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CARCASS GRADING AND CLASSIFICATION

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Experience suggests that, in international conferences on topics of the kind with which this Symposium is concerned, much confusion and hence unprofitable argument can be avoided by clear definitions of terminology at the outset. It is important, therefore, that we should be clear about what we mean by such terms as "grading", "classification", "conformation", "cutability" and "eatability".

The terms "grading" and "classification" are sometimes used even by English-speaking butchers as if they were synonymous so this confusion could easily be carried over into translations. Grading is the division of a variable population of carcasses into a series of sub-groups on the basis of a set of parameters laid down by some independent organisations like a Ministry of Agriculture or a National Meat Board and a concept of value is attached to each sub-group. In other words, carcasses are allotted to Grades A, B, C or D and, by definition A is the best grade, B the next and so on down the line. In countries where the government pays a support price or a deficiency payment to livestock producers this concept of value may be reinforced by making differential payments on the basis of carcass grade. Where this happens it clearly encourages producers to aim for the grade which attracts the highest rate of subsidy and since the definitions of grades are usually imposed from outside the meat trade this can lead to a situation where the highest grades may be out of line with the requirements of both butchers and consumers. In the first place, meat traders' requirements vary in different parts of a country and even in different parts of a large city. This sort of variation can be seen even within a small country like England and is possibly even more marked in larger countries. For example, in the case of lamb carcasses the demand in the South of England is for a carcass weighing 14 or 15 kg with about 3 mm of fat over the loin whereas the demand in the North-east is for 20 - 25 kg carcasses with perhaps 8 - 10 mm of fat over the loin and an overall value grading system cannot cope with this situation.

In the second place, consumer demand and the pattern of meat trading have been changing progressively with time but a value grading system, once established tends to remain static. The outstanding feature of changing consumer demand is the increasing aversion to fat which means that demand has tended to move away from the alleged first quality but very fat grades towards grades which are less fat. This has happened, for example, in the American beef grading system where the second grade "choice" is generally preferred to the top grade "prime" and, but for the sales appeal of the word "choice" it is possible that the third grade "good" might be preferred to "choice". Apart from this, in a grading system of the A, B, C, D type, the carcasses in the top grade A may be reasonably uniform but carcasses may be placed in one or other of the lower grades for a variety of different reasons. For example carcasses placed in Grade B may be judged to have too little or too much fat for Grade A or may have the right amount of fat but be considered to have an inferior conformation.

For these reasons grading systems which are based on preconceived notions of what constitutes carcass quality have tended to fall into disrepute and to be replaced by carcass classification systems. Classification differs from grading

in that it merely sets out to describe carcasses in unambiguous terms without attaching a value to any particular sector of the system. This leaves the butcher with the decision as to what type of carcass best suits his particular trade and how much more than the average price he is prepared to pay for this type of carcass.

Apart from "grading" and classification terms which need some definition are "cutability", "conformation" and "eatability". Cutability is the proportion of trimmed retail cuts which can be obtained from a carcass. In the case of the beef carcass trimming would involve the removal not only of surplus fat but also virtually all the bone whereas in lamb carcass where bones are sold as part of the retail joint it merely involves the removal of excess fat. Many butchers would regard "cutability" as being closely related to conformation and might even use the two terms interchangeably. However, strictly speaking, "conformation" relates to the shape of the carcass and may be defined as the weight of meat per unit of carcass size. Thus the conformation of the hind-leg may be defined as the weight of meat per unit length of leg.

At this point confusion supervenes because with Continental European cattle which have very little fat, cutability is closely related with conformation. With British breeds, on the other hand, a high conformation score may be associated with reduced cutability because much of the additional weight of meat consists of excess fat which must be trimmed off prior to retail sale. It is thus not surprising to read statements by American Meat Scientists to the effect that fatness is "four times as important as conformation in determining carcass value" if as much as 20% of the weight of the carcass is excess fat which must be trimmed off before the carcass is fit for retail sale. Compared with this no other carcass characteristic is likely to make a significant impact on carcass value.

Because of the influence of excess fat on shape many British butchers would discount excess fat when assessing conformation and what they are really trying to assess is "fleshiness" or flesh thickness which is the weight of flesh (muscle + intermuscular fat) per unit length of bone. Thus the term "conformation" can mean different things to different people and confusion arises when it is used without previously agreed definition. The confusion has been added to by some scientists on the basis of carcass dissection results expressed as percentages of lean meat, fat and bone in a carcass and as ratios of weight of muscle to weight of bone and weight of muscle to weight of fat. On this basis they have related conformation to lean content and to muscle to bone ratio and concluded that conformation is of little commercial value because cattle with extremes of conformation like Jerseys and Herefords, for example, can have the same muscle to bone ratio. However, while Jerseys have relatively long thin muscles they also have long light bones so that when a muscle to bone ratio is calculated on a weight basis there may well be no differences between Hereford and Jersey carcasses but they are of very different value to the butcher because of the difference in thickness of flesh.

Having defined what we mean by carcass grading and classification we can consider the objectives at which these processes are aimed. The broad objective, as we have already said, is to take the very variable population of cattle, sheep and pigs coming onto the market and classify them according to defined characteristics so as to facilitate orderly marketing and distribution and to satisfy the various people concerned in the chain of distribution, viz. the producer, the wholesaler, the retailer and the consumer. If the system were working perfectly the housewife could telephone her retail butcher and order a particular cut of meat in the certain knowledge that he would deliver exactly what she had asked for. In our present state of knowledge this certainly could only extend to the type of cut, its weight, proportion of lean to fat and so on. It could not extend to

"eatability" which is the satisfaction which the consumer derives from eating the cooked meat. I do not propose to discuss further the problem of "eatability" in relation to carcass grading and classification because Dr Rhodes will do this in the second part of this symposium and restrict myself to saying that because "eatability" is entirely subjective and influenced by a number of factors additional to those inherent in the carcass from which the meat was derived classification of meat for eatability is likely to be a very difficult operation.

The retailer in turn should be able to order by telephone from his wholesaler exactly the sort of carcass which meets his requirements and the wholesaler should be able to specify to the producer the types of cattle, sheep and pigs which he is prepared to contract to purchase.

Having defined the objectives of a classification system it is necessary to identify which characteristics of a carcass need to be considered to make a classification system possible. In 1965 the O.E.C.D. suggested a system which included the following characteristics:-

(1) Carcass weight. For this purpose the carcass would be coded in accordance with the system of carcass descriptions devised by the Codex Alimentarius Committee on Meat and Meat Products.

(2) Category, e.g. steers, heifers, bulls, cows.

(3) Maturity.

(4) Conformation.

(5) Fat covering, i.e. subcutaneous fat.

(6) Internal fat, i.e. kidney and pelvic fat not intermuscular fat.

(7) Colour of meat.

(8) Colour of fat.

(9) Area of back muscle (m. longissimus dorsi).

(10) Marbling, i.e. the amount of visible fat seen in the cut surface of m. longissimus dorsi.

The system aims at being easily applicable for trade purposes without causing economic loss by damage to the carcass. For this reason items (9) and (10) were listed as optional since they can only be assessed in countries where it is customary to cut sides of beef prior to sale. They could not be included in Great Britain or France, for example, at the present time, because in neither country is it customary to cut sides of beef prior to sale.

Of the characteristics in the above list a knowledge of carcass weight and category are obvious requirements and are the two items in the list which can be defined with absolute certainty. Maturity, i.e. an estimate of physiological age is included because of its presumed relationship to eating quality but, while it is possible by examination of dentition and appearance of cartilages including the degree of ossification to distinguish, for example, between young and old cows it is not possible to distinguish with any certainty between age groups within steer and heifer carcasses.

The most important characteristics for inclusion in a classification after weight and category are undoubtedly (5) and (6) i.e. estimates of level of fatness. Retailers vary considerably in the amounts of fat which they can sell in retail cuts and they need accurate information about both these characteristics.

Fortunately both these indices of fatness can be assessed with reasonable accuracy by visual inspection.

Differences in conformation can also be assessed by visual inspection particularly if the basis of assessment is clearly defined and generally accepted, i.e. whether it is to refer to thickness of flesh or to shape disregarding the effect of fatness. In the case of both conformation and fatness consistent assessment is facilitated by the provision of photographic standards. At the Meat Research Institute we have produced such standards for beef in collaboration with the Meat and Livestock Commission and these are being subjected to the latter to large-scale field trials. We have also very recently produced similar agreed standards for lamb but these have yet to be tested. Agreement is also being sought through the European Association of Animal Production to a set of photographic standards for beef on a European basis.

The visual assessment of lamb carcasses and the provision of photographic standards has also been studied at the Meat Research Institute in collaboration with the Meat and Livestock Commission. Provisional photographic standards for fatness and conformation have been produced and will be subjected to field trials. It is anticipated that the assessment of fatness in lamb may prove to be considerably more difficult than in beef and may need further investigation. One possible source of difficulty may be the relatively wide range in market weights of lamb carcasses compared with beef. The surface area of a small carcass is relatively larger than that of a big one which means that a given percentage of subcutaneous fat is more thinly spread in the small carcass than in the big one and, on visual assessment, the latter tends to appear fatter than it really is. It may, therefore, be necessary to produce two sets of photographic standards for lamb carcasses , one to cover the range from about 14 to 18 kg and the other from 18 kg to 22 kg.

Classification of pig carcasses on the basis of visual appraisal has always been a difficult problem and it is, perhaps, fortunate that slaughter of pigs tends to be concentrated on a factory basis which justified taking objective measurements of fat thickness with an optical probe.

The O.E.C.D. recommended system of classification for beef carcasses includes colour of lean and of fat. In view of the wide range of conditions obtaining in abattoirs and the fact that the apparent colour tends to change with time from slaughter it seems rather doubtful that visual classification on the basis of colour could be really reliable. At the same time it must be recognised that, for example, excessively yellow fat or very dark meat are generally objectionable. It might, therefore, be desirable to classify carcasses according to weight, category, sex, fatness and so on and to record the colour of the fat as "normal" or "yellow" i.e. to regard yellow fat or very dark meat as blemishes.

A system like the O.E.C.D. scheme for beef by no means exhausts the possible number of carcass characteristics that could sensibly be incorporated in a classification system. For example, the value of a beef carcass to the retailer can be affected not only by the total amount of subcutaneous fat but also by the way it is distributed. A given amount of fat evenly distributed so that little or no trimming is necessary before retail sale results in a more valuable carcass than one in which the same amount of fat is unevenly distributed necessitating trimming. Similarly variations in the bone content and in the amount and distribution of intermuscular fat all affect the retail value of the carcass.

However, if a classification system is to be meaningful and readily acceptable it must, at least in the early stages of its introduction, be as simple as possible consistent with effectiveness. Thus if carcasses are to be classified for amount and distribution of subcutaneous fat, amount and distribution of intermuscular fat,

amount of kidney and pelvic fat and amount of bone and if five classes are allotted to each of these characteristics the total number of possible classes would be 30 for each category and weight group. Intermuscular fat can be eliminated because it is quite closely related to the amount of subcutaneous fat and in any case is very difficult to assess in intact carcasses. Apart from this the division of carcasses into 5 or even 7 classes for each of the remaining characteristics is possible for experienced assessors and indeed some European workers have suggested that each of 5 main classes could be further subdivided into 3.

Nevertheless a complex scheme is probably not immediately practicable partly because many meat traders would find it too difficult to operate and partly because of the cost involved in implementing it. It would, therefore, seem logical to restrict the characteristics to be assessed to three, fat cover, kidney and pelvic fat and conformation and to define the latter in terms of "fleshiness or thickness of flesh" rather than shape so as to relate it more closely to bone. Each of these items could be divided into 5 giving a total of 15 classes per category and weight group. This is probably as many classes as would be acceptable to the meat trade and at the same time, be capable of being categorised in a reasonably uniform manner over a country as a whole. As far as uniformity of assessment is concerned it must be remembered that these assessments will be carried out visually and while it is possible for a small expert panel to assess carcasses in a uniform and highly repeatable manner, the agreement decreases as more and more assessors are involved and, on a national basis, there is the further problem of the dominance of individual breeds in particular areas.

Classification of Carcasses in the Live Animal

The assessment of potential carcass value in the living animal is generally recognised to be a rather difficult matter but it is important to try to translate the classification of carcasses back to the living animal for two main reasons. Firstly, the beef producer needs guidance as to the stage of development at which he should market his cattle so that they fall into the most advantageous class for the wholesaler whom he is supplying and who, in consequence, can provide the producer with a better return. It follows from this that a classification system is likely to be most effective where production is deliberately planned to meet particular market requirements as, for example, by contracts between producers and wholesalers.

Secondly the breeder of beef cattle needs guidance on the carcass characteristics of his cattle to help him in his selection programme. Without such guidance the beef breed societies will draw up their own specifications and, indeed, have already done so in some cases. These breed society specifications are likely to be unnecessarily complicated restricting effective selection or, and perhaps worse, they may conflict with market requirements. For example, if one thinks of the musculature of the beef animal it is clear that its outline is irregular with various bulges and hollows corresponding to the main muscle masses. The fashionable, smooth rounded outlines of beef cattle can only be achieved by filling out the hollows with fat. At this stage the assessment of the carcass in the living animal becomes very difficult and there would be much to be said for assessing potential breeding animals at the beginning of the fattening phase of their life when muscular development is well advanced but before differences have been obscured by the deposition of excessive subcutaneous fat.

While it is easy to see that a reliable system of carcass classification in living animals would have great advantages it is much less easy to see how a reliable uniform system is to be devised. Some idea of the degree of fatness can be obtained by handling the animals but traditional ideas of good and bad conformation have not proved very helpful neither have simple linear measurements.

The problem needs critical re-examination on the basis of objective measurements but these are likely to be mathematically considerably more complicated than anything which has been attempted hitherto.

Summary

(1) The essential difference between carcass grading and classification is that while the latter merely aims at describing carcass characteristics in clearly definable terms the former adds a concept of value on the basis of preconceived ideas about "quality".

(2) In the quality concept embodied in grading schemes two distinct ideas are usually confused:-

(a) the idea of carcass quality or value to the meat trader as represented by, for example, the yield of boneless trimmed retail cuts.

(b) the value to the consumer, i.e. the satisfaction to be derived from eating the meat.

These two are not necessarily complementary and in some respects may even be antagonistic. Apart from this both consumer demand and the pattern of meat trading change with time so that the quality concept tends to become out of line with reality.

(3) The interrelationships between carcass quality and eating quality are not at all clear and it therefore seems unwise to try to combine these into a single grade. It would seem preferable to classify carcasses on the basis of characteristics which affect their value to the butcher and, if it is thought possible and necessary to classify according to eating quality, to do so quite separately. Although carcass quality characteristics may be assessed visually they are ultimately definable in quantitative, objective terms by measuring, cutting and, if necessary, tissue dissections. They are thus inherent in the carcass. On the other hand eating quality, while it may depend basically on inherent carcass characteristics, is markedly affected by other treatments such as pre-slaughter care, post slaughter storage and maturation and, not least, by cooking techniques.

(4) Carcass classification schemes should be as simple as possible consistent with effectiveness and characteristics should be excluded, even if their inclusion might be theoretically desirable if experience shows that, in practice, carcass assessors are unable to classify them accurately.

(5) In the long run it is desirable to be able to extend carcass classification to the living animal but at the present time this is not possible with any great certainty and the problem requires further investigation.

The Quantity/Quality Concept in Live and Carcase Grading

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