No difference in paratuberculosis seroprevalence between organic and conventional dairy herds in the Netherlands

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Introduction

Mycobacterium avium subsp. *paratuberculosis* (MAP) is the cause of a severe incurable gastroenteritis in ruminants, also known as Johne`s disease (see for extensive review: Chacon *et al*; 2004). It is an important cause of economical losses in dairy farming since the milk yield in animals with paratuberculosis decreases approximately 10-20%, the farmer is confronted with high veterinary costs and animals die or have to be killed due to the disease.

In 1998, more than half of the Dutch dairy farms had animals infected with paratuberculosis on their farms (Muskens *et al*, 2000). In the positive herds, approximately one out of twenty animals had circulating MAP antibodies.

Especially young animals are susceptible for infection with the bacterium, which is transferred via the faecal-oral route. The bacterium infects the gastrointestinal tract, ultimately, leading to a malnutrition syndrome and, finally, to the death of the animal. The disease is often overlooked in its early stages because the symptoms are not very specific. Once infected, an animal can begin shedding the bacterium via the faeces at an age of approximately two years.

The methods to diagnose paratuberculosis in cattle can be divided in those that detect the bacterium via culture or by bacterial DNA and those, whereby the immune response against the bacterium is measured. The immune response can be detected via a skin test, detection of gamma interferon to test cellular immunity or by performing an ELISA to detect circulating antibodies against the bacterium. Culturing the bacterium from faecal samples is considered as the golden standard, but is extremely time consuming (weeks to months). The ELISA test is gaining popularity, as results can be available within hours/days. Although most tests have a high specificity, the sensitivity is quite low, meaning that none of the diagnostic tests are capable of identifying all sub-clinically infected animals. Most research and prevention programmes therefore aim at an analysis of paratuberculosis at the herd level.

Food safety aspects

The mycobacterium, responsible for paratuberculosis in ruminants, has long been suspected to have a role in chronic inflammatory bowel disease in humans, especially Crohn`s disease (Chiodini *et al.*, 1984). This suspicion has been based on the detection of the bacterium in inflamed intestinal tissue from patients with inflammatory bowel disease (Bull *et al.*, 2003).

Many researchers have addressed this issue, but to date the MAP issue in the aetiology of human inflammatory bowel disease is still controversial, due to conflicting results and differences in laboratory techniques applied (Chacon *et al*., 2004).

Prevention of paratuberculosis in cattle

Since young animals are extremely susceptible to becoming infected, prevention starts at the time of calving. Farmers are advised to use separate clean rooms for calving and to separate the calves from their mothers immediately after birth. Calves are allowed to drink colostrum (collected by the farmer) from their own mother but should not drink raw milk. Raw milk from infected cows can harbour the bacterium but can also be contaminated with small amounts of faeces.

Another advice to farmers includes using clean pastures for the calves. These pastures should not have been in use by older cows during the same season, nor should manure have been applied to the pastures. When new animals are introduced to the farm, the farmer should be aware of the paratuberculosis status of the farm where the animals came from. In the Netherlands, a farm can obtain a paratuberculosis status ranging from 0-10, depending on whether the herd contains animals with positive serology or faecal cultures for MAP. The farmer should also know the paratuberculosis scores of other farms supplying manure. Infected animals should be removed from the herd.

Organic farming and paratuberculosis

Organic dairy farming differs from conventional dairy farming in a large number of ways, of which some might influence, both in a positive and a negative way, the prevalence of paratuberculosis. On one hand, the strains of cows used or the management of the herd might offer a higher resistance against an actual infection with paratuberculosis. On the other hand, organic dairy farmers may be reluctant to separate calves from the mother cows immediately after birth. Furthermore, feeding calves with artificial milk is expensive and against the organic principles. To date, no studies have been published, whereby paratuberculosis prevalence between conventional and organic dairy herds was studied. This paper will describe results of a study carried out in the Netherlands in 2003.

Comparison of paratuberculosis risk factors

In 2003, we performed a study on 76 organic dairy farms, whereby farmers were interviewed concerning their management practice in relation to paratuberculosis prevention. A questionnaire was used that was developed by the Animal Health Service and allowed a comparison with data obtained earlier in conventional herds (two studies performed in 2001 and 2002).

As shown in Table 1, organic farmers differ from conventional farmers in that a lower percentage of organic farmers use a separate space for calving. Only 20% of organic farmers remove their calves from the mother after birth, as compared to 42-45% of conventional farmers. When comparing management of calves until weaning, it is evident that 50% of conventional farmers feed their calves with artificial milk, whereas only 4% of organic farmers do this (Table 2).

Table 1 Response of organic and conventional (group 1 and group 2) farmers to a questionnaire concerning paratuberculosis prevention management: Calving

1	**Calving**	**Organic %**	**Group 1 2001 %**	**Group 2 2002 %**
1.1	Calving in separate space	58	75	74
1.2	Before calving thorough cleanup floors and walls	11	15	16
1.3	Calves born on clean surface	45	49	57
1.4	Calving area only used for this purpose	25	24	33
1.7	Calves removed from mother immedialey	20	42	45

Table 2 Response of organic and conventional (group 1 and group 2) farmers to questionnaire concerning paratuberculosis prevention management: period until weaning.

2	**Calves: period until weaning**	**Organic %**	**Group 1 2001 %**	**Group 2 2002 %**
2.1	Calves receive colostrum from their own mother	83	80	86
2.2	Calves receive artificial milk after colostrum period	4	50	51
2.3	Drinking gear is cleaned with hot water after feeding	74	61	64
2.4	Calves sometimes drink penicillin milk, whey, cleaning water or milk with high cell count	80	53	52
2.5	Drinking bins in contact with bins of older cattle	11	3	3
2.6	Calves are fed grass sometimes contaminated with cow manure	31	39	38
2.7	Feed is fed so it cannot become contaminated	91	72	71
2.8	Animal contact or contact with manure from older animals (>2 jaar) is not possible	80	86	83
2.9	Before entering the calves area separate shoes or clothing is used	13	2	1

The results of calf management after weaning (Table 3) shows that more organic farmers keep their animals on grassland used earlier that season by cattle or goats than on conventional farms. Organic farmers are also less strict as to allowing their calves on pastures that have been fertilised the same season with cattle or goat manure. On the organic farms interviewed, the calves come into contact with cattle older than two years more often than on conventional farms.

Table 3 Response of organic and conventional (group 1 and group 2) farmers to questionnaire concerning paratuberculosis prevention management: Calves period after weaning.

3	**Calves management after weaning**	**Organic %**	**Group 1 2001 %**	**Group 2 2002 %**
3.6	Calves remain inside during the first year	30	46	42
3.7	Calves younger than 12 months can drink surface water	60	35	73
3.8	Calves younger than 12 months are kept on grass land used earlier that season by cattle or goats	46	22	23
3.9	Calves younger than 12 months are kept on grass land onto which goat or cattle manure was applied in the same season	39	6	7
3.10	Calves younger than 12 months sometimes come into contact with goats	5	3	2
3.11	Calves younger than 12 months sometimes come into contact with cattle older than 2 years	20	50	54

When comparing general hygiene on the farm (Table 4), it is apparent that less organic farmers have a separate room and clean clothes/shoes for visitors than on conventional farms. Organic farmers more often buy animals from a farm with an unknown paratuberculosis status. Furthermore the organic farmers more often use manure from other farms.

Table 4 Response of organic and conventional (group 1 and group 2) farmers to questionnaire concerning paratuberculosis prevention management: General hygiene.

4	**General hygiene**	**Organic %**	**Group 1 2001 %**	**Group 2 2002 %**
4.1	Farm has a separate area where visitors can obtain farm clothes and where hands and shoes can be cleaned	34	79	85
4.2	Animals are sometimes bought from a farm with an unknown or lower paratuberculosis status	41	22	22
43	Cattle or goat manure obtained from other farms is sometimes used on the grassland	32	3	3
4.4	Machines and animal transport vehicles of third parties that come on the farm area are clean, empty and free from manure	26	36	43

Comparison of paratuberculosis prevalence

The data presented above indicate that organic herds appear to have a higher risk for paratuberculosis than conventional farms. Whether this is reflected in the actual infection of the animals was the next question of our project. To investigate paratuberculosis infection, blood samples were taken from all animals older than 36 months and tested for the presence of MAP antibodies using a commercially available ELISA (Institute Pourquier, Montpellier, France). Tests were performed by the Animal Health Service and results were compared with data obtained earlier from conventional herds.

In total, 3,688 organic cows were tested, of which 43 (1.2%) were positive and 7 (0.2%) were borderline positive (Table 5). When combining positive and borderline positive animals, 1.4% of the investigated organic cows older than three years tested positive. Data collected by the Animal Health Service showed that 1.7% of conventional cows tested positive.

Table 5 Number of organic cows with positive paratuberculosis serology

Paratuberculosis antibodies	Number of animals	Percentage of animals
Positive	43	1.2%
Bordeline	7	0.2%
Negative	3,638	98.6%
Total tested	3,688	100%

Analysis of the data at farm level showed that 36% of the organic farms versus 39% of conventional farms had one or more infected animals on their farms (Table 6). These differences were not statistically significant.

Table 6 Farms with positive plus borderline positive animals: organic versus conventional dairy herds.

Number of positive animals per farm	Number of organic farms	Percentage of organic farms	Percentage conventional farms
0	48	63%	61%
1	20	26%	20%
>1	8	10%	19%
Total	76		

Discussion

Despite a higher risk to contract paratuberculosis due to farm management, the actual number of infected farms or animals is not different in organic farms in the Netherlands when compared to conventional farms. This could be due to the fact that, despite the presence of the MAP bacterium, animals resist infection due to a higher degree of natural defence mechanisms as compared to conventionally reared animals. As yet, no proof is available showing that organically reared animals have a better immunity than conventionally reared animals. Genetic background of the animals probably does not appear to have an important role, as most Dutch organic farmers use the same type of cows as the conventional farms. On the other hand, it could be argued that some of the risk factors such a the immediate removal of calves from the mother or giving raw milk to calves may not be as important risk factors as initially claimed.

Studies from Scotland point to a role of rabbits in the transmission of paratuberculosis (Greig *et al*; 1999; Beard *et al*; 2001a). MAP strains isolated from rabbits on these farms were related to the cattle strains and were used to produce disease in experimentally infected cattle (Beard *et al*; 2001b). The role of wildlife in transmission of paratuberculosis in the Netherlands has not yet been reported.

The prevention program to decrease the prevalence of paratuberculosis in the Netherlands is based on a large number of risk factors, of which some have been mentioned in this paper (Groenedaal *et al*. 2003). It appears that the program has been successful, as the number of seropositive herds has decreased from 55% in 1998 to 39% in 2001. The contribution of calf management to this decrease is not known.

Although the paratuberculosis situation in Dutch organic herds does not seem to differ from that found in conventional herds, it is mandatory to keep monitoring the prevalence so that measures can be taken if seroprevalence starts to rise again.

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