

FACTORS BEARING ON THE FORMATION OF DFD MEAT

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INTRODUCTION

The incidence of DFD meat (dark, firm, dry meat) is a difficult problem in Finland. The average incidence of DFD meat is, according to this study, c. 22 %. The characteristics of DFD meat, viz. its dark colour, mild taste and aroma, and especially its poor presevability when packed in vacuum, are well known to meat scientists and meat technologists. In Finland the most valuable cuts from a carcass, fillets and rounds (M. longissimus dorsi, psoas major, semimembranosus, adductor, biceps femoris and vastus lateralis), are mainly packed in vacuum packs. The purpose of this work was to study the incidence of DFD meat in Finland and to try to find and eliminate as far as possible the factors affecting the formation of DFD meat. In this paper only the main results are presented. The technological aspects of the use of DFD meat will be presented elsewhere (see also PUOLANNE et al. "The effect of pH value, salt and phosphate content on water-binding capacity in cooked sausage" in this publication).

MATERIAL and METHODS

The study was conducted at 14 slaughterhouses in various parts of Finland in March - October 1979. The total number of animals investigated was 13,286.

The following information was collected for each animal:

date of slaughter	fatness grade
sex	distance of transport
breed	duration of transport
weight	length of the rest period
quality grade	mode of lairage
	pH value

The pH value of M. longissimus dorsi adjacent to the 5th and 6th vertebrae was measured 24h post mortem. The pH meter normally used in slaughterhouses was a Knick Portamess 96 (Knick Elektronische Messgeräte, FRG) with an Ingold type 10-404-3041 meat electrode (W. Ingold AG, Switzerland). The pH meters were intercalibrated with a control pH meter by simultaneous control measurements carried out by the authors. The pH measurements were carried out by trained personnel at each slaughterhouse.

In this study pH values below 5.99 indicated normal meat, pH values of 6.00-6.39 moderately DFD meat and a pH of 6.40 or above extremely DFD meat.

RESULTS

The incidence of DFD meat was very high in bulls, but lower in cows and heifers (Fig. 1). The highest count was in young cattle - a group of minor importance due to their small contribution to total meat production. The total amount of DFD meat in the carcass of a DFD bull was 17-27 %, but only 3-6 % in the carcass of a DFD heifer.

The effect of different rearing methods on the formation of DFD meat was also investigated as part of the present study (YLISELÄ et al. 1980). A significant relationship was found between the quality and hygiene of lairage in farms, subjectively determined, and the incidence of DFD meat (Fig. 2.). This relationship was found to be independent of the slaughterhouse or the mode of lairage in the slaughterhouse.

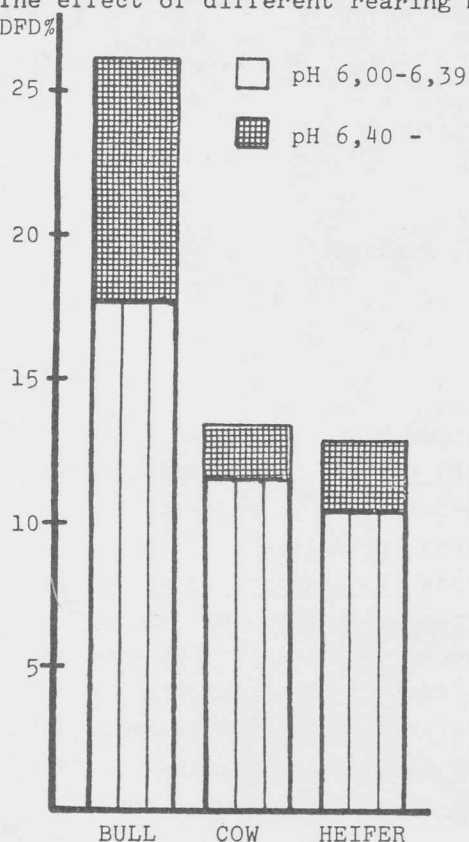


Fig. 1. The incidence of DFD meat in bulls (N=6909), cows (N=3042) and heifers (N=1735).

The correlation coefficient between the distance of transport and incidence of DFD meat was not significant, but when the average distances of transport to different slaughterhouses were plotted against the incidence of DFD meat (Fig. 3), the latter was seen to exert a weak effect. The greater the average distance of transport, the higher the incidence of DFD meat.

The so-called "rest period" is a very important factor in the formation of DFD meat. In Finland there are two ways to keep animals during the rest period. Until now the most commonly used method is to keep 4-20 animals together in an open pen. In this situation the animal are very restless, and there is continual fighting. According to the present study the average incidence of DFD meat was 27.9 % in open pens

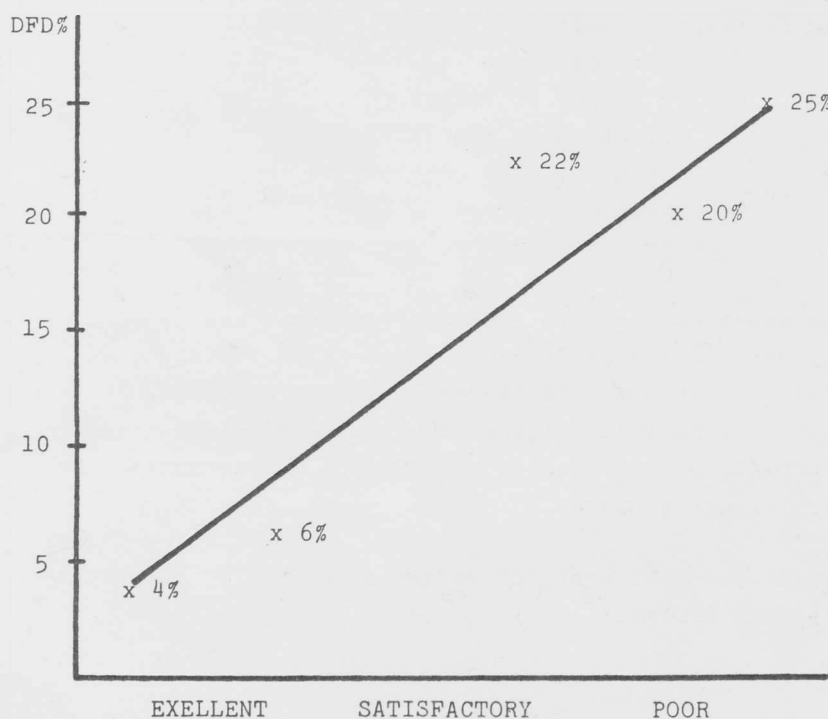


Fig. 2. The effect of farm lairage hygiene on the incidence of DFD meat.

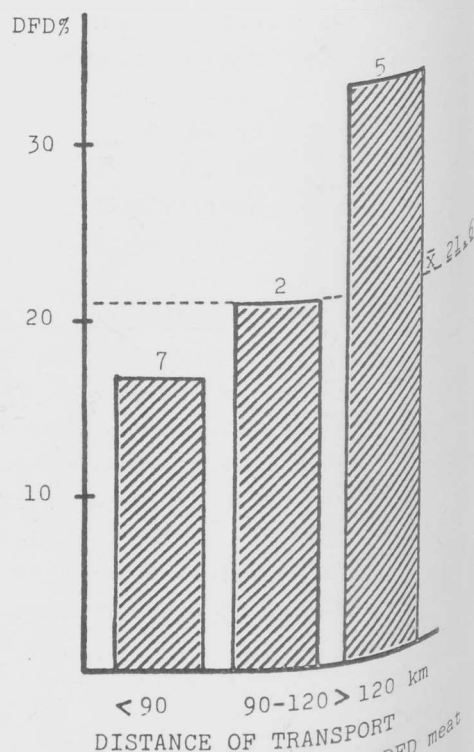


Fig. 3. The incidence of DFD meat in slaughterhouses by average distance of transport.

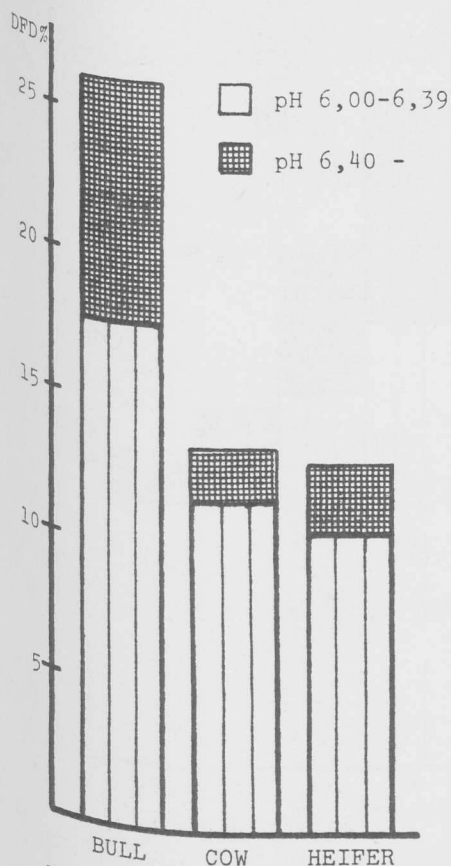


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and the pH value of the meat 5.87. The other means of lairage - keeping the animals tethered or in single pens - gave an average incidence of 12.3 % and a pH value of 5.62. Thus the incidence of DFD meat be considerably lowered by constructing single pens in slaughterhouses to replace open pens.

The effect of the length of the rest period is presented in Fig. 4 for open pens and in Fig. 5 for single pens and tethered animals. It can be seen that as the length of the rest period increased, the incidence of DFD meat decreased. At 8-12 hours there was a sudden increase in DFD meat, which is visible in both figures. After this the incidence decreased to the same level as before 8-12 hours. It was not possible at this stage of the present study to conclude whether the increase was due to physiological reasons or to some until now unknown environmental factors. AUGUSTINI et al. (1979) found a similar increase in their study at 6-8 h, which is practically the same result as that obtained in the present study.

Fig. 6 is presents the incidence of DFD meat carcasses of different quality grades. The grade E+ is the best, having the highest scores for meatiness and colour. The quality of the carcasses then gradually decreases to the right of the diagram. It can be seen that in the better quality grades the incidence of DFD meat is lower than in the lower quality grades.

The amount of fat seems to be connected with the incidence of DFD meat. Fig. 7 shows that more DFD carcasses fall into the first two fatness grades (fatless or almost fatless), than carcasses with more fat.

The weight of the carcass is also slightly connected with the incidence of DFD meat (Fig. 8.). The heavier the carcasses, the higher the incidence of DFD meat. The same effect is seen both with animals kept in single pens or tethered and with animals kept in open pens.

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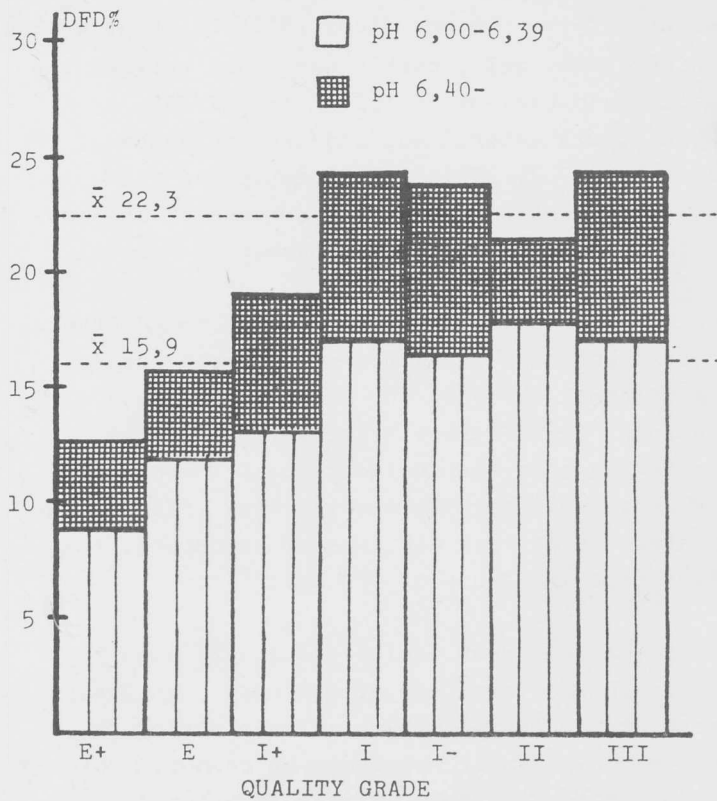


Fig. 6. The incidence of DFD meat by quality grade.
E+=best... III=worst quality grade

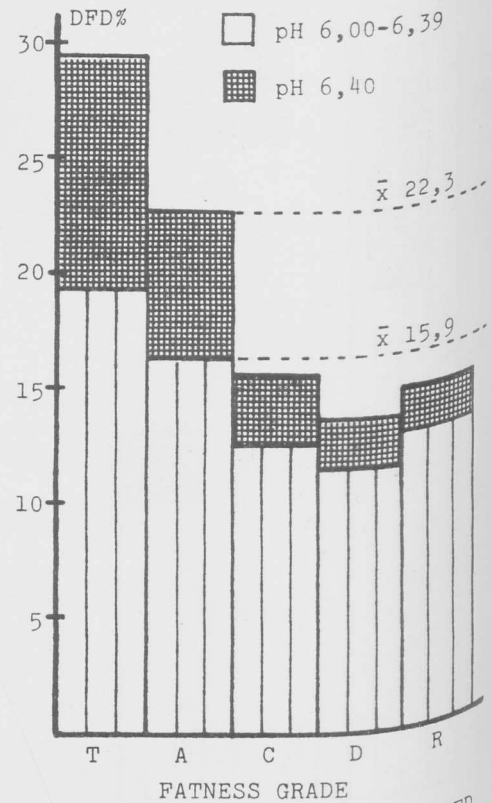


Fig. 7. The incidence of DFD meat by fatness group.
T=fatless... R=extremely overfatted

It can be concluded that to lower the incidence of DFD meat it is vitally important to handle the animals gently, to let them rest before slaughtering in a single pen or tethered, and to ensure a good supply of air and water.

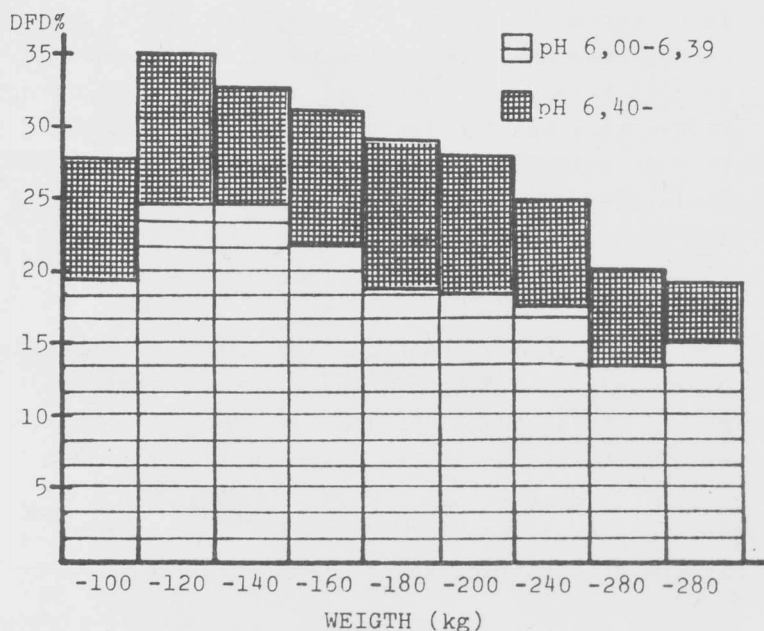


Fig. 8. The incidence of DFD meat by weight group.

REFERENCES

- Yliselä, E., Tuori, M & Syrjälä, Liisa
1980. Effect of meat production circumstances in the farm on the incidence of DFD meat. „In preparation.”
Augustini, Chr., Fischer, K. & Schön, L.
1979, Zum Vorkommen von dark cutting beef unter Praxisbedingungen. Fleischwirtschaft 59: 342-344.