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EFFECTS OF CLIPPING ON BEHAVIOUR, PRODUCTION AND ADRENAL CORTICAL FUNCTION IN GOATS

(With 4 Tables & 1 Figure)

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تأثير قص الشعر على سلوكيات وانتاجيه الماعز وعلى نشاط الغده الجار كلويه

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أجرى هذا البحث لدراسه تاثير عمليه قص الشعر فى الماعز كمحاوله جديده لمساعده الحيوانات على التخلص من الحمل الحرارى للجسم فى درجات الحراره العاليه أثناء موسم الربيع والصيف وتم تقدير تأثير الأجهاد المسبب من هذه العمليه أثناء الثلاث ساعات الأولى بقياس هرمون الكورتيزون والنتائج المنعكسه على السلوك ومعدل الزياده فى الوزن فى الستة أسابيع الأولى بعد الجز وكانت النتائج كالتالى: وجد أن الحيوانات التى تعرضت للقص قضت وقت أطول فى عمليه تناول الغذاء والأجترار وزمن الوقوف ساكناً وكذلك معدل سلوكيات الراحه مثل لحس الجسم وحك الجسم بالحوائط وتحريك الذيل وهز الرأس والأذن وركل الأرض بالاقدام وعلى النقيض من ذلك وجد انخفاض فى معدلات الحركة والعدو. وجد أن ذكور الماعز تقضى وقت أطول فى تناول الطعام والاجترار ورغبة الوقوف عن إناث الماعز وكذلك وجدت زيادة فى معدلات الحركة وحك الجسم وحركة الذيل والرأس وركل الأرض والسلوكيات العدائية فى الذكور عن الإناث. أثناء مدة التجربة شوهدت زيادة تدريجية فى وقت تناول الطعام والوقوف ساكنا ومعدل الحركة وانخفاض فى وقت الرقاد وسلوكيات الحركة بينما سلوك الاجترار والعدو والسلوك الإجتماعى لم يأخذ منوالا واحدا سواء بالزيادة أو الانخفاض. كان تركيز هرمون الكورتيزون مرتفع بعد القص مباشرة عن المجموعة الضابطة وكذلك فى الذكور عن الإناث وسجل أعلى تركيز له بعد الجز بنصف ساعة وبعد ذلك حدث انخفاض فى هذا التركيز حتى وصل الى أقل مستوى له بعد ثلاث ساعات من القص. دلت النتائج المتحصل عليها من هذه التجربة أن قص شعر الماعز فى موسم الربيع والصيف يزيد من معدلات النمو وكذلك أن الذكور تتمتع بمعدلات زيادة فى الوزن أعلى من الإناث.

SUMMARY

Thirty male and thirty female goats, 8-12 months of age, reared in the goat project belonging to Animal Husbandry Department, Faculty of Veterinary Medicine, Alexandria University were allotted into two groups, each consists of thirty goats, 15 males and 15 females. One group was subjected to clipping of their coats and the second was kept as control. Behaviour was observed and blood serum cortisol was estimated to know the ability of existence in different situations to improve their welfare and to test their performance. The obtained results revealed that clipping resulted in significant increase in feeding and rumination times. Furthermore, clipped goat spent more time resting than unclipped ones. Standing and walking frequencies were significantly increased, however, running was found to be decreased. Except resting and running, all these behaviours were influenced by sex, in favour to males, however, the differences were not significant. Social interaction between members of the flock was found to altered by clipping, where clashing frequency was significantly increased. On the other hand, vocalization and sneezing frequencies were significantly decreased. However, these behaviours were significantly higher in males than females. Clipping was found to increase body care activities since clipped animals had, significantly higher tail wagging, ear flicking, pawing, scratching and rubbing. Moreover, males were engaged in great deal of rubbing, tail wagging, ear flicking and pawing than females. Blood serum cortisol level was significantly higher in clipped than unclipped goats and in males than in females. Generally, reducing a heat stress by clipping of goat's coat resulted in significantly higher weight gain and body weight, although at the start of the experiment the average weight of control group was higher than clipped group.

Key words: Clipping, Adrenal, Cortical, Behaviour

INTRODUCTION

Goats are one of the early domesticated species and considered as an ideal animal for poor family, as they are multipurpose animals, producing milk, meat, skin and hair. They have unique ability to adopt and maintain itself in harsh environments. Although, some breeds are capable to produce relatively large amounts of milk, the majority of goats owe their existence to the fact that they thrive as meat producers in conditions under which

other species of domestic livestock find difficulties to survive, especially in countries with a large goat population.

From long time all sources of animal protein including goats are subjected to much studies to improve both quantity and quality of the meat produced by them. These studies including physiological, biochemical and nutritional aspects (Alexandr, 1974, Brindley et. al., 1989 and Louca et. al., 1977) in natural conditions at pasture or in housing systems (Boe,1990). Little interest was existed to the welfare of these animals, acclimatisation with the surrounding environment and what is going within animals' body.

Like other farm animals, goats are directly and indirectly affected with the external environmental conditions such as light and temperature (Boe 1990 and Brindley et. al., 1989) since they are sensitive to sun and heat stroke in the tropical and subtropical areas where the ambient temperature exceeds in some instances 40°C. In some conditions leads to increasing body care activities including scratching and rubbing to get rid of heat load and external parasites (Hart et. al., 1992). Moreover, because animals welfare affected under different social conditions (Sato et. al., 1991), so it is expected that shearing will play an important role in the welfare of such animals.

Because of little knowledge are known about the goat clipping effect, so our study was carried out to investigate the effect of goat clipping and foot trimming on their performance. However, the body weight and average daily gain and the internal status of the animal body represented by the behavioural pattern and blood serum cortisol were studied to notice the extent of stress to which goats would subjected.

MATERIAL and METHODS

Animals:

Thirty males and thirty females Baladi goats (8-12 month of age) reared in the goat project belonging to Animal Husbandry Department, Faculty of Veterinary Medicine, Alexandria University, were penned in a well-bedded and well-ventilated night accommodation. Animals during the day time from 7:00 a.m. to about 5:00 p.m. were fed on berseem and grass pasture. After returning back to night accommodation, they were provided with concentrated ration (cotton seed cake, yellow corn, wheat bran, mineral mixture and common salt obtained from Rashid factory for animal feed). The water was supplied *ad-libtum* in clean utensils. All animals were

carefully examined to ensure their freedom from disease and parasites and administered a dose of broad-spectrum anthelmintics at recommended dose.

The animals were allotted into two groups (thirty of each, fifteen males and fifteen females) on the base of age and weight:

Group I: The animals in this group were subjected to clipping. Clipping was carried out by the use of clipping machine and hand clipper in a longitudinal storks manner parallel to the longitudinal axis of the body. Claws trimming was carried out by the use of claw cutter.

Group II: were kept as control.

Productive traits estimated in this study was body weight and weight gain. Animals were weighed at the start of the experiment and repeatedly at weekly interval. Weighing was performed before morning feeding (fasted body weight). Weight gain was calculated according to the following formula: Weight gain = W2-W1/ T2-T1 where W2 is the weight of the end of interval T2 and W1 is the weight at the beginning of interval T1

Assay procedures:

The blood samples were collected from all animals by jugular venepunture one sample was collected just before and six samples during the next 3 hours after treatment at half hour interval. Blood samples were kept in refrigerator for about 12 hours after clotting for serum separation thereafter. They were centrifuged at 3000 r.p.m for 10 minutes and the serum was transferred into epindorf tubes by micropipette then stored frozen at -20 °C until estimation of cortisol level. The serum was assayed for cortisol concentration by Synchron Enzyme Linked Immuno Sorbent Assay (ELISA) using Quantitative Enzyme Immunoassay kits for the determination of cortisol in serum and saliva.

Behavioural observation:

The animals within each group were identified by using coloured neck straps and the behavioural observations were carried out from 7:00 a.m. till 5:00 p.m. A total of 160 hours observation beginning from the day of treatment till six week later.

Statistical analysis:

The analysis of data in this experiment was carried out by using MSTAT (1984).

RESULTS

The presented data in (Table 1) summarized the effect of clipping on ingestive behaviour, resting and movement activities of goats. The data showed that the clipped goat spent significantly ($P<0.05$) longer feeding and rumination times than unclipped ones (36.06±0.94 and 0.41±0.06 vs. 33.94±0.93 and 0.26±0.04 min/h., respectively). Moreover, with respect to treatment - sex interaction the clipped males spent significantly ($P<0.05$) longer feeding time (37.50±1.33 min/h) than unclipped ones (33.21±1.28 min/h). Similarly, the time spent in rumination was longer in clipped than unclipped males (0.48±0.10 vs. 0.21±0.05 min/h) and females (0.35±0.07 vs. 0.31±0.06 min/h). The overall sex effect on the ingestive behaviour of goats revealed that male goat spent longer time in feeding and rumination (35.35±0.93 and 0.34±0.06 min/h) than females (34.65±0.94 and 0.33±0.05 min/h).

The resting and movement activities of goats were clearly altered by clipping (Table 1), where clipped goats showed a longer resting time (4.73±0.57 min/h) and more standing frequency (6.60±0.14) than that of unclipped goats (4.29±0.05 min/h and 5.94±0.14, respectively). However, the logical reverse trend was observed for walking and running where clipped goats had lower frequencies (3.13±0.14 and 0.18±0.05) than unclipped ones (3.88±0.15 and 0.22±0.05).

Moreover, it could be easily recognized that clipping resulted in an increase in recumbency time in males (from 4.04±0.71 to 4.42±0.77 min/h) and female goats (from 4.54±0.77 to 5.04±0.85 min/h). Similarly the standing frequency in both males (5.81±0.19 to 6.93±1.77) and females (6.08±0.20 to 6.26±0.22) was also increased. On the other hand, the walking and running frequencies were decreased in clipped males (3.08±0.19 and 0.18±0.07 vs. 4.18±0.22 and 0.21±0.08) and female (3.19±0.20 and 0.18±0.07 vs. 3.58±0.21 and 0.23±0.08).

In this experiment it was noticed that female goats had longer recumbency time (4.79±0.57 min/h) and running frequency (0.20±0.05) than males (4.23±0.52 and 0.19±0.05, respectively) and the males had higher standing and walking frequencies than females (6.37±0.13 and 3.63±0.15 vs. 6.17±0.15 and 3.39±0.15, respectively).

Helping the goats for caring their bodies by clipping their coats was found to increase the body care activities, (Table 2) in form of scratching (0.53±0.07 vs. 0.49±0.06), rubbing (0.10±0.04 vs. 0.09±0.02), Tail wag (2.28±0.17 vs. 1.43±0.12), ear flicking (0.84±0.08 vs. 0.50±0.06) and

pawing (0.72±0.09 vs. 0.46±0.06). Moreover with considering the sex effect on comfort activities, (Table 2), the females displayed significantly higher (P<0.01) scratching frequency (0.61±0.07 vs. 0.40±0.06), while, males were enggaged in a great deal of rubbing (0.11±0.04 vs. 0.08±0.03), tail wag (2.18±0.17 vs. 1.52±0.13), ear flick (0.73±0.08 vs. 0.60±0.06) and pawing (0.68±0.09 vs. 0.50±0.07).

The interaction between treatment and sex (Table 2) on the scratching frequency was highly significant (p<0.01), where, the clipped males displayed higher scratching, rubbing, tail wagging, ear flicking and pawing frequencies than unclipped ones (0.61±0.11 vs. 0.20±0.05, 0.13±0.06 vs. 0.08±0.03, 2.77±0.26 vs. 1.60±0.19, 0.94±0.14 vs. 0.53±0.09 and 0.84±0.14 vs. 0.51±0.10, respectively). Similarly the clipped females had a higher frequencies of tail wagging (1.78±0.20 vs. 1.25+0.16), ear flicking (0.73±0.10 vs. 0.48±0.08) and pawing (0.59±0.10 vs. 0.41+0.08) and reverse trend for scratching (0.45±0.08 vs. 0.78±0.10) and rubbing (0.06±0.03 vs. 0.09±0.04).

Social interaction between clipped goats and other member of the flock was found to be altered where the clashing frequency was significantly (P<0.05) increased (0.01±0.01 vs. 0.03±0.02), and the vocalization and sneezing frequencies were significantly (P<0.05) decreased (0.01±0.01 and 0.02±0.01 vs. 0.05±0.02 and 0.07±0.02, respectively). The male goats had a significantly higher (P<0.05) frequencies of clashing (0.04±0.02 vs. 0.00±0.00), vocalization (0.05±0.02 vs. 0.01±0.01) and sneezing (0.09±0.02 vs. 0.00±0.00) than females. The interaction between clipping treatment and sex showed a highly significant effect (P<0.01), where, vocalization and sneezing were decreased in shorn than unshorn males (0.00±0.00 and 0.04±0.02 vs. 0.09±0.04 and 0.14±0.04, respectively) however, there was no significant difference between females.

The listed data in Tables (3), revealed that there is a significant increase (P<0.01) in blood serum cortisol in clipped goats as compared to control group (8.94±1.07 vs. 6.98±0.50 µg/100 ml). Moreover, the male goats were liable to be stressed than females which reflected in the form of higher blood serum cortisol level (8.19±0.86 vs. 7.73±0,.84 µg/100 ml). The interaction between treatment and sex (Table 3) showed the same trend where the clipped males and females goats had higher serum cortisol level than non clipped males or females (9.30±1.55 and 8.59±1.54 vs. 7.08±0.75 and 6.87±0.69 µg/100 ml, respectively). Moreover, the effect of sampling time revealed that the blood serum cortisol concentration was

increased significantly ($P<0.01$) after clipping, where the peak was attained during half an hour after clipping then the blood serum cortisol started to reduced to normal level (Fig. 1).

Under Egyptian environment clipping is practised as a mean of reducing heat stress from the goats bodies. The results of such practice in this study revealed that body weights of goats (23.88±1.11 vs. 22.56±1.54 kg), although at start of experiment the mean weight of control group was higher than clipped group (20.50±1.47 vs. 19.81±1.36 kg). Similarly, the average daily gain was significantly higher ($P<0.01$) in clipped goats than unclipped group (84.82±3.14 vs. 49.11±3.75 g/day).

The data presented in Tables (4) showed that sex had a significant effect ($P<0.0$) on body weights of goats where, the males were higher body weight (22.56±0.36 vs. 17.75±0.32 kg) than for females during the 1st week of the experiment, although they were nearly of the same age. This difference continued throughout the experiment till the 6th week (25.44±0.41 vs. 20.50±0.41 kg). Moreover, the weight gain was higher in males than females (68.45±12.51 vs. 65.48±10.31 g/day) throughout the six weeks of the experiment. The interaction between effect of treatment and sex showed that clipping improve body weights and weight gain of both sexes as compared to control group (Table 4).

DISCUSSION

Because the ingestive behaviuor is influenced by climatic conditions there were significantly ($P<0.05$) longer feeding and rumination time spent by the clipped goats than those unclipped ones. Similarly clipping of feral goats in early spring would accelerate heat loss at the skin surface which likely to cause longer feeding time than unclipped goats (Brindely et al., 1989 and Hargreaves and Hutson, 1990). Moreover, Diverio et al. (1993) confirmed that clipping in farmed red deer increased the feeding time than untreated animals.

The male goats spent longer feeding and rumination times than females, this may be due to the smaller sizes of females although they were nearly at the same age, so, the requirement of body for feed was higher, consequently, feed intake will increase. These results are in close accordance with those obtained by Risenhoover and Birrell et al. (1991) and Diverio et al. (1993).

From Table (1) it could be easily recognized that clipping resulted in an increase in recumbency time and standing frequency and decreased the

walking and running frequencies in clipped (male and female) than unclipped goats, this indicated that the clipped goats invoked physical-thermoregualtory process to conserve metabolic heat, (Curits, 1981). Similar results were observed by Boe (1990) who reported that sheep in an insulated buildings showed longer resting after clipping than before clipping. Moreover, Diverio et al. (1993) confirmed that there was a significant increase in movement frequency after clipping in farmed red deer. Moreover, females showed a higher recumbency time and running frequency than males this may be due to the engagement of males in social encounters than females which were hidden between brushes and rest and when stand for feeding the males chased them. These results are in close agreement with those obtained by Coe et al. (1992) who reported that heifers stood less than bull calves in stalls.

Generally comfort-activities are mostly directed towards extensive skin areas which receive attention in grooming as a distinct localised skin. If the animals have opportunity of choice they often show clear preference for the tactile nature of the substrate on which they will more readily stand or lie. Clipping found to increase body care activities for goats in form of scratching, rubbing, ear flicking, tail wagging and pawing. These activities are likely to be frequently exhibited by shorn goats because of their greater sensitivity to contract flies, in combination with an increased attraction of flies to the head, neck, back and belly (Brindely et al., 1989).

Males exhibited longer periods of standing so they greatly annoyed by the flies leading to increasing the frequency of rubbing, tail wagging, ear flick and pawing. These patterns seemed to be positively correlated with standing in males, while, females stayed long periods recumbent which had negative correlation with these activities, therefore, in many cases there are no need for such activities in lying posture. On the other hand, The reduction in scratching frequency in males may be attributed to that coat grow faster and protect body from the flies, so scratching would decreased accordingly. However, the reverse trend observed for other patterns may be due to the accumulation of insects around perineum, axial and around eye so the animal tend to display these behaviours in such ways to get rid of flies. Sato (1984) who found that heifers performed more frequent grooming than steers and Hart et al. (1992) who reported that Wildebeest antelope females had longer scratch-grooming episodes per bout than territorial.

The higher frequency of clashing (Table 3) between clipped goats may be attributed to the change of the animals appearance by clipping

which are likely to be as a newly introduced member to the flock. In addition, the male goats are considered to be the main members in the flock so, they exhibited more clashing and vocalisation than females. Moreover, the interaction between the effect of clipping and sex was reported to indicate that clashing is higher in clipped than unclipped males, however, the vocalisation was more pronounced in unclipped male group. High aggression frequencies between males may be due to androgen hormones which responsible for male sexual behaviour and aggression. These results are in agreement with those obtained by Hinch, et. al. (1982) and Appleby (1986) who reported that bulls with high sexual hormones performed more aggression than steers, moreover, Sato et al. (1991) found that social interactions did not differ between steers and heifers where castration reduce androgen levels in steers so they were similar to females in such behaviour. Since aggressive behaviour mostly seen when groups of animals are temporary formed. Therefore frequent changing of group members should be avoided. Since the aggressive social interactions taking place for several days during which the production and physiological responses of the animals would altered.

Plasma cortisol estimations have been used in a number of reports to assess pain and stress reflected upon animal due to changing their environmental situations. Hargreaves and Hutson (1990) observed that plasma cortisol significantly elevated after clipping such increase was declined to the basal level 90 minutes after clipping. Here the plasma cortisol showed immediate increase during 30 minutes after clipping. This may be attributed to the stressful events caused by restraining during clipping and the use of clipping machine and hand clipper which may produce some skin injuries that induce the release of cortisol via activation of hypothalamic-pituitary-adrenal axis. However, the plasma cortisol level declined progressively to reach the basal level after 2.5 hours from clipping. Fortunately, the less sustained plasma cortisol responses suggesting that generally clipping stress is not extremely strong so, it returned to the basal level after short period of time. These results are in close accordance with those obtained by Brindely et al. (1989), Boe (1990) and Diverio et al. (1993).

Goats thrive as meat producers in conditions under which it is difficult for other species of domestic livestock to survive. Under Egyptian environment clipping is practised as a mean of reducing heat stress and improving weight gain. The improvement in body weight and weight gain due to clipping in this study may be due to reduction in heat load which

may reduce the feed intake and its utilisation. Moreover, metabolises consumed in hair growth may converted to weight gain. This finding is supported by the longer time spent feeding and rumination by clipped goats. This results are in close accordance with those obtained by Arnold and Birrell (1977) and Brindley, et al. (1989) who reported that clipped goats spent longer time feeding than others in dry weather.

The increase in the body weight and weight gain of males than females may be due to androgen hormones that have anabolic effect and increase the masculinity of the males than females. This result is in agreement with those obtained by Fahmy et al. (1969) who reported that males have higher growth rate than females and Louca et al. (1977), and Babiker et al. (1985) who found that intact males with highest levels of androgen have high growth rate than castrated ones.

Conclusion: From this experiment it could be concluded that clipping of goats before summer season resulted in an increase in feeding time, rumination time, resting time, standing, comfort and movement activities in form of clashing as well as increase both body weight and weight gain. So it is fair to say that it is advisable for goat breeders, in Egypt to carry out clipping before summer season to obtain highest productivity from their animals.

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Table (1): Means and their standard error to the effect of clipping on the ingestive, resting and movement activities of goats.

Item	Mean ± S.E.					
	Feeding	Rumination	Recumbency	Standing	Walking	Running
Treatment						
Clipping	36.06±0.94^{a}	0.41±0.06^{a}	4.73±0.57	6.60±0.14^{a}	3.13±0.14^{b}	0.18±0.05
Control	33.94±0.93^{b}	0.26±0.04^{b}	4.29±0.52	5.94±0.14^{b}	3.88±0.15^{a}	0.22±0.05
Sex:						
Male	35.35±0.93	0.34±0.06	4.23±0.52	6.37±0.13	3.63±0.15	0.19±0.05
Female	34.65±0.94	0.33±0.05	4.79±0.57	6.17±0.15	3.39±0.15	0.20±0.05
Treat x Sex:						
Male						
Clipped	37.50±1.33^{a}	0.48±0.10	4.42±0.77	6.93±0.18^{a}	3.08±0.19	0.18±0.07
Control	33.21±1.28^{b}	0.21±0.05	4.04±0.71	5.81±0.19^{b}	4.18±0.22	0.21±0.08
Female						
Clipped	34.63±1.31	0.35±0.07	5.04±0.85	6.26±0.22	3.19±0.20	0.18±0.07
Control	34.67±1.34	0.31±0.06	4.54±0.77	6.08±0.20	3.58±0.21	0.23±0.08

Means within the same column carry different small superscripts are significantly different at p<0.05.

Table (2) : Means and their standard error to the effect of clipping on the comfort activities of goats.

Item	Mean ± S.E.				
	Scratching	Rubbing	Tail wag	Ear flick	Pawing
Treatment:					
Clipping	0.53±0.07	0.10±0.04	2.28±0.17^{A}	0.84±0.08^{A}	0.72±0.09^{A}
Control	0.49±0.06	0.09±0.02	1.43±0.12^{B}	0.50±0.06^{B}	0.46±0.06^{B}
Sex:					
Male	0.40±0.06^{A}	0.11±0.04	2.18±0.17^{A}	0.73±0.08	0.68±0.09^{a}
Female	0.61±0.07^{B}	0.08±0.03	1.52±0.13^{B}	0.60±0.06	0.50±0.07^{b}
Treat x Sex:					
Male					
Clipped	0.61±0.11^{A}	0.13±0.06	2.77±0.26	0.94±0.14	0.84±0.14
Control	0.20±0.05^{B}	0.08±0.03	1.60±0.19	0.53±0.09	0.51±0.10
Female					
Clipped	0.45±0.08^{B}	0.06±0.03	1.78±0.20	0.73±0.10	0.59±0.10
Control	0.78±0.10^{A}	0.09±0.04	1.25±0.16	0.48±0.08	0.41±0.08

Means within the same column carry different capital superscripts are significantly different at P<0.01.
Means within the same column carry different small superscripts are significantly different at p<0.05.

Table (3): Means and their standard error to the effect of clipping on social behaviour and blood serum cortisol of goats.

Item	Mean ± S.E.				
	Vocalization	Butting	Clashing	Sneezing	Serum cortisol (ug/dl)
Treatment:					
Clipping	0.01±0.01^{b}	0.16±0.03	0.03±0.02^{a}	0.02±0.01^{B}	8.94±1.07^{a}
Control	0.05±0.02^{a}	0.16±0.03	0.01±0.01^{b}	0.07±0.02^{A}	6.98±0.50^{b}
Sex:					
Male	0.05±0.02^{a}	0.16±0.03	0.04±0.02^{a}	0.09±0.02^{A}	8.19±0.86
Female	0.01±0.01^{b}	0.16±0.04	0.00±0.00^{b}	0.00±0.00^{B}	7.73±0.84
Treat x Sex:					
Male					
Clipped	0.00±0.00^{B}	0.15±0.05	0.06±0.03	0.04±0.02^{B}	9.30±1.53^{a}
Control	0.09±0.04^{A}	0.17±0.05	0.02±0.02	0.14±0.04^{A}	7.08±0.75^{b}
Female					
Clipped	0.01±0.01	0.17±0.05	0.00±0.00	0.00±0.00	8.59±1.54
Control	0.00±0.00	0.15±0.05	0.00±0.00	0.00±0.00	6.87±0.69

Means within the same column carry different small superscripts are significantly different at p<0.05.
Means within the same column carry different capital superscripts are significantly different at P<0.01.

Table (4) Means and their standard error to the effect of clipping on goats' body weight and weight gain over 6 weeks post clipping.

Item	1st Wk body weight (kg)	6th Wk body weight (kg)	Average daily gain 1st-6th g/day
Treatment:			
Clipping	19.81±1.36	23.38±1.39	84.82± 6.14^{A}
Control	20.50±1.47	22.56±1.54	49.11± 3.75^{B}
Sex:			
Male	22.56±0.36^{A}	25.44±0.41^{A}	68.45±12.51
Female	17.75±0.32^{B}	20.50±0.41^{B}	65.48±10.31
Treatment x Sex:			
Male			
Clipped	22.13±0.38	25.75±0.25	86.31±14.88
Control	23.00±0.50	25.13±0.88	50.60± 8.93
Female			
Clipped	17.50±0.50	21.00±0.50	83.33± 6.54
Control	18.00±0.50	20.00±0.50	47.62± 7.94

Means within the same column carry different small superscripts are significantly different at p<0.05.
Means within the same column carry different capital superscripts are significantly different at P<0.01.

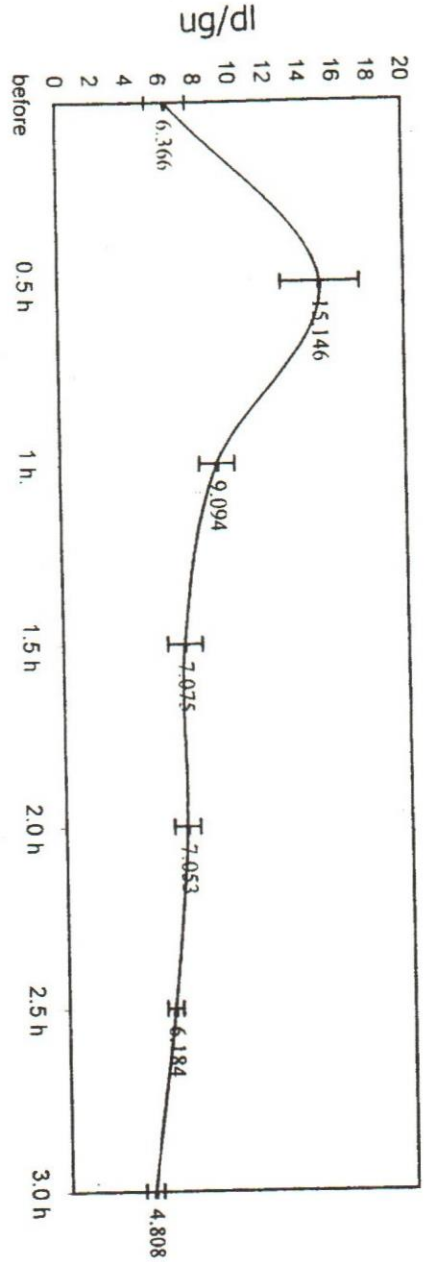

Fig. 1: Effect of shearing on the blood serum cortisol level 3 hours after shearing.