Performance and carcass composition of Baggara cattle raised to two slaughter weights
I. Feedlot performance and slaughter characteristics

M.E. Mansour, I.M. Tibin, and F.M. Elamin*,

Animal Production Research Centre, P .O. Box 1335 Kuku, Khart. N. Sudan

SUMMARY

Forty-eight Sudan Baggara bulls were used. They were divided into two groups according to their ages, young (1-2 years) 143.5±7.5kg and mature (3-4 years) 249.0±9.6kg. The bulls were kept for a period of 25 weeks, during which they were fed *ad libitum* on a concentrated diet (20% CP and 11.1 MJ/kg DM ME). Representative animals from each group slaughtered at weeks 5, 10, 15, 20 and 25 of the feeding period.

Mature bulls consumed more feed and had better daily weight gain than young ones. But young bulls showed better feed conversion ratio than mature bulls.

No significant treatment effect ($P>0.05$) on trunk length, heart girth, height at withers and hip, neck and hump length was observed. However there were significant effect on chest depth ($P<0.05$), pelvic width ($P<0.01$), shank width and barrel circumference ($P<0.001$). Mature bulls showed higher dressing percentages (54.2, 59.3) than young (53.9, 58.7) bulls on full and empty body basis, respectively. Body weight had a significant effect ($P<0.001$) on the weights of all offal parts except spleen and rumen fill weight.

At an equally adjusted slaughter weight, young bulls had heavier omentum, mesenteric, head and hide weights, while mature bulls had higher liver, spleen and rumen fill weights.

INTRODUCTION

Sudan has a very high potential of livestock resources which is dependent on natural grazing and open range condition. Crop residues and forages are fed in an irregular pattern. Recently special efforts were made to develop meat industry, based mainly on the indigenous livestock, cattle and sheep that constitute about 41 and 50 million heads, respectively (M. A. R. F, 2002).

The cattle of the Sudan are divided into three ecological groups, Northern Zebu *(Bos* in *dicus)*, Nilotic and Nuba Mountain cattle. The N. Zebu provides the bulk of beef consumed in the country and contribute to the live animals and the meat export trade. These cattle give good performance on dry-lot fattening. Their daily weight gain and dressing percentage were quite satisfactory (El Khidir, *et al*., 1988).

The objective of this work is to study changes and variations in performance and slaughter data associated with age, weight and fatness of Baggara bulls.

MATERIALS AND METHODS

Fort-eight Baggara bulls purchased from Umdurman local market were divided into two groups. The first group included eighteen bulls (Mature) with an average age of 3-4 years and an average live weight of 250kg. In the second group there were thirty (Young) bulls of 1 – 2 years age and weighed 145 kg.

.The animals were randomly allotted to pens provided with watering and feeding facilities. Mature bulls were kept in 6 pens of 3 bulls each. Young bulls were housed in 6 pens of 5 bulls each.

Upon receipt all animals were ear-tagged and vaccinated against internal & external parasites. They were kept for a pre-experimental period of 2 weeks for adaptation. At the end of this period the bulls were individually weighed after an overnight fast except for water to obtain the initial live-weight. The initial live-weights were 249.0±9.6kg, and 143.5±7.5kg for mature (group A) and young (group B) bulls, respectively.

The animals were fed *ad libitum* on a diet composed of 52% molasses, 39% wheat bran, 5% groundnut cake, 3% urea and 1% common salt **(Table 1).** Also sorghum straw was offered to mature animals at the rate of 2kg/head/day and to young bulls at the rate of 1.5kg/head/day. Green Berseem *(Trifolium alexandrium)* was offered at the rate of 2kg/head/week as a source of Vit A. Feeds were offered in two meals at 8.00 a.m. and 4.00 p.m. The feeding period lasted for 25 weeks. The daily feed intake was calculated as the difference between feed offered and refusal. The diet was analyzed for crude protein, ether extract, crude fibre, ash and nitrogen free extract (AOAC, 1980). Metabolizable energy was calculated as described by Ellis (1981).

Table 1. Ingredient composition of the experimental diet.

Ingredient	Percent
Molasses	52.0
Wheat bran	39.0
Groundnut cake	5.0
Urea	3.0
Common salt	1.0
Calculated chemical composition	11.09
ME (MJ/kg)*	
C.P.%	20.0

* *ME (MJ/kg) = 0.012 CP + 0.005 CF + 0.013 EE + 0.014 NFE*
Where nutrients are gm/kg feed (Ellis, 1981).

Animals were weighed individually at weekly intervals using a weigh bridge of 1500kg max-capacity load balance and 5 divisions. Weighing was done in the morning (8.00 a.m.) before feeding and after an overnight fast except for water.

Representive animals from each group were slaughtered at 5, 10, 15, 20 and 25 weeks of the experimental period. The number of animals from first group that were slaughtered at

the crossponding weeks was 6, 3, 3, 3 and 3, respectively. Those from second group were 8, 6, 6, 5 and 5 animals, respectively.

Live animal measurements were taken according to procedure described by Brown *et al*., (1973) and Boggs and Merkle (1984). These measurements included wither height, hip height, pelvic width, body length, heart girth, abdomen circumference, chest depth; hump length, shank width and neck length. They were recorded for each animal immediately prior to slaughter (in centimeters) with using a flexible tape except wither and hip height, in which a calibrated stick was used.

The bulls were slaughtered following the local Moslem practices. After dressing and evisceration, the internal organs and offals were removed and weighed. The weight of gut-fill subtracted from the slaughter weight to obtain the empty body weight. The kidney and kidney-knop channel fat were left intact. The carcass weight was recorded. The carcass was chilled at 4C for 24 hours.

Data analysis:-

Analysis of variance was done according to the General Linear Model (GLM) Procedure of Statistical Analysis System (SAS, 1990).

RESULTS AND DISCUSSION

Performance characteristics:-

Analysis of variance of live weight, daily feed intake, weight gain and feed efficiency are shown in **Table 2.** The present finding indicated that mature bull had heavier ($P<0.01$) body weights at the five phases, than young bulls. These differences between the two groups in the different phases are explained in terms of differences in initial feedlot weight. In the present study the mature bulls consumed more daily feed than young bulls throughout the experiment period. The difference in dry matter intake noted here between the two treatment groups could be attributed to the difference in the live body weight. This was in agreement with Gaili and Osman (1979), Preston (1987) and Gumaa (1996) who reported that cattle with heavier starting initial weight achieved higher feed intake in the feedlot.

Table 2. Feedlot performance at five different phases, of young and mature Sudan Baggara bulls.

Phase / Parameter	Treatment effect	Treatment groups		s.e
		Young	Mature	
Phase I: (1-5 Wk.)				
Body weight (kg)	***	160.7[a]	266.5[b]	7.58
Daily feed intake (kg)	**	6.3[a]	8.1[b]	0.28
Daily weight gain (kg)	NS	1.2	1.3	0.18
Feed conversion ratio	NS	6.0	6.8	1.19

DFI (% LW)	**	3.9[a]	3.1[b]	0.13
Phase II: (6-10 Wk.)				
Body weight (kg)	***	185.1[a]	296.3[b]	7.58
Daily feed intake (kg)	*	5.9[a]	6.9[b]	0.29
Daily weight gain (kg)	NS	0.8	1.0	0.16
Feed conversion ratio	NS	7.9	8.2	1.14
DFI (% LW)	***	3.2[a]	2.3[b]	0.11
Phase III: (11-15 Wk.)				
Body weight (kg)	*** 19	211.9[a]	306.9[b]	7.58
Daily feed intake (kg)	***	5.5[a]	7.4[b]	0.17
Daily weight gain (kg)	NS	0.8	0.9	0.13
Feed conversion ratio	NS	6.8	8.9	1.00
DFI (% LW)	NS	2.6	2.5	0.17
Phase IV: (16-20 Wk.)				
Body weight (kg)	***	236.4[a]	351.9[b]	7.58
Daily feed intake (kg)	***	5.8[a]	8.6[b]	0.23
Daily weight gain (kg)	NS	0.9	1.1	0.14
Feed conversion ratio	NS	7.3	8.6	1.93
DFI (% LW)	NS	2.4	2.4	0.01
Phase V: (21-25 Wk.)				
Body weight (kg)	***	264.5[a]	383.6[b]	7.58
Daily feed intake (kg)	***	6.7[a]	9.0[b]	0.12
Daily weight gain (kg)	NS	0.8	0.8	0.15
Feed conversion ratio	NS	9.0	10.9	1.31
DFI (% LW)	***	2.5[a]	2.3[b]	0.02

s.e. = Standard error of mean.
** P<0.05 ** P<0.01 *** P<0.001 NS P>0.05.*
a, b, Means in the same row followed by different superscript letters are significantly different.
I Daily feed intake as percentage of live weight.

The overall dry matter intake was comparable to that reported by ElShafie and McLeroy (1964), ElHag and Gorge (1981), Mohamed (1999) and Eltahir (1994) for the same breed. However it was slightly higher than the result reported by ElKhidir *et al.*, (1988) in Kenana

bulls. The discrepancy between the results might be attributed to differences between breeds, live weights and ration types. The present result on dry matter intake is less than that of Simmental and Friesian breeds (O' Donovan *et al*., 1987). Thus differences in dry matter intake were attributed to the large size of these breeds.

The present findings indicated that mature bulls had better daily rate of gain throughout the study period except the last phase. The mean of the daily live weight gain ranged from 0.8 to 1.3kg and from 0.8 to 1.2kg for mature and young bulls, respectively. The rate of growth was very high in phase one then decreased in the second and third phases.

Again it started to increase in forth and fifth phase. The present results of daily weight gain in phase one was comparable to the values of bulls from Baggara and Kenana breeds **(Table 3).**

Table 3. Average daily gain and dressing percentage of Sudanese cattle breeds.

Cattle breed	Average daily gain (kg)	Dressing percentage (%)	Reference
Baggara	1.0-1.2	53.7-54.2	El Shafie and McLeroy (1964)
B. bulls	1.26	55.7	El Shafie and Osman (1965)
Butana calves	0.91	53.0	El Shafie (1965)
Baggara	1.25	51.8	Ahmed *et al*., (1977)
B. bulls	1.31	53.6	Gaili and Osman (1977)
B. bulls	1.13-1.36	52.8-54.0	Gaili and Osman (1979)
Kenana calves	0.94-1.11	49.0	El Khidir *et al*., (1988)
Baggara bulls	1.10	-	El Tayeb *et al*., (1990)
Baggara bulls	0.94	50.3	El Khidir *et al*., (1995)
Baggara bulls	0.74-1.54	57.8	Gumaa (1996)
Kenana bulls	0.75-1.1	56.4	Gumaa (1996)
Baggara bulls	1.0-1.01	53.7	Mohamed (1999)
Baggara bulls	1.02	-	El Khidir *et al*., (1999)
Baggara bulls	1.13	52.0	El Tahir (1994)

Baggara bulls	0.7-1.0	48.0-52.0	Ahmed (2003)
Baggara bulls	0.8-1.3	54.2	This study
Baggara bulls	0.8-1.2	53.9	This study

Throughout the study period feed conversion ratio ranged between 6.0 to 9.0 and 6.8 to 10.9 in young and mature bulls, respectively. Young bulls showed better feed conversion ratio than mature bulls. The efficiency of feed utilization decline with increase in live weight and fattening period. This was in agreement with Gumaa (1996) and Trenkle (1998).

The feed conversion ratio in this study was comparable to that reported by Ahmed *et al.*, (1977), Gaili and Osman (1979), ElHag and Gorge (1981) and Mustafa *et al.*, (1990) for Baggara bulls. Also, it was comparable to that reported by ElShafie and Osman (1965), Fawzi and Abdelrahim (1967) in Kenana bulls.

Table (4) shows the result of the analysis of external body measurements. Analysis of covariance (using body weight as covariate) revealed no significant (P>0.05) treatment effect on trunk length, heart girth, height at wither, height at hip, head, neck and hump length. But there was a significant treatment effect on chest depth (P<0.05), barrel circumference (P<0.001), pelvic width (P<0.01) and shank width (P<0.001). Apparently the latter measurements were more influenced by animal age than weight.

Table 4. Mean (± s.e) adjusted ✞ external body measurements (cm) of fattened Young and Mature Sudan Baggara bulls.

Item	Treatment effect	Body weight (covariate) effect	Treatment groups	
			Young	Mature
Body length	NS	NS	106.6±1.31	107.7±2.06
Heart girth	NS	NS	157.2±1.21	152.1±1.91
Height at withers	NS	***	116.0±0.79[a]	114.0±1.25[b]
Height at hip	NS	***	122.1±0.70[a]	121.2±1.1[b]
Chest depth	*	NS	57.4±0.98[a]	62.4±1.54[b]
Abdominal circumference	**	***	177.4±1.17[a]	169.1±1.84[b]
Head length	NS	NS	43.0±1.77	42.5±1.21
Neck length	NS	**	36.9±1.01[a]	36.9±1.19[b]
Hump length	NS	***	36.0±0.85[a]	32.8±1.33[b]
Pelvic width	**	***	42.1±0.82[a]	36.5±1.28[b]
Shank width	***	NS	42.0±0.91	50.1±1.42

✞ = Adjusted to a common body weight by covariance.

s.e. = Standard error of mean.

** P<0.05 ** P<0.01 *** P<0.001 NS P>0.05.*

a, b, Means in the same row followed by different superscript letters are significantly different.

Feedlot performance and slaughter characteristics of Baggara cattle.

The present results indicated that external body measurements of Baggara bulls were comparable to those reported by Agag (1994) for the same breed of cattle. Also, they were similar to those obtained by Mohamed (1999), except that of heart girth and body length. The present results were lower than those reported by ElShafie (1968) and Abdalla (1987) for Baggara and Kenana cattle.

Slaughter traits:-

Table (5) displays slaughter data of treatment groups. The treatment affected (P<0.01) slaughter, empty body and carcass weights but not the dressing percentages calculated on full or empty body basis.

Table 5. Mean (± s.e) Slaughter traits of fattened young and mature Sudan Baggara bulls.

Item	Treatment effect	Treatment groups	
		Young	Mature
Slaughter weight	***	265.2±10.01[a]	352.7±14.43[b]
Empty body weight	***	244.2±9.78[a]	322.4±14.09[b]
Warm carcass weight	***	143.6±6.12[a]	191.7±8.83[b]
Dressing percentage[1]	NS	53.9±0.38	54.2±0.54
Dressing percentage [2]	NS	58.7±0.32	59.3±0.46

1. Dressing percentage (Hot carcass weight / slaughter weight).
2. " " (" " " / empty body weight).
s.e. Standard error of mean.
**** Significant at P<0.001.*
NS P>0.05.
a, b, Means in the same row followed by different superscript letters are significantly different.

Mature Baggara bulls had heavier slaughter, empty body and warm carcass weights than young bulls.

The dressing-out percentage mean values were reasonably similar in young and mature bulls. The mature bulls showed higher dressing percentages (54.2, 59.3) than young (53.9, 58.7) on full and empty body basis, respectively. This was in agreement with Gaili and Nour (1980) who reported that dressing percentage increased as live weight increased.

The dressing percentage in this study was similar to that reported by ElShafie and McLeroy (1965), Gaili and Osman (1979) for Baggara bulls and Hall (1962) of Sudan Zebu steers.

The present results for dressing percentage were higher than that reported by El Khidir *et al*., (1988) for Kenana bulls. Also, the present results on dressing percentage were higher than those reported by El Khidir, *et al*., (1995) and Eltahir (1994), this difference might be due to differences in slaughter weight.

The results of offal parts as summarized in Table **(6)** indicated that body weight had a significant effect on the weight of all offal parts except spleen and rumen fill weight. On the removal of the effect of body weight by covariance there were only significant treatment effect on liver, spleen, rumen fill and hide weight.

At an equally adjusted slaughter weight, young bulls had heavier omentum, mesenteric, head and hide, while mature bulls had higher liver, spleen and rumen fill weight. This result was attributed to development changes in young and mature animals.

The proportions of offal parts reported in this study were comparable to that reported by Gaili and Osman (1979), Eltahir (1994) and Gumaa (1996) for the same breed. Generally the present results on offal parts were higher than the values reported by ElShafie and McLeroy (1964) for Sudan Baggara bulls.

Table 6. Mean (± s.e) Body components (kg) of fattened young and mature Sudan Baggara bulls.

Item	Treatment effect	Treatment groups	
		Young	Mature
Omentum fat	*	3.8±0.29[a]	5.0±0.42[b]
Mesenteric fat	NS	1.4±0.09	1.5±0.14
Liver	***	3.7±0.08[a]	4.8±0.12[b]
Pluck	***	3.3±0.09[a]	3.9±0.13[b]
Spleen	***	3.9±0.04[a]	1.3±0.06[b]
Rumen fill	***	21.0±0.81[a]	30.3±1.16[b]
Head	**	14.7±0.55[a]	17.9±0.80[b]
Hide	NS	20.4±0.87	23.2±1.26
Feet	***	5.5±0.15[a]	6.5±0.22[b]

s.e. = Standard error of mean.

** P<0.05 ** P<0.01 *** P<0.001 NS P>0.05.*

a, b, Means in the same row followed by different superscript letters are significantly different.

Feedlot performance and slaughter characteristics of Baggara cattle.

REFERENCE

Abdalla, S.A. (1987). Growth, carcass characteristics and carcass composition Kenana and Kenana crossbred bull calves slaughtered at different weight. M. Sc. Thesis, University of Gezira.

Agag, R.A. (1994). Carcass characteristics, meat yield and quality of different type of Western Baggara cattle. M. Sc. Thesis, University of Khartoum.

Ahmed, F.A., ElShafie, S.A. and Osman, H.A. (1977). Fattening of Baggara cattle on rations of conventional concentrate agricultural by-products. Acta veterinaria (Beograd), 27: 21-27.

AOAC (1980). Official Methods of Analysis of the Association of Official Analytical Chemists, W. Howritz (ed.), 13th ed., Washington, D.C.

Boggs, L.D. and Merkel, R.A. (1984). Live animal, carcass evaluation and selection manual Kendall / Hunt, publishing Company, Dubuque, Lowa, USA.

Brown, J.E., Brown, C.J. and Butts, T.M. (1973). Evaluation relationship among immature measurements of size, shape and performance of beef bulls. I Principal components as measures of size and shape in young Hereford and Angus bulls. J. Anim. Sci., 36: 1010.

ElHag, G.A. and George, A.E. (1981). Performance of Western Baggara bulls fed on rations containing high levels of poor quality agro-industrial by-products. Agric. East Afr. Afric. Forest. J. 47 (2): 43-48.

El Khidir, O.A., Khalafalla, A.M., Sulieman, Y.A. and Morgos, F.I. (1988). Effects of a traditional and unconventional fattening diets on feedlot performance of Kenana bull calves. Sudan J. Anim. Prod., 1 (1): 1-6.

Ellis, N. (1981). The nutrient composition of Sudanese animal feeds. Bull. No. 1: North and Central Sudan. Central Nutrition Res. Lab., Kuku, Khartoum North.

ElShafie, S.A. (1968). Investigation on feeding high concentrate ration of Sudan zebu cattle. Sudan J. Vet. Sci., Anim. Husb., 9: 285-294.

ElShafie, S.A. and McLeroy, G.B. (1964). Carcass characteristics of feedlot fattened Northern and Western Sudan zebu cattle. Sudan J. Vet. Sci., Anim. Husb., 6:3-11.

ElShafie, S.A. and Osman, A.H. (1965). Fattening of Sudan zebu cattle. II: Weight gain and carcass analysis of Kenana cattle under two different types of feed. Sudan J. Vet. Sci., Anim. Husb., 6: 75-82.

Eltahir, I.E. (1994). Beef Production Potential of Western Baggara and 50% Friesian Crossbred. M. Sc., Thesis, University of Khartoum.

Fawzi, H. and A/Rahim, I. (1967). Economical fattening of Kenana calves on Gezira Agricultural by-products. Sudan J. Vet. Sci., Anim. Husb., 8 (2): 120-123.

Gaili, E.S.E. and Osman, H.F. (1979). Effect of initial feedlot weight on the finishing performance and body composition of Western Sudan Baggara cattle. Trop. Agric. (Trinidad), 27 (1): 69-74.

Gaili, E.S.E. and Nour, A.F.Y.M. (1980). Development of body

components in Kenana cattle. I: Development of carcass and non-carcass components of the body. J. Agric. Sci., Camb., 94: 257-262.

Gumaa, A.Y. (1996). Beef production potential of some Sudan Zebu cattle. Ph. D. Thesis, University of Khartoum.

MARF (2002). Department of Statistics and Information, Ministry of Animal Resources and Fisheries. Khartoum, Sudan.

Mohamed, H.K. (1999). The effect of different dietary energy levels on performance, carcass characteristics and meat quality of Sudan Baggara cattle. Ph. D. Thesis University of Khartoum.

Mustafa, A.F. Mohamed, T.A. and Eltayeb, A.E. (1990). Effect of feeding millet sorghum stover in a conventional concentrate diet on performance of Western Sudan Baggara cattle. Sudan J. Anim. Prod., 3 (2): 57-67.

O'Donovan, P.B., Gebrewolde, A., Kebede, B. and Galal, E.S.E. (1978). Fattening studies with cross-bred (European x Zebu) bulls. I: Performance on diets of native hay and concentrate. J. Agric. Sci., Camb., 90 (2): 425-429.

Preston, T.R. (1987). Conference summary and overview. Symposium Proceedings-Feed Intake of Beef Animals, pp. 387-391.

SAS (1990). Statistical Analysis System, SAS Institute Inc., SAS/STAT User's Guide, Version 6, Vol. 2, Cary, NC, pp. 846.

Trenkle, A. (1998). Effect on initial body condition, frame size and concentration of Dietary energy on performance of finishing steers. A.S. Leaflet (1537). Beef Research Report. Iowa State University.

Authors:

Muawia El Hassan Mansour
Ibrahim Musa Tibin
Faroug Mohamed El Amin.

معاوية الحسن منصور ، إبراهيم موسي تبن[2] وفاروق محمد الأمين[2]
مركز بحوث الإنتاج الحيواني[1] كلية الإنتاج الحيواني – جامعة الخرطوم[2]

الأداء الجسماني ومكونات ونوعية ذبائح أبقار ا لبقارة عند وزنين مختلفين

1- الأداء الجسماني وخصائص الذبيحة لأبقار البقارة

ملخص البحث:

تم استخدام 48 ثورآ من أبقار البقارة لدراسة الأداء الجسماني وخواص الذبيحة . قسمت الحيوانات إلي مجموعتين حسب أعمارها صغيرة (1–2 سنة) وعددها 30 ثورآ وناضجة (3–4 سنوات) وعددها 18 ثورآ . استمرت فترة التجربة لمدة 25 أسبوعآ تم خلالها تغذية الحيوانات علي عليقة مركزة (20% بروتين خام و11.1 ميجاجول/كجم طاقة) . تم ذبح الحيوانات علي دفعات في الأسابيع 5 ، 10 ، 15 ، 20 و25 بعد أخذ الأوزان النهائية وقياسات الجسم .

كانت الثيران الناضجة هي الأكثر استهلاكآ للعلف اليومي وكذلك الزيادة اليومية في الوزن الحي ، غير أن الثيران الصغيرة كانت الأفضل من حيث كفاءة تحويل الغذاء . لم تظهر النتائج أي فروقات معنوية ($P>0.05$) في طول الجسم ومحيط الصدر والارتفاع عند القارب والقطن وطول الرقبة والسنام ، غير أن هناك فروقات معنوية في عمق الصدر ($P<0.05$) وعرض الحوض ($P<0.01$) وعرض الكتف ومحيط البطن ($P<0.001$) .

أظهرت الثيران الناضجة تفوقآ في نسبة التصافي (59.3 ، 54.2%) علي الثيران الصغيرة (58.7 ، 53.9%) في حالتي الوزن الممتليء والفارغ علي التوالي . وجد أن هناك أثرآ معنوياً عالياً ($P<0.001$) لوزن الجسم علي وزن كل الأحشاء عدا الطحال ومحتويات الكرش .

عند تثبيت وزن الذبيح كانت ذبائح الثيران الصغيرة الأعلي في وزن دهن البطن الترب ودهن الأمعاء (المساريقا) ووزن الرأس والجلد ، أما الثيران الكبيرة كانت الأعلي في وزن الكبد والطحال ومحتويات الكرش .