

PARATUBERCULOSIS IN COLOMBIA: PAST, PRESENT AND FUTURE

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Colombian studies on paratuberculosis

Twenty-six original studies referring to Johne's disease and *Mycobacterium avium* subsp. *paratuberculosis* (MAP) detection have been carried out in Colombia. So far, no study in Colombia has attempted the detection of MAP in food or humans. In addition to the 26 original studies mentioned above, 14 reviews, case reports, case series reports, and editorials were considered in this document, but they are of great value for the national knowledge on MAP or Johne's disease (JD) and demonstrate the national concern about MAP and its impacts in Colombia through several decades. According to an unavailable document by Plata, 1931, the existence of MAP in Colombia was first documented by the Cuban veterinarian Ildefonso Pérez Viguera in 1924, in a herd of imported cattle of the municipality of Usme (province of Cundinamarca) in cattle with Johne's disease (Vega, 1947).

Most studies on MAP or JD have been carried out during the present decade. Most studies have been carried out in animals of the Provinces of Antioquia and Cundinamarca, some in Caldas and Tolima, and few in Nariño and Boyacá. The original studies on MAP in Colombia have reported results from cattle, sheep, goats, and buffaloes. Studies on cattle have been the most common compared to sheep and goats, and buffaloes. Other relevant species in the country (wild mammals or humans) have not been found or cited in any original study reviewed. The most common diagnostic test used to investigate MAP in Colombia is the enzyme-linked immune-assay (ELISA), followed by microscopy on Ziehl-Neelsen (ZN)-stained samples (on feces, rectal mucosa scrapings, or tissues), polymerase chain reaction (PCR), intradermal Johnin test (IJT, with bovine and/or avian-purified protein derived), culture (from feces or tissues, and individual or pooled), complement fixation, indirect immuno-fluorescence, and counter immuno-electrophoresis. The studies published so far include cross-sectional, diagnostic test comparisons, risk factor analyses, and clinical trials (on treatments). Thus far, no cohort or case and control studies have been published in Colombia.

What Colombian studies on paratuberculosis are telling us?

According to several anecdotal reports and opinions, the national or regional distribution of MAP or JD in cattle and small ruminants in Colombia is not homogeneous or conclusive. Some academics and producers consider JD as a significant problem, while others claim the absence or very low prevalence of MAP in farmed animals. The number of publications reporting original studies on MAP, especially JD, in recent years is relatively low compared to other countries in Latin America (Fernández *et al.*, 2014), but higher than expected for Colombian conditions. The increasing number of publications suggests a growing interest on MAP research in the country, as well as an increasing concern about this microorganism and its negative effects on animal health, animal production, and its zoonotic potential (public health impact) from the academic and producers. Although JD is a notifiable disease in Colombia (ICA, 2015) it is not of major concern to animal health authorities

and its control is a responsibility of the farmer (Anonymous, 2010a; Fedegán, 2010; Fernández *et al.*, 2014). This could explain the low number of initiatives for the research, prevention, and control in animals, as well as for the detection of the microorganism in food, the environment, and humans.

The locations of most Colombian studies do not follow a clear trend but could be related to the high concentrations of cattle in some of the provinces (i. e. Antioquia and Cundinamarca; ICA, 2017), or to the interests of academics, scientists, or cattle producers. Since the first report in 1924, Cundinamarca has been a province with common reports of JD (Vega, 1947; Huber, 1954; Isaza, 1978; Mogollón *et al.*, 1983; Góngora and Perea, 1984; Mancipe *et al.*, 2009). This could be explained by the long tradition of the Facultad de Medicina Veterinaria of the Universidad Nacional de Colombia in Bogotá —the oldest faculty of veterinary medicine in the country, where the first studies in the early 20th century were carried out. More recently, the Province of Antioquia has been publishing the majority of original studies, all of them from academics at the Universidad de Antioquia and the Universidad CES. As expected, studies on cattle were the most common, most likely due to the size of the population in the country and to the production systems related to milk and meat. In contrast, studies on sheep populations are less common in the country and could be due to their smaller populations (ICA, 2017).

The common use of ELISA, ZN-staining, IJT is not surprising given their relatively low cost and availability of materials, qualified personnel, and infrastructure for these types of tests. However, the use of culture and PCR is becoming more common and could be related to the recent development of the diagnostic capacity in universities, compared to national laboratories and to the expansion of the reagents and equipment supplies for such diagnoses in the country. The absence of cohort and case-control studies is common in animal health research in Colombia. These high-profile observational studies, as well as the experimental approaches are more complex, laborious, demanding, and expensive, given the microbiological and pathophysiological characteristics of MAP. Nevertheless, the current MAP situation in Colombia demands additional observational studies in addition to surveys and case reports to enhance our comprehension of the epidemiological situation and to assess the true zoonotic threat.

Definitively, the country needs to cover some knowledge gaps to get to a true understanding of the disease. It is necessary to define the exact status of the disease through well-designed prevalence/incidence studies, considering that no whole national data is available. On this refer, just some local estimates are available so far (Patiño and Estrada, 1999; Ramírez *et al.*, 2001; Fernández *et al.*, 2011a; 2011b; Benavides *et al.*, 2016; Correa *et al.*, 2016). The harmonization of diagnostic methods, considering the epidemiologic and biological behavior of MAP under local agro-ecological, productive, and cultural conditions is also needed. In addition, the laboratory infrastructure — mainly developed for foot-and-mouth disease control, should cover other entities with relevance for public health and international trade such as JD (Calderón and Góngora, 2008), improving their testing capacity and the access to diagnostic reagents. It is also necessary to improve the training of the farmers, bringing them closer to the importance of disease control, not only of Johne’s disease, but also of many others that generate economic losses and are considered of sanitary risk.

Only one study reported the molecular characterization of strains isolated in Colombian territories (Fernández *et al.*, 2011b), being this insufficient to consider the definition of “indigenous strains” and the ulterior design of vaccines. It would be necessary to carry on studies on wider regions, considering infection-assessment on cattle and other-than-cattle susceptible populations (even local wildlife), and, in this way, generate our own prophylactic strategies, according to Colombian

MAP molecular and epidemiological diversity. The relationship between MAP and Crohn's disease (CD) has been essentially not discussed in academic fields in the country, except for some sporadic reviews (Góngora and Villamil, 1999; Calderón and Góngora, 2008; de Waard, 2010). The CD has been known in Colombia since the 1950s and the incidence and prevalence rates are increasing (estimated point prevalence of 77,000 CD cases), but no national consolidated information about the disease is available (Calderón and Góngora, 2008). According to some of these authors, efforts should be made to correlate these two diseases in areas with a high prevalence or incidence of both. In general, important progress has been made on MAP research in the areas of diagnosis and epidemiology as is reported by the studies included in this report. However, many unanswered questions remain and research opportunities in the country are plentiful.

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