Lamb Carcass Evaluation and Grading

• Before beginning to evaluate lamb carcasses, the carcasses must be identified as to their sex condition (or class) and their maturity group (or kind).

• It is necessary to identify kind and class of sheep carcasses prior to grading so that one can apply the correct set of standards and grades because they differ slightly among classes and especially among the different kinds.
# Lamb carcass evaluation

<table>
<thead>
<tr>
<th>Class</th>
<th>Kind</th>
<th>maturity group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex group</td>
<td>Lambda</td>
<td></td>
</tr>
<tr>
<td>Ewe</td>
<td>Lambda</td>
<td>Yearling mutton</td>
</tr>
<tr>
<td>Wether</td>
<td>Wether</td>
<td>Mutton</td>
</tr>
<tr>
<td>Ram</td>
<td>Ram</td>
<td>Yearling mutton</td>
</tr>
</tbody>
</table>

- **Ewe** – female 
- **Wether** – castrated male 
- **Ram** – male 

- **Lamb**
- **Yearling mutton**
- **Mutton**

Normally wethers marketed before reach mutton stage. Most mutton carcasses from old ewes, rams (no wethers).

## Determination of **kind** (Maturity)

- **Lamb**
- **Yearling mutton**
- **Mutton**

<table>
<thead>
<tr>
<th>2-14 m</th>
<th>12-25 m</th>
<th>&gt; 24 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lamb</td>
<td>Yearling mutton</td>
<td>Mutton</td>
</tr>
</tbody>
</table>
Lamb

- **2-14 months** of age

- Characteristics
  - **break joint** on **at least one** of their front shanks
    - on the front shank (at least 1)
    - color, moistness, porosity of the break joint
  - **flank muscles color**
    - color on the inside of carcass
    - slightly dark pink – slight dark red

- Ribs
  - Shape: quite round to moderately flat
  - some redness on the exposed rib surfaces color

Yearling mutton

- **12-25 months** of age

- **spool joint** or 1 spool joint and 1 imperfect break joint or 2 imperfect break joints

- **flank** muscle color
  - slightly dark red – moderately dark red

- Ribs
  - moderately wide – tend to be flat
  - slightly redness – no redness on exposed ribs surfaces
  - When older
    - marrow in ribs → lose ability to make red blood cells
    - → marrow become yellow → bone-like in color
Mutton

• > 24 months

• Always have **spool joints**

• **flank** muscle color
  – dark red – very dark red

• wide, flat ribs

• mature bone color

---

Break joint: younger animals

• the **epiphyseal** (骨後) **cartilaginous** area of the **cannon bone** (metacarpal)

• not ossified in young sheep
  – breaking when pressure applied → “break joint”
Spool joint: older animals

- epiphyseal area **ossify and fuses** to the diaphysis (骨幹) of the metacarpal
- cannot be broken

- imperfect break joint = spool joint

When assesses maturity stage
- rib shape → ok as the criteria
- rib color → as an indicator

Ribs
- When older
  - marrow in ribs lose ability to make red blood cells → marrow become yellow → bone-like in color
Determination of **Class (Sex)**

- **Ewe**
  - **Udder**, wet udder (yellow brown exudates, esp for mutton)
    - Removed during slaughter
  - Lamb and yearlings: long & smooth fat deposit

- **Wether**
  - *“cod fat”*
    - Rough, irregular shape
    - Smaller deposit of fat vs. udder
  - Udder (ewe), heifer
  - Cod fat (wether), steer
  - Scrotal fat (ram), bullock

- **Ram**
  - Much less fat in the scrotal area < wether or ewe
  - Irregularly shaped fat = fat in wether
  - Wide, heavy shoulder
  - Thick necks

---

Carcass wt and Dressing percentage

- Hot carcass: obtained just prior to chilling
- Chilled carcass: by calculation

- **Hot carcass shrunk (about 2.75%)** WHY???

- Hot carcass wt \( \times 0.9725 = \) chilled carcass wt.
- Hot carcass wt = chilled carcass wt. \( \times 102.75\% \)

- Dressing percentage (DP)
  - \( \text{DP} = \frac{\text{chilled carcass wt}}{\text{live wt}} \times 100\% \)
  - If KP fat not removed, each 1% KP fat \( \rightarrow \) DP - 0.5%
Ribbing lamb carcasses

• Lamb carcasses ribbing
  – between the 12th and 13th rib
  – to expose the ribeye muscle and actual fat thickness.

• Commercially, lamb carcasses seldom ribbed
  – Lamb carcasses should be quality graded prior to ribbing.
  – Lamb carcasses are yield graded after the carcass is ribbed.

Ribbing procedures

• Between the 12th and 13th ribs
  – Leave approx. 2-3 inch flank muscle attached to the hindsaddle
  – If cut through → fore saddle and hind saddle

• Fig 14.4 p166
Ribeye area

- not used in quality or yield grading (WHY?)

- average right and left ribeye areas measured
- with a grid (20 dats/in$^2$) or by a compensating planimeter

Lamb Carcass Grading

- Must both quality and yield graded

- Quality grade
  - estimation of palatability-indicating characteristics
    - Tenderness
    - Juiciness
    - flavor

- Yield grade
  - estimation of boneless, closely trimmed, retail cuts from leg, loin, rack, and shoulder
Quality grade

• evaluation of
  – Conformation
  – Maturity
  – lean flesh quality
    • Evaluated by the
      – quantity of fat streaking on the inside flank muscles
      – Lean flesh firmness
      – External fat

• Quality grade of lamb
  – **USDA Prime, Choice, Good, Utility, Cull**  P. 167, P. 173
  – most graded as Prime or Choice

Kinds, Classes & Grades of Sheep
Lamb carcass grading: Conformation

- An assessment of overall muscling in the lamb carcass
- evaluated by averaging the conformation of the component parts
- Relative development of the muscular and skeletal systems
- Quantity and distribution of external finish

Conformation

- Emphasis on
  - muscling development
  - Highest priced primal cuts
    - Leg  loin  rack (rib)  shoulder
  - Thickness of muscling
  - Overall degree of thickness and fullness of the carcass
Conformation

• better conformation
  – a higher proportion of edible to bone and higher primal cuts
  – Very thickly muscled, very wide and thick in relation to the length
  – Very plump, full, and well-rounded appearance

• Minimum conformation required
  – Table 14.5

  P. 172

• Table 14.5 minimum conformation qualification for quality grade of lamb carcass

  • P172
Leg conformation

• Most easily and accurately evaluated (WHY?)
• So, more emphasis of carcass conformation on “leg” part

• Other parts evaluated
  – Loin, rack and shoulder regions
    • Muscle development
    • Amount of fat left (normally 0.25 in.)

Fig 14.6 (P. 168)

• Carcass conformation
Lamb carcass grading: Maturity

- An assessment of the physiological age of the animal
  - Usually < 1 yr
  - Less age effect on palatability
  - Maturity group A, B, vs. yearling mutton (1-2 yrs)
- Determined by an assessment of bone and muscle characteristics
  - Bone
    - Break joint
    - Rib shape
  - Muscle
    - Inside flank muscle color
- A⁻ (youngest), A⁰, A⁺(older)
- Lamb (most A maturity) vs. yearling lamb

Maturity indicators in lamb carcasses

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Maturity A (young)</th>
<th>Maturity B (old)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ribs</td>
<td>Moderately narrow, slightly flat</td>
<td>Slightly wide, moderately flat</td>
</tr>
<tr>
<td>Break joint</td>
<td>Moderately red, moist and porous</td>
<td>Slightly red, slightly dry and hard</td>
</tr>
<tr>
<td>Color of inside flank muscles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>US Prime</td>
<td>Slightly dark pink</td>
<td>Light red</td>
</tr>
<tr>
<td>US Choice</td>
<td>Moderately dark pink</td>
<td>Moderately light red</td>
</tr>
<tr>
<td>US Good</td>
<td>Dark pink</td>
<td>Slightly dark red</td>
</tr>
</tbody>
</table>
Flank fat streaking

- Fat deposit visible on the surfaces of the primary and secondary flank muscles
  - More extensive in the 2nd flank
- To predict marbling (WHY???)
- Lamb carcass not ribbed
  - No Marbling standards in lamb carcasses

- Beef grading vs. lamb grading
  → Marbling vs. flank fat streaking

Table 14.3 degree of flank fat streaking
### Table 14.3 degree of flank fat streaking

- Abundant
- Moderately abundant
- Slightly abundant
- Moderate
- Modest
- Small
- Slight
- Traces
- Practically devoid
- Devoid

<table>
<thead>
<tr>
<th>Degree</th>
<th>High(+)</th>
<th>Typical (0)</th>
<th>Low(-)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abundant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traces</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Practically devoid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Devoid</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Marbling vs. Feathering & fat streaking

- 1 級富量 (abundant)
- 2 級多量 (moderately abundant)
- 3 級次多量 (slightly abundant)
- 4 級中量 (moderate)
- 5 級普通量 (modest)
- 6 級少量 (small)
- 7 級微量 (slight)
- 8 級稀量 (traces)
- 9 級 幾乎全無 (practically devoid)
- 10 級 全無 (devoid)

<table>
<thead>
<tr>
<th>Degree</th>
<th>moderately abundant</th>
<th>slightly abundant</th>
<th>moderate</th>
<th>modest</th>
<th>small</th>
<th>slight</th>
<th>traces</th>
<th>practically none</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abundant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slight</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traces</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Practically devoid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Devoid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

P. 130

P. 130
Lean flesh firmness and external fat

• hand checking → flank region

• Flank firmness
  – highly influenced by carcass fatness
  – fattest lamb: firmest fat and lean
    vs.
  – Very thin covering of fat: have softest lean and fat

Table 14.4
Minimum firmness required for quality grade

- very soft
- moderately soft
- tends to be moderately soft
- **slightly soft** (min for US Good)
  - tends to be slightly soft
- **tends to be slightly firm** (min for US Choice)
  - slightly firm
- **tends to be moderately firm** (min for US Prime)
  - moderately firm
  - tends to be firm
  - firm
  - tends to be extremely firm
  - extremely firm

firmer
minimum degree of external fatness

• why minimum degree of external fatness required?

• To protect carcass from
  – excessive shrink
  – Discoloration
  – Dehydration

• Thin fat covering over the back > 0.07 inch
  = 0.1 inch at 12th rib

• Most have > min required external fat degree

Table 14.5 minimum conformation qualification for each quality grade (Lamb)
Final quality grade (FQG)

- Determined by combining of
  - Conformation
  - Maturity
  - flank fat streaking
    - minimum external fat (for US Prime, Choice)
    - minimum degree of firmness of lean flesh and external fat (for US Prime, Choice, Good)

Yield grade of lamb carcass
Yield Grade (YG)

• Yield of bone less, closely trimmed (0.1 inch)

• Retail cuts from leg, loin, rack, shoulder
  – 4 wholesale cuts
    • 80% carcass wt
    • 90% carcass value

• 2/3 carcass value: hindsaddle (esp. leg, loin)

• Yield grade: 1 to 5
  – YG 1: highest yield of retail cuts, YG 1.0 = 51.0% retail cuts
  – YG 5: lowest yield of retail cuts, YG 5.9 = 44.7% retail cuts
  – Table 14.6 (P. 177)

<table>
<thead>
<tr>
<th>YG</th>
<th>% retail cuts</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>52.1</td>
</tr>
<tr>
<td>0.2</td>
<td>52.0</td>
</tr>
<tr>
<td>0.3</td>
<td>51.9</td>
</tr>
<tr>
<td>1.0</td>
<td>51.0</td>
</tr>
<tr>
<td>2.0</td>
<td>49.7</td>
</tr>
<tr>
<td>3.0</td>
<td>48.4</td>
</tr>
<tr>
<td>4.0</td>
<td>47.1</td>
</tr>
<tr>
<td>5.0</td>
<td>45.8</td>
</tr>
<tr>
<td>5.9</td>
<td>44.7</td>
</tr>
</tbody>
</table>
• Yield grade = 0.4 + (10 * adjusted 12th rib fat thickness, inch)

• Adjusted 12th rib Fat thickness

<table>
<thead>
<tr>
<th></th>
<th>Lamb A</th>
<th>Lamb B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjusted fat thickness (inch)</td>
<td>0.15</td>
<td>0.33</td>
</tr>
<tr>
<td>YG(A)= 0.4+(10*0.15)=1.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>YG(B)= 0.4+(10*0.33)=3.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

• Ribbed carcass: evaluated fat thickness btwn 12th and 13th rib
• Unribbed carcass: estimate

Yield Grade (YG)

• As the amount of external fat increases, the percent of retail cuts decreases.
  – Each .05 inch change in adjusted fat thickness over the ribeye muscle between the 12th and 13th ribs changes the yield grade by one-half a grade.

• Five yield grades are denoted by numbers 1 through 5
  – 1 represents the highest degree of cutability.
Kidney and Pelvic fat (KP)

- Subjectively evaluated
- Expressed as % of carcass wt

  - Beef grading vs. lamb grading  
    KPH       KP
  - Less heart fat in lamb carcass

Leg conformation

- To subjectively evaluate leg muscling (in unribbed carcass) for overall muscling.