



Effect of Host Factors on the Prevalence of Gastrointestinal Parasites in Goats of Maharashtra

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ABSTRACT

A year round epidemiological survey of gastrointestinal parasites of goats from different regions of Maharashtra was carried out during 2017-18 in which faecal samples of 667 goats were examined. The overall prevalence of parasitism in goats was recorded as 74.66%. While it was to the tune of 87.57%, 76.15%, 65.00% and 71.57% for goats and for sheep it was 70.16, 56.57, 66.66 and 51.33 percent from Western Maharashtra, Vidarbha, Marathwada and Konkan region, respectively. The age wise prevalence reported in the goats of Western Maharashtra showed higher prevalence in adult stage as 91.44% as against 22.22% in the age group below one year. As regards sex wise prevalence there recorded non-significant difference among both the sexes from across the state. In Vidarbha, Marathwada and Konkan regions it was almost equal in quantum in both the age groups. Regarding breed-wise prevalence in goats, it showed non-significant differences among the four breeds from all the regions of state.

HIGHLIGHTS

- Goats of all the geographic regions of Maharashtra are equally susceptible to GI Parasites.
- Age, sex, breed are equally important risk factors for GI Parasites in goats.
- Gastrointestinal nematodes constitute major part of GI Parasites of goats in Maharashtra.

Keywords: GI Parasites, Maharashtra, goats, biotic factors, nematodes

As compared to large ruminants like cattle and buffalo, the small ruminants (sheep and goat) do not require big investments in terms of land, infrastructure and funds and therefore have been considered a major component for securing the livelihood of marginal and landless farmers in India (Kumar *et al.*, 2010). Thus, the rural communities, particularly from drought prone area of different parts of country including Maharashtra have been involved in husbandry of small ruminants as their means of livelihood (Gokhale *et al.*, 2002). Goat is considered a bank on hooves for the farmers as the deposits in this bank can be liquidated and utilized for cash gains during difficult times (Joy *et al.*, 2020). The goat husbandry due to its nature of being practiced even under scarce resources has been

widely adopted in several social development schemes of government and non-government agencies (NABARD, 2018). Among the infectious diseases, bacterial and viral infections such as PPR, anthrax, hemorrhagic septicemia and foot and mouth disease can be prevented effectively through vaccination. However, parasitic infections particularly gastro-intestinal nematode parasites (GIN) are widely prevalent and persistent across the length and breadth of India. Unlike bacterial and viral diseases,

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subclinical nature of GI parasites, lack of effective deworming implementation and non-availability of vaccines are responsible for persistent and wide prevalence of parasitic diseases throughout country (Kumar *et al.*, 2008). The reasons for which is sub-clinical nature of GIN infections, lack of effective and proper implementation of deworming strategies in infected animals and moreover the non-availability of vaccines against them (Kumar *et al.*, 2016). GI parasites are primarily responsible for malnourishment, particularly in younger animals leading to stunted growth and loss of production (Selemon, 2018). In addition to this, the gastro-intestinal parasites indirectly influences the reproductive cycles leading to late puberty and irregular oestrus cycle.

Among the GI parasites of goats, *Haemonchus* sp. Is the most prevalent, hematophagous, highly pathogenic and economically important nematode species inhabiting in the abomasum (Selemon, 2018). It represents 15 percent of all gastro-intestinal diseases of small ruminant's world-wide and results in extensive financial losses as per FAO information (<http://www.fao.org>) Acute clinical haemonchosis results in severe anemia and may prove fatal in infected animals whereas, *Haemonchus* sp. Affects its hosts in several ways resulting in anemia and often becomes fatal in extremely affected animals (Nikolaou and Gasser, 2006). In less severe conditions, decreased production and economic loss due to treatment costs and control measures are common (Qamar and Maqbool, 2012; Getachew *et al.*, 2007).

It has been estimated that the gastro intestinal parasites are responsible for economic losses to the tune of 1191.71 million of rupees annually (Swarnkar and Singh, 2012). Owing to economic significance, it becomes imperative to control gastro-intestinal parasitism and in particular haemonchosis for sustainable and profitable goat farming. For which, adequate and accurate information about occurrence of GI parasites, their seasonal dynamics and about host factors like age, breed and sex predisposition is prerequisite. Based on such knowledge and integrated efforts in the form of Integrated Parasite Control (IPC) can be effectively run. Therefore, the present study was designed with the objective to record the state wide prevalence of GIN and haemonchosis from goats of Maharashtra.

METHODOLOGY

The epidemiological study of gastrointestinal parasitism was carried out in the different regions of Maharashtra, India having latitude 19.601194 and longitude 75.552979 co-ordinates of 19° 36' 4.2984" N and 75° 33' 10.7244" E. The prevalence of gastrointestinal parasitism in small ruminants of Maharashtra was worked out by collecting faecal samples from sheep and goats from four different regions of Maharashtra *viz.* Konkan (zone 2- very high rainfall zone with non-lateritic soil), Western Maharashtra (zone 3-Ghat Zone), Marathwada (zone 6 – Scarcity zone) and Vidarbha (zone 7- Assured rainfall zone) (Table 1). The faecal samples were collected during three different seasons *viz.* rainy, winter and summer. Two centers were identified in each region for collection of faecal samples of sheep and goats. Minimum 25 faecal samples each of sheep and goats were collected from all identified centers during all season. A total of 667 fecal samples were collected from goats throughout the study period of one calendar year *i.e.* October 2017 to September 2018.

Table 1: Centers selected for collection of faecal samples

No.	Name of the region	Name of centers
1	Konkan	Mumbai sub urban Area Dadae / Alonde, Tq. Vikramgad Dist. Palghar
2	Western Maharashtra	Punyashlok Ahilyadevi Maharashtra Mendhi va Sheli Vikas Prakshetra, Dahiwadi, Tq. Maan Dist. Satara Sheep and Goat Farm, M. P. K. V. Rahuri Dist. Ahmednagar
3	Marathwada	Golegaon, Tq. Sillod Dist. Aurangabad Jafrabad, Tq. Jafrabad Dist. Jalna
4	Vidarbha	Konti, Tq. Khamgaon Dist. Buldana Chandol, Tq. Buldana Dist. Buldana

The faecal samples either naturally voided or directly from rectum were collected in mini zip locked polythene bags and brought to the laboratory for further processing. Enough care was taken to retain moisture in the faecal samples during transportation. Each faecal sample was labeled appropriately to denote the species, age, breed and sex of the host as well as the location and season of

collection. The faecal samples were examined grossly for any parasitic infection. Then microscopic examination was carried out by floatation and sedimentation technique. The ova /oocysts encountered during the microscopic examination were identified with the help of standard keys described by Soulsby (1982).

The epidemiological data recorded throughout the investigation was analyzed by employing chi square test using online software WASP 2.0 (www.ccari.res.in) developed by ICAR – Central Coastal Agricultural Research Institute, Goa.

RESULTS AND DISCUSSION

The overall prevalence of parasitism in goats was recorded to the tune of 74.66 percent, while it was to the tune of 87.57, 76.15, 65.00 and 71.57 from Western Maharashtra, Vidarbha, Marathwada and Konkan region, respectively. Current study was conducted to appraise of the different gastrointestinal parasites of goats of Maharashtra state. The non-significant difference was recorded in the prevalence of GI Parasites of goats among the regions of Maharashtra. These observations however are in contradiction to those by Sivajothi and Reddy (2018) and Faizal and Rakapakshe (2001), as they reported that the difference in macro and microclimates in different geographical regions does impact on the distribution of GI Parasites of ruminants. Also the difference in husbandry practices and breed composition of animals from different areas have significant role in regional variation in occurrence of GI Parasitic infection goats (Amran *et al.*, 2018).

Owing to the higher susceptibility of goats to sub-clinical and clinical gastro-intestinal parasitism, as always considered, present study is no exception where 71.57% overall prevalence of GI Parasites was recorded. The percent prevalence of GI parasitic infections reported in the present study for goats when graded in context to many other studies from various corners of India, fits in the grade as higher infection. In goats percent prevalence of 82.97 from Rajasthan (Choubisa and Jaroli, 2013), 79.24 from Punjab (Singh *et al.*, 2017), 58.4 from Uttar Pradesh (Anugrah *et al.*, 2018) and 51.89 from Maharashtra (Dappawar *et al.*, 2018) is comparable with present study carrying the infection level of 71.57% fits as higher grade level.

Prevalence rate of GI parasitism in goats ranging from 39.34 –92.4 percent have been reported from different states of India *viz.* Andhra Pradesh (Sreedhar *et al.*, 2009), Chhattisgarh (Pathak and Pal 2008), Haryana (Gupta *et al.*, 1987), Jammu and Kashmir (Tariq *et al.*, 2010; Khajuria *et al.*, 2013; Lone *et al.*, 2012), Maharashtra (Sutar *et al.*, 2010; Padwal *et al.*, 2011) Meghalaya (Bandyopadhyay *et al.*, 2010a, b), Punjab (Singh *et al.*, 2012), Sikkim (Rahman *et al.*, 2012) and Uttar Pradesh (Anugrah *et al.*, 2018). Studies which have reported prevalence rate above 50 percent as Anugrah *et al.* (2018), 58.4 percent, Sutar *et al.* (2010) reported as 60.83 percent, Singh *et al.*, 2013 as 75 percent and present study as 74.66 per cent.

Goats from Western Maharashtra showed higher prevalence in adult age as 91.44 percent as against 22.22 percent in the age group below one year. In Vidarbha, Marathwada and Konkan regions it was almost equal in quantum (*at par*) in both the age groups. The percent prevalence recorded was 73.07 % and 76.80%; 43.75 and 67.78 and 62.02 and 78.37 percent in the age group up to 12 months and one year and above age in the regions Vidarbha, Marathwada and Konkan, respectively. Physiological changes between different age groups which also determines the grazing pattern, presumably have considerable effect on the prevalence rate of GI parasitism in goats. To test this hypothesis present exercise has been followed to group the goats in two age groups and study GI parasitism between these two age groups. The results showed that the hypothesis presumed before study proved as false as there were non-significant differences between the different age groups of goats. It implies that all age groups of goats are more or less equally susceptible to GI parasitism and needs deworming. However, few studies opined slightly deviating views from the present study. In one such study Khandare (1999) observed that kids and lambs were found more prone to the Strongyles as compared to other age groups. However, overall he observed the infection of roundworms *at par* in all ages with *Strongyloides* and *Trichuris* more common in higher age group. Also in another study, Palampalle (1998) reported an ‘arc’ relationship between the age of sheep and roundworm infection, indicating that the infection was higher in lambs, then reduced during growing stage and again increased during adult age group.

Table 2: Sex wise and age wise prevalence of gastrointestinal parasites in goats of Maharashtra

Region	Male			Female			χ^2	Below 1 years			Above 1 year			χ^2	Total		
	N	P	% p	N	P	% p		N	P	% p	N	P	% p		N	P	% p
West	23	19	82.60	138	122	88.40	0.07 [#]	9	2	22.22	152	139	91.44	4.47 [@]	161	141	87.57
Vidarbha	19	14	73.68	132	101	76.51	0.02 [#]	26	19	73.07	125	96	76.80	0.04 [#]	161	115	71.42
Marathwada	27	14	51.85	138	94	68.11	0.91 [#]	16	07	43.75	149	101	67.78	1.27 [#]	165	108	65.45
Konkan	34	24	70.58	156	112	71.79	0.00 [#]	79	49	62.02	111	87	78.37	1.73 [#]	190	136	71.57

N – Total samples tested; P- Number of samples found positive; %p – per cent prevalence; @: Significant; #: Non-significant.

Table 3: Breed wise prevalence of gastrointestinal parasites in goats of Maharashtra

Region	Osmanabadi			Sangamneri			Sirohi			Non-Descript			χ^2	Total			χ^2
	N	P	% p	N	P	% p	N	P	% p	N	P	% p		N	P	% p	
West	145	130	89.65	16	11	68.75	0	0	0	0	0	0	0.72 [#]	161	141	87.57	3.294 [#]
Vidarbha	64	50	78.12	0	0	0	0	0	0	87	65	74.71	0.53 [#]	161	115	71.42	
Marathwada	103	72	69.90	0	0	0	0	0	0	62	36	58.06	0.83 [#]	165	108	65.45	
Konkan	145	102	70.34	0	0	0	10	2	50.00	35	29	82.82	1.3 [#]	190	136	71.57	

N – Total samples tested; P- Number of samples found positive; %p – per cent prevalence; @: Significant; #: Non-significant.

It was interesting to note that bucks and does showed *at par* prevalence rate of GI parasitism in all the regions of Maharashtra. Chi-square analysis indicated no significant difference between the two sexes. The prevalence recorded was 82.60, 73.68, 51.85 and 70.58 percent in males and 88.40, 76.51, 68.11 and 71.79 percent in females of Western Maharashtra, Vidarbha, Marathwada and Konkan region, respectively. The sex wise analysis indicated that there was non- significant difference between the two sexes of goat. On account of the very less number of male animals as compared to females under this study, the results on sex-wise prevalence remain imprecise. However it was observed during the present study that sex of the goats has some impact on the prevalence GI parasitism in Maharashtra state. Earlier work also reports the influence of sex of sheep and goats on prevalence of GI parasitism in their respective geographical areas (Anugrah *et al.*, 2018, Dappawar *et al.*, 2018). Contrary to it, few studies didn't observe any impact of sex (Sivajothi and Reddy, 2018).

Genetic predisposition and differential susceptibility owing to hormonal control are two important factors which influences the susceptibility of animals to various infections (Radostits, 2000). Similarly physiological status of female animals and lactating mothers makes them nutrient deprived and are likely to be more susceptible to

the infections due to insufficient/unbalanced diet against higher needs (Anugrah *et al.*, 2018). Similarly, present study revealed higher prevalence of GI parasites in does than bucks, which is in totally agreement with recent studies of Dappawar *et al.* (2018) and Verma *et al.* (2018). While, Mpofu (2020) observed equal frequency of GI parasites in males and females and mentioned that it could be the result of identical management systems offered to both the sexes.

As regards breeds of goats, Osmanabadi and non-descript (ND) goats are reared in all the four regions of Maharashtra, while population of Sangamneri goats is only predominant in Western Maharashtra and Sirohi goats in Konkan region. GI parasitism prevalence reported had shown non-significant differences among the four breeds from all the regions of state. However such non-significant difference does not have any relevance owing to their adaptability with local climatic conditions of respective region. Osmanabadi goats are more adapted to the Marathwada region being their native place and hence showed numerically lower prevalence as compared to higher prevalence observed in Osmanabadi goats of other regions. The prevalence of GI parasitism in Osmanabadi goats noted in Marathwada region was lowest as 69.90 as against 70.34, 78.12 and 89.65 percent reported in Konkan, Vidarbha and Western

Table 4: Gastrointestinal parasites identified from goats of Maharashtra

Region	Total	<i>Strongyle</i> sp		<i>Strongyloides</i> sp		<i>Trichuris</i> sp		<i>Amphistome</i> sp		<i>Coccidia</i> sp		Mixed Infection	
	N	P	%p	P	%p	P	%p	P	%p	P	%p	P	%p
Western Maharashtra	161	119	73.91	48	29.81	74	45.96	17	10.55	65	40.37	88	54.65
Vidarbha	151	90	59.60	38	25.16	26	17.21	07	4.63	53	35.09	49	32.45
Marathwada	165	96	58.18	41	24.84	18	10.90	06	3.63	38	23.03	46	27.87
Konkan	190	90	47.36	35	18.42	44	23.15	13	6.84	72	37.89	56	29.47

N – Total samples tested; P- Number of samples found positive; %p – per cent prevalence.

Maharashtra regions, respectively. Sangamneri goats and Sirohi goats were adapted respectively to Western Maharashtra and Konkan regions, till then they have shown more than 50 percent prevalence. From the table 4, it can be inferred that whatever the region and whichever the breed reared, GI parasitism exist in more than 50 percent population. Overall Osmanabadi goats and non-descript goats were found comparatively more prone to the infection. However, comparison between different breeds for the susceptibility and resistance to a particular infection is a trait of breed hence comparison in the breeds may not be justified.

Breed of a particular host species carries the impression of genetic constitution. Hence susceptibility of any breed to the GI parasitic infection largely depends on the genetic resistance of a particular breed and its interaction (adaptability) with the existing environmental condition of the region. In consonant with this principle, the observations of the current study also reported lower prevalence rate in locally adapted breeds of goats to a particular geographic region compared to imported or non-adapted breeds. However, Maqsood *et al.* (1996) do not observed any difference in the different breeds of sheep and goats in regards to infection of *Haemonchus contortus*. Further, Dappawar *et al.* (2018) presented an important observation that overall prevalence noted was 48.93% in ND (Non-descript) and 52.89% in Osmanabadi goats from Marathwada region of Maharashtra and statistically there was no significant difference exists between the breeds. Additionally, Amran *et al.* (2018) also observed that different goat breeds shows variation in the occurrence of gastrointestinal parasites infection.

While studying the prevalence of GI parasitism, collected faecal samples were simultaneously analyzed for species of parasites involved in the infection. It is worth noted that three gastrointestinal nematode species and amphistomes and enteroprotezoan species i.e. coccidia were found prevalent in all the regions of Maharashtra state. It also signifies their common occurrence, prevalence and predominance. The prevalence of amphistomes was quite low in Marathwada and Vidarbha region as against Western Maharashtra, owing to the unavailability of suitable intermediate host snail, lack of irrigation facilities and low rainfall. The predominance of strongyle infections were observed amongst the all GI parasites reported. Similarly, infection with more than two species as a mixed infection was found to be common phenomenon. However, amongst four regions of Maharashtra state; all the species found in sizable quantum in goats from Western Maharashtra region and percent prevalence reported was 73.91, 29.81, 45.96, 10.55, 40.37 and 54.65 for Strongyles, *Strongyloides*, *Trichuris* sp., *Amphistome* sp., *Eimeria* sp. and mixed infections, respectively.

In the present study several possible permutations and combinations of mixed GI parasitic species were observed. Studies on mixed infection pattern can be suggestive for the drugs to be administered during deworming schedule along with coccidiostats. In most of the studies including present study, the parasitic species commonly encountered during GI parasitism in small ruminants are Strongyles, *Trichuris* and amphistomes (Admasu and Nurlign, 2014; Bedada *et al.*, 2017; Anugrah *et al.*, 2018). Predominance of Strongyle group of parasites was always noted because it constitutes a large number of nematode species including



Trichostrongylus, *Haemonchus*, *Oesophagostomum*, *Ostertagia*, *Cooperia*, *Chabertia* and *Nematodirus*. Findings of the current study was also consistent with earlier records as Strongyle group of parasites were found as the most common and predominant parasites (Bedada et al., 2017; Anugrah et al., 2018; Sivajothi and Reddy, 2018).

CONCLUSION

The susceptibility of goats to gastrointestinal parasitism with respect to intrinsic biotic factors viz age group, sex and breeds was found at par, hence barring these factors deworming shall form a part of regular management. Strongyles group being the predominant parasitic fauna and their different species are widely prevalent in different regions of Maharashtra state. Coccidia and amphistomes have also shown their existence to the sizable grade indicating need of timely treatment and preventive medications of goats.

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