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The role of objective and subjective evaluation in the production and marketing of goats for meat

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ABSTRACT
Objective and subjective evaluations of goats for meat production are related to important determinants of production and profitability. The most important attributes in assessment of goats for market are: live weight; body condition score; and the age of goats. As goats grow, their carcass and body organs increase in weight in proportion to the empty body weight. For farmers and field workers the linear regression approach for estimating carcass weight by measuring live weight is the most suitable as it accounts for 88 to 97% of the variation in carcass, offal and boneless meat weight. Live weight scales or heart girth tapes should be used and the risks and errors associated with these methods are summarized. The proportion of a live goat that is the carcass, known as dressing percentage, increases from 35% to about 50% as goats grow. The usefulness and errors associated with dressing percentage in field estimation are discussed. A valuable subjective method for estimating the nutritional status of goats is the use of body condition scoring as it accounts for 60 to 67% of the variation in live weight change, carcass weight and fat reserves of goats. A method for body condition scoring and a similar fat scoring system are explained. Body condition score is also associated with mortality risk and reproductive performance of goats. The number of permanent incisors in the lower jaw of goats is a method of estimating the age of goats but is biased by differences in live weights of goats. The value and role of ultrasound scanning the carcasses of goats is summarized. For the marketing of kid meat no permanent incisors should have erupted. Other useful practices for the successful marketing of goat meat are discussed including: knowing market specifications and chemical withholding periods; animal health; prevention of bruising; identification of goats; size of consignments; timeliness; provision of paperwork. A checklist is provided. The use of subjective and objective assessment techniques in evaluating goats for meat production will provide the best results. Where only subjective assessment techniques are available they will provide satisfactory performance provided the skills have been learnt and are applied.
1. INTRODUCTION

Objective and subjective evaluation of goats for meat production have important roles to play in developing and developed economies. These methods of assessment are related to important determinants of meat production and enterprise profitability. In many countries, low cost subjective evaluation methods are the only methods available. The application of subjective evaluation methods in developing countries are valuable tools that can greatly help goat farmers improve the health and survival, reproduction and meat production of their goats.

1.1. Purpose of evaluation in meat production and marketing

There are several important reasons to assess live goats during production and before they are sold for meat including (McGregor, 2007a):

1. To select goats which closely match the specifications of a buyer;
2. To decide if goats need additional feeding to maintain growth rate;
3. To decide if goats need additional shelter or management inputs during pregnancy and adverse climatic conditions;
4. Determine animal health treatments such as the size of doses for drugs such as anthelmintics;
5. To estimate carcass attributes of goats before sale for meat;
6. To avoid being penalized for failing to meet buyer specifications;
7. To evaluate goats for selection and breeding.

1.2. Methods of live animal assessment

The three most important methods of assessing goats for market are:

- live weight measurement or estimation;
- body condition scoring; and
- estimation of the age of goats.

The use of ultrasound scanning of live goat carcasses is discussed. Other important descriptors of goats include sex and breed which will not be discussed further in this chapter.

1.3. Preparing goats for meat marketing

In undertaking the assessment of live weight, body condition score and age of goats for meat marketing there are other attributes of goats and practices of farmers that are required for
successful marketing. The last section of this Chapter discusses ten important issues that farmers should be aware of for the successful marketing of goat meat.

2. LIVE WEIGHT MEASUREMENT OR ESTIMATION

The most precise estimate of carcass production and offal yields from goats are made using empty body weight (ingesta free live weight) (McGregor, 1985). However farmers and field workers are unable to accurately determine empty body weight and use either 24 hour fasted live weight or live weight, with a subsequent loss of accuracy in prediction. Thus for most goat farmers the live weight of their animals is the most important aspect of a goat that determines meat yield.

2.1. The use of live weight in predicting carcass and organ yield

As goats grow, their carcass and other body organs increase in weight (Figure 1). Fat reserves also increase as goats grow. These observations have been confirmed in numerous studies on a wide range of goat breeds as well as in all other farm animals (Tulloh, 1963; Gall, 1983; Gall, 1983; McGregor, 1985; Warmington and Kirton, 1990).

![Figure 1. The relationships of carcass fat (▲), omental fat (⊙) and perirenal fat (■) with the live weight of castrated male Angora goats (from McGregor, 1992).](image)

The relative growth coefficient (RGC) of body components relative to the fasted body can be estimated using the allometric growth equation:

\[
\log y = \log a + b \log x;
\]

where \(x\) is the fasted live weight at slaughter, \(y\) is the fresh organ weight and \(b\) represents the RGC of the organ relative to the fasted body.

Allometric growth equations are usually more precise and account for more of the variation of dependent variables than linear equation approaches. Allometric growth equations indicate
that during growth of goats from birth to maturity, fat reserves and the carcass develop at slightly faster rate than the entire body, while bone develops more slowly than the entire body (Wilson, 1958; Owen et al., 1977; McGregor, 1982, 1992). For example, with Saanen and Angora goats given similar grazing and slaughter management, the relative growth of carcass and various fat deposits was > 1 while carcass protein was no greater than 1 (Table 1). For Saanen goats the perirenal and omental fat depots grew 2.6 times faster than the fasted body weight.

Table 1. The relative growth coefficient (RGC) of body components of grazing goats relative to fasted body weight for Saanen castrate goats (McGregor, 1982) and Angora castrate goats (McGregor, 1992).

<table>
<thead>
<tr>
<th>Component</th>
<th>Saanen</th>
<th></th>
<th>Angora</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RGC</td>
<td>100 $r^2$</td>
<td>RGC</td>
<td>100 $r^2$</td>
</tr>
<tr>
<td>Carcass$^1$</td>
<td>1.098</td>
<td>99</td>
<td>1.015</td>
<td>96</td>
</tr>
<tr>
<td>Carcass fat$^1$</td>
<td>2.155</td>
<td>86</td>
<td>1.039</td>
<td>88</td>
</tr>
<tr>
<td>Carcass protein</td>
<td>0.930</td>
<td>98</td>
<td>1.003</td>
<td>96</td>
</tr>
<tr>
<td>Perirenal fat</td>
<td>2.665</td>
<td>83</td>
<td>1.068</td>
<td>72</td>
</tr>
<tr>
<td>Omental fat</td>
<td>2.620</td>
<td>86</td>
<td>1.074</td>
<td>76</td>
</tr>
</tbody>
</table>

$^1$excluding perirenal fat

This Chapter will focus on studies that used the linear regression approach for estimating carcass weight as this approach is more suitable for application with farmers (McGregor, 1985; Warmington and Kirton, 1990).

With linear regressions the farmer estimates the carcass weight as follows:

$$\text{Carcass weight (kg)} = m \times (\text{live weight, kg}) + c;$$

where $m$ is the regression coefficient or slope; and $c$ is the regression constant (which is often negative).

2.2. Prediction of saleable meat on goats

2.2.1. Live weight and carcass weight

Studies with goats indicate that as goats grow, carcass weight increases by 0.43 to 0.54 kg for every 1 kg increase in live weight. Table 2 provides examples for different goat breeds grazed on pasture in a similar way in the same temperate environment and slaughtered using the same standardized procedures (Aus-Meat, 2001).
The role of subjective and objective evaluation in the production and marketing of live meat goats

Table 2. Regression constants (± s.e.) and correlation coefficients for linear relationships between carcass weight (kg) and live weight (kg) for Australian goats of different breeds, ages and sexes (castrated males, C; mixed sex kids, M). The shaded data relates to animals slaughtered after periods of nutrition that resulted in zero or low live weight gain. The residual standard deviation is shown as RSD.

<table>
<thead>
<tr>
<th>Breed (Age years)</th>
<th>Sex</th>
<th>Regression coefficient</th>
<th>Constant</th>
<th>RSD</th>
<th>100 r²</th>
<th>Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angora (0.4)</td>
<td>M</td>
<td>0.488 (0.018)</td>
<td>-1.3</td>
<td>0.45</td>
<td>90</td>
<td>McGregor (1996)</td>
</tr>
<tr>
<td>Angora (0.5 to 4)</td>
<td>C</td>
<td>0.523 (0.021)</td>
<td>-2.3</td>
<td>1.00</td>
<td>96</td>
<td>McGregor (1996)</td>
</tr>
<tr>
<td>Cashmere (0.3)</td>
<td>M</td>
<td>0.450 (0.031)</td>
<td>-0.9</td>
<td>0.46</td>
<td>88</td>
<td>McGregor et al. (1998)</td>
</tr>
<tr>
<td>Cashmere (0.6)</td>
<td>M</td>
<td>0.515 (0.025)</td>
<td>-1.7</td>
<td>0.94</td>
<td>88</td>
<td>McGregor et al. (1998)</td>
</tr>
<tr>
<td>Cashmere (2.5 to 4.5)</td>
<td>C</td>
<td>0.434 (0.014)</td>
<td>-0.8</td>
<td>1.64</td>
<td>90</td>
<td>McGregor (1990)</td>
</tr>
<tr>
<td>Saanen (0.3 to 3)</td>
<td>C</td>
<td>0.504 (0.025)</td>
<td>-1.4</td>
<td></td>
<td>97</td>
<td>McGregor (1982)</td>
</tr>
</tbody>
</table>

Using live weight to predict carcass weight accounted for 88 to 97% of the variation in the studies illustrated in Table 2. The residual standard deviation in these studies ranged from about 0.5 to 1.6 kg. The precision of prediction can be improved further when the subjectively assessed body condition score is used with live weight in prediction equations. Body condition scoring is discussed in the following section.

Nutrition does affect carcass development and carcass yields. Table 2 illustrates that the regression coefficients were lower for goats subject to periods of maintenance of live weight or of low live weight gain, when the proportion of the live animal that was carcass was less than for goats subject to periods of good nutrition.

2.2.2. Dressing percentage

As goats gain live weight, the proportion of the body that is the carcass, increases. This proportion, called the dressing percentage, is determined as: (carcass weight × 100) / live weight. Dressing percentage is used as a rule of thumb for estimating carcass weight. For example, for goats at 10 kg live weight the carcass may represent about 35% of live weight but at 50 kg live weight the carcass may represent 48% of live weight. Higher dressing percentage values are sometimes obtained. Dressing percentage values can suffer from two major deficiencies:
1. Standardized methods of determining dressing percentage are often not used and so published reports can be misleading. Descriptions of a standardized carcass have been developed and mandated by industry in goat meat exporting countries such as Australia (Colomer-Rocher et al., 1987; Aus-Meat, 2001). Issues include the removal of pelvic channel fat and the position of removal of the head, feet and tail.

2. Unfortunately dressing percentage can vary substantially depending on the management of the animal and its sex, whether it has been fasted, the diet which affects gut fill and the amount of fleece. As many goat keepers and research workers obviously fail to recognize these influences, the most important influences are summarized in Table 3.

Table 3. Influences on the apparent dressing percentage of goats (McGregor, 1985).

<table>
<thead>
<tr>
<th>Influences that increase dressing percentage:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk fed kids – have little rumen development and gut fill</td>
</tr>
<tr>
<td>Concentrate feeding – reduces gut fill, increases fat deposits</td>
</tr>
<tr>
<td>Fasting – reduces gut fill before weighing</td>
</tr>
<tr>
<td>Age – older animals tend to be heavier</td>
</tr>
<tr>
<td>Live weight – heavier animals usually have more muscle and fat</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Influences that reduce dressing percentage:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weaning – increases gut fill, reduces fat reserves</td>
</tr>
<tr>
<td>Hay and straw feeding – increases gut fill and live weight</td>
</tr>
<tr>
<td>Lactation – usually reduces fat reserves</td>
</tr>
<tr>
<td>Mating – for bucks reduced appetite and weight loss</td>
</tr>
<tr>
<td>Dry pastures – usually loss of live weight and fat reserves</td>
</tr>
<tr>
<td>Heavy fleece – over estimates true live weight</td>
</tr>
<tr>
<td>Large horns and testicles - in bucks these will reduce relative carcass weight</td>
</tr>
</tbody>
</table>

To enable goat farmers, market agents and researchers to accurately estimate the expected yields and therefore market value of carcasses from live goats it is important that in each environment, with a given breed and management practice, that dressing percentage be determined over a range of live weights.

2.2.3. Boneless meat yield from carcasses

For many manufactured goat meat products, such as mince required for sausages, goat meat is removed from the bones before processing. The yield of this boneless meat is a lower proportion of the live animal compared with the carcass yield, as the bone and some fat is discarded during the trimming process. There is a lack of knowledge about the actual boneless meat yield from entire goats.

Research on boneless meat yield from Angora goats in Texas (Smith et al., 1972; Eggen et al., 1973) indicated that culled 2 to 6 year old does of mean live weight of 30.7 kg produced 12.8 kg
carcasses that yielded 57% meat. With 9 to 14 kg Angora goat carcasses the edible portion of meat rose from 56 to 63% as the degree of muscling and live weight increased. With heavy weight 2.5 to 4.5 year old Australian cashmere goats of 44 to 79 kg live weight, carcass production was 20.5 to 32.6 kg with a boneless meat yield of 64.2%. With lighter weight 14 kg carcasses the boneless meat yield declined to 61.1% (McGregor, 1990). Linear regression coefficients indicated that for every 1 kg increase in live weight or hot carcass weight boneless meat yield increased 307 g or 670 g, respectively (Figure 2).

![Figure 2](image.png)

**Figure 2. The relationships between the live weight and the hot carcass weight of castrated male goats and the amount of boneless meat (McGregor, 1990).**

### 2.3. Live weight measurement or estimation

Where possible, accurate livestock scales are recommended for weighing goats. Where this is not possible, particularly in the small-scale farming sector, the use of a heart girth tape or small scales for smaller animals, are useful. However these methods can have large errors. If small-scale farmers must estimate the body weight of their goats without any aids then inaccuracies in decision-making and husbandry will be the consequence.

#### 2.3.1. Livestock scales

Live weight is best determined by weighing goats on scales designed for sheep and goats. Crates with specially fitted gates are best for this purpose. Modern electronic scales that have weigh bars can be used provided a suitable platform or crate is made to restrain the animals. Electronic scales are more expensive and need power either from a mains supply or from a car battery. There are important issues to carefully manage to ensure accurate operation of livestock scales (Table 4).
Table 4. Risk factors that must be managed to accurately operate livestock scales.

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Operation guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Scales not calibrated accurately</td>
<td>Prior to, during and at the end of each operation, use check weights to ensure accurate operation. Recalibrate if needed.</td>
</tr>
<tr>
<td>2. Scales on uneven ground</td>
<td>Use scales only on level ground or a level floor.</td>
</tr>
<tr>
<td>3. Scales do not move freely</td>
<td>Keep scales from touching hard objects during operation, e.g. away from fences, walls, sides of yards and handling equipment. Check scales frequently during operation. If possible fix scales to level surface using bolts. During use keep area underneath scales clean by removing any stones, sticks or other material from near the scales.</td>
</tr>
<tr>
<td>4. Scales not tared properly</td>
<td>Ensure scales tared to zero before use. Check scale tare regularly during use especially if scales are bumped, knocked or pushed by rough animals.</td>
</tr>
<tr>
<td>5. Animal not weighed properly</td>
<td>Ensure all four feet are on weighing platform. Ensure no other goat has its foot on weighing platform.</td>
</tr>
</tbody>
</table>

2.3.2. Heart girth tapes
Heart girth tapes are calibrated to the live weight of a particular breed of goat. As there are differences in the physical frame size and time to maturity between breeds of goats (McGregor, 1985; Warmington and Kirton, 1990) heart girth tapes need to be calibrated for the breed and sex of animals to be evaluated and for pregnant and non-pregnant does (Pomroy et al., 1987; Mohammed and Amin, 1997; Slippers et al., 2000; Nsoso et al., 2003; Mekasha et al., 2008). This calibration needs to be done with the aid of those with livestock scales and the ability to complete linear regression analyses. In some countries commercial or industry sponsored heart girth tapes are available (e.g. USA, Australia).

The correct method for using a heart girth tape is to:
- Use a non-elastic calibrated tape;
- Have the goat standing squarely on all four legs;
- Measure the heart girth around the chest, directly behind the forelegs and across the back;
• Draw the tape in firmly, especially for fleece bearing goats, and read the value.

Examples of the relationship between girth measurements and live weight for some breeds of goats are shown in Table 5. Using girth tape measurements to estimate live weight has accounted for about 90% of the variation in live weight.

Care should be exercised in extrapolating from the data used to calibrate heart girth tapes to animals outside the ranges of those measured. As noted in numerous studies the correlation between heart girth and live weight in adults is lower than for growing goats and for females in advanced pregnancy (Mohammed and Amin, 1997) and it is lower when goats are losing live weight than when they are growing (Nsoso et al., 2003).

Table 5. Examples of regression constants (± s.e.) and correlation coefficient for relationships between heart girth measurement (cm) and live weight (kg) for different breeds and sexes of goats from published sources.

<table>
<thead>
<tr>
<th>Breed</th>
<th>Comment</th>
<th>Regression</th>
<th>Constant</th>
<th>100 ( r^2 )</th>
<th>Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saanen</td>
<td>Doe</td>
<td>1.42</td>
<td>-74.8</td>
<td>88</td>
<td>Pomroy et al. (1987)</td>
</tr>
<tr>
<td>Angora</td>
<td>Doe</td>
<td>0.96</td>
<td>-42.9</td>
<td>88</td>
<td>Pomroy et al. (1987)</td>
</tr>
<tr>
<td>Sahel (Borno White)</td>
<td>Kids multiple birth</td>
<td>0.50</td>
<td>-13.6</td>
<td>98</td>
<td>Mohammed and Amin (1997)</td>
</tr>
<tr>
<td>Nguni</td>
<td>Doe</td>
<td>1.08</td>
<td>-47.7</td>
<td>94</td>
<td>Slippers et al. (2000)</td>
</tr>
<tr>
<td>Nguni</td>
<td>Buck</td>
<td>0.99</td>
<td>-43.0</td>
<td>88</td>
<td>Slippers et al. (2000)</td>
</tr>
<tr>
<td>Tswana</td>
<td>Wet season</td>
<td>0.50</td>
<td>-11.2</td>
<td>85</td>
<td>Nsoso et al. (2003)</td>
</tr>
<tr>
<td>Tswana</td>
<td>Dry season</td>
<td>2.97</td>
<td>-181</td>
<td>74</td>
<td>Nsoso et al. (2003)</td>
</tr>
</tbody>
</table>

The use of the upper 95% confidence limit when using the girth measurements has been recommended when determining dose rates for animal health use (Pomroy et al., 1987). In practice the upper 95% confidence limit required the addition of 11 kg to estimates of Saanen doe live weight and 6 kg for estimates of Angora and cashmere/feral doe live weight (Pomroy et al., 1987). The addition for the upper 95% confidence limit potentially overestimates the live weight of small goats such as those less than 20 kg. As a consequence the use of girth
measurements is not recommended for the estimation of body weight when using mineralized drenches or other drugs of narrow or uncertain safety limits (Pomroy et al., 1987).

2.3.3. Errors in live weight measurement

There are three common errors related to live weight measurement: inaccurate operation of measuring equipment (discussed earlier for scales and tapes); fasting times; variations in the time of day that weighing takes place.

Fasting refers to the amount of time that animals are deprived from food and water. The importance of fasting become apparent when it is realized that for a grazing goat with a live weight of 32 kg, the gut contents (stomachs and the intestines) may comprize nearly 25% or one quarter of the live weight (McGregor, 1982, 1992). If goats are removed from feed and water for 24 hours it is normal that they commonly lose 1 to 2 kg of live weight or more in hot environments. It is important to standardize the method to be used for measuring the live weight of goats. For example, animals are taken straight from pasture and weighed without any fasting or animals are taken from pasture and left in livestock yards for 4 hours. Whichever procedure is chosen it should be used routinely.

It is also important that if comparisons are being made over time, that the time of day when weighing takes place is standardized. This is important as animals usually have a grazing, resting and drinking routine. Goats can drink several litres of water in one session so their live weight can increase by 2 kg or more. It is therefore important to choose a standard routine when weighing goats. Choose a time, preferably in the cool of the morning, and keep to this time of day for any future weighing of the goats.

3. BODY CONDITION SCORING

Body condition scoring is a subjective method to assess the relative nutritional status of animals. Body condition scoring in goats has been shown to be related to goat live weight, milk production, carcass production, carcass fatness, reproductive performance and mortality. All of these production parameters are of commercial importance in goat meat production. Body condition scoring is therefore an essential practical skill for farmers, extension agents, meat buyers and researchers in both developing and developed economies.

Body condition scoring has been used on sheep in Australia since at least the 1940s and was first explained by (McClymont and Lambourne (1958) and Jefferies (1961). Body condition scoring has been applied with goats since at least 1982 (McGregor 2010a). Body condition scoring can be used to:
1. Monitor the live weight change of goats when no objective method is available.
2. Monitor the nutritional state of goats. A decline in body condition score is a good indication of a decline in nutrition.
3. Assist in the selection of goats prior to slaughter.
4. Assess the risk of goats to mortality in adverse weather (McGregor and Butler, 2008).

There are three methods of body condition scoring: body condition scoring of the short ribs; fat scoring the long ribs, and palpating the sternum. Palpating the sternum is the preferred method for use with dairy goats (Aumont et al., 1994; Morand-Fehr, 2005) and is not covered here. Details of this method are summarised by Smith and Sherman (2009).

This section discusses the methods of body condition scoring, the relationships of body condition scores to carcass attributes and the use of body condition scoring to assist in selling goats for meat.

3.1. Body condition scoring of short ribs

Body condition scoring is the easiest method for farmers, meat buyers and researchers to use as it allows and easy “hands on” estimation of standing goats. Body condition scores give a direct assessment of the amount of tissue present over one of the prime carcass site. Scientific studies have shown that body condition scoring to be reliable in predicting carcass weight when used with the live weight of goats. While goats may have less subcutaneous fat than sheep it is easier to gain a more reliable estimate of the body condition and carcass yield of goats using body condition scores than it is with sheep.

3.1.1. How to body condition score

a) The animal must be standing on all feet and "relaxed", not tensed up or pushed into a corner. It is not possible to score if an animal is crouching under or jumping over other animals.

b) Use the "balls" of the fingers and thumb rather than the tips.

c) Feel the body along the backbone just behind the last long rib in the loin area. Feel for the prominence of the spine, its sharpness and the amount of flesh on each side of the spine (Table 6).

d) Now span the loin with the hand with fingers and thumb extended. Feel the ends of the spinal processes and press the fingers gently under the ends to assess the amount of flesh present (Table 6).
e) Finally feel the eye muscle by feeling the thickness and coverage of flesh between the backbone and the spinal processes. Use the open flat palm of the hand and gently push against the eye muscle to feel its shape. Is it rounded, flat or depressed?

f) For animals with a dense fleece, the fleece should be parted to feel the skin more easily.
Table 6. What body condition scores feel like and the cross section appearance of the tissue reserves in the loin area of the short ribs on the carcass of a live goat (Jefferies, 1961; McGregor, 1983; Mitchell, 1983; McGregor, 2005)

<table>
<thead>
<tr>
<th>Body condition score</th>
<th>What the score means for meat production</th>
<th>Carcass cross section in the loin area of the short ribs</th>
<th>What can be felt at each site</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Backbone</td>
<td>Spinal processes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spinal processes</td>
<td>Fingers easily pass under ends.</td>
</tr>
<tr>
<td>3 Medium.</td>
<td>Ideal for prime kids. May be too fat for adult goats where a slightly lower score is often preferred.</td>
<td>Smooth and round over the top but still elevated.</td>
<td>Smooth.</td>
</tr>
<tr>
<td>4 Fat.</td>
<td>Too much feed has been used. Fat has to be cut off meat when processed.</td>
<td>Only detected with pressure.</td>
<td>Cannot be felt.</td>
</tr>
</tbody>
</table>
3.1.2. Reliability of body condition scores

The reliability of body condition scoring improves with practice. It is recommended that scoring should be practiced whenever goats are handled, yarded or fed. Body condition scoring should be used at livestock shows and meat markets.

The original systems for body condition scoring of sheep used six levels of body condition (0 to 5, McClymont and Lambourne, 1958; Jefferies, 1961) although the 0 level, indicating severe emaciation at the point of death following extended drought or disease, was not commonly used. Thus most descriptions of the body condition scoring system since this time referred to only five levels of body condition, 1 to 5. Skilled assessors can assign body condition scores that are intermediate between the main scores. Many Australian farmers assign one score between each main category providing an 8 step range. For example: 1, 1.5, 2, 2.5, 3, 3.5. Research has been published where two scores were assigned between each of the main categories providing an 11 step range (McGregor, 1990, 1992, 2005, 2010a). For example: 1.7, 2.3, 2.7, 3, 3.3. The difference between these systems is not important. However Australian experience indicates that the very high body condition score of 5 for very fat sheep is not relevant to goats. This view is supported by the lower level of subcutaneous back fat deposits of goats compared with sheep (McGregor, 2005).

Within a year a goat may experience an increase and a decrease in its body condition score depending on nutrition and live weight change (McGregor, 2010a). Within a mob of goats, it is usual to observe a range in body condition scores (McGregor, 2005).

3.1.3. Body condition score, live weight and carcass attributes

3.1.3.1. Body condition score, nutritional treatment and live weight change

Changes in live weight associated with differences in nutrition are reflected in changes in body condition score (McGregor, 1988, 2010a). Table 7 illustrates the typical response of body condition score to long-term nutritional treatments that result in substantial changes in live weight. The data come from housed goats fed the same forage diet at different levels of energy provision (McGregor, 1988). Those goats fed to lose weight (below maintenance of live weight 0.8 M) lost 4.9 kg and their body condition score declined 1 unit. The goats that gained live weight increased their body condition score in proportion to the amount of live weight gain at a rate of approximately 6.5 kg per 1 score.
Table 7. The live weight and body condition score and their changes with time for individually housed goats fed forage diets at different levels of energy provision over a 5 month period. The energy nutrition treatments are relative to the maintenance of live weight (M) (McGregor, 1988).

<table>
<thead>
<tr>
<th>Nutrition treatment</th>
<th>Live weight (kg)</th>
<th>Body condition score</th>
<th>Change</th>
<th>30/11/84</th>
<th>22/04/85</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.8 M</td>
<td>28.4</td>
<td>23.5</td>
<td>-4.9</td>
<td>2</td>
<td>1</td>
<td>-1.0</td>
</tr>
<tr>
<td>M</td>
<td>28.4</td>
<td>27.9</td>
<td>-0.5</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>1.25 M</td>
<td>28.2</td>
<td>30.6</td>
<td>+2.4</td>
<td>2</td>
<td>2.3</td>
<td>+0.3</td>
</tr>
<tr>
<td>1.5 M</td>
<td>28.5</td>
<td>33.3</td>
<td>+4.8</td>
<td>2</td>
<td>2.7</td>
<td>+0.7</td>
</tr>
<tr>
<td>AD LIB</td>
<td>28.4</td>
<td>36.4</td>
<td>+8.0</td>
<td>2</td>
<td>3.3</td>
<td>+1.3</td>
</tr>
</tbody>
</table>

For grazing Angora goats the change in live weight associated with a change of 1 score in body condition is approximately 7.0 kg (McGregor, 1992) to 9.4 kg (McGregor, 2010a). The impact of seasonal nutritional conditions and long-term stocking rate on the body condition score of Angora goats are illustrated Figure 3. In small east African goats in Zimbabwe a change in condition score of 1 represented an average change of 12% in live weight (Honhold et al., 1989). The association between body condition score and live weight of goats can be quite high with regression correlation coefficients as high as 0.93 (McGregor, 2010a).

Figure 3. The relationship between the body condition score (△, □) and the fleece-free live weight (▲, ■) of Angora goats grazed on annual temperate pastures from March 1982 to September 1983 at stocking rates of 7.5 animals/ha (△, ▲) and 12.5 animals/ha (□, ■) (modified from McGregor, 2010a).
3.1.3.2. **Body condition score and carcass attributes**

Body condition score of goats, when used in linear regressions, has been shown to account for 44 to 67% of the variation in a range of carcass attributes (Table 8). This indicates that as a subjective method for assessing carcass attributes body condition scoring can be a useful and practical aid for farmers without livestock scales.

![Photo 1](image.png)

**Photo 1. A confident farmer weighing and body condition scoring his goats.**

Table 8. Regression constants (± s.e.) and correlation coefficients for linear relationships between carcass attributes (kg) and total body fat (kg) and body condition score for Angora goats (modified from McGregor, 1992).

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Regression coefficient</th>
<th>Constant</th>
<th>RSD</th>
<th>100 r²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcass weight</td>
<td>4.13 (0.85)</td>
<td>7.6</td>
<td>2.26</td>
<td>62</td>
</tr>
<tr>
<td>Carcass fat</td>
<td>1.56 (0.29)</td>
<td>0.26</td>
<td>0.76</td>
<td>67</td>
</tr>
<tr>
<td>Total body fat</td>
<td>2.73 (0.51)</td>
<td>-0.26</td>
<td>1.36</td>
<td>66</td>
</tr>
<tr>
<td>Subcutaneous back fat</td>
<td>1.18 (0.34)</td>
<td>-0.83</td>
<td>0.91</td>
<td>44</td>
</tr>
<tr>
<td>Carcass protein</td>
<td>0.58 (0.14)</td>
<td>1.62</td>
<td>0.37</td>
<td>55</td>
</tr>
<tr>
<td>Fat free carcass weight</td>
<td>2.57 (0.62)</td>
<td>7.30</td>
<td>1.65</td>
<td>53</td>
</tr>
</tbody>
</table>

3.2. **Fat scoring the long ribs**

Fat scoring is used in live stock market reports in Australia as a method of estimating fat classes for sheep and for describing animals for sale. This system has been applied for specification of goat carcasses (Aus-Meat, 2001). Fat classes of carcasses are objectively determined in the meat works by measuring the tissue depth of the carcass at the GR site. The
GR site is on the second last long rib (12th rib) as a site 110 mm from the midline (ridge of the spine). See Figure 4.

![Diagram showing the position of the GR site on the 12th long rib and the short ribs.](image)

**Figure 4. The position of the GR site on the 12th long rib and the short ribs.**

The tissue depth at the GR site includes muscle and fat. The GR site is regarded as a good reference point as it provides a reliable indication of the meat and fat content of the carcass and is easy to measure. Examples of the relationship between the GR tissue depth and other carcass attributes are available (McGregor, 1990, 1992, 1996). Fat scores and fat classes range from 1 to 5 and for goats are explained in Table 9. The fat class descriptions for sheep carcasses have different tissue depths at the GR site compared with those used for goat carcasses.

**Table 9. The relationship between goat fat classes and tissue depth at the GR site (AusMeat, 2001).**

<table>
<thead>
<tr>
<th>Fat Class</th>
<th>Description</th>
<th>Tissue depth at GR site</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very lean</td>
<td>up to 3 mm</td>
</tr>
<tr>
<td>2</td>
<td>Lean</td>
<td>4 to 6 mm</td>
</tr>
<tr>
<td>3</td>
<td>Moderately lean</td>
<td>7 to 9 mm</td>
</tr>
<tr>
<td>4</td>
<td>Moderately fat</td>
<td>10 to 12 mm</td>
</tr>
<tr>
<td>5</td>
<td>Fat</td>
<td>over 12 mm</td>
</tr>
</tbody>
</table>

**How to fat score**

Fat scoring uses the sense of touch to estimate the fat class into which an animal will be assigned to for sale.
a) The animal must be standing on all feet and "relaxed", not tensed up or pushed into a corner. The side of the animal must be accessible. It is not possible to properly score if an animal is crouching or jumping over other animals.
b) Use the "balls" of the fingers rather than the tips.
c) Feel the body over the 12th long rib where the GR measurement would be taken. Feel for the prominence of the rib and the amount of tissue over the ribs (Table 10).
d) The easier it is to feel the rib the lower is the fat score (Table 10).
e) For animals with a dense fleece, the fleece should be parted to feel the skin more easily.

Table 10. What fat scores feel like on a live goat.

<table>
<thead>
<tr>
<th>Fat Score</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What is felt at the GR site</strong></td>
<td>Fingers ‘fall’ between ribs.</td>
<td>Fingers fit between ribs.</td>
<td>Fingers sit on ribs.</td>
<td>Ribs can be felt.</td>
<td>Ribs only felt with pressure.</td>
</tr>
<tr>
<td>No tissue can be felt over ribs.</td>
<td>Slight amount of tissue over ribs.</td>
<td>Some tissue over ribs.</td>
<td>Lots of tissue present.</td>
<td>Tissue very prominent and may be fluid.</td>
<td></td>
</tr>
</tbody>
</table>

No objective data relating the use of fat scores to either goat meat production or animal management issues has been found.

**3.3. Other uses of body condition scoring in goat meat production**

Body condition scoring has been shown to have important associations with other management issues of vital importance in goat meat production. In particular body condition scores are associated with risk of mortality in adverse climatic conditions and from pregnancy toxaemia and to reproductive performance.

**3.3.1. Mortality risk for goats**

Mortality in flocks of Angora goats grazing pastures and subjected to adverse climatic risks was most related to the body condition score reached during the preceding two months (McGregor and Butler, 2008). For flocks of Angora goats there was no mortality at body condition score \( \geq 2.5 \) and mortality increased sharply at mean body condition score \(< 2.0\). For individual Angora goats, mortality increased as body condition score declined and stocking rate and grazing combinations were additive in effect on mortality. Grazing with sheep increased mortality of Angora goats at higher stocking rates. Live weight loss was not related to mortality rates of goats once body condition score had been accounted for. It was concluded that body condition score and stocking rate were highly significant determinants of...
welfare risk in Angora goats. The analysis of the individual goat mortality rate indicated that these results were applicable in many situations. Consequently, farmers and animal welfare assessors can confidently use body condition scores to determine welfare risk in goats (McGregor and Butler, 2008).

Morand Fehr et al. (1992) noted that the risk of pregnancy toxaemia to dairy goats was related more to a decline in body condition score rather than to body condition score per se.

3.3.2. Reproductive performance

Body condition scores of less than 2.5 have been implicated with increased abortions and reduced kidding rates in Mexican native goats grazed under extensive conditions (Mellado et al., 2004). Compared with all other does, the thinnest goats (body condition score < 1.5) were nine times more likely to abort. Body condition score was not identified as a risk factor regarding pregnancy in these goats.

4. ESTIMATING THE AGE OF GOATS USING DENTITION

The dentition of goats has commercial importance, particularly the age at the eruption of the first pair of permanent incisors, as this affects the commercial value for meat production and the sale of animals for breeding purposes. For meat production, the eruption of permanent first incisors in small farm ruminants is used to signify a change in meat quality by altering the classification of lamb and kid carcasses. Thus in many developed meat markets, it is essential to know the age of goats at sale.

For goats that are provided with ear tags in their year of birth it is easy to determine their age. The systematic use of coloured ear tags, where the colour of the tags is different for each year of birth, allows easy identification of the age of goats. Goats of different birth year with different coloured ear tags can be easily separated by drafting in a race. However if ear tags are not used then the subjective assessment of the dentition of goats can be used to estimate the age of animals.

Goats have two successive dentitions, the deciduous dentition ($n = 20$) and permanent dentition ($n = 32$). Upper incisors are absent and are replaced by a very thick connective tissue pad (palate). Permanent first incisors are easily distinguishable from the deciduous first incisors due to their relatively large size. The number of incisor and molar teeth that have erupted (broken through the gum surface) in the lower jaw of a goat is used to describe the age of a goat. Within a mob of goats of similar age there will be a range in age for when individuals show the eruption of permanent incisors (Table 11).
Table 11. The estimation of age by dentition.

<table>
<thead>
<tr>
<th>Dentition (number of teeth erupted)</th>
<th>Age (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No permanent incisors</td>
<td>0 up to 15</td>
</tr>
<tr>
<td>First pair of permanent mandibular molars</td>
<td>3 to 5</td>
</tr>
<tr>
<td>First pair of permanent incisors</td>
<td>13 to 21</td>
</tr>
<tr>
<td>Second pair of permanent incisors</td>
<td>18 to 24</td>
</tr>
<tr>
<td>Third pair of permanent incisors</td>
<td>22 to 32</td>
</tr>
<tr>
<td>Fourth pair of permanent incisors (full mouth)</td>
<td>27 or more</td>
</tr>
</tbody>
</table>

There are few scientific reports of eruption patterns of permanent incisors in goats (Wilson and Durkin, 1984; Mitika et al., 1992; Kwantes, 1994; McGregor and Butler, 2011) but text books (Gall, 1981; Pugh, 2002; Radostits, 2007; Smith and Sherman, 2009) also provide tables of eruption ages for goats. Photographs and X-rays of the lower jaw of different aged goats are available to show the development of incisors and molars (Holst and Denny, 1980).

McGregor and Butler (2011) have shown that the time to reach similar development stages for first permanent incisor eruption was about three months longer for the lightest yearling goats compared with the heaviest yearling goats. Further, where the eruption of permanent first incisors is used to estimate the age of goats, allowance needs to be made in estimates of the age of lighter goats compared with heavier goats within the same cohort, as each 1 kg decrease in live weight was associated with an increase of about 6 days in the time to reach each stage of permanent first incisor development, such as the loss of first deciduous incisors or the eruption of permanent first incisors. Thus it should not be assumed that all lighter goats within a cohort are younger just because their permanent first incisors have not reached the same stage of development observed in heavier goats. Within this research flock, the differences in live weight of goats explained 3 months in the variation in eruption of permanent first incisors, which is about half of the reported variation in age at eruption shown in Table 11.

A practical application in goat meat marketing of the use of dentition is to describe goats as kids that have no evidence of eruption of permanent incisors (Aus-Meat, 2001) even though these goats may be up to 15 months of age. For very young kids the eruption of the first mandibular molar could be used for aging (Holst and Denny, 1980). It is very common for
goats to be described in livestock sales as 2-tooth, 4-tooth or full mouth for example, meaning that they are respectively 1 year old, 2 years old or adult, even though there could be a range in ages within such descriptions.

5. ULTRASOUND SCANNING LIVE GOATS
Real time ultrasound scanning (ultrasonography) is a noninvasive technique used in animal production to detect pregnancy status, live animal body and carcass attributes. Ultrasound scanning can be used as a method of indirect measurement of the eye muscle depth (Mm. *longissimus dorsi*), subcutaneous back fat depth, and sternum fat deposits in goats using the same techniques that are used with sheep and pigs (Wood and Fisher, 1990; Stanford *et al.*, 1995; Hopkins *et al.*, 2007; Teixeira *et al.*, 2008). There has been much more intensive evaluation of the use of ultrasound scanning of the carcass attributes of sheep than of goat carcasses. However, the relevance and specific transfer of research findings with sheep to goat carcasses needs to be cautioned by the knowledge that fat distribution within goats differs significantly to that of sheep (Gall, 1981; McGregor, 1985) and goats have been subject to far less genetic selection for carcass traits than have sheep.

However the costs of both equipment and hire of consultants to conduct ultrasound scanning are likely to result in these techniques being applicable only in larger commercial breeding flocks, during genetic selection programs for carcass attributes and where carcass attributes are important in the classification of carcasses at meat works.

Eye muscle area has been shown to be positively related to hot carcass yield in Jamunapari goats (Amin *et al.*, 2000). Teixeira *et al.* (2008) reported that the best correlation for muscle depth in Spanish Celtiberica adult goats was found for ultrasound measurements taken between the third and fourth lumbar vertebrae. These estimates accounted for 70% of the variation in muscle depth. The lumbar vertebrae sites are the same as those used for body condition scoring. The practical question is therefore to what extent does expensive ultrasound measurement provide better estimates of carcass yield, carcass composition and muscle attributes of goats than the easily applied technique of on-farm body condition scoring? The on-farm measurements of live weight and body condition score used together accounted for 58% of the total variation in eye muscle depth of Angora goats or 87% of that accounted for by the best model, which required carcass weight (McGregor, 2010b). It appears that ultrasound measurement of muscle depth does not account for all the variation in
The role of subjective and objective evaluation in the production and marketing of live meat goats

this attribute and that goat meat producers can achieve near similar results using other methods.

In centralized breeding schemes in Australia where ultrasound scanning has been used on-farm to measure eye muscle depth in meat sheep (Hopkins et al., 2007; LambPlan, 2008) improvements have been obtained in growth, carcass weight and a significant medium-term return on investment has been obtained (Holst, 1999). While a centralized breeding scheme for goats has been available in Australia for some years (KidPlan, 2008) few breeders have invested in applying ultrasound measurements to evaluate their bucks. However it has been shown that there are significant differences between the progeny of Angora bucks in eye muscle depth and subcutaneous back fat at 14 months of age with a range of 1.3 mm and 2.8 mm respectively between sire groups of progeny (Ferguson and McGregor, 2005). For Boer bucks the range from the 1 percentile to the 100 percentile of measurements indicates differences of 3 mm in eye muscle depth and 2.2 mm in subcutaneous back fat depth (KidPlan, 2008).

However the evidence that it is cost effective to use ultrasound measurements must be questioned given the findings of two recent reports. Using ultrasound measurements of subcutaneous lumbar fat depth and eye muscle depth to predict commercial carcass yield of Angora goats added only an extra 2.4% to the 89.1% of variance accounted for by live weight, body condition score and sire (McGregor, 2010b). For total muscle prediction Teixeira et al. (2008) reported that using ultrasound measurement at the lumber site only increased the precision of muscle prediction by 8% (to a total of 90% of variance accounted for) compared with using body weight alone. Thus the evidence available suggests that with goats the use of body weight and body condition scoring are adequate and cost effective method for goat meat producers to use to estimate meat yield and carcass attributes and that the additional expense of using ultrasound measurements currently provides little extra benefit.

6. PREPARING GOATS FOR MEAT MARKETING

Commercial marketing of goats for meat involves identifying the market, correct husbandry and nutritional management, proper assessment of goats suitable for marketing and the correct preparation of goats prior to dispatch to the market. This section summarizes the correct preparation of meat goats prior to dispatch to the identified market (McGregor, 2007b).
Commercial market requirements can vary with seasons and between years so it is important that farmers intending to sell goats for meat contact potential buyers, agents or marketing networks in advance to ensure that they clearly understand the current market requirements. When goats are being prepared for market, the farmer must time their work carefully to ensure that the buyer will accept delivery of the goats on time and according to specification. During the months prior to delivery, husbandry operations must be carefully planned to enable goats to arrive at the correct specifications and appearance.

Ideally, goats delivered for slaughter will:

1. meet specification;
2. be outside any chemical withholding period;
3. be healthy;
4. be clean and dry;
5. have short fleeces;
6. have no bruizes;
7. have clear identification;
8. be delivered in the agreed sized load;
9. be ready on time; and
10. be accompanied with appropriate paper work.

6.1. Meet specification
It is critical to only sell goats that closely match the specifications of the buyer. Usually buyers will specify the age, live weight or carcass weight and condition score of the goats they wish to buy. The assessment procedures required for the marketing of goats are discussed earlier in this Chapter.

All goats that are being considered for sale should be inspected. Any goat that does not match the specifications should be rejected to avoid penalties for failing to meet specifications. The main penalty will be not being paid for goats that are outside specification. If the inspection of goats occurs well before marketing, a farmer can decide if the goats that are currently unsustainable will benefit from additional feeding before sale. Live weight should be directly measured. The body condition should be monitored. Goats that do not have the correct condition score should not be sold. The age of sale goats should be determined from farm records or from dentition (teeth development).
6.2. **Be outside chemical withholding periods**
In most developed markets farmers must maintain and carefully check farm records to ensure that goats being sold will be outside the withholding periods for any chemical treatment that they may have received. It is common for goats to be treated with veterinary drugs such as vaccines, drenches to control internal parasites and chemicals to control lice. Each chemical treatment has an associated specified withholding period (Anon, 2009). Withholding periods are designed to ensure a reasonable time period between chemical treatment and slaughter so that any chemical residues that may exist in the food are below the relevant maximum residue limit. Maximum residue limits apply to all food products sold in many countries and are legally binding. The withholding period is printed on chemical and drug labels.
Farmers selling goats destined for export need to be aware of any Export Slaughter Interval (ESI) that may apply. For example in Australia, the ESI reflect the differences between Australian and overseas maximum residue limits (Anon, 2009). The ESI may be longer than a chemical withholding period in order to satisfy lower overseas maximum residue limits.
It is the responsibilities of farmers to ensure withholding periods and ESIs are honored. Products without goats on the label should not be used on goats for export meat production unless there is a permit for the use issued by the National Registration Authority.

6.3. **Be healthy**
Only healthy goats should be sent to market. It may be a breach of any Code of Welfare and Code of Transport that may apply to goats to send sick or injured animals to market. Animals with broken limbs, broken horns or other physical injuries should be removed from any mob of goats being sold and carefully treated. Such codes of practice apply in Australia (Anon, 2001; 2002).
Kids that are sold for meat should be weaned from their mothers just prior to transport. This means that farmers must be well organized so as not to delay the transport carrier. Kids do not have a large gut full of food. Prolonged periods of food deprivation will result in dark and dry carcasses that will be unsuitable for the high value kid meat markets.

6.4. **Be clean and dry**
Goats contaminated with mud, weed seeds, dags or scour should be cleaned up. Wet and dry dags must be removed from the breech, tail and legs.
Where practical, goats should be loaded when they are dry. If it is raining and the yards are muddy, keep stock under cover and if possible arrange to load stock out of a shed.
Goats should have access to water up until the time of shedding or yarding. Feed and water should be withheld for 12 hours prior to transport of adult goats. This will result in cleaner and safer transport and make unloading easier.

There is no advantage in having goats ready earlier than needed as prolonged deprivation of feed and water results in a loss of body and carcass tissue weight.

Load goats only into a clean transport vehicle. Do not put straw or hay onto the floor of the vehicle. Such material will blow about and become lodged in the fleece of the goats.

If goats ready for sale have to be held for some time, place them in large holding yards or paddocks with ample feed, shade and water. Avoid using overhead hay racks as goats can become covered with seeds and litter.

Animals suffering from scouring should be removed from any consignment. Scouring animals: foul themselves; foul other animals in the consignment; and lead to higher rates of carcass contamination that will reduce the shelf life of goat meat products.

Animals given a chemical treatment to stop scouring or reduce internal parasitism, cannot be sold until the withholding period has expired.

6.5. Have short fleeces

Goats are best sold with short fleeces, ideally less than 3 cm long. Fleece bearing Angora and cashmere goats should be shorn preferably 3 weeks prior to slaughter. A 3 week period will allow any cuts and bruising to heal. A short fleece will enable goats to be transported more efficiently. Angora goats should be sold no later than 10 weeks after shearing.

A short fleece will also reduce any contamination and make slaughter more efficient. Goats destined for the “skin-on” carcass trade must have short fleeces, as it is difficult to remove long fleece during processing.

6.6. Have no bruizes

Bruising and dog bites result in downgrading, severe trimming or condemning of goat carcasses in the meat works. Bruising costs farmers and marketing agents hundreds of thousands of dollars each year. Any bruising caused by, physical blows or pulling of the fleece will show on the carcass possibly leading to trimming and downgrading.

To minimize bruising, goats should be handled quietly and carefully. Do not use electric prodders. Ensure that there are no projections in handling facilities such as yards and races. Keep handling to a minimum. Do not frighten the goats with dogs, loud noizes or noisy machines.
If dogs are used they should be muzzled. Do not pull fleeces or the skin. Rough handling causes bruising. When transporting, keep the pens small and not overcrowded. Goats tend to pack down and small pens avoid large pile-ups and suffocation of goats at the bottom. Put goats into groups of similar sex and size. The transport vehicle should drive and stop carefully. The vehicle should stop occasionally and the driver should check to ensure that the goats are comfortable. In Australia transport drivers should be familiar with the Code of Practice for Welfare of Farm Animals during Transport. In Australia livestock transport drivers are expected to have a Quality Assurance system in place such as TruckCare (2009). TruckCare has been developed for livestock transporters by the Australian Livestock Transporters Association. The program is aimed at raising awareness, introducing a quality management system which can be audited by customers, or by an externally qualified auditor and integrated with customers or road transport quality assurance programs. The Australian Livestock Transporters Association developed TruckCare in response to the need to improve animal welfare, occupational health and safety of its members and to reduce bio-security risks in the livestock industries.

6.7. Have clear identification
Clear identification of each goat being sold supports the farmer being paid for their product. Discuss identification of goats with the agent before goats are dispatched for market. Identification can be with ear tags, ear notches, leg tags, raddle or colour mark on the head or horns of the goats. Do not mark the body or fleece with coloured marks as this will downgrade the value of the skin. In some countries microchip ear tags are being used which ensures national recognition for identified livestock. One benefit of microchip identified livestock is that they cannot be lost in the system. If a farmer is disposing of several grades of goats at the same time, make sure different grades are marked with different identifiers such as different colours. It is also essential that the agent knows what all identifiers mean.

6.8. Deliver agreed load size
It is very important for farmers to deliver the number and type of goats that were agreed to be sold. Agents organize their purchases to match deliveries along the meat supply chain.
Carcasses cannot be stored for extended lengths of time and will deteriorate. Delivering too many or too few goats or not on time causes disruption to orderly marketing arrangements.

6.9. Ready on time

Goats should be ready for loading when the live stock transport arrives. Transport drivers do not appreciate long delays while they wait for farmers to move animals. Usually transport drivers have complex timetables to meet, in both collecting and delivering animals to a range of locations. Be considerate of the driver and the next farmers by having all animals nearby at the agreed upon time.

6.10. Fill in all paper work

Livestock transporters do not want to wait while farmers search for or fill in any necessary forms. Prepare all forms the night before a consignment is to be loaded. Be organized and keep a supply of the correct forms. If no-one will not be present when the transport arrives, arrange for a safe and dry place for the paper work to await collection by the driver.

6.11. Time table for selling

Table 12 gives the outline of routine activities to be completed before the dispatch of goats for slaughter. This table can be used as a checklist by ticking each activity when completed.
Table 12. A suggested list of routine activities to be completed before the sale of goats for meat. The table can be used as checklist by ticking each activity when completed.

<table>
<thead>
<tr>
<th>Time before sale</th>
<th>Activity</th>
<th>✓</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 months</td>
<td>Research suitable markets.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contact agents to determine market specifications.</td>
<td></td>
</tr>
<tr>
<td>5 months up to sale</td>
<td>Implement correct nutrition and husbandry practices.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Record chemical usage.</td>
<td></td>
</tr>
<tr>
<td>6 weeks</td>
<td>Ensure compliance with any withholding periods.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Organize shearing or crutching if needed.</td>
<td></td>
</tr>
<tr>
<td>4 to 5 weeks</td>
<td>Contact agent to reconfirm marketing arrangements.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inspect and evaluate (weigh and condition score) all potential goats for suitability for market.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adjust nutrition as needed.</td>
<td></td>
</tr>
<tr>
<td>3 weeks</td>
<td>Shearing and crutching must be completed.</td>
<td></td>
</tr>
<tr>
<td>2 to 7 days</td>
<td>Inspect and evaluate each animal (weigh and condition score, health) for compliance with market specification.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reject animals not meeting specification.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Move to paddocks near yards.</td>
<td></td>
</tr>
<tr>
<td>0 to 1 day</td>
<td>Draft suitable animals into the agreed size sale lines.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Identify different sale lots.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adult goats given 12 hour fast.</td>
<td></td>
</tr>
<tr>
<td>0 to 1 day</td>
<td>Fill in all required paper work and forms.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If wet, put goats into clean undercover shedding.</td>
<td></td>
</tr>
<tr>
<td>Day of transport</td>
<td>Wean kids before transport arrives.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Driver signs and takes copy of required forms.</td>
<td></td>
</tr>
<tr>
<td>After marketing</td>
<td>Make contact with agent or marketing group to obtain feed-back on sale.</td>
<td></td>
</tr>
</tbody>
</table>
6. CONCLUSIONS

The marketing of goats that meet the specifications of the meat buyers is essential for goat meat farmers. Goat meat farmers are strongly advised to improve their skills in live weight assessment and body condition scoring. For meat production from goats:
1. live weight is the best single indicator of the carcass weight and boneless meat yield;
2. farmers aiming to market goats should weigh and inspect their goats regularly;
3. farmers should use body condition scoring to monitor nutritional management and commercial suitability of goats prior to slaughter; and
4. farmers should ensure that they prepare their goats to meet market specifications and other marketing, transport and regulatory requirements.

7. REFERENCES

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