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THE QUALITIES OF RAM CARCASSES

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SUMMARY

Carcasses classified as rams fetch the lowest price of all unblemished carcasses sold in New Zealand. Ram carcasses contain more muscular tissue at any carcass weight than ewe carcasses. Rams over 1 year of age have a higher proportion of forequarter than ewes, but the importance of this observation is questioned because of the contribution of fat to the difference.

Laboratory and consumer taste panels gave no evidence for any off flavours or odours being associated with the meat from mature rams. Loin meat from the rams was tougher than that from ewes but leg roasts from two-tooth rams was highly acceptable.

The results in total were used to support the case that the carcasses of rams of more than 2 years of age should be as suitable as those from ewes for manufacturing purposes and that the regulations preventing the sale of ram hogget carcasses as cuts on the New Zealand market appear unjustified.

A LARGE NUMBER of experiments both overseas and in New Zealand have shown that the carcasses of ram lambs contain more meat and are of similar conformation and palatability to wether or ewe lamb carcasses (Walker, 1950; Clarke, 1965; Robertson, 1966; Kirton, 1968; Rhodes, 1969; Field, 1971). Ram lambs may be graded "First", for consumption in New Zealand (Anon. 1962) and most ram lambs will grade for export; about 3,000 were downgraded to the "Ram" grade in the 1970-1 season (N.Z. Meat Producers Board (pers. comm.)). Yet the Meat Board has indicated that there is no place for ram lambs on the United Kingdom market (Polson, 1971).

As the least valuable unblemished carcass produced by farmers comes from the ram of more than 12 months of age (hereafter designated "mature ram") plus downgraded ram lambs (Table 1), it seemed worth while to collect data on older ram carcasses to see whether the market prejudices were justified. Bradford and Spurlock (1964) investigated the carcass quality of 15- to 16-month rams run in 2 locations and found that the yearling rams had 1 to 2% more forequarter than similarly-aged wethers. At one location there was little difference in palatability between the rams and wethers except that the rams had slightly

TABLE 1: CARCASS SCHEDULE PRICES FROM A NORTH ISLAND FREEZING WORKS, 1970-1

<i>Carcass Type</i>	<i>Price</i>	
	<i>cents/kg</i>	<i>(cents/lb)</i>
Beef ¹	59.7-52.9	(18-24)
Lamb	24.3-46.3	(11-21)
Hogget	19.8-26.5	(9-12)
Goat	17.6-26.5	(8-12)
Wether (22-29 kg)	11.0-22.0	(5-10)
Ewe (22-29 kg)	8.8-22.0	(4-10)
Ram (any weight)	2.2- 4.4	(1-2)

¹ Ranging from young steers and heifers to old cows and bulls.

tougher loins whereas at the other location the heavy ram carcasses (averaging 45 kg; 99 lb) were tougher than the wethers. Rhodes (1969) noted that 4- to 6-year-old rams had been tasted at the British Meat Research Institute without evidence of the type of taint found in boar carcasses, whereas, at the CSIRO Meat Research Laboratory, taste panels have detected a ram flavour (Anon., 1970b).

ANNUAL PRODUCTION OF MATURE RAM MEAT AND POTENTIAL RETURNS

Included in the National sheep flocks at June 30, 1970, were 992,000 rams and 329,000 ram hoggets (Anon., 1971). After allowance for deaths, the latter figure suggests that approximately 300,000 young rams are being kept annually to replace old rams that can then be slaughtered, with the balance of the young rams not selected also being culled for slaughter. In 1970, just under 100,000 rams were slaughtered at abattoirs and meat export works (Department of Agriculture, pers. comm.) with an estimated mean carcass weight of 26 kg (57 lb). This suggests by difference from the earlier statistics that approximately 200,000 rams are slaughtered annually on farms to supply food for dogs, or, in the case of hoggets and yearlings, for home consumption. Some of these rams may also be converted to wethers by late castration.

As farmers receive one-half or less the return per unit weight of ram carcass than from similar weight ewes or wether carcasses (Table 1), it is interesting to speculate on the potential returns from ram meat. In making comparisons with ewe mutton, it should be borne in mind that round 65% of this product is used for manufacturing pur-

poses (N.Z. Meat Producers Board, pers. comm.) so the suitability of ram meat for export should be considered on a similar basis. Anon. (1970a) indicated that ewe mutton carcasses in the 22 to 29 kg range (49 to 64 lb) returned in 1968-9 an average f.o.b. price of 15 to 20 c/kg (7 to 9 c/lb) and a limited amount of ram meat including boneless trimmed meat and carcasses was exported at 24 c/kg (11 c/lb). If 300,000 ram carcasses were slaughtered for export and sold at 18 c/kg (8 c/lb) f.o.b., this should yield more than \$1 million annually provided overseas buyers consider that ram carcasses are as suitable as mutton carcasses for some purposes. These calculations make no allowance for a potential additional return for the sale of ram testes, which in the U.S.A. for example are sold as lamb fries retailing at up to \$1.50/lb (Barton, 1971).

RED MEAT CONTENT

The complete dissection of 212 ewe and ram carcasses of the Romney and Southdown breeds and their cross was undertaken by Fourie *et al.* (1970) at Ruakura. The results showed that at all carcass weights from birth to maturity, ram carcasses contained on average more meat and bone and less fat when compared at the same weight as ewe carcasses. At the mean carcass weight for mature ram slaughterings (26 kg; 57 lb) the relative composition of ram and ewes carcasses, respectively, for the various tissues was: fatty tissue, 31.3%, 39.0%; muscular tissue, 53.9%, 50.0%; bone, 9.5%, 7.8% (the remainder being tendon and waste). These figures suggest that for manufacturing purposes at least, ram carcasses should be as valuable as ewe carcasses provided there is no off flavour or odour associated with the meat.

CARCASS CUTOUT DATA

EXPERIMENTAL

The carcasses of 19 each cull ewes and rams slaughtered at the Ruakura abattoir were used. Seven two-tooth, 4 four-tooth, 4 six-tooth and 4 eight-tooth animals of each sex were chosen and all were Romney except for 3 of the oldest rams which were Border Leicester-Romney \times Corriedale. The carcasses were removed from a freezer after a few days' storage, weighed, and split down the vertebral column with a meat bandsaw, and the halves weighed. The left half of each carcass was jointed as de-

scribed by Kirton *et al.* (1967) except that the loin was always removed by a cut between the last thoracic and first lumbar vertebrae. The joints were weighed and then the kidney and the perinephric fat were removed from the loin and weighed separately. Joints, including the loin without perinephric fat and kidney, were expressed as a percentage of the left side weight. Measurement C (Palsson, 1939) was also taken, as was a subcutaneous fat thickness over the mid-point of the gluteus medius muscle (L3), where the leg was removed from the loin.

Differences between the means of the percentage cutout data were tested for significance by analysis of variance. Age of animal was not considered in the analysis because inspection of the data indicated no increase in cutout differences with increasing age over the range covered in this experiment.

RESULTS

The cutout data are given in Table 2. The ram and ewe carcasses were of similar mean weights and were light in comparison with the national mean weights of such carcasses. The rams had a higher proportion of neck, shoulder and breast and shank which supports the commonly heard

TABLE 2: CUTOUT DATA FROM RAM AND EWES CARCASSES (19 animals/group)

Item	Mean		S.E.	Ram-Ewe diff.
	Ram	Ewe		
Frozen carcass (kg)	19.2	19.3	—	-0.1
% Neck	5.8	4.2	0.24	1.6**
% Shoulder	23.4	22.2	0.45	1.2**
% Breast and shank	10.1	7.7	0.32	2.4**
% Ribs	10.8	11.8	0.44	-1.0*
% Forequarter	50.1	45.9	—	4.2
% Flap	6.8	8.5	0.30	-1.5**
% Loin	10.1	11.8	0.32	-1.7**
% Leg	30.4	30.1	0.53	0.3ns
% Perinephric fat	1.8	3.0	0.16	-1.2**
% Kidney	0.6	0.5	0.04	0.1ns
% Hindquarter	49.7	53.7	—	-4.0

¹ Normally about half the flap is included in the forequarter but here it is all included in the hindquarter.

** $P < 0.01$; * $P < 0.05$; ns = Not significant.

belief that rams have a higher proportion of forequarter. The ewe carcasses had a higher proportion of ribs, flap, loin and perinephric fat, all of which are indicative of a higher carcass fat content. The leg, which is a valuable lean cut, did not differ between the sexes. The subcutaneous fat thickness (C) over the loin averaged 2.2 mm for the rams and 5.7 mm for the ewes and the leg subcutaneous fat thickness (L3) averaged 4.1 mm for the rams and 12.0 mm for the ewes.

LABORATORY TASTE PANEL DATA

EXPERIMENTAL

Loins were removed from 10 two-tooth ram, 10 two-tooth ewe, 10 older ram and 10 older ewe carcasses. The older ewes and rams were balanced for age on the basis of teeth and comprised 3 six-tooth animals and 7 eight-tooth animals. The carcasses were held in a chiller for 2 days before the loins were removed and frozen.

Samples of the longissimus dorsi muscle were removed and cooked as described by Kirton (1970) and served to a panel of 9 tasters. Two ewe and 2 ram samples were cooked in 4 electric frying pans following the methods of Kirton (1970) with the sheep sexes at any sitting being paired on the basis of age. Panel members were served 4 samples at any sitting and asked to score them independently for overall preference, tenderness, flavour and juiciness on the 9-point hedonic scale of Peryam and Pilgrim (1957). The preferences were converted to a numerical scale in which the higher the scores for any characteristic, the better the meat is liked. The data were statistically analysed by analysis of variance in a manner similar to that described by Kirton (1970) with age (two-tooth or older), sex (ram or ewe) and age \times sex interaction mean squares being tested for significance against the variation between carcasses within age-sex groups (36 d.f.).

RESULTS

The laboratory taste panel results are given in Table 3. Although most of the panel scores are round the mid-point of the hedonic scale (score 5), too much notice should not be taken of the relatively low scores because the meat was not cooked by a normal method for home use and was served without the normal additives such as gravy or mint sauce. The emphasis should be placed on the comparative ratings.

TABLE 3: LABORATORY TASTE PANEL SCORES
(10 animals/group)

	Rams		Ewes		Sex Diff.	Age Diff.
	2-tooth	Old	2-tooth	Old		
General preference	5.38	4.80	5.54	5.81	ns	ns
Tenderness	5.13 ^a	3.73 ^c	6.50 ^b	6.13 ^{ab}	**	*
Flavour	5.90	6.18	5.62	6.04	ns	ns
Juiciness	4.52 ^{ab}	3.99 ^a	4.83 ^{ab}	5.28 ^b	**	ns

^{a b c} Means with the same superscript do not differ significantly when tested by the multiple range test (Duncan, 1955).

** $P < 0.01$; * $P < 0.05$; ns = Not significant.

In terms of overall preference of the meat, it was surprising that there were no significant differences between the 4 classes of meat even though the old ram meat was liked least. With larger numbers of carcasses the old ram meat may have scored lower than the highest of the remaining means but there was no indication of any difference between the remaining three classes.

However, the meat from the old rams was undoubtedly tougher than the meat from the remaining animals, and the meat from the young rams, while more tender than from the old rams, was significantly tougher than from the young ewes. This was the only difference that showed up when comparing the meat from the two-tooth sheep of different sex. Tenderness was the only characteristic where the meat from the younger animals showed up as differing from the older ones and, as expected from general results in the literature, the meat from younger animals was more tender.

Neither age nor sex had any influence on the panel scores for the flavour of the meat, but it was of interest that, if anything, the meat from the older rams scored highest for flavour, giving no indication of any off-flavour or odour being associated with the meat from male sheep.

The meat from the old rams was scored as drier than the meat from old ewes. Juiciness is normally associated with a higher fat content and as old ewes are normally fatter than similar weight old rams this might have been expected. The addition of sauces and gravies with a normal meal would tend to offset the dryness of the meat if this was regarded as a disadvantage.

CONSUMER EVALUATION OF RAM MEAT

The laboratory taste panel, while useful for measuring the presence or absence of differences, suffers from several

disadvantages. The meat from several animals is tasted at one sitting which differs from the normal household situation where the meat from only one carcass is normally purchased at the one time. The laboratory panel was not exposed to the cooking odours as much as a cook normally is in the household situation. Thirdly, the samples cooked for the laboratory panel were cubes of muscle without any of the normal covering of subcutaneous fat and, in the case of boar odour at least, the sex odour is mainly present in the fat (Craig *et al.* 1962). For these reasons, when about 400 13- to 18-month rams (progeny tested for growth rate) were slaughtered, a number of the ram legs were submitted to a taste panel (Kirton, 1968) for evaluation. The consumers were asked to roast the legs and the meat was scored on the hedonic scale of Peryam and Pilgrim (1957). In addition, the panel members had an opportunity to add comments which, for example, might include the presence of objectionable smells while cooking.

Of the 31 rams used, 8 were Merino \times Romney, 1 Border Leicester, and the remainder Romney. They averaged 19.5 kg (43 lb) in hot carcass weight (S.D. 6.1 kg). In most cases, the two legs from each carcass were allocated to different families, but with a few carcasses only one leg was tested.

RESULTS

The results from the consumer taste panel are given in Table 4. Replies were received on 55 legs that had been tasted by 106 individual tasters. The mean scores for all characteristics were very high, being of a similar order to the scores on the legs from wether and ram lambs previously reported (Kirton, 1968) and being higher than the scores reported from the legs of lamb carcasses of good and poor conformation by Kirton and Pickering (1967).

TABLE 4: CONSUMER TASTE PANEL SCORES ON TWO-TOOTH RAM LEGS
(106 Tasters¹; 55 Legs)

<i>Taste Panel Scores</i>	<i>Mean</i>	<i>S.D.</i>
General preference	7.60	1.01
Tenderness	7.25	1.13
Flavour	7.44	1.22
Juiciness	6.72	1.25

¹ Total in a few cases including the same panel member tasting 2 different legs.

No adverse comments about cooking odours were made and only two legs were given mean flavour scores on the dislike end of the scale. In both cases, the other leg from the same carcass was tasted by another family and was liked—in one case very much.

CURED RAM LEGS

As an initial study and before there was evidence of the absence of objectionable flavours and odours from ram meat, a number of legs from old rams were cured and smoked. These were allocated to staff who were asked to cook them as they would ham or corned beef and indicate how much they would be prepared to pay for them relative to corned brisket at 103 c/kg (47 c/lb) and corned silver-side at 132 c/kg (60 c/lb). Although some people did not like the cured ram meat, the bulk of the replies were in the 66 to 132 c/kg (30 to 60 c/lb) range.

DISCUSSION AND CONCLUSIONS

The present and previous results, which show a higher muscle content in rams than for ewes and the absence of any objectionable flavour or odour associated with the meat from the eye muscle or from leg roasts, suggest that ram carcasses should be at least as suitable as ewe carcasses for manufacturing purposes. In some products the ram meat should even be as satisfactory as beef. Some discount may be justified relative to ewes to allow for the greater difficulty in skinning.

The present experiment raises questions as to the justification for downgrading 1 to 2 year rams (ram hogget in meat trade terms) into the manufacturing grade for local consumption as required by regulation (Anon., 1962). Also in question is the justification for downgrading rams of this age to the "Ram" grade under the export specifications.

Although the first impression from the cutting tests given in Table 2 is that the ram carcasses were markedly inferior in conformation, a closer examination shows that ewe carcasses contain a higher proportion of kidney fat and flap, regions of very low value. In addition, ewe carcasses contain a higher proportion of loin and ribs which is an advantage only if the greater thickness of subcutaneous fat associated with these cuts does not require trimming and the consumer does not object to the generally higher level of mutton fat indicated by this fat thick-

ness. Further research is required to settle this point, but the conclusion is reached that even if it is accepted that ewe carcasses have a slightly higher proportion of high-priced cuts, the advantage is small and would justify only a very small price differential.

In terms of eating quality, the present work shows that the palatability of the loins and leg roasts of ram hoggets was acceptable; Bradford and Spurlock (1964) showed that in comparison with wethers, yearling rams were in some cases inferior. It is apparent that if any consumers in the present trial detected the ram flavour reported by Anon. (1970b), they did not judge it objectionable. While in total all the evidence might justify a slightly lower-priced grade for ram hoggets than ewe or wether hoggets of similar age, there appears to be no justification for downgrading such carcasses to the "Ram" grade at markedly inferior prices.

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