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Original paper

Prevalence of haemoprotozoan and gastrointestinal parasites of sheep imported from Syria into Sulaymaniyah province of Iraq

Aram Ahmad MOHAMMED

Department of Microbiology, College of Veterinary Medicine, Sulaimani University, Kurdistan Region, Iraq

E-mail: aram.mohammed@univsul.edu.iq

ABSTRACT. Parasitic haemoprotozoan and gastrointestinal (GI) diseases are a big issue in animal husbandry and one of the most significant causes for livestock economic losses in underdeveloped countries. This study aimed to record preliminary information on the prevalence of haemoprotozoan and gastrointestinal parasites of Awassi breed of sheep imported from Syria into Sulaymaniyah province, Iraq. Faecal and blood samples were randomly collected from a total of 714 sheep of both sexes from June to September 2019. Giemsa staining technique, direct faecal smear, saturated salt flotation method, and simple sedimentation technique, were applied to diagnose the parasitic stages in the coprological and blood specimens. The overall prevalence rate was 75.63%. Single and mixed infection rates of parasites were 55.46%, and 20.16%, respectively. GI parasites and haemoprotozoan infection rates were 78.15%, and 20.16%, respectively. Of all parasites, the most prevalent was *Eimeria* spp. (68%), followed by *Babesia* spp. (20.15%), *Balantidium coli* (5.90%), *Fasciola hepatica* (2.50%), and strongyles (1.7%). The prevalence rates for GI parasites and haemoprotozoa varied considerably in regard to sex categories. It is recommended that strict quarantine procedures, adequate parasitological monitoring, and therapeutic approaches should be implemented to animals transported from bordering countries to minimize the incidence of parasite infection.

Keywords: preliminary study, blood protozoa, GI parasites, imported herds, Iraq

Introduction

Gastrointestinal (GI) parasite infection in sheep is one of the main economic and health problems facing the sheep industry. The common abnormalities in animals infected with GI parasite are decreased in plasma protein, protein metabolism alteration, diarrhoea and weight gain. Others include decreased productivity, care and prophylaxis costs, and occasional mortality [1]. Studies have also shown that certain sheep GI parasites are of concern to human health and have been linked to infections with zoonotic diseases, whether through direct or indirect contact with sheep faecal materials [2–4].

The frequency of GI parasitism and the intensity of the infection varies considerably based on the included parasitic genera, animal species, regional environmental factors, and management practices [5]. Early identification and preventive action can be used to reduce losses caused by gastrointestinal parasitism [6].

Blood parasites are commonly known to cause red blood cell damage that results in anaemia, anorexia, jaundice, decreased weight gain, productivity and reproduction loss, high morbidity, and even mortality [7,8]. Babesiosis is a tick-borne haemoparasitic disease caused by various protozoa species belonging to the *Babesia* genus [9].

Almost all cattle and sheep possess boundless economic benefit, as all animals provide considerable quantities of milk, meat and skin, with sheep becoming a valuable source of fleece [10,11]. Nevertheless, the benefits obtained from these animals are far below the predicted quantity and quality due mainly to low productivity caused by haemoparasites.

A number of studies have been conducted on the occurrence of GI parasites and haemoparasites in

Table 1. Prevalence of haemoprotozoan and GI parasites of Awassi breed of sheep (N =714) imported from Syria

Parasites	n (%)	*P*-value of X^2
Single infection		
Eimeria spp.	342(47.90)	
Babesia spp.	54(7.56)	
Total	396(55.46)	
Mixed infection		
Eimeria spp. + *Babesia* spp.	90(12.60)	< 0.001
Eimeria spp. + *Balantidium coli*	24 (3.36)	
Eimeria spp. + *Balantidium coli* + *Fasciola hepatica*	18(2.52)	
Eimeria spp. + Strongyle type	12(1.68)	
Total	144(20.16)	
Overall	540(75.63)	

N: total number of examined sheep; n: number of infected sheep

sheep in various parts of the country [11–16]. However, information or report on the occurrence of parasites in imported sheep breeds from neighboring countries is limited. Therefore, the aims of the current study were to establish the prevalence of haemoprotozoan and GI parasites of the Awassi breed of sheep imported from Syria into Sulaymaniyah province, Iraq.

Materials and Methods

Study sheep and specimen collection

This study was conducted in the Sulaymaniyah province, Kurdistan Region, north-east Iraq. The province is located between 35°04′–36°30′ latitude and 44°50′–46°16′ longitude. The region is characterized by seasonal rainfall from October to May, and insufficient farmers' knowledge of the ruminants' husbandry and control of endoparasites. Sheep population is around 1.2 million according to the survey done by Sulaymaniyah Veterinary Directorate.

Faecal and blood samples were randomly collected from a total of 714 sheep of both sexes imported from Syria. The faecal specimens obtained from rectum were stored at 4°C until parasitological analysis. The blood was collected into anticoagulant test tubes and refrigerated until processed. Information was registered, such as animal source, sex, age, and sheep breed. Sheep were categorized as Awassi breed, adult male and female, and originated from Syrian neighboring country. The sampling period was from June to September 2019.

Parasitological screening

Faecal samples were analyzed to recover parasitic stages including helminth eggs, cysts, and protozoan oocysts, by using common test tube flotation procedure employing saturated salt solution (sodium chloride solution). A simple technique of sedimentation was used to find fluke ova and some other roundworms and tapeworms, whose eggs were not recovered in a saturated salt solution. The direct faecal smears also prepared for the detection of GI protozoan trophozoites and cysts [17]. A thin blood smears stained with Giemsa were prepared and screened for detecting haemoparasites in the samples taken under the oil immersion objective light microscope lens [17,18]. The haemoprotozoan and GI parasites were recognized based on morphological keys [17–19].

Data interpretation

The data were analyzed with X^2-test using SPSS® software V.25. The values of probability below 0.05 were deemed statistically important.

Ethical approval

This research was performed in compliance with applicable national and international animal handling standards, with care to ensure animal health is respected. All procedures were clarified to obtain the approval of flock owners and the owners. Ethical consideration was obtained from Ethics Committee of the College of Veterinary Medicine, Sulaimani University.

Table 2. Sex-based prevalence of haemoprotozoan and GI parasites of Awassi breed of sheep (N =714)

Parasites	Prevalence	Sex category		
	n^a (%)	Adult male (n^b=324)	Adult female (n^b=390)	*P*-value of X^2
Gastrointestinal parasites	558(78.15)	246(75.92)	312(80.00)	< 0.001
Eimeria spp.	486(68.00)	210(64.81)	276(70.77)	< 0.001
Balantidium coli	42(5.90)	20(6.17)	22(5.64)	0.754
Fasciola hepatica	18(2.50)	10(3.08)	8(2.05)	0.635
Strongyles	12(1.70)	6(1.85)	6(1.53)	1.000
Blood Protozoa	144(20.15)	60(18.51)	84(21.53)	< 0.034
Babesia spp.	144(20.15)	60(18.51)	84(21.53)	< 0.034

N: total number of examined sheep; n^a: number of infected sheep; n^b: number of examined sheep

Results

Out of 714 faecal and blood samples examined, the total rate of parasitic infection was 75.63%. The single and multiple parasite infection rates were 55.46% and 20.16%, respectively with statistically significant variations. *Eimeria* spp. was the most predominant parasite to have reported the majority of multiple infections (Tab. 1).

In this study, the prevalence of GI parasites (78.15%) was higher than haemoprotozoa (20.15%). The prevalence rates of GI parasites and haemoprotozoan in reference to the sex categories were significantly different (Tab. 2).

Three types of protozoan oocyst/cysts and two types of helminth ova were found in the faecal examined in the present study, and blood samples, namely *Eimeria* spp. (68.00%), *Balantidium coli* (5.90%), *Babesia* spp. (20.15%), *Fasciola hepatica* (2.50%), and strongyles (1.70%) (Fig. 1). Among GI parasites, *Eimeria* spp. in adult females (70.77%) was significantly higher than in adult males (64.81%). Also, the prevalence of *Babesia* spp. in adult females (21.53%) was statistically higher than in adult males (18.51%).

Discussion

GI parasite disease control in animals needs detailed information on epidemiology, field management, and environmental factors such as rainfall and temperature [20]. The number of protozoan oocysts and helminth eggs that can develop inside the host animals varies according to the species of the parasite, the degree of susceptibility of the host, the animals' health and immune status [20].

In the current study, the findings demonstrated high GI parasitic infection in sheep (78.15%).This finding varies from that documented in other Iraqi regions: it was higher than the prevalence registered in Baghdad (75.1%) by Fadl et al. [21], and higher than that documented by Al-Bayati and Arsalan [22] in Mosul (54%), Al-Robaiee et al. [16] in Kirkuk (53.1%), and Al-Zandee et al. [14] in Garmiyan (48%). Likewise, higher frequency of GI parasitism has been recorded in Pakistan: (72%) [23], Iran: (70%) [24], Egypt: (50%) [25], and Bangladesh: (65.9%) [26]. In contrast, Minnat [13] and Almalaik et al. [27] registered higher rate of GI parasite infection in Iraq's Diyala province (87.71%) and in Sudan (94.9%), respectively. These differences may be due to inequalities in geoclimatic conditions, small ruminant and nutritional status along with management [26].

In the present investigation, female sheep (80%) had higher prevalence of GI parasite than male sheep (75.92%). This finding was consistent with Islam et al. [26] who showed that, in Bangladesh, female sheep (83.6%) were more exposed to parasitic GI infection than male sheep (64.7%). Contrary, Yeasmin et al. [28] and Raza et al. [29] recorded that male sheep were more exposed to helminthosis than females in Bangladesh and Pakistan, respectively. Dabasa et al. [30] indicated that high female prevalence may be due to stress and poor immune function during pregnancy, paresis and lactation [30]. Likely, higher level of prolactin and progesterone hormones also increased the susceptibility of female to any infection [31].

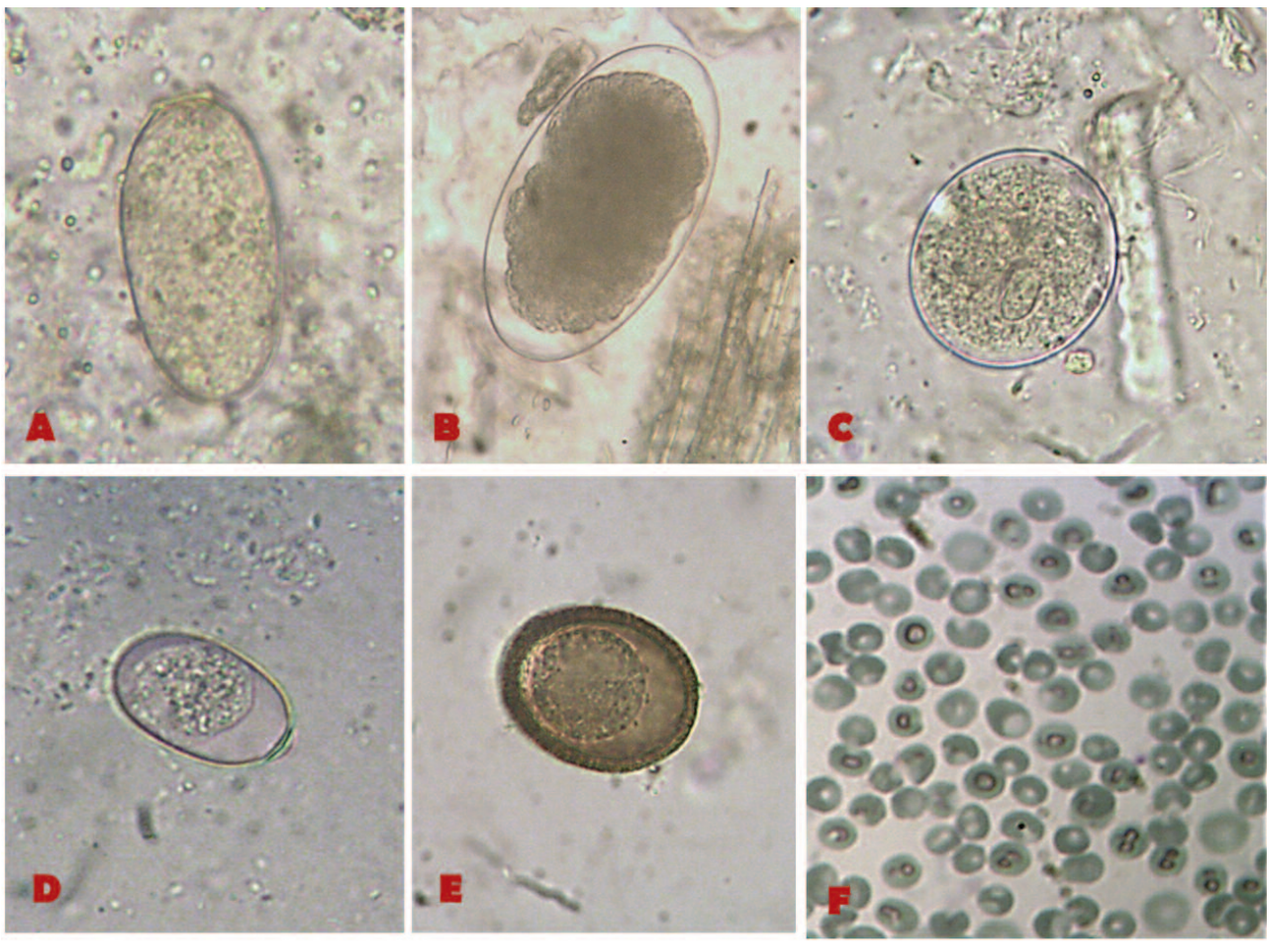

Figure 1. Faecal smears of sheep (×40): A. *Fasciola hepatica* (egg); B. Strongyle type (egg); C. *Balantidium coli* (cyst); D and E. *Eimeria* spp. (oocyst), Giemsa-stained blood smear of sheep (×100); F. *Babesia* spp.

This research recorded higher rate of single parasitic infection (55.46%) compared to mixed infection (20.16%). This result disagreed with Al-Robaiee et al. [16] and Al-Zandee et al. [14] in sheep of Kirkuk and Garmiyan provinces of Iraq, respectively. The high percentage of mixed infection could be associated with contamination of pastures with the eggs of different parasites, and the susceptibility to infection due to immune status of infected animals [16].

During this study, *Eimeria* spp. (68%) was the most abundant parasite identified in the sheep. This finding varies from that reported in other provinces of Iraq, and was higher than recorded in Mosul: (60.5%) [32], Baghdad: (49%) [33], Erbil: (3.25%) [34], Garmiyan (31.3%) [14], and Kirkuk: (27%) [16]. In comparison, Minnat [13] in Diyala reported higher rate of infection (86.09%). This disparity may be attributed to variations in the host's environmental factors, management practice, immune status and nutrition status. In addition to that, other reasons could be included such as variation in sampling periods and diagnostic methods.

Babesiosis and theileriosis are the most important protozoan diseases in ruminants, causing high economic losses worldwide each year [35]. The most popular method of diagnosing piroplasmosis involving Giemsa staining of blood smears [36]. The diagnosis of vector-borne diseases, including babesiosis, theleriosis, and anaplasmosis also relies on the parasites being found in the infected erythrocytes. Although the identification of parasites can be easily implemented in the field, the sensitivity of the method and its inability to detect piroplasmosis demonstrate the disadvantage of parasitological diagnosis by Giemsa stained blood smears, if the number of parasites in the peripheral blood is too low [37].

According to the result of current study, *Babesia* spp. was the only haemoparasite diagnosed in imported breed of sheep with prevalence rate of 20.15%. Higher prevalence of *Babesia* spp. has

been recorded among sheep in Sulaymaniyah city of Iraq (56.3%), Syria (22.1%), and Iran (23.5%) by Abdullah and Mohammed [12], Hasan [38], and Razmi et al. [39], respectively. Whereas, lower occurrence of *Babesia* spp. has been recorded among sheep in Nigeria (0.97%), Kurdistan Region of Iraq (1.5%), Tunisia (2.9%), Turkey (9.9%), and Mosul province of Iraq (0.01%) by Jatau et al. [40], Renneker et al. [11], Rjeibi et al. [9], Bilgic et al. [41], and Abdullah et al. [15], respectively. Disparity in study time, breeds of sampled animals, differences in sample size, the diagnostic method used, and the management and nutritional status of animals sampled may have resulted in the incoherence of prevalence reported in this study as opposed to other researchers [15]. Moreover, such difference in the occurrence might be associated to other factors involving variation in localities and difference in environmental conditions, which may affect the dispersal and activity of the vector [38].

Concerning sex-wise prevalence of *Babesia* spp., female sheep (21.53%) were more exposed to babesiosis compared to male sheep (18.51%).This result coincides with Rjeibi et al. [9] who found female (10.8%) sheep were more subjected to *Babesia* spp. infection than male sheep (2.1%) in Tunisia. It might be due to the fact that because of the hormonal changes associated with gestation and lambing, female sheep are less immunologically prepared. On the contrary, Iqbal et al. [42] in Pakistan illustrated that males were more infected than females. This may be clarified by the fact that most female sheep graze while males are kept indoors.

Fasciola hepatica eggs were found in the present survey with low prevalence (2.5%). This rate is somewhat similar to that recorded by each of Elmonir et al. [43] in Egypt (0.41%) and Garduno et al. [44] in Mexico (1.7%). The low prevalence might be linked to successful implementation of control program for liver fluke disease. In addition to that, improved public awareness about the disease impact on animal health and productivity has strengthened the usage of fasciolicidal compounds for decreasing the rate of fasciolosis [25].

Balantidium coli cysts were recovered in this study with low prevalence (5.9%). This result disagreed with Sultan et al. [25] in Egypt who found lower prevalence (1.79%). Imported sheep may have *B. coli* infection by cross-infection with infected domestic animals (i.e. cattle, donkeys). Furthermore, sheep may also be infected with human or livestock excreta from contaminated pastures and water sources, particularly with the increased possibility of infection in the outdoor farming system from those sources [45].

Strongyle eggs were diagnosed in the current study with lowest frequency rate (1.7%). Higher occurrence has been recorded by Minnat [13] in Diyala province of Iraq (75%). This could be due to difference in sample size, and breed of animal sampled, management practice, immune and nutritional status of the animals.

In summary, to the best of our knowledge, this is the preliminary study conducted on prevalence of haemoprotozoan and GI parasites of sheep imported from Syrian neighboring country into Sulaymaniyah province of Iraq. This research revealed a high incidence of GI parasites in sheep, and it was concluded that the most prevalent parasites found in imported sheep were *Eimeria* spp. and *Babesia* spp. This data will provide baseline information on the prevalence of haemo- and GI parasites in imported sheep that is likely to be very beneficial for handling and controlling the parasitic infection. It is recommended that government should support the veterinary authority in applying parasitological screening to animals imported from neighboring countries to reduce the economic effect of parasitic diseases.

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