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**Sero-prevalence of *Coxiella burnetii* and
Chlamydia abortus infections in Sheep, Goats
and Man in Diyala Governorate**

A Thesis

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1.1 Introduction

Zoonotic diseases are infectious and are transmissible between vertebrate animals and humans directly or indirectly (WHO, 2005).

Zoonotic agents can have significant impact on public health. Most (61%) human pathogens are known to be of animal origin, with 75% of emerging pathogens affecting humans in the past decade being classified as a zoonotic (Taylor *et al.*, 2002; WHO, 2005).

Abortion, stillbirths, giving birth to weak neonates, infertility and mastitis are serious health issues associated with great economic problems in raising domesticated ruminants worldwide (Da Silva *et al.*, 2006).

Brucella, *Listeria*, *Coxiella*, *Chlamydia* and *Toxoplasma* are important examples for such microorganisms that cause abortion in small ruminants and cause disease in man (Jonker, 2004; Benkirane *et al.*, 2015).

Q fever (in man) or coxiellosis (in animals) is an important zoonotic disease caused by the Gram negative obligatory intracellular bacteria *Coxiella burnetii* it is increasingly reported globally. *C. burnetii* is an important cause of abortion in goats, with occasional outbreaks in sheep; it has been identified as a zoonotic disease with socio-economic impact in various countries worldwide (Can *et al.*, 2015). It is of great significance in farmers, slaughterhouse workers, butchers and veterinarians (Woldehiwet, 2004; Batelli, 2006; EFSA, 2010). Cows, goats, ewes and pets are considered important sources of infection with *C. burnetii* for humans (Angelakis and Raoult, 2010).

Infection of animals with *C. burnetii* is mostly asymptomatic, but infertility, abortions, stillbirths, and early neonatal death are prominent sequel of infection in domesticated ruminants (Marrie, 2007). Mastitis is a more common symptom in dairy cattle where abortion is rarely detected (To *et al.*, 1998). On the contrary, in man, Q fever is associated with

different signs; the acute form is associated with pyrexia, myalgia, generalized weakness, lethargy with signs of pneumonia and hepatitis (Angelakis and Raoult, 2010; Porter *et al.*, 2011). Poor prognosis is expected if chronic form of Q fever is left undiagnosed and subsequently untreated; as it has high morbidity and mortality rates (Million *et al.*, 2010).

In animals transmission of infection is usually from other infected animals in the herd or from contaminated pastures by inhalation or ingestion (Abdel Rahman, 2014).

For humans, the aerosol route and inhalation of infected fomites is found to be the main route of infection with *C. burnetii* (Gale *et al.*, 2014).

As culture is not a usual or easy task for diagnosing *C. burnetii* infection; many serological tests are available for diagnosing this disease in animals and man (Tissot-Dupont and Raoult, 2007).

So determining infected animals by serology is the first step to be followed for initiation of control measures.

In Iraq, Many studies have been conducted regarding prevalence of infection with *C. burnetii* in human (Gati *et al.*, 2010; Abed *et al.*, 2010; Abdallah *et al.*, 2015; Lafta and Muhsen, 2016).

In 2004, the first human Q fever infection were detected in US soldiers in Iraq during that period, using immunofluorescence assay (IFA) (Gleeson *et al.*, 2007). In Thi-Qar Governorate, ELISA was applied for detecting *C. burnetii* in cows and sheep (Abed *et al.*, 2010).

Another important cause of abortion in farm animals is *Chlamydia* spp., especially *Chlamydia abortus*, it is also considered as a zoonotic disease (Wheelhouse and Longbottom, 2012).

Chlamydia spp. are Gram negative, coccoid, non-motile, obligate intracellular bacteria which cause abortion, conjunctivitis, respiratory disease and other clinical affections in animals and people (Everett *et al.*, 1999;

Kauffold et al., 2014; The Center for Food Security & Public Health, 2017).

Chlamydia abortus (*C.abortus*), which causes enzootic abortion of ewes (EAE), has been and still considered the most frequent cause of reproductive failure in small ruminants particularly sheep all over the world (Rodolakis *et al.*, 1998; Yin *et al.*, 2014).

In sheep infection is characterized by abortion in the last 2 to 3 weeks of pregnancy, although goats can abort at any time of gestation but late abortion is mostly observed (Matthews, 1999; Nietfeld, 2001).

In human, *C. abortus* can be acquired by inhalation, ingestion, direct inoculation into the eye and venereal transmission. Sources of these organisms may include birth products, vaginal discharges, feces, urine, semen, and ocular and nasal secretions (The Center for Food Security & Public Health, 2017).

C. abortus may be isolated on tissue culture cells, the antigen of this bacteria may be detected in infective materials using different antigen detecting systems as the PCR, histochemical and immunological staining of smears prepared from infected tissues and discharges (Masala *et al.*, 2005; Da Silva *et al.*, 2006).

Serology also be applied for diagnosing *C. abortus* infection in man and animals, different serological tests are successfully used to diagnose this disease as immunofluorescence tests (IFA), ELISAs, and the complement fixation test (CFT) (Nietfeld, 2001; Rekiki et al., 2002).

In Iraq, this bacterium has been isolated for the first time from an outbreak of abortion in ewes in 1987 (Nidhal, 1993). The first report on chlamydial abortion in Nineveh Governorate was in 2014 using ELISA (AL-Dabagh *et al.*, 2014). In South of Iraq, antibodies against *C. abortus* have been detected in sheep and cattle using iELISA and passive hemagglutination (PHA) tests (Cati *et al.*, 2008).

As far as we know, studies concerning prevalence of Coxiellosis and Chlamydiosis in animals or man have not been conducted in Diyala Governorate.

Aims of study:

This study aimed at detecting the prevalence of *C. burnetii* and *C. abortus* infections in Diyala Governorate and highlights the importance of this infections as a zoonotic disease in this area of Iraq. This was accomplished through:

1. Detecting the sero-prevalence of *C. burnetii* and *C. abortus* in sheep and goats present in some districts of Diyala Governorate with recent and previous history of breeding abnormalities.
2. Detecting antibodies against *C. burnetii* and *C. abortus* in serum samples of humans in contact with these animals and or in patients visiting Baqubah general hospital.