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Assessment of Milk Replacer Supplementation on Growth Performance and Mortality in Pre-weaned Lambs under Field Conditions in Guntur District of Andhra Pradesh

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ABSTRACT

Lamb mortality and poor growth rates are the major constraint in sheep farming of Andhra Pradesh where Nellore and Macharla lambs often fail to reach their genetic growth potential due to inadequate maternal milk and limited feed resources. To address this, nutritional interventions such as milk replacer feeding have emerged as practical strategies to supplement maternal milk, improve survivability, and enhance growth in lambs. With this perspective, Krishi Vigyan Kendra, Guntur, under the Indian Council of Agricultural Research – Agricultural Technology Application Research Institute (ICAR–ATARI), Zone X sponsored Impactful Interventions programme, conducted a field study to evaluate the effect of milk replacer supplementation on pre-weaning lamb performance. A total of 84 lambs aged 2-3 weeks from 12 flocks with an initial body weight of 4 ± 0.5 kg divided into two groups: Control group (CON) without supplementation and milk replacer (MR) group supplemented with formulated milk replacer procured from the ICAR–National Institute of Animal Nutrition and Physiology (ICAR–NIANP). The MR group lambs were fed with 50-70 grams per day per lamb from 2-14 weeks of age along with maternal milk and ad libitum green fodder. The trail conducted for 14 weeks with regular recording of body weights and mortality. Results revealed that MR lambs attained average body weight of 18.2 kg compared to 13.8 kg in CON group by the end of 16 weeks of age. The MR group recorded significantly (P=0.028) higher average daily gain (141 g/day) compared to CON group (93 g/day), while the mortality was markedly reduced to 7.14% versus 21.4% in non-supplemented lambs. The economic analysis revealed 33 % higher net return and cost benefit ratio of 1.39 in MR group. These findings demonstrate that milk replacer supplementation during the pre-weaning period is a farmer-friendly, cost-effective strategy to enhance lamb survival, growth, and overall productivity in smallholder sheep farming systems.

KEYWORDS: Growth performance, Milk replacer, Mortality, Pre-weaning lambs, Sheep farming

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INTRODUCTION

Andhra Pradesh ranks first in India with a sheep population of 25.6 million, playing a vital role in meat production, food security, and rural livelihoods. Sheep farming is one of the most important livelihood options for resource-poor farmers in the state. However, lamb mortality and poor growth performance remain a major constraint to productivity and profitability. Earlier studies indicate that approximately 10–35% of lambs die by six months of age under different agro-climatic conditions (Yapi et al., 1990; Green and Morgan, 1993), with neonatal lambs being most vulnerable (Gama et al., 1991). In India, Mandal et al. (2007) reported an overall lamb mortality rate of 12.6% from birth to one year of age, with pre- and post-weaning mortality rates averaging 6.6% and 6.0%, respectively.

Major cause of lamb mortality includes pneumonia, digestive disorders, starvation, and parasitism, while perinatal deaths often occur due to dystocia, cold stress, and mismothering (Green and

Morgan, 1993). Additionally, mortality rates are influenced by environmental conditions (Wilson and Murayi, 1988), flock management practices, and even sire progeny groups (Dalton et al., 1980).

From an economic perspective, lamb mortality significantly reduces flock replacement rates and meat production potential, thereby directly lowering farm profitability (Huffman et al., 1985). Fast growing breeds such as Nellore and Macharla with genetic growth potential and feed efficiency pre-weaning survival is critical under limited feed resource situations. Beyond mortality, compromised growth performance poses another major challenge. Many lambs fail to achieve their genetic growth potential due to inadequate maternal milk, limited grazing resources and rising feed cost. Together these factors restrict the nutrient availability during the critical preweaning period, consequently leading to poor growth trajectories reducing flock productivity and profitability.

Globally milk replacers are primarily intended to serve as an alternative nutritional strategy for orphaned or early weaned calves, kids/lambs, widely adopted by western countries. However, several studies have reported that even under such controlled and intensive management systems, complete replacement of dam`s milk with artificial milk replacer adversely affected lamb performance (Grosskopf et al. 2017; Menghwar et al., 2018). These findings indicate that while milk replacers can be a valuable managemental tool, their exclusive use as substitute for dam`s milk may not support optimum growth and health. Under Indian conditions where flocks are largely maintained in extensive and semi-intensive systems such complete replacement could further aggravate nutritional and economic constraints.

Therefore, Nutritional interventions during the pre-weaning stage through partial supplementation may offer practical balance between growth performance and economic returns. Milk replacer supplementation has the potential to support optimum nutrition, reduce dependence on maternal milk, and improve overall survivability. With this perspective, under the ICAR-ATARI, Zone X sponsored Impactful Interventions programme, Krishi Vigyan Kendra, Guntur conducted field trials to assess the effect of milk replacer supplementation on lamb performance under farmer-managed conditions.

MATERIALS AND METHODS

Location of study

This present field study was carried out in Guntur district of Andhra Pradesh under the impactful interventions (Veterinary) of ICAR-ATARI Zone-X, Hyderabad and executed by Krishi Vigyan Kendra (KVK), Sri Venkateswara Veterinary University, Lam, Guntur. The study was conducted in three adopted villages of KVK – Venigandla (Pedakakani Mandal), Jonnalagadda (Tadikonda Mandal) and Kantepudi (Sattenapalli Mandal) during the period July 2024 to October 2024. The region is characterised by semi-arid tropical climate characterised by hot summer and mild winter and moderate humidity with average rain fall of 800-900 mm with predominance of extensive grazing and well-established sheep rearing.

Beneficiary selection and enrolment of lambs

For this study, Shephards having more than 50 breeding sheep and the flock with minimum eight lambs of 2-3 weeks age (Nellore brown/Macharla) were identified through local animal husbandry assistants and survey analysis of KVK, Guntur. Based on these criteria a total of eighty-four lambs from 12 beneficiaries with an average body weight of 4 ± 0.5 kg were enrolled for undertaking the trial. Each beneficiary was considered as one experimental block to minimise the managemental bias arising due to individual variations in grazing practice, feed source and housing management. With in the flock the enrolled lambs were randomly divided into two experimental groups: Control (CON) with no supplementation raising solely on dam`s milk and natural grazing (n=42), Milk replacer (MR) group, (n=42) where lambs were allowed to suckle the dam and additionally bottle/pail fed with diluted milk replacer (1 in 3 parts) ratio using lukewarm water along with access to natural grazing. All the lams were reared under extensive field conditions with little or no shelter provision. The flocks including the dam and enrolled lambs were allowed 8-12 hrs of daily grazing with little or no concentrate supplementation.

Procurement and milk replacer feeding

A total of 200 kg milk replacer, designed for pre-weaned lambs by ICAR- National Institute of Animal Nutrition and Physiology (ICAR–NIANP), Bengaluru, was procured in 2 kg packs through KVK, Guntur. The milk replacer composition was in accordance with the formulation described by

Bhatt et al., 2009 with Crude protein 22-24%, Crude Fat 8-10% and Crude fiber 2-3%. Milk replacer was provided to 44 lambs aged two weeks with initial body weight of 4±0.5 kg was allotted to MR group and were fed with following daily feeding regimen: 2-4 weeks- 50 g (150 ml), 4-6 weeks- 70 g (200 ml), 6-10 weeks - 50 g (150 ml) and 10-14 weeks- 30 g (100 ml). The lambs were weaned at 14 weeks of age and body weights were recorded till 16 weeks of age. A total of 2 packs (4 kg) were distributed per lambs as per the feeding schedule given by Kumar et al. (2021) with minor modifications to suit to local conditions. The milk replacer was reconstituted with warm water and shepherds were instructed to feed the lambs twice daily from 2-6 weeks and then once afterward.

Health management

At the time of enrolment, the lambs were examined for the health status and were dewormed with piperazine adipate @50 mg/kg body weight. The shepherds were instructed to report the deviations in feeding or health status of lambs so as to provide veterinary aid. Mortality of enrolled lambs was recorded and possible causes were assessed based on housing, feeding weather and other managemental details collected from the shepherds.

Data collection and cost economics

The trial was conducted for a period of 14 weeks. Body weight changes of individual lambs were recorded at fortnight intervals using platform electronic weighing balance with 0.2 kg sensitivity. Mortality data were tracked and documented throughout the study period. The cost economics of supplementary strategy with milk replacer was calculated by considering the cost of milk replacer Rs (290/- per kg), mortality rate, body weight gain and kg live weight cost of lambs (Rs.420/) as per the prevailing market price.

Statistical analysis

As the study was conducted under practical shepherd manged flocks maintained in extensive field conditions, inherent variations in lamb age, dam parity, grazing intensity and managemental variations were unavoidable. These variations were minimised by distributing the enrolled lambs uniformly into treatment groups for performance comparison. The collected data was consolidated to represent the field level performance trends rather than rigorous statistical analysis. Mean body weights, average daily gains were subjected to *t*-test, while mortality % was compiled and presented to assess the efficacy of milk replacer feeding on performance and profitability. Statistical significance of collected data was evaluated at 95% level of confidence ($P \leq 0.05$).

RESULTS AND DISCUSSION

The growth performance of lambs fed with and without milk replacer are presented in Table 1. The initial body weights of lambs did not differ significantly between the two groups indicating the uniformity in enrolment of experimental lambs at the start of trial. By the end of 16 weeks, lambs in MR group attained significantly (P=0.021) higher body weight of 18.2 kg over 13.7 kg in control. The MR lambs gained 50% extra body weight over CON group (9.14 kg vs 13.8 kg) during the 14 weeks period (Fig.1). Similarly, the ADG were also found significantly (P= 0.028) higher in MR group (141 vs 93 g/day). These results indicate a positive growth response to milk replacer supplementation during pre-weaning and early post weaning period of lambs.

These observations can be better understood in the context of early life nutrition, which is critical factor for lamb growth survival (Danso et al., 2014). Dam`s milk is the

Table 1. Growth performance and mortality of lambs fed with and without milk replacer

Parameter	Control	Treatment	SEM	P Value
Initial Bwt (kg)	4.56	4.43	0.321	0.914
Final Bwt (kg)	13.7	18.2	0.842	0.021
Body weight gain (kg)	9.14	13.8	0.94	0.009
ADG (g/day)	93	141	32.7	0.028
Mortality (No.s)	8 (42)	3 (42)	-	-
Mortality %	21.4	7.14	-	-

primary source of nutrient for growth, but supplementary feeding along with suckling provides the additional nutrients essential for rapid weight gain, particularly in lambs nursed by ewes with limited feed resources. In the current study all the dams of enrolled lambs were maintained under extensive grazing and could not meet the DM requirements (4% of BW) of lactating ewe with 30-35 kg, as recommended by ICAR, 2012. This nutritional limitation likely contributed to lower weight gains in control lambs, despite their genetic growth potential. Supplementary feeding with milk replacer in MR group in addition to natural suckling helped lambs to express their growth potential, as reflected in higher body weight gains. Similar improvement in weight gains was reported earlier (Lakshmi and Murthy, 2017) in Mandya lambs fed with cow milk as a supplementary feeding source in addition to dam`s milk. Danso et al. (2014) also observed higher growth rates and accelerated rumen and organ development in early weaned Suffolk ram lambs fed with milk replacer and pellets. Further supplementation of milk replacer has also been reported to advance sexual maturity and semen quality in Malpura ram lambs (Kumar et al., 2021).

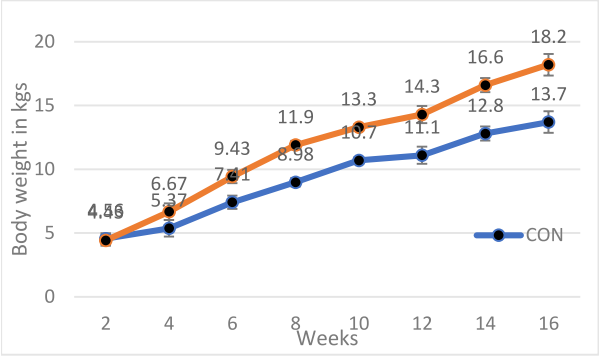

Fig 1: Fortnightly body weights of lambs fed with and without milk replacer

The improved growth in MR lambs was accompanied by reduced mortality rates - only 7.14% (3 out of 42) compared to 21.4% (8 out of 42) in control group - indicating the role of nutritional interventions in improving lamb survival. Similar findings were reported by McManus et al. (2014), where inclusion of bovine milk and multi mixture in suckling lamb diets significantly decreased lamb mortality. The lamb mortality of current study coincides with continuous rainfall during August 2024, primarily attributed to higher humidity, poor housing facilities and diarrhoea incidence.

Alongside the growth performance the economic viability of the intervention was also evaluated (Table 2.) Although the MR group incurred additional cost of Rs. 45,240/- towards milk replacer supplementation (4 kg per lamb at Rs.290/- per kg), the overall income from sale of MR lambs (Rs. 2, 98,116/-) was substantially higher than that of control group (Rs.1, 89,882) resulting in 33% net return. The additional benefit obtained through milk replacer supplantation was Rs. 1,615/- per lamb, with a benefit cost ratio of 1.39. Menghwar et al. (2018) reported a much lower net return when lambs maintained solely on milk replace due to poor growth rate and increased diarrhoea incidence. In contrast, the higher economic returns in present study can be attributed to supplementary rather than complete replacement feeding. Consistent with these findings, Bhatt et al. (2022) reported 20% higher net returns in Malpura lambs raised on milk replacer as compared to control lambs.

Table 2. Cost economics of milk replacer feeding in lambs

	CON	MR
		Rs. 45.240/-
Cost towards milk replacer	Nil	4 kg per lamb @290 per kg
Mortality	9	3
lambs survived	33	39
Avg wt of lamb at 16 wk (Kgs)	13.7	18.2
Income from sale of lambs @420/- per kg live weight	Rs. 1,89,882/-	Rs. 2,98,116/-
		Rs. 2,52,876/-
Net return from enrolled lambs	Rs. 1,89,882/-	
Net return per lamb	Rs. 5,754/-	Rs. 6,484/-
Economic benefit of MR feeding		
MR group (39 lambs)		Rs. 62,994/-
MR group (per lamb)		Rs. 1,615/-
Benefit cost ratio (BCR)		62,994/45,240 = 1.39

While these findings strongly suggest the advantages of milk replacer feeding supplementation, the level of supplementation also plays a crucial role in long term outcomes. Although higher level milk replacer (4% of BW) enhances short term weight gains, Huang et al. (2023) observed reduced starter intake a key factor stimulating the rumen development and microbial colonisation leading to adverse long-term effect on lamb performance. Therefore, moderate supplementation is desirable in balance growth and rumen development. In this study MR lambs were fed with 50-70 g/day of milk replacer along with natural suckling resulting in optimum performance suggesting this as suitable supplementary dose.

Supplementary feeding with milk replacer as demonstrated here, represents more practical and sustainable approach resulting in higher weight gains, improved survival rates and enhanced flock profitability. Collectively, these findings suggest that milk replacer supplementation during the pre-weaning and early post weaning stages is an effective and economically viable intervention to reduce lamb mortality and promote sustainable productivity in small holder and semi-intensive small ruminant production systems.

CONCLUSION

Milk replacer supplementation in young lambs significantly improved the performance in terms of average daily gain and reduced the mortality under real farming conditions. This study conducted by Krishi Vigyan Kendra, SVVU, Guntur under impactful interventions, successfully introduced cost effective strategy for improving the survivability and growth potential in resource limited sheep farming systems of Andhra Pradesh.

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