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Epidemiological Risk Factors and Progression of Gastrointestinal Parasitic Infestation among Food Animals of Bangladesh: A Systematic Review and Meta-analysis

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A B S T R A C T

The gastrointestinal parasitic infestation seems to have a substantial economic impact on the entire livestock production industry. Because of the parasites' environmental appropriateness, numerous domestic animals in Bangladesh are particularly susceptible to the infestation; however, the extent to which people are aware of the potential risk factors is debatable. Therefore, the current meta-analysis' objective is to determine the precise understanding of potential risk variables and the impact of climatological variations on five important gastrointestinal parasites: Paramphistomum species, Strongyloides species, Trichuris species, Schistosoma species, and Moneizia species. Four globally recognized databases, including Web of Science, Scopus, PubMed, and Google Scholar were screened to choose the studies published in English language from 2000 to 2020. Finally, 29 studies were selected for further analysis and recorded the maximum prevalence in Paramphistomum species (26%; 95% CI: 19-33), followed by Strongyloides species (9%, 95% CI: 5-12), Trichuris species (10%, 95% CI: 4-17), Schistosoma species (19%, 95% CI: 7-31), and Moneizia species (8%, 95% CI: 5-10); besides the overall prevalence was noted as 15% (95% CI: 11-18). Furthermore, subgroup analysis revealed that parasite infestation was most prevalent in females (21%) and the elderly animal population (14%) and the summer season (26%). To sum up, the current meta-analysis visualized the epidemiological risk factors with the overall incidence of five major parasite infestations in livestock animals in Bangladesh; hence, the government and shareholders may employ it as proof before launching any control programs or improving farmers' awareness.

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Introduction

Livestock farming is a great way to live for many Bangladeshi families, with approximately 80% pastoral people wholly or partially linked with farming (Siddiki et al., 2010). However, several gastrointestinal (GI) parasites, including *Paramphistomum species*, *Strongyloides species*, *Trichuris species*, *Schistosoma species*, and *Moneizia species*, causing a significant threat to the livestock population such including cattle, buffalo, goat and sheep (Squire et al., 2018), consequently has to count a massive financial losses (Mavrot et al., 2015). To be somewhat more specific, parasitic infestations in lactating cows reduce milk yield by 1.2 to 2.2 kg per cow per day (Moussouni et al., 2018). Moreover, poor reproductive efficiency, weight loss, and gastrointestinal discomfort have also been documented (Mavrot et al., 2015); besides, the pathogens are responsible for amplifying bacterial and viral diseases exposure, the deformability of carcass and organ condemnation losses along with drug and veterinary costs (Gunathilaka et al., 2018).

Furthermore, in Bangladesh, the affirmative geographical environment such as the bounty of water, low-lying areas, inadequate husbandry practice, and lack of feed instigate for multiplying and rapid spreading of the above-listed parasites (Ilyas et al., 2016a). Additionally, owning to Bangladesh's moderate winter and prolonged summer, comprising the rainy season, gastrointestinal parasites and their intermediate host, known as the snail, are more ubiquitous (Islam et al., 2017). Nevertheless, GI parasitism is underestimated because of most infected animal exhibit merely a few disease manifestations during their productive lives. Consequently, clinical symptoms such as lack of appetite, diarrhea, and malabsorption are only used to establish a preliminary diagnosis, and various fecal examination tests practiced to confirm the diagnosis (Hoste et al., 2006). In contrast, anthelmintics and antiprotozoal agents have been applying recklessly to treat gastrointestinal parasitic infections in the field practice and escalating the anthelmintic drug resistant parasites among Asian countries including Bangladesh (Gunathilaka et al., 2018).

Since last two decades, numerous epidemiological studies on the ruminant gastrointestinal parasites have previously been conducted in Bangladesh's various regions including, Chittagong (Bhowmik et al., 2020), Sirajgong (Kabir et al., 2019), Sunamgong (Hossain et al., 2016), and Pirgang (Rahman et al., 2014). In conjunction, these experiments were performed at a specific time and confined to a particular species and areas. Therefore, current meta-analysis aims to compile all previous studies conducted between 2000 and 2020 to provide detailed information on the prevalence, epidemiological risk factors of major gastrointestinal parasitic that assist Bangladesh's Livestock department and the government to take effective control and prevention initiatives for mitigating potential occurrence. Moreover, the data could be an assisted tool to the farmers for proper management as well as increase productivity.

Materials and Methods

Study Protocol and Literature Search Strategy

The “preferred Reporting Items for Systematic Studies and Meta statement (PRISMA)” protocol was utilized for the configuration, appraisement, anatomization, and critique of all certified studies (Moher et al., 2015). To evaluate the manifestation of gastrointestinal parasites in cattle from the perspective of Bangladesh, we used a methodical meta-analysis of full manuscripts or compendium of publications accessible online. Research papers were published 2000 to 2020, which were scrutinized in four illustrious databases: Web of sciences, Scopus, PubMed, and Google Scholar, as well as regional journals. To accomplish the Google, the following scientific names or terminologies or words were applied: ‘Intestinal and gut parasites’ or ‘Paramphistomum spp.’, ‘Strongyloides spp..’, ‘Trichuris spp..’, ‘Schistosoma spp.’, and ‘Moneizia spp..’), as well as (‘Predominance or Epidemiology’), and finally (‘cattle,’ ‘bovine,’ ‘buffalo,’ ‘caprine,’ ‘goat,’ ‘sheep’) and Bangladesh. We also accumulated the source section of entire interconnected studies for other indistinguishable investigations that are not included in search keywords.

Selection of Studies and Data Extraction

The authorized studies' headlines and synopses were elected first. Following that, multitudinous data were removed, the entire text of pertinent documents was reestablished, and the articles validation was confirmed. The indispensable data was then processed and recorded in Microsoft Excel for further examination. Each study's first author's name, publication date, research length, division (location), sex and age of the individual population, diagnostic process, number of samples, case positives, and percentage of seroprevalence were accumulated for the meta-analysis. As a criterion for selecting studies for methodical evaluation and meta-analysis, we implemented six inclusion criteria: (1) The current state of affairs is restricted to cattle, buffalo, sheep, and goat; (2) Pervasiveness, which includes epidemiological inspections, written and broadcasted in English with complete narrative or synopses as well as the geological location in Bangladesh; (3) Direct smear, Flotation, Sedimentation, Histopathology, Saturated solution, McMaster, ova Stool's count, Alcohol retraining, and Morphology detection techniques were applied in experiments to diagnosis the parasitic infection; (4) Papers published between January 1st, 2000, and December 31th, 2020; (5) Grasping the sample size (more than 31) comprising the prevalence rate.

Assessment of Bias, Data Preparation and Analysis

The biases, working clustered passiveness with 95 percent confidence interval (CI), and aimed at computation utilized via Jamvoi 1.2.27 software to finalize this scrutinization. Meta-analysis is a procedure that acknowledges authentic proportions to be dispensed through published papers. We applied the subgroup (specific prevalence in cattle, buffalo, sheep, and goat) study with conceivable risk factors to the clustered passiveness of overall omnipresence (age, sex, sample size, season, and duration).

Besides, we observed the I^2 statistical test range of 50% out of 100% as more heterogeneous when seeking research heterogenicity. Similarly, Q-statistics and Z-test were computed, and the overall prevalence was concocted in a forest diagram. Finally, we illustrate the funnel plot graphically to demonstrate the predicaments of publishing bias. P-value (<.001) was implemented in all statistical examinations and techniques in this inspection or analysis. Finally, we visualized study location (Figure 2), forest plot (Figure 3), funnel plot (Figure 4) and risk factors (Figure 5) of all gastrointestinal parasite listed above.

Result

Bibliography search result

Figure 1 represents the study selection process, were searching the related article in recognized database. Then we got 70 research papers fulfilled the primary criteria. From the selected articles, after accessing the duplicate study and abstract reading, 29 studies were selected for final evaluation. The features of the included study were presented in Table 1.

Prevalence with Risk Factors

With regards to risk factors, a decade of studies (2000-2010) demonstrated total 11 studies with 19% prevalence (95% Cl: 13-25). Again, in the second phase (2011-2020), there were total 14 studies which reported 11% prevalence (95% Cl: 7-15). Species wise, for cattle: total 16 studies incorporating with 14% prevalence (95% Cl: 9-20). For buffalo, total 4 studies regarding with 18% prevalence (95% Cl: >0-44). For goat, total 9 studies with 16% prevalence (95% Cl: 11-21). For sheep, total 5 studies including with 14% prevalence (95% Cl: 7-20).

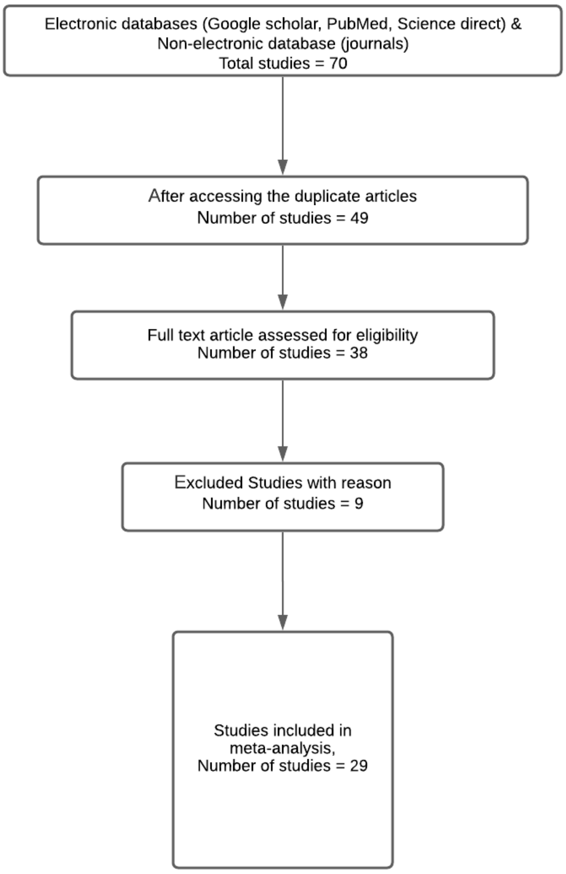

Figure 1 Flow chart of the study selection process based of PRISMA guidelines

Figure 2 Study location on the basis of districts of Bangladesh

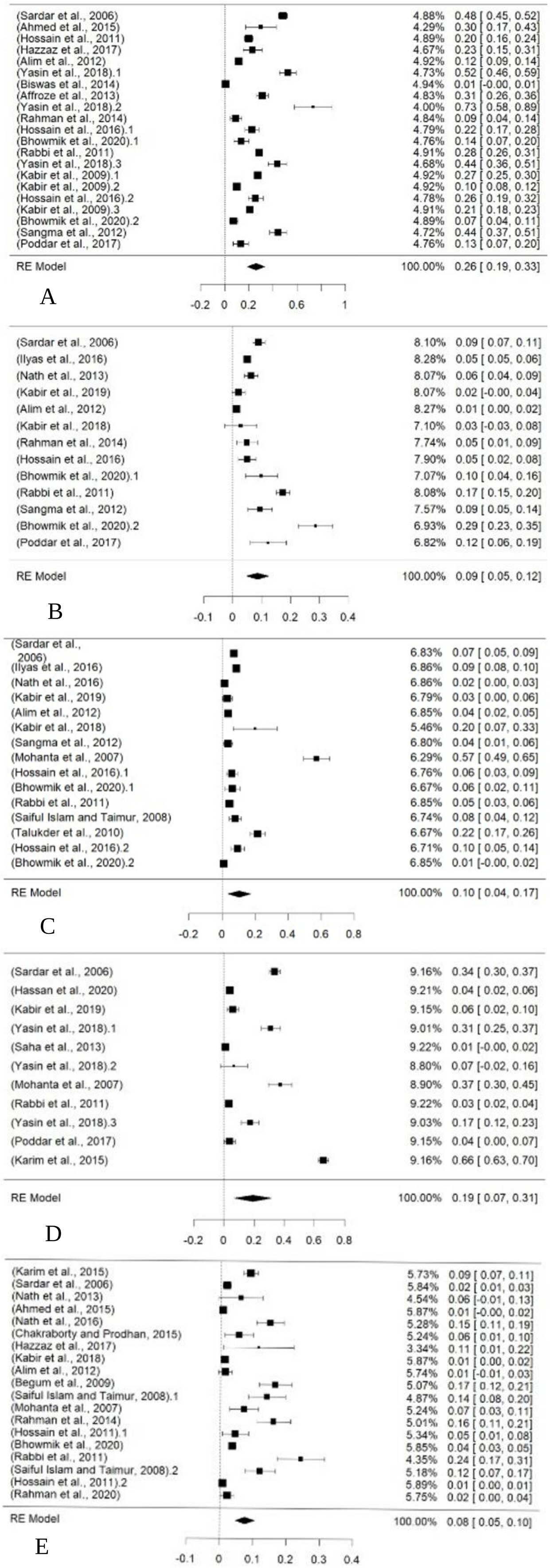

Figure 3 Forest plot showing the prevalence of gastrointestinal parasite among livestock populations.
(A: *Paramphistomum species*, B: *Strongyloides species*, C: *Trichuris species*, D: *Schistosoma species*, and E: *Moneizia species*)

Table 1. Features of the included studies in the systemic review and meta-analysis

Study	Duration	Species	Test method	PC/TS	Pr	P
(Sardar et al., 2006)	2002-2003	Cattle	Direct smear/ Sedimentation/ McMaster	347/720	48.19	P1
(Ahmed et al., 2015)	2013	Cattle	Direct smear/ Sedimentation/ Flotation	15/50	30.00	P1
(Hossain et al., 2011)	2014-2015	Cattle	McMaster /Direct smear	100/500	20.00	P1
(Hazzaz et al., 2017)	2016-2017	Cattle	Sedimentation/ Flotation/Stool's Ova Counting	25/109	22.94	P1
(Alim et al., 2012)	N/A	Cattle	Direct smear/ Sedimentation/ Flotation	79/684	11.55	P1
(Yasin et al., 2018)	N/A	Cattle	Sedimentation	108/206	52.43	P1
(Biswas et al., 2014)	2011-2012	Buffalo	Egg's morphology/ Quantitative test	3/497	0.60	P1
(Affroze et al., 2013)	2008-2009	Cattle	Stoll's Ova Counting technique	109/350	31.14	P1
(Yasin et al., 2018)	N/A	Buffalo	Sedimentation	22/30	73.33	P1
(Rahman et al., 2014)	2010	Goat	Direct smear/ Sedimentation/ Flotation	13/140	9.29	P1
(Hossain et al., 2016)	2014	Goat	Sedimentation/ Flotation/ McMaster	45/200	22.50	P1
(Bhowmik et al., 2020)	2019	Goat	Direct smear/ Sedimentation/ Flotation	15/110	13.64	P1
(Rabbi et al., 2011)	N/A	Goat	Stoll's Ova Counting technique	316/1110	28.47	P1
(Yasin et al., 2018)	N/A	Goat	Sedimentation	70/160	43.75	P1
(Kabir et al., 2009)	2008	Cattle	Histopathology	398/1460	27.26	P1
(Kabir et al., 2009)	2008	Buffalo	Histopathology	62/620	10.00	P1
(Hossain et al., 2016)	2014	Sheep	Sedimentation/ Flotation/ McMaster	51/200	25.50	P1
(Kabir et al., 2009)	2008	Goat	Histopathology	203/970	20.93	P1
(Bhowmik et al., 2020)	2020	Sheep	Direct smear/ Sedimentation/ Flotation	16/220	7.27	P1
(Sangma et al., 2012)	2010	Sheep	Stoll's Ova Counting/ Morphology	84/190	44.21	P1
(Poddar et al., 2017a)	2016	Sheep	Stoll's Ova Counting technique	14/106	13.21	P1
(Sardar et al., 2006)	2002-2003	Cattle	Direct smear/ Sedimentation/ McMaster	65/720	9.03	P2
(Ilyas et al., 2016b)	2009-2010	Cattle	Direct smear/ Sedimentation/ Flotation	278/5400	5.15	P2
(Nath et al., 2013)	2011-2012	Cattle	Flotation/ Saturated Solution	29/450	6.44	P2
(Kabir et al., 2019)	2016	Cattle	Direct smear/ Sedimentation/ Flotation	3/150	2.00	P2
(Alim et al., 2012)	N/A	Cattle	Direct smear/ Sedimentation/ Flotation	9/684	1.32	P2
(Kabir et al., 2018)	N/A	Cattle	Flotation	1/35	2.86	P2
(Rahman et al., 2014)	2010	Goat	Direct smear/ Sedimentation/ Flotation	7/140	5.00	P2
(Hossain et al., 2016)	2014	Goat	Sedimentation/ Flotation/ McMaster	10/200	5.00	P2
(Bhowmik et al., 2020)	2019	Goat	Direct smear/ Sedimentation/ Flotation	11/110	10.00	P2
(Rabbi et al., 2011)	N/A	Goat	Stoll's Ova Counting technique	193/1110	17.39	P2
(Sangma et al., 2012)	2010	Sheep	Stoll's Ova Counting/ Morphology	18/190	9.47	P2
(Bhowmik et al., 2020)	2020	Sheep	Direct smear/ Sedimentation/ Flotation	63/220	28.64	P2
(Poddar et al., 2017a)	2016	Sheep	Stoll's Ova Counting technique	13/106	12.26	P2
(Sardar et al., 2006)	2002-2003	Cattle	Direct smear/ Sedimentation/ McMaster	53/720	7.36	P3
(Ilyas et al., 2016b)	2009-2010	Cattle	Direct smear/ Sedimentation/ Flotation	473/5400	8.76	P3
(Nath et al., 2016)	2011-2012	Cattle	Flotation/ Saturated Solution	7/450	1.56	P3
(Kabir et al., 2019)	2016	Cattle	Direct smear/ Sedimentation/ Flotation	5/150	3.33	P3
(Alim et al., 2012)	N/A	Cattle	Direct smear/ Sedimentation/ Flotation	26/684	3.80	P3
(Kabir et al., 2018)	N/A	Cattle	Flotation	7/35	20.00	P3
(Sangma et al., 2012)	2010	Sheep	Stoll's Ova Counting/ Morphology	4/190	3.68	P3
(Mohanta et al., 2007)	2005-2006	Goat	Histopathology	86/150	57.33	P3
(Hossain et al., 2016)	2014	Goat	Sedimentation/ Flotation/ McMaster	12/200	6.00	P3
(Bhowmik et al., 2020)	2019	Goat	Direct smear/ Sedimentation/ Flotation	7/110	6.36	P3
(Rabbi et al., 2011)	N/A	Goat	Stoll's Ova Counting technique	51/1110	4.59	P3
(Saiful Islam and Taimur, 2008)	2005-2006	Goat	Sedimentation/ Flotation/ Saturated Solution method	18/224	8.04	P3
(Talukder et al., 2010)	2007-2008	Goat	Histopathology	70/325	21.54	P3
(Hossain et al., 2016)	2014	Sheep	Sedimentation/ Flotation/ McMaster	19/200	9.50	P3
(Bhowmik et al., 2020)	2020	Sheep	Direct smear/ Sedimentation/ Flotation	2/220	0.91	P3
(Sardar et al., 2006)	2002-2003	Cattle	Direct smear/ Sedimentation/ McMaster	242/720	33.61	P4
(Hassan et al., 2020)	2014-2015	Cattle	McMaster /Direct smear	20/500	4.00	P4
(Kabir et al., 2019)	2016	Cattle	Direct smear/ Sedimentation/ Flotation	9/150	6.00	P4
(Yasin et al., 2018)	N/A	Cattle	Sedimentation	64/206	31.07	P4
(Saha et al., 2013)	2012	Buffalo	Direct smear/ Sedimentation/ Flotation	3/270	1.11	P4
(Yasin et al., 2018)	N/A	Buffalo	Sedimentation	2/30	6.67	P4
(Mohanta et al., 2007)	2005-2006	Goat	Histopathology	56/150	37.33	P4
(Rabbi et al., 2011)	N/A	Goat	Stoll's Ova Counting technique	36/1110	3.24	P4
(Yasin et al., 2018)	N/A	Goat	Sedimentation	28/160	17.50	P4
(Poddar et al., 2017a)	2016	Sheep	Stoll's Ova Counting technique	4/106	3.77	P4
(Karim et al., 2015)	2012-2013	Cattle	Sedimentation/ Methylene blue	504/762	66.14	P4
(Sardar et al., 2006)	2002-2003	Cattle	Direct smear/ Sedimentation/ McMaster	64/720	8.89	P5
(Nath et al., 2013)	2011-2012	Cattle	Flotation/ Saturated Solution	8/450	1.78	P5
(Ahmed et al., 2015)	2013	Cattle	Direct smear/ Sedimentation/ Flotation	3/50	6.00	P5
(Nath et al., 2016)	2014	Cattle	Direct smear and Formol-ether concentration	3/400	0.75	P5
(Chakraborty and Prodhan, 2015)	2011	Cattle	Direct smear/ Sedimentation/ Flotation	42/283	14.84	P5
(Hazzaz et al., 2017)	2016-2017	Cattle	Sedimentation/ Flotation/Stool's Ova Counting	6/109	5.50	P5
(Kabir et al., 2018)	N/A	Cattle	Flotation	4/35	11.43	P5
(Alim et al., 2012)	N/A	Cattle	Direct smear/ Sedimentation/ Flotation	9/684	1.32	P5
(Begum et al., 2009)	N/A	Cattle	McMaster and Stoll's ova method	2/138	1.45	P5
(Saiful Islam and Taimur, 2008)	2005-2006	Goat	Sedimentation/ Flotation/ Saturated Solution method	37/224	16.52	P5
(Mohanta et al., 2007)	2005-2006	Goat	Histopathology	21/150	14.00	P5
(Rahman et al., 2014)	2010	Goat	Direct smear/ Sedimentation/ Flotation	10/140	7.14	P5
(Hossain et al., 2011)	2014	Goat	Sedimentation/ Flotation/ McMaster	32/200	16.00	P5
(Bhowmik et al., 2020)	2019	Goat	Direct smear/ Sedimentation/ Flotation	5/110	4.55	P5
(Rabbi et al., 2011)	N/A	Goat	Stoll's Ova Counting technique	41/1110	3.69	P5
(Saiful Islam and Taimur, 2008)	2005-2007	Sheep	Sedimentation/ Flotation/ Saturated Solution method	33/136	24.26	P5
(Hossain et al., 2011)	2014	Sheep	Sedimentation/ Flotation/ McMaster	24/200	12.00	P5
(Rahman et al., 2020)	2018	Cattle	Direct smear/ Sedimentation/ Flotation	12/1491	0.80	P5
(Bhowmik et al., 2020)	2020	Sheep	Direct smear/ Sedimentation/ Flotation	5/220	2.27	P5

P: Parasite, PC/TS: Positive case / Total sample, Pr. Prevalence (%), P1: Paramphistomum spp., P2: Strongyloides spp., P3: Trichuris spp., P4: Schistosoma spp., P5: Moneizia spp.

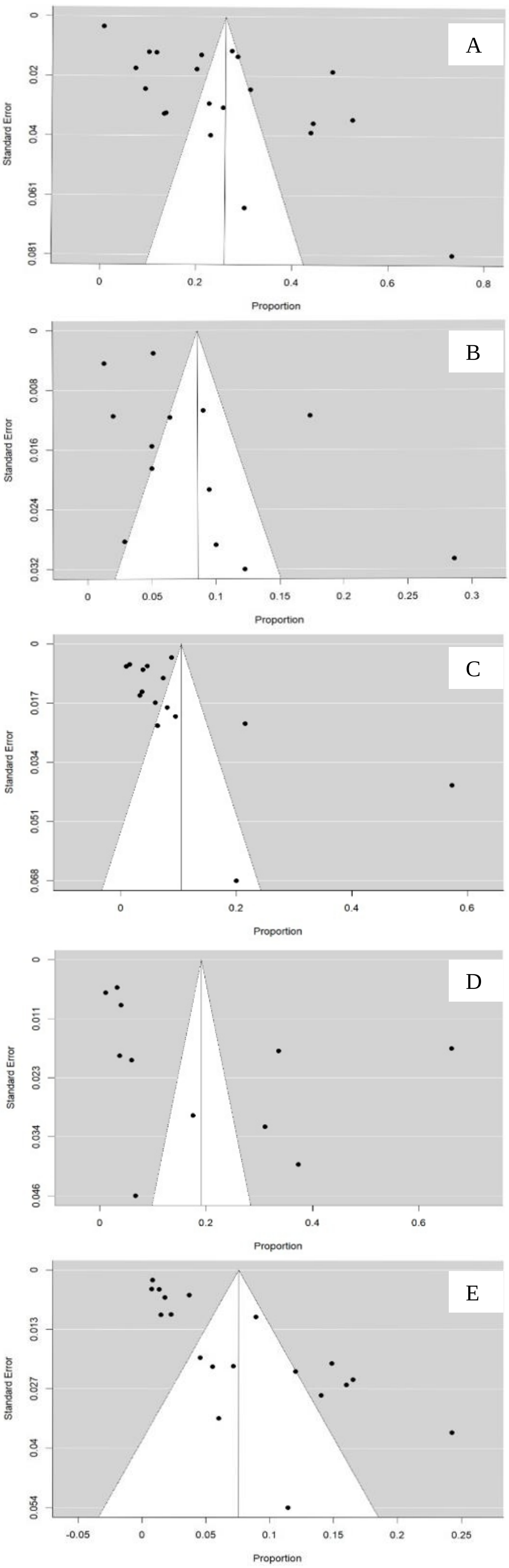

Figure 4. Funnel plot for included studies.
(A: Paramphistomum spp., B: Strongyloides spp., C: Trichuris spp., D: Schistosoma spp., and E: Moneizia spp.).

Gender wise, both for male and female total 10 studies, where in male had 16% prevalence (95% Cl: 9-24), and female had 21% prevalence (95% Cl: 12-30). Age wise, both for young and adult total 10 studies, where young had 12% prevalence (95% Cl: 7-17), and old had 14% prevalence (95% Cl: 7-12). Season wise, three seasons: winter, summer and rain had same total 6 studies, where we found total 25% prevalence (95% Cl: 13-37) in winter, 26% prevalence (95% Cl: 13-39) in summer, and 24% prevalence (95% Cl: 10-38) in rain. Finally, the overall prevalence was 15% (95% Cl: 11-18)

In *Paramphistomum species*, 15 studies were conducted with sample size of 8632, where 2095 cases found with 26% prevalence (95% Cl: 19-33). In *Strongyloides species*, 12 studies were conducted with sample size of 9705, where 716 cases found with 9% prevalence (95% Cl: 5-12). In *richuris species*, 13 studies were conducted with sample size of 10168, where 843 cases found with 10% prevalence (95% Cl: 4-17). In *Schistosoma species*, 9 studies were conducted with sample size of 4164, where 968 cases found with 19% prevalence (95% Cl: 7-31). In *Moneizia species*, 16 studies were conducted with sample size of 6850, where 361 cases found with 8% prevalence (95% Cl: 5-10).

Discussion

Parasitism is extremely important in many agro-ecological zones and is a notable threat to the global livestock economy (Borges et al., 2013). In most cases, infections remain subclinical, resulting in significant financial losses owing to animal mortality and lower output (Charlier et al., 2015). Conferring to the findings of our meta-analysis, the overall prevalence was reported as 15%; however, (Dagnachew et al., 2011) stated that the prevalence of gastrointestinal parasites in domestic animals from all over the world differed from 0.72 to 84.1%; meanwhile, more precisely the prevalence rate reported 55.6% in Ghana (Squire et al., 2018), and 60% in Ethiopia (Telila et al., 2014). Thus, the current meta-analysis attempted to focus on the prevalence of gastro-intestinal parasites by describing various risk factors such as period, species, gender, age, and season (Table 2). According to parasite species, the highest prevalence (26%) was found in *Paramphistomum species*, which ranges from 17.83% in Pakistan (Tehmina et al., 2016). In contrast, the lowest prevalence of 8% was inscribed in Moneizia spp. (Table 3). Likewise, other studies also stated (Admasu and Nurlign, 2014; Swarnakar et al., 2015) the lower prevalence rate of Moneizia spp. in livestock animals, which could be due to less egg dissemination in the feces from the gravid segments (Radostits et al., 1994). Moreover, analyzing the result, our proposed meta-analysis asserted a meaningful prevalence rate (19%) between 2000 and 2010, as opposed to the previous decade. The reasons, including physical condition, breeding status, farmer advanced educational level, financial capability, improved management standard, and proper anthelmintic use, could significantly decrease the prevalence rate in recent years (Awraris et al., 2012).

Furthermore, the highest prevalence was found in buffalo than cattle, analyzing the subgroup of species based on large ruminants. Likewise, previous research affirmed the higher prevalence rate of 75% in buffalo than cattle (56.25%) (Bilal et al., 2009). To be somewhat more specific, the buffalo's wallowing activity may blame the high prevalence rate. Besides, the feeding habit and geoclimatic conditions may favor the survival of infective stages of parasites and intermediate hosts for species-specific differences (Kakar et al., 2008). In opposition, for small ruminants, the study found that sheep had a 14% prevalence rate termed a much lower prevalence rate than goats (16%). Similarly, the results are consistent with previous research (Gadahi et al., 2009; Poddar et al., 2017b), exposed that goats had a higher susceptible rate of gastrointestinal parasitic infections than sheep. The grazing habits of parasitism in goats and sheep may play a role in the variation of parasitism. Additionally, developed sheep's gastrointestinal physiology or sheep could be genetically more repellent to gastrointestinal parasites than goats (Rahman et al., 2017).

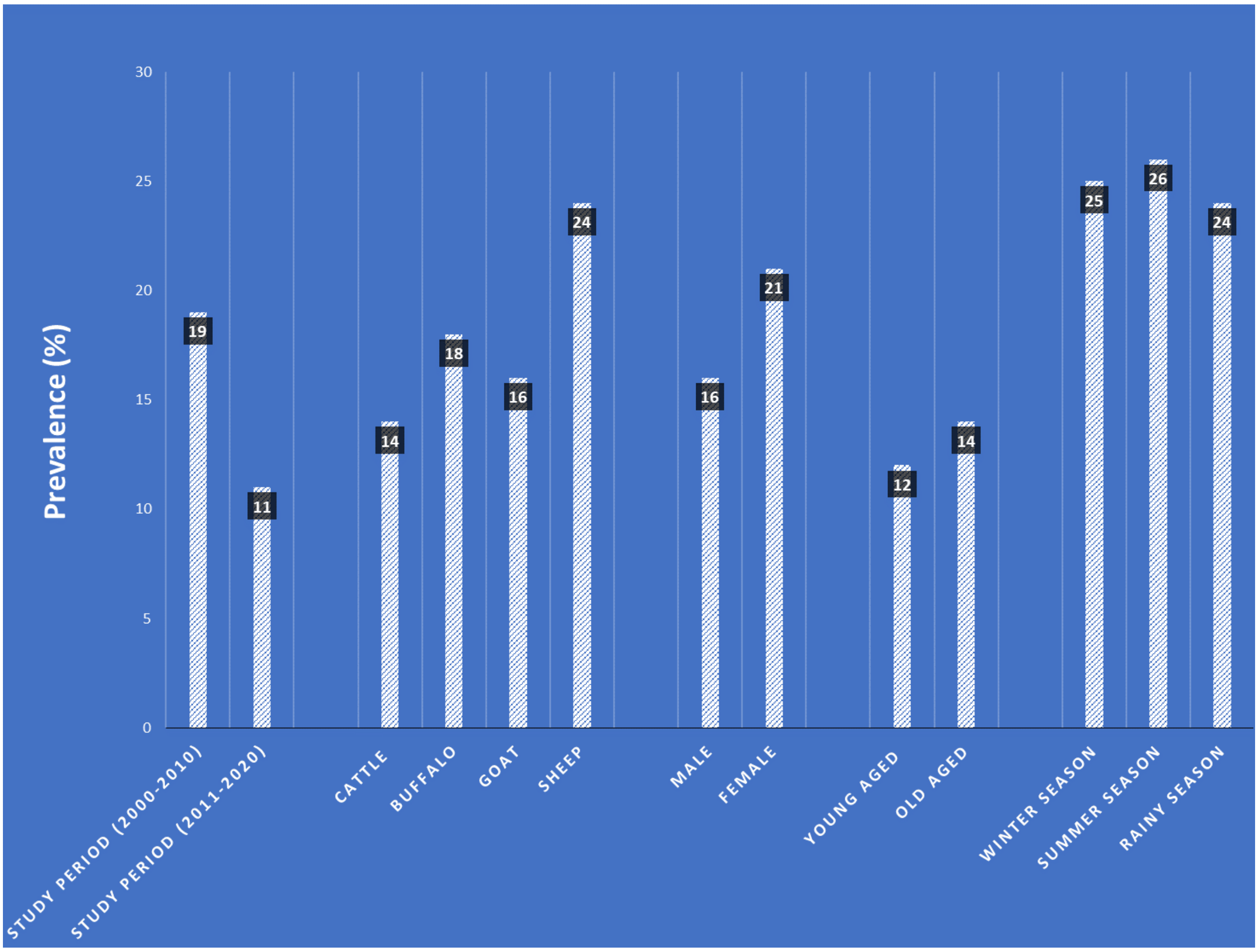

Figure 5. Graphical representation of risk factors.

Table 2. Potential risk factor with heterogenicity test of the gastrointestinal parasites.

Variables	Sub group	No. of studies	Pooled prevalence		Heterogeneity			
			Prevalence (%) (Random model)	95% CI	P value	Z- Value	Q-value	I^2 (%)
Study period	2000-2010	11	19	13-25	< .001	6.27	1584.7	99.4
	2011-2020	14	11	7-15	< .001	5.09	1974.4	99.4
Species	Cattle	16	14	9-20	< .001	5.19	3718.1	99.7
	Buffalo	4	18	>0-44	< .001	1.32	137.1	99.9
	Goat	9	16	11-21	< .001	5.97	959.6	98.8
	Sheep	5	14	7-20	< .001	4.25	331.2	97.9
Sex	Male	10	16	9-24	< .001	4.16	980.3	98.8
	Female		21	12-30	< .001	4.43	1745.3	99.3
Age	Young	10	12	7-17	< .001	4.72	1460.2	99.4
	Old		14	7-12	< .001	3.86	229.5	97.5
Season	Winter	6	25	13-37	< .001	4.02	1136.8	99.8
	Summer		26	13-39	< .001	3.89	1176.2	99.4
	Rain		24	10-38	< .001	3.30	1165.2	99.8
Overall		29	15	11-18	< .001	8.65	5437.4	99.6

Table 3. Overall prevalence with heterogenicity test of the gastrointestinal parasites

Parasite species	No. of studies	Species pooled prevalence			95% CI	Heterogeneity		
		Sample size	Cases	Prevalence (%)		Q-value	I^2 (%)	Z value
Paramphistomum species	15	8632	2095	26	19 - 33	2154.5	99.12	7.04
Strongyloides species	12	9705	716	9	5 - 12	286.2	98.1	4.35
T*Trichuris species*	13	10168	843	10	4 - 17	408.4	99.5	3.00
Schistosoma species	9	4164	968	19	7 - 31	1695.5	99.6	3.05
Moneizia species	16	6850	361	8	5 - 10	276.2	98.3	5.06

Separating the age group, the prevalence was significantly affected by age in the current study. The meta-analysis exposed higher infection in adult (14%) than young ruminants (12%) that in line with the previous study (Biu et al., 2009; Hassan et al., 2011), informed that old aged conferred more susceptivity to gastrointestinal parasitism. In contrast, other researchers reported that the susceptibility and pathogenicity of nematode infections were more remarkable in young animals, possibly due to differences in agroecology of the study areas (Awraris et al., 2012).

Afterward, the sex-wise distribution, the parasitic prevalence rate was higher in females considering the males that advocate the previous study (Maharana et al., 2016). Going deeper, physiological characteristics of female animals, which often act as stressors, lowering their immunity to infections, and because they are lactating mothers, females are weak and malnourished, as a result of which they are more susceptible to the infections besides some other reasons (Mir et al., 2013; Singh et al., 2017).

Findings from our data analysis, the highest prevalence is in the summer, followed by rain and winter, consistent with previous research (Yadav et al., 2006). Furthermore, (Singh et al., 2013) found that cold stimulus causes larval development to be halted. Animals are also partially stall-fed during the winter and rain to reduce the risk of infection. Grazing time is reduced during these times, and pre-parasitic stages go through hypobiosis, resulting in low infection.

Considering the limitation, the current study has some flaws, such as small sample size and a lack of studies from all parts of the country. As a result, the prevalence rate in the study may differ slightly from the actual prevalence rate.

Conclusion

The parasitic infection of the gastrointestinal tract in livestock animals is a major threat to the developing economies of Bangladesh, as the parasite is responsible for inappetence, diarrhea, and poor growth. As a result, having a thorough understanding of the parasitic prevalence and the risk factors identified in the meta-analysis may in the implementation of control and prevention programs.

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Declarations of interest

None

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