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Body chemical composition, tissue deposition rates and gain composition of young Nellore cattle selected for postweaning weight

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ABSTRACT - Empty body and carcass chemical composition were determined in 67 Nellore bulls from Selection Nellore (NeS) and Control Nellore (NeC) herds of an animal breeding program for growth, slaughtered at 570 days of average age, after 100 days of feedlot. Selection Nellore animals had, respectively, 360 and 430 kg of initial and slaughter body weight, and NeC animals had 318 and 373 kg for the same traits. Animals were slaughtered and empty body composition was determined by chemical analysis of the components blood, hide, head and feet, viscera and carcass. Tissue deposition rates and gain chemical composition were also determined based on gains estimated by comparative slaughter technique. Significant differences were detected between NeS and NeC animals for slaughter body weight, empty body weight, empty body gain rate, and contents of water, protein, ash and retained energy in empty body, showing that selected animals had greater body sizes and growth rates. There were no significant differences in fat contents in empty body and carcass, suggesting that selected animals had higher growth rates as compared with the control, and were slaughtered with good body and carcass fat contents in the same feedlot time. Control Nellore animals showed a 10% higher gain in fat percentage than NeS in the period. This shows that the growth of bone and muscle ceased earlier and NeC group accumulated more fat. Animals selected for growth have heavier carcasses and greater tissue deposition rates with proportional composition similar to unselected animals.

Key Words: *Bos indicus*, efficiency, fat, protein, selection, weight gain

Introduction

Modern animal husbandry is aimed at maximizing productivity and the generation of profits. Investments in animal breeding designed to increase carcass size have been shown to be a suitable alternative to improve production indices. Although poorly efficient production systems that use little technology still predominate in Brazil, the country harbors the largest commercial cattle herd in the world, with an estimated 205 million heads (IBGE, 2010). Zebu cattle are the predominant breed. Genetic improvement of this type of herd provides high gains within a short generation interval.

In Brazil, a pioneering selection program based on higher postweaning weight has been developed to determine the response to selection for growth in *Bos indicus* and *Bos taurus* cattle adapted to tropical conditions. A number of scientific articles published since 1985 have reported notable progress in growth and reproduction traits of these experimental herds (Razook et al., 1993; Mercadante et al., 2003; Bonilha et al., 2008). Trends in genetic gain for weight at 378 days were estimated at 3.08 kg/year (Cyrillo et al., 2001).

Genetic evaluation is an extremely important tool for the genetic improvement of herds and consists of the identification and selection of genetically superior animals and their multiplication, consequently increasing the frequency of desired genes in the herds. One essential aspect of this approach is the definition of selection objectives, and knowledge of genetic variability in traits of interest is therefore important.

The production of animals with greater edible portion and better fat deposition requires the inclusion of carcass traits as selection criteria (Reverter et al., 2000). Important traits are body chemical composition and rates of body weight gain. Techniques to estimate these traits include the determination of rib-eye area and fat thickness by ultrasound. However, direct evaluation of all body tissues is necessary to confirm these indices, thus allowing for the determination of the direction of breeding in the herd and comparison of the dynamics of tissue deposition. Therefore, the present study was conducted to evaluate empty body and

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carcass chemical composition, tissue deposition rates, and chemical composition of empty body and carcass weight gain in Nellore cattle selected for postweaning weight in order to summarize the effects of 30 years of selection for growth on the body composition of these animals.

Material and Methods

A genetic selection program of the Nellore breed began in 1976 in the Instituto de Zootecnia research unit at Centro APTA Bovinos de Corte based on a higher selection differential for growth. Control and selected lines were established, using bulls with a high selection differential for yearling weight for selected Nellore group, and bulls with a selection differential for yearling weight around zero for control Nellore group. The program is in progress, and the 67 males (33 born in 2006 and slaughtered in 2008: Experiment I; 34 born in 2007 and slaughtered in 2009: Experiment II) evaluated in this study belong to the 26th and 27th calf crops of the program.

Residual feed intake (RFI) was evaluated in the experimental animals housed in individual pens for 74 days plus 28 days of adaptation. Every year, RFI was calculated as the difference between observed individual dry matter intake and predicted intake using regression equations developed as a function of mean metabolic body weight and average daily gain: estimated DMI = $-1.301015+2.300828*ADG+0.091755*BW^{0.75}$ ($r^2 = 0.89$) for 2007, and estimated DMI = $-0.95165+2.5576*ADG + 0.081*BW^{0.75}$ ($r^2 = 0.89$) for 2008, in which DMI is dry matter intake (kg), $BW^{0.75}$ is the mean metabolic body weight (kg) and ADG is the average daily weight gain (kg/day) observed throughout the experiment. The standard deviations found for RFI were 0.287 and 0.340 kg/d of dry matter, respectively, for performance tests in 2007 and 2008. The animals were then classified as low RFI (< mean – 0.5 standard deviation), medium RFI (±0.5 standard deviation from the mean), and high RFI (> mean + 0.5 standard deviation).

Animals of the high and low RFI groups were selected for the finishing period, whose duration was based on the time the animals needed to reach 4 mm of subcutaneous fat thickness on the *longissimus* muscle. The animals were divided into three experimental categories: reference (RG) group, restricted feeding (RF) group, and *ad libitum* feeding (AL) group. In Experiment I, eight animals were assigned to category RG, 16 to AL, and nine to RF. In Experimental II, eight animals were assigned to category RG, 17 to AL, and nine to RF, corresponding to 67 experimental animals.

The diet consisted of brachiaria grass hay, corn, cottonseed, cottonseed meal, citrus pulp and mineral mixture, and contained 850 g/kg of dry matter and 820 g/kg (as fed) of total digestible nutrients (Table 1).

The experimental period comprised 28 days of adaptation plus the period of data collection determined by the time the animals were finished. At the end of the adaptation period, the animals of category RG were slaughtered and the animals of the other categories were kept in feedlots until reaching the minimum criterion for slaughter. Respecting the proportion of two AL animals per one RF animal, when two AL animals reached the criterion for slaughter, one randomly chosen RF animal was slaughtered together.

Weight and ultrasound measurements were performed at the beginning of the feedlot period and at intervals of 28 days. Vegetable oil was used as an acoustic coupling agent for image acquisition. Measurements were made between the 12th and 13th rib on the *longissimus* muscle using an Aquila (Pie Medical) veterinary ultrasound apparatus equipped with a 17-cm probe. The images were analyzed using the Echo Image Viewer 1.0 program (Pie Medical Equipment B.V.).

The animals were slaughtered in an experimental slaughter house in accordance with current federal guidelines after a 16-hour fast from solids and fluids. The animals were stunned by cerebral concussion, suspended, and bled through the jugular vein. Blood samples were collected immediately after slaughter, stored in glass containers, and frozen for subsequent analysis of chemical composition.

Animals were skinned and eviscerated and the carcass was divided into two symmetrical halves. The hide was

Table 1 - Composition and nutritional characteristics of the diet

Composition	g/kg of DM
Brachiaria brizantha hay	186
Corn	394
Cottonseed	123
Cottonseed meal	77.0
Citrus pulp	182
Urea	12.0
Mineral mixture[1]	26.0
Chemical composition	g/kg as fed
Dry matter	853
Crude protein	141
Ether extract	50.3
Neutral detergent fiber	300
Acid detergent fiber	229
Total carbohydrates	767
Lignin	36.9
Roughage:concentrate	19:81
Total digestible nutrients	820

[1] Composition of the mineral mixture (per kg of product): 180 g calcium; 90 g phosphorus; 10 g magnesium; 13 g sulfur; 93 g sodium; 145 g chlorine; 17 mg selenium; 1,000 mg copper; 826 mg iron; 4,000 mg zinc; 1,500 mg manganese; 150 mg iodine; 80 mg cobalt; 900 mg fluoride.

weighed and divided along the dorsal line. The right half was discarded and the left half was cut into squares of approximately 3 cm and ground for chemical analysis. The organs were weighed and stored in plastic bags for freezing. The digestive tract was weighed, emptied, washed, and weighed again. The weight of the organ was added to that of the washed digestive tract and of the other parts of the body (carcass, head, hide, tail, feet, and blood) to determine empty body weight. The ratio between empty body weight and live body weight of animals of category RG was used to estimate the initial empty body weight of animals that remained in the experiment using the live body weight at the end of the adaptation period. The difference between initial and slaughter empty body weight was used to calculate the gain of AL and RF animals.

The trimmed and washed carcass halves were kept in the chilling chamber at 2 ºC for 24 h. After chilling, the right carcass halves were deboned and retail cuts were separated to determine the carcass edible portion and hindquarter and forequarter yields based on the ratio between total meat cuts weight and carcass weight. Rib-eye area and subcutaneous fat thickness were measured at the site of the ultrasound measures.

The tissues (head, feet, viscera, soft tissue and bones) frozen after slaughter were processed to determine the centesimal composition of the empty body and carcass by direct assessment, grinding, sampling, chemically analyzing, and combining all tissues (blood, hide, head and feet, viscera and carcass) of the animal. The samples of the processed material were lyophilized for about 80 hours, the time necessary to reach a constant weight. Next, the samples were ground in a blender with dry ice until a powder was obtained, identified, and stored in a freezer until the time for chemical analysis.

Water content was determined after lyophilization and correction by analysis of dry matter in an oven at 105 ºC. Ether extract content was evaluated in duplicate in 2-g samples stored in qualitative filter paper cartridges and extracted for 3 hours (drip rate of 5-6 drops/second) in an XT15 extractor (Ankom®) using petroleum ether according to the method of the AOCS (2009). Mineral content was determined by burning 2 g of the samples in a furnace at 600 ºC for 4 hours. To determine the protein content, the difference between the total sample weight and the sample amounts of ether extract, water and minerals was calculated. Retained energy was calculated from protein and fat content and their calorie equivalents using the following equation (ARC, 1980): EC = 5.6405 BP + 9.3929 BF, where EC = energy concentration (Mcal), BP = body protein (kg), and BF = body fat (kg).

The experimental design was completely randomized. Statistical analysis was performed using the PROC MIXED procedure of the SAS program (Statistical Analysis System, version 9.0). The data were analyzed using a mixed model that included herd as fixed effect and experimental category (feed regimen) as random effect. The effects of year and interactions were tested, but were not significant, and were therefore removed from the model. Means were fitted by the least square method and compared by the *t*-test, adopting a probability level of 0.05.

Results and Discussion

The differences observed between the NeS and NeC herds are a consequence of the selection for growth to which the herds were subjected, since both herds originated from the same base population. According to Marshal (1994), carcass traits such as weight, edible portion and trimmed fat show medium to high heritabilities. The analysis of carcass traits in different genetic groups is therefore interesting since these traits are transmitted across generations.

No significant differences in RFI (P = 0.9179) were observed between the NeS and NeC herds (Table 2). Residual feed intake was close to zero in the two genetic groups, which is the mean of this variable, indicating that the dry matter intake of the animals of these herds is close to the expected value. Interestingly, there are animals with low and high RFI in the two herds, a fact demonstrating the existence of genetic variation with the potential to be explored in breeding programs designed to improve the efficiency of beef cattle herds. Another important aspect is the presence of more and less efficient animals in the NeS herd, indicating that selection for postweaning weight practiced for 30 years at Instituto de Zootecnia in Sertãozinho had no effect on the efficiency of feed utilization by the animals.

With respect to live body weight, NeS animals were heavier at the beginning of the feedlot period (P<0.0001) and at slaughter (P<0.0001). Similar results have been reported by Bonilha et al. (2008). Razook et al. (2002), studying the 16th calf crop from the same herds, found slaughter weights of 543 and 448 kg, respectively, for NeS and NeC herds, values higher than those obtained in the present study. However, the animals were older and were slaughtered at 824 days of age. These results demonstrate the effects of cumulative genetic improvement over the years of the program, since comparison of NeS animals from the 26th and 27th calf crops to the 16th calf crop showed that they reached similar weights 260 days earlier.

No significant differences in feedlot time (P = 0.4115) or age at slaughter (P = 0.1001) were observed between NeS

Table 2 - Feedlot, body and carcass traits of Nellore bulls selected for postweaning weight

	NeS	NeC	P-value
Number of animals	40	27	-
Residual feed intake, kg/d	–0.009±0.033	0.014±0.039	0.9179
Initial body weight, kg	359a±5.16	314b±6.14	<0.0001
Final body weight, kg	420a±6.47	361b±7.69	<0.0001
Feedlot time, d	85.4±3.65	81.0±4.43	0.4115
Age at slaughter, d	545±4.48	556±5.33	0.1001
Liver, kg	4.62a±0.095	4.04b±0.113	<0.0001
Kidney, kg	0.871a±0.023	0.631b±0.027	<0.0001
Empty gastrointestinal tract, kg	25.0a±0.610	22.9b±0.752	0.0203
Other internal organs, kg	11.6a±0.225	10.5b±0.267	0.0010
Blood, kg	16.0a±0.294	13.2b±0.349	<0.0001
Hide, kg	43.5a±0.753	38.9b±0.895	<0.0001
Head, kg	11.3a±0.184	10.0b±0.219	<0.0001
Tail, kg	1.15a±0.030	0.974b±0.036	0.0001
Feet, kg	8.07a±0.090	6.43b±0.107	<0.0001
Kidney, pelvic and heart fat, kg	6.01±0.431	6.72±0.512	0.2604
Fat thickness, mm	3.47±0.233	3.86±0.277	0.2569
Rib-eye area, cm^2	75.4a±1.65	71.2b±1.97	0.0436
Edible portion, kg/100 kg of carcass	79.5±0.276	80.1±0.328	0.1075
Hindquarter, kg/100 kg of carcass	47.8a±0.297	46.9b±0.357	0.0458
Forequarter, kg/100 kg of carcass	40.6±0.319	41.2±0.379	0.2095

Means followed by different letters differed significantly from one another (0.05 of probability, t-test).
NeS - Nellore selection line; NeC - Nellore control line.

and NeC animals. This finding demonstrates that selection for growth resulted in heavier animals with a higher amount of meat in carcass, but without altering the time of finishing of the animals. Significant differences between NeS and NeC animals were detected for most internal organs (liver (P<0.0001), kidneys (P<0.0001), empty gastrointestinal tract (P = 0.0203), and other internal organs (P = 0.0010)) and body tissues (blood (P<0.0001), hide (P<0.0001), head (P<0.0001), tail (P = 0.0001), and feet (P<0.0001)). These findings were expected, since NeS animals were heavier and the superiority in body weight is obviously reflected in internal organs and body tissues weights.

Selection Nellore animals presented higher hindquarter proportion (P = 0.0458) and rib-eye area (P = 0.0436) than NeC animals, which indicates the superiority of these animals in terms of meat in the carcass. The higher hindquarter proportion found in NeS animals indicates they have a greater amount of good meat, since the most valued meat cuts, because of the greater quality, are located in the hindquarter of the animals. Selection Nellore and NeC did not differ significantly with regard to kidney, pelvic and heart fats (P = 0.2604), fat thickness (P = 0.2569), or forequarter proportion (P = 0.2095). Studying Nellore and crossbred animals, Luchiari Filho et al. (1989) obtained values of rib-eye area, fat thickness and edible portion similar to those of the present study, although the authors evaluated animals at 770 days of age. In that study, forequarter yield was similar and hindquarter yield was slightly lower (4 kg/100 kg of carcass). Animals selected for postweaning weight were more productive as indicated by a larger body size without changes in retail cut yields and final fat cover in animals of the same age group.

As observed for live weight at the beginning of the feedlot period and at slaughter, a significant difference was observed in empty body weight (P = 0.0001) (Table 3), confirming the superiority of NeS animals over NeC animals in terms of weight and body size. Following the same trend, the amount of water (P<0.0001), protein (P<0.0001) and mineral (P<0.0001) was higher in NeS animals as compared with NeC animals. Since NeS animals were heavier, they presented higher amounts of muscle and bone tissue. However, ether extract content was similar (P = 0.8719) as expected, since the dynamics of tissue deposition is characterized by an increased accumulation of adipose tissue at the cessation of bone growth and reduction of muscle tissue deposition. Since NeC animals are smaller, fat deposition occurs earlier and similar amounts are observed after sexual maturity in the two groups (Razook et al., 2002).

Selection Nellore animals presented lower relative amount of fat in the empty body than NeC animals (P = 0.0021). No significant differences in relative amounts of water (P = 0.1341) or protein (P = 0.0756) in the empty body were observed between the genetic groups studied. In contrast, empty body mineral content (P = 0.0150) and retained energy (P = 0.0196) were higher in NeS animals compared with NeC animals. Both genetic groups presented a high proportion of adipose tissue, but the amount of muscle tissue and consequent retained energy were higher in NeS animals. Bonilha et al. (2007), studying animals of the same origin, found no differences in relative water, ether extract or protein amounts between the NeS and NeC groups. However, mineral content differed between these animals and was higher in the NeS group. The relative amounts of minerals found in the empty body of the two groups were similar to those obtained by Leme et al. (1994) for Nellore animals (44 g/kg). In that study, relative protein and ether extract amounts in the empty body were 179 g/kg each. By contrast, Backes et al. (2002), studying Santa Gertrudis animals with a mean weight of 450 kg, found relative empty body fat and protein amounts of 199 g/kg and 205 g/kg, respectively.

The rates of empty body gain (P = 0.0215) and water deposition (P = 0.0019) were higher in NeS animals than in NeC animals (Table 4). Control Nellore animals presented higher rates of fat deposition in the empty body than NeS animals (P = 0.0469). This finding is expected since these animals, which are lighter and smaller, started to deposit fat earlier. The rates of protein (P = 0.0644), mineral (P = 0.1356) and energy (P = 0.1840) deposition in the empty body did not differ significantly between NeS and NeC animals. No significant differences in water (P = 0.4804), protein (P = 0.7143) or mineral (P = 0.1341) content in empty body gain were observed between NeS and NeC animals. Contrastingly, NeC animals retained higher relative amounts of ether extract in empty body gain (P = 0.0398). Other studies involving animals of the same origin also reported no differences in the rates of gain (Bonilha et al., 2007).

Although the animals consumed a diet with high levels of concentrate (810 g/kg as fed), the relative amount of fat in empty body gain was not very high. This fact might be explained by the young age of the animals, which probably had not reached physiological maturity and were in a phase of accelerated muscle tissue deposition, resulting in high relative amounts of water and protein in empty body gain and consequently lower deposition of adipose tissue. Berndt et al. (2002), evaluating Santa Gertrudis bulls also fed 80% concentrate, observed 420 g/kg of fat in empty body gain. Contrastingly, Backes et al. (2002) detected fat gains of 460 g/kg also in Santa Gertrudis animals; however, the animals were older (42 months), i.e., animals that had already reached maturity and presented zero bone

Table 3 - Initial and final chemical composition of the empty body in Nellore bulls selected for postweaning weight

	NeS		NeC		Initial P-value	Final P-value
	Initial	Final	Initial	Final		
Number of animals	8	25	8	26	-	-
Empty BW, kg	372a±7.33	402a±7.69	315b±8.39	351b±9.59	0.0003	0.0001
Water, kg	236a±6.80	252a±4.26	200b±7.78	217b±5.32	0.0051	<0.0001
Ether extract, kg	53.2a±1.77	59.6±2.48	47.1b±2.02	60.2±3.09	0.0493	0.8719
Protein, kg	64.4a±2.92	72.1a±1.25	53.2b±3.34	59.5b±1.56	0.0306	<0.0001
Minerals, kg	17.8a±0.694	19.9a±0.514	14.4b±0.795	16.2b±0.641	0.0086	<0.0001
Energy, Mcal	862a±24.9	917a±20.3	743b±28.5	843b±24.3	0.0094	0.0196
Water, g/kg of body	635±11.2	627±3.25	635±12.9	619±4.05	0.9836	0.1341
Ether extract, g/kg of body	143±4.34	148b±4.03	150±4.97	169a±5.02	0.3871	0.0021
Protein, g/kg of body	174±9.20	180±2.97	170±10.5	171±3.71	0.8080	0.0756
Minerals, g/kg of body	48.0±1.85	49.5a±0.89	45.8±2.12	46.0b±1.10	0.4724	0.0150

Means followed by different letters differed significantly from one another (0.05 of probability, t-test).
NeS - Nellore selection line; NeC - Nellore control line.

Table 4 - Empty body weight gain, chemical composition and deposition rates of body chemical components and retained energy in Nellore bulls selected for postweaning weight

	NeS	NeC	P-value
Number of animals	25	26	-
Empty body weight gain, kg/day	0.770a±0.035	0.641b±0.043	0.0215
Water, kg/day	0.453a±0.031	0.294b±0.038	0.0019
Ether extract, kg/day	0.118b±0.023	0.190a±0.028	0.0469
Protein, kg/day	0.156±0.010	0.127±0.012	0.0644
Minerals, kg/day	0.043±0.005	0.030±0.007	0.1356
Water, g/kg of body	582±50.6	526±62.5	0.4804
Ether extract, g/kg of body	153b±32.8	261a±40.4	0.0398
Protein, g/kg of body	206±11.1	200±13.7	0.7143
Minerals, g/kg of body	59.3±19.1	53.9±23.6	0.1341
Energy, Mcal/day	1.99±0.244	2.50±0.301	0.1840

Means followed by different letters differed significantly from one another (0.05 of probability, t-test).
NeS - Nellore selection line; NeC - Nellore control line.

tissue deposition and almost zero muscle tissue deposition. This type of analysis provides evidence supporting the explanation of the differences in the rates of fat deposition and relative fat amount in empty body gain between NeS and NeC animals, since the latter reach mature size earlier. Thus, the animals are in different stages of growth and consequently have different tissue deposition curves.

As observed for weights at the beginning of the feedlot period and at slaughter, as well as empty body weight, there were also significant differences in cold carcass weight (P<0.0001) (Table 5), confirming differences in body size and growth potential between the NeS and NeC groups.

The amounts of water (P<0.0001), protein (P<0.0001), minerals (P = 0.0042), and energy (P = 0.0332) in the carcass were higher in NeS animals. However, when the content of these components was expressed in relation to carcass weight, there was no difference between the two genetic groups, demonstrating that the carcasses of animals selected for growth were larger, but the proportion of the tissue components was maintained. With respect to the content of ether extract in the carcass, the results followed the same trend as observed for the empty body. Animals of the NeC group presented a similar (P = 0.9085) but higher relative amount (P = 0.0189) of ether extract in the carcass when compared with the NeS group, since adipose tissue deposition tends to occur earlier in smaller than in larger animals. Importantly, despite the lower carcass relative fat amounts, animals of the NeS group showed satisfactory degree of fat cover for slaughter, with a minimum subcutaneous fat thickness on the *longissimus* muscle of 4 mm. Coleman et al. (1993) found relative carcass ether extract and protein amounts of 320 g/kg and 220 g/kg, respectively, in Angus heifers. This high relative ether extract amount is likely to be due to the studied breed, whose carcasses are known to be rich in fat.

There were no significant differences in carcass weight gain (P = 0.0846) (Table 6). However, the existence of RF animals in the two genetic groups should be taken into account, a fact increasing the variability in this trait. One possible explanation is related to the dynamics of tissue deposition since it is known that the growth of the carcass and empty body of animals occurs in spurts. The rate of gain varies according to sexual class, body size, hormonal factors, and genetic group, among others (Owens

Table 5 - Initial and final chemical composition of the carcass in Nellore bulls selected for postweaning weight

	NeS		NeC		Initial P-value	Final P-value
	Initial	Final	Initial	Final		
Number of animals	8	25	8	26	-	-
Carcass weight, kg	245a±5.40	267a±5.19	205b±6.18	229b±6.47	0.0004	<0.0001
Water, kg	149a±5.33	160a±2.63	125±6.10	133b±3.28	0.0125	<0.0001
Ether extract, kg	37.1a±1.74	41.5±2.08	33.2b±1.99	41.2±2.59	0.0474	0.9085
Protein, kg	44.9a±2.12	49.8a±0.903	36.0b±2.43	41.2b±1.13	0.0197	<0.0001
Minerals, kg	14.3a±0.487	16.0a±0.526	11.7b±0.557	13.5b±0.656	0.0043	0.0042
Energy, Mcal	602a±22.6	671a±21.8	515b±25.9	620b±27.1	0.0298	0.0332
Water, g/kg of carcass	606±14.5	599±4.37	606±16.6	585±5.45	0.9867	0.0566
Ether extract, g/kg of carcass	152±7.17	154b±5.60	162±8.21	176a±6.99	0.3937	0.0189
Protein, g/kg of carcass	184±10.3	187±2.59	176±11.8	181±3.22	0.6396	0.1718
Minerals, g/kg of carcass	58.5±1.88	59.9±1.49	56.7±2.16	58.2±1.86	0.5525	0.4602

Means followed by different letters differed significantly from one another (0.05 of probability, t-test).
NeS - Nellore selection line; NeC - Nellore control line.

Table 6 - Carcass gain chemical composition, deposition rates of carcass chemical components and retained energy in Nellore bulls selected for postweaning weight

	NeS	NeC	P-value
Number of animals	25	26	-
Carcass gain, kg/day	0.470±0.028	0.393±0.035	0.0846
Water, kg/day	0.274a±0.028	0.156b±0.034	0.0090
Ether extract, kg/day	0.118b±0.023	0.190a±0.028	0.0469
Protein, kg/day	0.089±0.013	0.100±0.016	0.5942
Minerals, kg/day	0.043±0.005	0.030±0.007	0.1356
Water, g/kg of carcass	573±62.7	414±77.5	0.1099
Ether extract, g/kg of carcass	143±38.8	238±47.9	0.1215
Protein, g/kg of carcass	211±32.2	270±39.8	0.2495
Minerals, g/kg of carcass	72.6±12.2	77.9±15.0	0.7804
Energy, Mcal/day	12.2±2.24	15.6±2.77	0.3414

Means followed by different letters differed significantly from one another (0.05 of probability, t-test).
NeS - Nellore selection line; NeC - Nellore control line.

et al., 1995). In view of the major difference in body size between the NeS and NeC groups, it is likely that the rates of gain in the carcass are similar despite differences in the rates of gain in the empty body. The genetic groups also did not differ significantly in terms of water (P = 0.1099), ether extract (P = 0.1215), protein (P = 0.2495), or mineral (P = 0.7804) content in carcass weight gain.

The rates of water (P = 0.0090) and fat (P = 0.0469) deposition in the carcass differed significantly, with NeS animals depositing more water and NeC animals depositing more fat. These rates thus followed the same trend as those of tissue deposition in the empty body. No significant differences in the rates of protein (P = 0.5942), mineral (P = 0.1356), or energy (P = 0.3414) deposition in the carcass were observed between NeS and NeC animals. In a study involving ¼ *Bos indicus* × ¾ *Bos taurus* animals, Bulle et al. (2002) found no effect of breed on the composition of empty body gain, with the animals presenting a relative fat amount of 289 g/kg and energy content of 3.67 Mcal/kg. According to Berndt et al. (2002), weight gains related to high fat deposition, although more efficient energetically, are less efficient than feed conversion associated with low fat deposition since the dry matter content of adipose tissues is higher than that of muscle (80:30). Tedeschi et al. (2002), studying castrated and non-castrated Nellore cattle fed *ad libitum* or 65% of *ad libitum* intake, observed a significant difference in the relative amounts of water (619 and 632 g/kg) and protein (175 and 183 g/kg) in empty body gain between treatments for non-castrated animals.

Conclusions

Selection for postweaning weight is effective in increasing the productivity desired by the meat production system. After 30 years of selection for growth, selected animals are heavier and present good retail-cut yields and carcass finishing.

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