The Tenderness of Beef

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Tenderness is the most sought-after quality of table meat, particularly beef. It is also, unfortunately, one of the most variable qualities. This article discusses a new method of hanging which may assist in ensuring the tenderness of meat.

The Variability of Tenderness

Many factors are known to affect the tenderness of meat including the species, breed and age of the animal at slaughter, the particular muscle concerned, fatigue prior to slaughter and other pre-slaughter and post-slaughter variables, including the method of cooking. Be cause of the large number of factors which affect tenderness, it is unlikely that any simple theory will explain all the facts. Until recently, tenderness was thought to be affected mainly by the amount and type of connective tissue in the meat, and the extent to which it is softened during cooking. However, it is now realized that tenderness also depends to a considerable extent on the state of contraction of the muscle.

Much valuable information about tenderness can be obtained through the judgement of trained observers who score the amount of effort required to chew the meat. This quality can be also measured objectively by various instruments or mechanical devices.

Ageing

In the process of ageing, the natural breaking down of tissue (autolysis) is allowed to occur in meat, generally stored at temperatures just above freezing point for two to three weeks. More rapid ageing is possible at higher temperatures but the risk of rapid growth of microbes at higher temperatures is a serious disadvantage. Unless the temperature is kept below 7°C (45°F), food poisoning bacteria could make the meat dangerous to eat. One way to obtain greater tenderness whilst avoiding spoilage by bacteria is by ageing in an atmosphere that will slow down microbial growth. It has been demonstrated that such an atmosphere develops when meat is packed in gas-impermeable films, due to the liberation of carbon dioxide from the meat itself. This procedure has been widely accepted overseas. Both time and chiller space are required, which add to the costs. Other disadvantages of the process are that its success depends on the gas-tightness of the pack to maintain the inhibitory atmosphere. Variations in the composition of the atmosphere occur from pack to pack, and scrupulous care must be taken to ensure adequate sealing, sanitation and temperature control. Furthermore, any bacterial growth which does take place can cause greening on dark-cutting or low acid beef (pH 6 and above).

Plate 1.—A side of beef hanging conventionally.

Hanging of Carcasses

Meat is most tender at the time of slaughter and as the carcass passes into rigor mortis the muscle fibres shorten and the meat becomes progressively tougher, reaching maximum toughness when it has just gone into rigor. Within certain limits of contraction and elongation, the shorter the muscle fibre length, the tougher the meat. Any means, therefore, of reducing the contraction of muscles improves tenderness.

A recently developed method of hanging beef sides minimizes contraction and consequent toughening of certain meat cuts. Improvements in tenderness have occurred as a result of hanging sides from the pelvis or aitchbone, rather than from the hock or Achilles tendon, which is the conventional way.

Method of hanging: The hot side is suspended with a hook by the aitchbone as shown in Figure 1. This must be done within 1½ hours of slaughter. Some mechanical means is necessary to raise the side up and free the hock from the rail. One end of a sterilized hook is inserted into the eye ("pope's eye") of the aitchbone; then the side is lowered and the other end is hooked to a conventional roller on the rail. The full weight of the side is taken on the aitchbone. The hook should be of approved material and of sufficient length to ensure clearance between the top of the carcass and the rail above it.

The sides must be left in the chiller for at least 24 hours suspended by the aitchbone. After this period the side or quarter can be hung by the Achilles tendon.

Tenderization: The improvement in tenderness in the rump (sirloin butt) thick flank (knuckle), topside (inside), striploin and scotch fillet (cube roll) resulting from the aitchbone hanging is equivalent to 3 weeks' ageing at about 2°C (35.5°F). The improvement in tenderness of these cuts corresponds to changes from "slightly tough" to "tender".

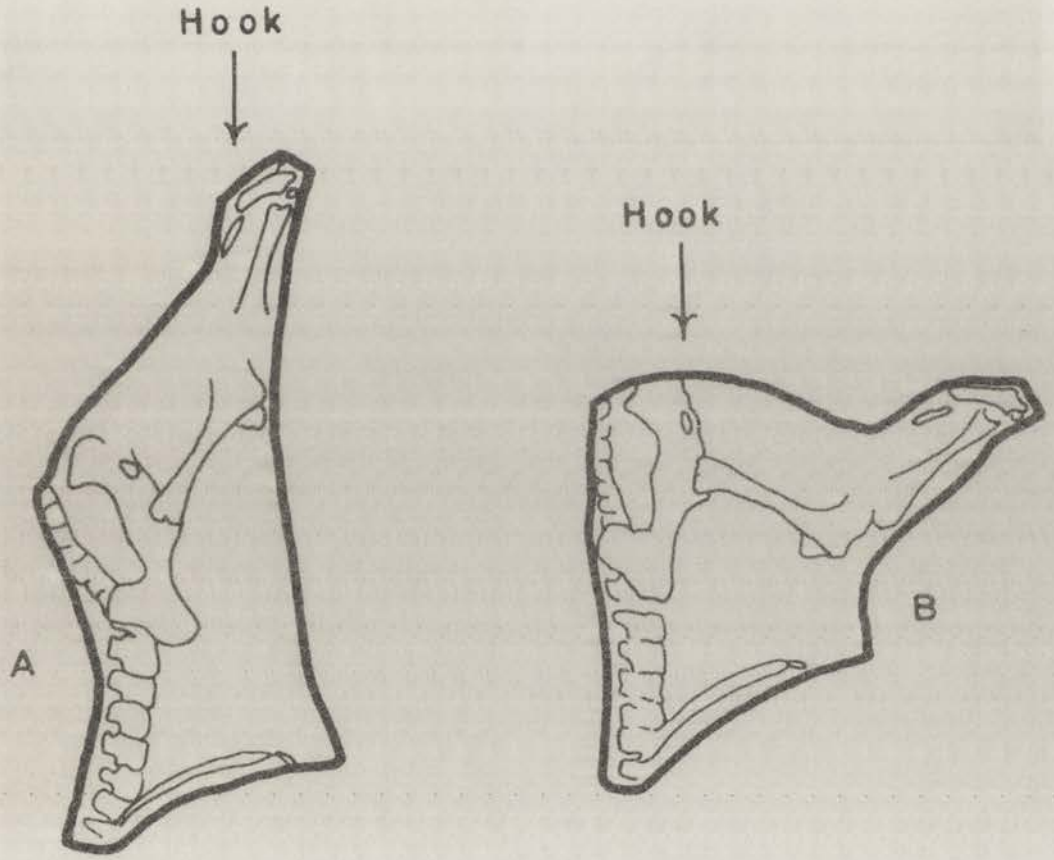

Figure 1.—A. Normal suspension from the Achilles tendon. B. Aitch-bone suspension.

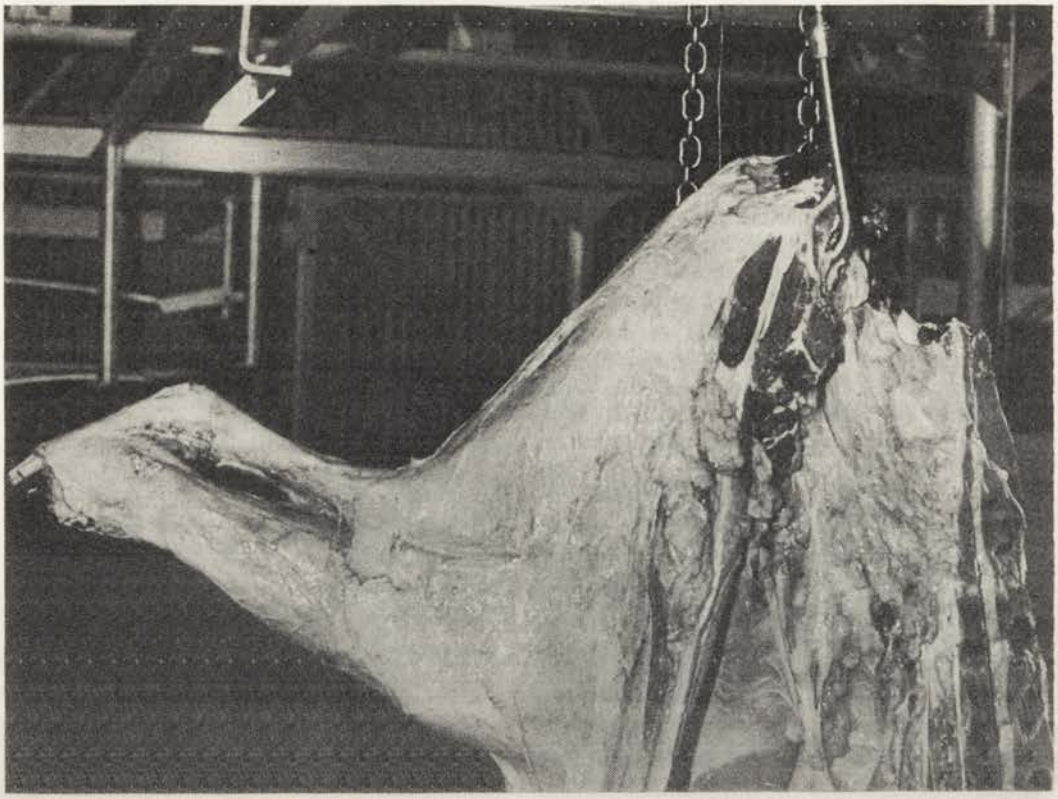

Plate II.—A side is suspended from a hook under the aitchbone, the leg protruding at right angles.

The silverside (outside) is not improved to the same extent as the above cuts, while the blade roll (chuck tender) is not affected at all. The fillet (tenderloin) becomes a little less tender but this is not sufficient to affect the acceptability. The percentage yield of cuts is not affected. A possible disadvantage is that butchers and boners may have to adapt to the new shape of some of the stretched muscles.

Other Methods of Producing Tenderness

There are other methods of making meat tender, although they are not used in Papua New Guinea. Both beef and mutton can be tenderized by subjecting muscle from freshly slaughtered animals to very high pressure for short periods. Pressures of the order of 1,000 atmosphere (15,000 psi) applied for about 2 to 4 minutes have given marked improvements in tenderness.

It has been known for some time that meat may be tenderized by injecting solutions of enzymes, such as papain, into the blood stream a few minutes before slaughter. Proteolytic enzymes such as papain can also be injected into selected parts of the carcass after slaughter.

Conclusion

In butcher's language, a beef carcass is described in terms of conformation, finish and quality. To the butcher the beast with the best conformation is one which will yield a large proportion of valuable joints and a small proportion of bone. 'Finish' refers to the external covering of fat. The quality of the meat depends on the condition of the muscle and is associated with the texture. This depends on the size of the muscle bundles and the quantity of connective tissue.

A large number of factors influence this quality in beef and among the more important are: breed, condition, age, sex, activity, pre-slaughter and slaughter conditions, and finally the methods of storage. A number of these are, of course, interdependent, but they all exert an important influence on the final product.

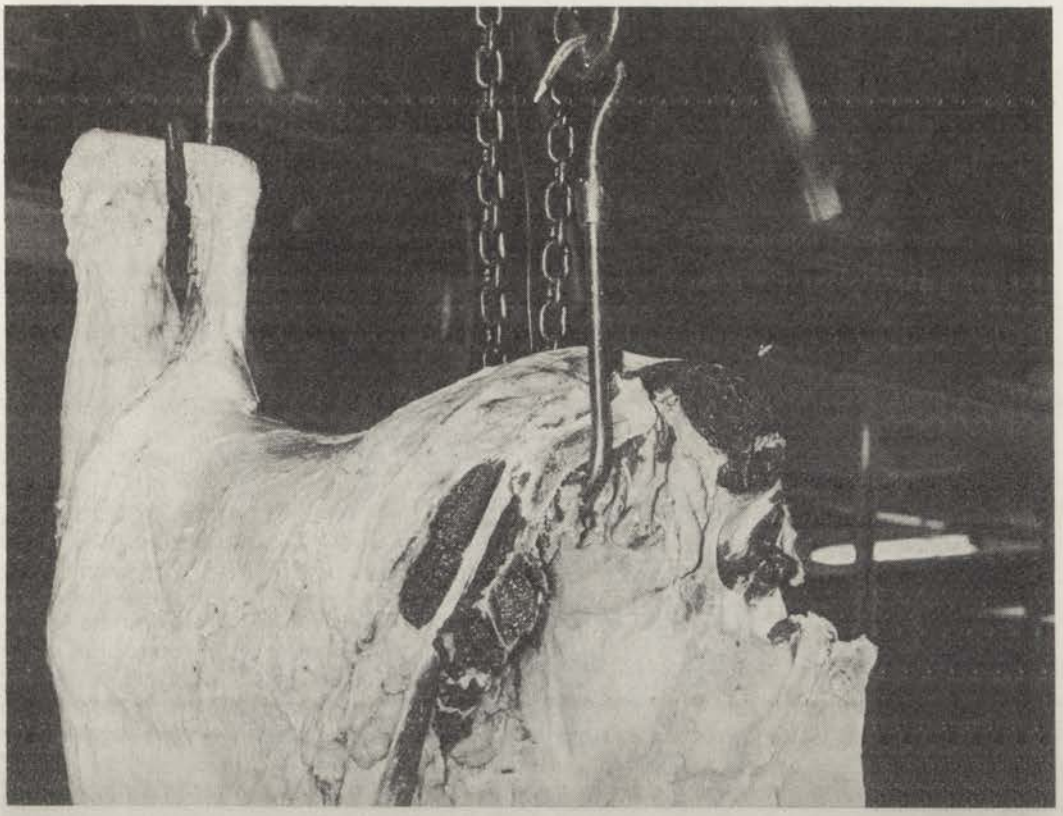

Plate III.—If preferred, the side may be suspended from both the aitch-bone and the Achilles tendon.