Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2017; 5(3): 822-825

Received: 24-03-2017
Accepted: 25-04-2017

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# Infestation and biochemical content of Cysticercus tenuicollis cysts (Taenia hydatigena cysts) in sheep and goats

**Nadjet Amina Ouchene-Khelifi and Nassim Ouchene**

**Abstract**
The present study was carried out in abattoirs at northeast Algeria and concerned 420 carcasses, including 256 sheep and 164 goats were examined for the presence of *Cysticercus tenuicollis*. Biochemical analysis was also conducted on ten *C. tenuicollis* cysts from each species and concerned: glucose, urea, creatinine, cholesterol, triglycerides, calcium, sodium, potassium and magnesium. *C. tenuicollis* cysts were found in 24.21% of sheep and 43.90% of goats carcasses. Prevalence in goats was higher compared to sheep ($P<0.001$). Biochemical parameters contents were very close between sheep and goats. Excepting for creatinine and calcium, contents in goats (52.30±0.88 µmol/l and 12.63±0.31 mmol/l, respectively) were higher than sheep (29.39±6.42 µmol/l and 4.46±1.76 mmol/l, respectively) ($P<0.0001$). Infection by *C. tenuicollis* affects significantly the carcasses weight of sheep and goats. In weightier carcasses (31-40 kg), the prevalence of infestation (4.83% in sheep and 5.55% in goats) and the number of cysts isolated (4 in sheep and 12 in goats) were lowest ($P<0.0001$). The present study represents the first report on *Cysticercus tenuicollis* infection in small ruminants and biochemical profile of cysts fluid, in Algeria. The results suggest that cysticercosis is common in Algeria, and that this may constitute economic and health problems in the meat industry.

**Keywords:** *Cysticercus tenuicollis*, sheep, goats, biochemical content, Algeria

## 1. Introduction

*Cysticercus tenuicollis* is a larval stage of the canine tapeworm *Taenia hydatigena*. Sheep, goats and others domestic and wild herbivores including pig and horse, act as intermediate hosts. Dogs, wolf, hyaena and other wild carnivores are the final hosts [13, 29, 32, 34].

Adult *Taenia hydatigena* tapeworms are found in the intestine of final hosts which can harbour tapeworms from several months to a year or more [29, 32]. Tapeworm segments, containing many eggs, pass into the external environment through the feces. After disintegration of segments, eggs are disseminated in pastures by wind and insects [8].

The intermediate host is infected through the ingestion of tapeworm eggs that hatch in the intestine. The oncospheres are carried in the blood to the liver in which they migrate for about 4 weeks before they emerge on the surface of this organ and attach to the peritoneum. Within a further 4 weeks each develops into the large metacestode, *Cysticercus tenuicollis* [8, 32] found attached to the greater omentum, mesentery and liver [13]. Aberrant migrations sometimes occur with *Cysticercus* found in the lungs or other organs [29].

*Cysticercus tenuicollis*, about 5-8 cm in diameter, contains a single invaginated scolex (bladderworms) with a long neck [8, 32] and is often found at meat inspection without any clinical previous signs (Kaufmann 1996), but severe infection of liver/tissues may result in liver/carcass condemnation at slaughter [8, 32].

The prevalence of infection in small ruminants is high. In some regions more than 80% of the slaughtered sheep and goats show *Cysticercus tenuicollis* [13].

However, no studies have been conducted on sheep and goat cysticercosis in Algeria. The present study represents the first report in Algeria. Its aims to estimate the prevalence of infection and to study the biochemical profile of cysts fluid of *Cysticercus tenuicollis* in sheep and goats.

## 2. Material and Methods

### 2.1. Samples

In this study, 420 carcasses, including 256 sheep and 164 goats were examined for the presence of *Cysticercus tenuicollis* on post-mortem inspection at abattoirs in northeast Algeria (El Tarf region).

The visceral organs of all animals included in the survey were examined slowly for the detection of the cysts on post-mortem inspection. All cysts recovered from the infected animals were placed separately in the sterile vials and were further processed. Epidemiological data related to each animal were collected.

The age of all animals slaughtered varied between 8 and 36 months. The weight of each carcass was also recorded.

### 2.2. Laboratory analysis

The cysts were transferred to the parasitology laboratory. The size, the weight and the volume of each cyst were measured.

For each animal species, ten cysts were selected for biochemical analysis. The fluid of each cyst was aspirated aseptically, centrifuged at 15000 rpm at 4ºC for 30min, and the supernatants analyzed for various biochemical parameters: glucose, urea, creatinine, cholesterol, triglycerides, calcium, sodium, potassium and magnesium.

Glucose was measured using glucose oxidase method; urea by diacetyl monoxamine method; creatinine by Jaffe's method; Triglycerides and cholesterol by the enzymatic method. Calcium was determined by the o-cresolphthaleine-complexon method. The concentration of sodium and potassium were measured using flame photometry and magnesium by spectrophotometry.

### 2.3. Statistical analysis

The statistical program used was R i386 3.0.2 for Windows GUI front-end. Chi-square test was used to study the influence of *C. tenuicollis* infection on carcasses weight. Results of biochemical analysis of cysts fluid and prevalence of *C. tenuicollis* infection among sheep and goats and between different regions have been studied using Student test (t). Differences were considered as significant when P value was less than 0.05.

## 3. Results

Post mortem inspection of 256 sheep and 164 goat carcasses at El Tarf abattoirs revealed *Cysticercus tenuicollis* cysts in 62 (24.21%) and 72 (43.90%) carcasses respectively. These prevalences were statistically significant ($P<0.001$). Most of the cysts were present in abdominal cavity of sheep and goats, except few which were found in the liver.

Biochemical analyses of the cysts fluid in sheep and goats are presented in Table 1. A significant correlation was observed between sheep and goats ($P<0.0001$).

Mean contents of the different biochemical parameters were very close between sheep and goats. Excepting for creatinine and calcium, contents from goats *C. tenuicollis* cysts (52.30±0.88 µmol/l and 12.63±0.31 mmol/l, respectively) were higher than sheep (29.39±6.42 µmol/l and 4.46±1.76 mmol/l, respectively) ($P<0.0001$) (Table 1).

**Table 1:** Biochemical profiles of *C. tenuicollis* cysts fluids in sheep and goats (mean ± S.E)

| Biochemical profiles | Sheep | Goats |
|---|---|---|
| Cholesterol mmol/l | 0.24±0.21 | 0.595±0.590 |
| Triglycerides mmol/l | 0.19±0.17 | 0.169±0.079 |
| Urea mmol/l | 9.46±8.03 | 8.10±2.85 |
| Creatinine µmol/l | 29.39±6.42 | 52.30±0.88 |
| Glucose mmol/l | 4.13±2.19 | 3.10±2.16 |
| Calcium mmol/l | 4.46±1.76 | 12.63±0.31 |
| Sodium mmol/l | 55.65±3.48 | 60.58±3.48 |
| Potassium mmol/l | 1.63±0.42 | 1.03±0.42 |
| Magnesium mmol/l | 2.09±0.36 | 2.19±0.36 |

Carcasses weight in sheep and goats was influenced by the presence of *C. tenuicollis* cysts. Indeed, in sheep, weightier carcasses (31-40 kg) seem the least infected (4.83%) and contain only 4 cysts (17.01g of weight) ($P<0.0001$) (Table 2). And in goats, highest prevalence of infection (70.83%) was observed in carcasses that have the lowest weight (10-20kg) and the highest number of isolated cysts, 97 cysts (625g of weight) ($P<0.0001$) (Table 3).

**Table 2:** Prevalence of infection, number and total weight of *C. tenuicollis* cysts according to the carcasses weight in sheep

| Carcasses weight (kg) | Number of Carcasses infected (%) | Total number of isolated cysts | Total weight of cysts (gr) |
|---|---|---|---|
| 10-20 | 31 (50) | 46 | 367.37 |
| 21-30 | 28 (45.16) | 46 | 276.30 |
| 31-40 | 3 (4.83)*** | 4 | 17.01 |

*** highly significant

**Table 3:** Prevalence of infection, number and total weight of *C. tenuicollis* cysts according to the carcasses weight in goats

| Carcasses weight (kg) | Number of carcasses infected (%) | Total number of isolated cysts | Total weight of cysts (gr) |
|---|---|---|---|
| 10-20 | 51 (70.83)*** | 97 | 625 |
| 21-30 | 17 (23.61)*** | 39 | 277 |
| 31-40 | 4 (5.55)*** | 12 | 70 |

*** highly significant

## 4. Discussion

*C. tenuicollis*, cysticerci of *Taenia hydatigena,* is responsible for a high degree of morbidity and mortality in livestock [11]. In Algeria it has not yet available information on infection rates of *C. tenuicollis* in ruminants. The first results are presented in this study. The prevalences of 24.21% and 43.90% in sheep and goat, respectively, were recorded in this study are comparable to the results presented in goats from Ethiopia [25] and in sheep from Nigeria [5] and Egypt [6].

The infection rates of *C. tenuicollis* in the world wide are well known and variable ranging from 0.2% in sheep and 0.3% of goats in Tanzania [15] to 85% in sheep in Spain [7] and 55.05% of goats in Iran [19].

Our findings are lower than the results of Wondimu *et al*. [35] and Sissay *et al*. [28] from Ethiopia and Pathak and Gaur [20] from India. Also, relatively higher than that reported by Singh *et al*. [27] and Nath *et al*. [17] in India.

In Australian and German sheep the infection rate is 11.4%-15.2% and 16.7%, respectively [4, 9]. In India, 37.03% in sheep and 27.29% in goats [20] and in Turkey ranged between 12.13% and 56.7% [26, 12].

This variation in the prevalence mainly accounted to the grazing behaviour and management system prevailing in the local areas [16]. The presence of stray dogs in pastures and beside abattoirs is the main causes of the persistence of the disease [16].

The prevalence of *C. tenuicollis* by species was higher in goats as compared to sheep in our study. Similar result was reported in Ethiopia by Singh *et al*. [27] and Wondimu *et al*. [35] which indicated that this may be due to close contact between dogs and goats and, according to Torgerson *et al*. [33], under condition of high infestation of *C. tenuicollis* most sheep develop protective immunity early in life and this immunity regulate the parasite population, whereas goat develops the immunity more slowly.

On the other hand, Mekuria *et al*. [14], from Central Ethiopia, reported that there was no significant variation in the prevalence of *C. tenuicollis* between sheep and goats. Pathak

and Gaur [20] revealed that the rate of infection was higher in sheep than in goats.

Most of the cysts were present in abdominal cavity of sheep and goats, except few which were found in the liver, which is in accord with the results of Singh *et al*. [27] and Radfar *et al*. [23].

The present study aimed also, to determine biochemical (glucose, cholesterol, triglycerides, urea, creatinine, calcium, sodium, potassium and magnesium) contents in *C. tenuicollis* cysts. These substances reflected the relationship between the intermediate host (sheep and goat) and parasite.

Several studies were conducted on biochemical characteristics of *C. tenuicollis* [1, 17, 18, 24, 31]. In the present study, we compared between sheep and goats the biochemical parameters of cysts fluid to determine if the animal species infected affects the biochemical profile of cysts fluid. No significant difference in biochemical profiles between sheep and goats cyst fluid was detected. However, Sing *et al*. [27] and Radfar *et al*. [23] observed that there is a significant difference in cysticerci from sheep and goats.

For sheep, results of Al-Bayati *et al*. [2] are in agreement with our findings. Nazifi *et al*. [18] signaled higher contents than ours, apart from triglycerides and cholesterol, the two results are in accords.

In goats, contents of glucose, Triglyceride and Cholesterol in the present study are in accord with Athmar K Abbas AL azawi [3]. For the rest of parameters, our results are in disagreement with Nath *et al*. [17] and Athmar K Abbas AL azawi [3].

The contents of calcium and potassium on sheep and goats was found lower than of sodium, which constituted the major ion in the fluid, these results were in agreement with many studies [3, 18, 21].

A study conducted by Radfar and Iranyar [21] and Radfar *et al*. [22] on *Echinococcus granulosus* cysts in small ruminants revealed comparable values with ours results concerning, cholesterol, triglycerides, urea, creatinine, and glucose. On the other hand for minerals, our results are lower except for the calcium, we have revealed higher values.

*C. tenuicollis* may be an important cause of economic loss in the meat industry since viscera harbouring them may be rejected for aesthetic reasons [10] and mortality in lambs was reported [30]. The analysis of risk factors considered for this study showed sheep and goats with lowest weight were the most affected compared to the medium and higher weight. This finding is in line with the report of Torgerson *et al*. [33], Senlik [26] and Samuel and Zewde [25] from Northern Jordan, Turkey and Central Ethiopia, respectively. When animals suffer from shortage or scarcity of nutrition, and infected with gastrointestinal internal parasites their immunity compromised. Hence, possibly this can be accounted for the higher prevalence of the cyst in poor body condition animals [14].

## 5. Conclusion

The preliminary findings provide original information about infections with *C. tenuicollis* in sheep and goats in Algeria. The results suggest that infection of sheep and goats with *C. tenuicollis* is common in Algeria, and that this may constitute economic and health problems in the meat industry. The stray dog control has a key role in reducing the prevalence of *C. tenuicollis*. Biochemical analysis of cysts fluid has shown that there is no difference between sheep and goats.

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