

Original Article

A study on prevalence of some helminthic infections of the liver and lungs among ruminants in abattoir of Fars province, Iran

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ABSTRACT

Zoonotic helminths are often transmitted to humans through domestic animals. This retrospective study was performed to estimate the prevalence of some important zoonotic helminthic infections of the liver and lung including echinococcosis, fasciolosis and dicrocoeliasis in Kazerun and Shiraz abattoirs, Fars, Iran, during 2011-2013. A total of 12381 sheep, 6473 cattle, 22847 goats, 66 camels, and 10 buffalos were analyzed with regard to liver and lung helminthic infections including hydatidosis, fasciolosis, and dicrocoeliasis in Kazerun, during March 2011-January 2013. Moreover, 121100 sheep, 23515 cattle, 81293 goats, and 69 camels were investigated for the mentioned infections in Shiraz abattoir during one year since March 2012. Kazerun abattoir: The prevalence rates of liver hydatid cysts were 0.86%, 2.1%, 0.76%, and 15.1% in sheep, cattle, goats, and camels, respectively, whereas the prevalence rates of pulmonary hydatid cysts were 0.89%, 2.36%, 0.9%, and 16.6% in the mentioned animals, respectively. Fasciolosis was detected in 0.33%, 1.65%, and 0.24% of condemnation livers of sheep, cattle, and goats, respectively. However, dicrocoeliasis was just prevalent in 0.004% of goat livers. Shiraz abattoir: the prevalence rates of liver hydatid cysts were 3.44%, 3.12%, 2.94%, and 2.9% in slaughtered sheep, cattle, goats, and camels, respectively. In addition, 4.54%, 4.33%, 4%, and 4.35% of the lung of the mentioned animals were infected with hydatid cysts, respectively. Prevalence rates of *Fasciola spp* in slaughtered sheep and cattle were 2.49% and 1.86%, respectively, and rate of *D. dendriticum* infection in slaughtered sheep, cattle, and goats were 0.026%, 0.91%, and 4%, respectively. As compared with reports from other studies, it seems that Fars is among the low-endemic regions regarding this type of infection.

Keywords: Zoonoses, Helminthes, Abattoir, Fars, Iran

L'étude de la prévalence de certaines infections helminthiques affectant le foie et le poumon des ruminants d'abattage de la région de Fars en Iran

Résumé: Les helminthes zoonotiques sont souvent transmis à l'homme par les animaux domestiques. Cette étude rétrospective menée entre 2011 et 2013 dans les villes de Kazerun et Shiraz (région de Fars, Iran) avait pour but d'estimer la prévalence de certaines infections helminthiques importantes visant le foie et le poumon des animaux d'abattage, comme l'échinococcose, la fasciolose et la dicrocoeliase. Entre mars 2011 et janvier 2013, un total de 12381 moutons, 6473 bovins, 22847 chèvres, 66 chameaux et 10 buffles provenant des abattoirs de Kazerun ont suivi des analyses afin de déterminer la présence éventuelle de zoonoses comme l'hydatidose, la fasciolose et la dicrocoeliase. Les mêmes analyses ont été menées à Shiraz sur une période d'un an (à partir de mars 2012) incluant 121100 moutons, 23515 bovins, 81293 chèvres et 69 chameaux. A Kazerun, la prévalence des kystes hydatiques hépatiques détectés chez les moutons, bovins, chèvres et chameaux était respectivement de 0.86; 2.1; 0.76 et 15.1%. D'une autre part, la prévalence des kystes

hydatiques pulmonaires était sensiblement plus élevée, atteignant respectivement 0.89 ; 2.36 ; 0.9 et 16.6% dans les différents groupes d'animaux mentionnés. La fasciolose affectait le foie de 0.33% des moutons, 1.65% des bovins et 0.24% des chèvres, alors que la dicrocoeliase affectait uniquement 0.004% des chèvres. Dans les abattoirs de Shiraz, la prévalence des kystes hydatiques hépatiques détectés chez les moutons, bovins, chèvres et chameaux abattus était respectivement de 3.44 ; 3.12 ; 2.94 et 2.9%. Chez les mêmes groupes analysés et dans le même ordre, la prévalence des kystes hydatiques pulmonaires était respectivement de 4.54 ; 4.33 ; 4 et 4.35%. De plus, la fasciolose touchait respectivement 2.49 et 1.86% des moutons et bovins, alors que la prévalence des infections au *D. dendriticum* était de 0.026, 0.91 et 4% chez les moutons, bovins et chèvres, respectivement. En comparaison des résultats d'études similaires menées en Iran, la région de Fars semble l'une des moins touchées par ce type d'infections.

Mots clés : Zoonoses, Helminthes, Abattoir, Fars, Iran

INTRODUCTION

Zoonoses are the diseases transmitted from animals to humans, which are among the most significant and prevalent illnesses and are responsible for more than 60% of all human infections and 75% of emerging human infections (Cunningham, 2005). Zoonotic helminthes are globally transmitted to humans through their companion and domestic animals (Ekong et al., 2012). *Trichinella* in nematodes, *Echinococcus* and *Taenia* in cestodes, and *Fasciola* and *Schistosoma* in trematoda are well-known human zoonoses around the globe (Robinson and Dalton, 2009a). Cystic echinococcosis (CE) is a disease with worldwide distribution and hygienic and economic importance. The incidence of human infection is high in pasturing countries in the Middle East, where people have frequent contact with dogs (Sadjjadi, 2006; Rokni, 2009; Oryan et al., 2012). The disease is endemic and also responsible for almost 1% of patients in surgical wards in Iran (Rokni, 2008). Domestic dogs as definitive hosts play the most important role in dispersion of infection in the Middle Eastern countries, including Iran, via environmental contamination. In addition, sheep, goats, cattle, camels, and buffaloes have been frequently found infected with CE in Iran (Sadjjadi, 2006; Rokni, 2009; Oryan et al., 2012). *Fasciola spp* and *Dicrocoelium dendriticum* are the main helminthic parasites of sheep and cause economic losses to ranchers due to reduced milk and meat

production and fertility (Mas-Coma et al., 1999). Fasciolosis is considered endemic in some parts of Iran among humans and other definitive hosts (Rokni, 2008). During the two major epidemics of human fascioliasis, about 10,000 people were infected in North of Iran (Rokni, 2008) and there are different reports on livestock infection with *Fasciola* and *Dicrocoelium* across Iran (Ahmadi, 2005; Ansari-Lari and Moazzeni, 2006; Daryani et al., 2006; Khanjari et al., 2010; Oryan et al., 2012; Abdi et al., 2013). The prevalence of zoonotic helminths in humans can be associated with the rate of infections in animals (Ekong et al., 2012). Since official information and applicable reports for both animals and humans may create a clear and detailed picture of the incidence of zoonotic helminth infections, the present study aimed to estimate the prevalence of some zoonotic helminths of the liver and lung, including, *E. granulosus*, *Fasciola spp*, and *D. dendriticum*, among sheep, cattle, goats, and camels in Kazerun and Shiraz abattoirs in Fars, Iran, during 2011-2013.

MATERIALS AND METHODS

This retrospective study was performed to investigate slaughtered animals in an industrial abattoir Kazerun and a traditional slaughterhouse in Shiraz, Iran. A total of 12381 sheep, 6473 cattle, 22847 goats, 66 camels, and 10 buffaloes were analyzed considering liver and lung helminthic infections, i.e., hydatidosis, fasciolosis,

and dicrocoeliasis, in Kazerun abattoir during March 2011-January 2013. Moreover, a total of 121100 sheep, 23515 cattle, 81293 goats, and 69 camels were evaluated for liver and lung infections, namely, hydatid cyst, fasciolosis, and dicrocoeliasis, in Shiraz since March 2012 abattoir during one year. Fars province is one of the 31 provinces of Iran, which is located in South. Fars province has an area covering about 133299 km² (8.1% of Iran). There are three distinct climatic regions in Fars province, i.e., mountainous area of the north and northwest with moderate cold winters and mild summers, central regions with relatively rainy mild winters and hot dry summers, and south and southeast parts that have moderate winters with very hot summers (Soufi, 2004). Shiraz is the capital of Fars province and Kazerun is located in west of Shiraz (Figure 1).

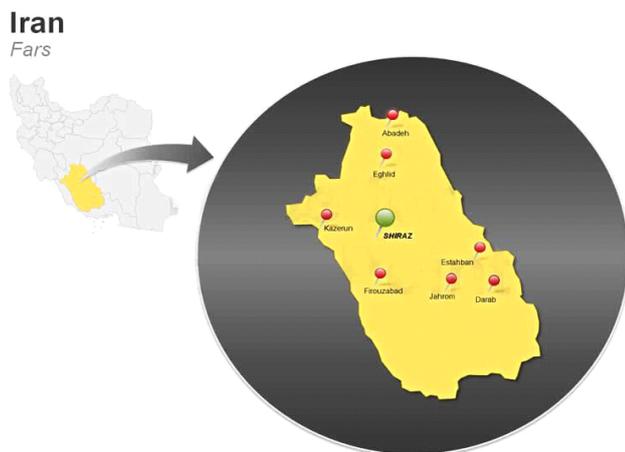


Figure 1. Map of Fars province in Iran, available at: <http://www.24point0.com/>

As part of the routine meat inspection, all the carcasses and visceral organs (liver, lung, kidney, heart, etc.) of slaughtered animals in Shiraz and Kazerun abattoirs were evaluated on a daily basis by a meat inspector appointed by Iran Veterinary Organization. All the partial and total pathological changes such as color, morphology, size, and presence of lesions and parasites were diagnosed by visual inspection, palpation, or if necessary, incision of the suspected cases according to the standards of the Iranian Veterinary Organization.

All the information about the slaughtered livestock and the contaminated organs were recorded on especially designed sheets. Statistical analysis was performed using SPSS version 18 (to run Chi-squared test) and Microsoft Excel 2010.

RESULTS

The slaughtered animals were found to be infected with hydatid cyst, fasciolosis, and dicrocoeliasis in the two abattoirs (Kazerun and Shiraz). The prevalence rates of helminth infections of the liver and lung were as follows.

Kazerun abattoir. The prevalence rates of liver hydatid cysts were 0.86%, 2.1%, 0.76%, and 15.1% in sheep, cattle, goats, and camels, respectively, whereas the prevalence rates of pulmonary hydatid cysts were 0.89%, 2.36%, 0.9%, and 16.6% in sheep, cattle, goats, and camels, respectively. Fasciolosis was also detected in 0.33%, 1.65%, and 0.24% of the condemnation livers of sheep, cattle, and goats, respectively, but dicrosoliosis was prevalent in 0.004% of the goat livers. With respect to the statistical analysis, differences between hydatid cyst prevalence in the liver and lungs were significant in sheep, cattle, and goats ($P<0.0001$). However, the difference was not significant in camels ($P=0.079$). The prevalence of hydatid cyst, *Fasciola spp.*, and *D. dendriticum* in Kazerun abattoir are shown in Table 1.

Table.1 The prevalence of hydatid cyst, *Fasciola spp.*, and *D. dendriticum* in different slaughtered animals in Kazerun abattoir

| Type of slaughtered animals | Number of slaughtered animals | Liver infection | | Lung infection | |
|-----------------------------|-------------------------------|-------------------|-------------------|---------------------|-------------------|
| | | Hydatid cyst No/% | Fasciola spp No/% | D. dendriticum No/% | Hydatid cyst No/% |
| Sheep | 12381 | 106/0.86 | 41/0.33 | 0/0 | 111/0.89 |
| Cattle | 6473 | 137/2.1 | 107/1.65 | 0/0 | 153/2.36 |
| Goats | 22847 | 174/0.76 | 56/0.24 | 1/0.004 | 206/0.9 |
| Camels | 66 | 10/15.1 | 0/0 | 0/0 | 11/16.6 |
| Buffaloes | 10 | 0/0 | 0/0 | 0/0 | 0.0 |

Shiraz abattoir. The prevalence rates of liver hydatid cysts were 3.44%, 3.12%, 2.94%, and 2.9% in the slaughtered sheep, cattle, goats, and camels, respectively. In addition, 4.54%, 4.33%, 4%, and

4.35% of the lung of the mentioned animals were infected with hydatid cysts, respectively. The prevalence rates of *Fasciola spp* in the slaughtered sheep and cattle were 2.49% and 1.86%, respectively, and infection rates of *D. dendriticum* in the slaughtered sheep, cattle, and goats were 0.026%, 0.91%, and 4%, respectively. According to the statistical analysis, differences between hydatid cyst prevalence in the liver and lung were significant in sheep, cattle, and goats ($P < 0.0001$), while the difference was not significant in camels ($P = 0.379$). The prevalence rates of hydatid cyst, *Fasciola spp*, and *D. dendriticum* in Shiraz abattoir are shown in Table 2.

Table 2. The prevalence of hydatid cyst, *Fasciola spp*, and *D. dendriticum* in different livestock reported in Shiraz abattoir.

| Type of slaughtered animals | Number of slaughtered animals | Liver infection | | | Lung infection |
|-----------------------------|-------------------------------|-------------------|--------------------------|----------------------------|-------------------|
| | | Hydatid cyst No/% | <i>Fasciola spp</i> No/% | <i>D. dendriticum</i> No/% | Hydatid cyst No/% |
| Sheep | 121100 | 4172/3.44 | 3015/2.49 | 31/0.026 | 5506/4.54 |
| Cattle | 23515 | 735/3.12 | 438/1.86 | 215/0.91 | 1020/4.33 |
| Goats | 81293 | 2394/2.94 | 0 | 3249/4 | 3247/4 |
| Camels | 69 | 2/2.9 | 0/0 | 0/0 | 3/4.35 |
| Buffalos | 0 | 0/0 | 0/0 | 0/0 | 0.0 |

DISCUSSION

Human health is substantially associated with animal health and production in both developing and industrialized countries, which can present a serious risk to public health with huge economic consequences. Approximately 75% of the new zoonotic diseases over the last decade were caused by pathogens originating from animals or their products (Robinson and Dalton, 2009b; Robinson and Dalton, 2009a). In this regard, the prevalence of zoonotic helminth infections has been evaluated among different livestock (sheep, cattle, goats, camel, and buffalo) in Kazerun industrial abattoir and a traditional slaughterhouse in Shiraz, Fars province, and the information was compared with the results of other studies in Iran. Echinococcosis is one of the important helminthic zoonosis in the Middle East. Various studies have shown the disease is generally found in sheep, cattle, goats, and camels throughout

this region (Sadjjadi, 2006) and causes substantial economic loss to ranchers due to condemnation of different organs. Thus, detection of hydatidosis in livestock could be advantageous for epidemiologic features and disease control. Rokni has reviewed the prevalence of hydatidosis in cattle, sheep, and goats based on data obtained from abattoirs. According to these information, the highest (38.3%, 74.4%, and 20%) and the lowest (3.5%, 9.3%, and 2%) infection rates in cattle, sheep, and goats were in Ardabil and Qom provinces, respectively (Rokni, 2009). Several studies investigated the status of hydatid cyst in slaughtered animals, particularly during the last decade. The prevalence of *E. granulosus* in slaughtered animals in different locations of Iran is summarized in Table 3. Accordance to these data, the highest and lowest infection rates in sheep are observed in Ardabil and Khomein, respectively. The highest prevalence of the disease in goats and cattle is observed in Sari, while the lowest rate is reported from Khomein. The hydatid cysts prevalence in livestock based on infected organs in various studies in comparison with our finding are demonstrated in Table 4.

Table 3. The prevalence of *E. granulosus* in different types of slaughtered animals in different regions of Iran

| City (Reference) | Sheep infection rate (%) | Goat infection rate (%) | Cattle infection rate (%) |
|---------------------------------------|--------------------------|-------------------------|---------------------------|
| Sari (Ziaei et al., 2011) | 65.2 | 37.8 | 40.1 |
| Khomein (Pareviz et al., 2013) | 1.73 | 1.55 | 2.94 |
| Lorestan (Rostami Nejad et al., 2012) | 21.22 | 12.97 | 26.71 |
| Shiraz (Oryan et al., 2012) | 45.52 | 10 | 11.6 |
| Urmia (Tappe et al., 2011) | 2.7 | ---- | 8.6 |
| Ardabil (Daryani et al., 2007) | 74.4 | 20 | 38.3 |
| Kashan (Arbabi & Hooshyar, 2005) | 2.25 | 3.1 | 4 |

The maximum infection rate in the liver of sheep, goats, and cattle is seen in Sari, whereas the minimum rate is observed in Kazerun. The highest prevalence of infection in the lung of goats and cattle is also seen in Sari, while the highest prevalence of pulmonary infection in sheep is found in Lorestan.

Table 4. The prevalence of infected animals with hydatid cyst based on involved organs in different regions of Iran

| City (Reference) | Sheep | | Goats | | Cattle | |
|---------------------------------------|---------|--------|---------|--------|---------|--------|
| | Liver % | Lung % | Liver % | Lung % | Liver % | Lung % |
| Sari (Ziaei et al., 2011) | 18.8 | 4.3 | 17.2 | 12.6 | 44.1 | 7.6 |
| Kashan (Arbabi & Hooshyar., 2005) | 1.7 | 2.8 | 2.3 | 3.9 | 4.4 | 3.7 |
| Lorestan (Rostami Nejad et al., 2013) | 9.2 | 7.9 | 9 | 11.1 | 4.9 | 5 |
| Urmia (Tappe et al., 2011) | 1 | 1.6 | ----- | ----- | 3.3 | 5.2 |
| Kazerun (the present study) | 0.86 | 0.89 | 0.76 | 0.9 | 2.1 | 2.36 |
| Shiraz (the present study) | 3.44 | 4.54 | 2.94 | 4 | 3.12 | 4.33 |
| Shiraz (Mehrabani et al., 2009) | 2.09 | 2.68 | 2.17 | 2.36 | 4.49 | 6.48 |

Table 5. The prevalence of *Fasciola spp* and *D. dendriticum* in different types of slaughtered animals in various locations of Iran

| City (Reference) | Sheep | | Goats | | Cattle | |
|--------------------------------|-------------------------|---------------------------|-------------------------|---------------------------|-------------------------|---------------------------|
| | <i>Fasciola spp</i> (%) | <i>D. dendriticum</i> (%) | <i>Fasciola spp</i> (%) | <i>D. dendriticum</i> (%) | <i>Fasciola spp</i> (%) | <i>D. dendriticum</i> (%) |
| Ahvaz (Borji et al., 2012) | 0.9 | ----- | 2.3 | ----- | ----- | ----- |
| Ilam (Abdi et al., 2013) | 0.6 | 0.7 | 0.34 | 0.63 | 3.58 | 0.22 |
| Tehran (Khanjari et al., 2010) | 2.01 | 5.83 | ----- | ----- | 2.2 | 2.5 |
| Ardabil (Daryani et al., 2006) | 5.3 | 6.8 | 4.9 | 12.4 | 25.9 | 10.6 |
| Amol (Khanjari et al., 2014) | 7.7 | 5.7 | 5.4 | 3 | ----- | ----- |
| Shiraz (Oryan et al., 2012) | 0.59 | 0.34 | 0.24 | 0.25 | 1.07 | 0.69 |
| Shiraz (the present study) | 2.49 | 0.026 | 0 | 4 | 1.86 | 0.91 |
| Kazerun (the present study) | 0.33 | 0 | 0.24 | 0.004 | 1.65 | 0 |

Furthermore, the lowest score of lung hydatidosis in the three types of animals was found in Kazerun. The existence of various levels of infection may be due to climatic variations, environmental conditions, the nature of pasture, and animal feeding (Abdi et al., 2013). In some parts of Iran, especially in North where a large number of jackals and foxes live near human habitats, interaction between domestic and sylvatic cycles can occur. In this regard, the animals may become infected by eating organs of other non-standard slaughtered animals (Abdi et al., 2013). Moreover,

climatic conditions can provide a better situation for growth of plants and grazing of livestock in these areas. Lifestyle is also another reason for living and eating herds without any limitation. Some researchers speculate that the highest prevalence of parasitic infections in North of Iran is related to the migration of non-indigenous animals to these areas (Ziaei et al., 2011). The considerable infection rates in some regions such as Lorestan (Rostami Nejad et al., 2012) could be associated with absence of primary equipment to perform the suitable disposal protocols. The high rates of professional or domestic communication with dogs and also easy access of dogs to contaminated organs of home-slaughtered animals provide excellent conditions for maintenance of infection (Arbabi and Hooshyar, 2006). Considerable differences in the prevalence of hydatidosis in Shiraz and Kazerun in Fars province could be due to preference for traditional slaughter methods in Kazerun. According to opinions of veterinarians, a large number of ranchers slaughter their livestock in primary stages of any disease to prevent economic loss; therefore, true estimation of infection is almost impossible in such regions. The comparison of our results with those of a previous study (Mehrabani et al., 1999) in Shiraz showed that liver and lung infection rates have increased in sheep and goats, but it has decreased in cattle. These variations could be true or might be due to source of data collection. The prevalence of buffalo hydatid cyst in Iran was estimated to range between 11.9% and 70% by Rokni (Rokni, 2009), Amin Pour et al. (2012) reported this problem in 344 (9%) cases among 3832 inspected cases. They also reported the maximum and minimum infection rates in Khuzestan (9.9%) and Ardabil (8%) provinces, respectively (Amin Pour et al., 2012). Borji et al. (2012) stated that the prevalence rates of hydatid cyst in livers, lungs, and carcasses of buffalos were 15.0%, 10.8%, and 0.3%, respectively (Borji et al., 2012). In another study, buffalo infection rate was 12.9% including 5% in the liver and 7.9% in the lung (Tappe et al., 2011). The number of slaughtered buffalos in the present study was only 10

uninfected cases in Kazerun abattoir. Hydatid cysts were detected in 233/661 (35.2%) of camels from five regions of Iran. Some authors reported the highest and lowest prevalence rates in Isfahan (59.3%) and Kerman (25.7%), respectively (Ahmadi, 2005; Sadjjadi, 2006). Among the 66 slaughtered camels in Kazerun abattoir, 10 (15.1%) and 11 (16.6%) had cysts in the liver and lung, respectively. Camel infection rates in Shiraz abattoir were 2/69 (2.9%) and 3/9 (4.45%) in the liver and lung, respectively. Various studies performed in Iran argue that the population of buffalos and camels is limited. Therefore, it seems these intermediate hosts could not play an important role in the epidemiology of echinococcosis. According to various surveys in Iran, the prevalence of pulmonary infection among different livestock (sheep, goats and camels) was higher than in the liver (Tappe et al., 2011), which is consistent with our findings. Fasciolosis was limited to specific geographical regions in the past, whereas it is prevalent all over the world and human cases of the infection are on a growing trend in different regions. The first human case of fasciolosis in Iran was diagnosed in 1955, and then as many as 100 cases were reported every year from different provinces, especially from Guilan and Mazandaran in the north and Isfahan located in the central part of Iran (World Health Organization, 2007). In the present study, prevalence rates of *Fasciola spp* and *D. dendriticum*, which are especially important in the economic cycle were evaluated and compared to the results of other investigations (Table 5). Considering different reports, the most important enzootic areas in Iran for fasciolosis and dicrocoeliasis are north and northwest (Daryani et al., 2006). According to Table 5, the highest prevalence rates of *Fasciola* in sheep and goats are from Amol (Khanjari et al., 2014), whereas the highest prevalence rate of this parasite in cattle is pertinent to Ardabil (Daryani et al., 2006). The lowest prevalence rate of fasciolosis in the mentioned hosts was in Kazerun (the present study) and Shiraz respectively (Oryan et al., 2012). The status of dicrocoeliasis shows that Ardabil has the highest prevalence rate (Daryani et al., 2006) and Kazerun has

the lowest prevalence in the three types of intermediate hosts (sheep, goats and cattle). As noted above, infection rate differences between slaughtered animals in Kazerun and Shiraz in this study may be related to culture of indigenous farmers regarding slaughter of animals, climactic conditions such as drought (that cause inappropriate situation for snail's life), or differences in animal resources. The differences between our results obtained from Shiraz and those of the previous studies could be related to differences in animal resources or different types of abattoirs. In the present study, a traditional abattoir in Shiraz was evaluated. Nowadays, industrial abattoirs have considerably high performance compared with traditional ones. The actual infection rate in traditional slaughterhouses, especially in low-prevalence areas, may be underestimated given the inadequate meat inspection, rapid slaughter rates, and insufficient health information and/or inadequate training of slaughterers. Compared with other reports, it is seems that Fars is among the regions with low prevalence of infection. Further studies on livestock in different areas, especially in different types of slaughterhouses, can provide valuable information for the responsible authorities. According to various data from Iran, it can be suggested that unwarranted killing of animals should be avoided, industrial abattoirs equipped with standard facilities and well-trained inspectors and workers should be established, and people should be educated on zoonotic infections and encouraged to consume the standard slaughtered meat produced in industrial abattoirs.

Ethics

We hereby declare all ethical standards have been respected in preparation of the submitted article.

Conflict of Interest

The authors declare that they have no conflict of interest.

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