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INVESTIGATION OF REPRODUCTIVE TRAITS AND HEMATOLOGY OF PARASITE INFESTED DAIRY COWS IN BANGLADESH

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ABSTRACT

The aim of this study was to investigate the parasitic infestation along with its impact on hematological indices and reproductive traits of crossbred and indigenous dairy cows at some selected areas of Dhaka division of Bangladesh. The study was conducted on 54 dairy cows (50% local and 50% crossbred) in three upazilas (Savar, Mirzapur and Manikgonj sadar) of Dhaka division from July 2022 to June 2023. Parasitic infestations especially *Fasciola spp*. represents a major health problem of dairy cattle impacting their health and reproduction. Individual fecal and blood were analyzed by a quantitative copromicroscopic and autohemoanalyzer to detect the number of parasitic eggs per gram of feces (EPG/OPG) and estimated blood profiles respectively. Results showed that the crossbred dairy cows (55.56%) were more susceptible to parasitic infestation than indigenous dairy cows (33.33%). The hematological values were also adversely affected by parasitic infestation which severely affected the reproductive traits such as age at puberty, service per conception rate, age at calving, postpartum heat period, length of lactation, calving interval as well as length of gestation in both crossbred and local breed of dairy cows. Overall, the reproductive traits of both cross and local breed dairy cows were severely affected by parasitic infestation based on the blood profile parameters.

Key Words: Parasites, reproductive performance, dairy cows, hematology.

INTRODUCTION

The profitability of dairy production is closely linked to the productivity and reproductive traits of dairy cattle (Lobago et al., 2007). In Bangladesh, approximately 85% of the population is engaged in agriculture and livestock farming (Raha, 2000), with the livestock sector playing a critical role in the subsistence agro-based economy. This sector contributes 1.85% to the national GDP and 16.52% to agricultural GDP (BBS, 2022-23). Additionally, it supports 20% of direct agricultural employment and 50% of indirect agricultural employment, sustaining the livelihoods of 80% of the rural population (BBS, 2022-23). The livestock industry is valued at 73,571 crore BDT and contributes 13% of total foreign exchange earnings (BBS, 2004). Bangladesh's cattle population is estimated at 24.86 million, with 20% of rural residents employed full-time in the sector. The need for animal protein, including milk and meat products, is partly met through local production, though domestic milk production is insufficient to meet demand. Consequently, milk and milk products are often imported. The daily per capita milk availability is projected to be 234.86 ml, while the requirement is 250 ml (BBS, 2022-23). The majority of cattle in the country are of the indigenous *Bos indicus* breed, with crossbred animals becoming increasingly common due to artificial insemination (AI) practices. Reproductive performance in dairy cattle is a multifaceted trait encompassing factors such as litter size, calving performance, calf survival, conception rate, fertility rate, and prolificacy. Gut (GI) parasitism is a global issue which has a negative impact on the production and health of animals and is thought to be one of the primary barriers impeding the expansion of the livestock population (Kakar et al., 2008; (Regassa et al., 2006). These infections also result in blood loss and depletion of plasma proteins (Arora et al., 2001). Furthermore, environmental and climatic stress, nutritional status, poor management practices, and lack of disease prevention contribute to impaired reproductive performance. Parasitic infections, in particular, have been identified as a major issue negatively affecting the reproductive outcomes of both local and crossbred dairy cows. Previous studies by

Rahman et al. (1998) revealed that milk production in native cattle is lower than that of developed breeds. Better reproductive and productive performance was observed in cattle that were older at first service and calving, had longer gestation periods, and produced higher quantities of milk. Additionally, body weight influenced the onset of estrus and fertility after calving (Khan et al., 1998). Alam et al. (2001) found that crossbred cows in regions with harsh environmental conditions may not exhibit the same productivity as native cows. Parasitic infestations are known to severely impact reproductive efficiency in dairy cattle.

Despite these findings, there is limited research on the combined effects of parasitic infestations on reproductive performance in dairy cattle in Bangladesh. This study aims to fill this knowledge gap and provide valuable insights into how parasitic infestations influence reproductive parameters in dairy cattle such as age at puberty, service per conception, age at first calving, lactation length, calving interval, gestation length, and postpartum period in dairy cows while also determining the blood parameters like levels of hemoglobin, packed cell volume, total leukocyte count, and total erythrocyte count.

MATERIAL AND METHODS

Study area and period

The samples were collected from Savar, Mirzapur and Manikgonj sadar upazila of Dhaka Division. The study was conducted at the Department of Anatomy, Histology and Physiology, Faculty of Animal Science and Veterinary Medicine, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh from July 2022 to June 2023. The selected dairy cattle were 2-3 years old.

Sample collection

Feces and blood were collected from 54 animals (27 were local cows and 27 were crossbred dairy cows) of studied area. Feces samples were collected in plastic bags containing 10% formalin. Blood samples were collected aseptically using sterile syringe-needle and was transferred to vials containing the anticoagulant ethylene diamine tetraacetate (EDTA). In our experiment, we considered parasite free cows as control animal.

Examination of samples

Approximately 10 gm of feces was collected from the animal after defecation. The collected feces was examined by sedimentation technique and blood by automated blood analyzer. By combining 5 grams of excrement with 10–20 times its volume of water, the sedimentation technique was carried out. After that, it was let to settle in a beaker for one to two hours. Until the supernatant fluid was clear, this process was repeated. A microscope was used to analyze the sediment that was removed from the bottom. The eggs of individual parasites were identified by following the characteristics of different parasites' egg. Approximately 4.0 ml of blood was aseptically collected from the jugular vein using sterile syringes and needles. The collected blood was placed into a vial containing the anticoagulant ethylene diamine tetraacetate (EDTA) for measuring the hemoglobin (Hb) level, total erythrocyte count (TEC), total leukocyte count (TLC), and packed cell volume (PCV).

Statistical analysis

The collected data for various factors were analyzed using Microsoft Excel.

RESULTS AND DISCUSSION

In total, we collected 54 fecal samples from crossbred dairy cows (n=27) and from local/ indigenous dairy cows (n=27). Among them total 15 crossbred dairy cows and 9 local/ indigenous dairy cows were affected with parasites. Common parasites were *Fasciola spp.*, *Paramphistomum spp., Schistosoma spp., Trichostrngylus spp., Strongylodes spp.* Therefore, the prevalence rate was higher in crossbred dairy cows (55.56%) compared to local/ indigenous dairy cows (33.33%).

Table 1: Hematological values of local and crossbred dairy cows at Dhaka division of Bangladesh.

Parameters	Local breed		Crossbred	
	Control	Parasite affected	Control	Parasitic affected
Hb gm.%	13.1 ±2.6	7.67±3.5	10.88±0.68	8.67±0.62
PCV%	43.2 ±7.9	27.20±6.5	38.1±1.68	28.20±3.68
TEC million/µl	6.30±0.25	5.99±0.22	5.83±0.19	5.49±0.25
TLC thousand/ **0**	6.5 ± 1.5	9.71±0.50	9.71±0.51	11.71±0.19

Mean ± SD, Hb = Hemoglobin, PCV = Packed cell volume, TLC = Total leukocyte count, TEC = Total erythrocyte count.

Hematological Profile

The results of hematological parameters of local and crossbred dairy cows are shown in (Table 1). The mean hemoglobin (Hb) % in local and crossbred dairy cows and control group of cows were 7.67±3.5, 8.67±0.62 and 13.1 ±2.6, 10.88±0.68, respectively. The hemoglobin (Hb) concentration was lower in both local and crossbred cows than control group of cows. The mean packed cell volume (PCV) % in local and crossbred cows and control group of cows were 27.20±6.5, 28.20±3.68 and 43.2±7.9, 38.1±1.68 respectively. Packed cell volume (PCV) in local and

crossbred cows was lower than control group of cows. The total erythrocyte count (TEC) of local and crossbred cows and control groups cows were 5.99±0.22, 5.49±0.25 and 6.30±0.25, 5.83±0.19 million/µl, respectively. The mean total leukocyte count (TLC) in local and crossbred and control groups of cows were 9.71±0.50, 11.71±0.19 and 6.5±l.5, 9.71±0.51 respectively. The Total Leukocyte Count (TLC) both in local and crossbred cows is significantly higher than the control groups of cows. All hematological components were affected with parasitic infection both in local and crossbred dairy cows that ultimately affects reproductive performances of both local and crossbred dairy cows.

The observed reduction in hemoglobin levels in parasite-affected cows compared to control is consistent with the findings of Akanda et al. (2020), who noted that parasitic infections, such as gastrointestinal nematodes and blood protozoa (*Anaplasma* and *Babesia*), cause anemia in cattle due to blood loss and erythrocyte destruction. This decrease in hemoglobin compromises oxygen transport and energy metabolism, potentially impairing reproductive performance. Significant decrease in PCV values in parasite-infested cows compared to controls indicates anemia and reduced erythropoiesis, likely due to nutritional deficiencies and parasitic blood loss. Similar trends were reported by Rahman et al. (2019), who attributed low PCV levels to the depletion of iron and essential nutrients caused by parasitic infestations. The reduction in TEC among parasite-affected cows compared to control groups further confirms the anemic condition. This aligns with findings from Das et al. (2021), who suggested that chronic parasitism suppresses erythropoietin activity and leads to erythrocyte destruction, thereby lowering TEC. A marked increase in TLC in parasite-affected cows compared to controls indicates an immune response to parasitic infections. This is consistent with observations by Ahmed et al. (2020), who noted elevated leukocyte counts in infected cattle as a defensive mechanism against parasites. Increased TLC is often associated with systemic inflammation and the activation of immune cells.

The compromised hematological profile in parasite-infested cows adversely affects their reproductive health. Reduced hemoglobin and PCV impair oxygen supply to reproductive organs, while anemia and immune stress disrupt hormonal balance, leading to issues like anestrus and repeat breeding, as highlighted by Khatun et al. (2022). Furthermore, increased leukocyte counts may reflect chronic inflammatory conditions that negatively influence uterine health and conception rates.

Reproductive Performances

Table 2. Reproductive traits of local and crossbred dairy cows at Dhaka, Bangladesh

Parameters	Local breed		Crossbred	
	Control	Parasite infected	Control	Parasite infected
Age at puberty (D)	1125.8± 6.8	1215.5±6.5	1401.5 ± 30.47	1476.5 ± 15.47
Service/Conception(N)	1.3 ± 0.20	1.32±0.13	3.36 ± 0.31	3.96 ± 0.23
Age at 1st Calving(D)	1380.5± 0.6	1420.5±6.5	1779 ± 20.76	1796 ± 10.56
Postpartum period (D)	103.2 ± 3.8	112.0±4.77	148.3 ± 22.54	168.3 ± 12.44
Lactation length(D)	197.5 ± 5.3	175.40±6.95	513.8 ± 28.1	468.5 ± 14.1
Calving Interval(D)	481.3 ± 0.8	492±0.75	581.5 ± 17.48	516.5 ± 9.48
Gestation Length(D)	286.2±1. 5	285±1.5	282 ± 2.86	283±3.26

D=days, N=Number

In this study, the average age at puberty in parasite-infected cows was higher for both local (1215.5±6.5 days) and crossbred cows (1476.5±15.47 days) compared to their respective control groups (1125.8± 6.8 days) for local and 1401.5±30.47 days for crossbred cows) (Table 2). This delay aligns with findings by Saha et al. (2008)**,** who reported that crossbred cows (HF × Local) took longer to reach puberty, particularly under conditions of poor nutrition and disease. Islam et.al. (2017), reported that age of sexual maturity of local and crossbred dairy cows were 1125.8±6.8 and 1401.5±30.47. According to Rahman et al. (2013)**,** parasitic infestations negatively influence puberty onset by impairing nutrient absorption, reducing energy availability, and altering hormonal regulation. Sultana et al. (2001) discovered that Desi and the Friesian cross reached puberty at ages of 25.2, 21.4, and 24.4 months, respectively. According to Saha et al. (2008), the average age of puberty for HF × L crossbreds was 1138.5±110.60 days. Dairy cows reach puberty at varying ages, which may be caused by parasite infestation, environmental factors, feeding practices, and psychological management.

Parasite-infected crossbred cows required more services per conception (3.96±0.23) compared to their control counterparts (3.36±0.31). Local breeds showed minimal differences between control (1.3±0.20) and infected (1.32±0.13) groups (Table 2). The results of this study are similar with the findings of Islam et al. (2017) who found service per conception rate in

crossbred and local breed dairy cows were 3.36±0.31 and 1.3±0.2, respectively.

Similar results were observed by Sarder et al. (2007), who reported that crossbreeds are more susceptible to infertility-related issues caused by parasitic load due to their higher metabolic demands. Hossen et al. (2012) also found that local cows generally required fewer services per conception, reflecting their resilience to environmental stressors and parasitic challenges. A number of other factors such as the quality and quantity of semen used in artificial insemination, improper detection of heat, the level of fertility, parasitic infestation which influences service per conception.

The age at first calving was delayed in parasite-infected groups for both local (1420.5 ±6.5 days) and crossbred cows (1796±10.56 days) compared to controls (1380.5±0.6 and 1779±20.76 days, respectively) (Table 2). Islam et al. (2017) highlighted similar trends, attributing delayed calving to the impact of parasitic infestations on reproductive health and nutritional deficiencies. Sultana et al. (2001) observed that Friesian crossbreds are particularly vulnerable to such delays due to their higher nutritional requirements and sensitivity to parasitic burdens. Islam et al. (1992) stated that there was no constant trend in age at first calving with level of Friesian inheritance. They also reported that age at first calving was lower in spring and summer than in winter, autumn and the rainy season.

The postpartum heat period was extended in parasite-infected cows, with local breeds averaging 112.0±4.77 days and crossbreds averaging 168.3±12.44 days, compared to 103.2±3.8 days and 148.3±22.54 days in control groups (Table 2). Chowdhury et al. (1994) and Rahman et al. (2013) found similar extensions in postpartum intervals due to parasitic infestation, which suppresses ovarian activity and delays estrus. Nutritional deficits caused by parasites further exacerbate the issue. The length of the postpartum interval is influenced by disease condition, parasitic load, nutrition, body condition, age, genetics and presence of the calf.

The lactation length decreased in parasite-infected cows, with local cows averaging 175.40±6.95 days compared to 197.5±5.3 days in the control group, and crossbred cows averaging 468.5±14.1 days compared to 513.8±28.1 days in controls (Table 2). This reduction is consistent with findings by Rahman et al. (2013), who reported that parasitic infestations lead to a decline in milk yield and lactation duration by reducing feed efficiency and overall metabolic performance. According to Hossen et al. (2012), lactation time was significantly impacted by the calving season, but sire, parity, and calving year had no significant effects.

The calving interval was slightly prolonged in parasite-infected cows, with local breeds averaging 492±0.75 days compared to 481.3±0.8 days in controls, and crossbreds averaging 516.5±9.48 days compared to 581.5±17.48 days in controls. Saha et al. (2008) attributed such variations to the effect of parasitic infections on uterine health and postpartum recovery. Hossen et al. (2012) also noted that crossbreds typically show longer calving intervals due to their increased susceptibility to environmental stressors and reproductive inefficiencies.

In this study the gestation length showed minimal variation, with local cows averaging 285±1.5 days and crossbred cows 283±3.26 days in parasite-infected groups, compared to 286.2±1.5 days and 282±2.86 days in controls (Table 2). These findings align with Rahman et al. (2013) and Kabir et al. (2013), who reported that gestation length is relatively stable, though parasitic infestations might have minor effects due to metabolic and hormonal disruptions. Rahman (2006) verified that the gestation lengths of 281.1 and 282.7 days, respectively, were observed for Sahiwal x indigenous and Friesian x indigenous. The gestation lengths of Desi, Friesian x Desi, and Sahiwal x Desi cows were reported to be 279.7, 278.2, and 278.8 days, respectively (Sarder et al., 2007). The average gestation length of Holstein-Friesian, or sahiwal, was determined to be 275±3.95, 276±4.26 days (Rukonojjaman et al., 2009). Variation in gestation length within the species may be contributed mainly by load of parasitic infestation, maternal and fetal factors. The maternal factors include age, nutritional status and body condition of the animals.

This study highlights the adverse effects of parasitic infestations on the hematological and reproductive performance of local and crossbred dairy cows. Crossbred cows exhibited a higher prevalence of parasitic infections compared to local breeds, indicating their greater susceptibility to parasitic and environmental challenges. Parasitic infestations led to reduced hemoglobin, packed cell volume, and total erythrocyte counts in both groups, causing anemia and impaired oxygen transport, while elevated leukocyte counts reflected an active immune response. These hematological changes were associated with delays in puberty, increased services per conception, extended postpartum intervals, reduced lactation lengths, and prolonged calving intervals, with crossbred cows experiencing greater reproductive inefficiencies. Despite minimal changes in gestation length, the overall reproductive performance was notably compromised in parasite-affected cows. These findings emphasize the importance of effective parasitic control, improved nutrition, and targeted management strategies to enhance the health and productivity of dairy cows, particularly crossbreds, in the region.

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Conflict of Interest
The authors declare no conflict of interest.

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