

Full Length Research Paper

Seroprevalence of chlamydial abortion and Q fever in ewes aborted in the North-West of Algeria

Karim Abdelkadir^{1,2*}, Ait Oudia Khatima¹ and Khelef Djamel¹¹National Veterinary Higher School of Algiers, Rue Issad Abbes, Oued Smar- Alger, Algeria.²Laboratory of Research, Food Hygiene and Quality Assurance System (HASAQ), High National Veterinary School of Algiers, Algeria.

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Very little information is available in Algeria on Q fever and chlamydial abortion sheep, two zoonosis caused by *Coxiella burnetii* and *Chlamydophila abortus* and their main reservoirs are domestic ruminants. This study aimed at investigating the seroprevalence of these two diseases in sheep flocks from six Daira (Telagh, Tanira, Moulay Slissen, Marhoum, Ras Elma and Merine). A serological survey was conducted in 39 flocks with a history of abortions, which were classified by size. A total 180 sera were collected from the aborted ewes. Q fever indirect ELISA kit and *C. abortus* indirect ELISA kit (ID Screen[®]) kits were used to know the percent prevalence in sheep. The results showed that 28% (N = 50/180) of sheep were seropositive for Q fever and 31% (N = 55/180) of sheep were seropositive for chlamydial abortion. Twenty eight herds (72%) showed at least one seropositive animal for Q fever and 29 herds (74%) showed at least one seropositive animal for chlamydial abortion. Larger herds led to more infected herds of small and medium for Q fever. These results showed that infection with Q fever and chlamydial abortion were common in the study area, therefore encouraging efforts are needed to propose measures to reduce the spread and zoonotic risk.

Key words: Q fever, chlamydial abortion, seroprevalence, enzyme-linked immunosorbent assay (ELISA), zoonosis.

INTRODUCTION

Chlamydial abortion and Q fever are two zoonoses caused by two small obligate intracellular Gram-negative bacteria, *Chlamydophila abortus* and *Coxiella burnetii* (Maurin and Raoult, 1999; Rodolakis, 2006; Aitken and Longbottom, 2007) which grow in the cytoplasm of

eukaryotic cells. They are the most important causes of reproductive failure in sheep and goats (Berri et al., 2001, 2005; Arricau-Bouvery and Rodolakis, 2005). These infections cause abortion, stillbirth, delivery of weak offspring and infertility in the small ruminant (Rodolakis et

*Corresponding author. E-mail: karimeabdelkadir@gmail.com.

al., 2004; Agerholm, 2013). The losses caused by these two agents evaluated on several levels. In economic terms, the non-sale of the product (lamb or goat), the non-renewal of young breeding (antenaïse or goat) and decreased milk production (dairy farming) are the most negative impact on the scale of livestock. In health terms, the main concerns are the risk of contamination of several lots on livestock, as well as professional zoonotic transmission. Both agents were the subject of increasing research from the years 2002 in small ruminants, due to their proven implication in human focus (Wallenstein et al., 2010).

The present study attempted to investigate the prevalence of chlamydial abortion and Q fever at the level of district Sidi Belabbes through sero-prevalence studies in flocks that have experienced abortions and correlate its possible association with managerial (flock size, region, type of farming, and contact with other flocks) risk factors. In conjunction, the study try to clarify the interpretation of complementary investigations required by veterinary practitioners by confirming diagnostic tools available for both agents searched.

MATERIALS AND METHODS

Animals and blood sampling

This study was carried out from September to December 2013 (season of lambing); this study was based on the declaration of 1, 2 or 5 abortions on a period less than or equal to 4 weeks as equivalent to an abortion episode. While those with two reported abortions at 5 weeks of interval were eliminated from this study.

From 39 sheep flocks, a total of 180 blood samples were collected by jugular venous puncture in 4 ml sterile vacutainer tubes using Tubes BD Vacutainer® secs "BD, France" from aborted ewes aged between 1 and 6 years. After storage at room temperature for 1 h, blood samples were centrifuged at 3000 rpm for 5 min at room temperature. Sera were carefully harvested and stored at -20°C until assayed. Selected flocks ranged in size from 42 to 450 sheep. Flocks sizes were <100, 100-200 and >200 sheep for 6, 22 and 11 flocks, respectively, in order to establish the sero-prevalence of chlamydial abortion and Q fever via an indirect diagnosis. All flocks visited only once, no vaccine against chlamydial abortion or Q fever used.

Serological techniques

For the detection of antibodies against *C. burnetii* and *C. abortus*, two different ELISAs were used. For Q fever, indirect ELISA kit and *C. abortus* indirect ELISA kit (ID Screen® France) were used. Positive and negative control provided by the manufacturer and an internal positive laboratory reference was included in each test. Results were expressed as a percentage of the optical density reading of the test sample (% OD) calculated as $\% = 100 \times \text{OD sample} / \text{OD positive control}$. Recommended readings OD%<40 as negative, OD%>40, OD%<50 as doubtful, OD%>50<80% as positive and OD>80 highly positive for *C. burnetii*, and OD%<50 as negative, OD%>50<60 as doubtful, and OD%>60 as positive for *C. abortus*.

Statistical analysis

All data were entered and validated using a Microsoft Excel package. To bring out the association between a supposed risk factor and the disease, the odds ratio (OR) and relative risk (RR) were calculated.

The odds ratio is the probability of having the disease according to the presence or absence of risk factors and allows for addition to the degree of significance of the association, the direction and strength of the association.

RESULTS

According to the experimental design, all 39 flocks studied had a history of abortions and stillbirths, 180 aborted ewes belonging to these 39 flocks were examined for antibodies against *C. abortus* and *C. Burnetii*. The seropositivity results towards for these two bacteria obtained in aborted sheep at individual and flock levels were summarized in the Table 1.

At the farm level, 74% (29/39, 95% CI: 58 to 86) of farms had at least one seropositive sheep to *C. abortus* and 72% (28/39, 95% CI: 55-84) of farms had at least one seropositive sheep to *C. burnetii*. The seroprevalence of *C. abortus* infection in ewes is not associated ($P > 0.05$) with the three flocks size groups, it was the same for *C. burnetii*. The seroprevalence rate ranged from 29 to 88% and from 45 to 95% for *C. abortus* and *C. burnetii*, respectively.

Overall, the sheep level seroprevalence was 31% (55/180, 95% CI: 23, 92 -37, 84) for *C. abortus* and was 28% (50/180, 95% CI: 21, 37 -34, 93) for *C. burnetii*. In sheep level, there was significant difference ($P < 0.05$) between the seroprevalence of chlamydial infection and the location (Table 2). The highest prevalence rate (46.67%) of chlamydial infection was observed in Telagh area, while the lowest rate (17, 65%) was observed in Tanira area.

DISCUSSION

Exposure of sheep to *C. abortus* and *C. burnetii* was evaluated by testing for the presence of antibodies with an indirect ELISA test. The detected antibodies in this study imply a natural response to exposure to the microorganisms because there is no vaccination program against ruminant chlamydiosis or Q fever in Algeria before. The survey design provided data on seroprevalence at the flock and the animal level in this area. Results of the present study revealed an animal-level seroprevalence to *C. abortus* of 31% and to *C. burnetii* of 28% in Sidi Bel Abbes region, Algeria. This figure is higher than that reported from other Algerians regions (Khaled et al., 2016; Hireche et al., 2014;

Table 1. Seroprevalence of *Chlamydophila abortus* and *Coxiella burnetii* infection in sheep according to flock size in Wilaya of SIDI BEL ABBES west of Algeria (2013).

Parameter	Flock size			Total	
	<100	[100 - 200]	>200		
Number of flocks	6	22	11	39	
Aborted sheep	27	178	153	358	
Aborted sheep taken	17	90	73	180	
Chlamydial abortion	Number of seropositives sheeps ^a (%)	7/17 (41%)	34/90 (38%)	14/73 (19%)	55 (31%)
	Number of seropositives flocks ^b (%)	5/6 (83%)	18/22 (82%)	6/11 (56%)	29 (74%)
	Range of seropositives flocks (%)	57%-88%	60%-94%	29%-83%	58%-86%
Q fever	Number of seropositives sheeps ^a (%)	6/17 (35%)	31/90 (34%)	13/73 (18%)	50 (28%)
	Number of seropositives flocks ^b (%)	3/6 (50%)	15/22 (68%)	10/11 (91%)	28 (72%)
	Range of seropositives flocks (%)	45%-88%	45%-86%	57%-94%	55%-85%

^aAnimal is considered positive if serum is positive (%DO > 40 by ELISA).^bFlock is considered positive if at least one animal serum is positive. * χ^2 test: $p < 0.05$.

Table 2. Seroprevalence of Q fever and chlamydial abortion depending on the region.

Area	Sera	Sera (+) for FQ	Seroprevalence (%)	Sera (+) for CH	Seroprevalence (%)
Telagh	30	7	23.23	14	46.67*
Ras Elma	30	7	23.23	15	50.00
Tanira	34	17	50	6	17.65*
M.slissen	40	8	20	9	22.50
Merine	27	8	29.63	7	25.93
Marhoum	19	3	15.79	4	21.05
Total	180	50	27.78	55	30.56

Sera (+) for QF: Sera positive for Q fever ; Sera (+) for CH: sera positives for chlamydial abortion. *Significant difference ($P < 0.05$) between areas by chi-square test.

Merdja et al., 2014). Also, several authors had previously reported high prevalence in Maghreb countries such as Morocco (El Jai et al., 2003), Tunisia (Russo et al., 2005), Egypt (Abdel-Moein and Hamza, 2017) and in world countries such as Turkey (Kennerman et al., 2010), Italy (Francesca et al., 2016), Slovakia (Trävnicsek et al., 2001), Spain (Mainar-Jaime et al., 1998) and Jordan (Al-Qudah et al., 2004). The overall seroprevalence rate at the flock level in our survey was 74% to chlamydial abortion and 72% to Q fever. These rates are higher than those reported by Francesca Rizzo et al. (2016) in flocks 38% in Italy and Angela et al. (2012) with 28% in Germany. However, due to numerous parameters such as differences in study design and inclusion criteria (e.g. high abortion rates), flock size and management, prevalence of other abortifacient agents (e.g. Brucellae, Salmonellae, Toxoplasma, Chlamydia, Campylobacter) it is virtually impossible to compare the present study's prevalence findings with the aforementioned studies

(Masala et al., 2004).

A higher prevalence rate was revealed for flocks with more than 200 animals compared with that of small flocks (91 and 50%, respectively) for Q fever, while, no significant correlation was revealed between flock size and the rate of seroprevalence for chlamydial abortion. The difference rate of seroprevalence revealed for the flock high size for Q fever might be that due to animal overcrowding in livestock buildings. Also may be related to the high number of lambing at lambing season, which increases the total population at risk and, subsequently, the risk of pathogen introduction and transmission, where high density may influence animal welfare and the occurrence of infectious diseases. The study showed that there is a significant difference ($P < 0.05$) between chlamydial infection in sheep and areas of northwest of Algeria (Table 2). Tanira and Ras Elma areas having the highest rate of chlamydial infection in sheep may be explained by the behavior of these species breeding in

these sites (frequency of herding group belonging to several farmers in the same village). These factors favor the rapid spread of infection.

Conclusions

The geographic distribution of *C. burnetii* and *C. abortus* indicate that both pathogens are present throughout the district of Sidi Bel Abbas. The highest percentage of positive samples was found for chlamydial abortion in Ras Elma (50%), and for Q fever in Tanira (50%). It seems that abortions in sheep following infection with *C. burnetii* and *C. abortus* have a higher frequency, even in young animals. Q fever and chlamydial abortion are a public health problem in Algeria. To for better control both in animals and humans, veterinary and public health sector should strengthen their collaboration for the establishment of a national program to fight against the major zoonoses in general and against Q fever and chlamydial abortion in particular.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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