

Prevalence of Anaemia in Sheep and its Associated Risk Factors in and Around Shivamogga, Malnad Region of Karnataka

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ABSTRACT

The present study examined the prevalence and risk factors of anaemia in sheep in Shivamogga region from March 2023 to February 2024. The study involved screening of 200 sheep of which 166 (83.00 %) were anaemic based on matching the conjunctival mucus membrane with the CSWRI developed color chart. Anaemia was most common in sheep less than 6 months (87.25 %), and in female sheep (84.82 %). Monsoon season had highest prevalence of anaemia (90.16 %) followed by post-monsoon (86.11 %) season, winter (78.00 %) and least in summer (77.35 %). Based on aetiological agents the endo-parasitic infection was the most common cause (96.00%), followed by ecto-parasitic infestation (81.60%) and least in mixed parasitic infection cases (69.23 %). Risk factors of anaemia were found in animals reared by farmers with lack of awareness about deworming and acaricide, no education, not using dose based on body weight, lack of acaricide usage, sheep shed with mud floors, extensive type of rearing, feed which included only green fodder without concentrate and sheep drinking pond water all had higher rate of anaemia.

Key words: Anaemia, CSWRI, Prevalence, Risk factors, Sheep, Shivamogga region.

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INTRODUCTION

Sheep harbor variety of helminth parasites, particularly gastrointestinal helminths, due to their close grazing habit. The parasitic helminthes degrades production ability of sheep which results in the economic losses. Sheep gets affected by various species of helminths and ectoparasites which can cause skin damage such as hyperkeratosis, weight loss, itching, and in rare instances, even death. These parasites can cause a wide range of diseases, from severe acute infections that result in high mortality, reduced wool output, and reproductive performance, to chronic forms that mostly cause diarrhea, dehydration, anaemia, and weight loss. Anaemia is a condition that is usually one of the symptoms of an illness and is caused by either a reduction in packed cell volume, haemoglobin or erythrocyte count. The main causes of anaemia in animals include severe ectoparasite infestation, haemoprotozoan diseases, helminthic infection, and nutritional deficiencies. Endoparasites (helminths and haemoprotozoa) and ectoparasites (fleas, lice, and ticks) are common causes of anaemia in small ruminants (Anumol *et al.*, 2011). This study was planned to find out the prevalence of anaemia in sheep and its associated risk factors in and around Shivamogga, Malnad Region of Karnataka.

MATERIALS AND METHODS

Sheep belonging to farmers in and around Shivamogga of Karnataka, India, were screened. Screening of 200 sheep

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for the presence of anaemia was done by matching the conjunctival mucous membrane colour with that of colour chart developed by The Central Sheep and Wool Research Institute (CSWRI), Avikanagar, India. Parameters such as conjunctival mucus membrane, oral mucosa, body condition

score, exercise intolerance, soiled hind quarters, presence of external parasites and their severity, presence of flea dirt and lice nits were recorded. Detailed parameters such as rectal temperature, heart rate and respiration rate were also recorded as per the standard procedures recommended by Kelly (1984). Flotation and sedimentation techniques were used for faecal sample examination as recommended by Soulsby (1982). The association between risk factors and anaemia of sheep was worked out based on the questionnaire. The data was expressed as percent frequency of anaemia among animals classified under different factors of investigation.

RESULTS AND DISCUSSION

In the present study a total of 200 sheep were screened from sheep farms in and around Shivamogga for anaemia. Among these 166 were found positive with an overall prevalence of 83.00%. This is in close agreement with the reports of Sivajothi and Reddy (2018), Khan *et al.* (2021) and Haritha and Ramesh (2022), whereas lower prevalence from 13.69 to 45.18% was reported by many others (Saleh, 2019; Rajendra *et al.*, 2021; Choudhari *et al.*, 2021; Jayalakshmi *et al.*, 2022). The difference in prevalence recorded by various workers might be due to diverse geographic location, variations in the population of vectors, variations in the climate, and genetic variations in the animals. The high level of anaemia in sheep in and around Shivamogga might be due to the warm and temperate climate, lack of information about proper management, under or over dosing of deworming agents, and unawareness regarding the usage of acaricides to farmers.

Age-wise Prevalence of Anaemia in Sheep

Anaemia was found to be most common in sheep below the age of 6 months (87.25%), followed by 7-12 months age group (86.05%), then in 13-24 months age group (75%), and was less common in age group above 25 months (70.37%) (Table 1). The present findings were in accordance with Rajendra *et al.* (2021) and Annarao *et al.* (2022), who reported higher prevalence of anaemia in sheep of less than 6-month age group. Highest incidence in less than 6 months of age grouped animals in the present study could be due to early separation of the young ones from the dam, which suppressed their immune systems and increased their susceptibility to infectious diseases and deficiencies (Velusamy *et al.*, 2015). It also increased their exposure to ectoparasites, as they are more vulnerable to infection due to lower immunity than older animals.

The present study is however not in accordance with the findings reported by Amin and Wani (2012), Choudhari *et al.* (2021), Khan *et al.* (2021), and Abdulmageed and Mohamed (2022), who showed the higher prevalence of anaemia in the age group of over one year. This could be attributed to the grazing habits of sheep, as grasslands are more likely

to harbor endo-parasite eggs and expose adult sheep to contaminated pasture more frequently than younger sheep, which predisposes them to anaemia from helminth-induced blood loss. Adult animals in large flocks were more likely than smaller ones to be infected with parasites (both ecto- and endo-parasites), and this was caused by close proximity, overcrowding, and unhygienic conditions on the sheep farm (Namutosi *et al.*, 2019).

Table 1: Age-wise prevalence of anaemia in sheep

Age group	No. of sheep examined	No. of positive	% prevalence	Chi square P value
0-6 months	102	89	87.25	(p ≤ 0.05)
7-12 months	43	37	86.05	
13-24 months	28	21	75	
25 months and above	27	19	70.37	

Sex-wise Prevalence of Anaemia

The present study determined the sex-wise prevalence of anaemia in sheep, with the more prevalence in females (84.82%, 95/112) in comparison to males (80.68%, 71/88). Similar findings of higher prevalence of anaemia in females (71.50 to 92.89%) were also reported by Bhatane *et al.* (2018), Sivajothi and Reddy (2018), Choudhari *et al.* (2021), and Haritha and Ramesh (2022). Predisposing factors for greater susceptibility of anaemia to female sheep over male include genetic constitution, hormonal involvement, pregnancy, and lactation stress (Sivajothi and Reddy, 2018; Choudhari *et al.*, 2021). The lowest prevalence of anaemia in male sheep might be due to higher erythrocyte count than female sheep that are moderately resistant to anaemia (Smith and Sherman, 2009).

Month and Season-wise Prevalence of Anaemia

The month-wise prevalence of anaemia in sheep in Shivamogga was recorded highest in the month of August (94.44%) and the least in March (66.66%) (Table 2). The results of present study were found to be closely associated with Shaju (2001) and Jayalakshmi *et al.* (2022). August is a monsoon month and there is a chance of more parasitic infection in sheep during this time due to high humidity and rain (Annarao *et al.*, 2022) and ideal conditions for the development of parasitic stages, identified as the primary cause of anaemia. In contrary to the present findings, Velusamy *et al.* (2015) and Premalatha (2020) reported increased incidence of anaemia in December to February (winter season) due to winter stress, different geographical location and different managemental practices.

Among seasons (Table 3), the highest prevalence was observed in monsoon (90.16%) followed by post-monsoon (86.11%), winter (78%) and the least in summer (77.35%) season. These findings were in accordance with Singh and Swarnkar (2012), Ananda and Pradeep (2021) and Jayalakshmi

et al. (2022). During the monsoon, high temperatures, heavy precipitation and high relative humidity were thought to be risk factors for parasite infection. The growth of infectious stages of parasites is facilitated by rainfall and warmth, which progressively increases the number of adult worms in grazing sheep (Velusamy *et al.*, 2015). Rainfall has a beneficial effect on egg load during the monsoon season and has been found to be responsible for a 19.2 times increase in egg count for every millimeter of rain (Chijina and Emehelu, 1984). These factors could also be attributed for higher prevalence of anaemia in monsoon season in present investigation.

Table 2: Month-wise prevalence of anaemia in sheep

Sl.No	Month	Number screened	Number positive (%)
1	March-2023	6	4 (66.66)
2	Apr-2023	16	11 (68.75)
3	May-2023	16	13 (81.25)
4	June 2023	15	13 (86.66)
5	July 2023	22	19 (86.36)
6	August 2023	18	17 (94.44)
7	September 2023	21	19 (90.47)
8	October2023	23	20 (86.95)
9	November2023	13	11 (84.61)
10	December2023	15	11 (73.33)
11	January-24	24	20 (83.33)
12	February-24	11	8 (72.72)
	Total	200	166

Data in parentheses indicate percentage prevalence

Table 3: Season-wise prevalence of anaemia in sheep

Season	No. of examined	No. of positive	% prevalence	Chi square P value
Monsoon	61	55	90.16	4.54
Post monsoon	36	31	86.11	(P < 0.208)
Winter	50	39	78	
Summer	53	41	77.35	

The present findings however were not in agreement with Yakhchali and Hosseine (2006) and Bhatane *et al.* (2018), who recorded highest prevalence of anaemia in winter (56.33 %) and lowest in monsoon (12.67 %) season and explained that these could be due to winter stress, especially in younger animals. Whereas, Khajuria and Kapoor (2003) reported the highest seasonal prevalence of helminth infection causing anaemia in sheep in the summer (73.46%) and the lowest in the winter (32.35%). These seasons are ideal for herbage growth in the area and for maintaining the necessary moisture on the grasslands, so the incidence begins to rise and peaks in the summer. The winter months have the lowest rate of infection and worm burden overall, possibly due to low temperatures and dry conditions that hinder the development of parasitic eggs and larvae.

Prevalence of Anaemia in Sheep based on Aetiology

Based on aetiological agents, the prevalence of anaemia in sheep was most commonly due to endo-parasitic infection, accounting for 96.00% (72/75) of cases, followed by ectoparasitic infestation (81.6%, 49/60) and mixed parasitic infection (69.23% ,45/65) (Table 4). These findings are in accordance with Haritha and Ramesh (2022), who reported higher incidence of anaemia due to endoparasitic infection (44.3%), followed by ectoparasitic infestation (30.4%), mixed infection (10.12%), while Khan *et al.* (2021) reported endoparasites and ectoparasites in 82 % and 39 % sheep, respectively.

Table 4: Prevalence of anaemia in sheep based on aetiology

Aetiology	No. of examined	No. of positive	% prevalence	Chi square P value
Ecto-parasitic infestation	60	49	81.6	203.2 (p ≤ 0.05)
Endo-parasitic infection	75	72	96	
Mixed parasitic infection	65	45	69.23	

Among endoparasitic infections, Strongyle was found to be the predominant species followed by *Eimeria* spp, Amphistome egg, *Moniezia expansa* and *Trichuris* spp. These findings were in accordance with the reports of earlier research of Sivajothi and Reddy (2018). The poor managerial practices may be the cause of the increased occurrence of endoparasites in sheep in the present investigation. During the rainy season, animals were kept in confinement for longer periods of time in order to prevent crop damage. As a result, the animals were more likely to have parasite diseases due to the overcrowding in unhygienic pens (Velusamy *et al.*, 2015). It has been documented that inadequate sanitization and poor farm management are risk factors for endoparasitic infections (Malan *et al.*, 2001). The results of the present study differed from those of Yakhchali and Hosseine (2006), Bhatane *et al.* (2018) and Rajendra *et al.* (2021), who reported that ectoparasitism was the primary cause of anaemia in small ruminants, possibly as a result of regional variations in climate. This discrepancy might be caused by the unclean state of the sheep shed, the illiteracy of the sheep farmers, their tendency to delay taking preventive action, and the high humidity and warmth that have been shown to encourage the growth of external parasites.

Risk Factors Associated with Anaemia

In the present study, chi-square test was used to determine the association between risk factors with anaemia based on the questionnaire (Table 5), according to which there was significant (p ≤ 0.05) association between the farmers lack of awareness about deworming and acaricide, farmers with no education, lack of deworming, not using dose according to body weight, lack of acaricide usage, sheep shed with mud floors, extensive type of rearing, only green fodder



Table 5: Risk factors associated with anaemia in sheep

Risk factors	Indicator	No. of examined	No. of positive	% prevalence	Chi square P value
Farmers education	Yes	64	36	56.25	p ≤ 0.05
	No	136	130	95.58	
Farmers awareness	Yes	76	55	72.36	p ≤ 0.05
	No	124	111	89.51	
Deworming	Yes	78	50	64.10	p ≤ 0.05
	No	122	116	95.08	
Dose based on b wt	Yes	20	8	40.00	p ≤ 0.05
	No	58	42	72.41	
Acaricide	Yes	70	38	54.28	p ≤ 0.05
	No	130	128	98.46	
Type of flooring	Mud/dung	118	109	85.59	p ≤ 0.05
	Concrete	62	47	75.80	
	Raised /slatted	20	10	50.00	
Rearing	Extensive	106	103	97.16	p ≤ 0.05
	Intensive	43	22	51.16	
	Mixed	51	41	80.39	
Feed	Green fodder	112	100	89.28	p ≤ 0.05
	Mixed feed	88	66	75.00	
Water	Indoor	87	62	71.26	p ≤ 0.05
	Pond	113	104	92.03	
Disinfectant	Yes	99	80	80.80	p < 0.32
	No	101	86	85.14	
BCS	2.5	43	41	95.34	p ≤ 0.05
	3	80	72	90.00	
	3.5	52	37	71.15	
	4	22	15	68.18	
	4.5	3	1	33.33	

feeding without concentrate and sheep drinking pond water, as all of these had higher rate of anaemia (Table 5). Present findings were in accordance with Odoi *et al.* (2007), Sertse and Wossene (2007) and Khan *et al.* (2021).

Large numbers of animals graze year-round together on community grazing land in an area under extensive management practice with high stocking density, this leads to increase in amount of eggs that contaminate the pasture and therefore increase in number of worms causing anaemia (Khan *et al.*, 2021). Anaemia in sheep caused by (endo and ecto) parasitic infection was widely prevalent due to poor management, inadequate farmer knowledge, and limited animal health services (Sertse and Wossene, 2007). The significant factor impacting gastrointestinal parasite infections was the frequency of deworming, the extended use of a same kind of anthelmintic, and under or over dosing of animals which leads to the selection and development of resistant strains of GI parasites (Odoi *et al.*, 2007). Concentrates plays a crucial role in providing protein in the diet, counteracting the hypoproteinemia caused by parasites.

Diagnosis of Anaemia in Sheep

In the present study, anaemia in sheep was identified by comparing with the color of the conjunctival mucus

membrane to a color chart developed by CSWRI, as well as by looking at the erythrocyte index and haemoglobin concentration. Sheep with moderate level of anaemia were indicated by a pale pink conjunctival mucus membrane and a haemoglobin level of 5-8 g/dL. These findings were in accordance with Singh and Swarnkar (2012), who ascertained the association between the blood parameters (packed cell volume and haemoglobin) and the severity of the *Haemonchus contortus* infection. They used color chart, which displays the expected color of the conjunctival mucosae of sheep with PCV of >32 % (category 1), 28-32 % (category 2), 23-27 % (category 3), 18-22 % (category 4), and <18 % (category 5), according they classified the animals in categories 1 to 3 as normal, while animals in categories 4 and 5 were considered anemic (Singh and Swarnkar, 2012).

CONCLUSION

The current study examined the prevalence and risk factors of anaemia in sheep in Shivamogga region over one year (March 2023 to February 2024). The overall prevalence of anaemia in sheep was 83 %. The higher prevalence of anaemia was recorded in August month, in less than 6 months age group, in female sheep, during monsoon

season and in sheep having endo-parasitic infection. The occurrence of moderate anaemia was more prevalent compared to mild and severe anaemia.

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