

Age and tenderness

Dr Ken Drew, head of deer research at AgResearch Invermay, expands on research into the relationship between age, sex and venison tenderness.

VENISON FROM older stags is less tender than that from 1 and 2-year old stags, but animal age does not seem to influence tenderness in meat from hinds.

This is a conclusion from a wide range of information covering stags ranging in age from one to eight years and hinds from one to 21 years.

People buy red meat by its appearance — especially colour — but like or dislike it mainly based on tenderness. Factors like texture, juiciness and flavour are also important, but the dominant aspect is tenderness.

Work by Invermay AgResearch in association with the Otago University Department of Consumer and Applied Science has shown that taste panel assessments of tenderness and texture in venison show good agreement with the MIRINZ tenderometer measurements.

It has therefore been possible to use the tenderometer as the main means of measuring venison tenderness.

Meat ultimate pH is a major factor in appearance, quality and shelf life. Most venison has an ultimate pH of between 5.4 and 5.7. Anything above 5.9 is likely to be associated with poor keeping qualities and an unattractive dark colour, rather like



Stags three years and over yield less tender meat than 1 and 2-year olds, but there appears to be no change in tenderness in venison from hinds with increasing animal age

the well-recognised dark, firm and dry beef — a poor product.

Factors affecting pH in venison

Stress in deer from transport to the slaughter plant or in animal management before slaughter at the plant can cause the small quantity of glycogen (carbohydrate) to be burned up in the body.

Post mortem, the glycogen depletion means less acid production in muscles. The result is high pH meat (greater than 5.9) with very poor keeping quality and poor, very dark colour.

In one case, an animal in a very

distressed state produced meat with an ultimate pH of 7.15. While the meat was extremely tender (almost mushy) it was extremely dark and taste panel members singled it out as having an objectionable "off" flavour.

Pre-slaughter handling in the deer yards, on the truck and at the plant must be done to a very high standard to avoid high pH meat.

Electrical stimulation straight after stunning dramatically increases the reduction in pH after death. In past work at Invermay non-stimulated carcasses from Red, Wapiti and Fallow deer took more than six hours to reach a pH of 6.0, whereas

those effectively stimulated reached pH 6.0 one to two hours after slaughter.

Cold shortening leads to tough meat and to avoid that MIRINZ work has shown that meat needs to reach a pH of less than 6.0 before the carcass is subject to chilled temperature.

Electrical stimulation is thus an insurance policy to reduce pH rapidly, and it is most important that the machinery is working properly and good electrical connections made from carcass to rail. MIRINZ has recently produced equipment to ensure effective carcass stimulation.

One of the consequences of high pH in venison is extremely poor appearance. The problem rapidly worsens the longer the chilled storage time.

Because consistency of quality is very important in a product like Cervena, a few pieces of venison from a high pH carcass could compromise a whole box of product.

One way of avoiding high pH meat would be to measure each carcass as it goes across the weigh bridge and put the small number of high pH carcasses onto a detain rail.

Measuring tenderness

Meat tenderness can be measured with a machine which records the force (kgF) required to shear or penetrate a piece of meat cooked to stringent specifications.

In practice, extremely tender meat will give a 2 kgF reading, while extremely tough meat can reach more than 20 kgF.

The specifications for chilled Cervena stipulate that product should be aged for 21 days at minus 1 deg C and show an average tenderness figure of not more than 5 kgF. No part should be greater than 10 kgF, while 95 per cent of all samples will have values of 8 kgF or less. Different muscles also show different tenderness values.

Factors affecting tenderness

Are there differences in tenderness between deer strains or species?

Table 1 shows tenderness measurements across four deer types (striploin and Denver leg cuts) from 2-year old males. All groups show very favourable tenderness values, with Fallow venison being exceptionally tender.

Breed/species	Tenderness (kgF)
Fallow (yearling)	3.1
NZ Red (2 years)	4.8
Wapiti hybrid (2 years)	5.4

	Tenderness (kgF) — no ageing	
	Non-stimulated	Stimulated
Red 15 month stags	10.5	5.3
2-year stags	11.7	6.5

Mix of strain/species/age	Tenderness (kgF)	
	Striploin	Denver
	3.3	5.0

Age (years)	Tenderness (kgF) — Red deer	
	Stags	Hinds
1	5.2	4.2
2	4.9	4.0
3	6.2	4.8
5	6.7	4.7
7	N/A	4.4
8	7.2	N/A
13	N/A	4.7
21	N/A	3.5

1 and 2-year old Red stags	Tenderness (kgF)	
	Fresh	Frozen/thawed
	4.75	3.75

How important is effective electrical stimulation?

This is absolutely vital, as shown in Table 2. Toughness values are almost halved by stimulation.

What about venison cuts?

Denver leg cuts are generally a bit less tender than the premium value striploin cuts (Table 3). However Denver legs with a tenderness value of 5 are very tender and are excellent for top-class restaurant meals.

Is animal age or sex important?

This is an important issue because there are age limitations on animals for Cervena (Table 4). Based on these data, stags give less tender meat from three years and above when compared with 1 and 2-year olds, but there appears to be no change in tenderness in venison from hinds with increasing animal age.

There may well be reasons other than tenderness, such as meat yield, to discriminate against carcasses

from very old culled hinds. There is a very clear reason to discriminate against carcasses from older culled velvet stags, as the venison from these older stags is less tender.

Does chilled storage time affect tenderness?

Research has shown that tenderness values in vacuum packed striploins from yearling Red deer held at 0 deg C declined by about 0.5 kgF over 12 weeks — that is, they became more tender with storage time.

Does freezing and then thawing affect tenderness?

Limited information from 1 and 2-year old Red deer suggests that a freeze/thaw does improve venison tenderness as shown in Table 5. However, thaw temperature and therefore the rate of thawing may also influence tenderness.

Implications for the venison industry

Carcass pH is an excellent indicator of problem carcasses, and it is entirely possible to measure it on line before the carcass is placed in a chiller.

A beef plant in South Africa putting through 500 animals/day where everything is hot boned has installed pH measuring equipment at the carcass weighbridge. Carcasses with a pH greater than 5.9 are placed on a detain rail and cold boned the following day.

New Zealand's top quality Cervena is marketed in North America mainly to hotel and restaurant executive chefs. The colour of venison before it is cooked is not likely to be a major issue as long as the chef is confident that a top quality meal can be produced for the customer.

However, when venison is sold in display packs through upmarket delicatessens, or more importantly test marketed in Asia, good colour will be vital to future sales.

If cull stags from the NZ velvet herd are used to increase venison production they must be carefully marketed and separated from "young farm-raised" venison.

On the other hand, cull hinds can confidently be marketed for tenderness. The really important point is that the Game Industry Board's quality management programme already in place is well able to manage the issues of venison pH and tenderness. □