Prevalence of gastrointestinal parasitic infections, haemoprotozoan diseases and their associated risk factors in sheep and goat in selected hilly areas of Bangladesh

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This is to certify that we have examined the above Master's thesis and have found that is complete and satisfactory in all respects, and that all revisions required by the thesis examination committee have been made

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The author
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ABBREVIATIONS

%	percent
A	Adenine
bp	Base pair
C	Cytosine
CAT	Card Agglutination Test
CVASU	Chattogram Veterinary and Animal Sciences University
DLS	Directorate of Livestock Services
e.g	example
ELISA	Enzyme Linked Immuno-Sorbent Assay
etc	Et cetra
FY	Fiscal Year
G	Guanine
GDP	Gross Domestic Products
GI	Gastrointestinal
GIN	Gastrointestinal Nematode
GIT	Gastrointestinal tract
HCT	Hematocrit Centrifugation Technique
HRM	High Resolution Melting
IFAT	Indirect Immunofluorescence Antibody Test
LAMP	Loop Mediated Isothermal Amplification
NARC	National Agricultural Research Centre
NGS	Next Generation Sequencing
nPCR	Nested Polymerase Chain Reaction
PCR	Polymerase Chain Reaction
qPCR	Quantitative Polymerase Chain Reaction
RFLP	Restriction Fragment Length Polymorphism
RLB	Reverse Line Blot
sp.	species
SSU	Small Sub-unit
T	Thymine

TBDs	Tick Borne Diseases
TBPs	Tick Borne Protozoa

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ABSTRACT

Gastrointestinal parasitism and haemoparasitism in small ruminants are known to impose substantial economic burdens on owners. A cross sectional study was conducted to investigate the prevalence of gastrointestinal parasites and haemoparasites of small ruminants from three unions of Khagrachari district, namely Panchori, Golabari and Sadar. The fecal samples, blood samples and tick samples were collected from a total of 279 goats (97) and sheep (182) from study areas. All the specimens were subjected to microscopic examination technique first then blood samples (118) and tick samples (12) were examined by polymerase chain reaction for the detection of haemoparasites. Selected positive samples (9) were sent for sequencing and then phylogenetic analysis was done using sequenced data. The overall prevalence of gastrointestinal parasitic infection was found 55.67% (54) and 63.19% (115) in goats and sheep, respectively. The prevalence of parasites was variable with *Fasciola* sp. (27.84%), *Strongyloides* sp. (15.38%), *Trichostrongylus* sp. (14.84%), *Paramphistomum* sp. (9.89%), *Trichuris* sp. (8.24%) and Oesophagostomum sp. (6.04%). Overall haemoprotozoan infections were 42.27% and 40.11% in goats and sheep, respectively. The prevalence of *Babesia* sp., *Anaplasma* sp. and *Theileria* sp. were detected (38.64%, 29.73%), (38.64%, 28.38%) and (25.00%, 17.57%) in goats and sheep respectively by polymerase chain reaction. Parasitic ova and haemoparasitic infection rate in male and female exhibited no significant variations ($p>0.05$) between them. The infection was significantly higher in adult than young. Seasonal variation was found between winter and summer season. Haemoparasites are more prevalent in summer but opposite observation was found in case of gastrointestinal parasites. Two types of ticks were identified where *Boophilus* sp. is more prevalent than *Haemophysalis* sp. in both goats and sheep. *Babesia* sp. is identified from extracted DNA of *Haemophysalis* sp. tick. Finally, the random sequencing of isolates from *Babesia* sp., *Anaplasma* sp. and *Theileria* sp. revealed *Babesia ovis*, *Anaplasma bovis*, *Anaplasma phagocytophilum* and *Theileria lewenshuni* from goat and sheep and phylogenetic analysis prove the transmission of *Babesia ovis* though *Haemophysalis* sp. tick. Further investigation is necessary for a structured surveillance to investigate more variances of them to formulate effective control measures.

Key words: Gastrointestinal parasites, Goat, Haemoparasites, Hilly areas, Ticks, PCR, Phylogenetic analysis, Sheep.