



# A meta-analysis of contagious caprine pleuropneumonia (CCPP) in Ethiopia



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## ABSTRACT

This systematic literature review was initiated due to lack of comprehensive information on the status and distribution of contagious caprine pleuropneumonia (CCPP) in Ethiopia. The objectives of the review were thus to provide a pooled prevalence estimate of CCPP in the country and assess the level of in between study variance among the available reports. Manual and electronic search was conducted between 8th of January and 25th of June 2015. A total of twelve published articles and one MSc thesis was retrieved from 19 initially identified studies. Twenty five animal level datasets were extracted at regional level considering some hypothesized predictors. The retrieved data were summarized in a meta-analytical approach. Accordingly, the pooled prevalence estimate of CCPP was 25.7% (95% CI: 20.9, 31.0). The inverse variance square ( $I^2$ ) that explains the variation in effect size attributed to reports true heterogeneity was 95.7%. The sub-group analysis was also computed for assumed predictors including, age, sex, type of study population, production systems and regional states. Among these predictors, study population type revealed statistically significant difference ( $P < 0.05$ ). Accordingly, the prevalence estimate for samples collected at abattoir was 39.2%, while that of samples collected at field level was 22.4%. In the final model, type of study population fitted the multivariable meta-regression model accounting for 22.87% of the explainable proportion of heterogeneity among the presumed predictors. Evidence on isolation and confirmation of *Mycoplasma capricolum* subsp. *capripneumoniae* in the country was obtained from five regional states. In conclusion, it is recommended to further investigate facilities related with transportation and collection premises along with potential role of sheep in the epidemiology of CCPP. Finally, the review emphasizes the need for monitoring the ongoing CCPP control intervention and introduces amendments based on the findings. Besides more surveys are needed in some of the regions where no or few valid data was available.

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## Contents

1. Introduction .....	232
2. Material and methods .....	232
2.1. Review protocol .....	232
2.2. Literature search .....	232
2.3. Data management .....	233
2.4. Prevalence estimate .....	233

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2.5.	Meta-analysis .....	233
2.6.	Potential bias assessment .....	233
3.	Results .....	234
3.1.	Search results and eligible studies .....	234
3.2.	Study characteristics and quality of the reports .....	234
3.3.	Meta-analysis .....	234
3.4.	Mccp isolation and identification .....	235
3.5.	Sub-group analysis .....	235
3.6.	Meta-regression .....	235
3.7.	Univariable meta-regression .....	235
3.8.	Multi-variable meta-regression .....	236
3.9.	Bias assessment and sensitivity analysis .....	236
4.	Discussion .....	236
	Conflict of interest .....	238
	Acknowledgements .....	238
	References .....	238

## 1. Introduction

Goats are among the major economically important livestock species in Ethiopia with a population estimated of over 22.6 million (Central Statistics Authority (CSA), 2012). Large proportions of farmers depend for their livelihood on them due to their comparative advantage of short generation interval and high frequency of multiple births (Yami and Markel, 2008). However, their productivity is constrained by a number of infectious diseases among which contagious caprine pleuropneumonia is causing major economic losses (Kusiluka and Kamarage, 1996; CFSPH, 2008).

Contagious caprine pleuropneumonia (CCPP) is a severe disease of goats with high morbidity and mortality and occurs in many countries in Africa and Asia (Prats-van der Ham et al., 2015). Though the disease is confined to goats, subclinical cases were reported in sheep and some wild ruminant species (Litamoi et al., 1990). Classical, acute CCPP is caused by *Mycoplasma capricolum* subspp. *capripneumoniae* (Mccp) (MacMartin et al., 1980; Leach et al., 1993), originally known as the F38 biotype. This organism was first isolated and shown to cause CCPP in Kenya (MacCowan and Minette, 1976; MacMartin et al., 1980). Mccp is a subspecies belonging to the *M. mycoides* cluster, which are serologically or genetically related organisms, consisting of six subspecies namely: *Mycoplasma mycoides* subspp., *mycoides* Large colony (MmmLc), *Mycoplasma mycoides* subspp. *mycoides* Small colony (MmmSc), *Mycoplasma mycoides* subspp. *capri*, (Mmc), *Mycoplasma capricolum* subspp. *Capricolum* (Mcc), *Mycoplasma capricolum* subspp. *Capripneumoniae* (Mccp) and *Mycoplasma* group 7 strains (Cottew et al., 1987). It has subsequently been isolated in Sudan, Tunisia, Oman, Turkey, Chad, Uganda, Ethiopia, Niger, Tanzania, Eritrea and the United Arab Emirates (Radostits et al., 2007; Srivastava et al., 1990).

Clinically, CCPP infected animals manifest anorexia, fever, and respiratory signs including dyspnea, polypnea, coughing, and nasal discharges (Radostits et al., 2007; OIE, 2014). At necropsy, fibrinous pleuropneumonia is the typical pathological lesion (Nicholas, 2002) with morbidity and mortality in goats reaching as high as 100% and 60–100%, respectively (Cottew, 1979; Thiaucourt and Bolske, 1996). It is one of the OIE listed diseases of small ruminants with implications for international trade (OIE, 2015a). Globally the disease has been reported from 38 African and Asian countries (Radostits et al., 2007), where it is endemic and is a major threat to the goat farming industry (Lorenzon et al., 2002).

In Ethiopia the presence of CCPP was confirmed in 1990 following isolation of Mccp from outbreaks (Thiaucourt et al., 1992, 2000). Following confirmation, several studies were conducted to assess the status of the disease in different parts of the country. These studies showed that the disease has a widespread occurrence in goats reared in sedentary, agro-pastoral and pastoral areas of

the country (Shiferaw et al., 2006; Ayelet et al., 2007; Mekuria and Asmare, 2010). In the year 2011, the country reported 12 outbreaks with 1236 cases and 486 deaths to African Union's Inter-African Bureau of Animal Resources (AU-IBAR, 2011). Ninety-six outbreaks were reported over a period of four years (2007–2011) to the epidemiology unit of the veterinary directorate of the Ministry of Agriculture from different parts of the country (MOA, 2012). Similarly, six outbreaks with 289 cases and 93 deaths, all affecting goats, were reported to the OIE in 2014 (OIE, 2015b). Outbreak reports and other studies that have so far been carried out to identify the etiologic agent and estimate its prevalence, though fragmented, have underscored the importance of the diseases in different parts of the country over the years. However, summarized information showing the overall nation-wide epidemiological status of CCPP, including the overall prevalence and major factors contributing to its widespread occurrence are lacking. The current review therefore aims at addressing some of the above mentioned gaps through systematic review of previous studies on CCPP employing meta-analytical approach.

## 2. Material and methods

### 2.1. Review protocol

The review was conducted on defined review criteria with the clear guidelines in order to comply with recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement by Moher et al. (2009). Data sources included online databases using electronic search engines, institutions repositories and resource people identified at the very outset. The guidelines were organized in three sections; the first was a preliminary screening guideline that helped to sort out article/manuscripts based on title and abstract content. The second is comprised of more detailed quality checks with inclusion and exclusion criteria, and a rating scale to decide whether to include or exclude a manuscript. Inclusion criteria were species of concern (sheep and goats); clarity of objective; appropriateness of methodology including internal validity of the reports; result presentation clarity; and the study reports had to be dated 1990 or later. The articles/manuscripts were excluded if they failed to comply with any of these points. Besides proceedings, outbreak reports and published theses were also excluded if redundant with the original articles. The third guideline was a systematic data extraction template.

### 2.2. Literature search

The literature search involved both manual and electronic searches. The search engines used were PubMed, Google scholar,

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