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Estimation of dressing percentage and carcass traits on slaughter weight in Sudanese zebu cattle

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Abstract: This Study was conducted at the Hilat Kuku Research Centre to determine the effect of slaughter weight on the slaughter traits and the whole sale cuts. A total of thirty-three bulls of the Western Sudan Baggara breeds were used. They were allocated purposively into three groups based on slaughter weights. Carcasses were measured and the slaughter traits determined statistically using ANOVA and Duncan Multiple Range Test. The results indicated that the external offal and viscera weights increased with an increase of slaughter weight. The dressing percentage on slaughter and empty body weight basis showed no significant difference (P> 0.05) due to differences in slaughter weight. Shrinkage percentage declined from 3.0 to 1.9 as slaughter weight increases. Carcass length and chest width and leg circumference increased insignificantly with the increase of slaughter weight. While shin length and abdominal depth increased significantly (p<0.05) with an increase of the slaughter weight. Whole sale cuts percentage increased with an increase of slaughter weight. Some of the cuts decreased with an increase of slaughter weight. Most of the slaughter traits are influenced by slaughter weight. Hence, the thin flank could be utilized to predict the carcass weight. Further comparative study is needed with the South Sudanese Nilotic zebu bulls.

Key words: Slaughter traits; Dressing percentage; Whole sale cuts; Sudanese zebu cattle

INTRODUCTION

Sudan is endowed with natural resources including a large population of livestock. Livestock population has been estimated at 48 Million heads of cattle, 49 million sheep, 42 million goats and 3.9 million camels (MAR, 2006). Cattle breeds are categorized into three major types; Northern Sudan Zebu cattle which include Kenana, Butana, Baggara, White Nile and the Nuba Mountains (Medani, 1996). Whereas in South Sudan Zebu cattle breeds include the Murle, Toposa and Mangalla as well as Nilotic cattle of the Dinka, the Shilluk /Shollo and the Nuer.

Meat is a good source of protein of high biological value and act as a rich source of vitamins-B complex, iron and other essential minerals except calcium (Rook and Thomas, 1983). Evidence has shown that the Western Sudan Baggara cattle are the major beef producing breed providing the bulk of meat consumed in Northern Sudan and contributed considerably in export trade of beef cattle (A.O.A.D, 1974). The whole sale cuts differ in economic value because of the differences in composition and consumers preference for lean meat (Koch *et al.*, 1981). In Sudan meat is marketed without a formal grading system. Hence, carcasses of all age groups and different parts of the carcass could be sold in a market for the same price.

The aim of this study was to determine the effect of slaughter weight on slaughter traits as dressing %, shrinkage % and non-carcass component % and on the whole sale cuts % and the variability of these cuts with slaughter weight.

MATERIALS AND METHODS

Study Area

This Study was conducted at the Animal Fattening Research Unit of the Animal Production Research Centre, Hilat Kuku, Khartoum North.

Management of the Research Unit

Animals in the unit were housed in a group of pens constructed from poles. The roof was made up of corrugated iron sheets and the floor was covered with soil. Animals were fed on 80% concentrate diet and 20% sorghum straw. The feed and fresh water were supplied *ad libitum*. Vaccination and hygiene programmes for animals were restricted. Animals were weighed weekly in the morning hours before feeding. In the said Centre bulls are fattened to commercial weights to be sold alive or slaughtered for commercial purposes.

Experimental Animals

Thirty-three Western Sudan Baggara bulls were used. They were allocated into 3 groups based on slaughter weight. Group (1) consisting of 9 bulls of slaughter weight 350 kg and above. Group (2) of 11 bulls weighing between 300 and 349 kg and Group (3) of 13 bulls weighing below 300kg.

Slaughtering Procedures and Data Collection

Animals were slaughtered when reaching slaughter weights using local Muslim procedures as described by Khalafalla *et al.* (2011). Then the carcass was split using sharp saw along the vertical column into two halves. Each half was weighed and chilled at 4°C for 24 hrs.

Linear Carcass Measurement

The measurements were made using a measuring tape graduated in centimeters as described by Mohammed (2004) Albertí *et al.* (2005) Eltahir (2007). These include: carcass length, leg length, shin length, abdominal depth, chest depth and neck length.

Carcass Whole sale Cuts

The carcass was split into 14 cuts following the methods described by M.L.C (1974) for cutting and

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preparing beef. The separation of each joint was made as follows: shin, clod and neck, brisket, thick (4bones) and thin (6 bones), chuck blade (4bones) and extended roasted rib (6 bones), thin flank, rumps, sirelion, thick flank and topside silver as well as leg.

Data Management and Statistical Analysis

All experimental data were managed and analyzed using a one-way ANOVA and Duncan Multiple Range Test to determine differences between means (Asharf, 2003).

Results

Table 1: Slaughter traits of the Western Sudan Baggara bulls at different live body weights

Variables	Group 1	Group 2	Group 3	Statistical results	
	H wt ≥ 350 (9)	M wt 349 - 300 (11)	L wt <300 (13)	SE	L.S
Slaughter wt (Kg)	^{a}379.4	^{b}334.1	^{c}255.0	5.78	**
Hot carcass wt (Kg)	^{a}198.8	^{b}171.6	^{c}134.0	3.87	**
Cold carcass wt (Kg)	^{a}191.6	^{b}198.9	^{c}130.0	3.26	**
Dr % on slaughter wt (%)	52.3	b 51.8	52.7	0.59	NS
Shrinkage (%)	^{a}1.9	^{a,b}2.5	^{a}3.0	0.35	*
Empty body wt(Kg)	^{a}223.6	^{b}288.8	^{c}221.8	5.33	**
Dr% on empty body wt(Kg)	61.4	59.5	60.4	0.77	NS
External offal wt(Kg)	^{a}50.8	^{b}44.8	^{c}36.9	1.33	**
Viscera wt(Kg)	^{a}64.8	^{b}59.9	^{c}54.6	1.60	**
External offal wt (%)	15.68	15.51	16.63	0.38	NS
Viscera wt (%)	20.00	20.79	20.56	0.55	NS

**= highly significant difference ($p< 0.001$). *= significant difference ($p < 0.05$). NS= non -significant difference ($p > 0.05$). a, b, c = different superscripts of significantly difference ($p < 0.05$). H wt = Heavy weight group. M wt = Medium weight group. L wt = Light weight group.
Dr = Dressing SE= Standard error

From table (1) the slaughter traits of Baggara bulls showed that slaughter, hot carcass, cold carcass and empty body weight group (H. wt.) were significantly ($p<0.001$) higher than medium weight group (M. wt). The latter was also significantly higher than the light weight group (L.wt). shrinkage percentage showed that the L. wt. was significantly ($p<0.05$) higher than H. wt group. M.wt showed no significant differences from both of L. and H. wt groups. The dressing percentage on slaughter and empty body weight basis showed no significant differences ($p>0.05$) for the three groups. Similarly, the external offal and viscera percentages showed the same manner.

Table 2: The whole sale cuts percentage of the Western Baggara bulls slaughtered at the examined body weight

Variables	Group 1	Group 2	Group 3	Statistical results	
	H wt ≥ 350 (9)	M wt 349 - 300 (11)	L wt < 300 (13)	SE	L.S
Half carcass wt(kg)	^{a}97	^{b}84.1	^{c}64.6	1.97	**
Shin (%)	^{b}2.9	^{b}3.0	^{a}3.4	0.12	*
Clod (%)	6.3	6.1	6.1	0.21	NS
Neck (%)	7.2	7.2	6.7	0.27	NS
Brisket (%)	8.3	7.8	7.9	0.19	NS
Thin ribs (%)	^{ab}3.2	^{a}3.4	^{b}3.0	0.10	*
Thick ribs (%)	5.8	5.7	5.7	0.20	NS
Chuck blade (%)	11.0	11.7	11.1	0.42	NS
Ext. roasted ribs (%)	7.8	7.1	6.8	0.36	NS
Thin flank (%)	^{a}6.4	^{b}5.6	^{b}5.5	0.23	*
Sirelion (%)	6.11	6.5	6.4	0.18	NS
Rump (%)	6.3	6.5	6.5	0.20	NS
Thick flank (%)	^{b}4.4	^{ab}4.8	^{a}5.1	0,19	*
T.s silver (%)	^{b}16.5	^{b}17.0	^{a}17.8	0.23	*
Leg (%)	^{b}4.6	^{b}4.6	^{a}5.3	0.10	*
Kidney fat (%)	^{a}2.8	^{ab}2.6	^{a}2.1	0.20	*
Kidney (%)	0.4	0.4	0.5	0.07	NS

**= highly significant difference ($p< 0.001$). *= significant difference ($p < 0.05$). NS= non -significant difference ($p > 0.05$). a, b, c = different superscripts of significantly difference ($p < 0.05$). H wt= Heavy weight group. M wt = Medium weight group. L wt = Light weight group.
SE= Standard error

From table (2) the whole sale cut percentages of the whole carcass for the H.wt, M.wt. and L.wt. groups showed that the half carcass weight of the H. wt was significantly $P<0.001$ higher than M.wt. group. The latter was also higher than L.wt. Shin, topside silver and Leg percentage. Hence, H. wt group was significantly ($P<0.05$) higher than M.wt and L,wt .The Thin flank of the H. wt group was significantly ($p<0.05$) higher than those of M.wt and L.wt groups . Similarly, the thick flank of the L.wt was significantly ($p<0.05$) higher than M.wt and H.wt. However, M.wt thick flank is lower than H. wt . Kidney fat % of H. wt was significantly ($p<0.05$) higher than that of L.wt. The kidney of M.wt showed no significant difference from both the L.wt and H.wt. The clod, neck, brisket, thick ribs, chuck blade, extended roasted ribs, sirelion, rump and kidney percentage showed no significant differences ($P>0.05$) among the three body weight groups.

Table 3: The Carcass measurement of Western Baggara Bulls Slaughtered at the Examined Weight

Variables	Group 1	Group 2	Group 3	Statistical results	
	H. Wt. >.350 (9)	M. Wt 349-300 (11)	L. Wt <300 (13)	SE	L.S
Leg Length(cm)	77.6	72.5	72.7	2.3	NS
Carcass Length(cm)	132.3	129.7	126.6	2.37	NS
Shin Length(cm)	a 40.3	b 37.4	b 36.3	0.68	*
Chest Width(cm)	75.1	71.8	68.8	1.77	NS
Abdominal Depth (cm)	a 85.3	ab 83.3	b 79.5	1.57	*
Leg Circumference	98.4	94.0	96.2	5.5	NS

* = significant difference (p < 0.05).
NS = non -significant difference (p > 0.05).
a, b = different superscripts of significantly difference (p < 0.05).
H wt = Heavy weight group.
M wt = Medium weight group.
L wt = Light weight group.
SE= Standard error

Table (3) showed that the shin length of H. wt was significantly ($p<0.05$) higher than those of M.wt and L. wt. The abdominal depth of H. wt was significantly ($p<0.05$) higher than L. wt. Whereas the M.wt showed no significant difference from both of H. wt and L. wt. The rest of the carcass measurements showed no any variation among the studied body weight groups.

Table 4: Matrix of Correlation Coefficient of the Whole sale cut with slaughter and hot carcass weights

Whole sale cut(kg)	Slaughter Weight	Hot carcass weight	Whole sale cuts (%)	Slaughter weight	Hot Carcass Wt.
Shin	0.75*	0.70*	Shin	-0.50*	-0.51*
Clod	0.82*	0.72*	Clod	-0.01	-0.01
Neck	0.84*	0.79*	Neck	0.22	0.22
Brisket	0.93*	0.84*	Brisket	0.31	0.27
Thin ribs	0.88*	0.77*	Thin ribs	0.35*	0.35*
Thick ribs	0.83*	0.68*	Thick ribs	0.09	0.18
Chuck blade	0.81*	0.61*	Chuck blade	0.06	0.07
Ext. roasted ribs	0.79*	0.76*	Ext. roasted ribs	0.31	0.29
Thin flank	0.85*	0.77*	Thin flank	0.41*	0.44*
Sirelion	0.88*	0.78*	Sirelion	-0.04	-0.01
Rump	0.87*	0.81*	Rump	-0.17	-0.20
Thick flank	0.68*	0.62*	Thick flank	-0.41*	-0.38*
T.s Silver	0.95*	0.86*	T.s and Silver	-0.68*	-0.68*
Leg	0.86*	0.82*	Leg	-0.69*	-0.71*
Kidney fat	0.67*	0.52*	Kidney fat	0.32	0.36
Kidney	0.63*	0.60*	Kidney	-0.44*	-0.52*

From table (4) both the slaughter and hot carcass weights correlated significantly and positively ($p<0.05$) with all of whole sale cut weight. While the slaughter and hot carcass weights correlated significantly and negatively to the percentage of shin, thick flank, topside silver, leg and kidney. They also correlated significantly but positively ($p<0.01$) with the percentage of thin ribs and thin flank. The slaughter and hot carcass weights showed no significant correlation with the rest of the whole sale cuts.

Discussions

As shown in the results the empty body weight increased with slaughter weight which is in line with the findings of Williams *et al.* (1992). The present study showed no significant differences in dressing percentage on both slaughter weight on empty body weight basis among the studied groups. Dressing percentages on slaughter weight basis (51.8%) are similar to the findings of Ahmed (1977) which were 51%, but higher than that reported by El-khidir *et al.* (1995) of 50% and lower than that reported by El-shafie and Mcleroy (1964) of 53.7% and Gumaa (1996) of 54.2% at same slaughter weight. Such disparities could be due to the degree of the carcass finishing. Carcass shrinkage was significantly ($p<0.05$) greater in lighter animals than heavier ones. This could be attributed to direct inverse relationship between shrinkage and fat content which acts as insulator. Baggara bulls cooler shrinkage was reported to decrease as carcass weights increase due to increase in amount of carcass fat that reduce moisture evaporation. This result is in line with that of Mohammed (2004). The proportion of whole sale cuts in the carcass as shown in table (2) showed that the percentage of shin and leg decreased with an increase of slaughter weight. This may be due to high proportion of bone in the two cuts as bones are early maturing tissues. Kidney fat percentage and thin flank increased with an increase of slaughter weight which is due to fat deposition as fat is considered as late maturing tissues.

Thick flank and topside silver percentage decreased with an increase of slaughter weight which may be reflected by the degree of finish. Such observation was explained by Mansour (2004) who reported that the amount of external, internal and inter-muscular fats in the carcass had more effect on percentage retail yield or lean cut than any other single factor. The relationship between slaughter weight and carcass measurement in table (3) showed no significant differences among the three groups in leg length, chest width, carcass length and leg circumference. This is in line with the work of Gaili and Osman (1979) and Khalafalla *et al.* (2011) who found no significant differences in linear measurement between treatment groups of Western Baggara bulls at different initial feed lot weight.

Thin length and abdominal depth were observed to decrease with an increase in slaughter weight, which may be due to the presence of fat in the abdomen depth. Moreover, Butter Field (1965) indicated that width measurements were usually influenced by fat deposition. The correlation coefficient of the whole sale cuts and slaughter as well as hot carcass weights were negatively correlated with thin flank and leg (Mohammed, 1999). This may be due to higher constitution of bone as an early maturing tissue. Thick flank and topside silver showed a negative correlation with both slaughter and hot carcass weights, which could be due to degree of the carcass finish.

Conclusion

This study concluded that most of the slaughter traits are significantly influenced by the slaughter weight. Moreover, most of the whole sales cut percentages are doing so by slaughter weight, whereas the weights of the whole sale cuts remain unaffected. Hence, thin flank can be utilized to predict the carcass weight using the following equation: Y=71.43 + 19.65x, Where Y= Carcass weight and x =Thin flank weight. (Coefficient of determination, r^2 =0.1681). Further comparative studies are needed for using a large number of animals including Nilotic Zebu cattle from South Sudan to provide information about such relationships.

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