Mycobacterium avium subsp. paratuberculosis

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1. INTRODUCTION

The Mycobacteriaceae family, although only made up of the genus Mycobacterium, includes numerous species widely distributed in the environment. The microorganisms that comprise this family are aerobic, do not form spores, and have cell walls that contain a great proportion of lipids with a high molecular weight that makes them resistant to acids and increases their survival in the environment. They multiply very slowly and are very difficult to cultivate, requiring, on occasion, several months in order to breed visible colonies.

Around 15 species pathogenic for human beings or animals are known:

- Mycobacterium tuberculosis, principal agent of human tuberculosis, probably the best known.
- Mycobacterium leprae: cause of leprosy.
- Mycobacterium bovis: source of a serious consumptive illness in livestock and wild fauna, which has almost been eradicated in the Autonomous Community of the Basque Country, and is a zoonosis; i.e., an animal pathology capable of affecting humans.
- Mycobacterium ulcerans: cause of Buruli ulcer (West Africa: the second most significant mycobacterial illness).
- Mycobacterium avium: cause of tuberculosis in birds. Although this is a ubiquitous species present in water, sawdust, etc., only some varieties are involved in human infection, normally in immunodepressed persons.
- Other species capable of causing the so-called atypical mycobacterioses and some cases of asymptomatic colonizations, especially in immunodepressed persons.
- Mycobacterium avium subsp. paratuberculosis (MAP), cause of paratuberculosis or Johne’s disease in domesticated and wild ruminants.

2. JOHNE’S DISEASE

Johne’s Disease or livestock paratuberculosis is a chronic infection of the intestine in animals that is caused by Mycobacterium avium paratuberculosis (MAP). The period of incubation of this bacterium is long and very variable. The clinical symptoms of the illness generally appear in the animal between 2 and 6 years of age, although they may also appear at the age of 4 months or 15 years. Stress, parturition, lactation, food restrictions or transport may precipitate the appearance of the illness in an animal.

Cattle are the most susceptible of being infected during the first few months of life, frequently while taking milk from the mother cow. The microorganism is excreted in the faeces of the animals (principal route of infection), as well as in colostrum and in milk.

Johne’s disease is endemic in Europe and probably all over the world. In Europe, there is no consensus on how to control and eradicate this illness, but it seems logical that every country should have its own national programmes, which would be more effective since they take into account the peculiar characteristics of each country, the handling of livestock and the pattern of the illness in their animals. However, over the long term, the existence of international programmes is important, given the increase in the mobility of animals between different countries.
3.- **CROHN’S DISEASE**

**Crohn’s Disease** is a chronic inflammation of the intestine in human beings. The wall of the intestine thickens and becomes inflamed, making the structure of the intestine smaller on occasion and totally obstructing the intestinal lumen in severe cases. The inflammation may progress towards ulceration, the formation of fistulae and even perforation. On occasion, the disease may be associated with other pathologies such as arthritis or anaemia. The diagnosis of this illness becomes difficult, especially when it comes to differentiating it from other illnesses of the digestive system, such as ulcerous colitis.

This human illness most commonly begins between 15 and 40 years of age and has a yearly incidence rate of new cases of between 3.6 (southern Europe) and 6.3 (northern Europe) for every 100,000 inhabitants, which translates into an annual prevalence (total old and new cases) of around one case for every 1,600 inhabitants. It is characterised by a decrease in appetite, abdominal pain, bloody diarrhoea and fatigue. It presents cycles of activity interspersed with remission, when the disease is absent or relatively inactive. The disease is activated by different factors, such as stress or dietary factors.

The cause of this illness is still unknown, but it seems possible that it is due to a combination of several factors, such as genetic predisposition, an abnormal immune response on the part of the intestine, or environmental factors.

The pathology of the lesions of the intestine in Johne’s Disease bears a great resemblance to those found in Crohn’s Disease. The similarity between the two is sufficient to lead us to think that a common causal agent is involved; however there are also very notable differences, so that it has not been possible to confirm the hypothesis in a universally accepted manner.

4.- **EXPOSURE WAYS**

If the hypothesis that MAP is involved in Crohn’s Disease were true, the most probable mode of exposure to the bacillus would be through food, followed by drinking water. MAP has been detected in the blood as well as in the milk of livestock with Johne’s Disease, so that it is probably also present in the meat of such livestock.

There are bibliographical references that indicate the possibility that MAP may survive milk pasteurisation in a small proportion of cases. There is also evidence that the microorganism may survive in some cheeses. No information has been found about its capacity to survive roasting or other ways of preparing meat and meat products. The possibility that the bacillus may also survive the treatment of drinking water has also been mentioned.

5.- **PREVENTION**

On the basis of several studies made by the British Food Standards Agency (FSA) which confirmed the resistance of MAP to pasteurisation, the interval of pasteurisation at 72 ºC was raised from 15 to 25 seconds in 1998. Subsequently, between 1999 and 2000, 827 milk products from different sales outlets in the United Kingdom were analysed, verifying
the existence of the bacteria in 2 % of the cases. Of the positive cases, 70 % had received treatment at 72 ºC for 25 seconds.

In the wake of all these studies, the British Ministry of Agriculture started a project for the purpose of establishing urgent actions in order to diminish human exposure to MAP, fundamentally aimed at eliminating its presence in pasteurised milk.

The British Food Standards Agency (FSA) is going to propose a set of measures for the entire production chain for the purpose of monitoring the presence of MAP in milk. This preventive strategy, based on the principle of precaution, includes the following points:

**In Livestock:**
- Follow-up and validation of present methods in MAP detection.
- Surveying the presence of MAP in livestock.
- Preparation of guidelines for the livestock breeder relating to the control of MAP infection.
- Prioritisation of MAP investigations in research programmes, including research on the development of a vaccine against the disease.

**With Regard to Milk Production:**
- A revision of hygienic practices in milking.
- Revision of the possible alternatives on disseminating hygienic practices in milking aimed at optimising milk deliveries.
- Research and dissemination of practices for cleansing udders.

**In Industry:**
- Production of a pasteurisation guide for industries particularly aimed at small industries and farm-based pasteurisers.
- Measures to improve and reinforce the inspection of direct sales.
- Recommendation to pasteurise for more than 25 seconds.
- Research to achieve an effective treatment to eliminate MAP.

**6. BIBLIOGRAPHICAL REFERENCES**

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