# EFFECT OF THE BODY WEIGHT ON CARCASS CHARACTERISTICS FROM YOUNG BULLS

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**Abstract – The young bulls (½ Angus vs. ½ Nellore) were slaughtered at light, medium and heavy body weight (BW) to investigate carcass characteristics. The bulls were distributed in a completely randomized design by a factorial scheme 3 x 3 and data analyzed by ANOVA using the GLM procedure. Twenty-one young bulls (243 ± 11.7 kg, 12 ± 2 month old) were allocated in individual pens and distributed into three experimental diets (n = 7): E0.0, diet without addition of the blend of EO; E3.5, 437 mg/kg of dry matter (DM) of the blend of EO; and E7.0, 875 mg/kg of DM of the blend of EO, for 4 months (sugar cane bagasse pellets, ground corn, soybean meal, limestone, yeast, mineral salt were used as-fed). The young bulls (16 months-old ± 2) were slaughtered at light, 386 ± 12.9 kg; medium, 443 ± 13.6 kg; and heavy, 500 ± 28.6 kg BW. The hot and cold carcass weight increased in according slaughter BW. Bulls slaughtered at medium and heavy BW had higher *Longissimus* muscle area and fat thickness. Whereas, bulls slaughtered at light BW had highest proportion of bone and others tissues (tendons, fascia, blood vessels), and lower proportion of total fat.**

**Key Words – carcass, fat, sugar cane pellets.**

## I. INTRODUCTION

The production of young bulls has been the subject of interest from researchers and Brazilian producers. The genetic group and diet are been determinant factors for young bulls achieve rapidly an adequate body weight at slaughter [1]. Nowadays, the Brazilian beef market requires carcass with good conformation and minimum 3 to 6 mm fat thickness. Thus, carcass characteristics have been the subject of studies to obtain higher portion of carcass comestible and higher weights in commercial cuts. Coproducts [2] and additives [3] are used in the diet of bulls finished in a feedlot to improve feed efficiency, to prevent metabolic diseases, to reduce the cost of production and carcass grade. The essential oils [4] contain many compounds, which confer antimicrobial activity on rumen bacteria's [5], and can be used in meat or meat products as antimicrobial [6] or antioxidant agents [7]. The synergism between compounds from essential oils can possibility an increased on antimicrobial [8] and antioxidant activities [9], which have largest potential to improve carcass grade from bulls finished in a feedlot. The aim of this study was to investigate the effect of final body weight (light; medium; and heavy) on carcass characteristics from crossbred bulls fed with blend of Essential oils.

## II. MATERIALS AND METHODS

Twenty-one 12 month-old crossbred (½ Angus vs. ½ Nellore) young bulls, average weight of 243.2 ± 11.7 kg, were randomly assigned to one of three finishing diets (n = seven young bulls per treatment). The three experimental treatments were: E0.0, diet without addition of the blend of essential oils (EO); E3.5, diet with 437 mg/kg of dry matter (DM) of the blend of EO; and E7.0, diet with 875 mg/kg of DM of the blend of EO. The blend of EO used consisted of seven plants extracts: oregano (*Origanum vulgare*), garlic (*Allium sativum*), lemon (*Citrus limonium*), rosemary (*Rosmarinus officinalis*), thyme (*Thymus vulgaris*), eucalyptus (*Eucalyptus saligna*) and sweet orange (*Citrus aurantium*), registered as Mixoil® (Animal Wellness Products – Oakland – Nebraska – USA). The blend of EO had powdery texture; and it was mixed directly

with the concentrate each two weeks in a commercial mixer where diets were prepared during the experimental period. The young bulls were finished with their respective diets under intensive conditions (90:10; respectively concentrate and forage). The concentrate consisted of corn grain (819 g/kg of dry matter, DM), soybean meal (65.2 g/kg of DM), Limestone (4.6 g/kg of DM), yeast (0.5 g/kg of DM), mineral salt (4.1 g/kg of DM) and urea (6.2 g/kg of DM). Sugar-cane pellets were used as-forage (100 g/kg of DM). The basal diet was formulated for a 1.5 kg/day average daily gain. All diets were isoenergetic and isonitrogenous. The total diet consisted of 125 g/kg of DM of crude protein, 22 g/kg of DM of ether extract, 303 g/kg of DM of neutral detergent fiber, 14.8 g/kg of DM of acid detergent fiber and 708 g/kg of DM of nutrient digestible total. The mineral salts consisted of (g/kg of DM) 150 Ca, 88.0 P, 0.08 Co, 1.45 Cu, 10.0 S, 1.0 Fe, 0.88 F, 0.06 I, 10.0 Mg, 1.10 Mn, 0.02 Se, 120 Na and 3.40 Zn. The bulls were finished for 4 months and slaughtered when they reached an average of 386 kg BW (light), 443 kg BW (medium), and 500 kg BW (heavy). All bulls (16 month-old ±2) were slaughtered by ethical procedures in a commercial slaughterhouse 20 km from Experimental Farm (Maringá, PR) according to Brazilian practices. The hot carcass weight (HCW) was determined soon after slaughter and prior to carcass chilling. The carcasses were labelled and chilled for 24 h at 4°C. After chilling, the cold carcass weight (CCW) was determined and the right side of carcass was used to determine the quantitative and qualitative characteristics. The *Longissimus dorsi* muscle area (LMA) was measured on the right side of the carcass, after a cross-section cut was made between the 12$^{th}$ to the 13$^{th}$ ribs using a compensating planimeter that measured the areas of irregular shaped objects. The *Longissimus* area/100 kg carcass (LMC) was defined by the ratio LMA:CCW, multiplied by 100. The fat thickness (FT) was measured by a caliper, between the 12$^{th}$ to the 13$^{th}$ over the *Longissimus* muscle (LM), and averaged oven three points. The sixth rib was removed, weighed and kept frozen (-20°C) before being thawed and dissected into muscle, fat (subcutaneous and intermuscular), bone and other tissues (tendons, fascia and blood vessels) [10]. The bulls were distributed in a complete randomized design by a factorial scheme 3 x 3, comprising three diets (E0.0, E3.5, and E7.0), and three different BW (light, medium, and heavy). All data under study were tested for normality. The data were analyzed by the ANOVA using GLM procedure (SAS, 2002), according to the following model: $Yijk = \mu + \alpha i + \beta j + (\alpha\beta)ij + Eijk$; where Yijk = observation of the animal undergoing treatment i, slaughter BW j, and repetition k; $\mu$ = constant overall; $\alpha i$ = effect of the treatment, i = 1, 2, 3; $\beta j$ = effect of slaughter BW, j = 1, 2, 3; $(\alpha\beta)ij$ = interaction treatment x slaughter BW, and Eijk = random error associated with each observation Yij and repetition k. Differences between group means were assessed by using the Tukey's test ($P \leq 0.05$).

## III. RESULTS AND DISCUSSION

The experimental design allowed for the examination of the effects of different body weight on carcass characteristics. The light, medium and heavy BW were defined at the beginning of the experiment to obtain 57 kg BW of difference between each treatment on slaughter. The young bulls (16 month-old ±2) were slaughtered at light, 386 ± 12.9 kg BW; medium, 443 ± 13.6 kg BW; and heavy 500 ± 28.1 kg BW.

Table 1 Effect of the body weight from crossbred bulls fed with a blend of essential oils on carcass characteristics

| Item | Slaughter body weight* | | | SEM[4] | *P*[5] |
|---|---|---|---|---|---|
| | Light[1] | Medium[2] | Heavy[3] | | |
| HCW[6], kg | 210$^{c}$ | 246$^{b}$ | 278$^{a}$ | 5.28 | <0.01 |
| CCW[7], kg | 206$^{c}$ | 241$^{b}$ | 272$^{a}$ | 5.17 | <0.01 |
| LMA[8], cm$^2$ | 64.5$^{b}$ | 73.4$^{a}$ | 80.5$^{a}$ | 3.12 | 0.01 |
| LMC[9], cm$^2$ | 31.3 | 29.8 | 28.9 | 1.14 | 0.53 |
| FT[10], mm | 4.69$^{b}$ | 7.33$^{a}$ | 7.90$^{a}$ | 0.64 | 0.01 |

[1]386 kg *BW; [2]443 kg *BW; [3]500 kg *BW; [4]Standard deviation; [5]Probability, n = seven bulls per treatment; [6]Hot carcass weight; [7]Cold carcass weight; [8]*Longissimus* muscle area; [9]*Longissimus* muscle area/100 kg CCW[7]; [10]Fat thickness; a, b: different superscripts represent significant differences ($P \leq 0.05$).

The HCW and CCW increased in accordance with the final BW defined for each treatment. Previous studies reported higher correlation between carcass weight and final BW [1]. The HCW and CCW was higher for bulls slaughtered at heavy BW ($P \leq 0.05$), intermediary for bulls slaughtered at medium BW and lower for bulls slaughtered at light BW ($P < 0.001$; Table 1). The bulls slaughtered at light BW did not achieve carcass weight required by beef market in Brazil (225 -250 kg) [1]. Previous study [11] reported, that carcass weight below of the required by beef market can influence the physical characteristics and chemical composition of the carcass, which results in economic losses for the industry and a low-quality meat. The diet used in this experience contains adequate energy and protein level to reach carcass weight required by beef market, for bulls slaughtered at 18 month of age on medium and heavy BW. The bulls slaughtered at medium and heavy BW had higher ($P \leq 0.05$) LMA and FT than bulls slaughtered at light BW (Table 1). On the other hand, when LM values were adjusted to HCW (LMC), these results were similar ($P > 0.05$) for bulls slaughtered at light, medium and heavy BW (Table 1). The LMA reflects the carcass muscle development and results in higher weights in commercial cuts, which is interesting to beef market industry. The FT for bulls slaughtered at medium and heavy BW had values above of the average required by beef market [1]. Many biochemical and structural events occurs on the first 24 h period after slaughter, during the process of conversion of muscle into the meat [12]. FT has significant role in the reduction of cold shortening on chilling processes of beef. Factors as rapid chilling and FT below 3 mm increases the risk for cold shortening [12]. The muscle tissue, subcutaneous and intermuscular fat were similar ($P > 0.05$) for bulls slaughtered at light, medium and heavy BW (Table 2). The bone and others tissues (tendons, fascia and blood vessels) were higher ($P \leq 0.05$) for bulls slaughtered at light BW (Table 2). Whereas, total fat tissue was higher ($P \leq 0.05$) for bulls slaughtered at heavy BW (Table 2). The higher values on FT and total fat for bulls slaughtered at heavy BW, and higher values of bone and others tissues for bulls slaughtered at light BW in the carcass, can be explained by physiological growth of the bulls. Previous studies reported that bulls in growth contains a higher proportion of bone [13], which is reduced by increased muscle and fat tissue when the bulls reaches physiological maturity.

Table 2 Effect of the body weight from crossbreed bulls fed with a blend of essential oils on muscle, fat and other tissues percentage in the carcass

| Item, % | Slaughter body weight* | | | SEM[4] | $P$[5] |
|---|---|---|---|---|---|
| | Light[1] | Medium[2] | Heavy[3] | | |
| Bone | 18.0[a] | 15.1[ab] | 14.1[b] | 0.01 | 0.01 |
| Muscle | 58.8 | 61.0 | 62.3 | 0.07 | 0.20 |
| Subcutaneous fat | 2.32 | 2.83 | 3.08 | 0.53 | 0.58 |
| Intermuscular fat | 13.6 | 14.0 | 14.9 | 1.20 | 0.73 |
| Total fat | 15.3[b] | 17.6[ab] | 18.0[a] | 0.02 | 0.04 |
| Others[6] | 7.77[a] | 6.07[ab] | 5.41[b] | 0.04 | 0.04 |

[1]386 kg *BW; [2]443 kg *BW; [3]500 kg *BW; [4]Standard deviation; [5]Probability, n = seven bulls per treatment; [6]Tendons, fascia and blood vessels; a, b: different superscripts represent significant differences ($P \leq 0.05$).

The BW did not influence subcutaneous fat percentage. On the other hand, results found on FT were higher for bulls slaughtered at medium and heavy BW. These results can be explained by the unit used and the position of measurement in the subcutaneous fat and FT, respectively 6th and 12th rib. Likewise, total fat was higher for bulls slaughtered at heavy BW. The intramuscular fat consists of 90% triacylglycerol [14], which is dependent on the fat level. While, phospholipids are constituents of cell membranes and are little influenced by species, breed, nutrition or age. Thus, the manipulation of the fat tissue occurs on triacylglycerol's, which can be influenced by fat level, age, genetic group and diet [14]. The diet used in this experience contains high levels of energy available for bulls, which provided of higher fat deposition in the carcass for bulls slaughtered at light BW, even not reaching carcass weight required by beef market.

## IV. CONCLUSION

The results of this study showed that bulls slaughtered at medium and heavy body weight had higher *Longissimus* muscle area and fat thickness, which can result in higher weights in commercial cuts. The bulls slaughtered at light body weight did not achieved the carcass weight

required by the beef market in Brazil, and contained a higher proportion of bone, others tissues (tendons, fascia and blood vessels), and a lower proportion of total fat in the carcass.

## ACKNOWLEDGEMENTS

The current project was supported by the São Paulo Research Foundation, SP (process 2012/18873-8); Araucaria Foundation, PR (process 2010/113); Brazilian Council for Research and Technological Development (CNPq); and Vet Science Nutraceuticals Ltda. (Maringá, Paraná, Brazil), for financial support. Trade names or commercial products in this publication are mentioned solely for the purpose of providing specific information and do not imply recommendations by the Department of Animal Science, State University of Maringá, Maringá, Paraná, Brazil.

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