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Managmental Studies of Different Liquid Feeding Regimes for Nili-Ravi Buffalo Calves

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ABSTRACT

A liquid feeding trial was carried out at the Dairy Animals Training and Research Centre, UVAS Ravi Campus, Pattoki, to explore effective methods for rearing Nili-Ravi buffalo calves using alternative feeding sources. Twenty-four (n=24) buffalo calves were divided into three groups, with eight calves in each group, and fed for 90 days. The feeding regimes included Whole Milk (WM), Milk Replacer-Vegetable Protein (MR-VP), and Milk Replacer-Milk Protein (MR-MP), following a Completely Randomized Design. Data on daily dry matter intake, weekly weight gain, feed efficiency, fecal score and linear body measurements were collected and analyzed. Mean daily dry matter intake (DMI) was significantly ($p < 0.001$) higher (991.89 ± 331.41gm) in calves fed WM and lowest in calves fed MR-VP (833.07 ± 297.64 gm). Mean daily weight gain for WM, MR-VP and MR-MP groups was 227.18 ± 88.04, 135.34 ± 47.17, 189.72 ± 86.99gm, respectively. Feed efficiency was highest (0.23 ± 0.08) in calves fed MR-VP, compared to calves raised on WM and MR-MP. Daily fecal score were 1.75 ± 0.10, 1.70 ± 0.16 and 1.58 ±0.16 for MR-VP, MR-MP, and WM groups, respectively, showing no significant difference among treatments ($p > 0.05$). Body measurement (height at withers, body length and heart girth) differed significantly among treatments ($p < 0.05$). The findings suggest the potential of milk replacer–vegetable protein source as a cost effective alternate for whole milk in resource limited systems.

Keywords

Dry matter intake, linear body measurements, milk replacer, Nili-Ravi buffalo calves, weight gain, whole milk

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Abbreviations

CP: Crude Protein
WM: whole milk
MR-VP: Milk replacer with vegetable protein
MR-MP: Milk replacer with milk protein
DM: Dry Matter
DMI: Dry Matter Intake

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The livestock sub-sector is a crucial component of Pakistan's economy, providing essential animal-based products such as milk, meat, and eggs. Among livestock species, the buffalo, often referred to as the "Black Gold of Pakistan," plays a critical role in milk and meat production. In 2023–2024, Pakistan's buffalo population was estimated at 46.3 million, producing approximately 41.9 million tons of milk annually, of which only 5% is used for nourishing calves [1]. Modern dairy farming employs a variety of feeding and management practices, including milk replacers, calf starters, and concentrate mixtures, to optimize general productivity [2,3].

Buffaloes are renowned for their naturally high milk fat content (6-8.5%), and nearly 99% of the global buffalo population (205 million) resides in Asia [4]. Buffalo milk due to its higher quality, is preferred over cow milk in South Asia and commands a higher price in the market [5,6].

Economic challenges often prevent the provision of sufficient whole milk to newborn calves. In many cases, calves are slaughtered at an early age to reserve milk for human consumption [7], resulting in high early mortality and poor growth in calves [8]. Given the increasing rising cost and demand for milk, exclusive whole milk feeding is economically impractical. Therefore, employing alternative feeding regimes can enhance both beef production and general development of replacement female calves, addressing these challenges viably [9].

Milk replacer is preferred and desirable when the price of whole milk is high, as it formulated to mimic the nutrient composition and digestibility of natural milk. They are free from pathogens such as salmonella, and can be medicated to enhance calf health. Additionally, they reduce the rate of scour incidence in calves and enhances their nutritional intake by supplementing essential vitamins such as A, D, E, and B complex. Whole milk and milk replacer (20-22% CP and 15-20% fat) are early feeding regimens for dairy calves. Calves raised with a diet containing 20% crude protein (CP) have shown superior weight gain and improved feed efficiency [10].

During the early stages of life, calves depend entirely on milk or similar liquid feeds, gradually transitioning to solid feed. Since newborn calves cannot digest hard solid feeds efficiently, making liquid feeds, such as whole milk or milk replacers, are essential for their early growth, development and nutrition [11].

To address challenges such as slow growth and high early mortality rates in calves, techniques like substituting whole milk with milk replacers and early weaning need to be explored more. These approaches have been broadly implemented in modern dairy systems for breeds such as Holstein Friesian and Jersey cattle [8]. However, similar data or studies focusing on buffalo calves are limited, highlighting the need for further research in this area.

Considering the significance of alternative feeding programs for cost-effective raising of calves, a study was conducted to evaluate the impact of different feeding regimes, including whole milk and milk replacer, on the growth performance of Nili-Ravi buffalo calves. The study focused on key parameters such as weight gain, dry matter intake, body measurements, and fecal scores to evaluate the effectiveness of these feeding strategies in enhancing growth rate and feed efficiency.

The study was conducted at the Dairy Animals Training and Research Centre, UVAS Ravi Campus, Pattoki, to evaluate alternative feeding regimes for Nili-Ravi buffalo calves. Twenty-four (n=24) calves, aged 3-4 days, were randomly assigned to three dietary treatments (n = 8 per group). The groups were raised on either whole milk (WM), milk replacer with vegetable protein (MR-VP), or milk replacer with milk protein (MR-MP), for over a 90-day period. Liquid diets were administered at 10% of each calf's body weight, and calves had free-choice access to calf starter. Data were collected on parameters such as daily dry matter intake, weekly weight gain, feed efficiency, linear body measurements, and fecal scores, with feed intake measured on a dry matter basis.

The average initial body weight of each calf was noted at the start of the experiment. Thereafter, the weight of each calf was weighed at weekly intervals to monitor growth throughout the study period. Feed efficiency was calculated using the weekly feed consumption and weekly weight gain of calves by dividing weight gain (kg) from feed intake (DM basis). Fecal score of each calf was noted on daily basis. Fecal scoring, which shows the digestive health of calves, was evaluated on a scale from 1 to 5. Feces that retained their shape upon falling to the ground were scored as 1, while semi-formed, pasty feces were given a score of 2, loose feces that remained on top of the bedding were scored as 3, watery feces that seeped through the bedding were relegated a score of 4, and watery feces containing blood received a score of 5. Additionally, the body length (cm) of each calf was measured from the pin bone to the point of the shoulder. Heart girth (cm) was measured as the chest circumference behind forelegs. Body length (cm) was taken as length from the withers to the platform surface. Data were analyzed under a Completely Randomized Design (CRD) using Analysis of Variance (ANOVA), and means were compared via the Least Significant Difference (LSD) Test [12].

Mean daily dry matter intake was significantly among treatments ($p < 0.001$). Calves fed WM con-

sumed the most (991.89 ± 331.41gm), while those fed milk replacer containing vegetable protein recorded the lowest intake (833.07 ± 297.64gm) (Table 1). The findings of the present study indicated higher DMI on milk replacer-milk protein source than milk replacer-vegetable source. Conversely, some studies reported no significant difference in DMI in Holstein Friesian calves fed on different sources of milk replacers during pre-weaning period [13,14]. Moallem et al. [15] reported higher DMI in Israeli Holstein heifer calves reared on milk replacer as compared to the whole milk during pre-weaning period, which this finding is in contrast with the results of the present study.

Mean daily weight gain varied significantly among groups ($p < 0.05$). Calves fed WM gained 227.18 ± 88.04 g/day, compared to 135.34 ± 47.17 g/day for MR-VP and 189.72 ± 86.99 g/day for MR-MP (Table 1). Least Significant Difference (LSD) analysis revealed a significant difference between the calves fed WM and MR-VP ($p < 0.05$), but it was non-significant between MR-MP and MR-VP ($p > 0.05$). Some studies also reporting higher weight gain in Sahiwal and Holstein calves fed whole milk compare to calves fed milk replacer [8,16-18].

Feed efficiency for each calf was recorded on weekly basis allocated to different treatments. Feed efficiency was numerically highest (0.23 ± 0.08) in WM (control) followed by MR-MP and MR-VP, but the difference were Statistically non-significant ($p > 0.05$). Donovan et al. [13] reported similar finding and recorded a non-significant difference for feed efficiency in calves raised under different feeding regimes ($p > 0.05$). The findings of Bhatti et al. [8] also consistent with the present study, who reported better feed efficiency in calves raised on whole milk compared to calves raised on milk replacer.

The daily fecal score were 1.58 ± 0.16 in WM, 1.75 ± 0.10 in MR-VP and 1.70 ± 0.16 in MR-MP. Statistically fecal score data indicated a significant difference between the calves on WM and MR diets ($P<0.05$). Hill et al. [19] and Donovan et al. [13] reported no differences in fecal scores of calves on WM and milk replacer diets, which is not in line with the result of the present study.

Calves fed WM had the highest mean height at wither (0.13 ± 0.03 cm), followed by calves fed MR-MP (0.12 ± 0.03 cm) and calves fed MR-VP (0.08 ± 0.03 cm) (Table 2). The BL and heart girth in calves fed on WM, MR-VP and MR-MP were 0.13 ± 0.03, 0.07 ± 0.02 and 0.12±0.03 cm, 0.22 ± 0.06, 0.13 ± 0.06 and 0.20 ± 0.06 cm, respectively. Body measurements regarding height at withers, body length and heart girth indicated a significant difference between WM and MR-VP diets ($p < 0.05$). Similarly, significantly ($p < 0.05$) higher wither height, body length and heart girth were also reported in calves raised on WM compared to calves raised on milk replacer [17,20].

The feeding trial assessed the impact of Whole Milk, Milk Replacer-Vegetable Protein, and Milk Replacer-Milk Protein on the growth performance of Nili-Ravi buffalo calves over a 90-day period. Results showed higher dry matter intake and weight gain in WM-fed calves, while MR-VP demonstrated superior feed efficiency. The study showed promising results, and suggests milk replacers as cost-effective alternatives whole milk in resource limited systems.

Table 1.
Mean (±SD) daily dry matter intake (DMI) weight gain, feed efficiency and fecal score in Nili-Ravi buffalo calves fed on different liquid feeding regimes

Treatments	DMI (gms)	Weight Gain (gms)	Feed Efficiency	Fecal Score
Whole Milk (WM)	991.89 ± 331.41^{a}	227.18 ± 88.04^{a}	0.23 ± 0.08^{a}	1.58 ± 0.16^{b}
Milk Replacer (MR-VP)	833.07 ± 297.64^{c}	135.34 ± 47.17^{b}	0.16 ± 0.05^{a}	1.75 ± 0.10^{a}
Milk Replacer (MR-MP)	884.35 ± 505.45^{b}	189.72 ± 86.99^{ab}	0.21 ± 0.08^{a}	1.70 ± 0.16^{ab}

a,b,c Means with different superscripts within same column are significantly different ($p < 0.05$)

Table 2.
Means (±SD) of height at wither (HAW), body length (BL) and heart girth (HG) in Nili-Ravi buffalo calves on weekly basis fed on different liquid feeding regimes

Treatments	HAW (cm)	BL (cm)	HG (cm)
Whole Milk (WM)	0.13 ± 0.03^{a}	0.13 ± 0.03^{a}	0.22 ± 0.06^{a}
Milk Replacer (MR-VP)	0.08 ± 0.03^{b}	0.07 ± 0.02^{b}	0.13 ± 0.06^{b}
Milk Replacer (MR-MP)	0.12 ± 0.03^{a}	0.12 ± 0.03^{a}	0.20 ± 0.06^{a}

a,b Means with different superscripts within same column are significant($p < 0.05$).

Ethical Statement

The required ethics committee report for the

study was obtained from Dairy Animals Training and Research Centre, UVAS Ravi Campus, Pattoki.

Availability of Data and Materials

The data presented in this study are available on request from the corresponding author Ray Adil Quddus.

Authors' Contributions

RAQ conceived and planned the experiments. RAQ also contributed to conceptualization, methodology and writing-original draft preparation. AYK contributed to validation, writing-review and data curation. MM helped in validation, formating and editing.

Competing Interests

The authors declare that there are no competing interests associated with the manuscript..

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