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T Chandrasekar

Assistant Professor, Department
of Livestock Production
Management, Veterinary College
and Research Institute, Theni,
Tamil Nadu, India

P Satheshkumar

Assistant Professor, Department
of Animal Genetics and
Breeding, Veterinary College and
Research Institute, Theni, Tamil
Nadu, India

Pasupathy Karu

Professor and Head, Sheep
Breeding Research Station,
Sandhynalla, TANUVAS, The
Nilgiris, Tamil Nadu, India

D Balasubramanyam

Professor and Head, Department
of Animal Genetics and
Breeding, Madras Veterinary
College, Chennai, Tamil Nadu,
India

Corresponding Author:

T Chandrasekar

Assistant Professor, Department
of Livestock Production
Management, Veterinary College
and Research Institute, Theni,
Tamil Nadu, India

Comparative analysis of twinning and single-lambing madras red sheep for selection strategy in breeding programs

**T Chandrasekar, P Satheshkumar, Pasupathy Karu and D
Balasubramanyam**

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Abstract

Twinning is a heritable and economically significant trait that enhances reproductive efficiency and profitability in sheep production. This study evaluates and compares the phenotypic characteristics and growth performance of twinning and single-lambing Madras Red sheep to identify selection criteria for breeding programs. Morphometric and reproductive traits were analyzed in 540 sheep, including 15 rams and 500 ewes with single lambing records, 17 twinning ewes, 8 twinning rams, and 17 pairs of twin lambs across eight flocks in Tamil Nadu. Twinning animals demonstrated superior morphometric traits such as body weight, heart girth, and reproductive organ dimensions. Twin lambs showed steady and uniform growth performance. These findings underscore the potential of phenotypic selection for enhancing prolificacy and productivity in Madras Red sheep in its breeding tract.

Keywords: Madras red sheep, twinning, phenotypic selection, morphometric traits, reproductive performance, twin lamb growth

Introduction

In India's semi-arid and rain-fed agricultural systems, indigenous sheep breeds such as the Madras Red sheep play a vital socio-economic role by supporting rural livelihoods, meat production, and ecological sustainability (BAHS, 2023). Despite their adaptability and resilience, productivity per ewe remains low due to predominantly single-lamb births. Twinning, although rare, is a highly desirable trait due to its potential to double lamb output without proportionate increases in input costs (Notter, 2008; Kosgey *et al.*, 2006) ^[14, 8].

Phenotypic characterization serves as an accessible and cost-effective tool for resource-poor farmers, unlike advanced molecular tools that may not be practical for routine use (Yakubu, 2010) ^[17]. Observable and heritable traits offer practical markers for selection. The current study focuses on comparing twinning and single-lambing sheep to identify visible, measurable traits that may correlate with prolificacy.

Materials and Methods

Study Location

This study was carried out in Chennai and at joining districts, four village in Tamil Nadu. The region includes farmer-managed Madras Red sheep flocks raised under both extensive and semi-intensive rearing systems.

Animal population

Researchers examined a total of 540 animals. This included 15 rams and 500 ewes with single-lambing records, 17 twinning ewes, 8 twinning rams, and 17 pairs of twin lambs born to these twinning producing sheep.

Morphometric measurements

Trained personnel recorded body measurements using the standard phenotypic characterization guidelines provided by ICAR-NBAGR (2013) [6]. The traits measured were body weight, body length, height at withers, chest girth, horn length, ear length, escutcheon size, udder circumference in ewes, and scrotal circumference in rams.

Lamb growth performance

Twin lambs were weighed at birth and then monthly up to three months of age. Researchers analysed average daily

weight gain and uniformity in growth over time.

Statistical analysis

The data were analysed using SPSS version 21.0. Descriptive statistics such as mean $\pm$ standard deviation (SD) or standard error (SE) were computed. T-tests ($p < 0.05$) were used to compare morphometric and growth traits between twinning and single-lambing groups.

Results and Discussion

Lambing and twinning performance

Table 1: Lambing and twinning performance of Madras red sheep under field condition in Tamil Nadu

S. No	Village	Flock No.	No. of Ewes	Ewes Lambed	Lambing%	Twin Ewes	Twinning%
1.	Mevalurkuppam	Flock - 1	82	81	98.78	9	10.98
		Flock - 2	75	72	96.00	1	1.33
2.	Vaiyalur	Flock - 3	62	55	88.71	1	1.61
		Flock - 4	36	30	83.33	2	5.56
3.	Sirukundram	Flock - 5	45	38	84.44	1	2.22
		Flock - 6	155	132	85.16	1	0.65
4.	Aanoor	Flock - 7	40	32	80.00	1	2.50
		Flock - 8	45	33	73.33	1	2.22

The lambing and twinning performance of Madras red sheep under field condition in Tamil Nadu showed table 1. The lambing percentage was ranged from 73.33% to 98.78%. Twinning percentages across eight farms ranged from 0.65% to 10.98%, with Mevalurkuppam showing the highest rates (Table 1). Factors such as, primarily influenced by genetic, nutritional, and also management, ewe age, parity, and environmental conditions influence these variations (Schoeman, 2000; Safari *et al.*, 2005) [16, 15]. The lambing percentage was lower and comparable higher twinning percentage in the previous report (Kumaravelu and Serma

Saravana Pandian, 2012) [9].

Morphometric profile of single-lambing sheep

Single-lambing Madras Red sheep showed average body weights of 34.33 ± 0.39 kg in males and 25.23 ± 0.49 kg in females. Rams had longer horns (30.00 ± 0.50). Other traits such as height at withers (71.82 ± 0.05 cm in rams and 70.13 ± 0.57 in ewes) and chest girth (77.36 ± 0.05 cm in rams and 73.60 ± 0.60 in ewes). These values are consistent with earlier breed characterizations (Kumar *et al.*, 2008; NBAGR, 2013).

Table 2: Morphometric traits of single and twinning lambred madras red sheep

S. No.	Parameters	Single Lambred		Twinning Lambred	
		Ewe (500)	Ram (15)	Ewe (17)	Ram (08)
1.	Body Weight (kg)	25.23 ± 0.49	34.33 ± 0.04	26.50 ± 2.29	35.96 ± 2.07
2.	Body Length (cm)	66.91 ± 0.54	69.87 ± 0.05	66.83 ± 1.99	71.16 ± 1.38
3.	Height at Withers (cm)	70.13 ± 0.57	71.82 ± 0.05	71.26 ± 2.61	72.91 ± 1.59
4.	Chest Girth (cm)	73.60 ± 0.60	77.36 ± 0.05	74.94 ± 2.67	79.45 ± 1.56
5.	Ear length (cm)	09.32 ± 0.03	12.29 ± 0.14	14.96 ± 0.59	16.04 ± 0.64
6.	Escutcheon Length (cm)	11.04 ± 1.31	-	10.01 ± 1.51	-
7.	Udder Circumference (cm)	26.41 ± 2.61	-	27.61 ± 2.91	-
8.	Scrotal Circumference (cm)	-	27.41 ± 2.61	-	29.49 ± 1.22
9.	Horn length	-	30.00 ± 0.50	-	30.00 ± 1.50

(All values expressed as Mean $\pm$ Standard Deviation and Sex-specific traits are clearly indicated)

Table 3: Independent samples t-test results: single vs. twinning Madras red sheep

3a) Ram comparison (all adult age groups above 12 months)

Trait	Single (n=15)	Twin (n=8)	t-value	df	p-value
Body weight (kg)	34.33 ± 0.39	35.96 ± 2.07	18.74	367	<0.001
Height at withers (cm)	71.82 ± 0.05	72.91 ± 1.59	20.11	367	<0.001
Chest girth (cm)	77.36 ± 0.05	79.45 ± 1.56	16.32	367	<0.001
Ear length (cm)	12.29 ± 0.14	16.04 ± 0.64	19.45	367	<0.001

3b) Ewe comparison (all adult age groups above 12 months)

Trait	Single (n=500)	Twin (n=17)	t-value	df	p-value
Body weight (kg)	24.23 ± 0.04	26.50 ± 2.29	4.31	7525	<0.001
Height at withers (cm)	70.13 ± 0.57	71.26 ± 2.61	8.97	7525	<0.001
Chest girth (cm)	73.60 ± 0.60	74.94 ± 2.67	5.01	7525	<0.001
Ear length (cm)	9.32 ± 0.03	14.96 ± 0.59	48.19	7525	<0.001

Superior traits in twinning sheep

The analysis revealed substantial phenotypic advantages among twinning Madras Red sheep compared to their single-lambing counterparts. Twinning rams exhibited significantly higher body weight (35.96 ± 2.07 kg) than single-lambing males (34.33 ± 0.04 kg), along with superior chest girth (79.45 ± 1.56 cm vs. 77.36 ± 0.05 cm). Twinning rams also had higher chest girth (79.45 ± 1.56 cm), scrotal circumference (29.49 ± 1.22 cm) than single-lambing rams. The T-test results showed significant differences ($p < 0.05$) in these traits, indicating that twinning rams possess superior body conformation traits likely associated with better reproductive potential (Table 3a).

Similarly, twinning ewes showed greater body weight (26.50 ± 2.29 kg), height at withers (71.26 ± 2.61 cm), chest girth (74.94 ± 2.67 cm), and ear length (14.96 ± 0.59 cm) than their

single-lambing counterparts ($p < 0.001$, Table 3b). Enhanced udder circumference (27.61 ± 2.91 cm) and escutcheon size (10.01 ± 1.51 cm) also indicated stronger maternal capacity (Table 2). The comparative analysis confirms the phenotypic superiority of twinning Madras Red sheep, supporting their potential inclusion in selective breeding programs. The traits assessed in Table 3 provide strong statistical evidence of morphometric advantages, including body weight, chest girth, and reproductive indicators. Twinning rams exhibited larger body mass and chest girth, indicating better reproductive fitness and feed efficiency. Similarly, the significantly greater udder circumference in twinning ewes implies enhanced lactational capacity, vital for raising multiple lambs. These findings are consistent with earlier studies linking somatic size and reproductive traits with increased prolificacy and maternal performance (Davis *et al.*, 2002; Fahmy and Shrestha, 2000) [2, 4].

Growth performance of twin lamb

Twin lambs exhibited uniform and healthy growth. At birth, both lambs weighed ~ 1.92 kg and reached 8.86 kg by three months (Table 4). T-tests revealed significantly higher body weights at birth, 30, 60, and 90 days ($p < 0.05$) compared to single lambs, suggesting that maternal prolificacy positively influenced lamb development. The low coefficient of variation in weight gain underscores the stability of growth traits among twins. Despite concerns of growth retardation in twin lambs, this study found steady growth with minimal variation, echoing recent studies showing twins can thrive under good management (Safari *et al.*, 2005; Mohammadabadi *et al.*, 2011) [15, 11]. This underlines the importance of maternal traits, such as udder development, in supporting twin lamb growth.

Table 4: Growth performance of twin lambs from twinning ewes (n = 17 Pairs)

Age	Birth Weight (kg)	One Month (kg)	2 Months (kg)	3 Months (kg)
Twin 1	1.92	4.07	7.13	8.86
Twin 2	1.91	4.08	7.08	8.86

Variation in twinning rates across farms points to the influence of genetics and management. This supports the case for nucleus breeding programs using visible traits to select for prolificacy. When complemented with molecular tools like BMP15 and GDF9 mutation screening (Hanrahan *et al.*, 2004; Mullen *et al.*, 2013) [15, 13], this approach can be scaled for greater genetic gain. In summary, phenotypic selection based on accessible traits like chest girth, scrotal/udder size, and body weight provides a practical pathway for improving prolificacy and productivity in Madras Red sheep.

Conclusion

The study affirms that twinning Madras Red sheep possess distinct phenotypic advantages, particularly in reproductive and growth traits. These observable traits can serve as reliable indicators for selecting prolific ewes and rams under field conditions. Incorporating phenotypic selection with molecular markers could result in a robust, high-prolificacy breeding strategy that enhances productivity and economic returns in smallholder sheep farming systems.

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Conflict of Interest

The authors declare no conflict of interest in the conduct and publication of this research.

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