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Effect of Non-genetic Factors on Reproductive Parameters and Greasy Fleece Yield in Kashmir Merino Sheep

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ABSTRACT

Background: A study was undertaken to estimate gestation length, birth weight, dam weight and greasy fleece yield in Kashmir Merino sheep and factors influencing these traits at Sheep Breeding Farm, Kralpathri in 2020-21.

Methods: The traits considered in the study were overall all body weight of dams at tupping (DWT), average wool yield of dams (AWY), gestation period (GP) and birth weight (BW). The averages of 39.00±0.27 (kg), 2.38±0.02 (kg), 150.17±0.17 (days) and 3.87±0.04 (kg) for DWT, AWY, GP and BW with coefficient of variation 12.83%, 12.75,1.65 and 17.70, respectively were observed in the present study. The data was analyzed by Harvey, 1990.

Result: Highest and lowest CV (%) was observed for BW and GP, respectively. Overall estimates of 37.43±0.41 (kg) and 2.21±0.02 (kg), 150.59±0.56 and 2.84±0.11 for DWT, AWY, GP and BW, respectively was observed in the present study. Effect of age of dam was significant ($p<0.05$) on DWT and AWY whereas effect of lamb weight at birth was significant on GP. The effect of genetic group of sire, dam weight, parity of dam, body weight of dam at tupping, sex and birth type of lamb had significant ($p<0.05$) effect on BW. Heaiver lambs were born to heavier dams. Therefore, increasing selection pressure at tupping for dam weight will result in improvement of birth weight and hence overall production performance of Kashmir Merino sheep.

Key words: Average wool yield of dam, Birth weight, Gestation period, Kashmir merino sheep.

INTRODUCTION

Kashmir Merino is major synthetic breed of Kashmir known for production of fine quality wool and fast growth rate. However, during last decade or so the production performance of the breed was not optimum at government sheep breeding farms. The decrease in production performance was correlated with increased inbreeding coefficient at these farms. Hence, to improve production and to avoide deleterious effects of inbreeding 120 rams and 299 ewes (Australian Merino) were imported during 2020-21. The earliest available trait (Lalit *et al*., 2016a) and an important component of overall performance of animal owing to its effect on lamb survival, growth rate and overall production (Iman and Slyter, 1996) is birth weight. Similarly mammals possess a characteristic and fixed gestation period with expected species, breed and individual variation. Sheep, an important livestock species differ in the length of the pregnancy due to the different lineage, genetic, nutritional and environmental factors (Anonymous 2021). Average gestation length of domestic sheep varies from 138 to 157 days. However, in most breeds the averages ranges from 144 to 152 days. It has been reported that mutton type breeds (Finn) have shorter gestation lengths (144 to 145 days) as compared to the fine wool (Rambouillet and Merino) with average of 148 to 152 days (Tilton *et al.,* 1964). The gestation period and birth weight are quantitative traits governed by polygenic inheritance (Rather *et al.,* 2019) and affected by non-genetic factors like birth type (Shrestha and Heaney 1990), season and year of birth, birth weight and sex of lamb (Mohammad 2006), parity, weight and age of dam (Mohammad 2006) and breed of lamb (Anderson *et al.,* 1981). Similarly, birth weight is an early available trait in sheep production system which influence lamb survival and futures growth rate governed by polygenic inheritance and affected by aforementioned non-genetic factors. Kashmir Merino sheep is an important synthetic sheep breed of Kashmir known for good quality fine wool production. The breed was crossed with Austrialian Merino Rams at Government Sheep Breeding Farm Kralpathri on trial bases to study the effect of cross breeding on it performance.

AIM

To study the effect of non-genetic factors on annual wool production and live weight at tupping. To study the effect of crossbreeding and nonhereditary source of variations on gestation length, lambing percentage and birth weight in Kashmir Merino ewes.

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MATERIALS AND METHODS

Place of work

The present study was under taken in 2020-21 on 354 ewes managed at sheep breeding farm Kralpathri. The farm is located at 33° 53′ latitude N and 74° 37′ longitude E, in hills of district Budgam about 45 kilometers from Srinagar. The topography of the farm is undulating hills covered by forest land spread over a vast area. The farm was established in the sixties for up-gradation of non-descript sheep population of Kashmir valley (Bashir *et al*., 2020).

During breeding season (*i.e*. September and October) sheep were managed on pastures only whereas during winter (15th November to 15 April) sheep were housed indoors and stall-fed for a period five months. The feed and fodder (kg) was fed to animals @ 0.60 and 1.5 kg, respectively to ewe along with mineral mixture and jaggry. However, during onset of lambing 100 grams of uncrushed maize and 100 grams of vegetables in form of cabbage, carrot and turnip were also included in feeding. Sharing was done just before breeding. The sheep were vaccinated against sheep pox, PPR, FMD and enterotoxaemia as per schedule. The animals were treated for any disease by expert veterinarians after proper diagnosis. Veterinary aid was provided as and when needed. Cleanliness of sheds and hygienic measures were regularly done. Lambing commenced in February. Naval dipping of lambs was done routine. Lambs were weighd one hour after birth. Before tupping ewes were weighed by digital platform balance. Wool was sheared both in spring and autumn and greasy wool yield was measured by digital balance. Similarly, at lambing, lambs were weighed, and birth weight, lambing date, sex and coat type of each lamb were recorded. The selection process at the farm is a multistage process. The animals are constantly monitored for growth upto November till animals attain age of 7 to 8 months. At this stage slow growing lambs and stunted animals are culled. At one year age the fibre traits *viz* modulation, fibre diameter, staple length, clean wool yield and crimps per inch are estimate and animal having modulation in wool are culled irrespective of body weight. At 18 months age, hoggets are weighed and animals below 30 Kg are culled. Male are similarly selected for breeding. Prior to mating the ewes were grouped into four groups based on age and score, estimated by following formula:

$$\text{Score} = (A+B)10$$

Where

A= Body weight (kg) of ewe at time of mating.

B= Last wool yield (kg) obtained during spring sharing.

However, maiden ewes (ewes put to mating for the first time with average age and body weight of 18 months and above 30 kg, respectively) were grouped separately in order to prevent dystocia. Culling of ewes having broken mouth, gummy mouth and age more than eight years were culled. Screening for brucellosis was done before tupping. The ewes having body weight less than 30 kg were abstained from breeding. The rams were similarly grouped into four groups based on breed and score. Six Australian Merino Rams with high score were assigned to ewes with high score and five Austrialian Merino rams with low score were assigned to ewes with intermediate score. Six Kashmir Merino rams with high score were assigned to ewes with low score whereas Kashmir Merino Rams with too low score were assigned to ewes tupped for the first time. The breeding was completed in two erstous cycles. Paint was applied on the brisket region of selected rams and put into the pens with allotted group of ewes during night hours only. Tupping was recorded in the morning. The lambing commenced on 15th February and terminated at the end of March.

Statistical analysis

The date was recorded in excel spread sheet. Coefficient of variation of all traits were estimated statistically (Snedecor and Cochran 1967) by SPSS software. Since the subclass numbers were unequal and disproportionate therefore, the data on various performance traits was subjected to Least-squares analysis by fitting constants to estimate magnitude of various genetic and non-genetic sources of variations on these traits. The analysis was carried out by using model-2 and model-8 of mixed model least-squares maximum likelihood (LSMLMW) computer (PC-2) programme designed by Harvey, 1990. The statistical analysis was carried out using Harvey's mixed model least squares and maximum likelihood software. Duncan's multiple range test (DMRT) was used for pair wise comparison for the effects significant in least squares modal.

RESULTS AND DISCUSSION

Descriptive statistics

The descriptive statistics of traits considered in the present study is presented in Table 1. The averages of 39.00±0.27 (kg), 2.38±0.02 (kg), 150.17±0.17 (days) and 3.87±0.04 (kg) for DWT, AWY, GP and BW with coefficient of variation 12.83%, 12.75%,1.65% and 17.70%, respectively were observed in the present study. Highest and lowest CV (%) was observed for BW and GP, respectively.

The least square means of body weight and overall wool yield of 37.43±0.41 (kg) and 2.21±0.02 (kg) were observed in ewes used for present study (Table 2). Contradictory to the results of present study lower estimate of body weight of 33.29±0.28 kg in Corriedale ewes and Khan *et al.,* (2011a) and 32.51±0.54 and 32.64±0.85 kg in Crossbred and Polled Dorset ewes were reported by Khan *et al.,* (2011b). Significant effect of parity on wool yield and body weight was observed in the present study. The significant effect of parity on dam weight is in consonance with the findings of Khan *et al.,* (2011 a;b).

The overall gestation period of 150.59±0.56 days was observed in the present study (Table 2). The overall least squares mean for gestation period in Kashmir Merino in the present investigation was in close consonance with the findings of Mohammad (2006) in Hammdani ewes

(151.29±2.10). However, Ozturk and Aktaş (1996) in Konya Merino (Turkey) reported gestation length of 152.7±0.25 days. The effect of sex of lamb, body mass of ewe, parity of dam, birth type, breed of lamb was non-significant whereas effect of body mass of lamb at birth was significant ($p<0.05$) on gestation length. Shrestha and Heaney (1990) also observed that sex of lamb and body weight of the ewe had no influence on gestation length of ewes. Kaulfuss (2002) in German Mutton Merino, German Blackhead Mutton and their Booroola crosses found that age, body weight of ewes as well as number, sex and birth weight of lambs had no or non-significant on the trait. However, Oztürk and Aktaş, (1996) reported significant effect dam age, birth type and birth weight of the new born on and non-significant effect of sex of lamb on the gestation length. Mohammad (2006) in Hammdani ewes reported significant effect of birth weight and body mass of ewes at tupping and non-significant effect of sex of lamb, birth type and age of dam on the trait. The gestation period of ewes carrying out bred lambs (Kashmir Merino×Kashmir Merino) was higher than ewes carrying only Kashmir Merino lambs. Anderson *et al.,* (1981) reported that mean gestation period for mixed-breed pregnancies was longer than for pregnancies with only one breed (Finn) lambs. Higher mean gestation in ewes carrying out bred lambs (Kashmir Merino×Kashmir Merino) the in ewes carrying only Kashmir Merino may demonstrate an interaction (Anderson *et al.,* 1981). There was a progressive increase in gestation length with increase in birth weight of lamb in the present study. Ozturk and Aktaş (1996) in Konya Merino also found that heavier lambs had a longer gestation length. The ewes carrying twins had slight higher gestation period. Ozturk and Aktaş (1996) also found that ewes carrying triplets had longer gestation length (153.7±0.73 days) then ewes carrying twins (152.8±0.16 days). The ewes carrying twins had longer gestation than ewes carrying single lambs (151.6±0.22 days). The ewes carrying female lambs

Table 1: Descriptive statistics.

Trait	N	Mean±SE	Std. Deviation	Range	CV (%)
DWT (kg)	355	39.00±0.27	5.00	31-55	12.83
AWY (kg)	355	2.38±0.02	0.30	1.8-3.2	12.75
GP (days)	206	150.17±0.17	2.47	144-146	1.65
BW (kg)	300	3.87±0.04	0.69	1.5-5.6	17.70

Table 2: Leat square means for gestation length, dam weight, birth weight and wool yield in Kashmir Merino sheep.

Effect	GP (days)		BW (kg)		DWT (kg)		AWY (kg)
	N	Mean±SE	N	Mean±SE			
Overall	206	150.59±0.56	302	2.84±0.11	354	37.43±0.41	2.21±0.02
Genetic group of sire		0.056 ^{N}		0.001**			
Crossbred	108	151.08±0.60	135	3.04±0.12			
Kashmir Merino	98	150.10±0.63	167	2.65±0.13			
Sex		0.365 ^{N}		0.03*			
Male	92	150.44±0.59	144	2.92±0.12			
Female	114	150.75±0.58	158	2.77±0.12			
BW (kg)		0.001**					
<3	14	148.75±0.69^{a}					
3-3.99	86	150.02±0.58^{b}					
4-4.99	91	150.99±0.69^{b}					
>4.99	15	152.62±0.90^{c}					
Birth type		0.292		0.000			
Single	198	150.06±0.34	249	3.72±0.06			
Twin	8	151.13±1.01	8	1.96±0.21			
Dam weight		0.873 ^{N}		0.000**			
30-34	43	150.57±0.77	64	2.61±0.14			
35-39	90	150.78±0.56	116	2.77±0.12			
40-45	48	150.43±0.61	78	2.83±0.12			
>45	25	150.59±0.74	44	3.16±0.15			
Parity		0.873^{N}		0.000**		0.000**	0.000**
Primeparous	23	150.64±0.76	34	2.61±0.14	35	35.47±0.77	2.00±0.04
Pluriparous	183	150.54±0.49	268	3.08±0.11	320	39.39±0.29	2.43±0.02

N= Non-significant, *=Significant at $p<0.05$, **=Significant at $p<0.0$.

had slightly higher gestation length than ewes carrying male lambs in the present study. Contradictory to the observation, Mohammad (2006) in Hammdani ewes reported higher gestation length in ewes carrying male lambs.

The least squares mean and test of significance of the factors affecting birth weight obtained in the present study is presented in Table 2. The estimate of LSM for birth weight observed in the present study is more or less similar to the estimates for the trait reported in literature (Khan *et al.,* 2011 a,b) Rather *et al.,* (2020 a,b). The effect of sex, genetic group of sire, birth type, parity of dam and body weight of dam at tupping had significant effect on the trait. Male lambs were significantly heavier than female lambs ($p<0.05$). The higher average birth weight in male lambs may be attributed to the difference in sex chromosomes and endocrinal system. The finding that male lambs were significantly heavier than female lambs at birth was in consonance with (Khan *et al.,* 2011a,b; Lalit *et al.,* 2016; 2017; Rather *et al.,* 2020a,b). Single born lambs and lambs born to Pluriparous dams presented higher birth weight than their twin born lambs and lambs born to primiparous dams. Momoh *et al.,* (2013) also reported significant effect of birth type and parity on the trait. Competition for nutrient and uterine space during prenatal period may be responsible for lower birth weight of twin born lambs. Similarly, higher birth weight of lambs born to primiparous dams in the present study might be attributed to reason that dams in first parity have less body weight and small uterine space than dams in advanced parities. The body weight and uterine space of ewes increase with advancement of parity. The low body weight and small uterine space of dams in the first parity have negative feed-back on prenatal lamb growth (Rather *et al.,* 2020 b). Similar significant effect of parity on birth weight was reported by Khan *et al*. (2011a,b) in Polled Dorset, Ramboillet and Cross bred sheep. Significant effect of dam weight at mating was observed in the present study. The effect of weight of dam at tupping presented in birth weight. Heavier dams produced heavier lambs because heavier dams may be providing better nutrition and more uterine space for developing fetus during prenatal life. Prince *et al.,* (2010) and Lalit *et al.,* (2016) also reported significant effect of dam weight on birth weight. Heavier lambs were born to ewes bred to Australian Merino rams probably due to only heavier dams and pleuriparous dams were assigned them during. Outbreding may also be responsible for higher birth weight in the dams assigned to Australian Merino (Imported during 2019-20).

Conclusion

Significant effect of non-genetic factors on birth weight was observed in the present study. Heavier lambs were born to heavier dams may be used to improve the trait in future by increasing selection pressure at tupping for dam weight. Further, it is doubtful that there would be any economic advantage in reducing gestation length by selection in view of the limited reduction achievable.

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