



## Study of Growth and Development of some Major Muscles in Baggara Cattle subtype Mesari and Nyalwi

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### Abstract

Twenty four mature Baggara bulls with an average body weight of 200 Kg were used in this study. The bulls were divided according to their subtypes into two groups *Nyalawi* and *Mesari*. Twelve bulls from each subtype were slaughtered at target weight of 250 Kg. Eighteen muscles from both fore quarter (eight muscles) and hind quarter (ten muscles) were dissected, weighed using digital weighing balance. The length and width of the selected muscles was recorded using metal ruler. The weight results revealed that fore quarter muscles *M. Biceps brachii*, *M. Infraspinatus*, *M. Latissimus dorsi* showed significant difference ( $P<0.01$ ) between the two Baggara cattle subtypes and all hind quarter muscles weight showed no significant difference between the two subtypes. The length and width of fore quarter showed no significant difference, where as the length of *M. Gluteus medius* and *M. Semimembranosus* showed significant difference ( $P<0.05$ ). Also the width results revealed that hind muscles *M. Gastrocnemius*, *M. Semimembranosus* showed significant difference ( $P<0.05$ ) between the two Baggara cattle subtypes.

**Keywords:** Baggara cattle, muscles measurements, Molasses.

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### Introduction

Sudan is mainly an agriculture country with a large livestock population, where most of the animals were owned by nomads. Cattle population estimated at 41 million head (M.A.R.F.R., 2010). Meat is define as whole or part of the carcass of cattle, camel, goat, sheep, buffalo, hare, deer slaughtered (Williams, 2007). Baggara cattle are the major type of beef cattle in Sudan. They

provide the bulk of meat consumed in northern Sudan and contribute considerably in export trade of beef cattle (A.O.A.D., 2002). Alsddig (2007) stated that the color of Baggara cattle was very variable and the basic color was white 45.5% or white with black marking 8.8% or grey 5.9% and less often black 5.9%. The brown, deep red or light red colors were also found and represented 15.4% and 18.5%

respectively. Baggara cattle subtypes have an excellent potential of beef production, but there is not enough information to increase the quality and quantity of meat produced by these subtypes. Eltahir (2007) reported that, information on how local resources are utilized for more efficient beef production and expected to contribute to the future development of the beef industry in Sudan should be provided. The cattle of Northern Sudan were divided by Payne (1970) as the Baggara, Kenana, Butana and White Nile. Baggara cattle are found in the savannah region between the White Nile and western borders of Sudan (Khlalil, 1961). They are raised by nomadic tribes in Darfur and Kordofan. Baggara cattle are named according to the tribal ownership into: Nyalawi subtype which found in Darfur region is white in colour; sometimes white coat color with black spots color is seen. Mesari subtype found in Kordofan region the coat color is dark red with a bright red strip on the back and at the top of the head in addition other variable red color is found; Rizigi subtype which found in Darfur with deep dark red coat color and black color along the neck, the lateral side of the head, the hind quarters and shoulder sides.

The growth of the muscle tissue consist of two processes first, the number of cell increase by cell division (hyperplasia) second, the cell increase in size (hypertrophy). Most hyperplasia occurs before the birth, about 30-40 cell division take place during gestation compared with 2-4 division postnatal.

After birth the cell hypertrophy occurs so the tissue mass increase in a consequence of increase in muscle cell size (Warriss, 2000) The major tissue of

bovine carcass show differential growth rates during development, muscle tissue has intermediate growth impetus (Berg and Butterfield., 1986).The beef carcass is made up of over a hundred different muscles. These muscles have different properties which affect processing characteristics and consumer acceptability (Bovine Myology & Muscle Profiling, 2004).

In this study eighteen major muscles were considered, the anatomical description of the muscles is stated according to Sisson (1965), fore quarter muscles are: *Supraspinatus*, muscle which occupies the Supraspinatus fossa, *Infraspinatus* muscle occupies the greater part of Infraspinatus fossa and extend beyond its tuberosity, *triceps brachii*, together with tensor fasciae antibrachii constitutes the large muscular mass which fills the angle between the posterior border of the scapula and the humerus, *Biceps brachii*, is a strong fusiform muscle, which lies on the anterior surface of the humerus. *Longissimus* (thoracis and lumborum) is considered as the largest and longest muscle in the body. It extends from the sacrum and ilium to the neck, filling up the space between the spinous processes medially and lumbar transverse processes and the upper ends of the ribs ventrally. *Latissimus dorsi*, is a wide triangular muscle (right angled triangle). *Subscapular*, this muscle occupies the Subscapular fossa, *Rhomboideus*, Is a heavier muscle just deep to the *Trapezius*, The hind quarter muscles include, *Semimembranosus* which is very large, three sided muscle lies on the medial surface of the preceding muscle and the *Gastrocnemius*, *Semitendinosus*, is a long muscle which extends from the first

two coccygeal vertebrae to the proximal third of the medial surface of the tibia , *Psoas major* is larger than *Psoas minor* muscle, by which it is partly covered. *Gluteus medius*, is thin but extensive, arising as far as the tuber coxae, and from the lower parts of the sacro-sciatic ligament, *Biceps femoris*, is a large muscle lies behind and in part upon the superficial and middle glutei, *Vastus lateralis*, lies on the lateral surface of the femur, extending from the great trochanter to the patella, it is wide in the middle, smaller at each end. *Vastus medialis* muscle resembles the preceding muscle and lies in similar position on the medial side of the femur, *Vastus intermedius*, muscle is deeply situated on the anterior face of the femur, *Gastrocnemius* muscle extends from the distal third of the femur to the point of the hock. Eltahir (2007) classified the individual muscle of beef carcass into three groups, the large muscles such as *Biceps femoris*, *Semimembranosus* and *longissimus dorsi* which weigh (3.17, 2.50 and 2.04 Kg) respectively, while moderate muscles include, *Infraspinatus* *Semitendinosus* and *Psoas major* which weigh (1.13, 1.10 and 1.01Kg) respectively. The small muscles such as *biceps brachii* and *rectus femoris* weigh (0.32 and 0.64 Kg) respectively.

The length of some individual muscles reported in (Bovine Myology & Muscle Profiling, 2004) as *Biceps femoris*, *glutes medius* and, *semimbranosus* where as 18.92, 10.7 and 13.85 cm respectively.

The objectives of this study are:

1. To study relative growth pattern of selected major muscles of two Baggara cattle subtype.
2. To study the measurements and weights of some selected muscles in

the two subtypes (Mesari and Nyalawi).

### Materials and Methods

**Experimental animals:** twenty four Baggara bulls (Nyalawi and Mesari) were selected from the commercial herd at the Animal Production Research Center (A.P.R.C) Kuku Khartoum North, with an average body weight of 200 Kg. The bulls were divided according to their subtypes into two groups Nyalawi and Mesari type (12 head for each).

**Experimental feed:** according to the feeding program of A.P.R.C, the bulls were feed add libitum on a concentrate diet made of 52% molasses, 39% wheat bran, 5% ground nut cake, 3% urea and 1% common salt(19.6% Cp and 11.6 Mj/Kg, ME). The diet offered was 80% concentrate and 20% sorghum straw.

**Slaughtering procedure:** the bulls were slaughtered at target weight of 250 Kg; the slaughter procedure followed the local Muslim practice i.e. by severing both jugular veins and carotid arteries by a sharp knife without stunning. After complete bleeding the head was removed at the atlano-occipital joint, the kidney and kidney knob channel fat were left intact in the carcass .the left side of the chilled carcass was divided into forequarter and hindquarter by inserting a knife between the 12<sup>th</sup> and 13<sup>th</sup> rib and sawing through the carcass cutting perpendicular to the back. The prepared left side was dissected into individual muscles. Eighteen muscles were dissected, weighed by digital weighing balance (1g-3Kg). Length and width of the selected muscles was recorded using metal ruler. The procedure of dissection adopted in this study is as described by Sisson (1965).

**Statistical analysis:** The results obtained from this study were analyzed using SPSS (Version 17.0, 2008) computer software program as independent student's T test.

**Results**

Table (1) shows the effect cattle subtype on the weight of some muscles, there

was no significant differences between the two subtypes( $p>0.05$ ) except for *M. Biceps brachii*, *M. Infraspinatus* and *M. Latissimus dorsi*, *M. Biceps brachii* and *M. Infraspinatus* were heavier in Nyalawi subtype whereas *M. Latissimus dorsi* was heavier in Mesari subtype.

**Table 1: The effect of Baggara cattle subtypes on the weight of some selected muscles (kg)**

Item	Mesari	Nyalawi	Significance
<b>Fore quarter muscles</b>			
No. of animals	12	12	
<i>M. Biceps brachii</i>	0.283±0.02 <sup>b</sup>	0.309±0.02 <sup>a</sup>	**
<i>M. Triceps brachii</i>	2.139±0.21	2.233±0.08	NS
<i>M. Infraspinatus</i>	0.940±0.06 <sup>b</sup>	1.034±0.12 <sup>a</sup>	*
<i>M. Supraspinatus</i>	0.738±0.07	0.786±0.04	NS
<i>M. Subscapular</i>	1.181±0.25	1.177±0.15	NS
<i>M. Latissimus dorsi</i>	1.095±0.10 <sup>a</sup>	0.971±0.08 <sup>b</sup>	**
<i>M. Longissimus thoracis</i>	1.697±0.22	1.606±0.18	NS
<i>M. Rhomboideus</i>	0.922±0.17	1.031±0.30	NS
<b>Hind quarter muscles</b>			
<i>M. Biceps femoris</i>	3.187±0.23	3.133±0.25	NS
<i>M. Gastrocnemius</i>	0.976±0.33	1.146±0.06	NS
<i>M. Gluteus medius</i>	1.172±0.59	1.474±0.14	NS
<i>M. Longissimus lumborum</i>	1.646±0.13	1.675±0.20	NS
<i>M. Psoas major</i>	0.846±0.09	0.887±0.17	NS
<i>M. Semimembranosus</i>	3.155±0.27	3.019±0.24	NS
<i>M. Semitendinosus</i>	1.235±0.12	1.192±0.09	NS
<i>M. Vastus intermedius</i>	0.648±0.07	0.646±0.05	NS
<i>M. Vastus lateralis</i>	1.111±0.06	1.154±0.08	NS
<i>M. Vastus medialis</i>	0.945±0.08	0.994±0.10	NS

\* Significance different  $P<0.05$

\*\* Significance different  $P<0.01$

NS: No significant

a,b means the mean with different superscript in the same row are significantly different at  $P<0.05$

Table (2) shows the length of the selected muscles from the two subtypes. There was no significant differences ( $p>0.05$ ) in muscles length except for *M. Gluteus medius* which was longer in Nyalawi subtype (32.67 cm). Table (3) showed the muscle width of the two subtypes. The result revealed there was no significant difference ( $p>0.05$ )

between the two subtypes in the muscle width except for muscles. *M. Gastrocnemius* which was wider in Nyalawi (14.0 cm) and (11.23 cm) in Nyalawi and Mesari respectively. *M. Semimembranosus* was wider ( $p<0.01$ ) in Mesari subtype (23.50 cm) compared to (21.79 cm) in Nyalawi.

**Table 2: The effect of Baggara cattle subtypes on length of some selected muscles (cm)**

Item	Mesari	Nyalawi	Significance
<b>Fore quarter muscles</b>			
No. of animals	12	12	
<i>M. Biceps brachii</i>	25.73±2.48	24.63±2.81	NS
<i>M. Triceps brachii</i>	33.59±1.43	33.88±1.51	NS
<i>M. Infraspinatus</i>	32.73±2.40	32.83±1.53	NS
<i>M. Supraspinatus</i>	31.55±2.01	32.21±1.20	NS
<i>M. Subscapular</i>	41.32±3.13	39.79±2.95	NS
<i>M. Latissimus dorsi</i>	35.23±4.77	36.08±1.88	NS
<i>M. Longissimus thoracis</i>	55.45±6.47	57.58±5.95	NS
<i>M. Rhomboideus</i>	26.91±2.91	27.92±3.80	NS
<b>Hind quarter muscles</b>			
<i>M. Biceps femoris</i>	58.64±1.80	59.83±2.98	NS
<i>M. Gastrocnemius</i>	26.23±9.92	26.25±0.87	NS
<i>M. Gluteus medius</i>	24.55±12.61 <sup>b</sup>	32.67±2.42 <sup>a</sup>	NS
<i>M. Longissimus lumborum</i>	31.14±1.98	32.04±2.51	NS
<i>M. Psoas major</i>	47.95±3.07	48.67±2.42	NS
<i>M. Semimembranosus</i>	31.41±1.85 <sup>a</sup>	29.75±1.96 <sup>b</sup>	NS
<i>M. Semitendinosus</i>	32.73±2.23	31.67±1.60	NS
<i>M. Vastus intermedius</i>	26.86±5.44	24.08±1.88	NS
<i>M. Vastus lateralis</i>	28.18±2.52	27.88±2.73	NS
<i>M. Vastus medialis</i>	27.23±2.54	27.63±2.17	NS

\* Significance different P<0.05

NS: No significant

a,b means the mean with different superscript in the same row are significantly different at P<0.05

**Table 3: The effect of Baggara cattle subtypes on width of some selected muscles (cm)**

Item	Mesari	Nyalawi	Significance
<b>Fore quarter muscles</b>			
No. of animals	11	12	
<i>M. Biceps brachii</i>	6.32±0.64	6.08±0.76	NS
<i>M. Triceps brachii</i>	18.23±3.15	18.71±2.95	NS
<i>M. Infraspinatus</i>	10.23±0.47	10.00±0.67	NS
<i>M. Supraspinatus</i>	7.82±0.72	7.50±0.60	NS
<i>M. Subscapular</i>	13.59±2.18	14.33±2.26	NS
<i>M. Latissimus dorsi</i>	24.05±3.00	22.67±1.80	NS
<i>M. Longissimus thoracis</i>	9.14±1.75	8.79±0.86	NS
<i>M. Rhomboideus</i>	12.86±0.81	13.25±1.59	NS
<b>Hind quarter muscles</b>			
<i>M. Biceps femoris</i>	16.63±1.70	17.46±1.34	NS
<i>M. Gastrocnemius</i>	11.23±4.09 <sup>b</sup>	14.00±1.30 <sup>a</sup>	*
<i>M. Gluteus medius</i>	13.59±6.75	17.13±1.19	NS
<i>M. Longissimus lumborum</i>	14.14±1.52	14.38±0.88	NS
<i>M. Psoas major</i>	7.82±0.87	7.71±0.75	NS
<i>M. Semimembranosus</i>	23.50±1.26 <sup>a</sup>	21.79±1.14 <sup>b</sup>	**
<i>M. Semitendinosus</i>	9.45±0.79	9.58±0.97	NS
<i>M. Vastus intermedius</i>	11.50±1.72	12.29±1.86	NS
<i>M. Vastus lateralis</i>	16.09±1.51	15.38±2.38	NS
<i>M. Vastus medialis</i>	9.91±0.74	9.75±0.84	NS

NS: No significant

\* Significance different P<0.05

\*\* Significance different P<0.01

<sup>a,b</sup> means the mean with different superscript in the same row are significantly different at P<0.05



## Discussion

Muscle weight is important parameters in meat production. Eltahir (2007) reported that *M. Biceps brachii* was small muscle in weight (0.32 kg) which agreed with the result of this study. Also the weight of *M. longissimus lumborum* was in the range that reported by Eltahir (2007) as 1.61 Kg. this result was in the range as that reported by Eltahir (2007), Mesari subtype had the longer *M. Semimembranosus* ( 31.41) compared to (29.75) cm in Nyalawi subtype. This result was less than that reported by (Bovine Myology & Muscle Profiling, 2004) as (33.4 cm) The length of *M. longissimus thoracis* found in this study (57.58 cm) was more than that reported by (Bovine Myology & Muscle Profiling, 2004). This result was almost similar to that mentioned by (Bovine Myology & Muscle Profiling, 2004) as (21.20 cm).

## Conclusion

Nyalwi showed high values in studied muscles parameters than Mesari subtype.

## References

- A.O.A.D. (2002). Report on the technical and economic feasibility of meat production project in the Democratic republic of the Sudan (in Arabic). *Arab Organization for Agriculture Development*.
- Alsiddig, M .A. (2007). *Some Aspect of Phenotypic and Genotypic Characterization of Baggara Cattle*. M.Sc. Thesis University of Khartoum.
- Berg, R.T. and Butterfield, R.M. (1968). Growth patterns of bovine muscle, fat and bone. *Journal Animal Science*, 27: 611-619.
- Bovine Myology and Muscle Profiling (2004). University of Nebraska,

Animal Science Department & Distributed Enviornments for Active Learning (DEAL); University of Florida, Department of Animal Sciences; Cattlemen's Beef Board, National Cattlemen's Beef Association. Available at <http://bovine.uX.edu/>

- Eltahir, I.E. (2007). *Growth and Development of Body Tissues and Characteristics of Major Muscle of Western Sudan Baggara Bulls*, Ph.D. thesis, Sudan Academy of Science (SAS).
- Khalil, I.M. (1961). Impact of tradition on livestock development in the Sudan. *Sudan Journal of Veterinay Science and Animal Husbandry*, 2 (2):166-175.
- M.A.R.F.R. (2010). Ministry of Animal Resources, Fisheries and Ranges. Estimation of livestock population Information Center. Khartoum - Sudan.
- Payne, W.J A. (1970). *Cattle Production in the Tropics*. vol.1. Breeds and Breeding. Longman Group Ltd London.
- Sison, S. (1965). *The Anatomy of the Domestic Animals*, Revised by J. D. Grossman W.B. Saunders Company. Philadelphia.
- SPSS (2008). *Statistical Packages for the Social Sciences*. Version 17.0 SPSS. Inc Chicago.
- Warriss, P.D. (2000). *Meat Science an Introductory Text*. CABI Publishing USA.
- Williams, P. (2007). Nutritional composition of red meat, Nutrition and Dietetics. *The Journal of the Dietitians of Australia*.

## دراسة نمو و تطور بعض العضلات الرئيسية في نوعين من سلالة ابقار البقارة (المسييري و النيالاوي)

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### المستخلص

أستخدم في هذه الدراسة عدد 24 رأس من عجول أبقار البقارة. قسمت هذه العجول إلي مجموعتين حسب الأنواع نيالاوي ومسييري (12 رأس لكل مجموعة) عند نهاية فترة التجربة تم ذبح العجول عند وزن 250 كجم. تم فصل عدد 18 عضلة رئيسة من الأرباع الأمامية والخلفية. وزنت العضلات بإستخدام ميزان رقمي وتم قياس الطول والعرض لكل عضلة بإستخدام مسطرة معدنية. أظهرت النتائج أن أوزان عضلات الأرباع الأمامية *M. M. Biceps brachii* و *Infraspinatus, M. Latissimus dorsi* وجود فروق معنوية ( $P<0.01$ ) بين النوعين. لم تسجل أوزان عضلات الأرباع الخلفية أي فروق معنوية ( $P>0.05$ ) بين النوعين. أظهرت نتائج عرض وطول عضلات الأرباع الأمامية لم تظهر وجود فروق معنوية ( $P>0.05$ ) بين النوعين، بينما أظهر طول العضلات الخلفية *M. medius Gluteus* و *M. Semimembranosus* وجود فروق معنوية ( $P<0.05$ ) كما أظهر عرض العضلات الخلفية *M. Semimembranosus* و *Gastrocnemius* وجود فروق معنوية ( $P<0.05$ ) بين النوعين.