Characteristics of beef from intensively fed western Baggara cattle: carcass yield and composition

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Abstract

Sixteen heifers and an equal number of bull calves of western Baggara type were used to study the characteristics of carcass and wholesale cuts at Kuku Livestock Research Station, Khartoum North, Sudan. Each of the two sex groups was subdivided into 4 subgroups of 4 animals. All the animals were fed, *ad libitum*, a similar complete diet for 16 weeks from 4 November 2002 to 24 February 2003. Bulls carcass had significantly (P< 0.05) greater proportion of forequarter than that of the heifers, whereas heifers carcass had significantly (P< 0.05) greater proportion of hindquarter than that of the bulls. Heifer's carcass had more primal cuts proportion than that of bulls, though the difference was not significant. Bulls carcass had significantly (P< 0.001) greater muscle proportion and significantly (P< 0.01) lower fat proportion in the forequarter than in that of heifers. Bone weight proportion of the heifers carcass forequarter was lower than that of the bulls, though the difference was not significant. Similarly hindquarter of the bulls carcass had higher proportion of muscle and bone, though the differences were not significant while the heifer carcasses hindquarter fat proportion was significantly (P<0.01) higher compared with that of bull carcasses. No significant differences were found in the yield of wholesale cuts weight as % of carcass weight other than the neck, chuck and blade and rump. The former two cuts were significantly (P<0.01) heavier in bull carcass, while the rump cut was significantly (P<0.05) heavier in heifer carcass. The proportion of muscle weight of the cuts as % of carcass weight was generally higher in all cuts except in the shin and rump cuts obtained from bulls as compared with that of heifers. On the other hand heifers gained higher proportion of fat in all carcass cuts as compared with that of bulls. Bulls had significantly (P<0.01) higher proportion of neck muscle and significantly (P<0.001) very high proportion of chuck and blade muscle and neck bone than that of heifers.

Keywords: Beef; Carcass quality; Composition; Heifers
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خصائص اللحم في عجول وعجلات أبقار البقارة المسمنة على التغذية المركزة: حاصل الذبيحة و مكوناتها

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الخلاصة

أخضعت أبقار البقارة (١٦ عجل + ١٦ عجلة) للتغذية على العلف الكامل بصورة حرة بعدأن قسمت الي مجموعتين رئيسيتين حسب الجنس ومن ثم كل مجموعة رئيسية الي اربعة مجموعات فرعية من اربعة رؤوس ولمدة ١٦ اسبوعاً ابتداءاً من الرابع من نوفمبر ٢٠٠٢ و حتي الرابع و العشرين من فبراير ٢٠٠٣ بمركز ابحاث الانتاج الحيواني، كوكو، الخرطوم شمال. تم اختيار الحيوانات بمتوسط وزن ابتدائي متساوي للجنسين لدراسة خصائص الذبيحة و قطع البيع الاجمالي لذبائح عجول وعجلات ابقار البقارة السودانية. لقد أثبتت التجربة

أن نسبة الارباع الامامية للذبيحة أكبر معنوياً بينما نسبة الارباع الخلفية اقل معنوياً في ذبيحة العجول مقارنة بذبيحة العجلات. لقد وجد أن ذبيحة العجول تحتوي على نسبة أعلي من العضل والعظم وعلي نسبة أقل معنوياً من الدهن في الارباع الامامية و الخلفية مقارنة بذبيحة العجلات بينما ذبيحة العجلات تحتوي علي نسبة أعلي من القطع الممتازة مقارنة بذبيحة العجول. لقد اثبتت التجربة أنه لا توجد فروقات معنوية في حاصل قطع البيع الاجمالي ماعدا قطع الكتف واللوح والرقبة والكفل حيث أن قطع الرقبة و الكتف واللوح اثقل معنوياً في ذبيحة العجول بينما قطعة الكفل اثقل معنوياً في ذبيحة العجلات مقارنة بالعجول. لقد أثبتت التجربة أن نسبة االعضل أعلي في كل قطع ذبيحة العجول ماعدا الرجل والكفل بينما نسبة الدهن أعلى في كل قطع ذبيحة العجلات مقارنة بالعجول كما تميزت قطع الرقبة و اللوح والكتف بنسبة عضل و قطعة الرقبة بنسبة عظم أعلى معنوياً في ذبيحة العجول مقارنة بالعجلات.

Introduction

Sudan is the largest country in Africa and of great agricultural potential. Livestock production contributes considerably to the national economy and according to FAO (1) Sudan ranks the first African country with respect to cattle population ownership.

The demand for meat in market is growing due to increase human population and per capita consumption of meat. Attention has been drawn nowadays to recent increase in fat trimmed deboned beef export to Egypt and other Arab countries.

The increased growth rate of western Baggara entire bull has led to increased fattening operations (2). Carcass quality of western Baggara entire bulls fattened on rations composed of mainly sorghum grains and agro-industrial by-products was considered by many research workers (3-5). Heifer's carcass output received little attention. This piece of work will compare carcass major parts and wholesale cuts yields and composition of heifers with that of bulls of western Sudan cattle type.

Materials and methods

Sixteen western Baggara heifers and an equal number of bulls of similar average initial body weight (170.0 vs. 173.3 kg) were purchased from local market and fattened on a complete diet composed of 40% sorghum grain, 10% molasses, 15% wheat bran, 15% groundnut cake, 0.2 urea, 17.8% groundnut hulls, 1% lime stone and 1% common salt, and of 11.5 Mj ME/kg DM and 17.5% crude protein at Kuku Livestock Research Station, Khartoum North, Sudan. Animals were divided according to sex into two main groups which were subdivided into 4 subgroups of 4 animals each.

At the end of the experimental feeding period of 16 weeks seven animals were randomly selected from each sex group and slaughtered and their carcasses were chilled at 4^{o}C for 24 hours. Chilled carcasses were split into two halves and then each half was weighed separately. The left side half of the carcass was cut into 14 wholesale cuts as described by Meat and Livestock Commission (6).

Wholesale cuts of the forequarter of the carcass included clod, neck, skin, chuck and blade, thick ribs, extended thin ribs and extended roast ribs. Hindquarter wholesale cuts included thick flank, hindquarter flank, top and silverside, rump, sirloin and leg. Primal wholesale cuts included extended roast ribs, thick flank, top and silverside, rump and sirloin, while minor wholesale cuts included neck, clod, shin, brisket, chuck and blade, extended thin ribs, thick ribs, hindquarter flank and leg.

The cuts were placed on a dissecting bench. Using scalpel and forceps (or knife) the subcutaneous layer of fat was removed then the muscles were separated from the bone, intramuscular fat and trimmings (connective tissues, fascia, lymph nodes, nerves and blood vessels). The separated tissues were covered with damp towels and weighed to the nearest gramme on a digital balance. Muscles, bone and trimmings were weighed separately for each tissue. Intramuscular and subcutaneous fats will give the cut fat. The data was analyzed statistically according to SAS (7).

Results and discussion

Yield and composition of carcass major parts weights as % of carcass weight of western Baggara heifers and bulls are shown in Table (1). Bulls had significantly ($P<0.05$) greater forequarter than heifers, whereas heifers had significantly ($P<0.05$) greater hindquarter than bulls. This was because of the well developed hump and shoulder region in bulls than in heifers whereas the latter had their most development in the hindquarter region. Likewise heifers had more primal (high-priced) cuts weight than that of bulls. This follows the well development of the hindquarter in the heifers and fits well with the findings of Preston and Willis (8) who reported that the desirable muscles which make up the first quality meat are situated in the proximal part of the hindquarter and dorsal area to the 5th rib.

Bulls forequarter had significantly ($P<0.001$) greater proportion of muscle and significantly ($P<0.01$) lower proportion of fat but non-significantly greater proportion of bone as compared with heifers. The present findings were consistent with earlier research results (9,10). This was because of increased fat deposition in heifers than in bulls and increased muscle developed in shoulder region in bulls than in heifers. On the other hand heifers hindquarter had

significantly (P<0.01) greater fat deposition and lower muscle and bone development, though the differences were not significant in than bulls.

Table 1: Yield and composition of major carcass parts of western Baggara bulls and heifers (% of carcass weight).[1]

Parts		Means (± S.D.)		Level of sign.
		Bulls	Heifers	
Fore-quarters		50.51 (1.22)	48.59 (1.24)	*
Hind-quarters		49.06 (1.30)	51.18 (1.65)	*
Primal (High priced) cuts		42.79 (1.04)	43.75 (1.51)	N.S.
Minor (low-priced) cuts		54.60 (0.71)	52.77 (1.00)	*
Fore-quarter	Muscle	33.26 (1.34)	28.42 (1.82)	***
	Bone	9.30 (0.71)	9.24 (0.74)	N.S.
	Fat	5.45 (1.38)	8.39 (1.38)	**
	Trimmings	2.91 (0.78)	2.49 (0.58)	N.S.
Hind-quarter	Muscle	32.11 (1.92)	30.87 (0.83)	N.S.
	Bone	7.47 (0.83)	7.26 (1.010	N.S.
	Fat	6.36 (1.70)	10.86 (2.57)	**
	Trimmings	2.62 (0.54)	2.78 (1.13)	N.S.

N.S.= Non significant, S.D.= Standard deviation, * = P<0.05, ** =P<0.01, ** = P<0.001.

[1] Carcass weight of bulls and heifers were 157.20 kg and 132.86 kg ,respectively.

Average percentage of wholesale cuts is presented in Table (2). Wholesale cuts % values indicated that bulls yielded heavier neck, clod, chuck and blade, thick flank, top and silverside than heifer. The differences were highly significant (P<0.001) in neck and chuck and blade percentage. This could be related to the greater development of neck and chest in bulls than in heifers.

Heifers yielded heavier shin, brisket, thick ribs, extended thin ribs, extended roasting ribs, sirloin and leg, though the differences were not significant. Rump was significantly (P<0.05) heavier in heifers than in bulls due to the better developed of pelvic region in heifers as compared with bulls.

The composition of wholesale cuts (Table 3) indicated that the proportion of muscle was generally higher in all cuts except shin and rump obtained from bulls. Bulls had significantly higher proportion of neck and chuck and blade muscle, while heifers had either higher or significantly higher proportion of fat in all cuts. Bone proportion was significantly higher in neck and higher in clod, shin, chuck and blade, brisket, leg, and top and silverside cuts of bulls as compared with that of heifers. This supported the results of Cole and Lawrie (11) and Colomer *et al*. (12) that bulls had stronger limb and neck than heifers as dictated by functional needs.

It may be concluded that heifers could be utilized as well as bulls to increase production of beef in the country. A few compositional discrepancies may be allowed for more lean in the neck and chuck and blade in bulls than in heifers and a more greater advantage of higher primal cuts in heifers than in bulls.

Table 2: Carcass yield of whole sale cuts of western Baggara bulls and heifers (% cold side weight).

Cuts	Means (± S.D.)		Level of Sign.
	Bulls	Heifers	
Neck	6.80 (1.06)	5.05 (0.41)	**
Clod	5.61 (0.33)	5.38 (0.96)	N.S.
Shin	2.98 (0.15)	3.06 (0.31)	N.S.
Chuck and blade	11.37 (1.32)	9.63 (0.81)	**
Brisket	9.12 (0.98)	9.46 (0.98)	N.S.
Thick ribs (4 bones)	4.97 (0.72)	5.09 (0.3)	N.S
Extended thin ribs (6 bones)	3.11 (0.96)	3.30 (0.40)	N.S.
Extended roasting ribs	7.16 (0.98)	7.61 (1.38)	N.S.
Leg	4.69 (0.34)	4.97 (0.97)	N.S.
Hind quarter flank	6.15 (0.47)	6.69 (1.02)	N.S.
Thick flank	4.95 (0.68)	4.91 (0.31)	N.S.
Top and sliver side	17.13 (0.53)	16.41 (0.87)	N.S.
Rump	6.69 (0.43)	7.55 (0.85)	*
Sirloin	5.87 (0.63)	7.04 (0.56)	N.S.

Table 3: Composition of whole sale cuts of western Baggara bulls and heifers (as % of carcass weight).

Cuts		Means (+ S.D.)		Level of sign.
		Bulls	Heifers	
Neck	Muscle	4.67 (0.73)	3.29 (0.17)88	**
	Bone	1.39 (0.16)	0.95 (0.13)	***
	Fat	0.33 (0.24)	0.59 (0.37)	N.S.
	Trimmings	0.41 (0.24)	0.31 (0.16)	N.S.
Clod	Muscle	3.15 (0.24)	2.77 (0.51)	N.S.
	Bone	1.32 (0.08)	1.24 (0.17)	N.S.
	Fat	0.64 (0.21)	1.13 (0.17)	N.S.
	Trimmings	0.46 (0.23)	0.28 (0.12)	N.S.
Shin	Muscle	1.34 (0.10)	1.37 (0.12)	N.S.
	Bone	1.25 (0.16)	1.19 (0.15)	N.S.
	Fat	0.14 (0.09)	0.18 (0.03)	N.S.
	Trimmings	0.38 (0.14)	0.39 (0.21)	N.S.
Chuck and Blade	Muscle	8.41 (0.83)	6.58 (0.76)	***
	Bone	1.78 (0.25)	1.71 (0.04)	N.S.
	Fat	0.76 (0.35)	0.83 (0.37)	N.S.
	Trimmings	0.57 (0.25)	0.49 (0.24)	N.S.
Brisket	Muscle	5.33 (0.89)	4.56 (0.89)	N.S.
	Bone	1.46 (0.30)	1.41 (0.24)	N.S.
	Fat	1.81 (0.45)	2.89 (0.44)	***
	Trimmings	0.52 (0.09)	0.64 (0.18	N.S.
Thick ribs	Muscle	3.87 (0.62)	3.75 (0.56)	N.S.
	Bone	0.25 (0.10)	0.32 (0.05)	N.S.
	Fat	0.64 (0.28)	0.89 (0.20)	N.S.
	Trimmings	0.19 (0.10)	0.14 (0.06)	N.S.
Ext. thin ribs	Muscle	1.93 (0.31)	1.86 (0.35)	N.S.
	Bone	0.62 (0.14)	0.71 (0.13)	N.S.
	Fat	0.26 (0.19)	0.56 (0.16)	**
	Trimmings	0.22 (0.11)	0.21 (0.11)	N.S.
Ext. roasting ribs	Muscle	4.50 (0.58)	4.42 (0.76)	N.S.
	Bone	1.36 (0.38)	1.57 (0.51)	N.S.
	Fat	1.02 (0.25)	1.39 (0.45)	N.S.
	Trimmings	0.27 (0.13)	0.24 (0.09	N.S.
Leg	Muscle	2.44 (0.25)	2.14 (0.49)	N.S.
	Bone	1.73 (0.12)	1.63 (0.31)	N.S.
	Fat	0.16 (0.10)	0.31 (0.12)	*
	Trimmings	0.40 (0.19)	0.76 (0.09	N.S.
Thick flank	Muscle	4.22 (0.67)	3.90 (0.38)	N.S.
	Bone	0.14 (0.07)	0.17 (0.03)	N.S.
	Fat	0.21 (0.06)	0.48 (0.16)	**
	Trimmings	0.39 (0.13)	0.30 (0.23)	N.S.
Hind quarter flank	Muscle	3.75 (0.44)	3.54 (0.80)	N.S.
	Bone	0.38 (0.07)	0.40) (0.12)	N.S.
	Fat	1.22 (0.35)	2.05 (0.80)	*
	Trimmings	0.81 (0.21)	0.67 (0.42)	N.S.
Top and silver side	Muscle	12.75 (0.81)	12.37 (1.19)	N.S.
	Bone	2.49 (0.47)	2.04 (0.67	N.S.
	Fat	1.39 (0.28)	1.73 (0.17	*
	Trimmings	0.50 (0.18)	0.43 (0.20)	N.S.
Rump	Muscle	4.43 (0.20)	4.67 (0.51)	N.S.
	Bone	1.34 (0.23)	1.49 (0.24)	N.S.
	Fat	0.61 (0.17)	1.01 (0.25)	*
	Trimmings	0.30 (0.06)	0.37 (0.23)	N.S.
Sirloin	Muscle	4.53 (0.59)	4.30 (0.57)	N.S.
	Bone	1.40 (0.26)	1.64 (0.21)	N.S.
	Fat	0.60 (0.14)	0.89 (0.25)	N.S.
	Trimmings	0.30 (0.14)	0.38 (0.28)	N.S.

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