

ECONOMIC LOSSES DUE TO MORTALITY AND MORBIDITY IN MARWARI BREED OF SHEEP: BODY WEIGHTS[#]

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ABSTRACT

Received Revised on: 03.03.2017

Accepted on: 16.06.2017

The health records of Marwari sheep from Central Sheep and Wool Research Institute, Arid Region Campus, Bikaner, were analyzed for economic losses due to various diseases in different age groups i.e. birth to three (suckling), three to six (weaning), six to twelve (hogget) and above twelve months (adult). Diseases were classified on the basis of body systems and tentative diagnosis made by the veterinarian. The total economic loss due to morbidity, mortality and treatment was Rs. 23256.56 in 0-3 months, 45914.36 in 3-6 months, 57983.53 in 6-12 months and 250468.22 in adult group. The losses due to body weight and treatment were the highest in the progenies of first genetic group followed by the progenies of third and second genetic group in all the age groups. According to the sex, the male and female were having almost equal economic losses in suckling group, whereas in the second and third groups, the male progenies were cause more economic losses as compare to the female progenies. In the adult group the female progenies accounted for higher economic loss due to higher incidence of reproductive diseases. Among the progenies of the sire group, the progenies of the seventh sire group resulted more body weight loss and cost of treatment followed by the sire group first in comparison the rest of progenies of sire group. The present results indicate that the overall economic loss of Rs. 377622.56 in body weight due to various disease in sheep flock of 2708 Marwari sheep.

Key words: Genetic groups, Marwari sheep, mortality, morbidity, sex, sire

Introduction

Among the various breeds of sheep the Marwari breed constitutes about 50 per cent of the total population of Rajasthan. The Marwari sheep is hardy, yielding coarse carpet type white wool with mixed hairy composition. Short ears, long legs, black face and a prominent nose characterize this breed. The tail is thin, short and pointed and this breed is very well adapted to dry and arid zones of Rajasthan. Small ruminant systems, in India, in general, are complex, diverse and prone to many risks. Proper recording of the diseases is difficult, though diseases are known for the major reason for mortality and production losses. Even at the organised farms, the diagnosis of different diseases is mainly based on clinical symptoms and diagnostic investigations are not very appropriate and most of the recording of incidence of different diseases is based on post-mortem lesions. Disease investigation facilities on organised farms and even at the production oriented research institutions are not adequately available. Therefore, it is necessary to assess economic losses on account of morbidity, mortality and treatment due to various diseases in Marwari breed of sheep in arid zone of Rajasthan.

Materials and Methods

The health records of 2708 Marwari sheep maintained at central sheep and wool research institute (CSWRI, arid region campus, Bikaner) were analyzed for estimating the economic losses due to morbidity and mortality in birth to three (suckling), three to six (weaning), six to twelve (hogget) and above twelve months (adult). The diseases recorded were classified on the basis of body systems and tentative diagnosis made by the veterinarian viz. diseases of respiratory system, digestive system-I, digestive system-II, urinary system, reproductive

system, blood, skin, eyes, surgical problems, predatory, foot rot, foot and mouth diseases, tetanus, listeriosis, peste des petits ruminants, mammary gland, pyrexia, heat stroke, lameness and gid were calculated on the basis of genetic groups, sex of animal and sire groups.

The body weights of healthy and diseased lambs were estimated by using LSMLMW statistical package (Harvey, 1990). The economic losses due to all diseases were estimated in terms of losses due to body weight and losses due to treatment cost.

Body weights losses during 0-3, 3-6, 6-12 and above twelve months of age due to morbidity from various causes were calculated using the following formula:

$$ELBD = EVB [(BH - DH) * ND]$$

Here, ELBD= economic losses in rupees due to reduced body weight, EVB= economic value of 1 kg body weight expressed as market price of one kg live weight. BH= average body weight of healthy lambs. DH= average body weight of diseased lambs. ND= number of diseased lambs

Economic losses due to treatment: The information's of actual expenditure on medicine for health care of Marwari sheep for eight years were utilized for estimation of cost of treatment per lamb. The expenditure on vaccination for prevention against enterotoxaemia, sheep pox, foot and mouth diseases and anthrax diseases were Rs.14855, 8550, 8165 and 1096, respectively. Thus, the total expenditure on vaccination was Rs. 32666. The total expenditure on treatment was obtained by subtracting the expenditure vaccination from total expenditure, as the vaccination is common practice for all animals. The actual expenditure on treatment was Rs. 71211 for 1189 animals.

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$$\text{Treatment expenditure per animal} = \frac{\text{Actual expenditure on treatment}}{\text{Total animals treated}}$$

Economic losses due to mortality were calculated on the basis of live healthy animals as follows:

$$\text{ELBM} = \text{EVW} [\text{BH} \times \text{ND}]$$

Here, ELBM = the economic losses (in rupees) in body weight due to mortality. BH = the body weight of diseased lambs. ND = number of lambs died. EVW = the economic value per kg body expressed as market price of 1 kg of live weight.

Results and Discussion

Economic losses due to body weight losses and treatment

Suckling group (0-3 months of age): The average body weight of 231 sick lambs was 0.165 kg lower in comparison to the healthy lambs. The total economic loss due to 38.115 kg body weight loss was Rs 1223.49 (Table 1). Senthil kumar *et al.* (2008) also observed economic losses due to disease. The cost of treatment of these sick animals was Rs 13834.59 (Table 2). Average loss in body weight was highest in the second genetic group (0.306 kg) followed by third (0.111 kg) and first (0.078 kg). The highest loss in the first group was due to more number of progenies in this genetic group. However, the expenditure/animal was highest for the first group followed by the second and third group. The male and female lambs were having approximately same number of progenies in this age group. The male and female lambs were having approximately same number of sick animal; however the total body weight losses and loss per lamb were higher in males as compare to the females indicative that male lambs were more sensitive for the diseases. Among the sire group, economic loss per lamb was highest for the first sire group followed by the fifth, sixth, seventh, second and third. This indicates that the progenies of fourth sire group were less sensitive for diseases in comparison to rest of progenies of sire group.

The average body weight loss due to the death of 97 lambs was 2.633±0.044 kg per lamb. Niel *et al.* (2014) also reported economic losses due to disease. The economic loss due to body weight loss of 255.401 kg was Rs. 8198.37. The losses in terms of body weight were 140.185 kg in genetic group first, 12.78 kg in genetic group second and 105.183 kg in genetic group third. The economic losses due to mortality were highest in genetic group first followed by third and second genetic group. The total body weights losses due to death of 50 male and 47 female lambs were 134.25 kg and 121.26 kg, respectively. In this group the loss in term of body weight economic loss was higher in males in comparison to the females. The overall total economic loss due to mortality, morbidity and treatment was Rs.23256.45. In term of body weight loss the highest loss was observed in the seventh sire group followed by first and third.

Weaning group (3-6 months): The difference in average body weight of healthy and sick lambs was the highest (1.602 kg) in this group in comparison of suckling, hogget and adult group. Due to morbidity of the various diseases, 254.718 kg body weight was lost, which cause loss of Rs. 8,176.44 in term of body weight and Rs. 9,522.51 in term of treatment cost. This economic loss was higher than the loss of suckling group.

The average body weight loss was the highest in the second genetic group followed by the third and first, but the total economic loss and losses per sheep due to total body weight loss was significantly higher in third group followed by first and second group. The highest expenditure in the treatment of first genetic group was due to the highest number of progenies in this group both in respect to total number and total sick animals. Similar to the previous group (0-3 month), the average body weight loss was significantly more in male than female lambs. The number of sick lambs was also higher in males as compare to females, however the total number of female progenies were more in this group in the flock. Due to the higher number of sick lambs in male group, the expenditure on the treatment and expenditure/animal was also higher resulted in to more economic loss.

Among the progenies of various sire groups, the progenies of first sire group were having the highest loss per sheep and progenies of fourth sire group were having the lowest losses in this group. The highest economic loss due to treatment was in the progenies of seventh sire group due to the more number of sick lambs and total number of progenies.

The least-squares mean of died lambs was 10.341±0.302 kg per lamb. The economic loss due to body weight loss of 878.985 kg of 85 lambs was Rs.28215.41. In term of money the losses due to mortality in first, second and third group were Rs. 16912.52, 1938.51 and 10013.14, respectively. The highest loss was observed in first genetic group followed by third and second. The total body weight losses in 41 male and 44 female lambs were 426.769 kg and 452.012 kg, respectively, due to which the economic losses suffered, were Rs. 13699.28 and 14509.58, respectively. In weaning group loss due to mortality was approximately same in both sexes. The economic loss due to total body weight was highest in the seventh sire group followed by first and third sire group. The overall total economic loss due to mortality, morbidity and treatment was Rs. 45914.36.

Hogget group (6-12 months): In this group, 321.165 kg body weight losses occurred due to illness of 351 lambs. This causes the economic losses of Rs. 10309.39 in terms of body weight and in term of treatment Rs .21021.39. Singh *et al.* (2014) also reported economic loss due to disease in small ruminants. The progenies of the genetic group third showed the highest decline of the average weight followed by first and second group. The numbers of the sick animals are more in the first group. The numbers of the sick animals are more in the first genetic group, which resulted to more economic loss (Rs. 17328.66) due to their treatment and body weight loss, thereafter in third (Rs. 9266.35) and second (Rs. 4797.15) genetic group. The economic loss per sheep was highest for first genetic group followed by the second and third group. Sex wise, economic losses pattern was similar to the previous 2 groups, but the differences was much higher in this group. This further conforming the observations that the male lambs were more sensitive to the diseases as compare to the female lambs. The average body weight of 54 died lambs were 15.376±0.119 kg, consequently the total body weight loss was 830.304 kg, thus the economic loss due to this body weight loss was Rs. 26,652.75. The losses in term of total body weight on account of death were 434.756 kg in first, 129.016 in second and 260.532 kg in third genetic group. The total body weight loss due to died

Table 1: Economic losses due to morbidity and mortality in different age groups.

Effect	Ave. body weight of Healthy lambs (kg.)	SICK LAMBS					DIED LAMBS				Total economic loss
		Av. Body wt (kg)	Av. Body wt loss (kg)	Total no.	Total body wt loss	Economic loss	Total no.	Body wt loss (kg)	Total body wt loss (kg)	Economic loss	
0-3 months (suckling group)											
Overall	2.79±0.01 (2477)	2.63±0.04 (231)	0.16	231	38.11	1223.49	97	2.63	255.40	8198.37	9421.86
Genetic groups											
First	2.72±0.01 (1206)	2.64±0.04 (139)	0.07	139	10.84	348.02	53	2.64	140.18	4499.93	4847.95
Second	2.86±0.02 (368)	2.55±0.11 (16)	0.30	16	4.89	157.16	5	2.55	12.78	410.23	567.39
Third	2.80±0.01 (903)	2.69±0.05 (76)	0.11	76	8.43	270.79	39	2.69	105.18	3376.37	3647.16
Sex											
Male	2.87±0.01 (1171)	2.68±0.05 (119)	0.19	119	22.96	737.24	50	2.68	134.25	4309.42	5046.66
Female	2.71±0.01 (1306)	2.58±0.05 (112)	0.13	112	15.34	492.54	47	2.58	121.26	3892.44	4384.98
Sire groups											
First	2.90±0.02 (357)	2.65±0.07 (40)	0.25	40	10.08	323.56	23	2.65	61.04	1959.44	2283
Second	2.68±0.02 (244)	2.43±0.10 (22)	0.24	22	5.41	173.72	10	2.43	24.37	782.27	955.99
Third	2.82±0.02 (318)	2.67±0.09 (29)	0.14	29	4.23	135.91	15	2.67	40.14	1288.49	1424.4
Fourth	2.84±0.02 (396)	2.80±0.10 (19)	0.03	19	0.64	20.73	4	2.80	11.23	360.67	381.4
Fifth	2.75±0.03 (209)	2.69±0.10 (25)	0.06	25	1.72	55.37	7	2.69	18.83	604.44	659.81
Sixth	2.79±0.02 (238)	2.57±0.09 (25)	0.22	25	5.57	178.95	8	2.57	20.56	659.97	838.92
Seventh	2.77±0.01 (715)	2.59±0.06 (71)	0.18	71	13.13	421.63	30	2.59	77.76	2496.09	2917.72
3-6 months (weaning group)											
Overall	11.94±0.06 (2403)	10.34±0.30 (159)	1.60	159	254.71	8176.44	85	10.34	878.98	28215.4	36391.8
Genetic groups											
First	11.82±0.08 (1151)	11.21±0.34 (96)	0.61	96	58.84	1889.02	47	11.21	526.87	16912.5	18801.5
Second	12.21±0.13 (362)	10.06±0.69 (17)	2.14	17	36.53	1172.7	6	10.06	60.39	1938.51	3111.21
Third	11.79±0.10 (890)	9.74±0.43 (46)	2.04	46	94.02	3018.17	32	9.748	311.93	10013.1	13031.3
Sex											
Male	12.24±0.08 (1118)	10.40±0.34 (95)	1.83	95	174.04	5586.68	41	10.40	426.76	13699.2	19285.9
Female	11.64±0.07 (1285)	10.27±0.39 (64)	1.37	64	87.80	2818.63	44	10.27	452.01	14509.5	17328.2
Sire groups											
First	11.69±0.14 (319)	8.58±0.64 (22)	3.10	22	68.33	2193.45	14	8.58	120.19	3858.09	6051.54
Second	10.86±0.17 (238)	8.88±0.76 (15)	1.97	15	29.65	951.92	6	8.88	53.31	1711.44	2663.36
Third	11.81±0.14 (318)	10.55±0.72 (14)	1.25	14	17.62	565.79	10	10.55	105.53	3387.51	3953.3
Fourth	12.73±0.12 (398)	11.37±0.79 (12)	1.36	12	16.32	523.87	2	11.37	22.74	729.95	1253.82
Fifth	12.58±0.18 (211)	10.80±0.83 (12)	1.78	12	21.39	686.81	6	10.80	64.8	2080.08	2766.89
Sixth	12.04±0.15 (238)	11.57±0.70 (14)	0.47	14	6.58	211.21	9	11.57	104.19	3344.59	3555.8
Seventh	11.87±0.09 (681)	10.61±0.36 (70)	1.25	70	88.13	2828.97	38	10.61	403.37	12948.1	15777.1

lambs was highest in first genetic group followed by the third and second. The total body losses for 27 males and 27 females were 418.986 kg and 411.318 kg, respectively. The number of died lamb and economic losses were same in

both sexes. Among the progenies of various sire groups, the progenies of seventh sire group were having the highest economic loss and progenies of sixth sire group were having the lowest economic loss. The overall total economic loss

6-12 months (hogget group)											
Overall	16.29±0.05 (1931)	15.37±0.11 (351)	0.91	351	321.16	10309.3	54	15.37	830.30	26652.7	36962.1
Genetic groups											
First	16.37±0.07 (856)	15.52±0.16 (199)	0.84	199	168.55	5410.55	28	15.52	434.75	13955.6	19366.2
Second	16.75±0.12 (304)	16.12±0.25 (60)	0.62	60	37.5	1203.75	8	16.12	129.01	4141.41	5345.16
Third	15.74±0.08 (771)	14.47±0.22 (92)	1.27	92	117.02	3756.47	18	14.474	260.53	8363.07	12119.5
Sex											
Male	16.63±0.07 (850)	15.51±0.13 (211)	1.12	211	236.53	7592.64	27	15.51	418.98	13449.4	21042.0
Female	15.94±0.06 (1081)	15.23±0.17 (140)	0.70	140	99.26	3186.24	27	15.23	411.31	13203.3	16389.5
Sire groups											
First	16.74±0.14 (202)	14.76±0.30 (37)	1.98	37	73.44	2357.58	5	14.764	73.82	2369.62	4727.2
Second	15.84±0.17 (170)	14.87±0.31 (49)	0.97	49	47.72	1532.00	8	14.87	118.96	3818.87	5350.87
Third	16.93±0.12 (276)	15.18±0.30 (38)	1.74	38	66.27	2127.33	10	15.18	151.86	4874.70	7002.03
Fourth	17.67±0.11 (356)	16.95±0.28 (46)	0.71	46	33.07	1061.67	5	16.95	84.76	2720.79	3782.46
Fifth	15.30±0.17 (168)	15.20±0.33 (42)	0.09	42	4.07	130.77	5	15.20	76.02	2440.24	2571.01
Sixth	15.70±0.13 (199)	15.20±0.33 (31)	0.50 2	31	15.56	499.54	4	15.20	60.82	1952.32	2451.86
Seventh	15.83±0.08 (560)	15.45±0.19 (108)	0.38	108	41.04	1317.38	17	15.45	262.70	8432.70	9750.08
Above 12 months (adult group)											
Overall	21.92±0.08 (1284)	21.12±0.13 (685)	0.79	68	546.63	17546.8	283	21.12	5978.0	191896.	209443.
Genetic groups											
First	21.23±0.11 (608)	20.18±0.17 (344)	1.05	344	361.88	11616.6	171	20.18	3451.6	110797.	122414.
Second	22.46±0.18 (218)	21.70±0.28 (88)	0.76	88	67.23	2158.14	20	21.70	434	13931.4	16089.5
Third	22.06±0.14 (458)	21.48±0.20 (253)	0.57	253	146.23	4694.11	92	21.48	1976.8	63455.4	68149.5
Sex											
Male	22.25±0.10 (661)	21.67±0.21 (155)	0.57	155	89.74	2880.81	55	21.67	1192.0	38265.4	41146.2
Female	21.59±0.10 (623)	20.57±0.14 (530)	1.01	530	539.01	17302.2	228	20.57	4690.8	150576.	167879.
Sire groups											
First	22.46±0.20 (144)	21.04±0.48 (29)	1.42	29	41.18	1321.87	12	21.04	252.55	8106.91	9428.78
Second	21.67±0.27 (99)	21.60±0.31 (91)	0.06	91	6.27	201.55	57	21.60	1231.3	39525.1	39726.7
Third	22.54±0.19 (176)	21.05±0.30 (77)	1.49	77	114.80	3685.30	24	21.05	505.27	16219.2	19904.5
Fourth	22.31±0.17 (241)	21.053±0.302 (95)	1.26 0	95	119.7	3842.37	30	21.053	631.59	20274.0	24116.4
Fifth	21.25±0.24 (123)	21.053±0.302 (77)	0.20	77	15.55	499.28	46	21.05	968.43	31086.8	31586.1
Sixth	21.60±0.20 (141)	21.116±0.289 (74)	0.48	74	35.81	1149.69	15	21.11	316.74	10167.3	11317.0
Seventh	21.60±0.13 (360)	20.96±0.18 (242)	0.64	242	155.12	4979.41	99	20.96	2075.5	66624.6	71604.0

Note: Figures in parenthesis indicate number of animal, Economic loss was calculated on the basis of present CSWRI rate Rs. 32.10/- per kg live body weight.

due to mortality, morbidity and treatment was Rs. 57983.53.

Adult group (above 12 months): The average body weight of sick lamb was 0.798 kg lower than the average body weight of healthy lamb. The numbers of sick lambs

were near about 50 per cent, which is the highest of all the previous group of lambs thereby causing the highest economic loss of Rs 58571.47. Singh and Prasad (2008) also observed the total annual average loss due to all

Table 2: Expenditure on treatment in different age groups.

Effect	Age group of lambs								Total expenditure Rs.
	Suckling group (0-3)		weaning group (3-6)		hogget group (6-12)		adult group (above 12)		
	No. of sick lambs	Expenditure on treatment	No. of sick lambs	Expenditure on treatment	No. of sick lambs	Expenditure on treatment	No. of sick lambs	Expenditure on treatment	
Overall	231	13834.59	159	9522.51	351	21021.39	685	41024.65	85403.14
Genetic groups									
First	139	8324.71	96	5749.44	199	11918.11	344	20602.16	46594.42
Second	16	958.24	17	1018.13	60	3593.4	88	5270.32	10840.09
Third	76	4551.64	46	2754.94	92	5509.88	253	15152.17	27968.63
Sex									
Male	119	7126.91	95	5689.55	211	12636.79	155	9282.95	34736.2
Female	112	6707.68	64	3832.96	140	8384.6	530	31741.7	50666.94
Sire groups									
First	40	2395.6	22	1317.58	37	2215.93	29	1736.81	7665.92
Second	22	1317.58	15	898.35	49	2934.61	91	5449.99	10600.53
Third	29	1736.81	14	838.46	38	2275.82	77	4611.53	9462.62
Fourth	19	1137.91	12	718.68	46	2754.94	95	5689.55	10301.08
Fifth	25	1497.25	12	718.68	42	2515.38	77	4611.53	9342.84
Sixth	25	1497.25	14	838.46	31	1856.59	74	4431.86	8624.16
Seventh	71	4252.19	70	4192.3	108	6468.12	242	14493.38	29405.99

diseases Rs. 264.8 lakh. The economic loss in this group could be minimizing by improving the managerial conditions and proper attention to the diseased lambs. Kihu *et al.* (2015) also reported that mortality of small stock due to PPR constituted the greatest economic loss valued at US \$ 16.8 million being 88 per cent of the total losses.

The losses in terms of total body weight and on animal basis were highest in genetic group first, followed by third and second genetic group. The numbers of sick sheep were more in female group than ram even than the numbers of female and male animals are approximately same. The higher economic losses in the female group might be due to the reproductive diseases as the animals grow older chances of reproductive diseases increases. Among the progenies of various sire groups, the progenies of third sire group were having the highest average body weight loss. Although the highest economic loss due to treatment was in the progenies of seventh sire group due to 40.20 per cent morbidity in this sire group. This is very alarming situation, indicative that the progenies of this sire group are more sensitive against the diseases, therefore more attention is to be paid for the animals of this group to reduced the economic loss. The total economic losses per animal were the lowest in the progenies of first sire group. The average body weight loss due to death of 83 lambs was 21.124±0.138 kg, consequently the total body weight loss was 546.63 kg, thus the economic loss due to this body weight loss was Rs. 191896. The economic losses were highest in the first genetic group followed by third and second genetic groups. The economic losses were higher in females as compare to the males indicating that female lambs were more susceptible to the diseases. Among the various sire groups, the progenies of seventh sire group were having the highest

economic losses and progenies of first sire group were having the lowest economic loss in adult group but the mortality rate was highest in the second sire group. The overall total economic loss due to mortality, morbidity and treatment was Rs. 250468.22. These economic losses may be reduced by improving the management practices, proper care and attention of the diseased lambs, regular deworming and vaccination schedule culling of diseases susceptible sire from the flock (Sharma *et al.* 2007).

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