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# Epidemiological study of the cystic echinococcosis in Morocco

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**Abstract**

The objectives of this epidemiological study on cystic echinococcosis (CE) in Morocco (2001–2004) were to update the prevalence of CE in different animal species living in the most important areas of the country and to collect protoscoleces and germinal layers for genetic research purposes. The post mortem inspection concerned 2948 sheep, 2337 goats, 618 cattle, 482 camels and 455 equines (325 horses, 60 mules and 70 donkeys) in five different regions: the Rif (Mediterranean coast and high mountains of the Rif), the Loukkos (Atlantic northwest plain), the center (Rabat and Casablanca regions), the Middle Atlas mountains and the south (arid and semi desert areas). The global CE infection prevalence rates obtained were 22.98% in cattle, 10.58% in sheep, 12.03% in camels, 17.80% in equines and 1.88% in goats. The infection rates were especially high in the Middle Atlas in cattle (48.72%) and in the Loukkos in cattle and sheep (37.61 and 31.65%, respectively).

The majority of infected cattle (49.6%) and sheep (52.1%) had hydatid cysts in both liver and lungs. Except for cattle, the liver was more infected than lungs in all the other animal species. Animals more than 5 years old were the most infected in all species. The mean CE infection rates of these animals were about 56% in cattle, 40% in sheep, 20% in camels, 17.80% in equines and 7% in goats. These rates were much higher in the Loukkos (85% of cattle and 59% of sheep) and in the Middle Atlas (68% of cattle and 45% of sheep) than in the other regions. Results showed that *Echinococcus granulosus* is in an endemic steady state with no evidence of protective immunity in the intermediate hosts. The mean numbers of infections per year are 0.099 for cattle, 0.063 for sheep, 0.03 for camels and 0.010 for goats.


*Keywords:* Cystic echinococcosis; *Echinococcus granulosus*; Epidemiology; Farm animals; Morocco

## 1. Introduction

Cystic echinococcosis (CE) is caused by the larval stage of *Echinococcus granulosus* (*Eg*), which has a much greater reproductive potential and requires two mammalian hosts. In Morocco, the parasite is transmitted in a synanthropic cycle involving dogs and livestock (sheep, cattle, camels, goats and equines).

Stray dogs in urban areas and free or roaming dogs in rural areas are the main definitive hosts. The infection pressure and the intensity of *Eg* in dogs were studied in several areas in Morocco. The results reported by Dakkak (1992), showed high prevalence

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ranging from 22 to 58.8% and intensities of 1 to 18,940 worms per infected dog. In Tunisia, Lahmar et al. (2001) found 21% of dogs infected and a mean of 2534 parasites per infected dog. According to Gemmel et al. (2001), 8470 eggs are shed from average infected dog per day. Thus, the high prevalence of echinococcosis in dogs either in rural or in peri-urban areas and the high proportion of stray and free roaming dogs lead to a very high pollution of the environment by *Eg* eggs (Dakkak, 2003). Therefore, the dissemination of eggs, the contamination of water and food and the risk to contaminate farm animals and human are very high.

Results of studies on CE in five regions of Morocco showed considerable variations of infection rates among farm animals. The high figures reported were 56.87% in cattle, 25.93% in sheep, 22.73% in goats, 80% in camels and 24% in equines (Ouchtou, 1980; Moumen, 1981; Chentoufi, 1982; El Berrahmani, 1983; Essaadouni, 1985; Mahboub, 1991). These prevalence rates were higher in the older animals; they, respectively, reached 86.84, 68.15 and 52.63% in cattle more than 5 years old, and in sheep and goats more than 3 years old.

This disease is an important zoonosis. It represents a serious public health problem and has an important effect on the economy and social welfare in Morocco. In 2003, a number of 1700 human surgical cases of CE (5.5 cases per 100,000 inhabitants) were recorded in the whole country. Surgeries were repeated in 10% and a mortality rate of 3% was observed (Ministère de la Santé, Maroc, 2003). The human ultrasound screening done in the Middle Atlas region showed a CE rate of 1% (Kachani et al., 2003). On the other hand, economical losses are also very important. The cost was estimated to about US$ 1500 for one surgical operation and US$ 2,550,000.00 for 1700 cases (Ministère de la Santé, Maroc, 2003). Lyagoubi et al. (1997) estimated this cost to US$ 1000 and 3000, respectively, for a simple cyst and complicated cases. Expenses due to further examinations, reduced quality of life following the surgery, morbidity due to undiagnosed CE and expenses and loss of income in fatal cases were not taken into account. Thus, the cost of human CE in Morocco is higher than the human health cost reported in Jordan, where it has been estimated from US$ 430 to 670 for hospital cost only and from US$ 612 to 3830 for the total human health cost (Torgerson, 2003). In addition, CE causes livestock productions decrease and condemnation of offal containing hydatid cysts in slaughterhouses.

In order to update the CE prevalence, to reinforce epidemiological knowledge and to study the transmissibility and infectivity of *Eg* strains, a molecular epidemiological study on *Eg* larva isolates collected from several regions and different intermediate hosts in Morocco was carried out. This will allow us to determinate the genotypes existing in the country and understand how occurs the transmission among different animal species and which strains affect humans.

In this first paper, we present the results of the epidemiological study.

## 2. Material and methods

### 2.1. Animals and Studied Areas

This study was undertaken from 2001 to 2004 and concerned sheep, cattle, goats, camels and equines (horses, mules and donkeys) slaughtered in rural and urban abattoirs of five regions in Morocco (Fig. 1): the Rif (Mediterranean coast and high mountains of the Rif), the Loukkos (Atlantic northwest plain), the Middle Atlas mountains, the central area (region of Rabat and Casablanca) and the south (desert and semi desert areas).

Studied areas are different by their geography, climate, livestock husbandry and human behaviours. Abattoirs where the slaughtered animals came from the same area were chosen for this study. Both adults and young animals slaughtered in these abattoirs were used. Seventy-six field visits were realized to these abattoirs. Among the five studied areas, equines are slaughtered only in Casablanca and Rabat. The other animal species were post mortem inspected in the following abattoirs: Ain Aouda, Benslimane, Sidi Bettach, Temara, Tiflet and Tlat Sidi Yahia Zaers in the center region; Laaouamra in Loukkos; Azrou, Elhajeb, Agourai, Sebt Jehjouh, Had Ifrane and Mrirt in the Middle Atlas region; Alhoceima, Beni Bouayach and Imzourene in the Rif; Laayoune, Guelmim and Ksabi in the south region. Six thousand eight hundred and forty slaughtered animals (618 cattle, 2948 sheep, 2337 goats, 482 camels and 455 equines) were examined. When visiting abattoirs, we