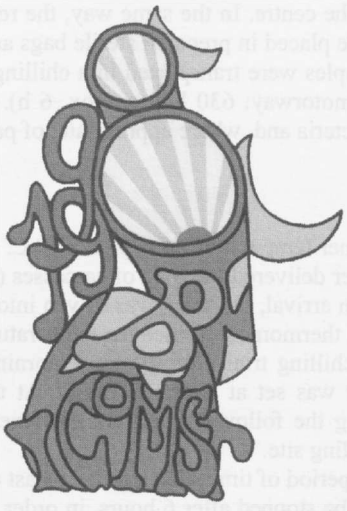
PS 2

Poster session and workshop 2

Hygiene, spoilage and safety



Monday, August 31st
17:15h-18:45h

Hygiene status of transport chilled slaughtered pigs

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Background:
Because of its optimal temperature and humidity, immediately after slaughter, fresh meat offers excellent growth conditions for microorganisms.
The most effective prevention of the growth and increase of pathogenic and saprophytic germs, which contaminate the meat during slaughter, is the cooling-down in a time as short as possible.
In Chapter XIV of Annex I the EU Fresh Meat Directive (64/ 433/ EEC) of the Commission (most recent version) prescribes for innercommunity trade at least for fresh meat from recognized EU-slaughterhouses, that immediately after meat inspection, carcasses and carcass parts are to be chilled to an inner temperature not above + 7° C, while by-products of slaughter should be maintained at a constant temperature not exceeding + 3° C.

Objectives:
For minimazing the costs and for a quicker disposal it has been suggested to allow the transport of meat with a temperature of 15° C or 20° C and to carry out the chilling down to + 7° C during the transport.
Those suggestions could be accepted only, if the efficiency of transport chilling would be at least as equal then the efficiency of stationary chilling.
The present study was carried out in order to ascertain if transport chilling under standardized conditions can be as efficient as stationary chilling, and thus to ascertain if chilling during transport is a feasible alternative.

Methods:
During the chilling trial on March 10. - 11., 1997, a load of pig halves was to be transported from East Westphalia to Munich. The transport vehicle was a custom-made chilling-trailer with additional insulation (Brandt Polarus TV-FL) and a built-in refrigeration unit (Thermo King RD II 50). The truck corresponded to requirements for the transportation of all easily perishable foodstuffs, including deep-frozen goods, and classified in the FRC-class, according to the ATP-agreement.
Prior to the chilling trial in the climatic chamber of TÜV Bayern 10 samples (1 pooled sample of 20 cm^2 with 4 partial samples of 5 cm^2 each were taken from microbiologically relevant sites, such as shoulders, legs, abdominal walls and contact surfaces, using a sterilized electric sampler, by selecting samples over the whole loading space in an X pattern. The same procedure was applied to sampling during off-loading at the end of the chilling trial. Sampling proceeded along two imaginary lines in the form of an X, which began in each corner of the loading space and crossed in the centre. Thus sampling began with a first sample taken at the front left corner of the loading space, and the second sample taken at the front right corner, while two samples were then taken on each arm of the X, and the fifth and sixth samples came from the centre. In the same way, the remaining 4 samples were taken from the arms of the X at the rear of the loading space. Samples were placed in prepared sterile bags and stored immediately in a refrigerator set at - 1° C. From there, at the end of the chilling trial, samples were transported in a chilling container with 5 chilling elements at - 1° C in batches of six containers by car to Hanover (by motorway: 630 km, approx. 6 h). Investigations followed legal requirements and included the differentiation of relevant spoilage bacteria and, where appropriate, of pathogenic bacteria.

Results and discussion:
At the time of loading, the pig carcasses had an inner temperature of approx. 32° C. Following an unusually long transportation time of nearly 12 hours for the 650 km stretch, the driver delivered the load of carcasses (class E and U) to TÜV Bayern Munich at 11.20 p.m., instead of 7.00 p.m., as had been planned. On arrival, the truck was driven into the climatic chamber. The inner temperature of the carcass halves was checked using a penetration thermometer. Since the temperature of all inspected carcasses was well below 20° C, the decision was made not to begin with the chilling trial until the next morning at 10.30 a.m.. During the night, the external temperature of the truck in the climatic chamber was set at constant 30° C. At this point, the median inner temperature of the carcasses was found to be close to 15° C. During the following 6 hours the inner temperature of the carcasses was reduced by between 0.8 and 3° C only, depending on the sampling site.
In a stationary cold-storage plant, during the same period of time, chilling by at least 6.5° C would have been achieved. In view of the relatively slow chilling procedure, the trial had to be stopped after 6 hours, in order to prevent further microfloral growth, which, at the time of arrival of the „borrowed" carcasses, had already been high enough to cause concern. The results of our microbiological investigation confirmed the need to abort the trial, because bacterial counts up to 10^6/ cm^2 were found. Samples taken prior to the chilling trial at 08.00 a.m., as well as after the trial at 04.30 p.m., respectively, showed a remarkable increase in the rate of growth of *Enterobacteriaceae, Bacillus spp.* and spoilage bacteria by a factor of almost 10^1 (e.g. 10^5 - 10^6) after a stay of 8.5 hours in the truck running at full chilling capacity. The hygiene status at the end of the trial was close to spoilage, according to the definition of BAUMGART (1990), that a bacterial count above 10^6/ cm^2 is indicative for spoilage of meat and meat products.

In this connection, division and generation rates of pathogenic and spoilage bacteria are of significance. At temperatures as low as 10° C , in raw minced meat at pH 5.4 - 5.7, *Salmonella* double in numbers every 10 hours and at 15° C after 3 hours. At 22° C *E. coli* requires only 1h 36 min for each cell division and *Pseudomonas* is known to have a generation interval as short as 4 hours.
In our trial the multiplication rate increase (mean 10^1) of microflora between the beginning and the end of the trial thus corresponds to literature. We were able to demonstrate the frequent presence of *Enterobacteriaceae* and *Bacillus spp.* as well as definite spoilage bacteria and there was a microbiologically remarkable rate of detection of these bacteria. We also frequently detected yeasts, which is also signifcant, because they can also grow at temperatures below freezing.

Conclusions:
The evaluation of the trial with pig carcasses demonstrates that - compared to stationary cold-storage plants - chilling in a semitrailer is distinctly less efficient and contains a high microbiologically risk.
From a technical point of view it is necessary to point out that in the transport of easily perishable goods, there is at presence a tendency to use every inch of available loading surface and volume. As a result, less efficient chilling units of the „33 pallet type", which require less space, are used in semitrailers, in order to be able to fit in at least 33 or even 34 pallets (although this is not permitted). Furthermore, account should be taken of coming legal requirements, such as the prohibition of the use of fluorohydrocarbons/ halons (EU, Montreal agreement on the prevention of ozone degradation), which will make the use of new non-HCF coolants in chilling units compulsory, although their efficiency is yet to be tested.

References:
BAUMGART, J. (1990):
Mikrobiologische Untersuchung von Lebensmitteln.
Behrs Verlag, Hamburg, p. 288

TÜV-BAYERN, ATP-Prüfstelle (1998):
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