

Prevalence and morphological characterization of *Cysticercus tenuicollis* (*Taenia hydatigena* cysticerci) from sheep and goats in Iran

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ABSTRACT

Prevalence and a comparative study on the larval rostellar hook morphology of *Taenia hydatigena* cysticerci from sheep and goats have been made in Iran. The 1336 sheep and 1674 goats slaughtered at the Kerman abattoir were investigated for infection with *Cysticercus tenuicollis* cyst. *C. tenuicollis* cysts were found in 172 sheep (12.87%) and 302 goats (18.04%) and this difference was significant ($P < 0.05$). The predominant predilection site of cysticerci in sheep (84.85%) and goats (82.14%) was significantly ($P < 0.05$) the omentum. The morphological characters in small hooks (including length of hooks, length of handle and length of guard) were significantly different in cysticerci from sheep and goats ($P < 0.05$). It is concluded that the cysticerci of sheep and goat origin probably represent two different strains and possibly follow the same pattern of speciation as reported in the related taeniid, *Echinococcus granulosus*.

Key words: *Taenia hydatigena* cysticerci, sheep, goats, prevalence, morphology

Introduction

Cestodes of the family *Taeniidae* which infect the dog (definitive host) are transmitted to a range of intermediate host species where they cause echinococcosis, cysticercosis or coenurosis. Infections with the larval stage of some species of *Taenia* are of veterinary importance because they cause economic losses due to condemnation of infected offal or meat (FLISSER et al., 1982; ECKERT et al., 1984; THOMPSON and LYMBERY, 1995).

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The cysticerci of *Taenia hydatigena* are responsible for a high degree of morbidity and mortality in livestock (ABIDI et al., 1989). Migration of cysticerci in the liver may cause haemorrhagic and fibrotic tracts and serofibrinous peritonitis occurs on approximately day 10 p.i. (SOULSBY, 1982; BLAZEK et al., 1985). This may result in condemnation of the liver at slaughter. Heavy infections and traumatic hepatitis in young lambs are leading to death (SOULSBY, 1982).

Different investigators around the world have reported the prevalence of cysticerci: 16.7% in sheep (HASSLINGER and WEBER-WERRINGHEN, 1988); 34.2% in goats and 21.4% in sheep (DADA and BELINO, 1978); 8.3% in goats (FOLARANMI et al., 1984); 33.3% in goats (NWOSU et al., 1996); 37.03% in sheep and 27.29% in goats (PATHAK and GAUR, 1982).

RAUSCH (1985) suggested that intraspecific variability similar to that found in *Echinococcus*, should be expected in other taenia species perpetuating through synanthropic hosts. Evidence of the variability within several species of taenia has been provided previously based on morphological, biochemical, physiological and other data (GASSER et al., 1999). ABIDI et al. (1989) in India report the differences in biochemical parameters of *Taenia hydatigena* cysticerci from goats and pigs origin that probably represent two different strains.

There are some reports on the prevalence of taeniasis and cysticercosis in north and west Iran (MOBEDI et al., 1973; MIRZAYANS et al., 1972; ESLAMI and MOHEBALI, 1988; ESLAMI et al., 1981). However, studies on the prevalence and on the comparative morphology of *T. hydatigena* cysticerci from sheep and goats in Iran non-existent. The present work was conducted to determine the prevalence and comparative study of the rostellar hook morphology of *C. tenuicollis* from sheep and goats in south-eastern Iran.

Materials and methods

Study of prevalence. During the period April 2001 to March 2002, 1336 sheep and 1674 goat carcasses of animals slaughtered at the main abattoir of Kerman (South-East Province, Iran) were examined for *Cysticercus tenuicollis* cysts. Animals examined were native breeds and after slaughter, abdominal, thorax and pelvis cavities were investigated for the presence of *C. tenuicollis* cyst.

Morphological analysis. Cysticerci attached to the omentum or mesenteries were collected from each host sheep and goats slaughtered at the official abattoir of Kerman and brought to the laboratory. The invaginated scolexes were collected for analysis of larval rostellar hook morphology. For the total number of rostellar hooks, 30 protoscoleces per sample and for hook measurements 10 protoscoleces per sample, 5 large and 5 small hooks per rostellum were used.

Protoscoleces were mounted in polyvinyl lactophenol and sufficient pressure was applied to the coverslip to cause the hooks to lie flat. All measurements were made by the same person using a calibrated eyepiece micrometer under oil immersion. The number of large and small hooks per rostellum (Large number, Small number), shape and arrangement of rostellar hooks were considered and several components of both large and small hooks measured: blade length of large (LBL) and small (SBL) hooks, handle length of large (LHL) and small (SHL) hooks, guard length of large (LGL) and small (SGL) hooks, and total length of large (LTL) and small (STL) hooks.

Statistical analysis. Difference between infection rates of cysticerci and the mean values obtained from rostellar hooks were analysed by Fisher exact, *t*-test and Mann-Whitney test, as appropriate. Significance was declared at a P-value <0.05.

Results

Of 1336 sheep and 1674 goats examined, 172 (12.87%) and 302 (18.04%) were found to be infected with *C. tenuicollis* cysts, respectively. The rate of infection of sheep and goats slaughtered and percentage of cysticerci in different organs is shown in Table. 1. The infection rate was lower in sheep than in goats (P<0.05). The cysts in sheep and goats had a tendency to be located more in the omentum. However, a low percentage were found in other organs and this difference between infections rate of omentum and other organs was significant (P<0.05).

Table 1. Infection rate, organ distribution of *Cysticercus tenuicollis* cysts recovered from slaughtered sheep and goats in south-eastern Iran

Animals	Number of animals examined	Number of infected animals	Infected Animals (%)
Sheep	1336	172	12.87*
Goats	1674	302	18.04*

	Infected organs									
	Omentum N° (%)	Liver N° (%)	Mesentery N° (%)	Lung N° (%)	Heart N° (%)	Gall bladder N° (%)	Uterus N° (%)	Peritonum N° (%)	Urinary Bladder N° (%)	Rumen N° (%)
Sheep	146 (84.85)*	22 (12.8)	12 (7)	1 (0.58)	1 (0.58)	1 (0.58)	0	0	0	0
Goats	248 (82.14)*	55 (18.24)	9 (2.98)	2 (0.66)	2 (0.66)	0	6 (1.99)	5 (1.65)	3 (0.99)	3 (0.99)

Table 2. Rostellar hook characteristics of *Cysticercus tenuicollis* cyst from sheep and goats (mean \pm SE., n = 30)

Rostellar characteristics		Sheep origin	Goat origin
Arrangement of hooks		Large and small hooks alternating in 2 rows	Large and small hooks alternating in 2 rows
Large hooks	No. of hooks	15.33 \pm 1.33	14.66 \pm 0.5
	Blade length (μ m)	94.8 \pm 7.4	95.7 \pm 5.48
	Handle length (μ m)	104.3 \pm 7.19	103.55 \pm 8.76
	Guard length (μ m)	35.65 \pm 5.07	37.9 \pm 7.48
	Total length (μ m)	199.1 \pm 10.93	198.7 \pm 10.49
Small hooks	No. of hooks	15.44 \pm 1.42	14.77 \pm 0.66
	Blade length (μ m)	73.55 \pm 5.12	74.65 \pm 6.64
	Handle length (μ m)	61.3 \pm 9*	67.45 \pm 9.75*
	Guard length (μ m)	31.75 \pm 4.2*	34.1 \pm 5.70*
	Total length (μ m)	134.85 \pm 11.63*	141.8 \pm 8.33*

The results of morphological analysis of the rostellar hooks from sheep and goats *Cysticercus tenuicollis* are shown in Table 2. The appearance of rostellum from samples of sheep and goat origin was similar, with two rows of alternating large and small hooks. Characteristics of large rostellar hooks of cysticerci in sheep and goats were similar. Some morphological characters of small rostellar hooks of cysticerci, including total length, handle length and guard length from sheep and goats, were significantly different, $P < 0.05$.

Discussion

Considering Iran as one of the endemic areas of *Taenia hydatigena* in dogs and wild carnivores as final hosts, and livestock and wild herbivores as intermediate hosts. The present investigation showed that sheep and goats were frequently infected with *C. tenuicollis* at 12.87% and 18.04%, respectively. The infection rate was higher in goats than in sheep and grazing behaviour and management can be considered as the major reasons for this. In some parts of Iran, particularly in the west and north of the country, the prevalence of cysticerci was reported in wild animals. For example, prevalences of 25% and 5.6% of *Cysticercus tenuicollis* were reported from wild boar (SOLAYMANI-MOHAMMADI et al., 2003) and wild sheep (ESLAMI et al., 1981), respectively. This suggested that in Iran a sylvatic cycle between wild carnivores and wild herbivores occurs and that interaction between domestic cycle and sylvatic cycles may occur. The prevalence of *C. tenuicollis* in sheep and goats in this study is relatively lower than that reported in other countries. For instance, in India,

a prevalence of 37.03% of cysticerci in sheep and 27.29% in goats (PATHAK and GAUR, 1982); in Nigeria, a prevalence of 21.4% in sheep, 34.2% in goats (DADA and BELLINO, 1978); 33.3% in goats (NWOSU et al., 1996); in Germany a prevalence of 16.7% in sheep (HASSLINGER and WEBER-WERRINGHEN, 1988) were reported. Infection rate with *C. tenuicollis* in this study was higher in goats than in sheep. Similar observations were made by some other workers (DADA and BELINO, 1978; EL-AZAZY and FAYEK, 1990).

In this study the predominant predilection site of cysticerci in sheep (84.85%) and goats (82.14%) was the omentum. A similar observation was made by EL-AZAZY and FAYEK (1990).

In morphological studies of rostellar hooks in this work data were finally collected from 30 protoscoleces per sample for the total number of rostellar hooks, and from 10 protoscoleces per sample, 5 large and 5 small hooks per rostellum for hook measurements. Other workers (PONCE GORDO and CUESTA BANDERA, 1997; KUMARATILAKE and THOMPSON, 1984; KUMARATILAKE et al., 1986; SAID et al., 1988; ECKERT et al., 1993; WORBES et al., 1989) analysed a similar sample size for morphological study of protoscoleces in *Echinococcus granulosus*. The present study showed that handle length, total length and guard length of small hooks in protoscoleces from sheep and goats were significantly different ($P < 0.05$).

The differences in the morphological characterization of rostellar hooks from the two cysticerci may be due to the existence of strain differences in *Taenia hydatigena* cysticerci. Results of the present study are similar to the situation found in *Echinococcus granulosus*, where different strains isolated from a variety of hosts reflects differences in the morphological characterization of larval rostellar hooks (PONCE GORDO and CUESTA BANDERA, 1997; KUMARATILAKE and THOMPSON, 1984). VARMA and AHLUWALIA (1986, 1987), ABIDI et al. (1989) and KEDRA et al. (2001) also recorded marked differences in the development and growth pattern, biochemical characterization and NADH dehydrogenase subunit 1 sequences in *Taenia hydatigena* cysticerci of different host origin. Therefore, in the light of these studies, the *Taenia hydatigena* cysticerci isolated from sheep and goats possibly represent two different strains and it is speculated that in cysticerci, the problem of speciation is similar to that occurring in *E. granulosus*. Further studies on isoenzyme characterization, DNA probe and ND1 sequences (YAP et al., 1987; RISHI and MCMANUS, 1988; KEDRA et al., 2001) are now required in order to ascertain the strain variation in cysticerci.

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SAŽETAK

Istraživana je proširenost i morfologija larvalnih rostralnih kukica cisticerka *Taenia hydatigena* ovaca i koza u Iranu. Pregledano je 1336 ovaca i 1674 koze zaklane na klaonici u Kermanu na invaziju cistama *Cysticercus tenuicollis*. Ciste *C. tenuicollis* su nađene u 172 ovce (12,87%) i 302 koze (18,40%) a razlika je bila značajna ($P < 0,05$). Omentum je bio najčešće predilekcijsko mjesto ($P < 0,05$) i to kod ovaca 84,85%, a kod koza 82,14%. Morfološke značajke malih kukica (uključujući dužinu kukica, dužinu drška i dužinu šiljka) značajno su se razlikovale u ovaca i koza ($P < 0,05$). Zaključak je da su cisticerci iz ovaca i koza vjerojatno dva različita soja, kako je opisano u srodne teniidne trakavice, *Echinococcus granulosus*.

Cljučne riječi: cisticerci *Taenia hydatigena*, ovce, koze, proširenost, morfologija
