DEFINITION AND MEASUREMENT OF MEAT QUALITY WITH PARTICULAR REFERENCE TO CARCASS CLASSIFICATION AND INFORMATION SERVICES

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Summary

While the difficulties of defining meat quality are highlighted, the importance of measuring quality attributes is recognised. However, it is suggested that emphasis be given during the immediate future to the current research programmes aimed at the design and evaluation of carcass classification and information services. Should the pilot runs of the services demonstrate that the likely costs will exceed the expected benefits, the progression towards implementation of the services should be reviewed.

Details are given of the potential key role that a continually revised frequency distribution could occupy in a porcine carcass classification service and attention drawn to the possibility of using a similar approach in bovine and ovine situations.

There is an urgent need for the development of automated measuring and recording equipment so that trial runs of classification procedures can keep pace with the speed of killing chains.

I. INTRODUCTION

Meat quality is a difficult term to define. Fredeen (1971) stated that quality should mean satisfaction, the enjoyment derived from good meat, cooked with care, seasoned to taste and served at the proper moment. However, to define specific characteristics of meat that make it appealing to all palates and under all the variety of cooking and seasoning techniques to which it would be subjected was seen to be little short of impossible.

Similar thoughts were expressed by Howard (1970) who suggested that quality is not some absolute attribute of a commodity but is rather the overall sum of various attributes which only become known when the end use of the commodity is stated. He believed that acceptance of this approach was leading away from grading which presupposes an absolute quality to the specification of various attributes which determine suitability for various end uses. These attributes were listed as; appearance, colour and aesthetic appeal, flavour, tenderness, juiciness and mechanical properties of manufactured products.

Difficulties arise in attempts to assign relative degrees of importance to attributes. Because it is an increasingly important buyer of Australian beef, the Meat Conference Standards of Japan (Anon 1970a) are of particular interest. These state that bovine meat quality consists of four items; marbling (most important), colour and gloss of meat, texture and firmness of meat, and colour, gloss and quality of fat. However, the Australian Beef Carcass Appraisal System (Anon 1971) does not award marks for marbling.

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Developments in the production of polyunsaturated meat by ruminants have introduced a new attribute. The field of diet as related to human heart disease is the subject of continuing review by a standing subcommittee appointed by the National Heart Foundation of Australia. In a recent review (Day et al. 1971), the subcommittee recommended that the Foundation promote a community education programme which includes a suggestion that diets be manipulated to achieve a polyunsaturated to saturated fat ratio of 1 to 1 or greater. Acceptance of this advice can be expected to produce a demand for the polyunsaturated meats derived from the process described by Cook et al. (1970).

In addition, an important attribute possessed by meat produced in Australia is the disease status. Gee and Whittem (1973) point out that freedom of Australian livestock from specified disease is an essential component in the trade relating to export of primary produce, livestock and livestock products. Continued freedom from, particularly, foot and mouth disease and rinderpest is a prerequisite to our access to markets such as the United States, Canada, Japan and the United Kingdom for dairy products and meat.

In noting the intensified interest being taken in the hygiene of abattoirs, Lee and Lee (1972) predicted that importing countries will impose bacteriological standards on meat and meat products, especially with respect to Salmonellae spp.

II. RECOMMENDATIONS FROM EXPERT PANELS ON ANIMAL BREEDING

Genetic approaches to improved meat production require careful definition of the aims of the programmes. At the request of Animal Production Committee, expert panels have formulated breeding aims for the bovine, ovine and porcine industries in Australia.

(a) Bovine

The expert panel on selection of bovine breeding stock (Rendel et al. 1968) concluded that the most important source of future improvement lay in improving the muscle/bone ratio. The other carcase characteristic considered of sufficient importance to be worth consideration when selecting breeding stock was finish, defined as the depth in millimetres of subcutaneous fat cover over the longissimus dorsi muscle. While the degree of finish considered optimal was seen to vary with the age and weight of the carcase, Mason and Beilharz (1970) have drawn attention to the problem of producing beef for a market where no definite standards have been established.

(b) Ovine

The report by this panel (Dun et al. 1970) suggested that the production of quality lamb inferred rapid growth (above 0.27 kg/d) producing a 13.6 to 18.2 kg prime lamb carcase without excess fat. They considered that the existing evidence showed that the desirable attributes of flavour, texture and tenderness of meat were not adversely affected in lambs with high rates of growth. Further, existing show standards defining desirable body shape were felt to have little worth in terms of real carcase value expressed as low percentage fat and high muscle to bone ratio. The panel concluded that the characteristics which determine the value of a sheep carcase to the consumer must be defined accurately, as a prelude to possible recommendations aimed at improving carcase composition.
This expert panel (Watson et al., 1973) concluded that on-farm testing was unlikely to be successful in achieving improvement in carcase characters in the industry unless there is a uniform carcase classification which provides a meaningful end point to the producer's efforts, while, at the same time, providing essential criteria on which to base selection. The panel suggested that attention be given to carcase backfat as a selection characteristic until a nation-wide system of porcine carcase classification was adopted.

Thus geneticists viewed fat cover as an important characteristic in all three species while there was seen to be a clear need for a porcine carcase classification system. Alexander and Carraill (1973) have drawn attention to the lack of an effective Australia-wide system of grading bovine and ovine carcases for the domestic market, thus there is little feed-back or monetary incentive for the producer to produce meat to standards defined by market requirements. In addition they pointed out that supermarket selling of meat is rapidly increasing and the requirement for standard products is becoming more apparent.

Cannon, Thatcher and Thomas (1973) have described the ovine market intelligence services as almost non-existent and claimed that there is no feed-back from consumer to producer. Wilson and Campbell (1971) reported that beneficial results followed from a feed-back of porcine carcase information from processor to producer.

III. CURRENT DEVELOPMENTS IN CLASSIFICATION AND INFORMATION SYSTEMS IN AUSTRALIA

The area of grading and classification of meat in Australia has been given much attention in recent times. The Select Committee (Anon 1972) which investigated the New South Wales meat industry included in its recommendations that there should be developed a weight and classification scheme for that state suited to national requirements embracing all meat carcases and also the development of a system of market intelligence and a method of relaying back to the producer information and advice to promote efficiency in livestock and meat production. A further recommendation was that the Meat Inspection Service of the New South Wales Department of Agriculture be charged with the responsibility of carrying out weight and classification procedures.

While there are export grading systems for all three species, the systems use subjective criteria and lack precise definition. Myama (1972) who represents a Japanese importing organisation, claimed that the existing bovine GAQ grade was too broad and could mean anything. Despite this, the widely used "Handbook of Australian Meat" (Anon 1970b) used in association with the grading systems for bovine and ovine carcases does permit the preparation of trading specifications. The Commonwealth Food Specifications Committee prepares trading specifications for meat and meat products purchased by the Commonwealth Government and these specifications require that the carcases used have been graded according to the export grading schemes. In addition, the National Health and Medical Research Council has prepared a model standard for meat and meat products. Although food legislation is a matter for individual states, uniformity is being achieved through the Food Standards Committee of the National Health and Medical Research Council whose recommendations require incorporation into state and territory legislation before legal status is achieved.
During the last five years the Australian Meat Board has appointed committees to investigate bovine and ovine meats grading and classification and is currently conducting a pilot study of a classification system for bovine carcases, based on the system designed by Charles (1971) with modifications by Scott (1971). The Bureau of Agricultural Economics is participating in the pilot study.

The Australian Pig Industry Research Committee has examined the feasibility of implementing a pig carcase grading system and is currently supporting research into the design of a classification and information system for which a benefit/cost ratio is being determined.

In addition a world-wide approach to the development of common terminology for use in meat trading is being developed. Hammer (1971) has outlined the activities of the Codex Alimentarius Commission which aims to implement an international code of food standards and hygienic practices. While deliberations are still subject to amendments, systems of describing bovine, ovine and porcine carcases are being considered, together with descriptions of meat cutting procedures. The systems of carcase description for bovine and ovine carcases being elaborated consider the characteristics of sex, age and weight. In addition, the bovine, description also includes conformation, objective and subjective assessments of fat cover, marbling of the longissimus dorsi muscle, colour of meat and colour of fat. The porcine carcase description system includes sex, weight, measurement of backfat thickness and visual assessment of the degree of muscling of the hind leg. In addition, the meat colour, fat colour, consistency and moisture content of meat and consistency of fat tissues may be considered.

The classification systems being examined for the bovine and porcine carcases in Australia include carcase weight, sex, fat depth and, in the case of bovine carcases, age is also determined by dentition.

The study of the porcine classification system also includes the design of a comprehensive information service for the Australian pig industry. The proposal being considered involves the recording of carcase weight, sex and backfat thickness, together with the registered tattoo on the carcase. The tattoo would allow identification of the producer who shipped the carcases, At the end of each daily kill, records would be sent to a central computer and collated. Producers would receive a print-out showing the measurements recorded from each carcase in the shipment. For producers who consign pigs to processors operating grading systems based on the classification information, the computer could be programmed to allocate grades and also calculate the value of the shipment. These statements would be mailed direct to the producer from the computing organisation.

Since additional characters could be placed under the registered tattoos, boar progeny groups and groups on differing nutritional or management treatments could be identified and compared. The computer could also be programmed to punch the carcase information and tattoos onto cards so that the information could be sent to other organisations for use in computerised genetic improvement programmes, such as the one in use at the University of Western Australia.

A key role in the proposed information service is seen for a continually updated frequency distribution which summarises the current situation of pig carcases in terms of fat depth and carcase weight. The form of the frequency distribution which summarises the five day collection of records is shown in figure I. Producers would receive a copy of the state distribution, together with the printout showing the measurements.
recorded on each carcase in the shipment. Thus producers would be able to compare the degree of fatness of carcases they shipped with the state frequency distribution.

An effective price reporting service could be developed based on the frequency distribution. By collecting price information on consigned carcases it would be possible to report prices according to carcase weight and depth of backfat. This information would be made manageable by dividing the carcase weight range into light, medium and heavy groups. Radio and telephone answering service market reports could inform producers of current prices for light carcases of above, average and below average backfat measurements, and then repeat the procedure for the medium and heavy groups. Separate prices would be given for culled breeding stock carcases.

The frequency distributions would be made available to other market participants so that the whole industry was kept informed of the type of carcases being produced and the prices being paid for the various types of carcases.

Should it be found that consistent price differentials develop within the frequency distribution, the way is open for investigating other means of marketing, including the teletype approach now operating in some provinces of Canada. The frequency distribution also provides the sort of information required for the operation of forward trading in porcine carcases.

Trend forecasting could also be developed based on the information forthcoming from the carcase measurements of weight and sex. Using a
demographic approach, trends could be discerned in the proportions of females being slaughtered and the proportions of breeding stock in the total kill. Used in conjunction with cereal crop forecasts, it is anticipated that trend forecasting could become very effective.

It is suggested that a similar approach to the use of a frequency distribution could be adopted by the bovine and ovine industries. In the case of bovine carcases, separate distributions could be set up for bulls, cows, steers, heifers and vealers. Thus, while market reporting would take more time, it would be no less effective than with porcine carcases. The routine collection of carcase classification information would permit continuing analysis of trends in the bovine industry using a similar approach to that followed by Fogarty (1972).

IV. APPLIED RESEARCH AND DEVELOPMENT NEEDS

There is a need for the conduct of comprehensive pilot runs of classification systems. These runs will highlight the problems associated with implementing the systems and provide economists with detailed estimates of costs of operating the services at the abattoir level. However, there is also a need to formulate the information services which could be developed from computerised manipulation of the carcase classification measurements. This will provide extension specialists with details of information which could be forthcoming from computerised analysis of classification data, thus enabling them to present the possibilities to producers and determine from them what information producers want and can use and which should be built into the computer programme.

Collection of the records on sex, carcase weight, fat cover and age will be a repetitious task and if purely manual methods are relied upon, delays could be caused in the operation of killing chains. In view of this it is considered that there is an urgent need to develop automatic weigh scales with keyboard attachments for recording information on carcase identification (tattoo or tail tag for porcine and bovine respectively), sex and fat depth. The data collected on each carcase would be entered on a punch tape and the machine would also print cards carrying carcase information for attachment to the carcases.

The electrical probe described by Weste and Anderson (1972) has much to offer in the area of fat depth measurement and high priority should be given to further developments of the probe aimed at overcoming problems of measuring fat depth on warm bovine carcases and of penetrating the skin of porcine carcases.

Apart from the pilot runs and the development of the recording equipment, there is a need for detailed benefit/cost analyses of the classification proposals. These will need to examine current costs of marketing procedures and an examination of the benefits to livestock production and marketing the introduction of the classification systems and associated information services would permit.

If it becomes clear that classification systems and associated information systems should be introduced, there will be a need for attention to a multitude of administrative details such as possible amendments to marketing acts, information security, standardisation between states and detailed negotiations with participants in the production, processing, marketing and consumption of meat.
V. CONCLUSION

I believe that carcase classification systems will be introduced into the Australian meat industry. These systems will fulfil a need for consistent goals in meat production required by animal breeders and workers elaborating production systems.

Since classification procedures will collect data relating many combinations of sex, age, weight and fatness, there will be a need to reduce these to comprehensible information which can form the basis of marketing reports and production analyses. A contemporary frequency distribution is seen to hold promise in this area.

Once classification procedures become established it will be of utmost importance to characterize within the broad classification areas, the attributes present in the meat which affect its usefulness for various end uses. This will provide consumers with information outlining which broad classification areas are most likely to include meat possessing the particular attributes they desire. There will be a need for establishing means and standard deviations of these attributes where possible.

Such basic information, together with consumer acceptance studies, will be needed to guide geneticists and nutritionists in further elaboration of breeding and production programmes so that their attention is continually directed towards industry needs.

Apart from the need to develop reliable instrumentation for operating the classification procedures, attention should be given to the development of small mechanical de-boning machines for use in assessing the muscle/bone ratio of shins as suggested by the bovine expert panel.

VI. REFERENCES


