

Targeting abattoirs to control cystic echinococcosis in Algeria

Le ciblage des abattoirs dans la lutte contre l'échinococcose kystique en Algérie

M.C. Benchikh ElFegoun · K. Kohil · C. L'Ollivier · M. Lleu · B. Babelhadj · M. Piarroux · M. Gharbi · R. Piarroux

Reçu le 7 septembre 2015 ; accepté le 19 avril 2016

© Société de pathologie exotique et Lavoisier SAS 2016

Abstract Cystic echinococcosis (CE) is an important anthro-pozoonotic parasitic common in Algeria. The predominant life cycle of *E. granulosus* is a synanthropic cycle with domestic dogs as definitive hosts and livestock animals as intermediate hosts. Slaughter activity represents a potential source for dogs to access infected offal. The aim of the present study was to determine if the contact between dogs and potentially infected offal was possible in licensed abattoirs. Eighty-one private and public abattoirs located in eastern Algeria were assessed with respect to their level of protection against the intrusion of dogs. We have demonstrated that in 42 % of these abattoirs, dogs could easily come in contact with potentially parasitized offal. The most common incorrect practices were the dumping of offal freely into the environment, the feeding of dogs with offal, and the leaving of unattended offal in an unsealed chamber. Overall, some hazardous practices remained common customs of workers, and enough abattoirs remain non-compliant that the cattle-dog domestic cycle of CE is unlikely to be broken. Hence, some recommended measures to interrupt parasite transmission include the following: recognition of the importance of

abattoirs in the maintenance of canine echinococcosis, the controlled and proper disposal of offal, the abolishment of the custom of feeding dogs with infected offal and improvements in the level of health education of abattoir staff.

Mots clés Echinococcose kystique · Abattoir rural · Abattoir semi-urbain · Abattoir urbain · Abats · Bétail abattu · Chiens · Algérie · Maghreb · Afrique du Nord

Résumé L'échinococcose kystique est une anthropozoonose parasitaire qui représente un problème de santé publique en Algérie. Le cycle de vie d'*E. granulosus* est principalement synanthropique avec comme hôtes définitifs les chiens domestiques et comme hôtes intermédiaires les animaux d'élevage. Les activités d'abattage de ces animaux d'élevage représentent une occasion idéale pour les chiens d'accéder à des abats parasités. L'objectif de cette présente étude a été de déterminer si le contact entre les chiens et les abats potentiellement parasités était possible au sein des abattoirs agréés. Quarante-deux abattoirs publics et privés situés dans la région est de l'Algérie ont été évalués sur leur niveau de protection contre l'intrusion des chiens dans les locaux. Nous avons démontré que dans 42 % de ces abattoirs, les chiens pouvaient facilement accéder aux abats potentiellement parasités. Les mauvaises pratiques les plus fréquemment retrouvées étaient le déversement sauvage des abats dans l'environnement, l'alimentation des chiens avec les abats, et le stockage non surveillé des abats dans des pièces non fermées. Dans l'ensemble, le cycle domestique entre le bétail et le chien est peu susceptible d'être rompu étant donné qu'il reste encore trop d'abattoirs non conformes au niveau de leurs locaux et que certaines des malversations pratiquées font parties des coutumes locales. Par conséquent, il est important de promouvoir les recommandations suivantes visant à interrompre la transmission du parasite au niveau domestique : reconnaissance du rôle des abattoirs dans le maintien de l'échinococcose canine, élimination contrôlée et appropriée des viscères après abattage, suppression de la pratique de nourrir les chiens avec

M.C. Benchikh ElFegoun (✉) · K. Kohil
Institut des sciences vétérinaires, Université 1,
25000 Constantine, Algérie
e-mail : blmc25@yahoo.fr

C. L'Ollivier · M. Lleu · R. Piarroux
CHU Timone Adultes, Aix Marseille Université,
Assistance publique, Hôpitaux de Marseille,
13005 Marseille, France

M. Piarroux · R. Piarroux
Aix-Marseille Université, UMR MD3, 13885 Marseille, France

B. Babelhadj
Laboratoire de protection des écosystèmes des zones arides
et semi-arides, Université Kasdi Merbah, 30000 Ouargla, Algérie

M. Gharbi
Laboratoire de parasitologie, Université Manouba,
École nationale de médecine vétérinaire de Sidi Thabet,
2020 Sidi Thabet, Tunisie

des abats non contrôlés et amélioration du niveau d'éducation sanitaire du personnel d'abattoir.

Keywords Cystic echinococcosis · Rural abattoir · Semi-urban abattoir · Urban abattoir · Offal · Slaughtered livestock · Dogs · Algeria · Maghreb · Northern Africa

Introduction

Echinococcus granulosus is a cestode belonging to the family of *Taeniidae* that infects mainly domestic dogs as the definitive host. It is transmitted to a wide range of intermediate-host domestic ungulates, which harbor the hydatid cysts [2]. Dogs acquire infection from hydatid-carrying livestock. Cystic echinococcosis (CE), caused by *E. granulosus*, is an important zoonotic parasitic infection that causes morbidity and mortality in humans playing the role of dead-end intermediate hosts [9]. In Algeria, CE is endemic in humans, with an annual incidence ranging from 1.78 to 2.26 per 100,000 humans. In order to break the transmission cycle of the parasite, control programs have been implemented in North African countries, particularly the prevention of contact between dogs and infected offal.

The present study was carried out in Algeria to investigate the level of protection of private and public abattoirs with respect to the intrusion of dogs.

Material and methods

Study area

Algeria has an area of 2,381,741 km² and is divided into 48 administrative districts, called wilayas. The present survey was carried out in 81 slaughterhouses located in 18 wilayas in eastern Algeria. Abattoirs were also classified according to the human population: urban areas (> 200,000 inhabitants), semi-urban areas (50,000 to 200,000 inhabitants), and rural areas (<50,000 inhabitants). Abattoirs were also classified according to the number of yearly slaughtered animals: large (>8,000 heads/year), medium (3,000-8,000 heads/year) and small (<3,000 heads/year).

Data collection

In each abattoir visited, the level of protection of abattoirs against trespassing dogs, and the elimination process of the infected offal were evaluated. Moreover, we considered the slaughterhouse to be engaged in appropriate behavior to break the CE transmission cycle if dogs could not access offal and if the elimination procedures involved the incineration or burial

of offal. In contrast, if one of these conditions was not met, we considered the level of protection to be inadequate.

Results

Eighty-one abattoirs were visited during the survey, of which 23, 28 and 30 were large, medium and small slaughterhouses, respectively. Seventy-nine slaughterhouses were under the control of the municipality, while the remaining 2 were private. Rural, semi-urban, and urban abattoirs represent 70.4%, 22.2% and 7.4% of abattoirs, respectively.

Contact between dogs and offal was possible in 41.97% (34/81) of all slaughterhouses (Table 1) because they were not isolated and remained unattended (n=7); or offal was dumped in the environment (n=21); or because technicians and butchers used it to feed dogs (n=6). The proportion of urban, semi-urban and rural abattoirs categorized as engaged in good or bad practices was not significantly different (p= 0.095). Likewise, no significant difference was observed between the large, medium and small centers (p= 0.248) (Table 1). Appropriate procedures of offal disposal were either burial (58.5%) or incineration (41.5%), but such procedures did not always preclude from avoiding any contacts with dogs. Indeed, in 6 cases, the offal remained unattended and accessible to stray dogs.

Discussion

Over the past five decades, control programs of hydatid disease have been undertaken in several jurisdictions around the world with varying degrees of success [3]. Dogs are a potential source of contamination of the immediate human environment, and they may expose family members, especially children, to infection when the dogs return to their owners [8]. A number of factors have been found to influence the frequency and intensity of canine echinococcosis. The most important of these is the potential access that dogs have to uncooked and infected offal [7]. In Algeria, the prevalence of stray dogs infected with *E. granulosus* ranges from 16% to 42% [1]. Our study found that in one-third of abattoirs, dogs could easily gain access to potentially parasitized offal. The most common bad practice we found was the dumping of offal into the local natural environment instead of a definitive elimination of offal by incineration or burial. Furthermore, the absence of a fence around the abattoirs also facilitates dogs accessing the interior of the abattoir even if the downstream processes are respected. These deficiencies may be relatively easy to overcome. Even if large abattoirs have better infrastructure than smaller abattoirs, our study shows that regardless of the size, the dogs may have access to abattoirs.

Table 1 Proportion of the different categories of abattoirs (n=81) with respect to the level of offal access by dogs / *Répartition des différentes catégories d'abattoirs (n=81) en fonction du traitement des abats..*

	Number of Abattoirs with malpractices			total	Number of Abattoirs with good practices
	Offal remain unattended	Offal are dumped in the environment	Dogs are fed with offal		
Urban Unity*					
Urban	0	0	0	0	6
Semi-urban	3	3	1	7	9
Rural	4	18	5	27	32
total	7	21	6	34	47
Size**					
Large	0	6	1	7	16
Medium	6	8	0	14	12
Small	1	7	5	13	19
Total	7	21	6	34	47

Abattoirs were categorized according to their size and to their urban unity.

* urban unity corresponding to prefectures (> 200,000 inhabitants), semi-urban unity corresponding to the sub-prefectures (50,000 to 200,000 inhabitants), and rural unity corresponding to small towns (<50,000 inhabitants).

** size of abattoirs according to the number of animals slaughtered per year (head/year): large (>8,000 heads/year), medium (3,000-8,000 heads/year) and small (<3,000 heads/year).

Even more hazardous practices were also observed, such as the direct feeding of dogs with offal by technicians. These practices reveal the urgent need to educate workers on this subject. In particular, abattoir staff needs to be better educated by veterinarians about hydatid disease and the available control options. Another control measure is the control of stray dog populations. In Algeria, the population of stray dogs tends to increase year after year, despite campaigns to cull stray dogs organized by the municipal public health offices. As known from ecological studies, wild or feral populations are usually limited by access to food. If on one side, campaigns are organized to control stray dogs, but on the other they are fed at slaughterhouses, it will be difficult to obtain any positive result.

Encouragingly, some control programs in other countries have shown that satisfactory results can be achieved in less than 15 years if all control measures are carried out without major constraints and financial restrictions [4-6]. These programs were to target critical points in the transmission of *E. granulosus*, including increasing awareness of the disease risks among the population, treating dogs with praziquantel, improving the control of stray dogs, echinococidal treatments of working sheep dogs, and ensuring the safe disposal of slaughtered sheep offal and safe disposal of dead sheep in sanitary pits. However, our results showed that, in Algeria, the first steps of such an elimination program have yet to be reached. Even the prevention of access of domestic and stray dogs to official abattoirs remains problematic, despite the fact that it represents one of the easiest goals to be achieved when implementing a hydatidosis control program.

Liens d'intérêts : Les auteurs déclarent ne pas avoir de liens d'intérêts.

References

- Bentounsi B, Meradi S, Ayachi A, Cabaret J (2009) Cestodes of Untreated Large Stray Dog Populations in Algeria: A Reservoir for Herbivore and Human Parasitic Diseases. *Open Veterinary Science Journal* 3:64-7
- Carmena D, Cardona GA (2013) Canine echinococcosis: Global epidemiology and genotypic diversity. *Acta Trop* 128(3):441-60
- Craig PS, Larrieu E (2006) Control of cystic echinococcosis/hydatidosis: 1863-2002. *Adv Parasitol* 61:443-508
- Gemmell M, Roberts M, Beard T, Lawson J (2001) Control of echinococcosis. In: Eckert J, Gemmell M, Meslin F.X., Pawlowski Z (Eds.), WHO/OIE manual on echinococcosis in humans and animals: a public health problem of global concern. Paris, France: World Organisation for Animal Health, pp 143-6
- Jiménez S, Pérez A, Gil H, Schantz P, et al (2002) Progress in control of cystic echinococcosis in La Rioja, Spain: decline in infection prevalences in human and animal hosts and economic costs and benefits. *Acta Trop* 83(2):213-21
- Larrieu E, Costa MT, Cantoni G, et al (2000) Rate of infection and of reinfection by *Echinococcus granulosus* in rural dogs of the province of Rio Negro, Argentina. *Vet Parasitol* 87(4):281-6
- Otero-Abad B, Torgerson PR (2013) A systematic review of the epidemiology of echinococcosis in domestic and wild animals. *PLoS Negl Trop Dis* 7(6):e2249
- Reyes MM1, Taramona CP, Saire-Mendoza M, et al (2012) Human and canine echinococcosis infection in informal, unlicensed abattoirs in Lima, Peru. *PLoS Negl Trop Dis* 6(4):e1462
- Torgerson PR, Budke CM (2003) Echinococcosis – an international public health challenge. *Res Vet Sci* 74(3):191-202