Control program against hydatidosis and the decreased prevalence in Uruguay

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Abstract. Cystic hydatidosis/echinococcosis is an important zoonosis caused by the tapeworm Echinococcus granulosus. Hydatidosis is a serious parasitic disease in Uruguay, and in 1991 a new national control program was implemented by the national commission against hydatidosis (CHLCH). In 1991 (before the control program), farm and town dogs were examined for the prevalence of the parasite in Tacuarembó, Uruguay, using fecal samples of farm dogs after an arecoline purgation and samples of small intestine of town dogs obtained by necropsy. The prevalence of E. granulosus was 23 and 4% in farm and town dogs, respectively. In order to evaluate the impact of the control program, two surveys on ovine hydatidosis were carried out in Tacuarembó before and during the national control program. Sheep were examined in 1991–1992 (before the control program) and 1999 (during the control program). Both prevalence and intensity of E. granulosus infection increased with age in both 1991–1992 and 1999. The prevalence of ovine hydatidosis was 41.6 and 8.5% in 1991–1992 and 1999, respectively. The prevalence of fertile cysts in sheep more than 4 years old was 7.3% and 2.3% in 1991–1992 and 1999, respectively. The remarkable decreased prevalence of ovine hydatidosis suggested the successful control program by CHLCH in Uruguay.

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1. Introduction

Cystic hydatidosis/echinococcosis is an important zoonosis caused by the tapeworm Echinococcus granulosus. The parasite is distributed world-wide [1], about 2–3 million patients are estimated in the world [2]. The definitive hosts of E. granulosus are dogs that harbor adult tapeworms and excrete the parasite eggs with their feces. Main intermediate hosts of the parasite, livestock and human, take the eggs orally, and are infected with larval stage, hydatid cyst in the liver and lungs. The cyst with protoscoleces is called a fertile cyst.
Older sheep harbor more fertile cysts. When dogs eat the fertile cysts, protoscoleces are released from the cyst, and develop into adult tapeworms in the small intestine of the dogs.

The protoscolex of *Echinococcus* spp. can develop in two directions, one is adult tapeworm in the definitive host and the other is hydatid cyst in the intermediate host. If the protoscoleces are dispersed in the abdominal cavity of the patients during the operation, they cause severe secondary hydatidosis [3].

To control the parasite, treatment of dogs with anthelmintic is the main procedure [8]. Some progress was achieved with this procedure and the prevalence in sheep was reduced significantly in some countries or areas. But after these control campaigns were interrupted, prevalence of the parasite increased. From the endemic status to extinction status, control can be divided into 4 phases; planning, attack, consolidation and maintenance of eradication [4].

2. Control program against hydatidosis in Uruguay

Uruguay is a middle-income developing country, situated between Brazil and Argentina, and is a highly endemic area of *E. granulosus*. The main industry of Uruguay (human population 3.3 million; size of the land 176,215 km$^2$) is animal husbandry with about 50,000 farms, 20 million sheep and 10 million cattle. Hydatidosis is endemic in Latin America, especially in Uruguay and some regions of Argentina, Brazil, Chile and Peru [1]. In Uruguay cattle are consumed mainly in the urban area, and inspected in large-scale modern slaughterhouses. Thus, many cattle are infected with hydatid cyst, but they are not important intermediate hosts for the transmission of the parasite [5]. In farms, sheep are home-slaughtered routinely. About 20% of the inhabitants carry out home-slaughtering. On such occasions dogs can gain access to viscera of the infected sheep. About 60% of inhabitants own at least one dogs. The prevalence in sheep is one indicator of the endemic situation of *E. granulosus* in Uruguay. Mean life expectancy at birth of the sheep population in Uruguay was estimated at 3.5 and 4.8 years for male and female sheep, respectively [6]. Old sheep are home-slaughtered frequently on farms.

Hydatidosis is a considerable public health problem in Uruguay. The number of patients during the period 1962 to 1971 was estimated at 552 per year (17.4/100,000) [7]. But the seroprevalence of hydatidosis in rural human population was 1.24% [8]. Two surveys using abdominal sonography also showed the prevalence of 1.39% and 1.6% in asymptomatic population [9,10]. The minimum cost (US$25 million/year) was estimated from the condemnation costs of infected offal, production losses of livestock, actual costs of hospital treatment and the reduced income of patients [11].

In Uruguay several efforts have been made since 1965. In 1965, hydatidosis was declared a national pest and all measures aimed at its eradication were declared, and a national commission against hydatidosis (Comission Honoraria de Lucha Contra la Hidatidosis, CHLCH) was organized. A program of Option 2 [4] was operated from 1970–1991. In Option 2, anthelmintic tablets were provided for the owners to treat their dogs periodically. But the prevalence in livestock was not decreased until 1990. The owner may have not given anthelmintic to their dogs properly. In 1991 a new national control program (Option 5 [4]) was started and conducted by CHLCH. The schedules for control included planning phase (1990), diagnosis phase (1991), attack phase (1992–1996) and consolidation phase (1997–
2004) [12]. Option 5 is a fast track approach, and all dogs are treated with praziquantel monthly. In 1997 about 40 dosificadores went to farms periodically and gave anthelmintic to dogs throughout Uruguay. Two or three dosificadores worked for proper treatment of dogs with praziquantel in the Department of Tacuarembó. CHLCH reported that 92.3% of the entire rural dog population had been dosed in 1997 [12].

3. Materials and methods

We determined the epidemiological status of *E. granulosus* before and during the campaign against Hydatidosis/Echinococcosis, in 1991–1992 and 1999, respectively. In 1991–1992 (before the control program), 79 town dogs and 208 farm dogs in Tacuarembó were examined for the adult stage of cestodes by necropsy and fecal examination, respectively. Stray dogs in the town of Tacuarembó were necropsied and the small intestine examined. Fecal samples were obtained after arecoline purgation in rural area, which were taken by CHLCH. In Department of Tacuarembó, 639 and 375 sheep were examined in 1991–1992 (before the control program) and 1999 (during the control program), respectively. Ages of the sheep were estimated from their teeth. Viscera (the lungs, heart, liver, kidneys and spleen) of the sheep were obtained from several slaughterhouses, sliced in thickness of about 5 mm and examined for the hydatid cysts. The presence of laminated layer and the number of protoscoleces in each cyst were determined. Fertile cysts and sterile cysts were consequently differentiated. Small lesions (less than 5 mm in size) were examined histologically.

4. Results

4.1. Prevalence in dogs in 1991 (before the control program)

Seventy-nine stray dogs in the town of Tacuarembó were necropsied and examined for adult stage of cestodes (Table 1). The prevalence of *E. granulosus* was 4%. Other taeniid cestodes, whose intermediate hosts are livestock, were less prevalent. But the prevalence of *D. caninum*, whose intermediate hosts is the flea, was 38%.

The fecal samples after arecoline purgation were examined for cestodes in the rural area (Table 2). The prevalence of *E. granulosus* in farm dogs was 22.7%. The prevalence of *T. hydatigena* was also higher than in town dogs.


In 1991–1992 prevalence of hydatid cysts in sheep was 41.6%. The mean number of hydatid cysts in all examined sheep and in infected sheep were 1.58 (SD 3.97, range 0–
47) and 4.00 (SD 5.46), respectively. Frequency distribution of the number of cysts in each sheep was overdispersed. Both intensity and prevalence of *E. granulosus* infection increased with age (Fig. 1). Average increase in the number of cysts per year was about 1. In sheep older than 4 years the prevalence was 49.3% and 18.5% in 1991–1992 and 1999, respectively. Hydatid cysts were found mainly in the lungs (61% of total cysts) and the liver (39% of total cysts) except one case (0.09%) in the kidney and three cases (0.28%) in the spleen. Most of the hydatid cysts were partially regressive (caseificated or calcified and polymorphic or multicystic). In 1999, the prevalence (8.5%) and mean intensity of cyst (mean 0.28, range 0–10, SD 1.17) decreased significantly. The mean numbers of hydatid cysts in infected sheep were 3.28 (SD 2.58). The prevalence in sheep less than 3-years old and more than 4 years old was almost 0 and 18.5%, respectively.

Ratio of number of fertile cysts to number of total cysts was 11.3% (114/1069) and 15.7% (19/121) in 1991-92 and 1999, respectively (Fig. 2). About 84-89% of cysts did not form protoscoleces. In 1991-92, sheep more than 3 years old harbored fertile cysts. Prevalence of fertile cysts in more than 4-year-old sheep was 7.3% and 2.3% in 1991-1992.
and 1999, respectively. Mean number of protoscoleces per fertile cyst was 1,437 (n=73) and 5,827 (n=19) in 1991-1992 and 1999, respectively. Most of the fertile cysts contained less than 500 protoscoleces.

5. Discussion

In Uruguay a new national control program started in 1991 [12]. It was applied throughout the country up to the present. CHLCH reported that at the beginning of the program the prevalence in dogs was 10.7% and 29.7% in fecal examination after arecoline purgation in Uruguay and in Tacuarembó, respectively. Our present study in 1991–1992 showed that the prevalence in farm dogs was 22.7% in Tacuarembó. CHLCH and we obtained almost similar results in survey. But in town of Tacuarembó the prevalence in dogs was lower than reported by CHLCH. Our present results suggested that dogs had easy access to the viscera of the infected sheep in rural area. Department of Tacuarembó was a highly endemic area in Uruguay.

Cabrera et al. [13] determined the infection pressure of the parasite in Uruguay, and reported that dogs became reinfected with *E. granulosus* between 2 and 4 months after treatment. CHLCH reported that 18 and 4.43% of dogs ate offal in 1991 and 1997, respectively. The infection pressure decreased by the decreased prevalence in sheep and decreased access to viscera of sheep in Uruguay. According to the data from CHLCH the prevalence in dogs was 0.74% in Uruguay, and 1.51% of farms had dogs infected by the parasite in 1997, when 92.3% of the whole rural dog population in the country had been dosed.

The remarkable decreased prevalence in sheep suggested the successful control program by CHLCH in Uruguay. In our data the prevalence in sheep was 41.6% in
1991–1992. CHLCH reported that the prevalence in sheep was 43.4% in 1991. Our data support their data. In our data the prevalence in more than 4-year-old sheep was 49.3% and 18.5% in 1991–1992 and 1999, respectively. Cabrera et al. [5] reported that the prevalence of hydatidosis was 7.7% in lambs and 18.0% in adults in 1998. Our results and Cabrera’s data [5] were similar in adult sheep, but not in lambs. While the difference of both studies was in scale and place of survey, we do not know the cause of the difference.

The prevalence in more than 4 year old sheep was 18.5%. But a few young sheep were also infected with the parasite in 1999. It suggested that sheep were infected before 1997 in Uruguay. Even in the intensive attack phase of control (1992–1996) some sheep were infected. Young sheep, lambs, are usually sent to large-size, modern slaughterhouses and are consumed in the urban area [5]. In the urban area dogs usually have no access to viscera of infected sheep. But in the rural area old sheep with fertile cysts are home-slaughtered. So on the farms a few dogs had the chance to eat the viscera containing fertile cysts during the attack phase.

Although the control program led to the remarkable reduction of prevalence in animal populations in Uruguay, eradication of the parasite has not been achieved. A sustainable control program (less costly consolidation phase) is needed.

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