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Changes in body composition throughout lactation as determined by Dual Energy X-ray Absorptiometry (DEXA) in dairy goats.

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Source:
<https://meredithdairy.com/>

The industry in Australia...

- Industry growth at ~20% per year
- Driven by consumer demand
- Lack of research specific to Australia



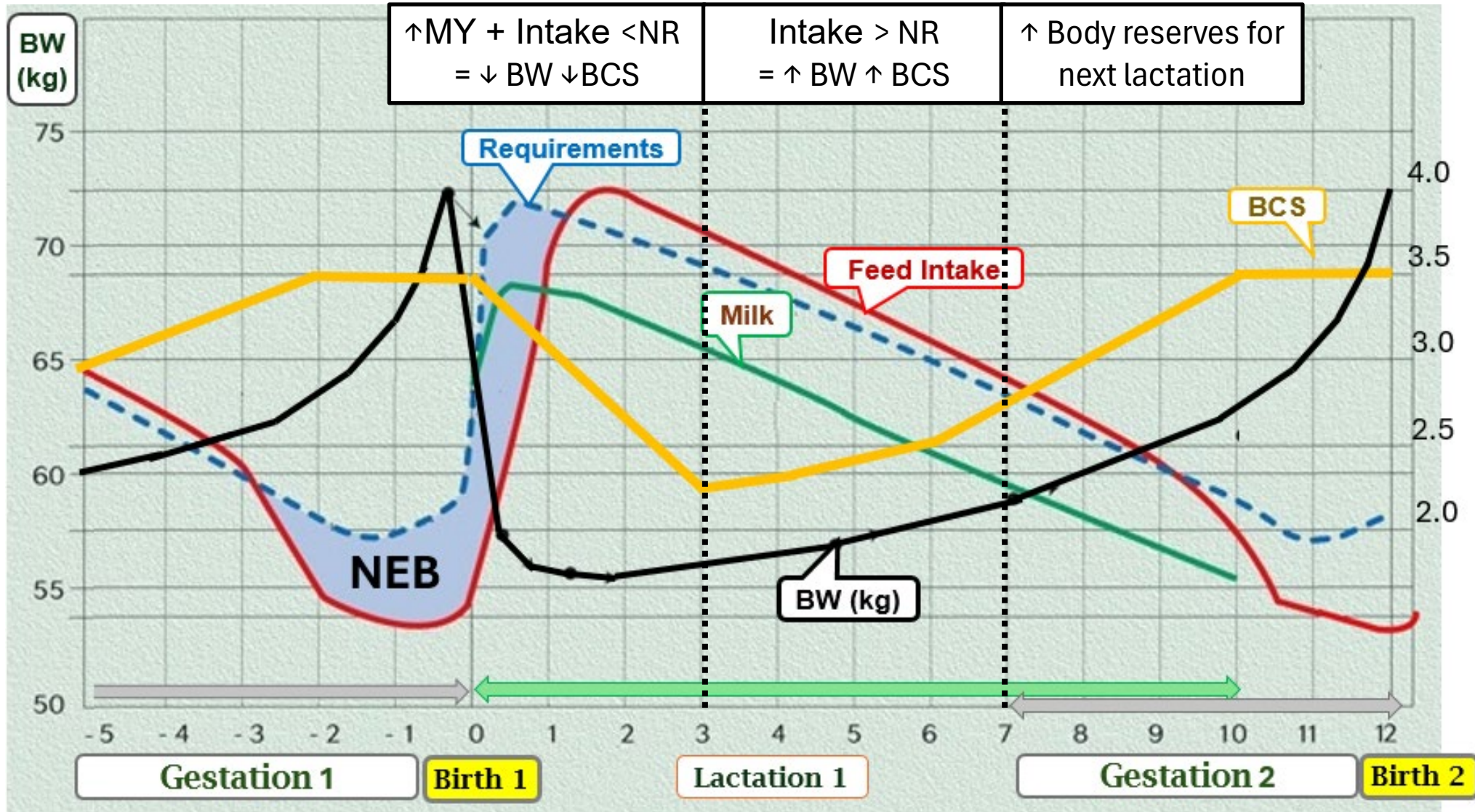
Source:
<https://meredithdairy.com/>

Why body composition?

- Understanding **mobilisation** and **accretion** of body reserves is important for:
 - Determining **lifetime productivity** and survival (reproduction, over/under weight)
 - Estimating **energy balance**
 - Assisting selection for **improved production** (milk quality + yield)

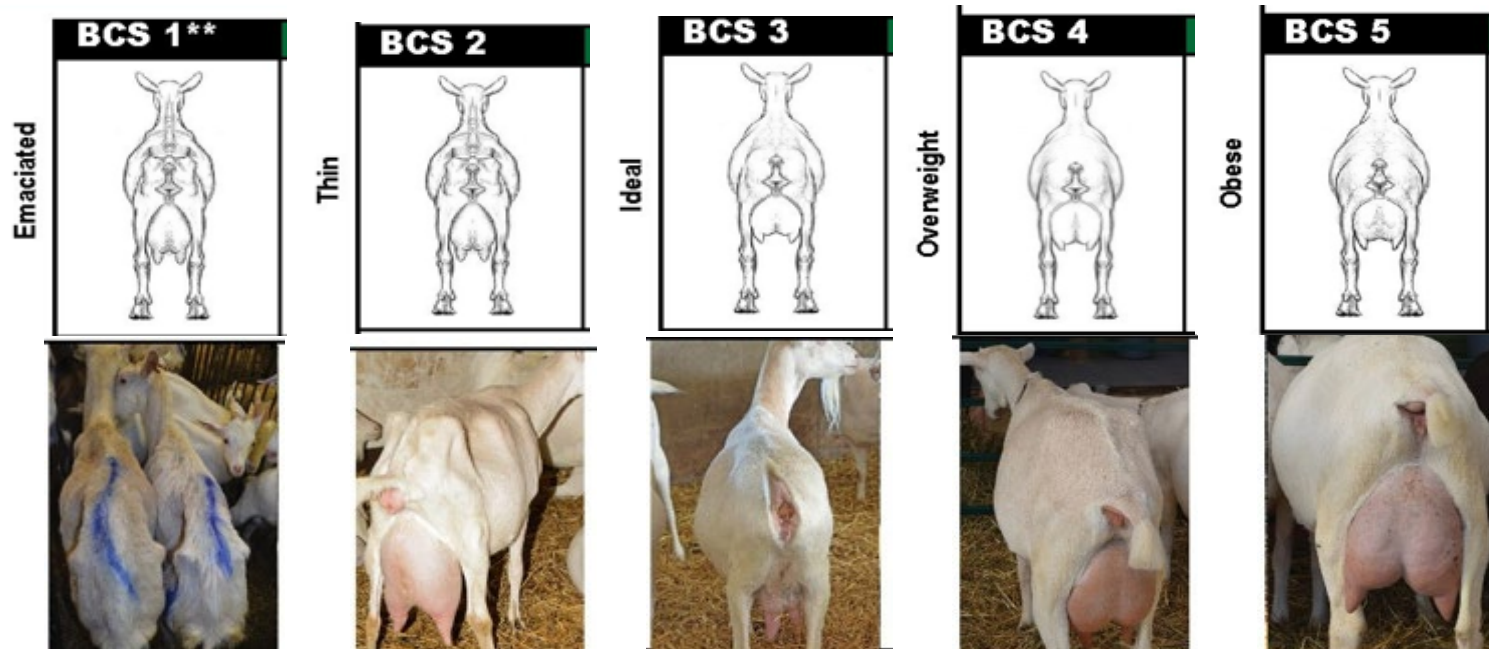


Goats in NEB for around 1 month...

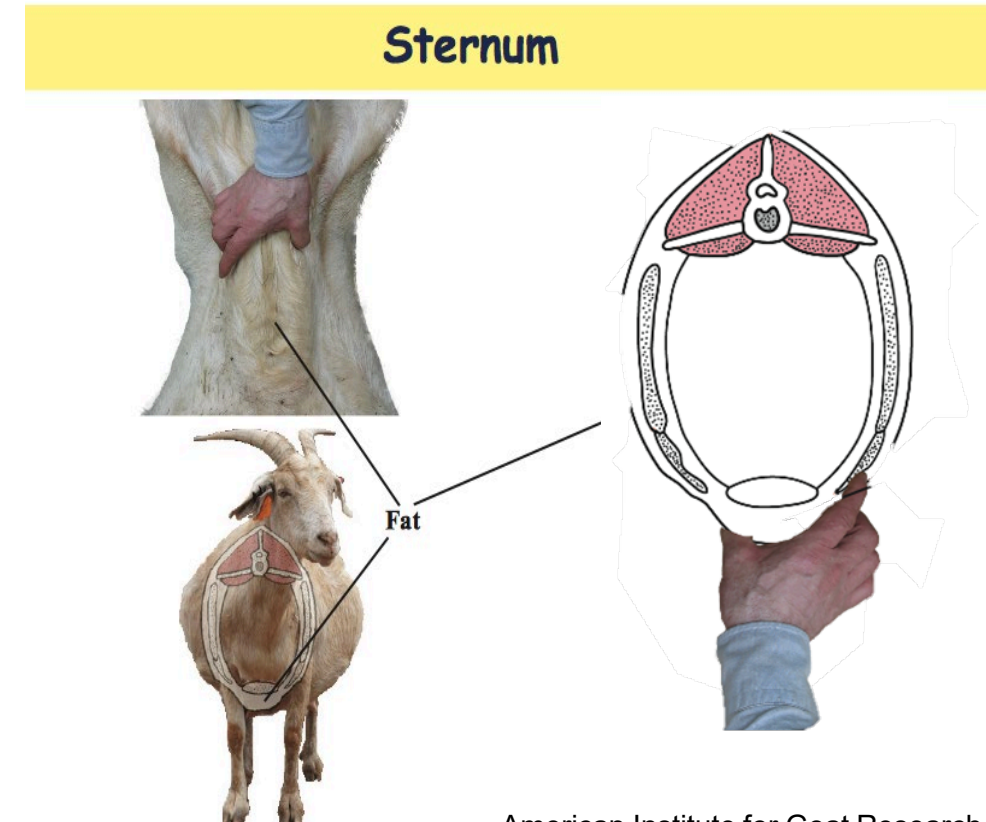


Traditional measures of composition...

- **Body Weight**
- **BCS**
 - Based mainly on sheep (dorsal/ lumbar)
 - Distribution of body fat (sternal/ visceral fat)
 - Include sternum palpation



Onrario Goat: Body Condition Score for Dairy Goats

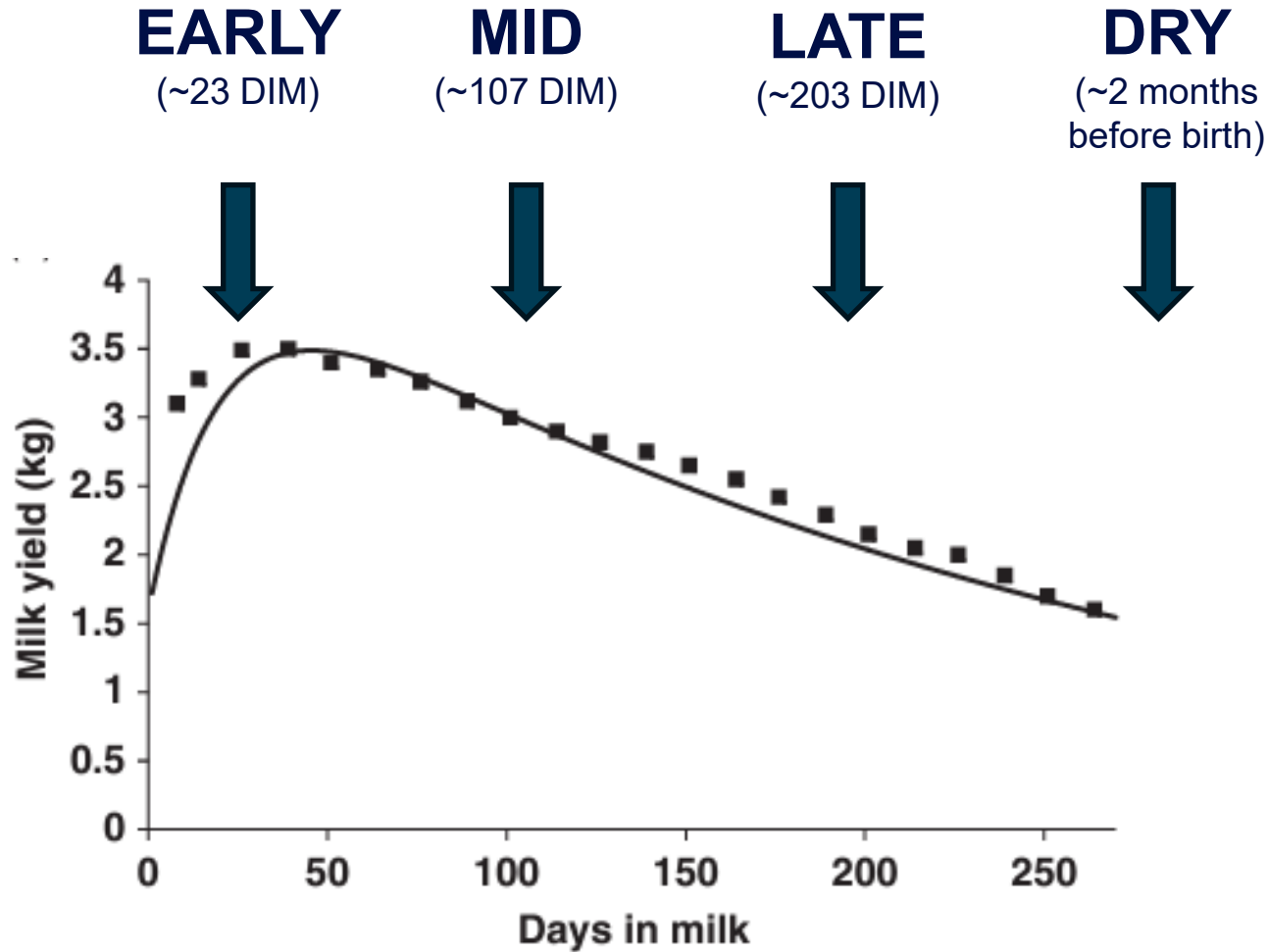


Research questions...

- How does body composition change throughout a lactation cycle?
- Comparisons of different measures of body condition scoring. How do “traditional” measures compare to DEXA?
- Are there differences in fat mobilisation and accretion between high- and low-producing goats?



Methods



Dairy goat lactation curve (Puillet et al., 2008).

- **40 Saanen dairy goats** (2nd-3rd parity)
 - 20 high milk production
 - 20 low milk production
- **Housed in group pens**
- **TMR diet**
 - 17.7% CP, 32.3% NDF, 12.6 MJ of ME/Kg DM
 - Silage/Hay, Lupins, Barley, Pellet, Almond Hull based

Methods

- **Production Data:**

- Milk yield (daily)
- Milk composition (Early, Mid, Late)

- **On four occasions:**

- **Body composition measurements:**

- Body weight (BW)
- Body condition score (BCS)
- Sternum girth (caliper)

- **Blood collection:**

- NEFA, Glucose, Urea, BHB

- **Advanced Techniques:**

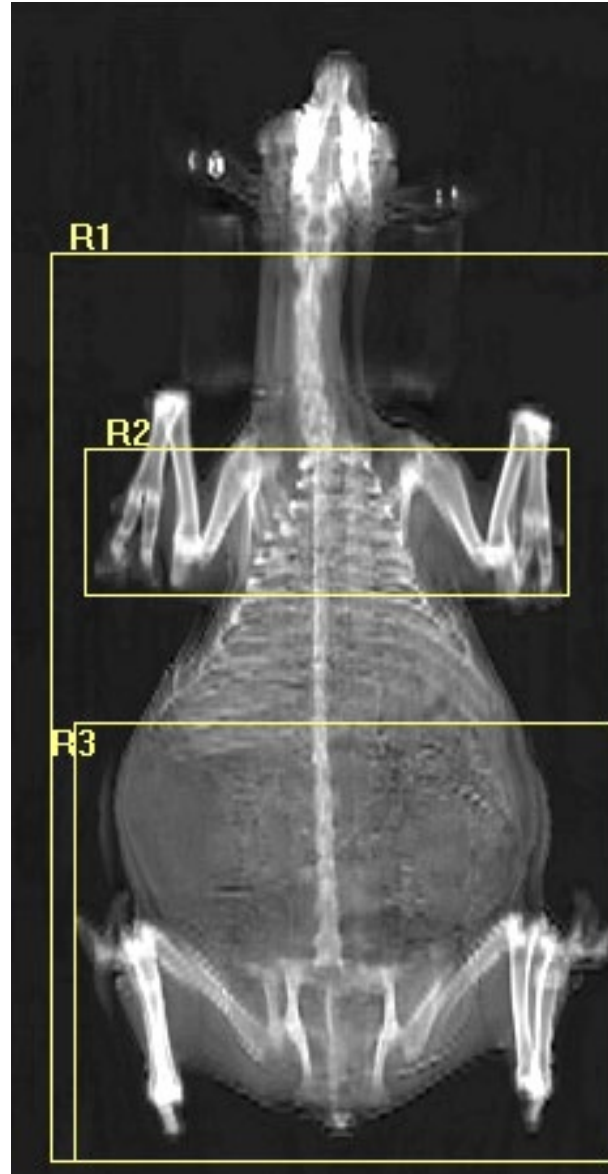
- Dual Energy X-Ray Absorptiometry (DEXA)
- 3D body Condition Score



Snapshots from 3D BCS
Footage



Dual Energy X-Ray Absorptiometry (DEXA)

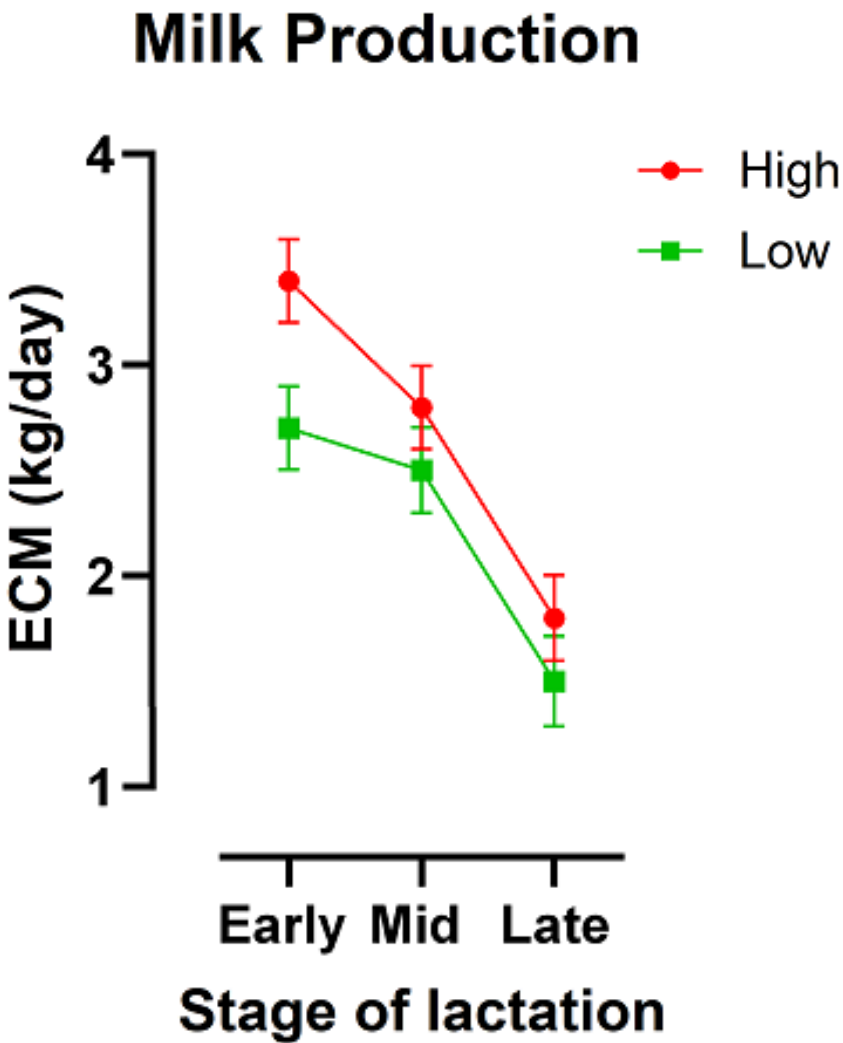


- Measures **fat, lean tissue, and bone mineral composition**
- **Non-Destructive**
- **Analysed by region:**
 1. Whole body excluding head
 2. Sternal region
(1st-6th sternal rib)
 3. Lower body
(tail to bottom of ribs)

BW and BCS increased through lactation



- Focusing on overall changes between stages of lactation

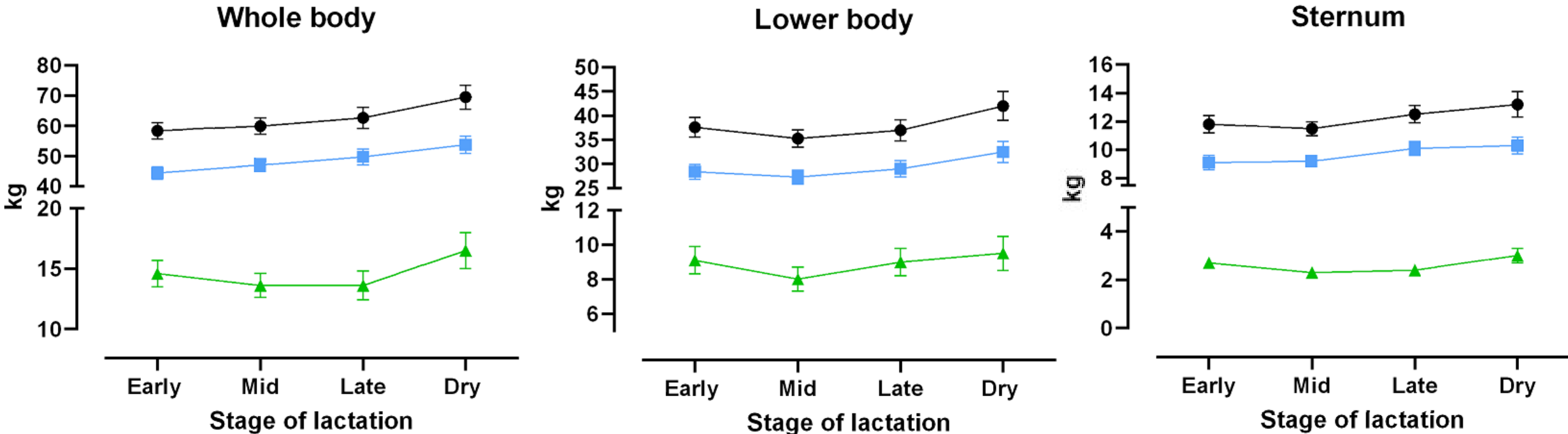


	Stage of Lactation				SED ²	p-value
	Early	Mid	Late	Dry		
n	40	39	36	29		
BW (kg)	66 ^c	68 ^b	70 ^b	76 ^a	2.5	<0.001
BCS	2.5 ^d	2.6 ^c	2.8 ^b	2.9 ^a	0.07	<0.001

¹Values are restricted maximum likelihood means. ²SED = standard error of differences.

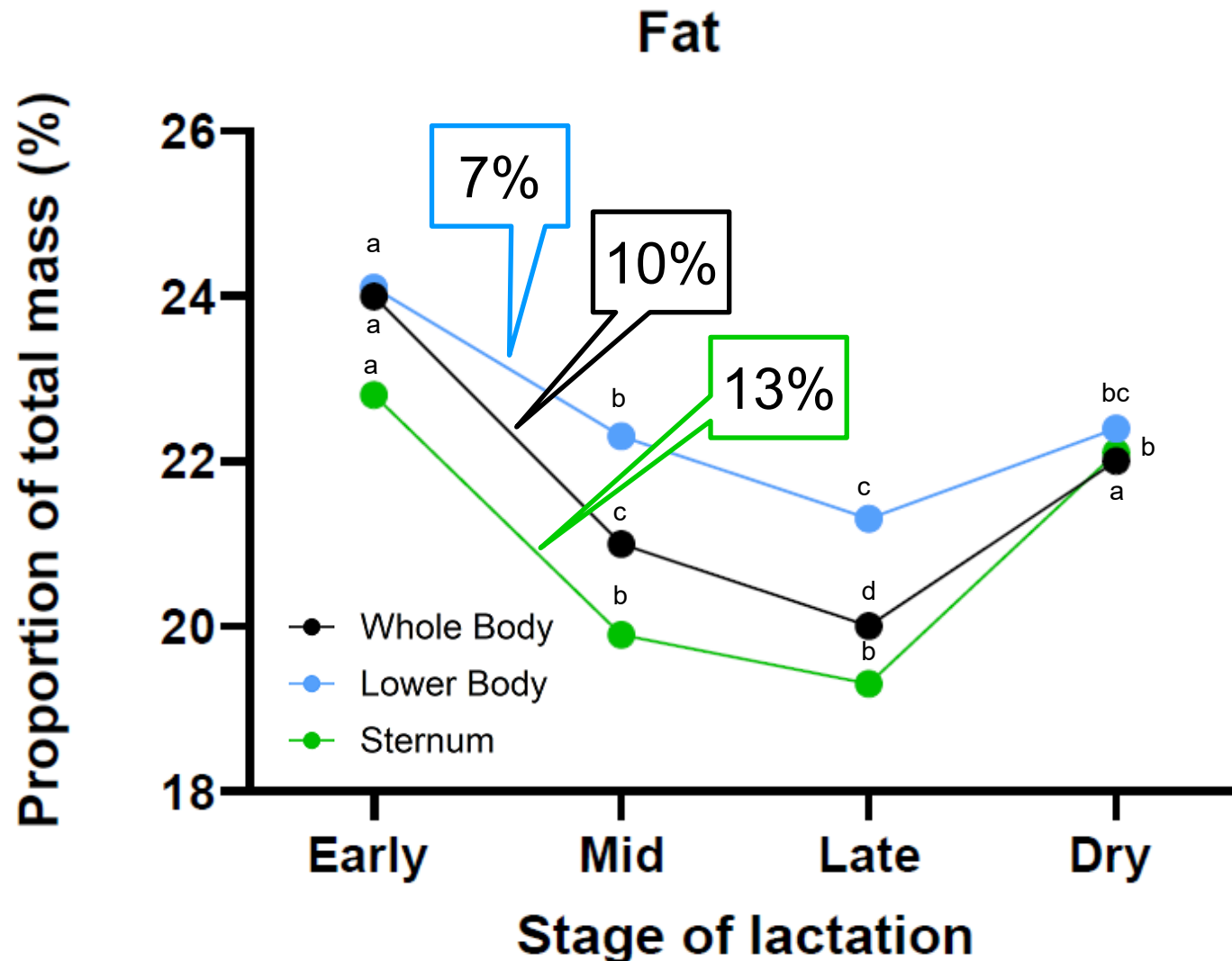
Mass increased through lactation...

● Mass (kg) ■ Lean (kg) ▲ Fat (kg)



Values are restricted maximum likelihood means. Error Bars are Standard error of differences.

Adipose tissue in sternum is readily able to mobilise fat



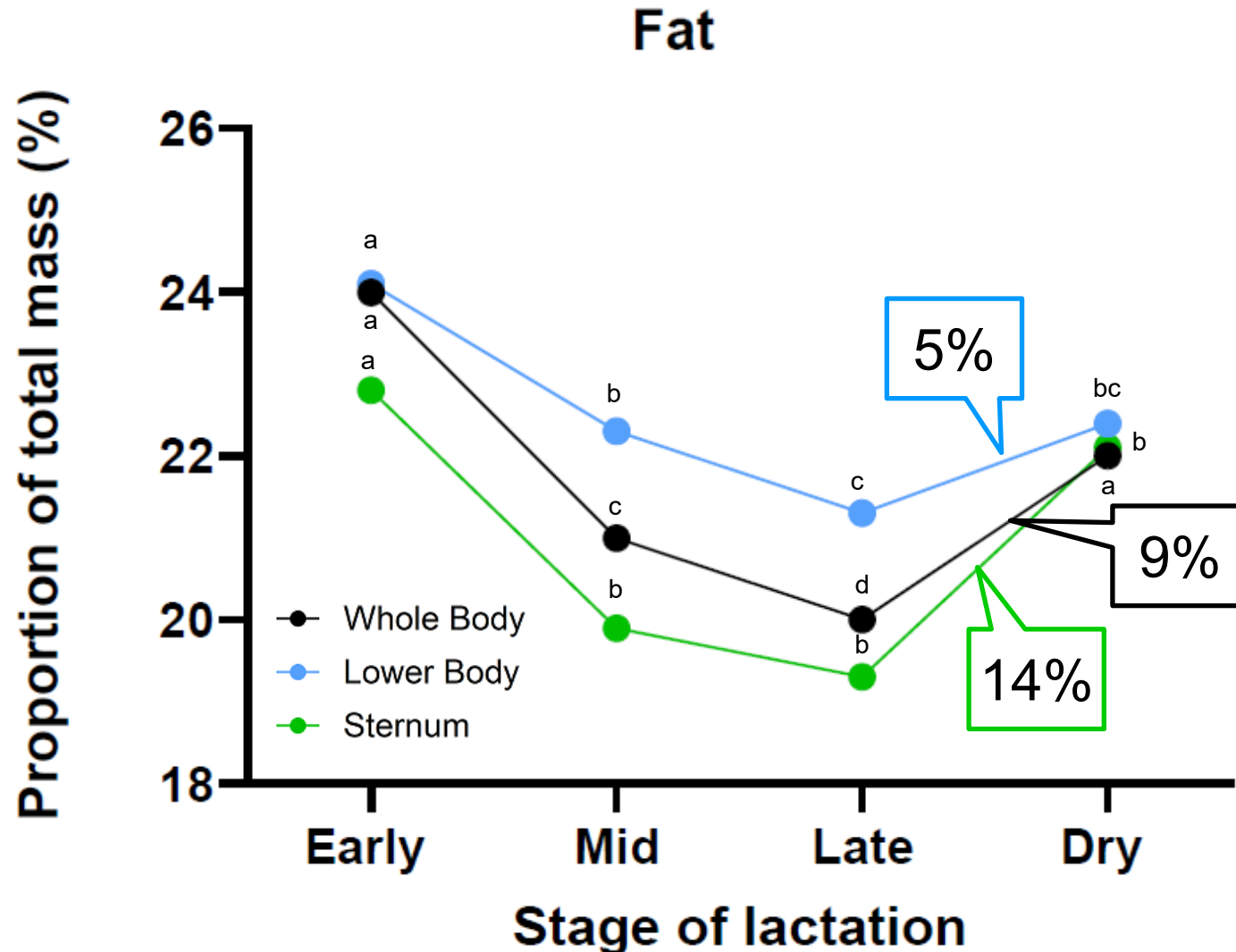
- Highest proportion of fat in early lactation

• ↓↓Fat (%)

- From Early to Mid:
 - 13% change in sternum fat
 - Readily able to mobilise fat

Different letters indicate significance across time (Stage of Lactation).

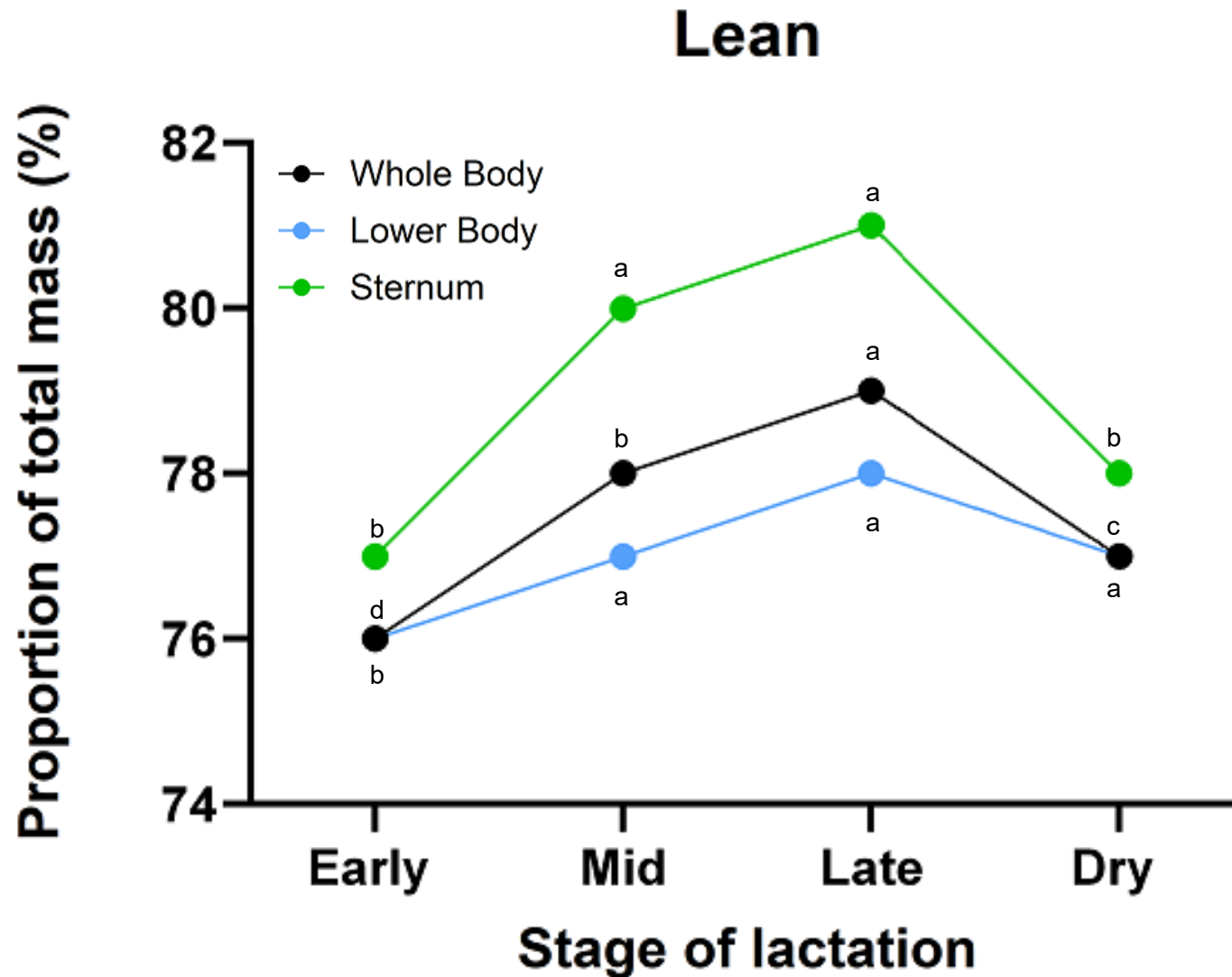
Adipose tissue in sternum is readily able to mobilise fat



- Highest proportion of fat in early lactation
- ↓↓ Fat (%)
- From Early to Mid:
 - 13% change in sternum fat
 - Readily able to mobilise fat
- From Late to Dry:
 - 14% change in sternum fat
 - Readily able to deposit fat

Different letters indicate significance across time (Stage of Lactation).

Lean Muscle



- Opposite to fat %
- Fat ↓, proportion of **lean muscle** ↑.
- **Decreases** during dry
 - Fat deposits ↑, lean ↓

Different letters indicate significance across **time** (Stage of Lactation).

To summarise...

- **EARLY to MID:**
 - ↑ BW and BCS
 - ↓ ↓ Fat % (13% sternum fat)
 - ↑ Lean %

→ Goats increased weight, but appear to also **mobilise fat stores** to sustain lactation
- **MID to LATE:**
 - ↑ BW and BCS
 - ↓ Fat %

→ Readily mobilise and deposit **sternal fat** → critical for sustaining lactation
- In **DRY:**
 - ↑ BW and BCS
 - ↑ Fat% (14% sternal fat)
 - ↓ Lean %

→ **Re-build fat deposits** in preparation for next lactation
→ Sternal fat



Take home messages...



- **BW and BCS:**
 - May not be reliable indicators of body fat distribution in goats
 - Inaccurate assessment of **body fat reserves**
- **Future research:**
 - 3D body condition scoring
 - Metabolites – NEFA, Glucose, BHB
 - Differences in production groups





Questions?

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