: 192.
- El-Nassan, A. F.; Sobeih, M. A.; Zamzam, H. A. and Mohamed, M. A. (1995):* Studies on some stress factors affecting the behaviour of camels. Ph.D. Thesis. Faculty of Veterinary Medicine. Suez Canal University.
- Fraser, A.F. (1964):* Observations on the pre-coital behaviour of the male goat. *Anim. Bihav.* 12,31-33
- Geist, V. (1971):* Mountain sheep: a study in behaviour and evaluation. Univ. Chicago press; Chicago.
- Haynes, N.B. and Haresign, W. (1987):* Endocrine aspects of reproduction in the ram important to the male effect. *World Rev. Anim. Prod.* 45, 49-50.
- Haupt, K.A. and Wolski, T.R. (1982):* Domestic animal behavior for veterinarians and animal scientists. 1st edition. The Iowa State University Press. pp.115.
- Karl, V.; Miller R.; Larry.M; Kenneth, J.F. and Karen, L.J. (1987):* Dominance testosterone levels and scraping activity in a captive herd of white-tailed deer. *J.Mamm.*,68(4):812-817.
- Khalil, A.M. (2002):* Role of sexual behaviour in mediation of successful reproductive performance in sheep and goats. *Assuit Vet. J.* Vol.46 No.92.
- Knight, T.W. (1973):* The effect of androgen status of rams on sexual activity and fructose concentration in the semen. *Aust. J.Agric. Res.*, 24:573-578.
- Lees (1965):* Seasonal variation in the breeding activity of rams. *Nature*, london. 207, 221-222.
- Lincoln, G.A. (1976):* Seasonal variation in the episodic secretion of lutenizing hormone and testosterone in rams. *J. Endocr.* 69, 213-226.
- Lindsay, D.R., Dunsmore, D.G., Williams, J.D. and Syme, G.J., (1976):* Audience effects on the mating behavior of rams. *Anim. Beh.*, 24:818-821.
- Maha, M.T., Ashraf, M. M.K., Fares, I.M. and Mohamed, M.A. (2000):* Effect of social structure and management factors on the sexual performance of goats. *Zag. Vet J. (ISSN. 1110-1458)* Vol. 28, No.2, pp.9-16.

- Mohamed, M.A., Ashraf, M.M.K., Fares, I.M. and Maha, M.T. (2002):* Effect of behavioural and managerial practices on testosterone levels in rams. 1st Int. Sci. Conf. Fac. Vet. Med. 10-11 March SVU- Qena- Egypt.
- Morrison, F.B. (1957):* Feeds and feeding, 2nd edition Morrison Publising Ithaca NY.
- Ortavant, R. (1956):* Action de la durce d'eclairment sur ledcs process spermatogenetics chez le b'eller C.r. Seanc. Soc. Biol. 150, 417-474.
- Pelletier, J. and Ortavant, R. (1964):* Influence de la duree' d'eclairment sur le contenu hypophysaire en hermonc gonadotropes FSH et ICSH chez le belier. Annls Biol. Anim. Biochim. Biophys. 4, 17-26.
- Pelletier, J. and Ortavant, R. (1975):* Photoperiodic controle of LH release in ram. I. Influence of increasing and decreasing light photoperiods. Acta endocr. Copenh. 78,435-441.
- Petitlerc, D. Chapin, I.T., Harkins, P.A. and Allen Tucker, H. (1988):* Evidence for photosensitive regulation for prolactine secretion in prepubertal bulls. Procceding of society for experimental biology and medicine,172:478-481.
- Rosa, H.J.D, Juniper, D.T. and Bryant, M. J. (2000):* The effect of exposure to cstrous ewes on rams sexual behavior, plasma testosterone concentration and ability to stimulate ovulation in seasonally anoestrous ewes. Appl. Anim. Behav. Sci., 67:
- Royer, Jr. G.L. et al. (1984):* Relationship between age and levels of total, free and bound testosterone in healthy subjects", Current Threputic research, 35, 345-353.
- Sendecore, G.W. and Cochran, N.G. (1980):* Statistical Methods. 7th edition. The Iowa State University. Press. Ames.
- Shank, C.C. (1972):* Some aspects of social behavior in a population of feral goats (*Capra hirculs.*). Z. Tierpsychol., 30,488-528.
- Tembrok, G. (1963):* Acoustic behavior of mammals. In "Acoustic behavior of animals." (R.G.Busnel,edi),pp.751-783. Elsevier, Amsterdam.

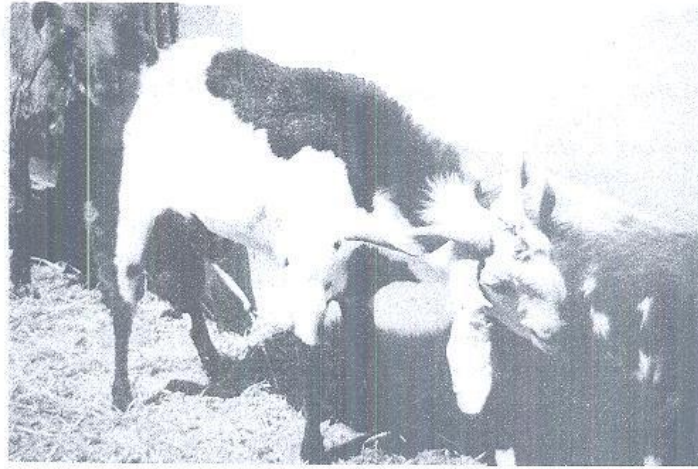


Plate 1: Waste ejaculation by a dominant buck despite the presence of estrous female goat.



Plate 2: Homosexuality between subordinate bucks.