VENISON PROCESSING, PACKAGING AND STORAGE

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INTRODUCTION

The new marketing strategy announced recently by the Game Industry Board (GIB, 1992) for farm-raised venison brings into focus the need to develop improved and new procedures to handle venison production. During the last year there have been massive changes in the number of hinds slaughtered for venison It is important to review what we know and don't know about product and product handling in this rapidly developing industry.

PROCESSING

1 Slaughter animals

The scale of female slaughter is shown in Table 1

Table 1. Deer slaughtered 1989/9 - 1991/2

	Males	Females	(% total)	Total
1988/89	76,000	7,000	(8)	83,000
1989/90	71,000	30,000	(29)	101,000
1990/91	103,000	55,000	(36)	158,000
1991/92	126,000	132,000	(51)	258,000

It is obvious that much of the 68% increase in slaughtered deer over the 4 years is in females The carcasses are small and difficult to market. If the national breeding herd is 750,000 and assuming a very conservative 80% calves at weaning and allowing for a 10%/year growth in the herd we could expect to slaughter about 150,000 females per year for venison Since slaughter of substantial numbers of females for venison is not going to go away we need planning and carcass information One of the obvious things that should be done is for farmers to use large terminal sires such as wapiti hybrids over a proportion of hinds The female hybrid progeny could all be slaughtered at a young age producing carcasses in the 55-60 kg highly preferred weight range

Recent work has shown that mature stags slaughtered after the rut when they have mobilised most of their body fat give carcasses which are tougher than those slaughtered pre-rut The difference may be due to the removal of fat layers which protect the carcass from cold shortening or toughening It may also be partly due to the amount and solubility of collagen resulting from the self-imposed feed intake reduction during the rut (Stevenson *et al* 1992).

2 Sex and age in relation to venison quality

Research has been done from Invermay with stags and hinds of various ages to examine venison quality Figure 1 shows the distribution of age and hot carcass weights Each group comprised 5 animals with the exception of 2-year-old stags where there were 15 animals ranging widely in weight Carcass weight in hinds ranged from 39 kg to 62 kg while stag carcasses ranged from an average of 61 kg in yearlings to 119 kg in 8-year-olds

All animals were slaughtered in late summer and fatness is shown in Figure 2 Stags older than 3 years were very fat and fatness increased with age Group average GR values in hinds show increases with age but rate of increase was not as high as in stags This information, however, masks the effects of carcass weight Above a carcass weight of 55 kg in hinds there was a massive increase in fatness (Figure 3) which was not well related to age The four hinds with the greatest GR values (and heaviest carcasses) comprised two 13-

year-olds, one 5-year-old and one 3-year-old At similar carcass weights hinds were generally fatter than stags and hence would be expected to have lower saleable meat yields. Exporters will have commercial information about yield from hind carcasses In this study 16% of the hinds graded AD (damaged) and this was mainly due to bruising

While carcasses from hinds may yield less saleable venison than from stags there is no evidence that meat tenderness is inferior In fact rather the reverse Figure 4 shows that topside and striploins from hinds remained uniformly good in tenderness even when animals were as old as 13 years Meat from 5- and 8-year-old stags was less tender than that from young stags or any hinds While venison from hinds may be difficult to market because of small carcasses or poor yield, quality appears to be very good

3 Age and venison colour

Venison is perceived to be a dark meat, especially after prolonged storage and this may be detrimental to consumer acceptance Hunt and Kropf (1985) have shown that meat colour is important for product acceptability. Colour is complicated to measure but Stevenson *et al* (1991) found that a portable Chroma meter (Minolta CR200b) could be used as a satisfactory substitute for a trained panel in assessing meat colour and that the instrument was about as good as a sophisticated Hunter Labscan 6000 machine

Carcass colour does change with age and the Chroma meter was used to measure carcass colour in neck muscles on 87 stags slaughtered in the spring/summer and 129 slaughtered in winter All animals were of known age and ranged from 1 to 8+ years. "Redness" was measured ("a" values) on all carcasses With this measure high values are more red, low values more brown and values less than 12 are usually considered to be "brown" Figure 5 shows that the redness value in spring/summer slaughtered deer gave excellent discrimination by age At a critical "a" value of 15 3 none of the 40 young animals (<3 years of age) would be misclassified as >2 years and only one animal out of the 47 which were >2 years of age would have been misclassified as young Practical age prediction from redness is not as good in winter slaughtered deer (Figure 6) where there was about a 10% error rate Age discrimination in winter slaughtered stags may be less important than pre-rut because fewer young stags in the future will be held until winter before slaughter. A limited amount of data suggests that carcass redness would not be a good way of establishing age in hinds because animals as old as 13 years had "a" values of about 17 5 If the industry wants to move towards carcass grading by age in stags then the portable chroma meter machine could be used on line in DSPs

PACKAGING AND STORAGE

Chilled product

As export venison volumes increase at a rapid rate more of the product will be chilled rather than frozen and this will be reinforced by the new marketing strategy aimed at USA in early 1993 Quality factors of careful animal handling to and in the DSP yards, clean processing in the plant and meticulous storage at -1°C during transport are essential to achieve best recognition by the consumer (Drew *et al.* 1991). Controlled atmosphere packaging (CAP) of meat using CO_2 has been shown to extend the shelf life of chilled lamb and the "CAPTECH" system developed by MIRINZ is now a commercial product (Gill 1986) When CO_2 CAP systems were compared with vacuum packed (VP) venison loins the VP meat was of acceptable quality after 18 weeks of chilled storage, and the CAP system contributed no additional benefit (Semen *et al* 1989)

Frozen product

Bulk frozen venison has been a significant export product mainly to Germany for many years While there is a strong and appropriate move towards more chilled and less frozen venison a range of new retail frozen packs can be made. The shelf life of frozen venison has been commercially assumed to be at least 2 years. This practise does not conform to generally recognised standards for other frozen red meats and has been criticised as being misleading and misrepresenting the product to intending customers Research at Invermay was done to measure changes in venison quality over a 28 month period Two storage temperatures (-12°C and -18°C), and 2 packaging films (oxygen permeable and impermeable) were examined The only effect of storage temperature was that venison stored at -12°C had slightly more lipid-oxidation (measured as TBA

values) than that stored at -18°C). There were no important changes in microbial counts during the 28 month period and mean levels were between 2 and 3 4 $\log_{10}$ c f u /g The incidence of leaking packs ("leakers") varied with time but was much higher in retail-ready portions in impermeable film (40-70%) than retail-ready permeable packs (35-45%) or whole muscle packs (4%)

Surface colour of frozen portions deteriorated very quickly with storage time such that colour score on a 0-5 (5 = bright fresh) scale decreased from about 4 to 2 in 12 months of storage and remained about that value for the rest of the trial After packs were thawed, opened and let bloom for 30 minutes the whole muscle surface colour was bright red (4 5 units) decreasing to slightly brown after 28 months of storage The retail ready portions after opening were moderately brown and showed no real change during 28 months of storage. Product tenderness did not change with length of freezer storage

CONCLUSIONS AND FUTURE OUTLOOK

Progress in further processing of venison is developing fast and this can be expected to continue at an even faster rate. World trends are moving very rapidly towards convenient partially-cooked meat products which can be processed in 2-3 minutes in a microwave oven In 1983 the US chicken industry was cutting and further processing only 19% of its product By 1990 the figure had climbed to 77% and is expected to reach 82% by 1995 The wider US market for convenience pre-cooked meat products is expected to increase from $100M in 1989 to $5,000M in 1995 What does this meat for NZ farm-raised venison? We start with a top quality inspected and audited product which can be brand-labelled to guaranteed quality standards That is the starting point from which to build a whole range of new top-value customer products as well as servicing the existing restaurant and hotel trade. These trends will assist in addressing the problems of small carcasses and add value which can be captured by people from the deer farm to the point of international transport Partial cooking of some products pre-sale before microwave cooking in the home will remove the problem of dark venison colour and inject quality control at the partial cooking step so that there is minimal opportunity for the consumer to damage eating quality in the final cooking step Our present knowledge of packaging and storage of venison is a starting point but a great deal of innovative technology will be needed to capitalise on the opportunities

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