# An evaluation of the lamb and mutton carcase grading system in the Republic of South Africa. 1. A survey of carcase characteristics of the different grades

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A survey of 468 lamb and sheep carcases of various breeds and crosses was conducted to investigate certain carcase characteristics. Carcases in each grade were divided into four mass groups, i.e. 10,1–15 kg; 15,1–20 kg; 20,1–25 kg and >25 kg. Four fat thicknesses, carcase and leg length, and the cold mass of each carcase were measured. Official graders scored carcases in 1/3 units according to fatness, conformation and grade for example, Super Lamb$^+$, Super Lamb, Super Lamb$^-$. The carcase mass/carcase length ratio (kg/cm) was found to be a more reliable predictor of the visual evaluation of conformation than the carcase mass/leg length ratio (kg/cm). The subcutaneous fat thickness measurement between the 3rd and 4th lumbar vertebrae, 25 mm from the midline, had the highest correlation with visual carcase fatness score. Large variation occurred for fat thickness within the mass groups as well as within carcase grades. A high percentage of the carcases were overfat in the grades Super Lamb (61%), Prime B (57%), Top C (37%), Lamb 1 (54%), B1 (51%), C1 (27%) Lamb 3 (50%), i.e. according to the fat thickness guidelines in the carcase grading regulations.

'n Opname van sekere karkaseienskappe van 468 lam- en skaapkarkasse van verskeie rasse en kruisings is uitgevoer. Karkasse binne elke graad is in vier massagroepe ingedeel, naamlik 10,1–15 kg; 15,1–20 kg; 20,1–25 kg en >25 kg. Vier vetdiktemate, karkas- en boudlengte en koue karkasmassa is bepaal. Amptelike gradeerders het karkasse vir vetheid, bouvorm en graad in 1/3 eenhede opgesom, byvoorbeeld Superlam$^+$, Superlam, Superlam$^-$. Die karkasmassa in verhouding met karkaslengte (kg/cm) was 'n meer doeltreffende maatstaf as karkasmassa tot boudlengte (kg/cm) vir die voorspelling van die visuele evaluering van bouvorm. Die onderhuidse vetmaat, geneem tussen die 3de en 4de lumbale werwels, 25 mm vanaf die middellyn, het die hoogste korrelasie getoon met die visuele evaluering van vetheid van karkasse. 'n Groot variasie in vetdikte binne massagroepe en binne grade het voorgekom. 'n Groot persentasie van die totale aantal karkasse was, volgens die vetdikteriglynnorme in die karkasgraderingsregulasies, oorvet in die grade Superlam (61%), Prima B (57%), Top C (37%), Lam 1 (54%), B1 (51%) en Lam 3 (50%) en was dus op grond van vetheid alleen foutief gegradeer.

**Keywords:** Lamb, mutton, carcase grading, evaluation, classified characteristics.

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## Introduction

In 1975 a study regarding the grading system for beef carcases was launched. This led to the new grading system for beef which was implemented in June 1981. At the same time changes occurred in the grading of lamb and mutton carcases. This was based on the results of a preliminary investigation on lamb and mutton carcases (Bruwer, 1984).

The main difference between the grading systems of 1972 and 1981 is that the 1972 system was merely a grading system while the 1981 system was a grading system based upon a classification system. Currently the South African grading system can be summarized as follows: Carcases are classified according to fatness in six different fatness classes (1 — very lean; 2 — lean; 3 — medium; 4 — fat; 5 — overfat and 6 — excessively overfat) in each of the three age groups (A age group — 0 permanent incisors (p.i.), 1 – 6 p.i. and more than 6 p.i.). Carcases are classified in five different conformation classes in each of the three age groups (1 — emaciated; 2 — flat; 3 — medium; 4 — round and 5 — very round). Carcases are then graded according to the classified principles in the different grades as shown in Table 1.

The results of Klingbiel, Naudé, Nel, Smit, Botha, Venter & Gouws (Unpublished mimeograph) showed that fatness as an indicator of carcase meat yield, and age of animal as an indicator of meat quality, were the two most important factors of significance in a carcase classification scheme. These two characteristics are used in most of the classification and grading systems in other meat-producing countries where grading is applied (Kempster, Cuthbertson & Harrington, 1982).

Results of a preliminary investigation have shown that a fat measurement taken between the 3rd and 4th lumbar vertebrae, 25 mm from the midline of the carcase is the best predictor of the visual evaluation of the carcase fatness of the four fat measurements that were investigated (Bruwer, 1984). This fat measurement was therefore included as a guideline for the different fat classes in the classification scheme (Government Gazette, 1981).

The objective of this survey was to determine the carcase characteristics of different grades of carcases and to ascertain the ability of the graders to classify carcases

**Table 1** The South African grading system

| Grade | Fatness class | Age group | V3 (mm)[a] | Conformation class | kg/cm[b] |
|---|---|---|---|---|---|
| Lamb 3, B3, C3 | 1 | A, B, and C | <1,0 | 2 - 5 | 1 = <0,13 |
| Lamb 1, B1, C1 | 2 | A, B, and C | 1,0 - 4,0 | 2 - 5 | 2 = 0,13 - <0,16 |
| Super Lamb, Prime B | 3 | A, B and C | 4,1 - 7,0 | 3 - 5 | 3 = 0,16 - <0,18 |
| and Top C | and 4 | | 7,1 - 9,0 | 3 - 5 | 4 = 0,18 - <0,19 |
| Lamb 2, B2 and C2 | 5 | A, B and C | 9,1 - 11,0 | 2 - 5 | 5 = 0,19 and more |
| | and 6 | | >11,0 | | |

[a] Measured between the third and fourth lumbar vertebrae, 25 mm of the midline on the intact carcase

[b] Cold mass as recorded divided by the carcase lenth as measured from the most distant end of the hind leg up to the lower surface of the neck next to the vertebrae

[c] Exceptions — carcases with code 2 conformation and code 3 fatness have to be graded as grade 1; and code 2 conformation with code 4 fatness have to be graded as grade 2 within the relevant age groups

correctly in the different fatness classes and grades according to the guidelines for fatness as specified in the grading regulations for reference purposes. In addition it was checked whether the reference measures used were indeed the most effective of their kind.

## Procedure

From each grade, carcases were selected on a slaughterline at the largest abattoir in South Africa and measurements taken in respect of four mass groups, i.e. 10,1–15,0 kg; 15,1–20,0 kg; 20,1–25,0 kg and >25 kg. No carcases of grade 3 for the B- and C-age group was incorporated in the sample, because these carcases were very difficult to obtain on the market. It was attempted to collect 20 carcases for each mass group and the following information was collected from each carcase:

1. Cold carcase mass.
2. Carcase length was measured on the intact carcase using the method of Moxham & Brownlie (1976).
3. Leg length was measured on the intact carcase using the method of Kirton & Pickering (1967).
4. Four fat measurements were taken on the intact cooled carcase with a calliper namely
   V1 — between the 3rd and 4th sacral vertebrae, 25 mm from the carcase midline (Barwick, 1977)
   V2 — between the 3rd and 4th sacral vertebrae, 50 mm from the carcase midline (Barwick, 1977)
   V3 — between the 3rd and 4th lumbar vertebrae, 25 mm from the carcase midline
   V4 — between the 12th and 13th vertebrae, 25 mm from the carcase midline (Kemp & Barton, 1966).
5. Age was determined by counting the permanent incisors (p.i.) prior to dressing the carcases. Carcases were then divided into one of the three age groups, namely Lamb (0 p.i.); B-age group (1–6 p.i.) and C-age group (7 p.i. and more) as indicated in the grading regulations.
6. Conformation and subcutaneous fatness scores were

Table 2 Averages and standard deviations (*SD*) of carcase mass, 'carcase thickness', 'leg thickness' and conformation score of lamb and mutton carcases in the different grades ($n$ = 468)

| Carcase characteristics | | Carcase mass (kg) | | [a]Carcase mass (kg) | [b]Carcase mass/carcase length ratio | (kg/cm) | Carcase mass/leg length ratio | (kg/cm) | Conformation score (1 - 15) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Grade | $n$ | $\bar{x}$ | *SD* | $\bar{x}$ | $\bar{x}$ | *SD* | $\bar{x}$ | *SD* | $\bar{x}$ | *SD* |
| L3 | 20 | 12,6 | 1,33 | 13,0 | 0,13 | 0,01 | 0,26 | 0,03 | 4,6 | 1,46 |
| L1 | 60 | 17,5 | 3,32 | 15,2 | 0,16 | 0,02 | 0,35 | 0,07 | 7,5 | 1,59 |
| SL | 60 | 17,9 | 3,73 | 18,0 | 0,16 | 0,03 | 0,36 | 0,06 | 9,0 | 1,77 |
| L2 | 40 | 19,9 | 2,67 | 17,8 | 0,20 | 0,02 | 0,40 | 0,05 | 8,3 | 1,34 |
| B1 | 40 | 19,8 | 2,94 | 17,5 | 0,18 | 0,02 | 0,38 | 0,04 | 7,7 | 1,74 |
| PB | 60 | 22,7 | 4,20 | 21,3 | 0,20 | 0,03 | 0,43 | 0,06 | 9,8 | 2,00 |
| B2 | 48 | 23,9 | 3,81 | 22,5 | 0,22 | 0,02 | 0,42 | 0,06 | 9,3 | 1,94 |
| C1 | 40 | 19,8 | 2,53 | 19,0 | 0,18 | 0,02 | 0,38 | 0,05 | 5,2 | 0,87 |
| TC | 60 | 22,7 | 3,92 | 22,7 | 0,20 | 0,03 | 0,43 | 0,07 | 9,2 | 1,89 |
| C2 | 40 | 25,4 | 3,60 | 24,9 | 0,23 | 0,03 | 0,49 | 0,06 | 8,3 | 1,68 |

[a]Meat Board, 1983 (National estimates) (No *SD* could be obtained)

[b]Presently used as guideline for conformation in the grading regulations

allocated to each carcase by the official graders using a 15- and 18-point scale respectively.

This survey was undertaken during the months of February 1983 – August 1983 on 468 carcases of which 180 were lamb carcases, 148 mutton carcases in the B-age group and 140 mutton carcases in the C-age group. For certain mass groups no carcases were included. This was because of the difficulty to obtain these carcases in the normal market situation where such carcases were not available at all.

## Results and Discussion

### Carcase mass

The average carcase masses for Super Lamb, Prime B and Top C were 17,9; 22,7 and 22,7 kg respectively. For Lamb 1, B1 and C1 grades the average carcase masses were 17,5; 19,8 and 19,8 kg respectively while the average carcase masses for Lamb 2, B2 and C2 grades were 19,9; 23,9 and 25,4 kg (Table 2) respectively. These figures approximated those of the Meat Board (1983), which is based on a national level, fairly closely, as shown in Table 2. It could therefore be concluded that this sample was representative of the current market situation.

**Table 3** The variation in conformation score which can be attributed to the carcase mass/carcase length ratio (M/K) and carcase mass/leg length ratio (M/B)

| | (kg/cm) | $r^2 \times 100$ |
|---|---|---|
| Lamb (0 p.i.) ($n$ = 180) | | |
| Conformation | carcase mass/carcase length | 47,65% |
| Score ($y$) | carcase mass/carcase leg length | 44,22% |
| B-age group (1–6 p.i.) ($n$ = 148) | | |
| Conformation | carcase mass/carcase length | 46,19% |
| Score ($y$) | carcase mass/carcase leg length | 47,17% |
| C-age group (more than 6 p.i.) ($n$ = 140) | | |
| Conformation | carcase mass/carcase length | 37,54% |
| Score ($y$) | carcase mass/carcase leg length | 33,94% |
| All age groups ($n$ = 468) | | |
| Conformation | carcase mass/carcase length | 39,36% |
| Score ($y$) | carcase mass/ carcase leg length | 35,99% |

### Conformation

The average carcase mass/carcase length ratios for Super Lamb, Prime B and Top C were respectively 0,16; 0,20 and 0,20 kg/cm. For Lamb 1, B1 and C1 mutton carcases the average carcase mass/carcase length ratios were 0,16; 0,18 and 0,18 kg/cm while the average carcase mass/carcase length ratios for Lamb 2, B2 and C2 were 0,20; and 0,22 and 0,23 kg/cm (Table 2a). The average 'carcase thickness' (kg/cm) increased when carcase mass increased. This was most evident for carcases in the overfat grades, i.e. Lamb 2, B2 and C2. This supports the findings of Kirton & Pickering (1967) and Cuthbertson & Harrington (1976) who found that with the accumulation of subcutaneous fat, carcases tend to have a more 'blocky' appearance and thus a higher carcase mass/carcase length ratio. There was little variation between the different carcase grades of similar fatness and mass for 'carcase thickness' (kg/cm).

The carcase mass/leg length ratio also increased as carcase mass increased (Table 2). The overfat grades, as in the case of carcase mass/carcase length ratios, had the highest ratios, although the variation in 'leg thickness', as measured by the ratios of carcase mass/leg length (kg/cm) is higher in the different grades compared to its measurement by the ratios of carcase mass/carcase length (kg/cm).

Carcases of the grades Super Lamb, Prime B, Top C, Lamb 2, B2 and C2 (fatter grades) had higher conformation scores than those of the grades Lamb 1, B1, C1 and Lamb 3 (leaner grades) (Table 2). This is a further indication that as fatness increases carcases show more blocky appearance and thus higher conformation scores (Jackson & Mansour, 1974; Hedrick, 1983).

In Table 3 the relationship between conformation

**Table 4** Averages and standard deviations (*SD*) of subcutaneous fat thickness measurements of lamb and mutton carcases in the different grades ($n$ = 468)

| Carcase characteristics | | V1 (mm) | | V2 (mm) | | [a]V3 (mm) | | V4 (mm) | | Fatness score (1–18) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Grade | $n$ | $\bar{x}$ | *SD* | $\bar{x}$ | *SD* | $\bar{x}$ | *SD* | $\bar{x}$ | *SD* | $\bar{x}$ | *SD* |
| L3 | 20 | 2,3 | 0,15 | 1,5 | 0,11 | 1,7 | 0,13 | 0,5 | 0,04 | 2,4 | 0,50 |
| L1 | 60 | 4,6 | 0,25 | 3,9 | 0,22 | 5,1 | 0,25 | 2,1 | 0,11 | 5,8 | 1,20 |
| SL | 60 | 9,1 | 0,35 | 7,7 | 0,36 | 9,0 | 0,32 | 3,6 | 0,17 | 8,7 | 1,28 |
| L2 | 40 | 18,5 | 0,53 | 14,1 | 0,48 | 13,1 | 0,32 | 8,7 | 0,27 | 13,7 | 1,77 |
| B1 | 40 | 5,8 | 0,30 | 4,3 | 0,21 | 4,9 | 0,24 | 2,6 | 0,16 | 5,8 | 1,52 |
| PB | 60 | 10,6 | 0,49 | 8,4 | 0,35 | 9,7 | 0,35 | 5,3 | 0,29 | 9,3 | 1,54 |
| B2 | 48 | 18,7 | 0,49 | 15,3 | 0,40 | 15,1 | 0,33 | 9,7 | 0,25 | 14,5 | 1,46 |
| C1 | 40 | 6,9 | 0,41 | 6,6 | 0,34 | 5,7 | 0,29 | 3,2 | 0,21 | 6,0 | 2,12 |
| TC | 60 | 6,5 | 0,29 | 6,6 | 0,24 | 8,2 | 0,27 | 4,5 | 0,19 | 8,7 | 1,38 |
| C2 | 40 | 17,8 | 0,47 | 15,8 | 0,46 | 15,2 | 0,34 | 10,9 | 0,27 | 14,2 | 1,71 |

[a] Presently used as guideline in the grading regulations

score and carcase mass/carcase length ratio and carcase mass/carcase leg length ratio is shown for each age group. The variation that occurred in conformation was best described by the carcase mass/carcase length ratios in all age groups except for the B-age group. This ratio is currently used as a guideline for the conformation score in the grading regulations. It was found to be the best objective measurement for conformation in a practical situation.

### Fat thickness

All the fat thickness measurements increased as the carcase grades increased in fatness (Table 4). Results of Veseley & Peters (1972); Kirton & Johnson (1979) and Vaught, Ringkob & Connor (1980) showed that as carcase fatness increased the subcutaneous fat thickness also increased. The average fat thicknesses for the different grades as indicated by the fat measurement currently used as a guideline in the grading regulations in comparison with the median of the guideline are as follows:

| Grade | Fatness Code | V3 (mm) | Median of guideline (mm) |
|---|---|---|---|
| L3 | 1 | 1,7 | 0,5 (< 1,0) |
| L1 + B1 + C1 | 2 | 5,2 | 2,5 (1,0 – 4,0) |
| SL + PB + TC | 3+4 | 9,0 | 6,5 (4,1 – 9,0) |
| L2 + B2 + C2 | 5+6 | 11,5 | 11,5 (>9,0) |

The average fat thicknesses for the different grades were therefore much thicker than the medians of the guidelines and several of the carcases in the different grades would be overfat. There was a large variation in the different measurements of fat thickness within as well as between the different grades as shown by the standard deviation (*SD*) (Table 4).

**Table 5** The variation in fatness score which can be attributed to the fat measurements V1, V2, V3 and V4

| | (mm) | $r^2 \times 100$ |
|---|---|---|
| Lamb (0 p.i.) ($n$ = 180) | | |
| | V1 | 73,27% |
| Fatness | V2 | 65,21% |
| Score ($y$) | V3 | 71,33% |
| | V4 | 70,91% |
| B-age group (1–6 p.i.) ($n$ = 148) | | |
| ($n$ = 148) | V1 | 61,45% |
| Fatness | V2 | 69,27% |
| Score ($y$) | V3 | 69,79% |
| | V4 | 65,84% |
| C-age group (more than 6 p.i.) ($n$ = 140) | | |
| ($n$ = 140) | V1 | 64,37% |
| Fatness | V2 | 60,08% |
| Score ($y$) | V3 | 73,96% |
| | V4 | 72,76% |
| All age groups ($n$ = 468) | | |
| | V1 | 67,32% |
| Fatness | V2 | 66,21% |
| Score ($y$) | V3 | 72,59% |
| | V4 | 70,39% |

The relationships between the visual fatness score and the different fat measurements are shown in Table 5. For lamb carcases the V1-fat measurement appeared to be the best predictor for the variation that occurred in visual fatness score (73,27%). For the B- and C-age groups as well as in the case of all age groups combined, the V3-fat measurement was the best measurement to desribe the variation that occurred for visual fatness score (69,79; 73,96 and 72,59% respectively). This fat measurement (V3) is currently used as guideline for visual fatness score of the grading regulations. Results of this study showed that V3 is still the most reliable predictor of visual carcase fatness evaluation for South African conditions. In order to find the most reliable fat measurement much research has been done by several researchers (Barwick, Evans & Thwaites, 1978; Kirton & Johnson, 1979; Thompson & Atkins, 1980 and Kempster, Chadwick, Cue & Grantley-Smith, 1986). It is quite evident from these reports, that there is no single fat measurement which can be used as a standard reference for visual carcase fatness in the various countries of the world. It would depend on the prevailing production system followed in each country concerned.

### Classification

In Table 6 is shown the frequency distribution (%) of carcases for different fat and conformation classes. The combination of fat class 3 and conformation class 3 contained most of the carcases, namely 20,09%. Of all the carcases ($n$ =468), 56,64% was classified in conformation class 3 and 32,70% in fatness class 3. This peak in distribution was also found in the MLC-classification system as well as in Australia (Moxham & Brownlie, 1976 and Kempster, Cook & Grantley-Smith, 1986).

### Evaluation of the application of the grading regulations according to the guidelines for fatness

A fatness code was allocated to each carcase in the survey according to the fat thickness measurement V3 (Table 7) and compared with the visual fatness code according to the official graders (Table 8).

From Table 7 it appeared that 37, 36 and 61% of the

**Table 6** The distribution (%) of carcases with different fatness and conformation combinations ($n$ = 468)

| | Fatness | | | | | | |
|---|---|---|---|---|---|---|---|
| Conformation | 1 | 2 | 3 | 4 | 5 | 6 | Total |
| 1 | 0,85 | 0,64 | | | | | 1,49 |
| 2 | 2,99 | 8,33 | 4,27 | 1,28 | 1,28 | 0,43 | 18,58 |
| 3 | 0,43 | 13,68 | 20,09 | 6,41 | 14,32 | 1,71 | 56,64 |
| 4 | | 1,50 | 6,20 | 5,34 | 5,98 | 1,28 | 20,30 |
| 5 | | | 2,14 | 0,64 | 0,21 | | 2,99 |
| Total | 4,27 | 24,15 | 32,70 | 13,67 | 21,79 | 3,42 | 100,00 |

**Table 7** The frequency distribution (%) of the different grades in their fat classes according to the fat measurement measured between the 3rd and 4th lumbar vertebrae, 25 mm lateral from the midline, as described as a guideline in the grading regulations

| | Fat class | | | | | | |
|---|---|---|---|---|---|---|---|
| Grade | 1 | 2 | 3 | 4 | 5 | 6 | Total |
| Lamb (0 p.i.) ($n$ = 180) | | | | | | | |
| SL ($n$ = 60) | 2 | – | 30 | 7 | 30 | 31 | 100,0 |
| L1 ($n$ = 60) | 3 | 33 | 43 | 13 | 5 | 3 | 100,0 |
| L2 ($n$ = 40) | – | – | – | 10 | 25 | 65 | 100,0 |
| L3 ($n$ = 20) | 45 | 55 | – | – | – | – | 100,0 |
| B-age group (1 – 6 p.i.) ($n$ = 148) | | | | | | | |
| PB ($n$ = 60) | 5 | 2 | 13 | 23 | 15 | 42 | 100,0 |
| B1 ($n$ = 40) | 3 | 35 | 50 | 7 | 5 | – | 100,0 |
| B2 ($n$ = 48) | – | – | 4 | 4 | 2 | 90 | 100,0 |
| C-age group (more than 6 p.i.) ($n$ = 140) | | | | | | | |
| TC ($n$ = 60) | – | 2 | 53 | 8 | 22 | 15 | 100,0 |
| C1 ($n$ = 40) | 2 | 33 | 45 | 5 | 5 | 10 | 100,0 |
| C2 ($n$ = 40) | – | – | – | 10 | 28 | 62 | 100,0 |

**Table 8** The frequency distribution of the different grades in their fat classes according to the official graders on the same carcases as in Table 7

| | Fat class | | | | | | |
|---|---|---|---|---|---|---|---|
| Grade | 1 | 2 | 3 | 4 | 5 | 6 | Total |
| Lamb (0 p.i.) ($n$ = 180) | | | | | | | |
| SL ($n$ = 60) | – | – | 78 | 22 | – | – | 100,0 |
| L1 ($n$ = 60) | – | 85 | 15 | – | – | – | 100,0 |
| L2 ($n$ = 40) | – | – | – | 3 | 97 | – | 100,0 |
| L3 ($n$ = 20) | 100,0 | – | – | – | – | – | 100,0 |
| B-age group (1 – 6 p.i.) ($n$ = 148) | | | | | | | |
| PB ($n$ = 60) | – | – | 55 | 45 | – | – | 100,0 |
| B1 ($n$ = 40) | – | 83 | 17 | – | – | – | 100,0 |
| B2 ($n$ = 48) | – | – | – | 2 | 77 | 21 | 100,0 |
| C-age group (more than 6 p.i.) ($n$ = 140) | | | | | | | |
| TC ($n$ = 60) | – | – | 77 | 23 | – | – | 100,0 |
| C1 ($n$ = 40) | – | 70 | 23 | 7 | – | – | 100,0 |
| C2 ($n$ = 40) | – | – | – | 13 | 73 | 14 | 100,0 |

carcases in the grades Super Lamb, Prime B and Top C respectively, were distributed in fat classes 3 and 4, while 61, 57 and 37% (fat classes 5 and 6) of the carcases should have been classified in the grades Lambs 2, B2 and C2 respectively as overfat carcases according to the guidelines for fatness. The official graders classified these code 5 and 6 carcases in the fat classes 3 and 4 and therefore did not identify them as overfat carcases (Table 8).

For the grades Lamb 1, B1 and C1 56, 57 and 50% of the carcases respectively had fatness codes 3 or 4 according to the guidelines for fatness (Table 7). According to the guidelines these carcases should have been graded as Super Lamb, Prime B and Top C respectively. There are, however, exceptions for carcases with code 2 conformation and code 3 fatness which has to be graded as grade 1; and code 2 conformation with code 4 fatness which have to be graded as grade 2 within the relevant age groups. Of the carcases in the grade Lamb 1 (56%) (Table 7) which had a fatness code of 3 or 4, 40% also had a conformation code of 3, 4 or 5 and should have been graded as Super Lamb, while 3% had a fatness code 4, and conformation code 2 and should have been graded as Lamb 2. By performing the same analysis for the grades B1 and C1 it was found that 40% and 3% of the carcases with a fatness code 3 or 4 respectively, also had a conformation code of 3, 4 or 5 and should have been graded as Prime B and Top C respectively. It was also found that 8, 5 and 15% of the carcases in the grades Lamb 1, B1 and C1 were overfat (fatness codes 5 or 6) and should have been graded as Lamb 2, B2 and C2 respectively. In total 54, 51 and 27% of all the carcases in the grades Lamb 1, B1 and C1 had been graded incorrectly according to the guidelines. When comparing these results with those in Table 7 it is evident that the graders were not grading according to the guidelines for fatness.

For the grades Lamb 2, B2 and C2 respectively, 10, 4 and 10% of the carcases had a fatness code 4 according to the guidelines. These carcases, however, had a conformation code 2 and were correctly graded as grade 2. When comparing results of the official graders (Table 8) with classification according to the guidelines (Table 7) differences in the application of the guidelines for fatness were evident. The graders did however apply the correct fat classes when allocating a grade to a carcase even though these fat classes did not comply with the prescribed guidelines. According to the fat thickness measurements and the guidelines there were 65, 90 and 62% the carcases with a fatness code 6 respectively for the grades Lamb 2, B2 and C2 (Table 7). The graders, however, identified no lambs with a fatness code 6 and only 21% of grade B2 and 14% of grade C2 carcases had a fatness code 6. Thus the frequency distributions of fat classes 5 and 6 according to the guidelines were greatly different from those of the official graders (Table 8). The same trend was found in the case of carcases in grade Lamb 3 where 55% of the carcases according to fat thickness measurements had a fatness code 2 (Table 7). However, 50% of the latter carcases also had a conformation code 2 and should have been graded as Lamb 1. The official graders did not identify these carcases with a fatness code 2 and all of them (50%) were graded incorrectly as grade Lamb 3.

## Conclusion

It appears that visual classification of fatness does not agree with the reference measurement. Already steps to this effect have been taken through an official changing of the carcase grading regulations in 1984. From this study it appeared that the carcase mass/carcase length

ratio was a better predictor of conformation score under practical situations than the carcase mass/leg length ratios. The fat measurement measured between the 3rd and 4th lumbar vertebrae (V3) was the best predictor (of the four measurements) of the visual evaluation of carcase fatness. It should now be ascertained whether this fat measurement is also a reliable predictor of total fat, subcutaneous fat and meat yield in the carcase.

## References


BARWICK, S.A., 1977. The use of measurements in Appraisal Systems with particular reference to Grading and Classification. M.Sc. thesis. Univ. New England, Armidale.

BARWICK, S.A., EVANS, J.C. & THWAITES, C.J., 1978. Comparisons between measurements of fatness in lamb carcases. *Proc. Aust. Soc. Anim. Prod.* 12, 243.

BRUWER, G.G., 1984. Objektiewe evaluering van die huidige karkasgraderingstelsel van lammers en skape in die R.S.A. M.Sc. verhandeling. Universiteit van Stellenbosch.

CUTHBERTSON, A. & HARRINGTON, G., 1976. The MLC sheep carcase classification scheme. *Proc. Carcase Classification Symp.*, Adelaide: Australian Meat Board.

GOVERNMENT NOTICE NO R 2722 OF 11 DECEMBER 1981. Regulations relating to the classification, grading and marking of meat intended for sale in the Republic of South Africa 1981 (7953) (Regulation paper no 3347) 13-14.

HEDRICK, H.B., 1983. Methods of estimating live animal and carcass composition. *J. Anim. Sci.* 57, 1316.

JACKSON, T.H. & MANSOUR, Y.A., 1974. Differences between groups of lamb carcases chosen for good and poor conformation. *Anim. Prod.* 19, 93.

KEMP, J.D. & BARION, R.A., 1966. Composition of lamb carcases and cuts of the New Zealand export grades. *N. Z. J. agric. Res.* 9, 590.

KEMPSTER, A.J., COOK, C.L. & GRANTLEY-SMITH, M., 1986. National Estimates of the body composition of British cattle, sheep and pigs with special reference to trends in fatness. A review. *Meat Science* 17, 107.

KEMPSTER, A.J., CHADWICK, J.P., CUE, R.I. & GRANTLEY-SMITH, M., 1986. The estimation of sheep carcass composition from fat and muscle thickness measurements taken by probe. *Meat Science* 16, 113.

KEMPSTER, A.J., CUTHBERTSON, A. & HARRINGTON, G. 1982. Carcase evaluation in livestock breeding, production and marketing. Granada Publishing: London.

KLINGBIEL, J.F.G., NAUDÉ, R.T., NEL, I., SMIT, M.C., BOTHA, E.C., VENTER, H.J. & GOUWS, P.J., 1979. Gradering van beeskarkasse. *Mimeograaf* 121p. *NIVS.*

KIRTON, A.H. & JOHNSON, D.L., 1979. Interrelationships between GR and other lamb carcase fatness measurements. *Proc. N.Z. Soc. Anim. Prod.* 29, 194.

KIRTON, A.H. & PICKERING, F.S., 1967. Factors associated with differences in carcase conformation in lamb. *N.Z. J. agric. Res.* 10: 183.

MOXHAM, R.W. & BROWNLIE, L.E., 1976. Sheep carcase grading and classification in Australia. *Proc. Carcase Classification Symp.*, Adelaide: Australian Meat Board.

SA MEAT BOARD, 1983. Annual Report

THOMPSON, J.M. & ATKINS, K.D., 1980. Use of carcase measurements to predict percentage carcase composition in crossbred lambs. *Aust. J. Exp. Agric. Anim. Husb.* 20, 144.

VAUGHT, W.G., RINGKOB, T.P. & CONNOR, J.M.. 1980. Carcase evaluation of polypay type wether lambs slaughtered at different weights. *Proc. West. Sect., Am. Soc. Anim. Sci.* 1, 85.

VESELEY, J.A. & PETERS, H.F., 1972. Muscle, bone and fat and their interrelations in five breeds of lamb. *Can. J. Anim. Sci.* 52, 629.