EFFECT OF SHEEP SHEARING ON BEHAVIOUR PHYSIOLOGY AND PERFORMANCE

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ABSTRACT

Shearing has been reported to impinge on the productivity, health and welfare of sheep. The following study examined the behavioural, physiological and performance response of sheep to the shearing process. Fifty male Barki sheep of 12-15 months of age (wethers) were used in this work , they were divided equally into five groups. Group one (G1), control not-shorn, Ns group and the other four groups were shorn(s) as group two (G2), hand shorn in early morning time of the day , group three (G3) was hand shorn in afternoon time, group four (G4), mechanically shorn in early morning and group five (G5), mechanically shorn in afternoon . The assessed variables were behavioral of and physiological response as well as the productive aspect (body weight gain). The results showed that there was a significant effect of shearing on ingestive, ruminating frequencies as it reduced these behaviours and consequently reduces the body weight gain of shorn sheep . The sheep shorn mechanically in early morning time of the day were the less affected by shearing than other groups. At the same time the shearing reduced the resting time and increase the locomotor activities among the shorn sheep while there was no significant effect of method of shearing and time of the day on locomotor activities and resting behaviour. Regarding physiological responses, there is a significant elevation in plasma cortisol level, Haematocrit % and glucose level due to shearing procedure, the elevation was higher in the hand shorn in afternoon time group than other groups of sheep. The body weight gain was affected significantly by shearing as the shorn sheep gained significantly less body weights than the not shorn control group of sheep. There was no significant effect of the method of shearing or the time of the day on the body weight gain in this study.

INTRODUCTION

Community concern about methods of farm animal production has mainly concentrated on the intensive animal industries. But recently attention has shifted to grazing industries, in particular the welfare aspects of sheep production. However, more information is needed before judgements or decisions concerning the welfare of sheep in extensive systems can be made (Townend, 1985 and whilloughby, 19988). Shearing of sheep is a management practice performed for economic purposes, to protect the animal from skin parasites and diseases, and also for surgical reasons. In Egypt, usually shearing takes place twice per year, in March and September.

Shearing has been reported to impinge on the productivity (Ensminger, 1979, El hadi, 1988 and Morris and McCutcheon, 1997), health (Baker, et al, 1982, Sumner et al, 1992 and Newman et al, 1996), and welfare (Hill,1983, Hargreaves, 1988, Hargreaves and Huston, 1990b and Gross and Siegel, 1993) of sheep. Recently, welfare issues have gained greater prominence

as awareness and attitudes of the community to the treatment of farm animal changes (Selye, 1976 and Hargreaves and Hutson, 1990 c and d). The wool is removed by noisy, sharp machinery, which is capable of cutting both wool and skin and consequently the sheep become under stressful conditions. Also, wool removal is of a fundamental importance to wool harvesting, yet it is the prime contributor to the stress response to handling (shearing) (Hargreaves and Huston, 1990 d).

A number of studies reported that many routine sheep handling procedures are stressful in that they result in elevated levels of cortisol, glucose, hematocrit and heart rate (Marks, 1959 and Pierzchala et al, 1983).The most stressful of these procedures is shearing (wheeler et al 1963 and Hargreaves and Hutson,1990 a). Gross and Siegel, (1993) reported that responses to stress can include anatomical, physiological and/or behavioral changes. Plasma cortisol and /or corticosterone are frequently used as criteria for measuring response to stressors. Another studies have described the response of sheep to shearing and transportation. these studies have had a variety of aims including assessment of the effects of shearing on ingestive behavior (Webster and Lyneh, 1966 and Arnold, 1976) .

The aim of this study was to investigate the

A-Response of sheep to one of the most important handling procedures i.e shearing. The response involved the following parameters which are thought to indicate different aspects of a response to stressors.

1- Behavioral response: ingestive behaviour, locomotion activities and resting behaviour

2- Physiological response: plasma cortisol, haematocrit% and Glucose level.

3- *Productive aspect***:** (body weight gain).

B-Effect of the method of shearing and day time on the above mentioned parameters.

MATERIALS AND METHODS

I-Animals (sheep):

Fifty male Barki sheep of about 12-15 months of age (wether) were used in this study. They were obtained from a sheep farm located at El – Nobaria region, Behaira Governorate and kept in a private sheep farm . The sheep were maintained under grazing (free range) conditions until one week prior to shearing process when each group of sheep was kept in covered pen and giving access to pasture with hay and water ad-libitum.

II-Experimental design

This work was carried out in a factorial design. The factors studied are the shearing itself, the time of the day (early morning or afternoon) and the method of shearing (hand or mechanical shearing).

The fifty male Barki sheep were randomly divided into five groups, each of ten animals, a control group (G1) including the not shorn sheep (NS) and four treated group (shorn sheep) as follow:

Group 2 (G2): hand shorn sheep in early morning time of the day.
Group 3 (G3): hand shorn sheep in the afternoon.
Group 4 (G4) : mechanically shorn in early morning.
Group 5 (G5): mechanically shorn in afternoon.

All five groups of sheep were washed 2-3 days before shearing. Shearing process was carried out in March in a covered yard with a wooden floor (shearing board), the entire fleece was removed using either very sharp, well-greased hand shears (hand shearing) or using clipping machine (mechanical shearing) (Trevalyan, 1982 and Holmes et al,1992).

The shearing took place either in the early morning or in afternoon times of the day (Alexander et al, 1979, Lynch and Alexander, 1980 and Al –Jaryan, 1991).

III- Blood sampling and analysis

Six blood samples were taken from each of the five treated groups of sheep, 15 minutes prior to shearing and five samples during the 90 minutes following shearing process (Just after shearing 0 time), 15, 30, 60 and 90 minutes post-shearing (Hargreaves and Hutson, 1990a and b)

10 ml samples were collected, transferred into two heparanized tubes and chilled, blood in one of these tubes (approximately 2 ml) was used for Haematocrit determination and blood the other tube was centrifugated and the plasma collected and stored frozen until assayed for total cortisol and glucose levels (Fulkerson and Jamieson, 1982)

IV- Parameters measured

(1): Behavioural measurements:

Daily observation was done between 8.00 and 10.00 a.m. and between 13.00 and 15.00 p.m. for one week post-shearing. The following behavioural patterns were observed and recorded during the observation time for each group of sheep (Moberg, 1987 and Gross ad siegel 1993).

A- Ingestive behavior: includes

- Feeding frequency, taking food while standing or laying

- Rumination :chewing regurgitated food while standing or laying and its frequency of occurrence (Arnold, 1976).

B- Locomotor activities :as walking, running, feeding and drinking (Friend, 1991)
C- Resting behaviour: the time spent resting or sleeping during observation time was recorded. (Friend, 1991).

(1) Physiological measurements

Cortisol level, Hematocrit%, and glucose level were recommended as physiological parameter responses (indicators) to the stressful conditions (Hargreaves and Hutson, 1990 b and d) .

A-Cortisol level (ng/ml-1):

The previously frozen plasma was used for cortisol assay using a radioimmunoassay according to the method of Jephcott et al, 1986 in duplicate at two dilutions using a commercial antisera (st C100,Steranti Resead, St. Albans,UK) (Meyer et al, 1988).

B-Haematocrit determincation

A 2 ml of each 10 ml blood sample was chillled in heperanized tube and used for determination of haematocrit by centrifuging samples, in triplicate, in mirco – haematocrit centrifuge for 5 minutes and measuring the red cell materials as a proportion of the total height of blood in the tube (Dobson, 1986 and Hargreaves and Hutson, 1990b).

C- Glucose determination (mg/dl):

Glucose level wa determined by using the glucose oxidase/ O- tolidine method. Samples were analysed on UV. Spectophotometer (Shimadza UV–120-02) (Fulkerson and Jamieson, 1982 and Meyer et al, 1988).

(2) Productive aspect :

Body weight gain:

The initial body weights of all groups of sheep were determined immediately before shearing and the final body weights were also recorded after 2 weeks of shearing to calculate the body weight gain for each of treated and control group of sheep (Al-Jaryan 1996 and Scobie, 1998).

(4) Statistical analysis

The difference among populations were tested using ANOVA test according to the methods of Snedecor and Cochran, (1989) .

RESULTS AND DISCUSSION

The welfare of an individual is its state as regards its attempts to cope with its environment. There are more than one measure showed that there is a problem or the animal is severely affected by the treatment. The most obvious indicators are changes in behaviour which show that some aspects of the situation is aversive (Hill, 1983). Physiological changes are associated with the behavioural responses (Hargreaves and hutson 1990a,b) .

(1) Behavioural response to shearing

A- Ingestive behaviour

As shown in table (1), the shorn sheep in all four treated groups showed variation in the frequency of eating in comparison with the not shorn control group. The eating frequency was significantly ($p < 0.05$) reduced immediately and for one week after shearing specially among sheeps shorn in the afternoon time of the day of shearing. The recorded frequencies sere (18.32±3.9 , 11.31± 2.3 , 8.18 ±1.8,10.18±1.3 and 12.11±1.7) for control group (G1) and the four treated groups (G2 , G3, G4 and G5), respectively. There was no significant effect of the method of shearing on the eating frequency.

Regarding ruminaition, animals in the treated groups showed a significant ($p < 0.05$) decline in frequency of rumination than those in not shorn control group and at the same time there was no significent effect of the method of shearing.

A number of studies have described the response of sheep to handling procedures , including shearing , transportation and restraint. These studies have had a variety of aims, including assessment of the effect of handling procedures on ingestive behaviour (wodzicka – Tomaszewska 1963., Arnold, 1976 and penning et al; 1991).

Rushen and Cogdon, (1986) and Hargeaves , (1988) stated that , it was established that electroimmibolization due to shearing may exacerbate the behavioural responses to shearing . The observed results agreed with that recorded by Webster and 1ynch (1966) and Al – Joryan (1991).

B) locomotor activities and resting behaviour :

Table (1) also showed that, there was a significant ($p < 0.0\ 5$) effect of shearing procedure on the locomotor activities and resting behaviors while there was no significant effect of the method of shearing and the time of day on these parameters, as the shorn sheep in all treated groups spent more time walking , running and less time resting than those in cont rol group .The less time spent resting may be due to the pain caused by shearing process or may be due to the fear reaction as a result of shearing noise or accidental injury of skin as fear is a hypothetical state of the brain or neuroendocrine system arising under certain conditions certain forms of behaviour .This result coincides with that observed by Dyrmundsson (1991) and Friend (1991).

Table (1) Behavioural responses of shearing in sheep (Mean ± SE)

Treatment	Not shorn control G1	Hand shorn		Mechanically shorn	
Parameter		Early morning G2	Afternoon G3	Early morning G4	After noon G5
Ingestive Eating frequency	abcde 18.32 ±3.9	abc 11.31±2.3	abce 8.18 ±1.8	acd 10.18+1.3	ace 12.11±1.7
Rumination frequency	abcde 12.22 ±2.1	abc 8.31 ± 1.9	abcd 5.71 ±1.1	acd 8.20 ± 1.9	ace 7.32 ±1.4
Resting behavior (min)	abcde 32.10±2.8	ab 23.24±1.9	ac 22.18±1.7	ad 24.66±1.8	ae 22.23±2.3
Locomotor activities (min)	abcde 24.70±2.1	ab 34.12±3.2	ac 33.11±2.8	ad 32.18±2.7	ae 34.10±3.0

[abcde] values with the same superscripts within columns were significantly differ at $p < 0.05$

(2) Physiological response to shearing

A-plasma cortisol level (ng / ml-1)

Table (2) showed that , there was a significant ($p < 0.05$) elevation in plasma cortisol level following shearing procedure in all shorn groups of sheep than that in not–shorn control group (G1). The recorded level of cortisol were (27.0±0.2 , 52.1 ± 3.6 , 68.2 ± 6.8 , 38.2±3.2, 48.2 ± 4.8 ng / ml-1) for control (G1) and the four treated groups (G2 , G3 , G4 and G5) , respectively.

Also as shown in table (2), it can be noticed that , there was a significant ($p < 0.05$) effect of both the method of shearing and the time of day, as the highest rise in cortisol (68.2 ± 6.8 ng /m-l) was recorded in sheep hand shorn in the afternoon time while the lowest level was in sheep mechanically shorn in the early morning time of the day (38.2 ± 3.2 ng / ml-1).

Generally the highest rise in cortisol level was at o time (immediately after shearing), then declined gradually in the 4 treated groups with time till up-ending at 9o minutes was at the basal level . On the other hand, there was no fluctuation of the cortisol level in the not shorn control group during the experimental period. These findings were agreed with those reported by (kilgour and de langen, 1970 ; Fulkerson and Jamieson, 1982; Pierzchala et al; 1983 , Hargreaves and Hutson, 1990b).

B – Haematocirt %:

Haematocrit % rose significantly (p <0.05) after shearing , it was 32.7 ± 2.3 , 38.1 ± 2.0 , 33.0 ± 1.9 , 32.1 ± 2.5 and 24.0 ± 1.7 for the four shorn groups (G2 , G3, G4, G5) and G1 , respectively) and the control not shorn group , respectively just after shearing , then declined for all treated groups to the pre- treatment levels within 9o minutes after shearing as it becomes 22.1 ± 1.7 , 24.1 ± 1.6 , 21.3 ± 1.5 and 22.8 ± 1.3 for the treated groups (G2 , G3, G4, and G5) respectively .The effects of the method of shearing and time of the day were significant only just after shearing as the higher elevation in haematocrit was among sheep hand shorn specially in the afternoon time of the day. The recorded values were agree to a large extent with those reported by Hargreaves, (1988), Hargreavs and hutson , (1990b) and Holmes et al, . (1992).

The elevation of cortisol and haematocrit levels after shearing is may be due to the potency of the acute short- term stress response to shearing due to wool removal or may due to noise of shearing itself which elicit the stress response (increasing haematocrit and cortisol level) as it effectively confers auditory isolation on the sheep.Haematocrit and plasma cortisol concentration were chosen as parameters of stress, reflecting catecholamine and pituitary adrenal response respectively. These parameters are thought to indicate different aspects of nonspecific response to stressors (Dantzer and Mormede 1983) or different stages of the general adaptation syndrome (Hill, 1983).

Table (2) : plasma cortisol level (ng / ml-1) of sheep which shorn or not (Mean+ SE).

Treatment	**Not shorn control G1**	**Hand shorn**		**Mechanially shorn**	
Time after shearing		Early morning G2	Afternoon G3	Early morning G4	Afternoon G5
- 15 min before	25.8 ±1.9	28.1±2.1	26.5 ±1.6	25.6±2.2	26.4±1.8
O time just after	Abcde 27.0±2.0	Adcd 52.1±3.6	Abcd 68.2±6.8	abcd 38.2±3.2	Acde 48.2±4.8
15 min	Abcde 24.8±1.6	Abcd 50.0±4.0	Abcde 64.1±5.4	abcd 32.4±3.0	Ace 41.1±3.6
30 min	Abcde 23.4±1.7	Abcd 42.7±3.2	abcde 54.8±4.6	abcd 29.7±2.7	Ace 38.2±2.9
60 min	Abc 25.0±2.0	Abc 34.2±2.6	Abcde 48.2±3.8	acde 23.5±1.6	Cde 30.5±1.9
90 min after shearing	Ac 23.0±1.9	B 27.1±2.5	ac 31.0±1.9	d 22.4±1.2	E 25.2 ±1.2

[abcde] values with the same superscripts within columns were significantly differ at p < 0.05

Table (3) Haematocrit % (mean + SE) of sheep as affect by shearing

Treatment	Not shorn control G1	Hand shorn		Mechanially shorn	
Time after shearing		Early morning G2	Afternoon G3	Early morning G4	After noon G5
- 15 min before	22.1±1.9	22.4±2.1	23.2±1.8	22.4±2.0	24.5±1.9
O time just after	Abcde 24.0±1.7	abc 32.7±2.3	abcde 38.1±2.5	Acd 33.0±1.9	ace 32.1±2.0
15 min	Abcde 23.7±2.0	abce 31.1±1.9	abce 35.2±1.7	Ad 32.1±1.7	ace 30.8±1.3
30 min	adcde 22.9±1.3	ab 27.3±1.4	ace 29.4±1.5	Ad 26.8±1.2	ace 25.1±1.7
60 min	a 22.0±1.8	b 24.0±1.3	c 26.1±2.0	D 24.2±1.2	e 23.8±1.4
90 min after shearing	a 22.8±1.8	b 22.1±1.7	c 24.1±1.6	D 21.3±1.5	e 22.8±1.3

abcde values with the same superscripts within columns were significantly differ at $p < 0.05$

Table (4) Glucose level (mg/dl) of sheep which were shorn (s) or not shorn (ns)(mean + SE)

Treatment	Not shorn control G1	Hand shorn		Mechanially shorn	
Time after shearing		Early morning G2	Afternoon G3	Early morning G4	Afternoon G5
- 15 min before	50.0±4.3	50.8±4.1	49.8±4.5	51.8±3.9	53.0±4.0
O time just after	Abcde 52.1±4.1	abde 68.3±4.8	acd 66.5±4.0	Abd 59.8±3.7	abe 60.1±3.9
15 min	abcde 52.0±3.9	abde 62.1±3.3	acde 63.0±3.5	Abcd 56.1±3.2	Abce 56.2±3.5
30 min	abce 50.8±4.2	ab 58.0±3.6	ac 58.5±3.2	Bcd 54.4±2.9	Ae 55.3±3.0
60 min	abc 49.8±4.0	ab 55.6±3.3	ac 55.0±4.0	D 53.2±3.8	e 54.0±3.1
90 min after shearing	a 50.2±3.9	b 52.8±3.8	c 51.4±3.9	D 50.2±3.1	e 52.1±3.0

abcde values with the same superscripts within columns were significantly differ at $p < 0.05$

Table (5) Effects of sheep shearing on body weight gain (mean + SE)(2 weeks period).

Treatment	Not shorn Control G1	Hand shorn		Mechanially shorn	
time after shearing		Early morning G2	Afternoon G3	Early morning G4	After noon G5
Initial body weight (KG)	32.1±2.1	32.8±1.9	32.8±2.3	30.3±3.0	32.6±1.7
Final body	34.9±2.8	34.1±2.3	33.0±2.9	31.6±2.7	33.8±1.9
Body weight gain (kg)	Abcde 2.8±0.6	Ab 1.3±0.7	ac 1.0±0.5	Ad 1.6±0.3	ae 1.2±0.8

[abcde] values with the same superscripts within columns were significantly differ at $p< 0.05$

C-Glucose level (mg / dl)

Table (4) showed that, there was a significant rise in the glucose level ($p<0.05$) immediately after shearing (0 time). The mean values were (52.1 ± 4.1, 68.3 ± 4.8, 66.5 ± 4.0 , 59. 8 ± 3.7 and 60.1 ± 3.9 mg/dl for the control not shorn and the four shorn groups of sheep ((G2 , G3, G4, and G5), respectively. This rise in glucose level declined again till reaching the baseline level within 90 min after shearing . The effect of method of shearing and time of the day of shearing was significant only till 30 minutes after shearing . The result agree to some extent with that reported by Holmes et al (1992) while marks (1959) reported that the glucose level wasn,t affected by shearing as a handling procedure .

Wool removal is the most potent component in eliciting a sympathetic adrenal medullary or pituitary- adrenal response to shearing and consequently secretion of adrenalin and non adrenalin from adrenal medulla which cause elevation of haematocrit and glucose level in blood (hyperglycaemia). Also as stated by Holmes et al. (1992) the secretion of adrenalin and noradrenalin as a result of stress factor (shearing procedure) produce glucose from the non carbohydrate source and also causing breakdown of glycogen through glycogenlysis producing hyperglycaemia i.e increase glucose level in blood.

(3) Productive aspects (performance response)

As shown in table (5) it can be noticed that, there were significant ($p< 0.05$) differences among sheep in control not shorn group and those in other four treated groups (shorn sheep) regarding their body weight gain as sheep in shorn groups attained signifcantly low body weight gain (1.3 ± 0.7 , 1.0 ± 0.5 , 1.6 ± 0.3 and 1.2 ± 0.8 kg.) in comparison with the corresponding non treated group (2.8 ± 0.6 kg.) . On the other hand there was no significant differences among the four treated groups of sheep and this indicate that there was no effect of both the method of shearing and time of the day on the body weight gain.

The low body weight gain due to shearing may be du to the reduced eating frequency and also may be due to the less time spent resting following shearing which may be lead to high energy expanditure. These results coincided with those reported by (El hadi, 1988; Holmes et al, 1992) and Aksoy, 1996) while sumner et al , (1992) and Newman et al, (1996) stated that, there was no significant effect of shearing as handling procedure on the body weight gain of sheep.

It can be concluded that, sheep shearing is an important management practice to take in account when improving techniques of sheep husbandry in order to attain high productivity without neglecting animal welfare , so shearing could be made less stressful by minimizing physical manipulation and social disruption to sheep through automated (mechanical) shearing in the early morning time of the day of shearing .

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