CARCASS AND MEAT CHARACTERISTICS OF YOUNG BULLS FROM LOCAL GOUDALI (ZEBU) CATTLE OF CAMEROON AND ITS CROSSES WITH ITALIAN SIMMENTAL

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Abstract – The objective of this study was to compare *in vivo* and at slaughter performances and *Longissimus thoracis* (LT) composition of Goudali (G) and Goudali × Italian Simmental (SG) young bulls. Fifty G and SG reared entirely on native pasture in Northwest Cameroon and belonging to one farm were considered. Body weight (BW) of animals was recorded on-farm. After slaughter, the cold carcass weight and the fifth quarter composition were recorded, and the killing out percentage calculated on the reconstructed *ante mortem* BW (BWam). After 24 h a sample joint was removed from the 8th rib position, dissected in lean, fat and bone portion and the proximate composition was carried out. SG showed higher BW at farm, BWam, cold carcass weight and KO%, than G, but also a marked loss of weight during transfer and lairage time. SG had lower percentage of feet, tail, filled gut, and higher weight of rib steak, ribeye and percentage of lean tissue than G. Conversely, the LT composition was similar between breeds. Results suggest that performances and fat composition of LT of F1 crosses, SG, in comparison with the pure breed, G, could be further increased by improving the bull's transfer and pre-slaughter conditions.

Key Words – Crossbreeding, *Longissimus thoracis* m. composition, Tropical environment.

I. INTRODUCTION

Cattle, with a population of over six million, contribute 28% approx. of the total animal protein produced in Cameroon and there is a strong potential for live-animal export to neighbouring countries in the sub-region. However, the productivity of the principal breeds of cattle, under the prevailing production environment, have remained relatively low over the years because of absence of a well-defined and sustained plan for improving nutrition, genetic selection within and between breeding stock. The increasing demand for beef and milk are veritable opportunities for poverty alleviation and livelihood improvement. Against this background SODEPA in technical collaboration with the Breeders' Association of Italian Simmental (ANAPRI), is working on an on-farm trial to improve the animal production by crossbreeding Goudali with the Simmental. The Goudali, a *Bos indicus*, is a popular autochthonous beef-type with good growth rate and appreciable tolerance to endemic diseases such as trypanosomosis and tick-borne infections [1], while the Italian Simmental is a rustic, ecologically-friendly and dual-purpose *Bos taurus* breed. This controlled crossbreeding programme targets the establishment of a more productive stock with a relatively improved potential for beef and milk that can diversify and improve significantly the income of livestock farmers in Cameroon.

II. MATERIALS AND METHODS

Three hundred and thirty Zebu Goudali (G) cows were recruited to constitute a breeding herd based on the following criteria: be between 5 to 8 years old, with at least two successful parturitions, of good mothering instincts, clinically healthy, nursing a calf of 1-3 months at point of recruitment, and be in good body condition. The selected cows were individually identified by use of plastic ear-tags and corresponding rumen transponders and then cordoned off within 600ha of the 38000ha of Dumbo Ranch located at Latitude 060 42' N and Longitude 0100 25' E. They were organised into five artificial insemination breeding herds. Oestrus was synchronised and the cows bred using frozen 0.25cc straw-type doses of semen from 13 different Italian Simmental (IS) bulls. After calving each of the ISxG crossbred calf (SimGoud,

SG) was identified by use of a plastic ear-tag and a corresponding rumen transponder.

To constitute a control against which the performances of the crossbred calves could be monitored, pure bred calves (G) born by Goudali cows on natural mount in the commercial ranch herds at about the same week with those produced by crossbreeding, were equally identified and subjected to the same nutritional plan (herbage grazed on Western Highland Plateau Savannah pasture+NaCl supplementation) and zoo-veterinary care, by introducing them immediately after calving in the artificial insemination breeding herds.

Figure 1. Representative sample of Goudali bulls at three years of age

Figure 2. Representative sample of SimGoud bulls at three years of age

Forty-two months after the first SG calving, 50 young male bulls of the two genotypes, from 20 to 41 months (Figs.1 and 2), were randomly selected in groups of 10 per experimental herd. The 25 SG young bulls were sired by five different IS bulls while the S ones originated from five different commercial herds of the ranch. The animals were weighed (body weight at farm, BWfarm) and and moved initially on-foot for 8 days over 208km to Bamenda and then loaded in unspecialised animal transport trucks, as is commonly practiced by cattle traders, to Douala in an 8hours drive over 306km. To alley stress the animals were rested for five weeks at the Douala Cattle market lairage during which they were grazed intermittently on native pastures on the outskirts of the town close to the market. After this the animals were slaughtered in the SODEPA industrial abattoir at Douala.

Immediately after slaughter, the fifth-quarter (FQ) components and the hot carcass weight (CW) were recorded and used to estimate the individual reconstructed *ante mortem* BW (BWam), the approximate empty body weight (EBW= BWam-filled gut) and the transfer losses (Tlosses,%= 100x[BWfarm- BWam]/BWfarm). After chilling for 24h, the half carcasses were weighted to obtain the cold carcass weight (CC) and the killing out percentage on the BWam (KO%). From the left side of carcass, a sample joint was removed from the 8th rib position, dissected in lean, fat, bone and other tissues portion and the proximate composition was carried out [2] on a sample of m. *Longissimus thoracis* (LT).

The normality of the data distribution was tested using the Kolmogorov-Smirnov test. The effect of genotype was evaluated by the analysis of covariance using 'genotype' (G *vs.* SG) as a fixed factor and 'age' as a covariate, an intra-class covariate when the intra-genotype coefficients were significantly different. In tables, the genotype means were adjusted to a covariate mean age of 31 months. The allometry coefficients were calculate by regressing the natural logarithm (ln) of the body component on the ln of the body (EBW or BWam).

III. RESULTS AND DISCUSSION

As expected, SG showed higher BWfarm than G ($P<0.05$; Table 1), with a four times higher growth rate between 20 to 41 months (9.46 *vs.* 2.57 kg/month). This result is due to the combination of additive and heterosis gene effects. In particular, considering that the F1 crosses are considered, the expected breed additive contributor and heterosis effect is 50% and 100% respectively. Demeke *et al*. [3], crossing Simmental breed with three different *Bos indicus* breeds in tropical Africa improved the yearling weight from 19 to 20%. However, many authors reported that heterosis effect is modulated by environment and production system [4,5].

Table 1 Weight of body, at farm and *ante mortem*, fifth quarter and cold carcass; losses during transfer and KO percentage of young bulls of different genotype

	Goudali	SimGoud	MSE	Age coeff.

	(G)	(SG)		G	SG
BWfarm (kg)	220[b]	354[a]	3.22	2.57[**]	9.46[**]
Tlosses (%)	-4.4[b]	6.1[a]	.763	0.48[**]	0.81[**]
BWam (kg)	228[b]	330[a]	2.39	2.26[**]	5.52[**]
FQ (kg)	104[b]	139[a]	1.27	0.56	0.80[*]
CC (kg)	103[b]	159[a]	1.61	0.89[*]	4.82[**]
KO (%)	45.1[b]	48.1[a]	.347	0.10	0.54[**]

[a,b] or [*] P<0.05; [**]: P<0.01

It is interesting to note that SG, despite having higher BWam than G (P<0.05), showed a marked loss of weight during transfer and lairage time (-6%). Conversely, G, during this period was able to increase BW of 4.4%. These results could be due to the higher nutrient requirements and/or to the lower adaptability to transfer condition of the crosses, SG, in comparison with the pure breed, G. At slaughter, SG showed higher carcass weight and KO% than G (P<0.05; Table 1) confirming the superiority of the F1 crosses in comparison with the pure breed. In a survey performed in Cameroon that involved G bulls from different production systems, Nfor *et al.* [6] recorded a hot carcass weight of 152 kg at 4 years. Williams *et al.* [7] highlighted a positive heterosis effect on carcass weight crossing *Bos taurus* and *Bos indicus* breeds.

Table 2 Fifth quarter composition (%BWam) and allometry coefficients in relationship with EBW

	Goudali (G)	SimGoud (SG)	MSE	Allometry G	Allometry SG
Head	5.75	5.53	.067	0.85[**]	0.85[**]
Feet	3.24[a]	2.93[b]	.069	0.29[*]	0.31[*]
Tail	1.18[A]	0.84[B]	.042	0.60	0.57
Skin	3.99	3.76	.138	1.33[**]	1.28[**]
Pluck	3.11	3.36	.082	0.78[**]	0.80[**]
Filled gut[1]	28.03[A]	25.02[B]	.527	0.18	0.22

[1]Allometry coefficient on BWam;
[A,B] or [**]: P<0.01; [a,b] or [*]: P<0.05

Considering the fifth quarter composition, SG showed a significantly lower percentage of feet, tail and filled gut, but similar percentage of head, skin and pluck (P>0.05) than G as reported in Table 2. As expected, the allometry coefficient was lower than 1 for head, feet and pluck in both experimental groups indicating that this parts are early maturing respect to EBW (Table 2). Also filled gut showed a diminutive allometry in relationship with BWam.

Table 3 Weight and tissue composition of the sampling cut (8th-9th rib section) from young bulls of different genotype

	Goudali	SimGoud	MSE
Rib steak weight (g)	510[b]	760[a]	17.2
Ribeye muscle (g)	102[b]	173[a]	4.96
Lean (%)	66.3[b]	68.9[a]	.358
Fat (%)	3.9	2.8	.363
Bone (%)	24.6	24.3	.765

[a,b]: P<0.05

As reported in Table 3, SG showed higher weight of rib steak and ribeye muscle at 8th-9th rib section level than G (P<0.05). The covariate, age, was significantly related to weight of rib steak and ribeye muscle for SG (21.5 and 5.9 g/month respectively, P<0.01), but not for G (1.7 and 0.7 respectively, P>0.05; data not reported in Tables). These results indicate that SG had a greater growth than G. In particular, considering the sampling joint composition, SG had higher percentage of lean tissue and similar percentage of fat and bone tissue than G (P<0.05; Table 3). Corazzin *et al.* [8] in a study that considered Simmental young bulls fed with concentrate, reported a sampling joint composition of 64.7% meat, 14.0% fat and 17.0% bone. Perotto *et al.* [9] crossing Nellore, a *Bos indicus* breed, with Simmental observed an increase, despite not significant, of 2.7% of the percentage of lean meat of sample joint at 12th rib. Theuissen *et al*. [10], crossing *Bos taurus* and *Bos indicus* breeds observed an heterosis effect of +0.8% on meat yield that was estimated considering the dissection of sample joint at 8th-10th rib level. Considering the sample joint and KO results, it could be speculated that SG had better carcass conformation at slaughter than G.

Table 4 *Longissimus thoracis* composition (g/100g fresh meat) of young bulls of different genotype

	Goudali	SimGoud	MSE
Moisture	76.6	76.0	.227
Protein	20.1	20.5	.248
Fat	.60	.76	.053
Ash	1.06	1.06	.017

LT composition is shown in Table 4. Differences between G and SG were not found (P>0.05). Marshall [11], reviewing the effects of different breed crosses, reported an average positive heterosis effect of 3.8% for marbling. Conversely, Gama et al. [4], crossing *Bos taurus* and *Bos indicus* breeds in pasture finishing conditions, showed a significant heterosis effect for moisture, +1.4%, but not for fat, protein and ash. The above

cited Authors explained that heterosis effect is strongly influenced by the animals' diet. Consequently, in our study, the lack of additive and heterosis effects at slaughter on meat fat content could be due to the severe transfer conditions of bulls from farm to slaughterhouse that have caused a probable reduction of the final fat level in muscle. Indeed, the average fat level was low, 0.68%, much lower than the value reported by Nfor *et al.* [12], 1.34% in G reared in Cameroon and with similar feeding conditions, but transported to slaughterhouse by truck. The average protein level found, 20.3%, fell within the range proposed for beef by Muchenje *et al.* [13], 20.0-22.9%, but it was lower than those showed by Salifu *et al.* [14] in zebu Fulani, 21.7%, and by Nfor et al. [6] in G bulls, 22.1%, both reared on natural pasture in tropical environment.

IV. CONCLUSION

G pure breed zebu showed much lower *in vivo* and at slaughter performance than their crosses with Simmental breed, probably because of additive and heterosis effects that interact with the severe rearing conditions of the animals. The results of this study indicate that, in order to maximize the crossbreeding effect, the bulls' transfer and pre-slaughter conditions should be improved.

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