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EFFICACY TRIAL OF LOCALLY AVAILABLE DRUGS (FARMEC® 2% AND NIDOZOLE) ON BODY CONDITION SCORE (BCS) OF PARASITE-INFECTED BUFFALO CALVES

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ABSTRACT

This study evaluated the effects of two antiparasitic drugs, Nidozole suspension (which contains oxfendazole, oxyclozanide, cobalt, and selenium) and Farmec-2 (which includes 2% ivermectin) on the body condition score (BCS) of buffalo calves aged 6 to 12 months that were naturally infected with parasites, specifically piroplasms, their vectors, and helminths. The calves were divided into three groups based on their history, clinical signs, and results from the FAMACHA anemia guide test. Each group has 10 calves provided with ad lib feed and water: Group A (Ivermectin), Group B (Nidozole), and Group C (Control). Firstly, Blood, ectoparasite, and fecal samples were collected to analyze the parasitic burden. Giemsa-stained blood smears confirmed the presence of Babesia in several calves, while fecal examinations identified eggs from various parasitic species, primarily Haemonchus spp. After thorough analysis, the antiparasitic medications were administered, and BCS, along with clinical improvements, was monitored before and after medication on day 0, day 15, and day 45. On the 30th day, only BCS was monitored without medication. The results indicated that Group A exhibited a slight improvement in BCS, while tick and lice infestations, which were prevalent before treatment, were nearly eliminated compared to Group B. Furthermore, calves in Group B showed a more significant improvement in BCS. Clinical observations revealed that prior to treatment, the calves had dull and rough hair coats, pale mucous membranes, reduced feed and water intake, and significant tick infestations. Following treatment, the calves displayed noticeably shinier and smoother hair coats, their mucous membranes regained typical coloration, and their appetite and water consumption increased compared to those in Group A. In comparison to the control group, both treatment groups showed improvements in BCS. The study concluded that Farmec-2 is highly effective against ectoparasites. At the same time, Nidozole positively influences BCS due to its combination of antiparasitic medication and micronutrients, which help eliminate parasites and enhance overall health. This study underscores the importance of early diagnosis and appropriate therapy in improving growth performance in parasitized calves.

1. INTRODUCTION

Parasitic and protozoal infections in animals pose a significant threat to livestock and agricultural productivity, particularly in developing countries. Livestock plays a pivotal role in Pakistan's economy by uplifting the socioeconomic conditions of resource poor farming communities and alleviating poverty.

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The livestock sector in Pakistan is primarily represented by smallholder farmers, who meet the population's nutritional needs, ensure food security, and generate income. In the financial year 2024/2025, the livestock sector contributed 14.97% to Pakistan's Gross Domestic Product (GDP), accounting for 63.6% of the value of all agricultural commodities (Jabbar *et al.,* 2015). Moreover, the buffalo is the most preferred animal for milk production in Pakistan. Its population is mainly concentrated in India, Pakistan, and China, accounting for 97% of the world's population (Ocampos & Riquelme 2024). In addition, Pakistan's diverse climate, water availability, land use, and physiography are categorized into ten agroecological zones, significantly influencing the distribution and occurrence of livestock diseases (Jabbar *et al.,* 2015). Calves, with their developing immune systems, are especially susceptible to both internal and external parasites.

However, early weaning in young calves produces risk for restricted growth or increased susceptibility to pathogens or parasites (Grindstaff *et al.,* 2003). Notably, ectoparasites (Ticks) that transmit protozoal diseases such as Babesiosis and Theileriosis. These diseases can lead to serious complications, including anaemia, significant weight loss, reduced growth rates, decreased productivity, and, if left untreated, may ultimately result in death. Babesiosis and Theileriosis are recognized as two of the most significant tick-borne diseases in Pakistan, particularly in the Sindh province, underscoring the critical need for effective management and control strategies (Bowman, 2014; Irshad, 2010; FAO, 2003). These tick-borne diseases pose a significant threat to cattle and buffalo populations (Merck Veterinary Manual, 2025; Bock *et al.,* 2004; Batiha *et al.,* 2019; Gebremedhin *et al.,* 2019) because they target red blood cells and, in some cases, white blood cells, leading to their destruction.

Diagnosis of these protozoal infections is commonly achieved through Giemsa-stained blood smears, wet film examination, lymph node aspirates, or molecular and serological tests (Merck Veterinary Manual, 2025). Treatment generally involves the use of antiprotozoal drugs such as diminazene aceturate, imidocarb dipropionate, buparvaquone, suramin, quinapyramine, or oxytetracycline, combined with supportive therapy and strict vector control to break the transmission cycle (Merck Veterinary Manual, 2025; Batiha *et al.,* 2019).

Helminths, nematodes, cestodes, and trematodes inhabit the gastrointestinal tract, blood, liver, and other organs of the host, causing significant internal damage. Primarily, they spread in tropical/subtropical climates, where high temperatures, rainfall, and humidity accelerate parasite life cycles and pasture contamination, thereby increasing infection burden (Sutherland & Scott, 2010). These Parasites can cause intestinal mucosal damage, resulting in malabsorption of nutrients and chronic diarrhoea. Blood-feeding parasites such as *Haemonchus* spp. and protozoan parasites destroy red blood cells, leading to anaemia and weakness (Soulsby, 1982). Some parasites lodge in the liver or lungs, causing fibrosis, obstruction, respiratory distress, and blood sucking worms can suck about 0.05 ml of blood per day (Javaremi *et al.,* 2012 & Bowman 2014).

Similarly, gastrointestinal parasites, coccidiosis, and giardiasis represent another group of infections that compromise livestock health. These parasites typically spread through ingestion of infective stages, such as larvae or oocysts, from contaminated pastures, feed, or water (Sani *et al.,* 2016). They primarily invade the gastrointestinal tract, where they cause damage to the intestinal lining or abomasum, leading to malabsorption, diarrhea (sometimes bloody), anemia, swelling under the jaw, dehydration, weakness, and poor growth performance. Diagnosis is made by fecal examination for eggs or oocysts, fecal egg counts, post-mortem findings, antigen detection, or PCR (Merck Veterinary Manual, 2025; Sani *et al.,* 2016). Treatment and prevention rely on drugs such as albendazole, ivermectin, metronidazole, or sulfonamides, along with clean drinking water, proper sanitation, and pasture management to reduce infection pressure (Sani *et al.,* 2016).

Additionally, Environmental conditions play a crucial role in the spread of both blood and gastrointestinal parasitic diseases. High humidity, unhygienic management, and the presence of intermediate hosts provide favorable conditions for parasite transmission (Walker *et al.,* 2003). In flood-prone or densely populated areas, fecal contamination of water sources further facilitates waterborne transmission, making

diseases like cryptosporidiosis, giardiasis, eimeriosis, babesiosis, and theileriosis highly prevalent (Dubey & Lindsay, 2006; Thompson, 2004). Parasitic infections can harm the health and productivity of animals. They are linked to problems such as slow weight gain and reduced reproduction. Animals suffering from parasitic infections often grow slowly, their immune systems do not function properly, and they are susceptible to other diseases. Additionally, these infections can lead to ineffective feed conversion, resulting in poor growth rates, weight loss, higher death rates, lower overall productivity, and low BCS in calves. (Muriu, 2023; Charlier *et al.,* 2014; Soulsby, 1982).

Ivermectin, an antiparasitic medication and macrocyclic lactone, is effective against a broad spectrum of internal and external parasites, including nematodes, mites, and ticks. In contrast, Albendazole, a benzimidazole anthelmintic, is widely used for controlling gastrointestinal nematodes, cestodes, and liver flukes (Horton, 2000). Moreover, ivermectin has a higher efficacy in improving BCS and eliminating ticks compared to albendazole. However, albendazole remains effective against a broader range of internal parasites (Rehman *et al.,* 2019). Therefore, the present study evaluates the effect of locally available antiparasitic medication and monitors the BCS of calves.

2. MATERIALS AND METHODS

Study Area

The study was conducted in the village (Tali), located in the taluka Sakrand, district, Shaheed Benazir Abad, Sindh, Pakistan. The climate of the district is characterised by hot summers and mild winters with limited but seasonal rainfall mainly during the monsoon period (July-September). The village has a mixed livestock population including buffalo, cattle, sheep, and goats.

Study design and animal selection.

A cross-sectional field trial design was used. From the selected village, we chose calves showing signs of poor health, such as pale mucous membranes (FAMACHA results), low body condition score, reduced appetite, lethargy, and a history of recent illness. These calves had not received anthelmintic or antiprotozoal treatment within the last three months. 30 calves aged 6-12 months were selected and divided into three groups with equal management strategies (Table 1).

Table 1 illustrates the division of calves based on medication.

Group-A	Group-B	Group-C
Ivermectin-treated group	Nidozole-treated group	Control

Sample Collection Protocol

During the present study on day 0 (before the start of treatment), calves were thoroughly examined to screen for ectoparasitic infestation, and blood and fecal samples were collected from each calf to monitor worm burden. All procedures were conducted under hygienic conditions to avoid contamination and ensure reliable laboratory results. Blood was obtained aseptically from the jugular vein using aseptic technique (Virginia Tech, 2017, & Wageningen University, 2018).

Approximately 5 mL of blood was collected into tubes containing ethylenediaminetetraacetic acid (EDTA) as an anticoagulant, which prevents clotting. The tubes were gently inverted several times to ensure proper mixing with EDTA without causing hemolysis (Davis, 2021). Fresh fecal samples were collected directly from the rectum using clean disposable gloves to avoid external contamination. The samples were placed into sterile, airtight containers and immediately labelled with the calf identification number (Zoetis, 2019; Wageningen University, 2018). After collection, all blood and fecal samples were stored in insulated cool boxes maintained at approximately 4 °C using ice packs. Maintaining the cold chain is essential to minimize cellular degradation and preserve parasite morphology until analysis (Davis, 2021; Zoetis, 2019). Samples were transported to the Department of Veterinary Parasitology, SBBUVAS, Sakrand.

Sample analysis:

Thin Blood smears were prepared, air dried, fixed with methanol, and stained with Giemsa stain (1:10 dilution for 30-45 minutes) or Field's stain (Field A and Field B dips for rapid staining. The stained slides were examined under a compound microscope (LABOMED LB 1270) at 100× magnification with oil immersion to detect Haemoparasites (Ibrahim *et al.,*

2010). Fecal samples were analyzed by performing EPG with the help of the McMaster technique (Bosco *et al.,* 2014).

Treatment Protocol

Treatment commenced on Day 0, with Group A receiving ivermectin-2% at the manufacturer's recommended subcutaneous dosage, while Group B received Nidozole oral drench according to the manufacturer's guidelines. Group C was the control group and received no treatment. To enhance overall efficacy against parasites at various life cycle stages and to alleviate the risk of immediate reinfestation, all animals were administered repeat (booster) doses of the same product on days 15 and 45. Before administering the booster dose, calves were clinically examined for body condition score, mucous membrane color, appetite, activity, and any abnormal signs.

3. RESULTS AND DISCUSSION

After the initial clinical examination and laboratory investigations, parasitic infections/infestations were identified in the buffalo calves. Blood smear analysis using Giemsa and Field's stains confirmed protozoal infections, particularly *Babesia* spp (Fig. 1) in multiple animals. In addition, fecal flotation tests revealed the presence of gastrointestinal parasites, most notably *Haemonchus* spp. The above-mentioned parasitic issues are commonly associated with anemia (Fig. 2), weakness, and stunted growth in young calves (Fig. 3).

Efficacy records of treatment

Results of treatment with ivermectin and Nidozole over the 45-day trial showed that both treatment groups showed significant improvement in overall health status compared with the control. Body condition score (BCS) steadily improved, with most treated calves shifting from poor to fair or good condition by the end of the study. In addition, due to ad lib feed and water BCS of the control group also slightly improved (Table 2). Farmers also reported satisfaction with both therapies, noting visible health recovery, increased weight gain, and better growth performance.

Before treatment, calves exhibited clinical signs such as dull and rough hair coats, pale mucous membranes, lethargy, reduced appetite, decreased water intake, and heavy tick infestation. These symptoms persisted in the control group, whereas treated calves showed gradual but consistent recovery. Within two weeks of post-treatment, improvements were evident, and by day 45, most treated calves had regained normal activity levels, healthy pink mucous membranes, and noticeably shinier and smoother coats. Feed and water intake also increased significantly. Among the two anthelmintics, Nidozole demonstrated powerful effects. Calves in the Nidozole group not only recovered from gastrointestinal parasitism but also exhibited a more pronounced improvement in body condition and growth rates compared to the ivermectin group. The drug's efficacy in reducing internal parasitic load translated into better nutrient absorption and overall productivity.

Meanwhile, ivermectin effectively controlled parasitic infestations and eliminated ticks and lice, but improvements in growth and body condition scores were relatively less marked than those observed in Nidozole-treated calves. No adverse reactions to either drug were observed during the 45-day study, where every 15-day BCS was monitored, confirming the safety of both Ivermectin and Nidozole under field conditions. The findings indicate that the timely administration of anthelmintics, along with boosters, is crucial for improving calf health and productivity. Both ivermectin and Nidozole significantly reduced parasitic burdens; however, Nidozole demonstrated superior effects on enhancing body condition, growth, and overall performance of calves under natural farm conditions.

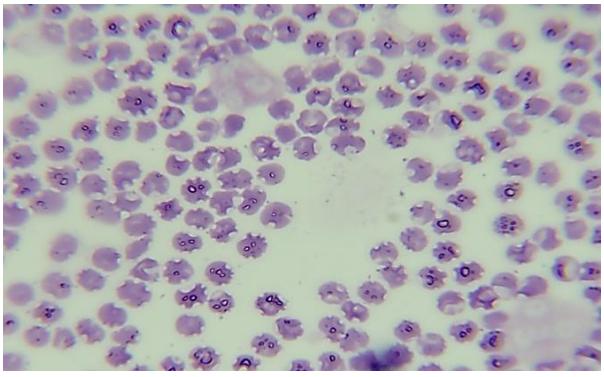

Figure 1: Shows a Giemsa-stained smear; dark purple dots indicate the presence of babesiosis.

Figure 2: shows the results of the FAMACHA Anemia guide test.

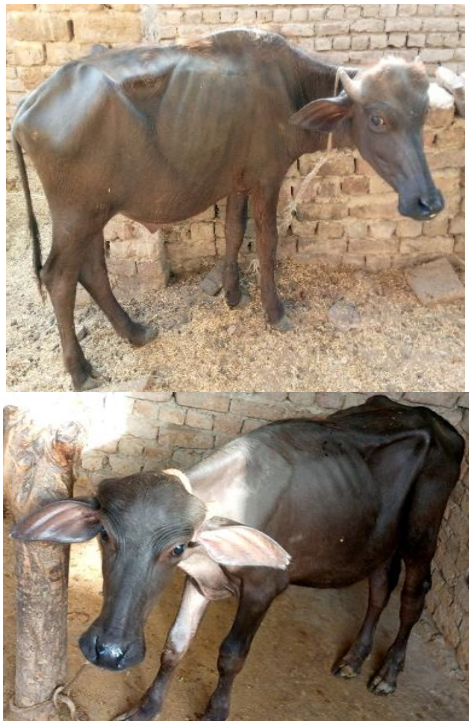

Figure 3: BCS of calves before treatments

Table 2: BCS of Randomly Selected Calves from the experimental groups compares Control, Ivermectin, and Nidozole at different time points (Day 0, 15, 30, 45)

S #	Group	BCS_ Day0	BCS_ Day15	BCS_ Day30	BCS_ Day45
1	Ivermectin	1.4	2.0	2.7	3.4
2	Ivermectin	1.8	2.6	3.3	3.5
3	Ivermectin	1.9	2.5	3.1	3.5
4	Ivermectin	1.5	2.2	2.7	3.3
5	Nidozole	1.6	2.4	3.2	4.0
6	Nidozole	1.6	2.6	3.6	4.0
7	Nidozole	1.8	2.5	3.3	4.0
8	Nidozole	2.1	2.9	3.6	4.0
9	Control	1.9	2.1	2.2	2.4
10	Control	1.9	2.1	2.4	2.6
11	Control	1.7	1.9	2.1	2.3
12	Control	1.6	1.7	1.9	2.1

BCS Scale:
1 = Poor (very weak, bones are prominent, dull hair coat)
2 = Fair (slight improvement, but still underconditioned)
3 = Good (healthy growth, smooth coat, bones well covered)
4 = Very Good/Excellent (excellent health, shiny coat, active, and well-fed calf)

In the present study, both Nidozole and ivermectin improved the health and body condition of parasitized calves compared to untreated controls. However, the Nidozole-treated group showed more pronounced improvements in body condition score (BCS), appetite, and overall clinical recovery than the ivermectin group. By the end of the 45-day trial, most Nidozole-treated calves achieved BCS values of 3–4, while ivermectin-treated calves showed moderate improvement, with final BCS values mainly ranging between 2.5 and 3.5. In terms of gastrointestinal

parasite control, Nidozole demonstrated superior efficacy. Our study revealed that calves treated with Nidozole exhibited faster recovery from diarrhea, anemia, and poor hair coat compared to those treated with ivermectin. These findings agree with those of (Sani *et al.,* 2016), who reported that albendazole significantly reduced gastrointestinal worm burdens and improved growth rates in cattle. Similarly, (Horton, 2000) described albendazole as a broad-spectrum benzimidazole effective against nematodes, cestodes, and trematodes. The ovicidal and larvicidal effects of albendazole, highlighted by (Sutherland & Scott, 2010), explain its ability to break the reinfection cycle by reducing pasture contamination. Thus, our results support previous reports that Nidozole is highly effective against gastrointestinal parasites, contributing to sustained improvements in animal performance. In contrast, ivermectin was more effective in reducing ectoparasite burdens, particularly ticks. In our study, calves treated with ivermectin showed a sharp decline in tick infestations within two weeks of administration. Clinical recovery was also visible through shinier hair coats, improved appetite, and increased activity. These results are consistent with the findings of (Rehman *et al.,* 2019), who observed that ivermectin effectively controlled ticks and some gastrointestinal nematodes in calves. Earlier, (Shoop *et al.,* 1995) had also emphasized ivermectin's broad antiparasitic action, especially its potent activity against ectoparasites.

However, in our study, BCS improvement in ivermectin-treated calves was comparatively lower than in the NIdozole group. This difference may reflect the fact that ivermectin's primary action is against ectoparasites, while its efficacy against gastrointestinal nematodes is becoming limited due to emerging resistance, as highlighted by (Kaplan, 2015). Taken together, the present study indicates that Nidozole is more effective in improving BCS and overall health of parasitized calves under field conditions where gastrointestinal nematodes are predominant. At the same time, ivermectin remains valuable for ectoparasite control, especially ticks. The combination of both drugs in integrated parasite management programs may provide optimal results. However, when used individually, Nidozole appears more suitable for improving productivity in calves raised under tropical and subtropical conditions.

A study conducted in Sindh by (Khan *et al.,* 2020) reported a high prevalence of Babesiosis and Theileriosis in cattle, with infection rates of 23% and 18% respectively. Control measures, including tick eradication, pasture management, and strategic deworming, have been shown to improve herd productivity significantly, and (Naveed *et al.,* 2021) emphasized the importance of early detection and strategic deworming to improve productivity. Early diagnosis of parasitic and protozoal infections in cattle and buffalo is critical to prevent severe health deterioration and economic losses. According to (Ciordia *et al.,* 1984), the timely administration of ivermectin significantly improved the performance of calves by reducing parasitic load at an early stage of infection. Similarly, the Cattle Parasite Control Guide (COWS, 2014) emphasizes that strategic and timely deworming schedules are essential to interrupt parasite life cycles and enhance growth efficiency. Drug references also support this strategy. For example, early treatment with albendazole against gastrointestinal nematodes prevents progressive weight loss and poor body condition in buffalo and cattle calves (Pfizer/Zoetis, 2012) & (Daily Med, 2019) recommends ivermectin at 200 µg/kg bodyweight as a standard preventive dose, stressing the importance of applying treatment before parasitic burdens reach clinical levels. The European Medicines Agency (EMA, 2018) also highlights that albendazole, at ~20 mg/kg bw, is most effective when administered promptly upon detection of infection in calves, thereby reducing morbidity and preventing spread within herds.

4. CONCLUSION

The present study demonstrated that both Nidazole and Farmec-2 significantly improved the health and BCS of parasitized calves compared to untreated controls. However, Nidozole proved to be more effective in enhancing body condition score, feed intake, and overall recovery. This improved efficacy can be attributed to its broad-spectrum activity and ovicidal action against gastrointestinal parasites. On the other hand, while Farmec-2 ivermectin effectively reduced ectoparasite loads, such as ticks, its impact on body condition was comparatively less pronounced, due to resistance observed in gastrointestinal nematodes. These findings indicate that Nidozole was

good for managing gastrointestinal parasitism in calves, while ivermectin continues to play a valuable role in integrated parasite control, especially against ectoparasites. A strategic combination or rotation of both drugs, alongside effective management practices, may offer the most sustainable and productive approach to enhancing calf health and livestock performance.

5. CONFLICT OF INTEREST

All authors have declared that there is no conflict of interest regarding the publication of this article.

6. FUNDING

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7. 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.

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