

FI

17th EUROPEAN MEETING OF MEAT RESEARCH WORKERS  
BRISTOL, ENGLAND 6-10 SEPTEMBER 1971

Research on PSE-meat and related problems.

Summaries formulated with help of the symposium participants by Prof. Dr. R.A. Lawrie.

Addendum

Summary muscle metabolism

The most important features of muscle metabolism were clearly reiterated before considering the information on PSE obtained in recent experimental work: the relevance to our understanding of the condition of the uncoupling of phosphorylation from oxygen uptake in mitochondria, by various chemicals, was given consideration.

There was general agreement that enhanced myofibrillar ATP-ase determines the post mortem changes which lead to PSE pork. Recent evidence for the existence of concomitant defects in the aerobic metabolism of PSE-musculature has been obtained. These are manifest when muscles are examined freshly post mortem or at biopsy. In particular there appear to be deficiencies in mitochondrial performance. A number of other biochemical and histological criteria including the level of various enzymes and hormones, and the size and shape of fibres, were discussed. But it is still not possible to associate these unequivocally with particular post mortem changes or to identify them clearly as the cause of PSE conditions. One difficulty is that the scatter of the data is considerable. The presumption that differences in muscle in vivo correspond to the degree of post mortem differentiation is not automatically valid; nor generally accepted.

The value of the model systems in elucidating the PSE condition was recognized. Thus the hyperthermia and concomitant biochemical changes which arise with halothane anaesthesia have been adduced to account for PSE. It seems likely that this kind of approach will prove valuable.

The desirability of establishing some criterion in vivo which could be used to forecast accurately the eventual development of PSE musculature was again emphasized. A number of criteria has shown promise in this respect. These include levels of creatine phosphokinase and of lactic dehydrogenase isoenzyme V in blood serum and that of glucose-6-phosphate in biopsy samples. The limitations of such parameters, however, have already been referred to. Thus, within-breed differences can not be relied to infer post mortem quality. Nevertheless, there is no doubt that between-breed differences may be fairly large and therefore useful for the investigation of the underlying processes involved.

Summary stunning

Irrespective of the mode of stunning employed at death three reactions arise: stimulation of the nervous system, anoxia and release of catecholamines. The influence of the former two factors is likely to be predominant, but all three should be studied further.

There were no dominant preferences between electrical and CO<sub>2</sub>-stunning. The main criterion is the practicability of the management. The CO<sub>2</sub>-method will produce a lower pH<sub>1</sub>, whereas the electrical stunning method will produce more pin-point bleeding. In contrast with animals, which are not stunned, both electrical and CO<sub>2</sub> stunning appear to lower pH<sub>1</sub>. There is room for further investigation on the nature of the electrical current used in stunning and the possibility that mixtures containing oxygen as well as CO<sub>2</sub> may be beneficial. In theory some method of neuromuscular blockage is desirable in combination with a stunning method.

It continues to be the general view that pigs should be handled as humanely and effectively as possible prior to stunning. At present there is no commercial incentive to implement correctly the current stunning methods or to develop new methods.

Sticking should be performed as soon as possible after stunning regardless of the method of stunning utilized. It is not clear whether it is a necessary requirement for effective bleeding that the heart continues to beat after stunning.

Drugs can be administered experimentally which, by causing relaxation, reduce the stresses of slaughter. Magnesium sulfate may be better than curare-like relaxants, in this respect, because it has an effect on the central nervous system. In principle, whether practicable or not, stunning procedures should be designed to minimize muscle ATP-ase activity.

The effects which slaughtering procedures have on the incidence of PSE post mortem require further study.

Summary transport

Further information on the clinical condition of stress susceptible animals in responding to adverse environmental conditions has become available. Their blood exhibits high PCO<sub>2</sub>, low PO<sub>2</sub>, low base content and low pH. Excess CO<sub>2</sub> is predominantly metabolic in origin<sup>2</sup> consequent upon rapid release of excess lactic acid from the tissues. It was suggested that enhanced resistance to handling and transport stresses could perhaps be built up through breeding programmes.

It is clear that the responses to transport and handling depend not only on the stress susceptibility of the animal as a whole, but on the specific muscles considered and endocrine parameters. Both the metabolic capability of individual muscles and the duration and severity of transport determine whether the PSE condition will develop and whether glycogen reserves will be sufficiently depleted to produce DFD meat.

Much of the stress sustained in transport and handling arises during loading and unloading. Tranquilizing drugs may be effective in preventing fighting, struggling and general distress at such times, and they may reduce the incidence of PSE, injury and death. There are reservations against their widespread employment.

Over the last ten years there has been a distinct increase in transport losses. Several reasons were suggested, including changing patterns of management as production units get larger, the composition of diets and the continuing operation of heritability. Estimates of the latter were given as 0.3 for the colour brightness of the fresh pork and considerably higher than that for cured and cooked meat.

High environmental temperature is one of the most important factors in causing death during the transport of stress susceptible pigs. A number of improvements in transport procedures was suggested, including the use of containers which could be loaded under stressfree conditions on farms and removed to factories when the environmental circumstances were favourable. There is still good evidence for some degree of adrenal insufficiency in stress susceptible pigs.

Summary fresh and processed pork

Before considering criteria which could be used to predict meat quality, a clear restatement was made of the firmly established aspects of changing meat characteristics during recent years. The rapidity and extent of pH fall in muscle post mortem is closely involved in the control of meat quality. The role of muscle ATP-ases is important in this connection especially in the increased sensitivity of the muscle of some pigs to stimulation. The control of Na/K balance may effect the latter issue.

The need to assess consumer acceptability was strongly emphasized as was the fact that it was regarded as urgent in 1968. A high lean content appears to be the criterion most sought by the consumer. Pink colour is preferred, pale is tolerated, but there is some resistance against darkness. Probably two tone character is the major factor in respect of colour causing consumer resistance. Opinion was divided as to the importance to the consumer of wateriness, though its seriousness for the producer of canned products is clear.

The economic significance of stress susceptibility appears to be demonstrated by the increased losses in rearing and in transport which are associated with it. Processing losses are a less significant economic factor except in countries and in products where the addition of phosphates is not permitted. Consumer reaction does not appear to be a major factor economically, but drip constitutes a problem in some countries with supermarket retailing of prepackaged fresh pork. Some workers have found lower pH<sub>2</sub> values give better microbiological keeping quality, and others pointed out that a poorer stability was often found at lower pH<sub>2</sub> values.

Much consideration was given to the validity of various selection indices which might be used to predict meat quality. CPK, pH<sub>1</sub>, glucose-6-phosphate, ADP/ATP ratio were prominent among the criteria considered. The degree of correlation with meat quality is moderate, however, rather than satisfactorily high. Moreover those methods dependant on blood sampling are subject to variability according to the sampling technique used. There was some difference of opinion as to the feasibility

F

of applying such methods when unskilled operators were involved. The need for simpler methods was emphasized as was the desirability of employing a selection criterion which could be applied in vivo. A combination of two criteria might create better results. Cured meat colour is important in selection schedules in some countries.

Even if ultimate quality were not a problem, those of rearing, fattening and transport justified continuing efforts to elucidate stress susceptibility and to seek its elimination.