

Prevalence of common human and livestock parasites (*Hydatid Cyst, Fasciolosis and Cysticercosis*) in small ruminants of southern Iran

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ABSTRACT

The levels of infection by hydatid cyst, fasciolosis and cysticercosis of ruminants liver were compared base on their relationship with age, sex, season and type of the livestock in Darab county's slaughterhouse, south of Iran. A total of 2675 livestock, 2029 (%75.9) goats and yearlings, and 646 (%24.1) sheep and lambs, were examined. The infection rates for hydatid cyst, fasciola, and cysticercus were found %9.8, %6.7, and %5.9, respectively. The high infection rates for hydatid cyst, fasciola and cysticercus were found in sheep (12.2%, 11.1% and 8.4%, respectively). The female animals showed the higher infection rates than male animals in entire studied pathogens. The excessive prevalence of the infection was found in the older animals than the youngsters. The prevalence rate of this infection was higher in spring than winter semester. The results of this study showed significant differences between the prevalence of hydatid cysts, fasciola and cysticercus with type, sex, age and season ($P < 0.05$). The infection rates of zoonotic parasites in tissue were average. According to economic losses due to animal mortality, discarding the carcasses, the life cycle, and risks for transmission to human, a comprehensive control of these parasites were recommended.

Keywords: Hydatid cyst, Livestock, Metacestodes, Parasites, Zoonosis

Introduction

Zoonoses are naturally transferred among vertebrate animals and humans, and are known as maladies and infections ^[1]. As one of the most important animals and public health problems, they are affecting the health of societies worldwide; and still a large number of them go unrecorded and are often overlooked ^[2]. Zoonoses caused by parasites have been assumed to have a

significant role in public health with some of them being involved in opportunistic infections. More than half zoonoses are stored in the animal repository but can be transmitted to humans as a result of various risk factors and behavioral features ^[3]. They are considered as a major threat to the economic and social development of developing countries. ^[4]. Nowadays, in most countries, especially in developing countries, parasitic infections in domestic animals have a lot of economic damage. Fasciolosis infection that now is identified as an emerging disease, is one of the most common economically important and widespread parasitic diseases of domestic livestock particularly in cattle, sheep and goats. The World Health Organization (WHO) has computed that further than 180 million are at risk of infection with fasciola and 2.4 million people are infected ^[5]. Unilocular hydatid cyst, is a zoonotic disease caused by the cystic larval stage of the tapeworm *Echinococcus granulosus*, and also known as hydatidosis. Hydatid cysts in livestock are diagnosed when

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animals are sent to slaughterhouses. This illness used to be particularly common in developing and undeveloped countries, including the Mediterranean region^[3]. Metacestodes are the larval phases of the tapeworms biding in moderate hosts. The Mediterranean, southwestern Asia and the Middle East, coast were considered of high endemic region for metacestodes infection. *Cysticercus tenuicollis* is One of the most ordinary metacestodes found in infected slaughtered sheep and it is the larval stage of *Taenia hydatigena*, a tapeworm of dogs and wild carnivores. The cysticercosis is most commonly found attached to the mesentery, omentum, live and peritoneum.^[6]

There are Several reports on the prevalence of cysticercosis and taeniasis in west and north of Iran^[7-9]. Due to the prevalence of traditional and nomadic livestock farming and especially seasonal migration and also the possibility of transmission of contaminated conditions to non-polluted areas in Darab, therefore, it is necessary to study the prevalence of hydatid cyst, fasciolosis and cysticercosis in small ruminants slaughtered in this region. As a result, this study was conducted to compare the levels of infection by hydatid cyst, fasciolosis and cysticercosis in small ruminants liver in a slaughterhouse to the relationship of infection to all three parasites with age, type of livestock and season in Darab city in south of Iran.

Materials and Methods

This cross-sectional study was conducted on the liver of sheep and goats slaughtered from December 2016 to June 2017 in Darab slaughterhouses of Fars Governorate, south of Iran. Darab is located at 28.7560° North latitude and 54.5547° East longitudes with an average altitude of 1170 m above sea level. A total of 2675 livestock in Darab slaughterhouse, including 2029 (75.9%) goats and yearlings, and 646 (24.1%) sheep and lambs were examined.

Pre-slaughter inspections of small ruminants were conducted in order to determine the species, age and origin of animals. The age grouping was performed based on arbitrary classification according to Steele (1996) and Gatenby (1991). The age assortment was based on dentition. Those which have not erupted permanent incisor teeth, were classified as young, while those with one pair or more permanent incisor teeth were classified as adults^[10, 11]. During post-mortem inspection of livers were thoroughly inspected by visualization, palpation and making systemic incisions to control for presence of cysts, parasites and other abnormalities. Pathological lesions were differentiated and judged according to FAO, (2000) meat inspection manual for developing countries guidelines and the results were recorded^[12].

The livers of the slaughtered animals were carefully inspected in the slaughterhouse. Hydatid cysts were identified by touching and cutting for destruction. To investigate the presence of fasciola parasite, a longitudinal incision was created in the biliary duct of the liver. By placing pressure on the two parts of the bile duct, if the infection was present, the parasite would be removed from the duct. The liver tissue of Livestock that was infected by cysticercosis was studied macroscopically to define the severity

of lesions in this larva. The severity of the lesions was determined by counting the migration routes at the membranal and visceral levels of the liver tissue and classified into three mild (Less than five immigration routes), moderate (From five to ten migration routes) and severe (More than ten immigration routes) grades.

All data collected from the study area and were recorded in a format developed for this purpose and later on entered in to Microsoft excel 2007 program and analyzed using SPSS 18 version. Liver condemnation rates defined as a proportion of condemned liver to the total number of liver examined. The data obtained during the study was subjected to chi square and One-Way ANOVA statistical analysis to see the association between rejection rates of liver, season, sex, age and type of animals and differences were regarded statistically significant if the P value < 0.05.

Results and Discussion

The variations in an infection rate of hydatid cysts, fasciolosis and cysticercosis, according to the type of livestock

Total of 646 sheep and 2029 goats were examined at Darab for the presence of Hydatid cyst, *Fasciola* spp and *C. tenuicollis*. Of these animals, 262 (9.8%) were found to be infected by Hydatid cyst. The rate of infection with hydatid cyst in goats and yearlings was 9% and in lambs and sheep was 12.2%. The incidence of fasciolosis in the studied livestock was 6.7%. The rate of infection with fasciolosis in goats and yearlings was 5.2% and in lambs and sheep was 11.1%. The results of cysticercosis test showed that The incidence of cysticercosis in the studied livestock was 5.9% and the rate of infection with cysticercosis in goats and yearlings was 5.1% and in lambs and sheep was 8.4%. The results of this study showed that the incidence of hydatid cysts, fasciolosis, and cysticercosis in lambs and sheep is higher than goats and yearlings. The statistical results of this study showed a significant difference between types of livestock and the rate of infection to hydatid cysts, fasciolosis and cysticercosis ($P < 0.05$). This result was agreed with Abdel-Maogood *et al.* (2005)^[13], (5.66%) in Cairo, in Egypt, Sissay *et al.* (2008)^[14] in Ethiopia, Al-Qureishy (2008)^[15] in Saudi Arabia (Figure 1).

The variations in an infection rate of hydatid cysts, fasciolosis and cysticercosis, according to the sex of livestock

From a total of 979 male and 1696 female livestock that were examined, The overall rate of infection with hydatid cyst for male slaughtered livestock was 9%, while for female it was 10.3% ; The rate of infection with fasciolosis for male slaughtered livestock was 8%, while for female it was 5.9%. also, 6% of male livestock and 2.5% of female livestock were infected with cysticercosis. Comparison of statistical results of this study showed that the incidence of hydatid cyst in female was more than males, while the incidence of fasciolosis and cysticercosis in males was more than females. It was observed that there was significant difference between sex of livestock and the infection

rate for fasciolosis ($P < 0.05$). However, there was no significant difference between the sex of the livestock and the hydatid cyst and cysticercosis ($P > 0.05$). On the other hand, Hashemnia *et al.* (2016) reported that the infection rate of cysticercosis in slaughtered sheep was significantly higher in males than females ($P < 0.05$) that was agreed with This result (Figure 2) ^[16].

The variations in an infection rate of hydatid cysts, fasciolosis and cysticercosis, according to the age of livestock

From a total of 2675 livestock that were examined, the amount of 931 livestock had less than a year of age and 1737 of them were older than a year. The incidence of hydatid cyst in the group of livestock younger than a year was 8.2% and in the group of older livestock was 12.8%. In the group of livestock younger than a year 5.9% and in the group of older of them 8% were infected with fasciolysis. The incidence of cysticercosis in the group of livestock younger than a year was 5.2% and in the group of older livestock was 7.1%. The results of this study reveal that the infection rates of hydatid cysts, fasciolysis and cysticercosis is more in the group of livestock younger than a year. The results showed a significant difference between age and the incidence of hydatid cyst, fasciolysis and cysticercosis ($P < 0.05$). This result was agreed with Ahmed K.D *et al.* (2017) in Egypt (Figure 3) ^[17].

The variations in an infection rate of hydatid cysts, fasciolosis and cysticercosis, in relation to season

Of 1489 livestock examined in winter, 9.5% were infected by hydatid cyst, 4.9% were infected by fasciolysis and 5.5% were infected by cysticercosis. In spring, From a total of 1186 livestock that were examined, 10.1% were infected by hydatid cyst, 8.9% were infected by fasciolysis and 6.3% were infected by cysticercosis. The results reveal that the incidence of hydatid cysts, fasciolosis, and cysticercosis in spring is more than winter. The results of this study reveal that there was a statistical significant difference ($P < 0.05$) in the prevalence rates of fasciolysis in spring and winter. However, no statistical significant difference ($P > 0.05$) in the prevalence rates of hydatid cyst and cysticercosis in spring and winter. This result was agreed with Hashemnia *et al.* (2016) ^[16]. While Al-Qureishy (2008) found that the highest infection rate (17.5%) was in autumn, followed by spring (14.3%), winter (9.7%) and the lowest was in summer (6.2%) (Figure 4) ^[15].

One of the important aspects of meat inspection is to assist in monitoring the diseases by providing feedback information to the veterinary service and eradicate or control diseases, to preserve the public from zoonotic hazards and to produce wholesome products. ^[18]. In the present investigation, the prevalence of hydatid cyst, fasciolysis and cysticercosis in liver of small ruminants slaughtered at Darab was inquired. In this study, the prevalence of hydatid cyst in 2675 livestock tested was 9.8%. This result is lower than those reported by Gebretsadik *et al.* (2010) ^[19] (32.11) in Addis ababa, Balkaya and Simsek (2010) ^[20] (34.3) in Turkey and Taghavi *et al.* (2013) ^[21] (14.93) in Urmia,

Iran. However, The percentage of hydatid cyst infection in this study, is higher than those reported by Abdi *et al.* (2013) ^[8] (3.18) in Ilam, Iran, Ezatpour *et al.* (2014) ^[9] (9.4) in Lorestan, Iran and Hussien *et al.* (2015) ^[22] (7.59) in Ethiopia. Comparing the results of this study with studies in other regions of Iran showed that the level of hydatid cyst in the region is moderate, and on the other hand, according to a study conducted by Tavakoli *et al.* (2008), the prevalence of hydatid cyst infection in slaughtered livestock in Fars province in Iran was 38.4%, which indicates that the parasite transmission cycle is active in the region ^[23]. Although the overall prevalence of pollution has risen slightly since that time, in the present investigate, the rate of infection with hydatid cyst in goats and yeanelings was 9% and in lambs and sheep was 12.2%. The results of this study showed that the incidence of hydatid cysts in lambs and sheep is higher than goats and yeanelings. In Lorestan, Iran, prevalence of 16.4% in sheep and 3.1% in goats were reported, that this result was agreed with current study ^[24]. However, this finding was not concurred by Rahimi *et al.* (2011), which reported the rate of contamination in sheep 7/9 and in 14/7 goats ^[25].

The incidence of fasciolosis in the studied livestock was 6.7%. This result is lower than those reported by Nayeb and Meshkehkar (2010) ^[26] (55.32%) and Hussien *et al.* (2015) ^[22] (24.29%). On the other hand, this result was higher than those reported by Jahed Khaniki *et al.* (2013) ^[27] (2.12%) and Abdi *et al.* (2013) (1.06%) ^[8]. The findings of this study indicated a lower incidence of fasciolysis in goats compared to sheep, which could be due to higher Resistance of goats for domestic parasites or differences in their nutritional habits with sheep.

In relation to the sex of the studied livestock, from a total of 979 male and 1696 female livestock that were examined, the overall rate of infection with hydatid cyst for male slaughtered livestock was 9%, while for female it was 10.3%. Females of slaughtered sheep (10.3%) were more susceptible to hydatid cyst infection than males (9%). Ahmadi and Moshkehkar (2008) also provided similar results ^[28]. This is probably due to the weakening of the immune system in female livestock during pregnancy, as well as the economic value of the female livestock that leads to their slaughter at an older age ^[29]. The overall rate of infection with fasciolysis for male slaughtered livestock was 8%, while for female it was 5.9%. The results indicate that the level of infection in male livestock is higher than female. This finding was not concurred by Ardo and Aliyara (2014) and Khanjari *et al.* (2010) ^[30, 31]. On the other hand, Fallah *et al.* (2014) reported that the level of infection in male livestock is higher than female, which was agreed with this result ^[29].

The incidence of hydatid cyst in the group of livestock younger than a year was 8.2% and in the group of older livestock was 12.8%. In the group of livestock younger than a year 5.9% and in the group of older of them 8% were infected with fasciolysis. The incidence of cysticercosis in the group of livestock younger than a year was 5.2% and in the group of older livestock was 7.1%. The results of this study indicated that the rate of infection with hydatid cysts, fasciolosis, and cysticercosis in the livestock increases with the age. Mbaya *et al.* (2010) and Ardo and Aliyara (2014), in their research, said that the rate of infection in adult

livestock was higher than younger ones. And these livestock are more affected^[30, 32]. Therefore, with regard to the time of livestock being moved to the ranch, the time it takes to part of the life cycle of the parasite in the host body of the ruminants, the low resistance of the parasite zygote to sunlight during the day and the reference to the pasture, is acceptable.

In relation to seasonal contamination, the results of this study reveal that the incidence of hydatid cysts, fasciolosis, and cysticercosis in spring is more than winter. Azami *et al.* (2013) reported that the highest levels of hydatid cyst is in the autumn and winter. Khanjari *et al.* (2014) reported the highest and lowest seasonal incidence of fasciola in the spring and summer^[33]. Comparison of the results of the studies conducted with the present study suggests that seasonal outbreaks of parasites do not follow the same pattern. The difference in weather conditions between the studied areas, especially the season of rainfall and humidity, may cause seasonal changes in the prevalence of contaminants. Temperature, humidity and precipitation patterns have paramount importance in the epidemiology of these parasitic infections.

Conclusions

Regarding the variability of infection rates in different years and not reducing the level of contamination of these parasites in ruminants, in order to protect public health and mitigate fatality, it is suggested to carry out an immediate control strategy for activation of the current and relevant legislations, proper meat hygiene and inspection in slaughterhouse, providing enough equipment and support to the veterinary services for treatment and immunization of livestock against these parasitic infections. In addition, economic losses due to animal mortality and discarding the carcasses or infected organs and decreasing production should be added, whereas according to the life cycle and transmission of this parasite and risks for transmission to humans' comprehensive control of these parasites was recommended.

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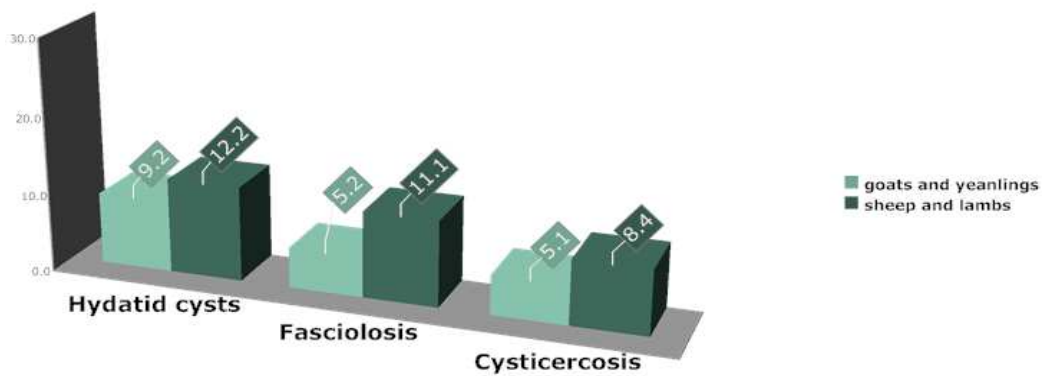


Figure 1. Comparison of the prevalence percentage of hydatid cyst, fasciolosis and cysticercosis based on type

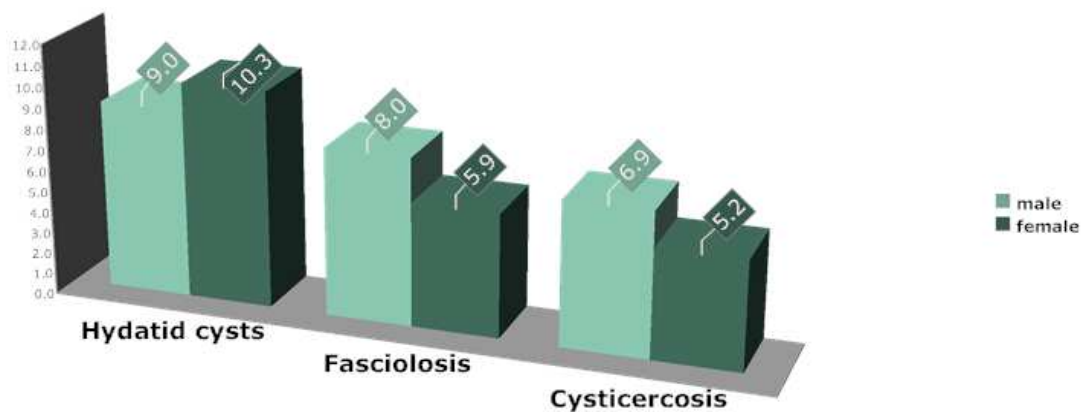


Figure 2. Comparison of the prevalence percentage of hydatid cyst, fasciolosis and cysticercosis based on sex

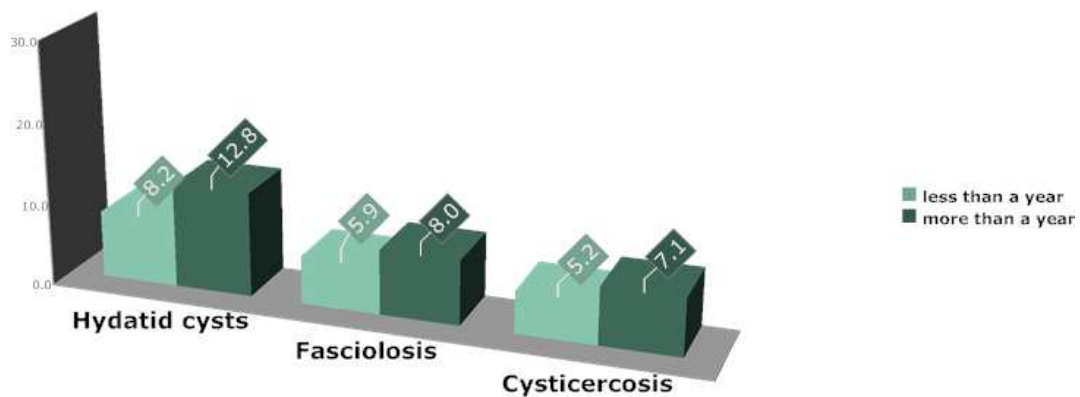


Figure 3. Comparison of the prevalence percentage of hydatid cyst, fasciolosis and cysticercosis based on age

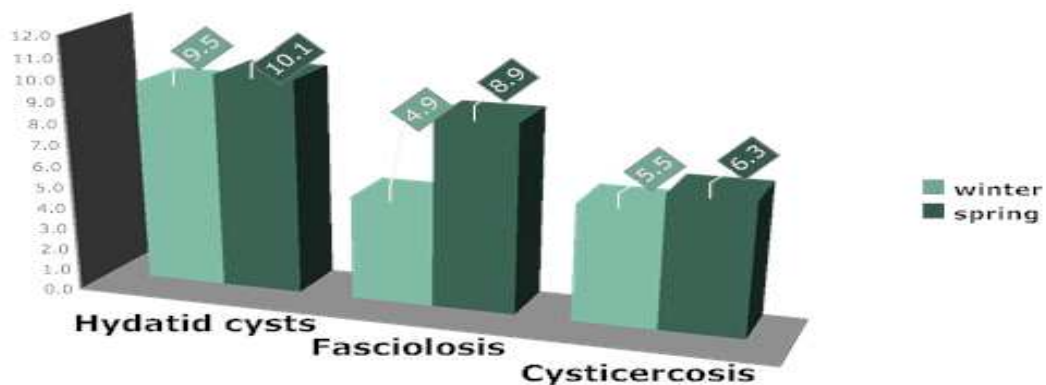


Figure 4. Comparison of the prevalence percentage of hydatid cyst, fasciolosis and cysticercosis based on season