Regional variations in the prevalence of gastro-intestinal parasitism among sheep populations of Maharashtra

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Journal of Livestock Science (ISSN online 2277-6214) 13: 221-226
Received on 1/9/22; Accepted on 30/9/22; Published on 20/10/22
doi. 10.33259/JLivestSci.2022.221-226

Abstract

A study conducted to appraise the prevalence pattern of gastrointestinal parasites present in sheep of different regions of Maharashtra recorded 61.88 % sheep positive for several helminthic infections. Regional variations in the GI parasitic infections of sheep revealed 70.16, 56.57, 66.66 and 51.33 percent positivity from Western Maharashtra, Vidarbha, Marathwada and Konkan region, respectively from the total 669 fecal samples examined. The age wise prevalence observed in sheep showed non-significant variation between two age groups studied viz. young sheep below one year of age and adults. The prevalence rate observed as non-significantly differing among ewes and rams in all four regions. Species composition of GIPs found in the study was Strongyles (50.52%), *Strongyloides* (29.30%), *Trichuris* sp (11.51%), amphistomes (2.51%), *Eimeria* sp (20.63%) and mixed infection (21.38%), respectively.

Key words: sheep; gastrointestinal helminthes; strongyles; strongyloides

Introduction

As per 20th livestock census, livestock population in India is 535.82 million including 74.26 million sheep and 148.88 million goats. Thus, sheep and goat population in India contributes 42 percent of total livestock population. 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 (Budisatria and Udob, 2013). Thus the marginal and landless farming communities, particularly from drought prone area of different parts of country including Maharashtra have adopted husbandry of small ruminants as their means of livelihood (Kumar, 2007) In India, small ruminants are mainly reared for meat purpose and further wool, milk and manure production also adds vitality to this business (Dikshit et al., 2012).

Unlike bacterial and viral diseases, 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 (Bandyopadhyay et al., 2010). Immunological prevention of bacterial and viral infections has been possible for long, however the analogous success could not be achieved till date in case of GI parasites of livestock. The effects of GI Parasites on small ruminants' health and production has already been reported through several studies (Sharma and Mandal, 2013; Singh et al., 2017). 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).

The epidemiology in terms of parasites' composition and their intensity of infection has been reported to vary according to several biotic and abiotic factors (Dixit et al., 2017). These variations however could be of key importance for planning and implementation of strategic control programmes of those GIPs (Income et al., 2021). Biotic factors such as age, sex and breed also tend to differ in different geographic setups. Looking towards the vast geographic spread of the Maharashtra state comprising of different agro-climatic profiles, the current study was planned to appraise the variations in GIP infections among the sheep of Maharashtra.

Methodology

The prevalence of gastrointestinal parasitism in small ruminants of Maharashtra was worked out by collecting faecal samples from sheep belonging to different villages and government farms of Maharashtra selected as per the administrative regions. The state is divided in 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). Two centers were identified in each region for collection of faecal samples of sheep. Minimum 25 faecal samples each of sheep were collected from all identified centers during all season totaling to 669 fecal samples examined during the study period.

Fecal samples from sheep were collected throughout the year in 2018. Samples were collected aseptically directly from rectum of sheep by inserting moistened finger. Samples collected in min-zip locked polythene bags were then transported to Veterinary Parasitology Laboratory of Mumbai Veterinary College with caution to retain the moisture of those samples. Qualitative and quantitative examination of those samples was done by adopting standard parasitological procedures in the laboratory. The eggs and oocysts of found during microscopic examination were identified with the help of keys as described by Soulsby (1982). The data on prevalence of parasitic fauna during this examination were then analyzed by chi square test using online software WASP 2.0 developed by ICAR – Central Coastal Agricultural Research Institute, Goa. The results were presented at 5% level of significance.

Results

The overall prevalence of GI parasitism in sheep was recorded as 61.88 per cent. The region wise prevalence was observed highest from Western Maharashtra as 70.16 percent followed by 66.66 percent from Marathwada region followed by 56.57 percent from Vidarbha region and lowest as 51.33 percent from Konkan region.

The age-group wise distribution of GI Parasitism in sheep of the state was non-significant (Table 2). However, numerically the higher prevalence was noted up to 12 months of age in Western Maharashtra; while in rest of three regions higher prevalence was noted in the age group of above one year. The prevalence rate was 85.71, 56.00, 47.61 and 35.71 percent in age group of up to 12 months and it was 67.32, 56.69, 69.09 and 48.14 percent in the age group above one year in the Western Maharashtra, Vidarbha, Marathwada and Konkan region, respectively.

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. Vikramgadh 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

Table 2. Sex wise and age wise prevalence of gastrointestinal parasites in sheep of Maharashtra

Region	Male			Female			$\chi 2$	Below 1 years			Above 1 year			$\chi 2$	Total		
	N	P	% p	N	P	% p	--	N	P	% p	N	P	% p	--	N	P	% p
West	36	26	72.22	145	101	69.65	0.03#	28	24	85.71	153	103	67.32	1.14#	181	127	70.16
Vidarbha	24	11	45.83	128	75	58.59	0.58#	25	14	56.00	127	72	56.69	0	152	86	56.57
Marathwada	21	12	57.14	165	112	67.87	1.04#	21	10	47.61	165	114	69.09	1.29#	186	124	66.66
Konkan	36	15	41.66	114	62	54.38	0.87#	42	15	35.71	108	52	48.14	2.21#	150	77	51.33
Total	117	64	54.70	552	350	63.41	--	116	63	54.31	553	341	61.66	--	669	414	61.88

N – Total samples tested; P- Number of samples found positive; %p – per cent prevalence ; @: Significant (5%) #: Non-significant

Table 3. Breed wise prevalence of gastrointestinal parasites in sheep of Maharashtra

Region	Deccani			Sangamneri (Strain of Deccani)			Madgyal			Non-Descript			$\chi 2$	Total			$\chi 2$
	N	P	% p	N	P	% p	N	P	% p	N	P	% p	--	N	P	% p	
West	126	84	66.66	25	17	68.00	30	26	86.66				1.38#	181	127	70.16	3.294#
Vidarbha	38	18	47.36	--	--	--	--	--	--	114	68	59.14	0.76#	152	86	56.57	
Marathwada	120	81	67.50	--	--	--	--	--	--	66	43	65.15	0.03#	186	124	66.66	
Konkan	59	21	35.59	--	--	--	79	48	60.75	12	08	66.66	4.77#	150	77	51.33	
	343	204	59.48	25	17	68.00	109	74	67.89	192	119	61.98	--	669	414	61.88	

N – Total samples tested; P- Number of samples found positive; %p – per cent prevalence ; @: Significant (5%) #: Non-significant

Table 4: Gastrointestinal parasites identified from sheep of Maharashtra

		Strongyle		Strongyloides		Trichuris		Amphistome		Coccidia		Mixed Infection	
Region	N	P	%p	P	%p	P	%p	P	%p	P	%p	P	%p
Western Maharashtra	181	107	59.11	38	20.99	27	14.91	06	3.31	33	18.23	41	22.65
Vidarbha	152	69	45.39	47	30.92	15	9.86	03	1.97	32	21.05	33	21.71
Marathwada	186	109	58.60	63	33.87	12	6.45	05	2.68	42	22.58	41	22.04
Konkan	150	53	35.33	48	32.00	23	15.33	03	2.0	31	20.66	28	18.66
Total	669	338	50.52	196	29.30	77	11.51	17	2.54	138	20.63	143	21.38

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

As far as effect of sex of the sheep on the prevalence rate of GI parasitism is concerned, there was a non-significant difference between these two groups (Table 2). Yet apparently the males has higher prevalence in Western Maharashtra where as female sex has higher prevalence in rest of three regions of state. The prevalence rate noted were 72.22, 45.83, 57.14 and 41.66 in male sheep and 69.65, 58.59, 67.87 and 54.38 percent in female sheep from Western Maharashtra, Vidarbha, Marathwada and Konkan region, respectively.

The four sheep breeds incorporated in the study were Deccani, Sangamneri (strain of Deccani), Madgyal and non-descript (N.D.). The Deccani breed of sheep is reared in all four regions of Maharashtra while Sangamneri (strain of Deccani) is restricted to Western Maharashtra, Madgyal in Western Maharashtra and Konkan region. There observed a non-significant variation in different breeds from different region of Maharashtra state (Table 3). From data it can be said that, breeds of sheep are equally susceptible to GI parasitism in Maharashtra state. However, Deccani sheep in the region Vidarbha and Konkan found to be less susceptible to infection and only 35.59 percent and 47.36 percent prevalence rate was recorded. This observation can be viewed from the angle of regional adaptability of the breed.

With regards to seasonal variation of GIP prevalence, it was found that thre was a significant variation among different regions. In Western Maharashtra the prevalence rate was significantly higher during monsoon as 87.27, winter as 75.00 percent and lowest during summer season as 44.00 percent. The corresponding seasonal prevalence for three regions was 83.33, 76.00, and 76.00 percent for monsoon, 74.66, 54.00 and 46.00 percent for winter season and 35.29, 40.38 and 32.00 percent during summer for Marathwada, Vidarbha and Konkan regions, respectively. It can therefore be assessed that in Marathwada and Konkan region monsoon season experiences higher prevalence rate as compared to winter and summer season.

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 enteroprotozoan species *i.e.* coccidia were found prevalent in all the regions of Maharashtra state (Table 4). 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 because unviability of suitable snail intermediate host due to less irrigation facilities and low rainfall. The predominance of group of Strongyle worms was observed amongst the all GI parasites reported. Similarly, infection with more than two species as a mixed infection was found as common phenomenon. However, when four regions taken into consideration, all the parasitic species were found in higher quantum in the sheep from Western Maharashtra region. The percent prevalence reported was 50.52, 29.30, 11.51, 2.51, 20.63 and 21.38 for strongyles, *Strongyloides* sp, *Trichuris* sp, *Amphistome* sp, *Eimeria* sp and mixed infection, respectively.

Discussion

Varied range of prevalence rates of gastrointestinal parasites in sheep has been reported from all over the country through earlier studies. to mention a few, Choubisa and Jaroli, (2013) from Rajasthan as 55.42%, Velusamy *et al.,* (2015) from Tamilnadu noted as 67%, Singh *et al.* (2017) from Punjab as 79.24% and Dappawar *et al.,* (2018) as 52.32% from Maharashtra state, while in the present study it was 61.88 percent. These studies stated about high susceptibility of small ruminants to GI parasitism and further it has been abundantly clear that, prevalence rate of gastrointestinal parasitic infection greatly vary from one geographical region to other. Factors responsible for variation may be a) farmers related: education of the farmers, grazing dependent husbandry, faulty design of housing (Anugrah et al. 2018); b) agro-climatic conditions: overstocking, grazing of young and adult animals together creates an ideal condition for the transmission of gastro intestinal parasites (Gadahi et al. 2009); c) management issues: keeping different species of animals and different age group together, malnutrition, negligible knowledge of pastoralists, insufficient veterinary services, no policy about restrictions on free movement of animals from one place to the other within the country (Bedada et al. 2017); d) effects of climate change; e) usage of anti-parasitic drugs and increase in animal transport responsible for changes in the prevalence and/or emergence of parasitic infection (Radiostits *et al.* 2007).

The obvious changes in physiological process in response to increase in age, which however also concurs with grazing pattern, are presumed to be reflected in ups and down in the prevalence rate of GI parasitism. To test this hypothesis present exercise the sheep populations under study have been categorized in two age groups to study variations in the GI parasitism between these two age groups. Subsequently, this hypothesis proved false and present study reported non-significant differences between the different age groups of sheep. Therefore based on these results, it can be inferred that all age groups of sheep are more or less equally susceptible to GI parasitism and need dewormer dosing. However, few studies also opined slightly deviating views from the present study. To quote one of such an evidence, 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. Similarly Palampalle (1998) had observed an 'arc' relationship between the age of sheep and roundworm infection, presenting that the infection was higher in lambs followed by a decrease during growing stage which again showed increase during adult stage. However in a study conducted in Udgir Dappawar *et al* (2018) reported that prevalence of GI Parasites in sheep were no significant differences in three age groups under study *viz*. lambs, young sheep and adults. Age always plays significant role in the susceptibility or resistance to the infection of any type of pathogen in the host. It is also true for the infection of GI parasites in sheep. In this regards three types of observations were observed by several scientists as: 1) growing age makes the host susceptible to GI parasitism (Regasa *et al.* 2006; Emiru *et al*. 2013; Nabi *et al*. 2014 ; Bedada *et al.* 2017 **;** Anugrah *et al.* 2018); 2) lower age group due to less immunity is more prone to GI parasitsim (Sangvaranond *et al.* 2010; Singh *et al.* 2016); 3) non-significant impact of age on GI parasitism (Soulsby, 1982; Waruiru *et al.* 2005; Admasu and Nurlign 2014)

The sex wise analysis indicated that there was non-significant difference between the two sexes of sheep. Owing to the very less number of samples of rams (samples of females are four times more as compared to male), sex-wise prevalence worked out in the present study appeared to be inconclusive. However, it was observed that ewes (63.41%) are more prone to GI parasitism than rams (54.71) during present study. however there are earlier evidences reporting significant difference of prevalence rates among sex of sheep (Anugrah et al., 2018) as against those with non-significant difference, as well (Dappawar et al., 2018).

Present study observed the trend of seasonal prevalence as highest in monsoon, lower in winter and lowest during summer in sheep and goats. Similar trends of seasonal prevalence were also observed by number of workers (Velusamy *et al*., 2015; Gaherwal *et al*., 2016; Singh *et al*., 2017).

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 (Bishop, 2012). The results of present study also advocates similar principle as the prevalence rate were slightly less in the locally adapted breeds of sheep to a particular geographic region as compared to imported or non-adapted breeds.

Conclusion

After thorough appraisal of results of the present study it can be concluded that age, breed and sex of sheep have no significant impact on the susceptibility to GI parasitism and sheep of all the categories of these risk factors are equally prone for GI parasites. Therefore while devising deworming schedule for sheep, these factors need not be considered instead more focus should be on physiological and seasonal factors of sheep should be given due weightage.

Acknowledgement

Authors express gratitude to the authorities of Mumbai Veterinary College, Mumbai and COVAS, Parbhani of MAFSU, Nagpur for providing necessary facilities for this study.

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