Research Article

Field Survey of Calf Population, Management Practices, and Parasitic Infections in Shaheed Benazirabad, Sindh, Pakistan

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Abstract | This study surveyed the population and health status of calves under 12 months of age across selected Union Councils (UCs) of Shaheed Benzairabad (SBA), an area supported by FAO health facilities for flood-affected communities. Most calves were primarily grazing-fed and experienced early weaning or received milk below their nutritional requirement. Many had a history of intermittent diarrhoea, weight loss, and were naturally infected with gastrointestinal parasites. Data was collected from April to May 2025 through structured questionnaires and clinical examinations, which revealed majority of calves suffering from early weaning in the SBA region or receiving inadequate milk experience significant growth suppression, primarily due to insufficient nutrition, parasitic burden, and poor management conditions. Based on intermittent diarrhoea history, clinical signs, and results from the FAMACHA anaemia guide test, faecal samples were collected for parasitic infection analysis. A total of 12,007 calves were registered. Among these, 64.68% were buffalo (*Bubalus bubalis*) calves, and 35.31% were cattle (*Bos taurus* and *Bos indicus*) calves. In terms of gender, there were 50.55% female calves and 49.44% male calves. Moreover, regarding age, 52.13% of calves were <6 months old, while 47.86% were >6 months. The survey assessing calf health reveals that a significant number are classified as underweight. Out of 12007 calves, 9030 falls within the 20-50kg body weight, which is below the standard weight for their age. Fecal samples revealed that 46.64% of calves were infected with gastrointestinal parasites. Among calves under 6 months of age, infection rates were 36.86% in buffalo and 50.2% in cattle. In contrast, for calves over 6 months, the infection rates rose to 55.88% in buffalo and 45.30% in cattle, with the primary parasites identified as *coccidia, Strongyles*, and *Trichostrongylus*. The study indicates that the compromised health of calves supports these parasites to succeed. The present study concludes that farmers are neglecting their calves and highlights the need for awareness sessions about calf health to improve future milk production.

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Introduction

Livestock is crucial to Pakistan's agriculture and economy, providing dairy products, meat, and wool. The livestock sector has taken the lead as the most substantial contributor to agriculture, representing about 62.7% of the agriculture value added and contributing 14.4% to the national GDP during the 2022-23 fiscal year reported by the Ministry of National Food Security and Research's economic survey (MNFSR, 2023; Rehman *et al*., 2017). Pakistan has a vast population of domestic animals, including buffaloes, cattle, goats, and sheep (Robinson *et al*., 2014). The growth of the domestic animal population in Pakistan has been a subject of interest for researchers and policymakers (Khan *et al*., 2022; Rehman *et al*., 2017). Furthermore, calf rearing is one of the most important foundations of livestock production in Pakistan. The future milk production, growth ability and overall performance of buffaloes and cattle depend heavily on how well they are raised during the early months of life. Consequently, the calf is born agammaglobulinemic and entirely dependent on the absorption of maternal Ig from colostrum after birth. Achieving early and adequate intake of high-quality colostrum is widely recognized as the single most important management factor in determining the health and survival of neonatal calves (Urie *et al*., 2018). In many rural areas, especially in Sindh, the management of newborn calves remains weak because of limited knowledge, economic pressure and traditional practices. As a result, calves often grow slowly, remain underweight and become more vulnerable to diseases. This pattern has been widely reported in many studies conducted across Pakistan and other developing countries (Soomro *et al*., 2021). This poor growth is closely linked with early-life feeding practices. Research clearly shows that calves fed enough colostrum within the first few hours of birth grow faster and remain healthier because of stronger immunity (Khan *et al*., 2020). When calves receive poor-quality or insufficient colostrum, they experience weak resistance to infection and lower overall weight gain during the first months of life (Ahmed *et al*., 2018). Furthermore, milk feeding is another critical factor. Studies from Pakistan, India and other Asian countries consistently show that calves fed at least 8-10% of their body weight in milk per day gain significantly more weight than calves raised under restricted milk feeding (Levy *et al*., 2015; Rosenberger *et al*., 2017). Restricted milk feeding is very common in rural Sindh because families depend on milk sales or household consumption, which leaves only a small amount for the calf. This pattern leads to slow growth, weak bones and poor body condition (Rashid *et al*., 2019).

Weaning for the offspring involves a complete transition from nutritional and social dependence on the mother to complete independence (Lynch *et al*., 2019). Weaning is considered the most critical phase in early life due to the significant dietary changes, which can lead to stress and ultimately disease susceptibility and attenuation of the immune system and growth (Hickey et al., 2003). Furthermore, pre-weaning diet and feeding have shown pronounced and long-lasting impacts on rumen microbial composition due to host-specificity of the rumen microbiome (Abecia et al., 2013). Calves weaned at 3 weeks of age with the introduction of solid feed intake showed greater microbial abundance in the rumen as compared to the calves weaned at 6 weeks of age (Anderson et al., 1987). Rumen development can be affected by different weaning practices such as milk quantity, weaning age, weaning scheme, and time of introduction of solid feeds to the young ones (Khan et al., 2016). Morphological and physiological development of the rumen can be improved by opting for a suitable weaning strategy, such as a step-down weaning method, which has shown a successful weaning of calves at 4 weeks of age (Carballo et al., 2019).

Starter feed and solid feed introduction also play a major role. When the calf starts to eat calf starter (a mixture of grains, protein source, minerals, and vitamins) and drink water, the rumen starts to develop. Calf starter should be fed to calves starting at four days of age. Calf starters should be formulated to include very palatable ingredients and to contain adequate protein, minerals, and vitamins. A coccidiostat or coccidioside, be included in the calf starter (Parsons *et al*., 2022). Calves that start consuming good-quality starter feed early develop their rumen faster and show better growth performance than those relying only on grass or low-quality fodder (Hodgson *et al*., 2016). This is a well-documented cause of growth failure in early calf development (Patel *et al*., 2017).

Another major contributor to poor calf performance is parasite load. Internal parasites such as strongyles and coccidia decrease feed absorption, reduce appetite and cause diarrhea and anemia (Keeton and Navarre,

2017). External parasites like ticks spread dangerous blood diseases such as babesiosis and theileriosis, which are widely reported in Sindh (Abbas *et al.*, 2021). Studies show that parasite-infected calves may lose their potential weight gain if not treated properly (Manzoor *et al.*, 2020). In addition, providing clean, dry and well-ventilated floors has better weight gain and fewer infections compared with calves kept in muddy, humid or overcrowded areas (Farooq *et al.*, 2018). Furthermore, contaminated water is a major source of parasite eggs and disease-causing bacteria; such conditions add further stress to the calves, reducing their ability to grow properly (Lanjar *et al.*, 2022). Moreover, as the human population and urbanization continue to grow rapidly, the demand for milk and milk products is increasing significantly. Beyond its essential nutritional value, milk production plays a crucial role in strengthening household economies and contributing to the overall economy. However, the dairy industry currently faces numerous challenges, including inadequate veterinary services, fodder shortages, infectious diseases, insufficient breeding programs and early weaning (Gebremichael *et al.*, 2019; Mulliniks *et al.*, 2013).

The present study is designed to determine the population ratio of calves, their rearing system, body weight, and parasitic infection in different Union Councils (UCs) of Shaheed Benzairabad (SBA), Sindh, Pakistan. The study focused on evaluating prevailing feeding practices, management systems, and the incidence of parasitic infections in calves. Data was collected through structured questionnaires, field observations, and sample analysis to understand the factors influencing calf health and productivity. The findings aim to support evidence-based recommendations for improving calf rearing.

Materials and Methods

Study area and selection of calves

This study was conducted in the Shaheed Benzairabad, Sindh, Pakistan. It is situated south of the Indus River in Sindh. The study area lies in the sub-tropical region between 26.2988° N, 68.2385° E. The district lies in a semi-arid zone with mean annual temperatures ranging between 40.7 °C and 47.4 °C. The study was conducted by the Department of Veterinary Parasitology, Shaheed Benazir Bhutto University of Veterinary and Animal Sciences, Sakrand and funded by the Food and Agriculture Organization (FAO) of the United Nations. The present study focused on the union council level. A questionnaire was prepared regarding the information, which contains the history of the farmers, number of calves, their feeding management, health, age, weight and the weaning time of the calves, after getting preliminary data through a questionnaire. A total of 12007 early weaned calves under one year of age were selected, and their health, body condition, skin and hair condition were monitored for any parasitic infection and infestation, plus fecal samples were collected for further analysis.

Body condition and weight of weaned calves

In most situations, the live weight before weaning was about 80-100 kg at an age of 12 weeks (Palczynski *et al.*, 2020). Calves with dry, coarse coats, 'woody calves', are almost certainly not receiving adequate milk from their mothers. Based on the body condition and the weight of the calves, we decide whether calves receive adequate milk or not.

Parasitic infestation

Early weaned calves underwent a thorough clinical examination for any signs of parasitic infection. During this examination, we utilized the FAMACHA anaemia guide test. The color of the mucous membranes was assessed on a scale of 1 to 5, with 1 indicating a healthy red color and no signs of anaemia, and 5 indicating pale or white membranes with severe anaemia. Additionally, faecal samples were collected for further analysis.

Sample collection

Fecal samples were collected directly from the rectum using lubricated disposable gloves following standard parasitological protocols (Prada Sanmiguel *et al.*, 2010; Khan *et al.*, 2007). Each sample was sealed in the same sleeve, air was expelled to prevent oxidation, and the samples were placed in ice-cooled containers for transport to the Department of Veterinary Parasitology, SBBUVAS, Sakrand. Immediate refrigeration prevented embryonation and maintained parasite egg viability during transit.

Sample analysis

Faecal samples were examined by the faecal flotation and sedimentation method. In flotation method, 3 g of faeces were measured, which were then mixed with a saturated salt solution, strained, and placed in a flotation vial. A coverslip was applied for 15-20

minutes, then transferred to a slide and examined under the microscope for parasite eggs and oocysts (Tagesu, 2018). For the sedimentation technique, 5g of faeces with 200 mL of water in a 250ml beaker was mixed thoroughly. Filtered the fecal suspension through a tea strainer into a second beaker. Allowed to sediment for 30 minutes. Removed the supernatant very carefully with a pipette. Combined the sediment with 200 mL of water and mix thoroughly. Repeated these steps until the supernatant was clear. After removing the supernatant for the final time, the sediment was transferred to a Petri dish, a drop of methylene blue was added, and the eggs were examined using a dissecting microscope (Luka *et al.*, 2019).

Data analysis

Descriptive data from the survey and parasite population were calculated and organized using MS Excel. The mean population of cattle and buffalo was calculated using the formula:

$$Mean(\bar{X}) = \frac{\sum x}{n}$$

Results

In SBA, livestock plays a crucial role as a primary source of income for rural families, with nearly every household owning buffalo or cattle for milk production. This study aims to survey the population of calves among large ruminants, assess their health and management status, and evaluate the parasitic issues and underlying causes contributing to these challenges. The current survey includes 12 UCs: 1-Abdul Hassan, 2-Bandi, 3-Bucheri, 4-Chanesar-1, 5-Chanesar-2, 6-Ghandtar, 7-Habberi, 8-Hamal Faqeer, 9-Khair Shah, 10-Morio Lakho, 11-Nathani, 12-Sun, conducted from December 2024 to January 2025 (Figure 1). During the survey, a total of almost 12,007 calves were registered. Out of these, around 64.68% were buffalo calves, while 35.31% were cattle calves. This shows that in SBA, buffalo rearing is more common than cattle rearing, which matches the general pattern of livestock keeping in interior Sindh. Farmers provide the reason behind that practice is that buffalo milk is economically preferred. Among these, male calves were 49.44%, and the female population was 50.55%. Moreover, the age distribution is as follows: <6 months, 52.13%; >6 months, 47.86% (Table 1).

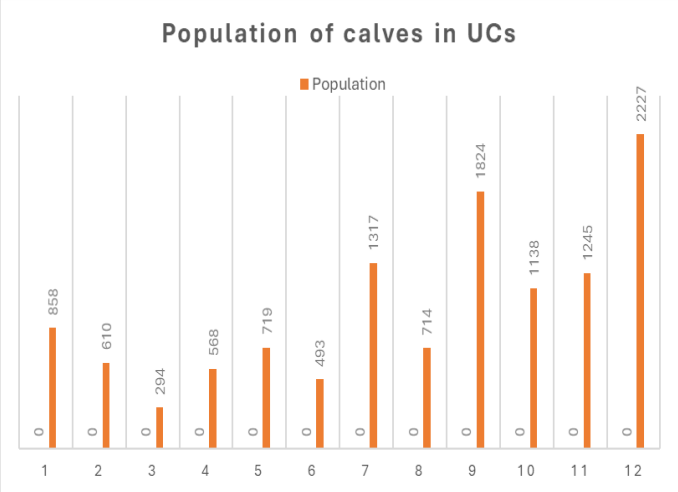

Figure 1: *Calves population in various areas (union councils-UCs): 1-Abdul Hassan, 2-Bandi, 3-Bucheri, 4-Chanesar-1, 5-Chanesar-2, 6-Ghandtar, 7-Habberi, 8-Hamal Faqeer, 9-Khair Shah, 10-Morio Lakho, 11-Nathani, 12-Sun.*

Table 1: *Calves population in 12 UCs of SBA, with their age and gender.*

Categories					
	1	**Animal**	**Buffalo**	**Cattle**	**Mean**
		Population	7767 (64.68%)	4240 (35.31%)	6003.5
	2	Gender	Female	Male	
		Population	6070 (50.55%)	5937 (49.44%)	
	3	**Age**	<6 months	>6 months	
		Population	6260 (52.13%)	5747 (47.86%)	

The objective of the survey assessing the health of calves reveals that a significant number are classified as underweight. Among the surveyed population, 3,321 calves weigh between 20-30 kg, while 3,533 fall within the 31-40 kg range. Additionally, 2,176 calves are in the 41-50 kg category, 1,193 in the 51-60 kg range, 708 in the 61-70 kg group, 486 in the 71-80 kg category, 169 calves weigh 81-90 kg, and 331 are within the 91-100 kg range. In comparison to their age, all calves are considered underweight (Figure 2). Additionally, the present study questionnaire addressed that large parts of these UCs depend on livestock for daily livelihood, which is why calves receive less attention. Furthermore, calf management practices vary widely from village to village and household to household. A major issue seen throughout the surveyed UCs is the difference between expected calf weight and the actual weight recorded in the field. Many calves show a clear gap between normal growth standards and their current body weight. This poor growth is closely linked with early life feeding practices.

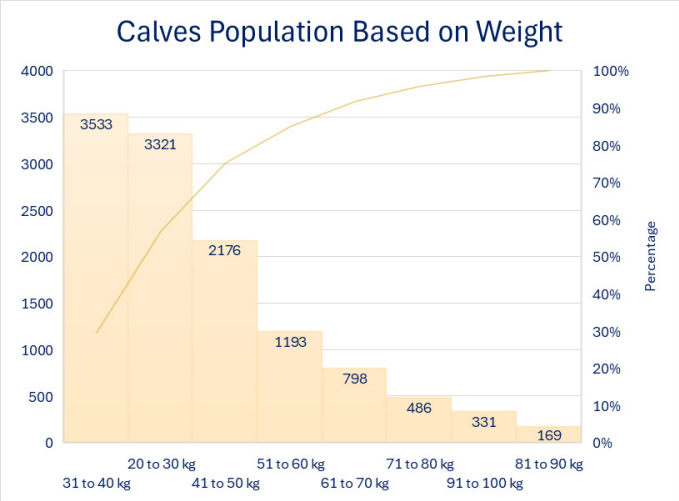

Figure 2: *Weight of the calves in the study area.*

Table 2: *Number and percentage of parasitically infected buffalo and cattle calves.*

Parameter	Buffalo calves	Cattle calves	Parasitic positive buffalo calves (%)	Parasitic positive cattle calves (%)	Overall prevalence %
Age					
< 6 month	4069	2191	1500 (36.86)	1102(50.2)	46.64%
>6 month	3736	2011	2088 (55.88)	911 (45.30)	
Sex					
Male	3848	2089	1501 (39)	990 (47.39)	
Female	4507	1563	2010 (44.59)	7.80)	

Parasitic burden in the survey population

An analysis of faecal samples revealed that 46.64% of calves were infected with gastrointestinal parasites, primarily *coccidia*, *Strongyles* and *Trichostrongylus*. Mixed species were also found, and many samples contained a small number of *Fasciola* and *Schistosoma* eggs. The calves mentioned above also graze in fields where mixed livestock are present. This is a significant reason for their infections, as these calves suffer from low body weight and are more susceptible to these issues. When examining the age groups within each species, it was found that 36.86% of buffalo calves under six months tested positive, compared to 50.2% of cattle calves. For buffalo calves older than six months, the positivity rate rose to 55.88%, whereas it was 45.30% for cattle calves in the same age category. We found that cattle below 6 months are more effective than buffalo, and in the category of above 6 months, buffalo are more susceptible than cattle. In terms of gender, 39% of male buffalo calves and 47.39% of male cattle were found to be positive. Among female buffalo calves, the positivity rate was 44.59%, while parasitically positive female cattle had a rate of 47.80%. When comparing both results, it is concluded that female calves are more susceptible (Table 2).

Discussion

During the survey, nearly 12,007 calves were registered. Of these, approximately 64.68% were buffalo calves, while 35.31% were cattle calves. This indicates that buffalo rearing is more prevalent than cattle rearing in SBA, aligning with the general livestock pattern in interior Sindh. Moreover, based on the survey questionnaire and clinical examination of calves, we found that most calves suffering from early weaning in SBA are experiencing significant growth suppression, primarily due to inadequate nutrition, parasitic burden, and poor management conditions. The high proportion of calves weighing below expected standards indicates chronic underfeeding, particularly during the first six months of life. Similar growth limitations have been widely documented in studies from Pakistan, India, and other developing countries, confirming that insufficient milk feeding and delayed introduction of quality solid feed are major drivers of poor weight gain in calves (Soomro *et al.*, 2021; Patel *et al.*, 2017).

In this study, more than half the calf population weighed between 20-50 kg, which was below the normal range expected for calves under 12 months. Such low weights strongly indicate restricted milk availability, which aligns with common practices in rural Sindh where households prioritize selling milk over calf feeding. Earlier research confirms that calves receiving less than 10% of their body weight in milk daily develop weak immunity, reduced rumen development, and decreased growth rates (Levy *et al.*, 2015; Rashid *et al.*, 2019). Therefore, the underweight condition observed in SBA calves is not only a nutritional issue but also a result of socio-economic pressures affecting feeding choices. Additionally, the lack or delayed provision of starter feed further hampers growth. Calves that are mainly dependent on grazing cannot meet their protein, mineral, and energy needs, particularly during early rumen development. Studies have demonstrated that calves introduced to starter feed at an early age develop better rumen papillae, improve feed conversion efficiency, and grow more quickly (Hodgson *et al.*, 2016). In SBA, many calves relied predominantly on grass and low-quality fodder,

explaining the widespread stunting and poor body condition scores. In the SBA survey, many households lacked regular deworming schedules, increasing the risk of parasite load. The present study analyzed the parasitic burden in calves and found that 46.64% are affected by gastrointestinal (GIT) parasites, with mild, moderate, and high worm egg counts. Previous studies also mentioned that variation in the parasite infection load may be attributed to differences in management practices, animal immunity, and the level of contamination in grazing areas (Rizwan *et al*., 2024). Moreover, we selected calves less than 12 months old revealed that cattle under 6 months old demonstrate higher parasitic infection compared to buffalo, while those over 6 months show that buffalo are more susceptible than cattle. Previous findings revealed that. Calves age group (9–12 months) were more susceptible to Gastrointestinal parasites (Ara *et al*., 2021). Moreover, gender analysis shows, 39% of male buffalo calves tested positive, whereas 47.39% of male cattle were positive. Among female buffalo calves, the positivity rate stood at 44.59%, while female cattle had a rate of 47.80%. This comparison leads to the conclusion that female calves exhibit greater susceptibility. These findings are correlated with a study that observed that the prevalence of gastrointestinal parasites was somewhat higher in females (80, 55.1, and 69.6%) than in males (75%, 42.8%, and 64.7%) (Ara *et al*., 2021). Overall, parasites are identified as a significant contributor to poor performance in early-weaned calves. The high prevalence of internal parasites, such as *strongyles, coccidia, Trichostrongyles* and other gastrointestinal worms, is closely associated with intermittent diarrhea and anemia observed during clinical examinations. Moreover, according to previous studies, parasitic infections can reduce weight gain by 20-40%, delay maturity, and substantially increase mortality risk (Adedipe *et al*., 2014; Keeton and Navarre, 2017). The lack of regular deworming schedules among SBA farmers further aggravated the problem. Only a minority of households reported following any systematic deworming plan, which is consistent with other studies conducted in rural Sindh (Abbas *et al*., 2021). Similarly, the high exposure to ticks due to poor hygiene and lack of acaricide use raises the risk of vector-borne diseases such as babesiosis and theileriosis, which are endemic in several parts of Sindh. These blood parasites severely affect haemoglobin levels, appetite and energy balance, thereby slowing growth and predisposing calves to secondary infections (Kenaw *et al* 2023; Velusamy *et al*., 2015; Taylor 2016). This combination directly slows growth and affects calf survival.

Environmental and management factors also played a crucial role in the observed poor growth patterns. In many surveyed UCs, calves were kept in muddy, humid, and overcrowded conditions. Housing and hygiene also contribute to the differences in weight. In many villages visited during the survey, hygiene conditions were poor, and clean water was not always available. Previous studies mentioned that poor housing is known to increase stress, weaken immunity, and promote rapid spread of infectious agents (Farooq *et al*., 2018). Contaminated water sources, which were frequently noted during the survey, are an important route for parasite eggs, bacterial pathogens and coccidial oocysts. These factors further worsen diarrhoea, dehydration and nutrient malabsorption. Such management-related challenges are widely recognized in livestock production systems of developing countries (Lanjar *et al*., 2022).

Conclusions

The current study indicate that buffalo calves were more numerous than cattle calves across the 12 UCs of SBA, reflecting the high economic value of buffalo milk in interior Sindh. However, both species showed similar growth challenges, indicating that the underlying issues of nutrition, parasitism, and housing are common across livestock systems regardless of species. The uniformity of these problems across different villages suggests structural issues within rural livestock management that require systemic intervention rather than isolated treatment. Calf population in SBA highlights the importance of livestock for rural households, but the poor growth patterns show that many calves are not receiving the nutrition and health care they need. The challenges identified, limited milk feeding, delayed starter feed, poor hygiene, irregular deworming, and high parasite presence, have been highlighted in numerous national and international studies. The findings from SBA fit closely with these earlier reports and confirm that improving early calf management can significantly increase future milk production, reduce disease risk and strengthen rural livelihoods. With proper awareness, training and simple management changes, the health and growth of calves in SBA can be greatly improved.

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Novelty Statement

This type of study has not been previously conducted within the specific UCs of the SBA region.

Author's Contribution

Conceptualisation by Sana Noor Panhwer; writing and research by Rabia Keerio, Gulzar Ali Junejo and Sana Noor Panhwer; review and reset by Majid Hussain Soomro and Sana Noor Panhwer. Community counselling support by Zahid Iqbal Rajput and Syed Noman Ali.

Ethical approval
All procedures involving animals were performed following established ethical standards for animal research. The study protocol was reviewed and approved by the Scientific Committee of the Shaheed Benazir Bhutto University of Veterinary and Animal Sciences (SBBUVAS), Sakrand, under the reference number SBBUVAS/ORIC-ACERC/20/2025.

Generative AI and AI-assisted technology statement
We used Grammarly for writing assistance.

Conflict of interest
The authors have declared no conflict of interest.

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