Food systems with integral and semi-integral diets, made with sugar cane forage (*Saccharum officinarum*): its effect on viscera morphometry and internal organs of crossbred Holstein bulls.

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A total of 10 stabulated crossbred Holstein bulls were selected, to evaluate food systems effect, with integral and semi- integral diet, in viscera and internal organs weight. The average live weights were 428 and 437kg, respectively, for treatments: A) sugar cane forage+ molasses-urea 2%+ concentrate (mixed as integral diet) and B) sugar cane forage+ molasses-urea 2%(mixed) +concentrate (separately feeding trough). Animals were weighed before moving them to the slaughter house and left to fast for 24h, with *ad libitum* water. Later they were slaughtered through the captive bolt method. Internal organs and fifth quarter components were separately weighed. A simple classification analysis was carried out. There was not significance difference between treatments for slaughter weight, head, hide, full and empty digestive system and legs. There was an increase ($P < 0.05$) of heart weight and the percentage regarding the live weight of the animals consuming semi-integral diet, regarding to the ones that consuming the integral diet, with values of 1.6- 1.2kg and 0.5- 0.45 for each treatment, respectively. It is concluded that the animals that consuming semi-integral diet showed a higher heart weight and percentage regarding the empty body weight, than the ones that consuming integral diet.

Key words: *bovine cattle, internal organs, sugar cane, fifth quarter*

The weight of the fifth quarter components (head, hide, digestive system and legs) related to the animal live weight has been studied by different authors (Soares *et al*. 2012 and Hernandez *et al*. 2013). Equations to foretell this relation has been developed (Costa and Silva *et al*.2012), since the animals carcass yield vary, according to food system.Gesualdi *et al.* (2001) stated increase of the gastrointestinal content, according the fiber in diet increased.Macitelli *et al*.(2005) and Menezes *et al*. (2003) informed that in some voluminous feed can be differences in the digestive system content.

This could be due to, that was informed by Buckey *et al.* (1990) about the negative correlation between animal yield and weight of the gastrointestinal content, when feed have higher amount of forage, since as the NDF content in the diet increases, the retention time of the feed in the rumen increases(Pereira *et al.* 2007).

Macitelli *et al.* (2005) and Moreno *et al.* (2010) showed that in animals feed different forage sources, those consuming sugar cane had a digestive system with higher percentage regarding the live weight. Nevertheless, there is not available information about the effect on the way of giving food in these indicators, when diets with similar relation forage- concentrates are used.

The objective of this research was to evaluate the food system effect, with integral and semi-integral diet, in viscera and internal organs weight of feed animals with sugar cane (*Saccharum officinarum*).

Materials and Methods

A total of 10 crossbred Holstein bulls, of 28 months of age were selected, placed according a completely randomized design, with an average live weight of 428 and 437 kg for 2 treatments, respectively. Each treatment included 5 animals which were the replications.

The treatments consists on mixing the used food in the following proportions: A) 73% of sugar cane forage (*Saccharum officinarum*), molasses urea 2 %(10%) and concentrate 17%) and B) same to A, but the concentrate was given in separately feeding trough. Feed was distributed twice a day, with six hours of difference. Animals were weighed before moving them to the slaughter house and left to fast for 24h, with *ad libitum* water. Later they were slaughtered through the captive bolt method and each one of the animal components was weighed, as dissection was performed. The digestive system was weighed and all gastrointestinal content was eliminated. Washing was made to weigh again and to determine the empty tract weigh.

Weight in kg was recorded from each of the organs and later the percentage that is represented regarding the live weigh before moving the animals to the slaughter house was calculated. The percentage regarding the empty body weigh was calculated, once the gastrointestinal content was eliminated and all animal component were added.

A simple classification analysis was carried out and Duncan (1995) multiple range test was applied in the necessary cases. The statistical package used was SPSS for Windows, version 11.5.1, 2002, Visauta (2002).

Results and Discussion

Results indicate that there were not significance differences between treatments for the evaluated indicators (table 1).Head and legs weight coincide with that informed by Zamora *et al.* (2007) and Rodriguez *et al.* (2013).These authors referring similar values to animals with live weigh between 430 and 440 kg.

Hide weigh was lightly higher to that informed by Rodriguez *et al.* (2013), although lower to that obtained by Zamora *et al.* (2007) in Siboney and Cebu animals. This difference could be related with the influence of genotypes have in these components weight (Menezes *et al.*2007).

The results of the full and empty digestive system did not show differences.

This demonstrate the effect on the voluminous feed in the diet supplies in this organ weight, then with higher NDF content, higher is the filling capacity of the organ and the retention time of the feed in the rumen increase (Pereira *et al.*2007).

In the group that received concentrate food, separately from the voluminous, heart weigh was higher regarding that obtained in the one that received integral diet (table 2), regardless that both had similar productive behavior (Rodriguez *et al.*2009). Differences for heart weight were informed by Menezes *et al.* (2007) and Cattlelam *et al.* (2011), when different racial genotypes were compared.

Kuss *et al.* (2008) showed that changes in heart weight are related with the growth stage, which is higher at the start of life. There were not considerable modifications from 26 months of age, regardless the weight increase in the contribution. Kuss *et al.* (2007) stated that there was not an increase of the heart in the empty body weight, in bulls of 465 to 566kg of live weight.

According to Ferreira *et al.* (2000), feed level, generally, did not influenced on the heart size, as this organ keep their integrity, due to their priority in the used nutrients in the organism. Therefore, it could be necessary to search weight differences in other causes.

There were not significant differences for head, hide and digestive system indicators in relation to the percentage that this represents in the live weight and empty body weight (table 3).For head, the obtained values in this research show, approximately, 6% of the empty body weight, higher in 3% to the data informed by Lema (2001).This higher percentage could be determined because the animals, in spite of having more than 30 months of age, there were not without horns, that influences in the higher head weight.

The hide represented, about, 9.1% of the empty live weight, lightly higher to 8 and 8.5% informed by Macitelli *et al.* (2005) and Rodriguez *et al.* (2013), respectively. These values coincided with that informed by Diaz (2008).

It is important to show that the percentage of the empty and full gastrointestinal tract coincide with that informed by Rodriguez *et al.* (2013) for sugar cane diets, although when it is compared with that reported by Macitelli *et al.* (2005) the percentage of the full gastrointestinal content does not coincide. This author informed a value of 18% for the mentioned indicator, lower to 25% stated in this study. Sugar cane in the mentioned research shows 54% of NDF. In this experiment had 65%.There are enough reports that showed that NDF concentration ,as well as its digestibility, is directly related with the retention time of the feed in the rumen.

These values related with NDF contributed to the empty live weight percentage regarding live weight, were very lower, with values of 0.76, lowers to that informed by Macitelli *et al.* (2005), Menezes *et al.* (2007) and Menezes *et al.* (2011).These show that with the feed technology used, with grass and forage as main

Table 1. Weight of different organs of feed bulls with sugar cane in two systems of giving food

Indicators	Sugar cane forage 73 % + molasses urea 2 % (10 %) + concentrates 17 % (complete diet)	Sugar cane forage 73 % + molasses urea 2 % (10 %) (mixed) + concentrates 17 % twice a day
Slaughter weight, kg	428.0 ± 3.4	437.0 ± 3.0
Head, kg	18.5 ± 0.3	18.8 ± 0.2
Hide, kg	30.0 ± 1.9	30.6 ± 1.7
Full digestive system, kg	82.7 ± 3.0	81.8 ± 2.7
Empty digestive system, kg	26.1 ± 2.8	28.4 ± 2.5
Forelegs, kg	4.1 ± 0.2	4.2 ± 0.2
Hind legs, kg	4.5 ± 0.2	4.8 ± 0.2

Table 2. Weight of different organs of feed bulls with sugar cane in two systems of giving food

Indicators	Sugar cane forage 73 % + molasses urea 2 % (10 %) + concentrates 17 % (complete diet)	Sugar cane forage 73 % + molasses urea 2 % (10 %) (mixed) + concentrates 17 % twice a day
Liver, kg	4.3 ± 0.3	4.3 ± 0.3
Heart, kg	1.2 ± 0.1	1.6 ± 0.1*
Respiratory system, kg	5.7 ± 0.5	5.4 ± 0.5

*P < 0.05

Table 3. Percentage of different organs regarding live weight of feed bulls with sugar cane forage in two systems of giving food

Indicators	Sugar cane forage 73 % + molasses urea 2 % (10 %) + concentrates 17 % (complete diet)	Sugar cane forage 73 % + molasses urea 2 % (10 %) (mixed) + concentrates 17 % twice a day
Head, % live weight	4.3 ± 0.1	4.32 ± 0.1
Head, % empty body weight	5.7 ± 0.1	5.62 ± 0.1
Hide, % live weight	7.0 ± 0.4	7.02 ± 0.4
Hide, % empty body way	9.2 ± 0.4	9.11 ± 0.3
Full digestive system, % live weight	19.3 ± 0.8	18.75 ± 0.7
Full digestive system, % empty body weight	25.5 ± 1.2	24.40 ± 1.1
Empty digestive system, % live weight	6.1 ± 0.7	6.53 ± 0.6
Empty digestive system, % empty body weight	8.0 ± 0.8	8.46 ± 0.7
Empty body weight / live weight	0.8 ± 0.02	0.8 ± 0.02

Table 4 Percentage of different organs regarding live weight of feed bulls with sugar cane forage in two systems of giving food

Indicators	Sugar cane forage 73 % + molasses urea 2 % (10 %) + concentrates 17 % (complete diet)	Sugar cane forage 73 % + molasses urea 2 % (10 %) (mixed) + concentrates 17 % twice a day
Liver, % live weight	1.0 ± 0.1	1.0 ± 0.1
Liver, % empty body weight	1.3 ± 0.1	1.3 ± 0.1
Heart, % live weight	0.3 ± 0.02	0.4 ± 0.02
Heart, % empty body weight	0.4 ± 0.03	0.5 ± 0.02*
Respiratory system, % live weight	1.3 ± 0.1	1.2 ± 0.1
Respiratory system, % empty body weight	1.7 ± 0.2	1.6 ± 0.2

*P < 0.05

feed sources specifically, an increase in the digestive system is obtained. Williams *et al.* (1992) calculated this increasing at about 0.92, when analyzing the different factors that could affect it, like fiber content in diet, amount of concentrate and maturity degree.

The percentage representing the liver and lung + trachea (respiratory system) did not show differences between treatments. Not being so with the heart, that showed differences regarding the empty body weight (table 4).The heart value (0.47) were higher to that obtained by Rodriguez *et al.* (2013).

Menezes *et al.* (2011) found variations in fat stool, according to the used food system. In this research was not carried out the dissection of the organ fat, which is why it could not confirm that the increase in weight and percentage is due to the fat increases. Further studies are suggested that allow determining if the way of giving the suplement can modified the amount of fat that is in different parts of the organism.

In food system based on sugar cane, the heart of the animals that received semi -integral diet had higher weight and percentage regarding the empty body weight, than the heart of those that consuming integral diet.

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Received: June 9, 2014