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Dried meat in Faroe Islands, the process and microbiological aspects – hygiene and safety aspects

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Introduction

In Faroe Islands there is an old tradition of drying meat. In the past the wind drying was important for the conservation of the meat; nowadays the dried meat products are considered delicacies and therefore this conservation process has survived in spite of modern conservation techniques. The most important meat product for drying is lamb. Other meat products used for drying are meat from the pilot whale, goose and even dried fish is very popular.

The majority of the production of dried meat takes place in the private households; almost every household has their own facilities for drying – a shed or room with bars. On the islands 21% of the households keep their own sheep, which is a very popular hobby (1). The total production of lamb is about 800 tons a year or about 18 kg per capita (2).

There is no authorized slaughtering plant in Faroe Islands, all the production depends on home slaughtering. Home slaughtering takes place at the farmers who slaughter up to 200 – 300 sheep each and even in the private households who typically slaughter one or two sheep.

The drying process

The meat is normally dried in sheds or rooms with bars called “hjall”. For fish and pilot whale, however, the meat typically is dried outside in the open air. Almost every household has its own “hjall”. The carcase is hung in the “hjall” in October; normally there is no pre-treatment of the carcase before drying, a slight salting of the carcase is however used in a few cases. The process takes 3 – 5 months (from October to January/Marts) depending on how dry you like the end product to be.

The fact that the production of dried lamb practically takes place without any control from the authorities demands a great responsibility and knowledge about hygiene from the producer. These skills have traditionally been learned from one generation to another, the boys learn the slaughtering techniques from their fathers. Moreover the authorities publish instructions about hygiene during the slaughtering and drying process. In spite of this effort several incidences of intoxication have been reported and will be discussed later.

Temperature

As the process depends on the weather the drying will vary significantly. The temperature is normally highest at the beginning of the process. In October the average temperature is about 7°C but can be in a range between -5°C to 13°C (3).

If the temperature is too low in the beginning of the period it will influence the taste of the dried product negatively. At high temperatures the risk of spoilage or growth of pathogenic bacteria is high and the product will be uneatable and maybe even dangerous to eat.

Water activity

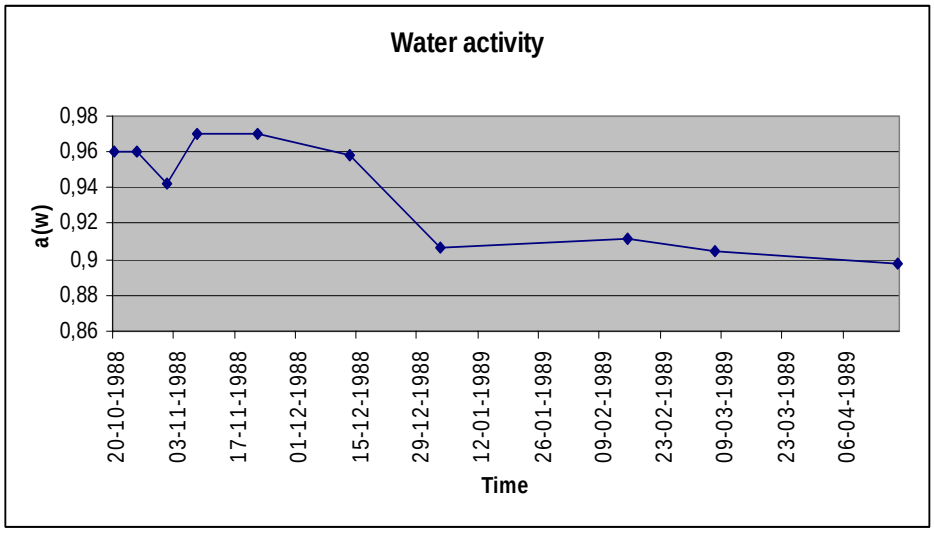

Fig. 1 Water activity during the drying period

The water activity in the dried lamb is about 0.90. At this temperature most spoilage and pathogenic bacteria are inhibited to grow. However, during the first two months of the drying period the product will maintain a water activity between 0,97 and 0,94 as depicted in fig. 1. During this period most bacteria will grow. The rate of the growth is however expected to be slow because of the relatively low temperature (4).

Micro-organisms

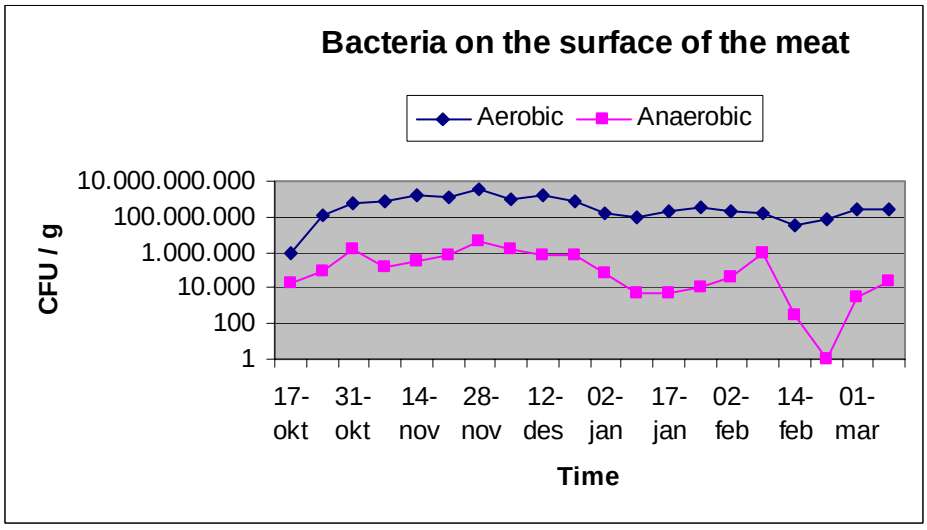

Fig. 2. Bacteria on the surface of the meat during the drying period.

On the surface of the meat the aerobic and anaerobic count increase fast during the first weeks of the process and thereafter stagnates for some weeks as depicted in figure 2. After that there is a slight decrease in the number of CFU. The aerobic count increases to numbers more than a billion CFU/g and then decreases to numbers about 400 millions CFU/g or less; the anaerobic count peaks at 5 million CFU/g and then slowly declines.

The aerobic flora on the surface is dominated by *micrococcus* during all the process although *staphylococcus spp.* and *enterobacteriaceae* also are represented. The anaerobic flora is not systematically identified but some sulphite reducing clostridia are detected. (4)

Other studies show some different results. One study shows *micrococcus* at the surface of the meat at the beginning of the process, but during the process the dominating flora consists of both *micrococcus* and *enterobacteriaceae*. (5) Another study shows that *Staphylococcus* is the most common, *flavobacterium*, *micrococcus* and *enterobacteriaceae* are however detected (6).

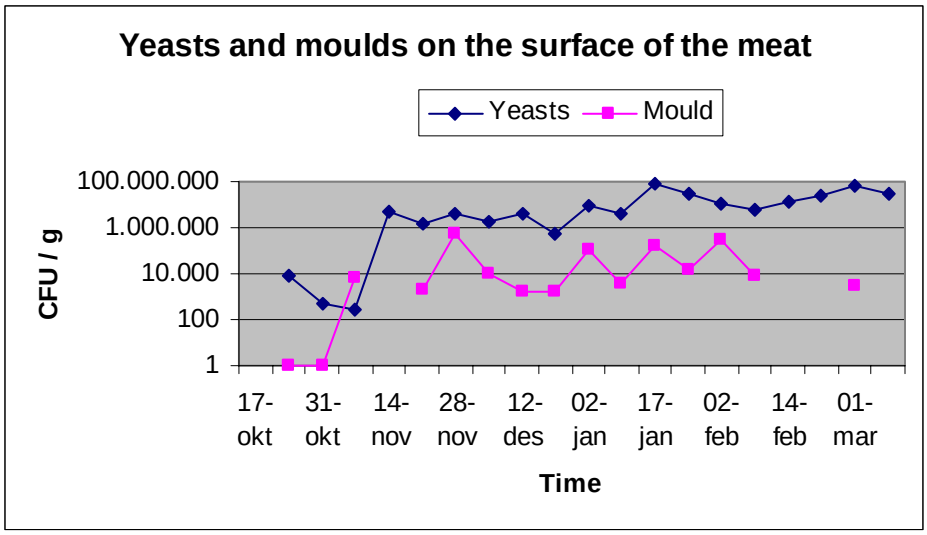

Fig 3. Yeasts and moulds on the surface of the meat

Figure 3 shows the level of Yeasts and moulds on the surface of the meat. The figure shows a considerable growth of yeasts during the drying period and in the end of the period 30 – 60 million CFU/g are found. The number of moulds is varying; the highest number is 500.000 CFU/g (4).

Identification of yeasts on the surface of dried meat reveals C*andida famata,candida membranofaciens, Thrichosporon mucodes* and *Rhodotorula glutinis. (*6) The identified moulds are *Cladosporium, Penicillium spp. (*most often *P. solitum)* and *Mucor*.(4) (6)

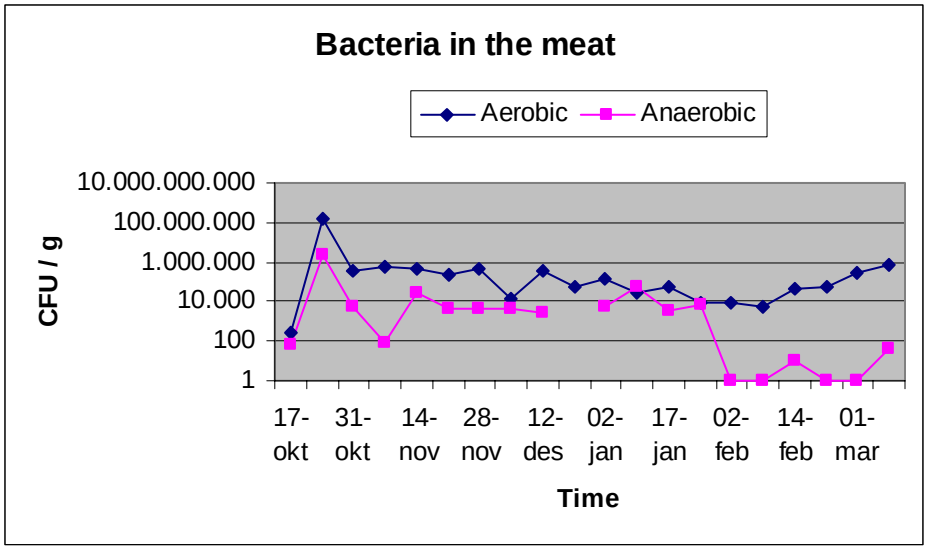

Fig. 4. Bacteria in the meat during the drying period.

In the meat the aerobic count increases fast during the first week, hereafter the CFU varies between 5.000 to 700.000 CFU/g. The anaerobic flora increases fast during the first week as well, then it stabilizes for 2 months and during the last period the number of CFU/g decreases considerably.

The dominating aerobic flora in the meat consists of *micrococcus* during all the process, *staphylococcus*, *enterobacteriaceae* and *alcaligenes* are represented as well (5). An other study shows however *pseudomonas* as the dominating flora in the meat at the beginning of the process. During and at the end of the process the dominating flora consists of both *micrococcus* and *enterobacteriaceae* (4).

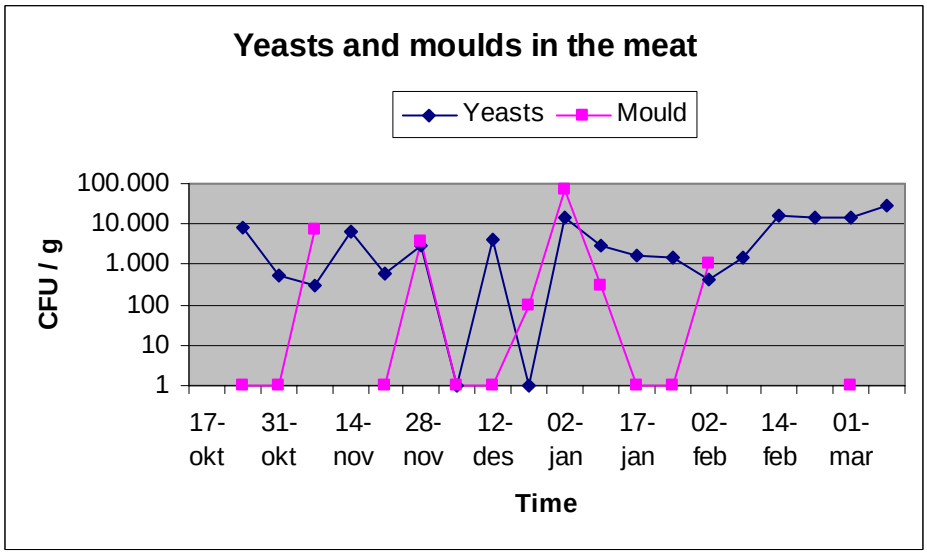

Fig. 5. Yeasts and moulds in the meat during the drying period

The amount of yeasts varies throughout the period. Most of the results are between 3 and 4 log units. The amount of moulds varies significantly.

Listeria monocytogenes

Listeriosis amongst sheep is well known in Faroe Islands, especially when the sheep are fed on silage. The water activity and the temperature during the first period of the drying process allow *Listeria monocytogenes* to grow. This makes dried lamb a possible source for human listeriosis. Information about the prevalence of *Listeria monocytogenes* is needed, because no known investigations have been done to cover this area. According to the annual reports from the medical officer of health, there has been no registered incidence of human listeriosis (7).

Clostridium botulinum

In the eighties several incidences of botulism caused by dried lamb were reported.

In 1988, a man aged 49, died from botulism after eating dried lamb (8).

In 1989 two incidences of botulism occurred:
In January two persons were intoxicated from dried lamb.
In June one person were intoxicated by botulism from dried lamb.

All these cases were caused by *clostridium botulinum type E.* The type E is considered an aquatic organism and when it is isolated from foods the source is normally fish products. It is believed that the meat is contaminated from fish products, perhaps the increased activity in fish farming on the islands was the cause of the sudden outbreaks of botulism (9).

In 1997 one person died from botulism, the source is unknown (10).

Since then there have been no incidences of botulism. The reason to this is unknown, but it might be that people are more careful because of the botulism incidences and are affected by the campaign on hygienic instructions from the authorities.

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