Benchmarking Northern Ireland Lamb for LMC

Linda Farmer, Terence Hagan,
David Sanderson and Alan Gordon

Agri-Food and Biosciences Institute,
Newforge Lane, Belfast BT9 5PX

Final Report, December 2017

Benchmarking Northern Ireland Lamb

Terence Hagan, Linda Farmer, David Sanderson and Alan Gordon
Food Research Branch,
Agri-Food and Biosciences Institute, Newforge Lane, Belfast

Final Report, December 2017

1. Introduction

Sales of Northern Ireland origin lamb faces strong competition from New Zealand lamb particularly immediately prior to the introduction of spring lamb on to the UK market.

Consequently the aim of the project was to determine the eating quality and acceptability of each of three sources:

1. Northern Ireland female lambs (young lamb, ca. 9-12 months).
2. Northern Ireland entire male lambs (young lamb, ca. 9-12 months).
3. New Zealand sourced lambs (ca. 4-6 months).

and to identify if sources 1 or 2 are any less acceptable than the younger New Zealand sourced lambs.

2. Experimental

Different elements of these trials were conducted at AFBI (Section 2.1) and elsewhere (Section 2.2). For completeness, all the results are reported here.

2.1. Sampling

Northern Ireland entire male and female lambs were selected from commercial production between 23 January and 3 April 2017; all animals were under 12 months of age and classed as "young lambs". The carcases were boned at 2-3 days post-slaughter. The leg and shoulder cuts were held chilled until sampling at 12-14 days for sensory panels on the fresh meat. The loin muscles were frozen at 2-3 days post slaughter immediately after boning.

Lamb from New Zealand was sampled from meat imported commercially during the same period and there was no information on gender. The animals would have been approximately 5-6 months of age at slaughter. The meat had been aged for several weeks in transit (>45 days). All samples and results were identified by a unique animal number/ kill number.

Samples were taken both for lay panels on leg and shoulder muscles and for sensory panels and consumer panels on loin.

The NI treatments sent to AFBI were from four sampling dates, during January to April 2017, with equal numbers of animals from each treatment on each date. For the imported NZ lamb, there were an equal number of samples from four different consignments. The sex of these samples was unknown, and their age would have been approximately 6 months younger than those from NI. Each loin was band-sawed when frozen into 10-12 chops. The loin chops from each animal were supplied in a vacuum pack bag labelled with the kill number.

On arriving at the Sensory Evaluation Unit at AFBI the frozen samples were first transferred to a commercial freezer at -18^{o} C freezer. For each session of consumer panels all the chops were first separated into individual chops which were then individually transferred to labelled vacuum pack bags and vacuum packed. The samples were then sorted into their assigned session/ presentation no/ consumer. As per the experimental design. A Latin square design was generated for each of the treatments by Fizz Network Biosystemes Software. An AFBI biometrician also generated a plan for assigning each specific animal of each treatment over the 120 consumers.

2.2. Odour on opening bag

During the preparation for cooking, as each of the sample vacuum pack bags were opened, two experienced AFBI staff assessed the odour emanating from the lamb cutlet for any off odours. The odours were assessed in a balanced design. The samples were scored on a *0-3 category scale*. as follows:

0= "normal uncooked lamb aroma ", 1= "hint of abnormal odour",
2 "definite abnormal odour", and 3: " very strong abnormal aroma."

2.3. Cooking

The lamb was then cooked in a commercial Rational Self Cooking Centre Oven at 180°C. When the internal temperature of a test sample inserted with the oven temperature probe reached an internal temperature of 70°C all the samples were removed. Samples were rested for two minutes, individual sample temperatures recorded and samples for possible microbial analysis taken before being served.

2.4. Consumer Panels.

Six panels of 20 consumers were conducted (120 consumers in total). Each consumer assessed a starter sample plus six test samples, two from each treatment. Each of the two samples of the same treatment served to any consumer were from different animals. They assessed each sample using 0-100 lines scales for the following attributes: lik*ing of aroma, tenderness, juiciness, flavour liking* and *overall liking*, where 100 = liked extremely, or very tender/juicy. Finally they were asked to assess the acceptability of the samples using a four point category scale as follows:

1= "unsatisfactory", 2= "satisfactory everyday quality",
3: "better than everyday quality", and 4: "premium."

Consumers were asked to cleanse their palate between sample presentations using still water and crackers provided. On completion of the consumer panels the results were scanned using the "Fizz Paper" software

2.5. Statistical Analysis.

All analyses conducted by AFBI were quality assured to the standards demanded by ISO 9001-2008. The statistical analyses were conducted by AFBI Statistical Services Branch.

3. Results

3.1. AFBI Trials - consumer acceptability of loin

Table 1 shows the results of the consumer trials on lamb loin using 120 panellists. There were no significant difference between males and females, or between NI and NZ lamb in terms of average scores.

Table 2 and Figure 1 compares the distribution of satisfaction ratings and again there is no significant difference. Thus, although the female lambs had slightly fewer "unacceptable" scores, there is no evidence of any difference in the distribution of quality scores between the different sources.

Table 1: Mean scores for hedonic assessment of lamb loin from three sources

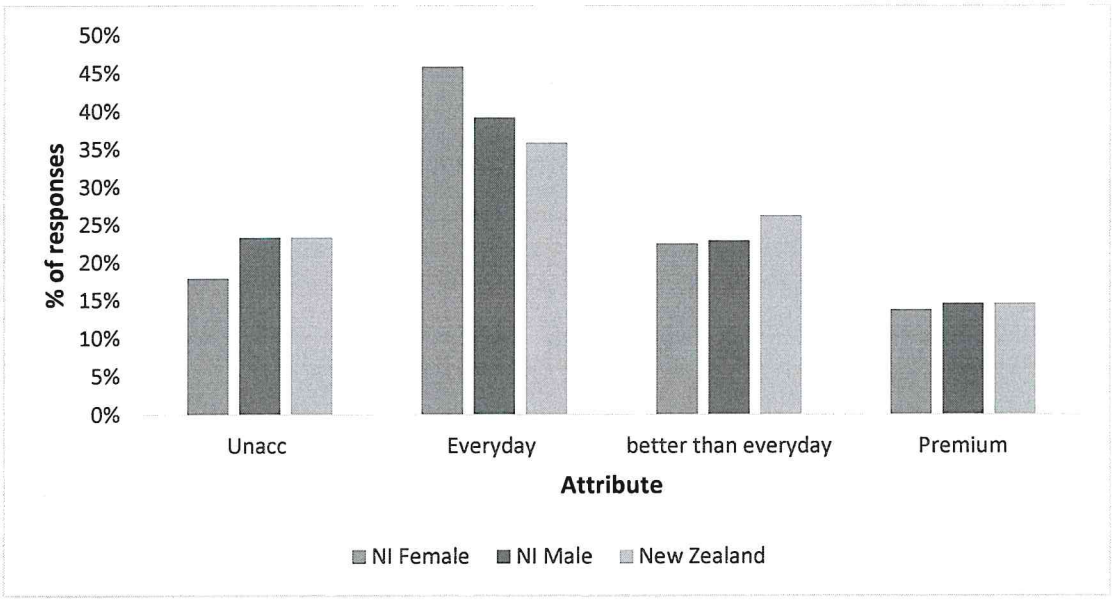
Attribute	NI Female	NI Male	New Zealand	Prob	Significance#
Liking of aroma	54.0	52.7	53.4	0.786	ns
Tenderness	57.2	57.0	57.3	0.996	ns
Juiciness	59.0	60.7	59.1	0.798	ns
Flavour Liking	57.3	56.8	57.3	0.984	ns
Overall Liking	56.8	55.8	56.7	0.929	ns

Samples were scored on a 0-100 line scale, where 100 = liked extremely or very tender/juicy. Lamb from 24 animals was assessed from each of the three sources.
ns = not significant; * = P<0.05; ** = P<0.01; *** = P<0.001.

Table 2: Frequency of satisfaction scores for each lamb source (no significant difference between treatment groups)

	Unsatisfactory	Satisfactory everyday quality	Better than everyday quality	Premium
NI Female	43	110	54	33
NI Male	56	94	55	35
New Zealand	56	86	63	35

Figure 1: Percentage scores for each of the four satisfaction categories



The breakdown of the scores by lamb gender /country and sampling date is shown in Appendix 1. This shows that there was some variation but, again, no significant differences between dates or sources.

Table 3 presents the results of an ad hoc assessment of the odour of the packs of raw lamb on opening by two assessors. The results show that 3, 8 and 11 packs were found to have an off-odour by one or two assessors for NI female, NI male and New Zealand lamb, respectively.

Table 3: Odour Scores on opening of vacuum bags containing individual thawed lamb cutlets.

NI Female	Tester 1	Tester 2	Description	NI Male	Tester 1	Tester 2	Description	New Zealand	Tester 1	Tester 2	Description
no.				no.				no.			
1	0[b]	1		25	0	1	ram note	49	0	0	
2	0	0		26	0	0		50	0	0	
3	0	0		27	0	1		51	0	1	
4	0	0		28	0	1		52	0	1	
5	0	0		29	0	1		53	0	0	
6	0	0		30	0	0		54	0	0	
7	0	0		31	0	1		55	0	1	ram note
8	0	0		32	0	0		56	0	0	
9	0	1		33	1	0		57	0	0	
10	1	1		34	0	0		58	0	0	
11	0	0		35	0	1	ram note	59	0	0	
12	0	0		36	0	0		60	0	0	
13	0	0		37	0	0		61	0	0	
14	0	0		38	0	0		62	0	0	
15	0	0		39	0	0		63	0	1	
16	0	0		40	1	0		64	0	1	
17	0	0		41	0	0		65	0	1	
18	0	0		42	0	0		66	0	0	
19	0	0		43	0	0		67	0	1	
20	0	0		44	0	0		68	0	2	sweet and lamb
21	0	0		45	0	0		69	0	1	
22	0	0		46	0	0		70	0	1	
23	0	0		47	0	0		71	0	0	
24	0	0		48	0	0		72	1	1	

[b] *0= normal uncooked lamb aroma, 1= hint of abnormal odour, 2 =definite abnormal aroma, 3 =very strong abnormal aroma*

4. Discussion

4.1. Sensory quality

The consumer trials found no significant differences between NI Female, NI Male and New Zealand lamb for *liking of aroma, tenderness, juiciness, flavour liking* or *overall liking* (Table 1) or the distribution of satisfaction scores (Table 2, Figure 1). It must be noted that the two NI samples were frozen at 2-3 days post-slaughter while the "control" samples from NZ had been aged in transit, so this comparison was not of "like with like". This means that these trials demonstrate that the NI lamb, whether entire male or female and even with minimal ageing, was not less acceptable than the imported NZ lamb.

The consumer trials on lamb loin found that there were no significant differences between any of the weeks of collection, either within sources or between sources (Appendix 1). Although some apparent differences were observed, these were not greater than the variation within each lamb gender/country and, therefore, were not statistically significant.

None of the consumer panels conducted showed any difference between NI male and female lambs. There is no evidence from these samples that meat from male lambs is less liked than that from female lambs at 9-12 months of age.

4.2. Odour on opening

Only one sample was rated as having a definite abnormal odour (a NZ lamb sample) while 21 were rated as having a "hint of abnormal odour" (3 female, 8 male and 10 NZ), out of a total of 72 lambs. These abnormal odours were variously described by as "ram note" or, in one case "lamb, sweet". Only two of these samples were agreed by both assessors (Table 3). The female lambs appeared to have fewer incidences while the highest incidence (11 out of 24 animals) was in the New Zealand lamb, possibly related to the longer ageing period. Thus the majority of the raw lamb samples had no abnormal odours.

5. Conclusions

The consumer comparisons show that loin meat from NI lamb, harvested at just under 12 months of age, without ageing, was of equal acceptability to New Zealand lamb imported at the same date, despite the fact that NZ lamb was only 4-6 months at slaughter and was aged for at least 45 days.

There is no evidence that loin meat from male lambs is less liked than that from female lambs at 9-12 months of age.

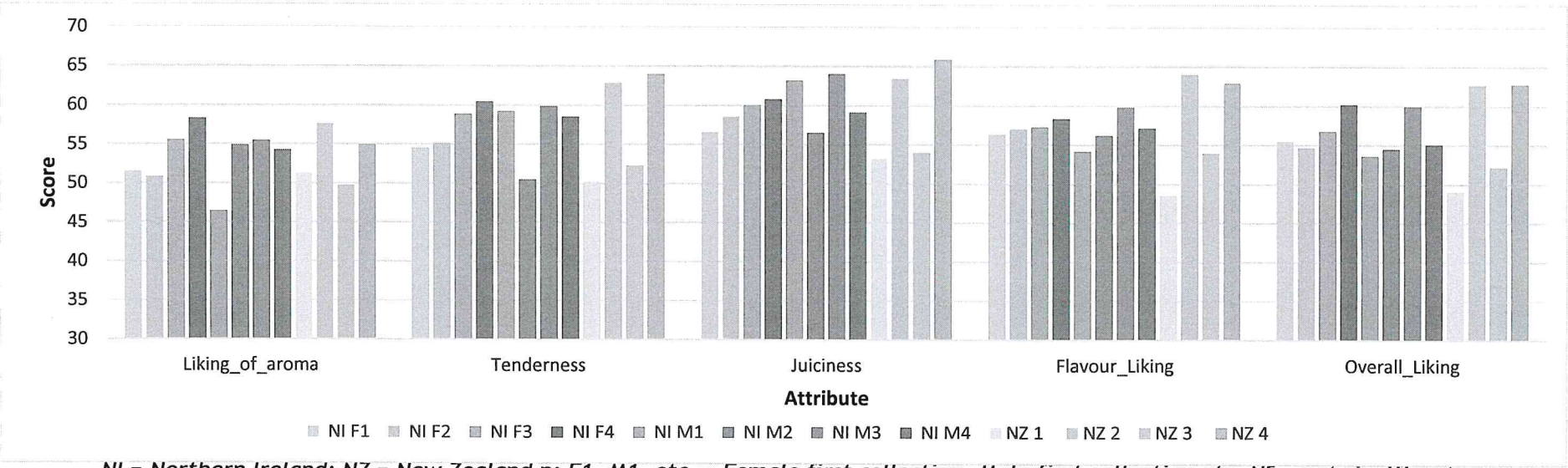
Appendix 1

Table i: Mean attribute score for each lamb source on each of the four collection dates (NS between dates or sources)

	NI F1[a]	NI F2	NI F3	NI F4	NI M1	NI M2	NI M3	NI M4	NZ 1	NZ 2	NZ 3	NZ 4	Sig
Liking of aroma	51.5	50.8	55.5	58.3	46.4	54.9	55.5	54.3	51.3	57.6	49.8	54.9	*ns*
Tenderness	54.5	55.1	58.8	60.4	59.2	50.5	59.9	58.5	50.2	62.8	52.3	64.0	*ns*
Juiciness	56.5	58.5	60.0	60.8	63.2	56.5	64.0	59.1	53.2	63.4	54.0	65.9	*ns*
Flavour Liking	56.3	57.0	57.3	58.4	54.2	56.2	59.8	57.1	48.5	64.0	54.0	62.9	*ns*
Overall Liking	55.5	54.7	56.8	60.2	53.6	54.5	60.0	55.1	49.0	62.7	52.2	62.8	*ns*

NI = Northern Ireland; NZ = New Zealand n; F1, M1, etc. = Female first collection, Male first collection etc. NS = not significant.

Figure i: Mean attribute score (0-100) for each lamb source on each of the four collection dates (NS)



NI = Northern Ireland; NZ = New Zealand n; F1, M1, etc. = Female first collection, Male first collection etc. NS = not significant.