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A study on effect of weaning stress on performance and behaviour of Deccani lambs

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Abstract

A study on effect of weaning stress on Deccani lambs was conducted to know the impact of weaning stress on growth, cortisol and behavioural response. Sixteen healthy Deccani lambs of 2 months age were selected and care was taken to see that the selected lambs were of uniform body weights. The study was carried out for the period of 90 days by dividing the period into one preweaning period and two months postweaning period and each period into three equal intervals initial, mid and final stage. Animals were maintained under standard housing and management conditions as practiced in the Livestock Farm Complex, College of Veterinary Science, Rajendranagar, Hyderabad. The selected lambs were divided into two equal groups (T₁- to be weaned and T₂- to be retained with mothers). The standard weaning age followed at livestock farm complex was 90 days. All the lambs were kept for adaption period of 7 days before the start of experiment. All the lambs (T₁ and T₂ group) are allowed to stay and suckle their mothers during preweaning period. After 90 days of age, both the groups were fed with concentrate mixture. In addition, fed with ad libitum grass and T₂ group are continued to stay and suckle their mothers. Clean and potable drinking water was provided ad-libitum to all the lambs. The revealed that there is significant ($p < 0.005$) decrease in body weight and average daily gain. Significant ($p > 0.05$) increase in cortisol level. Further significant ($p < 0.05$) increase in vocalization and significant ($p > 0.05$) decrease in feeding behavior in T₁ group of lambs during initial stage of post weaning period. No significant ($p < 0.05$) decrease was observed in overall performance, cortisol and behavioral response between preweaning and postweaning periods.

Keywords: Deccani lambs, weaning stress, cortisol, behavioural response, average daily gain

1. Introduction

Weaning is a widely accepted approach for enhancing productivity. This practice always accompanies undesirable stresses in lambs. The traditional system of rearing lacks the awareness about the impact of weaning or knowledge of weaning or scientific management. The spurt in demand for mutton is encouraging farmers and entrepreneurs to take up ram lamb fattening activity as a commercial activity wherein in weaned ram lambs are reared till slaughter age around 8-9 months. Weaning conditions can end up in high levels of distress vocalizations and activity. The behavioural response typically peaks during initial stage of weaning, but under some conditions young will continue to show higher levels of activity and vocalisation for several days after weaning. Many animals also experience a reduction in growth rates, often losing body weight for several days after weaning. This pronounced behavioural response forms an obvious welfare concern for these animals, and can be considered an important production challenge for the livestock industry (Weary *et al.*, 2008)^[31]. Weaning is a widely accepted approach for enhancing productivity. This practice always accompanies undesirable stresses in lambs. Weaning can be stressful for the ewes and the lamb with enforced ewe-lamb separation resulting in elevated cortisol secretion in young lambs (Perez-Leon *et al.*, 2006)^[21].

2. Materials and Methods

2.1 Selection of the Experimental animals

Sixteen growing healthy Deccani lambs of 2 months age (60 days) maintained at LFC, Rajendranagar, Hyderabad having almost similar body weights. The study was carried out for a period of 90 days (mid-April to mid-July 2022) i.e., for one-month during preweaning period (60-90 days) and two months during post weaning period (90-150 days). The preweaning and post weaning periods are subdivided as follows for tabulation of physiological response, serum

biochemical parameters and behavioural responses. The preweaning period (60-90 days) was subdivided into 3 stages.

Initial phase: 60-70 days

Mid phase: 70-80 days

Final stage: 80-90 days

The post-weaning period (90-150 days) was subdivided into 3 stages. (The standard weaning age followed at LFC was 90 days)

Initial phase: 90-110 days

Mid phase: 110-130 days

Final phase: 130-150 days

Adaption period: Seven days (one week) period was set as an additional period before the start of experiment.

2.2 Housing and Management of Experimental Animals

All the lambs in the experiment were housed under conventional housing provided with a floor space of 1m² / lamb in the covered area with asbestos roof. The experimental lambs were properly identified with ear tags for proper recording of the data. All the lambs were kept under hygienic conditions throughout the experimental period. Healthy surroundings and proper cleanliness were maintained in the experimental sheds. Proper feeding and watering arrangements were made hygienically as per the standard management practices followed at Livestock Farm Complex (LFC).

2.3 Feeding and Watering Management

During the preweaning stage (60 -90 days of age) all the 16 Deccani lambs of the two groups, T₁ (to be weaned) and T₂ (to be retained) were allowed to stay and suckle milk of their mothers without any restriction. After the completion of pre-weaning period i.e., at the age of 90 days the lambs were grouped and managed as per the identified procedure. Both T₁ and T₂ lambs were provided with concentrate mixture (18% CP, 72% TDN), and were provided with *ad libitum* lucerne and paragrass, T₂ group continued to suckle their mothers. Potable, clean and fresh drinking water was made available to all the animals in clean water troughs throughout the experiment period.

2.4 Growth parameters

Growth of the lambs *viz.*, bodyweight gain (kg), average daily gain (ADG) (gm) recorded at fortnightly intervals. The recordings were done as following

2.4.1 Body weights and Average Daily Gain (ADG)

Body weight of lambs (kgs) were recorded at fortnightly intervals using a digital electronic weighing balance before offering feed and water in the morning. Total weight gain was

calculated by subtracting final body weight from initial body weight at the start of the experiment and ADG was calculated fortnightly throughout the experimental period.

2.5 Cortisol estimation

The serum hormone i.e., cortisol was estimated using Lumax TM model 4101chemuliminiscence Immuno Assay (CLIA).

2.6 Behavioural response

Various behaviours were recorded daily for four hours at hourly intervals from 9:00 AM to 12:00 PM. Enough care was taken not to disturb the animals at the time of recording the behaviours. The behavioural observations were taken for period of one-month preweaning and two months post weaning in all the lambs individually in both the groups. During preweaning all the lambs in (T₁ and T₂ groups) were considered as a single group. The behavioural observations were done instantaneously at 10-minute intervals through scan sampling (Martin and Bateson 1993) [5] for each animal individually for both the groups.

The vocalization and feeding were recorded. The animal emits high bitch bleats due to stress. The animal was considered to be feeding when it was standing beside the feed trough while eating, chewing, and swallowing. (De *et al.*, 2019) [8].

3. Results

The data recorded during the experiment was tabulated, statistically analysed and interpreted.

3.1.1 Fortnightly Body Weights and Average daily gain (ADG)

The data obtained in the present study are presented in Table 1. The perusal of results revealed that the average birth weights (kg) were found to be 3.17±0.08 and 3.08±0.08 kg in T₁ and T₂ group, respectively. Significantly ($p < 0.05$) lower body weights were observed in T₁ group during fortnight F3 and F4 when compared to the same in T₂ group.

The total gain in average body weight (kg) from the beginning of the study to the end was found to be 5.45±0.22 in T₁ and 6.35±0.33 in T₂ group. Statistically there was no significant ($p > 0.05$) difference between the two groups. The observed fortnightly mean ADG (gm) in Deccani lambs are presented in the Table 2. The interpretation of results revealed that ADG was significantly ($p = 0.01$) lower during fortnight (F3) and (F4) in T₁ group when compared to T₂ group.

The overall mean ADG (gm) are presented in Table 3. No significant difference ($p > 0.05$) was found between preweaning and postweaning periods in both T₁ and T₂ group.

3.2 Cortisol

The cortisol levels (µg/dl) obtained during different stages of experiment are presented in Table 4. There was significant ($p < 0.05$) increase in cortisol level during initial phase of post-weaning period in T₁ group when compared to T₂ group.

The overall mean cortisol level (µg/dl) between pre-weaning and post-weaning period presented in Table 5. revealed that no significant ($p > 0.05$) difference was observed between pre-weaning and post-weaning periods.

Table 1: Fortnightly body weights (kg) (Mean±SE) in Deccani lambs

Period		Prewaning period (60-90 days)			Post-weaning period (90 -150 days)				Total gain in weight
Stage Group	At birth	F0 (60 th d)	F1 (75 th d)	F2 (90 th d)	F3 (105 th d)	F4 (120 th d)	F5 (135 th d)	F6 (150 th d)	
T ₁	3.17±0.08	9.82±0.43	10.8±0.43	11.8±0.43	12.33±0.42 ^b	13.01±0.68 ^b	14.23±0.74	15.2±0.65	5.45±0.22
T ₂	3.08±0.08	9.78±0.29	10.8±0.28	11.8±0.30	13.79±0.65 ^a	14.77±0.69 ^a	15.46±0.65	16.13±0.62	6.35±0.33
N	08	08	08	08	08	08	08	08	08
P value	0.95	0.93	0.98	0.99	0.04	0.04	0.08	0.07	0.56

^{ab} Means in columns with different superscripts differ significantly ($p < 0.05$)

F0: At the beginning of the experiment F1 to F6: Different fortnights from first to sixth. N: No. of animals in each treatment P Value: Probability Value T₁: Weaned group T₂: Unweaned group

Table 2: Fortnightly ADG (gm) (Mean±SE) in Deccani lambs

Stage Group	Prewaning period (60 -90 days)		Post-weaning period (90 to 150 days)			
	F1 (60 -74 d)	F2 (75 -90 d)	F3 (90 - 104 d)	F4 (105 - 119 d)	F5 (120 - 134 d)	F6 (135 - 150 d)
T ₁	70.64±0.03	72.32±0.05	35.91±0.25 ^b	55.80±0.43 ^b	73.50±0.24	72.10±0.12
T ₂	73.66±0.03	71.87±0.08	73.07±0.39 ^a	70.08±0.35 ^a	71.64±0.06	70.75±0.09
N	08	08	08	08	08	08
P value	0.42	0.96	0.01	0.40	0.26	0.37

^{ab} Means in columns with different superscripts differ significantly ($p < 0.05$)

F1 to F6: Different fortnights from first to sixth.

N: No. of animals in each treatment P Value: Probability Value

T₁: Weaned group T₂: Unweaned group

Table 3: Overall mean ADG (gm) during preweaning and post-weaning periods

Stage Group (N = 08)	Prewaning period (60 - 90 days)	Post-weaning period (90 - 150 days)	P value
T ₁	70.98±0.02	61.83±1.24	0.51
T ₂	72.76±0.03	70.38±1.32	0.21

N: No. of animals in each treatment P Value: Probability Value

T₁: Weaned group T₂: Unweaned group

Table 4: Cortisol levels (µg/dl) (Mean±SE) in Deccani lambs

Cortisol (µg/dl)		T ₁ (N = 08)	T ₂ (N = 08)	P value
Prewaning	Mid phase	1.47±0.21	1.46±0.13	0.46
	Initial phase	2.01±0.13 ^a	1.43±0.21 ^b	0.004
Post-weaning	Mid phase	1.46±0.16	1.41±0.15	0.28
	Final phase	1.43±0.12	1.45±0.18	0.56

^{ab} Means in rows with different superscripts differ significantly ($p < 0.05$)

Table 5: Overall mean cortisol levels (µg/dl) during preweaning and post-weaning periods

Group Stage	T ₁ (N = 08)	T ₂ (N = 08)
Prewaning period (60 - 90 days)	1.47±0.21	1.46±0.13
Post weaning period (90 -150 days)	1.63±0.13	1.43±0.18
P value	0.30	0.79

3.3 Behavioural response

Behaviour was taken as an indicator to assess the comfort level of the animals in reaction to the environment. The Deccani lambs were observed for expression of various behaviours at regular intervals for a period of 90 days during preweaning and post-weaning periods and results are tabulated

3.3.1 Vocalisation

Mean (%) of lambs showing vocalisation behaviour during post weaning period at regular intervals are presented in table 6

The results revealed that the percentage of lambs showing vocalisation behaviour seem to be significantly ($p < 0.05$) higher in T₁ group than T₂ group during initial stage of post weaning period. There was no significant difference ($p > 0.05$) in the overall mean (Table 8) of vocalisation behaviour between pre-weaning and postweaning periods.

3.3.2 Feeding

Mean (%) values of feeding behaviour in Deccani lambs during post weaning period at regular intervals are presented in Table 7 The percentage of lambs showing feeding behaviour seem to be significantly ($p < 0.05$) lower in T₁ than in T₂ group during initial stage of post weaning. There was no significant difference ($p > 0.05$) in the overall means (Table 8) of feeding behaviour between preweaning and postweaning period

4. Discussion

4.1.1 Fortnightly Body Weights and Average daily gain (ADG)

Body weight is an important economic indicator in any livestock enterprise, particularly lamb rearing. The fortnightly body weights (kg) presented in the table 1 revealed that during the preweaning period the bodyweights in T₁ and T₂ groups are similar with no significant ($p > 0.05$) difference, whereas during post-weaning period the bodyweights in T₁ group (12.33±0.42 and 13.01±0.68) were significantly ($p < 0.05$) lower than that of

Table 6: Mean % of lambs showing vocalisation behaviour during post-weaning period

Stage Group (N = 08)	Initial phase (90-110 days)	Mid phase (110-130 days)	Final phase (130 -150 days)
T ₁	64.28±5.81 ^a	42.85±3.44	35.71±3.05
T ₂	36.75±4.89 ^b	34.52±3.57	32.14±4.26
P value	0.02	0.33	0.64

^{ab} Means in columns with different superscripts differ significantly ($p < 0.05$)

Table 7: Mean % of lambs showing feeding behaviour during post-weaning period

Stage Group (N = 08)	Initial phase (90-110 days)	Mid phase (110-130 days)	Final phase (130 -150 days)
T ₁	76.09±2.47 ^b	80.12±2.29	85.78±1.93
T ₂	84.53±2.43 ^a	85.31±1.51	85.62±1.05
P value	0.04	0.10	0.91

^{ab} Means in columns with different superscripts differ significantly ($p < 0.05$)

Table 8: Overall mean % of lambs showing various behaviours during pre-weaning and post weaning periods

Stage Behaviour	Prewaning period (60 -90 days)	Post-weaning period (90 – 150 days)		P value
		T ₁ (N = 08)	T ₂ (N = 08)	
Vocalisation	35.80±2.25	47.61±1.98	34.47±3.72	0.38
Feeding	86.25±0.52	80.66±0.29	85.15±0.26	0.11

N: No. of animals in each treatment T₁: Weaned group

P Value: Probability Value. T₂: Unweaned group

T₂ group (13.79±0.65 and 14.77±0.69) during fortnight F3 and F4. The results were in close agreement with Orgeur *et al.* (1998) [20], Ugur *et al.* (2004) [28], Mohapatra *et al.* (2021) [17], Liu *et al.* (2009) [13], Neamt *et al.* (2019), Khan *et al.* (2011) [12] and Kantharaja *et al.* (2018) [11]. The results indicated that the decrease in body weights (kg) in T₁ group was due to effect of weaning which caused stress due to separation anxiety in the lambs but the slow increase in body weight thereafter indicated the successful activation of coping up process. The results further revealed that statistically there was no statistical difference in overall gain in body weights (kg) between T₁ and T₂ group. Results of present study were in accordance with Selaive-Villaruel *et al.* (2008) [26], Napolitano (2008) [18] but were contrary to the findings of Bharti *et al.* (2018) [3] who reported that body weight gain was higher in suckling group.

The perusal of results regarding ADG (gm) revealed that significant ($p < 0.05$) difference was noticed during 3rd fortnight (F3) i.e., after weaning in T₁ group (35.91±0.25) which was lower than T₂ group (73.07±0.39). However, ADG gradually increased from 5th fortnight in T₁ group lambs. The results were in accordance with the Atasoglu *et al.* (2008) [2], Abdel-Fattah *et al.* (2013) [1], Chai *et al.* (2015) [6] and Ekiz *et al.* (2012) [10]. The results indicated that the decrease in ADG (gm) initially after weaning was due to decreased feed intake caused by weaning stress but the gradual increase in ADG thereafter indicated that the weaned group of lambs were able to compensate the loss of maternal milk by increasing feed intake which was available through concentrates.

Further the results in table 4.3 revealed that there was no significant difference ($p > 0.05$) in overall ADG (gm) between pre-weaning and post-weaning period in T₁ and T₂ group. The results were in accordance with Schichowski *et al.* (2008) [25] and Canequé *et al.* (2001) [4]

4.2 Cortisol response

Cortisol was usually released in response to fear or stress by the adrenal glands as a part of flight or fight mechanism.

The results regarding cortisol level (µg/dl) revealed that significantly ($p < 0.05$) higher value was observed in the T₁ group (2.01±0.13) when compared to T₂ group (1.43±0.21) during initial phase of post weaning however the cortisol level was well within the range of standards (1.4 - 3.1 µg/dl) as reported by (Radostits *et al.*, 2006) [23]. When the overall

mean cortisol level was compared during pre-weaning and post weaning, there was no significant ($p > 0.05$) difference. The results were in accordance with De Souza *et al.* (2021) [9], Mohapatra *et al.* (2021) [17], Bharti *et al.* (2018) [3], Shi gang *et al.* (2010) [27], Miranda *et al.* (2012) [16] and Rhind *et al.* (1998) [24].

The increase in the value of cortisol during the initial stage of weaning can be considered as an acute stress response as the body's vital physiological responses shot up during that particular period in the weaned group of lambs. The cortisol response normalised by the final stage of the study.

4.3 Behavioural response

An Animal's behaviour can be taken as an indicator of animal welfare and discomfort. The various behaviours studied were vocalisation and feeding

Vocalization is an ideal technique for accessing stressful conditions in animals. It reflects the emotional state of fear and anxiety (Cordeiro *et al.*, 2013) [7].

The results regarding vocalisation behaviour revealed that T₁ group lambs (64.28±5.81) had shown significant ($p < 0.05$) increase in vocalisation than T₂ group (36.75±4.89) during initial stage of weaning but later the vocalisation declined as the time progressed. Further there was no significant difference in vocalisation ($p > 0.05$) between preweaning and postweaning period. Similar results were reported by Weary *et al.* (2000) [31], Watts and Stookey (2000) [29], Price *et al.* (2003) [2], Ugur *et al.* (2004) [28], Magistrelli *et al.* (2013) [14] and Schichowski *et al.* (2008) [25].

As T₁ group lambs were under some degree of psychological stress due to maternal separation, they vocalized more compared to T₂ group lambs during initial stage of weaning and later the vocalisation declined as the time progressed. During the initial stage of weaning the higher frequency of vocalisation recorded may be considered as a call for milk as bleating occurred more before feeding or may be a call by the lambs to reunite with their mothers.

The perusal of results regarding feeding revealed that there was a significant ($p < 0.05$) decrease in feeding behaviour during initial stage of weaning. Further there was no significant ($p > 0.05$) difference in overall feeding ($p > 0.05$) between preweaning and postweaning period. The results were in accordance with Neamt *et al.* (2019) [19], Mohapatra *et al.* (2021) [17] and Magistrelli *et al.* (2013) [14].

The results in the present study revealed that there was decrease in feed intake after weaning in T₁ group as during preweaning period the young lambs received mothers' milk which was more digestible and palatable, later after weaning they received solid feed this might have caused a stressful behaviour, The same could be correlated to decrease in the body weight after weaning in T₁ group, also the lambs were in emotional stress due to separation from their mothers during the initial stages that caused decrease in feeding behaviour.

5. Conclusion

The study revealed that weaning caused stress in Deccani lambs only during initial stage of weaning by reduction in bodyweight, increase in cortisol and changes in behaviour response only during initial stages and can be reduced by proper management practices.

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7. Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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