Acta Scientiae Veterinariae, 2014. 42: 1243.

RESEARCH ARTICLE
Pub. 1243

ISSN 1679-9216

Zoonotic Gastrointestinal Nematodes (Trichostrongylidae) from Sheep and Goat in Isfahan, Iran

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ABSTRACT

***Background*:** The most important genera of trichostrongylid nematodes that live in digestive tract of ruminants include *Teladorsagia*, *Haemonchus*, *Trichostrongylus*, *Cooperia* and *Marshallagia*. Out of the above-mentioned genera, four infect humans including *Teladorsagia*, *Haemonchus*, *Trichostrongylus* and *Marshallagia*. These parasites are an important part of ruminant pathogens, and some are extremely pathogenic and deadly, and thus vitally important from veterinary viewpoint. Hence, this study was performed to determine the latest status of zoonotic gastrointestinal trichostrongylid nematodes in sheep and goat, in Isfahan province, center of Iran.

***Materials, Methods & Results*:** The intestines and abomasums of 109 small domestic ruminants (56 sheep and 53 goats) which were slaughtered at Isfahan slaughterhouses were collected and placed separately in large containers to be transferred to the laboratory. To investigate morphological characteristics, the found nematodes were placed on glass slides appropriately, dyed by lactophenol and azocarmine as a temporary mount. Finally, their genus and species were identified according to morphological characteristics using valid taxonomic keys. Seven species of trichostrongylid nematodes belonged to four genera were isolated from intestines and abomasums of sheep and goats. The found species were *Trichostrongylus vitrinus*, *T. probulurus*, *T. colubriformis*, *Teladorsagia occidentalis*, *T. circumcincta*, *Marshallagia marshalli* and *Haemonchus contortus*. The dominant species in the intestines of sheep and goats was *T. vitrinus* with the frequency of 26.8% and 18.9%, respectively. In the abomasums of sheep, the dominant species was *M. marshalli* with the frequency of 57.1%, and that in goats was the species *T. circumcincta* with the frequency of 47.2%.

***Discussion*:** Livestock has undeniable role in the human life cycle and ecosystem balance. At times, coexistence of humans alongside livestock over the years has been accompanied by undesirable consequences like zoonotic diseases. According to the results of this study, infection of livestock with trichostrongylid nematodes is well established in Isfahan region. In this study, seven species of trichostrongylid nematodes were found in animals under study. Among those, *T. vitrinus*, *T. colubriformis*, *T. probulurus*, *M. marshalli* and *H. contortus* are zoonoses and therefore their control and prevention have been always a main problem in hyperendemic and endemic areas. Unfortunately, no study has been performed on human in any regions of Iran in recent years regarding prevalence of zoonotic gastrointestinal helminthes such as trichostrongylid nematodes. Hence, trichostrongylid nematodes in human in the area, if any, can be considered as neglected parasites. Moreover, some of the found parasites, namely *T. colubriformis*, *T. circumcincta*, *H. contortus*, are resistant to several medications. Given that these parasites have a direct life cycle, thus, lack of hygiene in farms where animals are kept leads to increased infection. To reduce infection, protect livestock, and increase production in endemic areas, it is recommended that drug resistance in the found species should be evaluated and livestock should be periodically treated with anthelmintic medications. Additionally, because of zoonotic nature of some species of the parasites, measures must be taken to protect the health of people who are directly engaged with these animals.

Keywords: zoonoses, Trichostrongylidae, sheep, goat, Isfahan, Iran.

Received: 13 July 2014 Accepted: 12 November 2014 Published: 12 December 2014

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INTRODUCTION

The most important genera of trichostrongylid nematodes that live in digestive tract of ruminants include *Teladorsagia*, *Haemonchus*, *Trichostrongylus*, *Cooperia* and *Marshallagia*. Out of the above-mentioned genera, four infect humans including *Teladorsagia*, *Haemonchus*, *Trichostrongylus* and *Marshallagia*, with the highest prevalence of these parasites in human in the world seems to be in Iran [4]. Iran is considered as one of the important endemic parts of the world for these parasites, with 67% infection in human in rural Isfahan [6]. With a prevalence of 20 to 80 percent, these parasites are an important part of ruminant pathogens, and some are extremely pathogenic and deadly, and thus vitally important from veterinary viewpoint. In terms of economics, these parasites cause reduction in growth and development of farm products (milk, meat, and wool) [3]. Traditionally, in rural areas, livestock are the mainstay of peoples' live; hence, there is a high probability of infection of people through parasites of animal origin. Trichostrongyliasis often considered as a health problem and an economic setback, because of difficulty in their control and prevention.

This study was performed to determine the latest status of zoonotic gastrointestinal trichostrongylid nematodes in sheep and goat in Isfahan province, central Iran. Results obtained reflect the current status of trichostrongylid parasites in the region, and it is hoped that this study encourages researchers to focus on various aspects of this subject.

MATERIALS AND METHODS

The intestines and abomasums of 109 small domestic ruminants (56 sheep and 53 goats) which were slaughtered at Isfahan slaughterhouses were collected and placed separately in large containers to be transferred to the laboratory. The gastrointestinal contents from each animal were washed in water and passed through different mesh size sieves. Initial separation of nematodes was done via stereoscope. Then, the found nematodes were placed in a fixative containing ethanol (95%) 85 mL, formaldehyde (37%) 10 mL, glacial acetic acid 5 mL, so-called FAA or AFA solution. To investigate morphological characteristics, the nematodes were placed on glass slides appropriately, dyed by lactophenol and azocarmine as a temporary mount. Finally, their genus and species were identified according to morphological characteristics using valid taxonomic keys [2,10]. It deserves mentioning that the photographs were taken by a 3.1 megapixel digital microscope camera (Leica DMC2900).

Table 1. The prevalence of nematodes from abomasums and intestines of sheep and goat slaughtered at Isfahan slaughterhouses, Iran.

Nematodes	Sheep		Goat	
	Intestine N. (%)	Abomasum N. (%)	Intestine N. (%)	Abomasum N. (%)
M. m	11 (19.64)	32 (57.14)	-	20 (37.74)
Te. c	4 (7.14)	26 (46.43)	-	25 (47.17)
Te. o	4 (7.14)	28 (50)	-	20 (37.74)
T. v	15 (26.79)	2 (3.57)	10 (18.87)	-
T. c	12 (21.43)	4 (7.14)	8 (15.09)	-
H. c	8 (14.29)	10 (17.83)	5 (9.43)	-
T. p	4 (7.14)	-	3 (5/66)	-

M.m= *Marshallagia marshalli*; Te.c= *Teladorsagia circumcincta*; Te.o =*Teladorsagia occidentalis*; T.v= *Trichostrongylus vitrinus*; T.c= *Trichostrongylus colubriformis*; H.c= *Haemonchus contortus*; T.p= *Trichostrongylus probulurus*.

RESULTS

Seven species of trichostrongylid nematodes belonged to four genera were isolated from intestines and abomasums of the sheep and the goats. The found species were *Trichostrongylus vitrinus*, *T. probulurus*, *T. colubriformis*, *Teladorsagia occidentalis*, *T. circumcincta*, *Marshallagia marshalli* and *Haemonchus contortus* (Figure 1). The prevalence of the found nematodes from sheep and goats together is presented in Figure 2. The dominant species in the intestines of sheep and goats was *T. vitrinus* with the frequency of 26.8% and 18.9%, respectively. In the abomasums of sheep, the dominant species was *M. marshalli* with the frequency of 57.1%, and that in goats was the species *T. circumcincta* with the frequency of 47.2% (Table 1). Distinctly, the frequency of nematodes in sheep and goats is presented in Figure 3. The findings showed that the infection of intestines and abomasums with different types of trichostrongylid nematodes was higher in sheep than in goats.

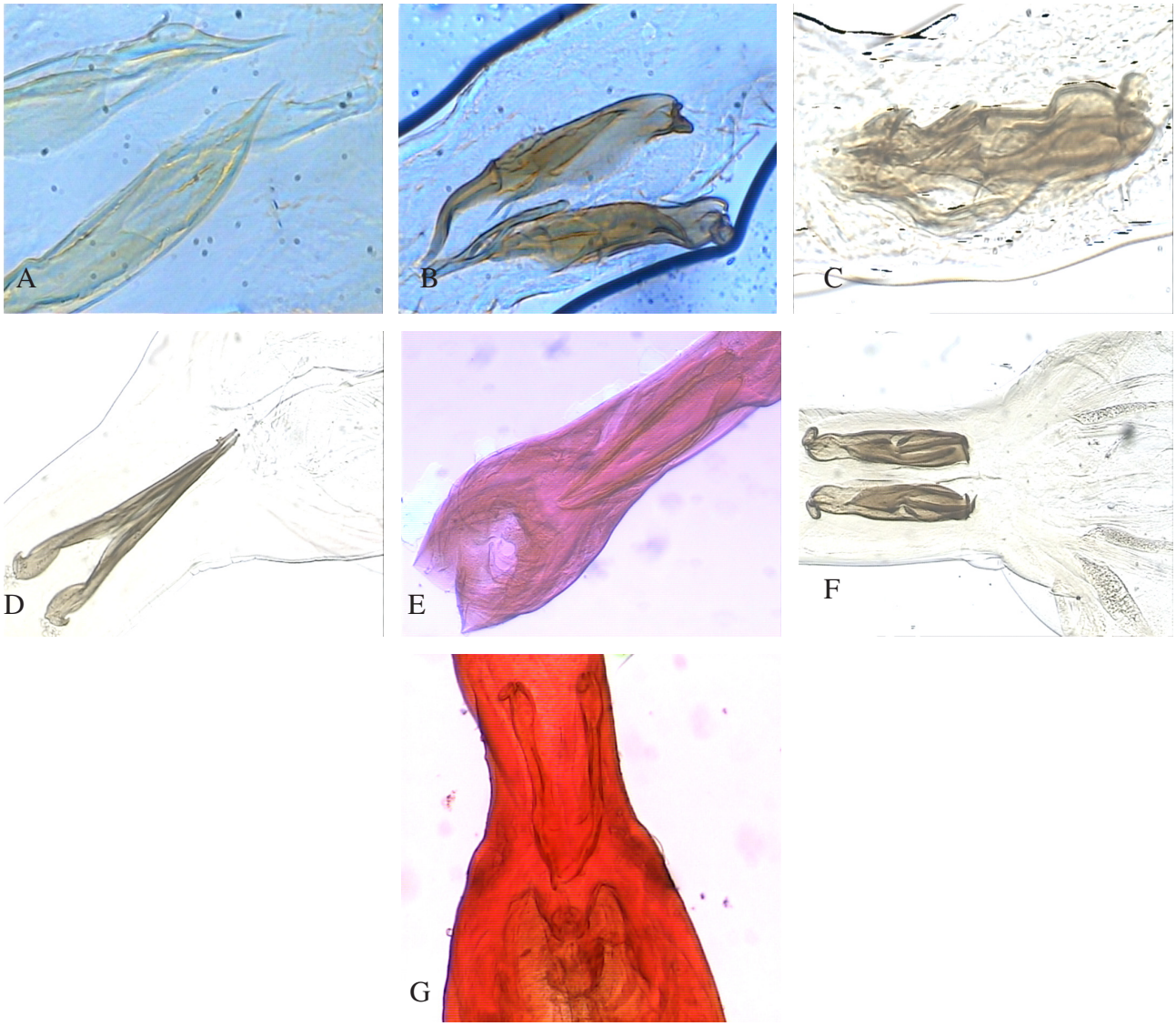

Figure 1. The identified species in sheep and goat in the current study. (A) *Trichostrongylus vitrinus*; (B) *Trichostrongylus colubriformis*; (C) *Trichostrongylus probulurus*; (D) *Haemonchus contortus*; (E) *Teladorsagia circumcincta*; (F) *Teladorsagia occidentalis*; (G) *Marshallagia marshalli*.

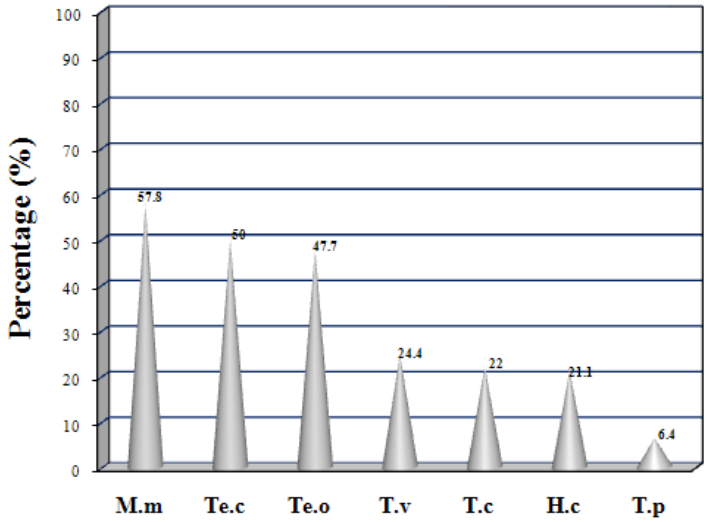

Figure 2. The prevalence of trichostrongylid nematodes from sheep and goats together. M.m= *Marshallagia marshalli*; Te.c= *Teladorsagia circumcincta*; Te.o =*Teladorsagia occidentalis*; T.v= *Trichostrongylus vitrinus*; T.c= *Trichostrongylus colubriformis*; H.c= *Haemonchus contortus*; T.p= *Trichostrongylus probulurus*.

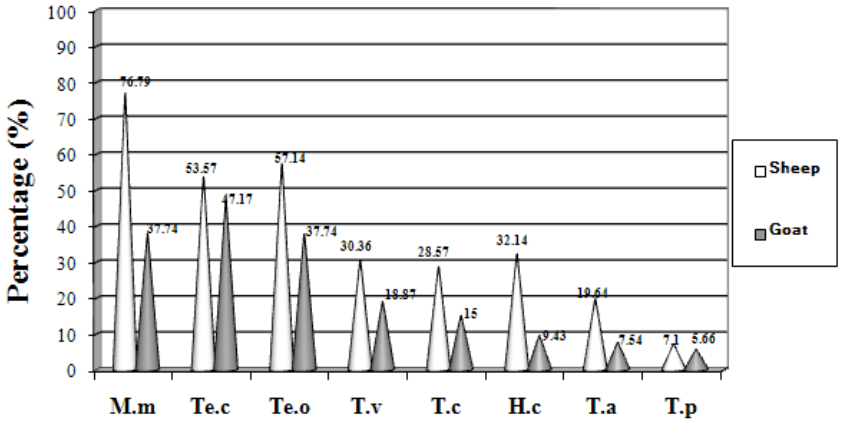

Figure 3. The frequency of nematodes in sheep and goats distinctly. M.m= *Marshallagia marshalli*; Te.c= *Teladorsagia circumcincta*; Te.o =*Teladorsagia occidentalis*; T.v= *Trichostrongylus vitrinus*; T.c= *Trichostrongylus colubriformis*; H.c= *Haemonchus contortus*; T.p= *Trichostrongylus probulurus*.

DISCUSSION

Livestock has undeniable role in the human life cycle and ecosystem balance. At times, coexistence of humans alongside livestock over the years has been accompanied by undesirable consequences like zoonotic diseases. According to the results of this study, infection of livestock with trichostrongylid nematodes is well established in Isfahan region. The rate of increase in number of livestock, seasonal migration of livestock across the land, and also Isfahan regional climate, all influence these parasites life cycle. The found intestinal nematodes in this study have been also reported throughout the world, but the prevalence of each species varies according to regional climates, cultural behaviors, and some other effective factors.

In this study, seven species of trichostrongylid nematodes were found in animals under study. Among those, *T. vitrinus*, *T. colubriformis*, *T. probulurus*, *M. marshalli* and *H. contortus* are zoonoses, and therefore their control and prevention have been always a main problem in hyperendemic and endemic areas [5,6]. Unfortunately, no study has been performed on human in any regions of Iran in recent years regarding prevalence of zoonotic gastrointestinal helminthes such as trichostrongylid nematodes. Hence, trichostrongylid nematodes in human in the area, if any, can be considered as neglected parasites.

Some of the found parasites, namely *T. colubriformis*, *T. circumcincta*, *H. contortus*, are resistant to several medications [1,11]. Among last-mentioned parasites, *H. contortus* has been mostly studied by researchers as a good model for trichostrongylid nematodes due to being highly pathogenic in sheep, zoonosis, and drug resistance [9]. Additionally, some variants have been reported regarding the parasite [7,12], which may justify its drug resistance. Distribution of the parasites varies from place to place in the world depending on difference in climatic conditions in various areas [11]. Interestingly, despite dramatic climatic changes during recent years in Isfahan such as serious reduction in rainfall, the life cycle of the parasites is well established among small ruminants, as shown in the present study. The infected ruminants are mostly asymptomatic, except in heavy infections that rarely occur, because in endemic areas, livestock are constantly exposed to the parasites and therefore their immune system adapted to coexist with the parasites. Traditionally, grazing sheep and goat together is a possible cause for persistence of the parasites in livestock, because goats do not become immune against the parasites and act as silent carriers to contaminate the pasture. They also metabolize anthelmintic medications more rapidly than sheep, and therefore are at risk of developing drug resistance more rapidly than sheep [8]. Hence, it appears that training of farmers is one of the key elements of reducing parasite burden in livestock in rural areas of developing countries.

CONCLUSIONS

Given that these parasites have a direct life cycle, thus, lack of hygiene in farms where animals are kept leads to increased infection. To reduce infection, protect livestock, and increase production in endemic areas, it is recommended that drug resistance in the found species should be evaluated and livestock should be periodically treated with anthelmintic medications. Additionally, because of zoonotic nature of some species of the parasites, measures must be taken to protect the health of people who are directly engaged with these animals.

***Funding*.** This work was supported by a grant from Deputy of Research, Isfahan University of Medical Sciences, Isfahan, Iran.

***Acknowledgements*.** Authors would like to thank the Isfahan farmers for their kind cooperation and generous assistance in performing the study.

***Declaration of Interest*.** The authors declare that there is no conflict of interest.

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