

# ALLOMETRIC GROWTH COEFFICIENTS OF NON-CARCASS AND CARCASS COMPONENTS OF SERIALLY HARVESTED IMPLANTED AND NON-IMPLANTED STEERS

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## INTRODUCTION

- Allometric growth: refers to the growth of a part in relation to a whole (Huxley and Teissier, 1936)
- Represented mathematically as  $Y = aX^b$ ; where Y=part, a=scaling factor, X=whole, and b=growth of part in relation to growth of whole
- Differences in growth can occur as a result of a number of factors (ie. sex, breed, environment, etc.)
- Implants increase lean and decrease fat deposition (Bruns, Pritchard, and Boggs, 2005) while still increasing live weight (Samber et al., 1996)
- The objective of this study was to quantify allometric growth coefficients of non-carcass and carcass components of implanted or non-implanted steers in relation to empty body weight

## MATERIALS AND METHODS

- Charolais × Angus (n = 80; 271 ± 99 kg) steers were paired by genetic group and estimated finished characteristics
- Pairs were randomized to harvest date (d0-42-84-126-168-210-252-294-336-378) and individuals within pairs were randomized to CON (negative control) or REV (Revalor-XS on d 0 and 190)
- Non-carcass components were measured after removal at harvest
- All organs were allowed to chill 24-h, emptied, cleaned, and weighed
- Carcasses were chilled 48-h and fabricated according to IMPS guidelines
- Data were log transformed to achieve a linear relationship; where coefficient b = slope (logY (weight of piece) ÷ logX (empty body weight))
- Data were averaged for each harvest date and treatment and analyzed via TTEST in SAS
- Coefficients > 1 exhibited faster tissue growth rates; coefficients < 1 exhibited slower tissue growth rates

## RESULTS AND DISCUSSION

### NON-CARCASS COMPONENTS

**Table 1.** Growth of non-carcass components relative to growth of the empty body of Charolais × Angus steers not implanted or administered Revalor-XS implant

| Item                      | Treatment <sup>1</sup> |      |         | Item            | Treatment <sup>2</sup> |      |             | Item               | Treatment <sup>2</sup> |      |             |
|---------------------------|------------------------|------|---------|-----------------|------------------------|------|-------------|--------------------|------------------------|------|-------------|
|                           | CON                    | REV  | P-value |                 | CON                    | REV  | P-value     |                    | CON                    | REV  | P-value     |
| n                         | 40                     | 40   |         | Esophagus       | 0.56                   | 0.42 | 0.16        | Heart              | 0.83                   | 0.90 | 0.82        |
| Metatarsals / Metacarpals | 0.52                   | 0.48 | 0.89    | Spleen          | 0.92                   | 0.96 | 0.96        | Thymus gland       | 0.61                   | 0.56 | 0.37        |
| Hide / Ears / Tail Switch | 0.69                   | 0.73 | 0.92    | Pancreas gland  | 0.76                   | 0.83 | 0.59        | Kidney             | 0.51                   | 0.58 | <b>0.06</b> |
| Pizzle                    | 0.70                   | 0.52 | 0.15    | Bladder         | 0.78                   | 0.88 | 0.13        | Oxtail             | 0.89                   | 0.97 | 0.28        |
| Head <sup>2</sup>         | 0.60                   | 0.65 | 0.15    | Rumen           | 0.73                   | 0.84 | 0.92        | GIT <sup>3</sup>   | 0.42                   | 0.51 | 0.97        |
| Brain / Spinal Cord       | 0.09                   | 0.17 | 0.42    | Reticulum       | 0.37                   | 0.46 | 0.98        | KPH Fat            | 2.11                   | 1.97 | 0.42        |
| Pituitary gland           | 0.56                   | 0.71 | 0.82    | Omasum          | 0.42                   | 0.61 | 0.57        | GIT Fat            | 1.69                   | 1.56 | 0.90        |
| Trimmed Tongue            | 0.72                   | 0.72 | 0.92    | Abomasum        | 0.41                   | 0.45 | 0.40        | Cod Fat            | 1.42                   | 1.49 | 0.46        |
| Lips                      | 0.90                   | 0.90 | 0.73    | Small Intestine | -0.05                  | 0.08 | 0.84        | Hot Carcass Weight | 1.03                   | 1.06 | 0.77        |
| Gallbladder               | 1.01                   | 0.97 | 0.79    | Large Intestine | 0.11                   | 0.13 | 0.14        | TST <sup>4</sup>   | 0.48                   | 0.55 | 0.73        |
| Liver                     | 0.59                   | 0.61 | 0.97    | Lungs / Trachea | 0.46                   | 0.52 | <b>0.09</b> |                    |                        |      |             |

<sup>1</sup>REV = Revalor-XS (200 mg trenbolone acetate and 40 mg estradiol) combination implant administered at 0 and 190 d; CON = negative control  
<sup>2</sup>Head = sum of skull, head meat, and cheek meat  
<sup>3</sup>GIT = sum of esophagus, stomachs, and intestines  
<sup>4</sup>Total Splanchnic Tissue (TST) = sum of esophagus, stomachs, intestines, liver, spleen, and pancreas

Table 1: Growth coefficient treatment comparisons for non-carcass components

- Tendency for the Lungs/Trachea and Kidneys to grow faster for REV
- Fat deposition does not differ between TRT in agreement with Hutcheson et al. (1997) and Parr et al. (2011)
- Pituitary gland grew numerically faster in implanted steers in agreement with Trenkle (1970)
- Carcass transfer was numerically greater for REV steers

### CARCASS COMPONENTS

**Table 2.** Growth of carcass components relative to growth of the empty body of Charolais × Angus steers not implanted or administered Revalor-XS implant

| Item              | Treatment <sup>1</sup> |      |         | Item                | Treatment <sup>1</sup> |      |         | Item                    | Treatment <sup>1</sup> |      |         |
|-------------------|------------------------|------|---------|---------------------|------------------------|------|---------|-------------------------|------------------------|------|---------|
|                   | CON                    | REV  | P-value |                     | CON                    | REV  | P-value |                         | CON                    | REV  | P-value |
| Brisket, primal   | 1.14                   | 1.23 | 0.98    | Flank, primal       | 1.45                   | 1.50 | 0.80    | Top Sirloin Butt        | 0.84                   | 0.84 | 0.11    |
| Brisket           | 0.94                   | 1.08 | 0.22    | Bottom Sirloin Flap | 0.98                   | 1.05 | 0.49    | Top Sirloin Butt Cap    | 1.05                   | 1.03 | 0.71    |
| Foreshank, primal | 0.86                   | 0.89 | 0.78    | Elephant Ear        | 1.40                   | 1.48 | 0.33    | Bottom Sirloin Ball-Tip | 0.49                   | 0.57 | 0.95    |
| Chuck, primal     | 1.01                   | 1.06 | 0.74    | Flank Steak         | 0.85                   | 0.72 | 0.01    | Bottom Sirloin Tri-Tip  | 0.78                   | 0.96 | 0.21    |
| Shoulder Clod     | 0.86                   | 0.92 | 0.84    | Rib, primal         | 1.21                   | 1.16 | 0.22    | Round, primal           | 0.79                   | 0.83 | 0.66    |
| Flat Iron         | 0.93                   | 1.05 | 0.55    | Ribeye Roll         | 0.96                   | 1.08 | 0.12    | Top Round               | 0.68                   | 0.71 | 0.16    |
| Petite Tender     | 0.78                   | 0.75 | 0.11    | Back Ribs           | 0.88                   | 0.88 | 0.98    | Sirloin Tip             | 0.60                   | 0.72 | 0.57    |
| Chuck Eye Roll    | 0.82                   | 0.90 | 0.01    | Rib Blade Meat      | 0.79                   | 0.88 | 0.06    | Bottom Round            | 0.70                   | 0.77 | 0.22    |
| Mock Tender       | 0.64                   | 0.74 | 0.59    | Short Ribs          | 1.10                   | 1.10 | 0.54    | Eye of Round            | 0.69                   | 0.80 | 0.01    |
| Pectoral Meat     | 0.26                   | 0.11 | 0.34    | Loin, primal        | 1.03                   | 1.04 | 0.74    | Heel Meat               | 0.58                   | 0.61 | 0.06    |
| Plate, primal     | 1.42                   | 1.49 | 0.62    | Hanging Tender      | 0.74                   | 0.74 | 0.38    | Total Lean              | 0.88                   | 0.95 | 0.45    |
| Outside Skirt     | 0.86                   | 0.85 | 0.84    | Striploin           | 0.72                   | 0.79 | 0.41    | Total Fat               | 2.17                   | 1.98 | 0.35    |
| Inside Skirt      | 0.84                   | 0.92 | 0.49    | Tenderloin          | 0.80                   | 0.84 | 0.49    | Total Bone              | 0.92                   | 0.75 | 0.29    |

<sup>1</sup>REV = Revalor-XS (200 mg trenbolone acetate and 40 mg estradiol) combination implant administered at 0 and 190 d; CON = negative control

Table 2: Growth coefficient treatment comparisons for carcass components

- Chuck eye roll and eye of round grew faster for REV
- Rib blade meat and heel meat tended to grow faster for REV
- Flank steak grew faster for CON
- Implanted steers had numerically lower carcass fat and bone, but higher carcass lean in accordance to findings by Perry et al. (1991) and Kellermeier et al. (2009)

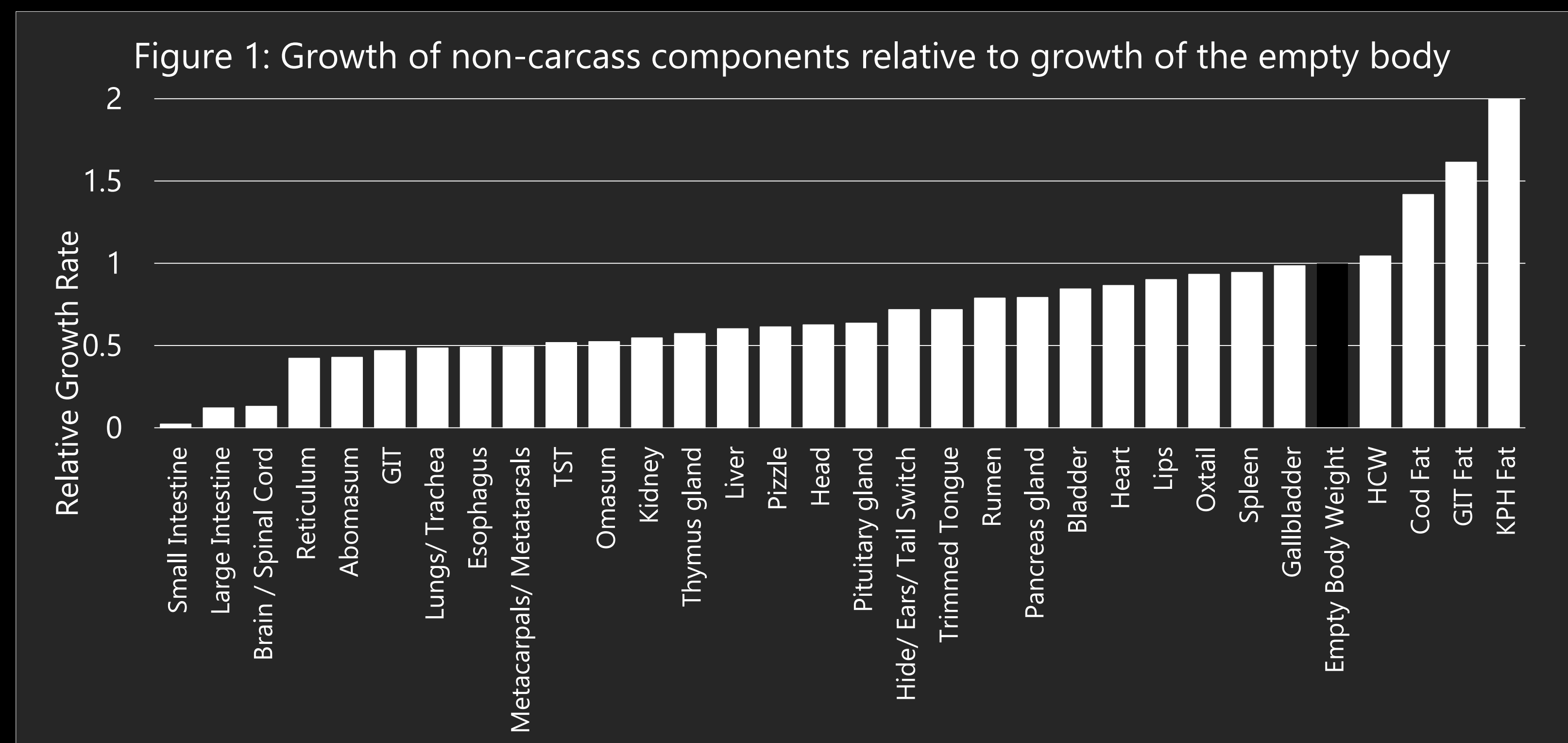


Figure 1: Non-carcass component growth coefficients

- Brain and intestines exhibited minimal growth throughout the study in agreement with Shea et al. (1987)
- Minimal intestinal growth in agreement with Palou et al. (1982)
- Fat deposition occurred at 1.42 - 2.01 times the rate of the empty body for fat deposits

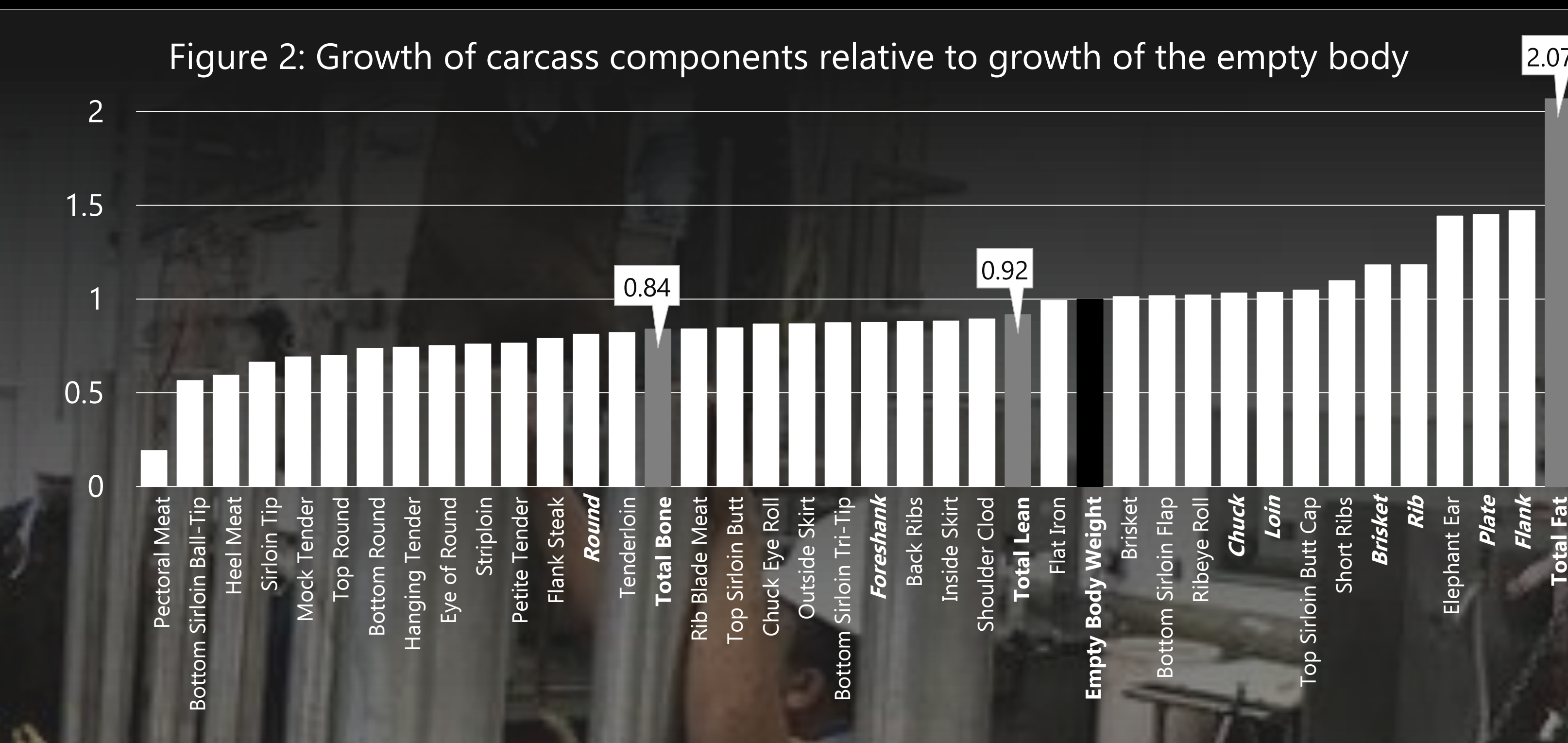


Figure 2: Carcass component growth coefficients

- Total fat was deposited at the greatest rate in accordance with Owens et al. (1995)
- Dorsal region primals had fastest growth rates agreeing with Priyanto et al. (2009)
- Elephant ear and short ribs are the fastest growing subprimals
- Limbs are the slowest growing components (Hammond and Appleton, 1932)
- Pectoral meat and round subprimals are the slowest growing (Butterfield and Berg, 1996)

## IMPLICATIONS

- Minimal allometric growth rate differences were detected between treatments
- Although not significant, lean was deposited more quickly in REV steers, whereas total fat and total bone were faster growing for CON steers
- The majority of non-carcass components exhibited growth rates less than the empty body
- Intestines exhibited almost no growth from the start to end of study
- GIT and cod fat were deposited at rates 1.5 times the empty body
- KPH was deposited at 2 times the rate of the empty body
- **In both the non-carcass and carcass components, fat was the fastest growing component, deposited at 2X the rate of the empty body**

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