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EFFECTS OF AGE AT FATTENING ON BUTANA CAMEL MALES CARCASS CHARACTERISTICS IN THE SUDAN

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ABSTRACT

Twelve male Butana camels were bought from Gadarif livestock market at 2, 3 and 4 years old (four in each age group) and fattened for eight weeks in the Animal Production Research Station in Gadarif, Gadarif State, Sudan. They were weighed before the morning meal at the beginning of the experiment and then weekly. The animals were fed sorghum stover ad lib in two equal meals at 8.00 am and 4.00 pm. Each animal was daily offered 2.0 kg concentrates. The animals were fed for two weeks as a preliminary period before fattening for eight weeks. At the end of the experiment the animals were fasted overnight, weighed and then slaughtered. Blood was collected and head, neck and legs were removed and weighed. The animals were then skinned, eviscerated and body components were removed and weighed separately. The gastro intestinal tract was weighed full and empty. The hot carcass was weighed with the kidneys intact and then one carcass side was divided into 6 whole sale cuts and the cuts were then dissected into muscle, bone and fat. Data was statistically analyzed by analysis of variance for a completely randomized design using SPSS program. The means were compared using least significant difference (LSD). Slaughter weight, EBW and hot carcass weight increased with age at fattening and were significantly ($P < 0.05$) lighter at 2 years old. Dressing percentages on LBW and EBW increased with age at fattening and were higher on EBW. They were least at 2 years old and highest at 4 years old. There was significant difference between 2 and 4 years old and between 3 and 4 years old on EBW. All body components weight increased with age at fattening, except lungs, heart and spleen. Mean weights of blood, head, liver, stomach and intestines were significantly ($P < 0.05$) higher at 4 years than at 2 years old, but not significantly ($P > 0.05$) different between 3 and 4 years old. Hides, fore legs and hind legs weights were significantly ($P < 0.05$) heavier at 3 and 4 years old than at 2 years old. Lungs weight increased up to 3 years and then declined. All body components weight as percentage of EBW increased with age, except lungs, spleen, kidneys and heart and was not significantly different among age groups.

Keywords: Camelus dromedarius, Age, Fattening, Carcass characteristics, Dressing percentage, Sudan

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Contribution/ Originality

This study is one of very few studies which have investigated the effect of age at fattening on carcass characteristics of *Camelus dromedarius*. It contributes in the existing literature. The papers primary contribution is finding that slaughter weight, EBW and hot carcass weight increased with age at fattening in *Camelus dromedarius*.

1. INTRODUCTION

Livestock population in Sudan was about 141.9 millions including 52.1 millions of sheep, 43.4 millions of goats, 41.8 millions of cattle and 4.6 millions of camels [1]. Livestock in the Sudan produces about 46.9% of total agricultural production, 20-25% of total local production and 23.1% of exports revenues. It is the main non- oil export in recent years.

Camels (*Camelus dromedarius*) are important in the Sudan due to adaptation to harsh environments, high population ranking second to Somalia in world 20 million camel population [2] and socioeconomic impacts. Camels are important in the Butana plain due to high population of about 0.75 million forming about 25% of camel population in the country [3]. Sudanese camels were classified according to location, tribal ownership, colours and function [4]. Camels are used for production of milk, meat, hides and waber and for riding, racing and packing [5]. Camels are important and efficient meat producers in arid and semi-arid zones where it is difficult to rear other meat producing animals [6]. The one humped camel has practical and unique attributes for meat production in intensive management in arid areas [7]. The amounts, composition and quality of camel meat vary with age, sex and feeding [8].

Sudan is among the major African countries with relatively well developed camel trade for slaughter [9]. According to Idriss [10] camel meat production in Sudan increased from 1275000 tons in 1996 to 1624000 tons in 2002. However, Camel meat consumption in the Sudan and exports are very low compared to their population. This was mainly because the main preferred meats were mutton, lamb and beef and camel meat is consumed in certain areas in the country and is not promoted. Camels are generally slaughtered at old ages with a decline in meat quality. Camels can play an important role in all pastoral societies in Butana area [11].

Nutrition is one of the main constraints for camel production in the Sudan as animals are mainly reared in traditional systems based on nomadism and rangelands which generally deteriorated due to many factors [12]. Seasonal rainfall and fluctuations in feeds quantity and quality lead to serious shortages in the dry season affecting animal's performance and health [13]. Animals are generally slaughtered at old ages with a decline in meat quality.

Mean slaughter weight of fattened mature desert camels was 456 kg and mean empty body weight (EBW) was 404.8 kg [14]. Camels dressing percentages vary greatly and are affected by many factors. They vary from 47 to 62 and were affected by sex, age, breed or type, body condition and digestive tract contents [15]. Fattened mature Sudanese desert camels dressing percentages were 55.8% on live body weight and 63.6% on EBW [14] and 47.4-51.4% [16].

Camels in the Butana area are important for improving meat production. However, there is no information on the appropriate age at fattening and effects of age at fattening on animals

carcass characteristics and body components. Therefore, this study was conducted to furnish these vital information.

2. MATERIALS AND METHODS

The experiment described below was conducted in the premises of the Animal Production Research Station in Gadarif, Gadarif State, Sudan. Gadarif State is situated between latitudes 12°-40 and 15° -45 N and longitudes 33°-45 and 36°- 45 E. Autumn is from July to October and annual rainfall is 602 mm. Average maximum temperature is 40°7 in April. The soil is generally sandy clay.

2.1. Animals

Twelve male Butana camels were bought from Gadarif livestock market at 2, 3 and 4 years old (four animals in each age) and brought to the Animal Production Research Station where the trial was performed. The age was determined depending on skilled animal owners. The animals were randomly assigned to twelve experimental pens.

2.2. Management

The animals were housed in individual pens constructed from heavy steel rails with feed and water troughs. They were vaccinated against prevalent diseases (Camel pox and haemorrhagic septicemia) and treated against external and internal parasites. The animals were weighed and allocated at random to the pens. They were weighed at the beginning of the experiment and then weekly to the end of the experiment. The animals were fed sorghum stover *ad libitum* in two equal meals at 8.00 am and 4.00 pm and each animal was offered daily 2.0 kg concentrates. The ingredients and composition of the concentrates are shown in table 1. Clean drinking water was offered *ad libitum*. The animals were fed the experimental rations for a two weeks preliminary period before the experiment commenced and then fattened for eight weeks.

Table-1. The ingredients of the concentrates mix fed to Butana male camels in Gadarif, Gadarif State, Sudan.

Ingredients	Percentages
Sorghum grain	50
Wheat bran	40
Ground nut cake	08
Oyster shell	01
Salt	01
CP	17
ME(MJ/Kg DM)	11

2.3. Measurements

2.3.1. Carcass Characteristics and Body Components

At the end of the fattening period the animals were transported by truck to Gadarif modern abattoir in El Rawashda area, about 20 km from the experimental site. They were fasted overnight (14 hours before slaughter) and weighed. They were slaughtered for the purpose of the

research according to Islamic rituals under veterinary inspection. There were no any pathological lesions detected at abattoir. Blood was collected and weighed and neck and feet were removed and weighed. The animals were then skinned and eviscerated. The carcasses were then hanged, opened and body components were removed and weighed separately. Each part of the gastro intestinal tract was weighed full and empty and the gut content was calculated.

The empty body weight (EBW) was calculated by difference between animals live body weight and gut contents weight. Body components were calculated as percentages of EBW. Dressing percentage was calculated on LBW and EBW.

2.4. Statistical Analysis

The means and SE or SD were calculated and the data was analyzed by analysis of variance for a completely randomized design using SPSS program. The means were compared using least significant difference (LSD).

3. RESULTS

3.1. Carcass Characteristics

The effects of age at fattening on carcass characteristics are shown in table 2. Slaughter weight, EBW and hot carcass weight increased with the increased age at fattening. They were significantly ($P < 0.05$) lighter at 2 years old and not significantly different between 3 and 4 years old.

Dressing percentages on LBW and EBW increased with increasing the age at fattening and were higher on EBW than LBW. They were significantly different between 2 and 4 years old. They were significantly different between 3 and 4 years old on EBW.

Table-2. Carcass characteristics of male Butana camels fattened at different ages in Gadarif State, Sudan.

Parameters	Age (Years)			S.E	C.V%
	2	3	4		
Slaughter weight (kg)	246.5±35.30 ^a	329.00±34.97 ^{bc}	356.00±32.50 ^c	17.81	15.3
EBW (kg)	211.28±28.94 ^a	284.38±26.20 ^{bc}	298.85±36.03 ^c	14.3	9.8
Hot carcass weight (kg)	115.40±17.22 ^a	157.19±13.57 ^{bc}	172.81±14.75 ^c	11.56	13.3
Dressing %: LBW	46.73 ^a	47.66 ^{abc}	48.47 ^c	2.39	6.7
Dressing %: EBW	54.21 ^a	55.00 ^{ab}	57.52 ^c	2.25	5.3

EBW=Empty body weight.

Means with the same letter within a row were not significantly different at $P \geq 0.05$.

Different letters within a row denote significant differences at $P \leq 0.05$.

S.E = standard error

3.2. Body Components

Table 3 shows mean body components weight in male Butana camels fattened at different ages.

All body components weight increased with age at fattening, except lungs, heart and spleen. Mean weights of blood, head, liver, stomach and intestines were significantly ($P < 0.05$) higher at 4 years than at 2 years old, but not significantly ($P > 0.05$) different between 3 and 4 years old. Hide, fore legs and hind legs weights were significantly ($P < 0.05$) heavier at 3 and 4 years old than at 2 years old. Lungs weight increased up to 3 years and then declined.

Table 4 shows that all body components weight as percentage of EBW were increased with age, except lungs, spleen, kidneys and heart. All body components weight as percentage of EBW were generally least at 2 years, except heart which was least at 3 years old. There were no significant differences in body components as percentage of EBW in male Butana camels fattened at different ages

Table-3.Body components weights (kg) in male Butana camels fattened at different ages in Gadarif State, Sudan.

Parameters	Age (Years)			S.E	C.V%
	2	3	4		
Blood	5.04± 1.45 ^a	6.54± 2.01 ^{ab}	7.45± 1.17 ^{bc}	0.36	4.4
Head	7.83± 0.84 ^a	9.36± 1.66 ^{ab}	10.93± 1.08 ^{bc}	0.77	17.6
Hide	12.13± 0.49 ^a	16.15± 1.79 ^{bc}	17.35± 2.42 ^c	1.25	18.5
Forelegs	4.83± 0.45 ^a	6.83± 0.90 ^{bc}	7.10± 0.91 ^c	0.74	24.7
Hind legs	4.00± 0.18 ^a	4.90± 0.52 ^{bc}	5.43± 0.69 ^c	0.36	20.4
Lungs	1.69± 0.24 ^{ac}	2.13± 0.25 ^{bd}	2.06± 0.31 ^{cd}	0.19	16.2
Heart	1.10± 0.43 ^a	1.10± 0.43 ^a	1.00± 0.41 ^a	0.31	37.7
Diaphragm	2.31± 0.69 ^a	3.25± 0.25 ^a	3.31± 0.55 ^a	0.46	25.6
Liver	3.19± 0.63 ^a	4.38± 1.33 ^{ac}	4.81± 0.77 ^{bc}	0.67	27.2
Spleen	0.380± 0.39 ^a	0.240± 0.01 ^a	0.270± 0.002 ^a	0.12	25.6
Kidneys	0.811± 0.13 ^{ac}	1.109± 0.08 ^{bd}	1.060± 0.18 ^{cd}	0.25	24.5
Renal fat	0.560± 0.35 ^a	0.690± 0.24 ^a	0.840± 0.19 ^a	0.40	26.7
Stomach	3.80± 0.94 ^c	5.50± 1.37 ^{abc}	7.38± 3.15 ^a	1.45	43.2
Intestines	8.53± 1.28 ^a	10.19± 1.34 ^{ac}	11.36± 0.89 ^{bc}	1.07	21.6
Tail	0.33± 0.01 ^a	0.50± 0.01 ^b	0.55± 0.1 ^b	0.01	25.4

Means with the same letter within a row were not significantly different at $P \geq 0.05$.

Different letters within a row denote significant differences at $P \leq 0.05$.

S.E = standard error.

Table-4.Body components (% of empty body weight) in male Butana camels fattened at different ages in Gadarif State, Sudan.

Parameters	Age (years)		
	2	3	4
Blood	2.43± 0.32 ^a	2.29± 0.15 ^a	2.47± 0.18 ^a
Head	3.78± 0.21 ^a	3.64± 0.17 ^{ab}	3.61± 0.14 ^{ab}
Hide	5.92± 0.36 ^a	6.05± 1.10 ^{ab}	5.71± 1.63 ^a
Lungs	0.82± 0.012 ^{ab}	0.75± 0.007 ^a	0.68± 0.007 ^a
Heart	0.50± 0.20 ^{ab}	0.37± 0.20 ^a	0.33± 0.20 ^a
Liver	1.53± 0.80 ^a	1.52± 0.80 ^a	1.58± 0.80 ^a
Fore legs	2.33± 0.33 ^a	2.41± 0.33 ^a	2.33± 0.33 ^a
Hind legs	1.94± 0.17 ^a	1.72± 0.17 ^a	1.78± 0.17 ^a
Kidneys	0.65± 0.40 ^a	0.63± 0.40 ^a	0.62± 0.40 ^a
			<i>Continue</i>

Tail	0.15±0.11 ^a	0.17±0.11 ^a	0.18±0.11 ^b
Spleen	0.33±0.12 ^a	0.35±0.12 ^a	0.36±0.12 ^a
Diaphragm	1.11±0.17 ^a	1.05±0.91 ^a	1.09±0.0 ^a
Stomach	1.86±0.62 ^a	1.95±0.55 ^a	2.38±0.46 ^a
Renal fat	0.23±0.07 ^a	0.22±0.06 ^a	0.21±0.06 ^a
Intestines	3.84±0.16 ^a	3.60±0.30 ^a	3.78±0.07 ^a
Hump	2.75±0.19 ^a	3.63±0.19 ^a	3.50±0.19 ^a

Means with the same letters within a row were not significantly different at $P \geq 0.05$.

Different letters within a row denote significant differences at $P \leq 0.05$.

4. DISCUSSION

4.1. Slaughter Weight and Carcass Characteristics

The increased slaughter weight with increasing age at fattening in male Butana camels was mainly due to increased initial and final body weights, feed intake and weight gain with increasing the age at fattening in this study and proportional growth [17]. Similar results were found by Abouheif, et al. [18]. Male Butana camels slaughter weight was within the range for camels fattened on molasses or sorghum grain based diets in Sudan [19] and lower than in Darfur (426.2kg) [20]. Male Butana camels weight at two years old was lower than at 21 months [21] and Sudanese camels at 24 months old [22].

The increased hot carcass weight with increasing age at slaughter in male Butana camels was mainly due to increased initial and final body weights, feed intake, weight gain and slaughter weight with increasing the age at fattening in this study and proportional growth [17]. Similar results were found by Adamou [23]. In addition Abouheif, et al. [18] found that hot and cold carcasses were increased with increasing the slaughter age. Male Butana camels carcass weight was lower than Sudanese camels in Darfur [20], Wilson [16] and values reported by Yousif and Babiker [14]. It was also lower than Ethiopian camels [24].

The increased dressing percentages with increasing slaughter age in male Butana camels were mainly due to increased BW, slaughter weight and carcass weight with age. It was reported that dressing percentages were affected by many factors including breed, nutrition and age [13, 25]. Male Butana camels dressing percentages were within the 54.42- 57.82% for Sudanese camels fed sorghum grains or molasses based diets *ad lib* [19]. Dressing percentages on EBW were close to the 55.9% on hot carcasses in Sudanese camels [26] and the 46.2 – 55.6 and 41.3 – 53.5 % in males and females, respectively [16]. They were also close to the 54% in Ethiopian male camels [24]. Male Butana camels dressing percentages were within the 52.1% for Majaheem and 56.1% for Hamra in Saudi camels [27]. Male Butana camels dressing percentages were higher than that reported by [28] and Adamou [23] and lower than in Darfur (49 %) [20].

4.2. Body Components

The generally increased body components weight with age at fattening in male Butana camels was mainly due to increased body weight and slaughter weight with age at fattening and proportional animal growth [17]. Similarly age affected body components development beside breed and nutrition [29]. Male Butana camels body components weight as percentages of EBW

were generally close to those in dromedary camel in Sudan [19]. Male Butana camels heart, liver and lungs weights were lower than Nigerian camels [30].

The non- significant differences in body components percentages on EBW among male Butana camel age groups were mainly due to proportional animals growth stated by Hammond [17]. Similar results were found in Sudanese camels fattened with sorghum grains and molasses based diets [19]. Male Butanacamels body components percentages on EBW were higher for the head and lower for the liver and hide than values reported by Yousif and Babiker [14].

5. CONCLUSION

Slaughter weight, EBW, hot carcass weight and dressing percentages increased with age at fattening. All body components weight increased with age at fattening, except lungs, heart and spleen. All body components weight as percentage of EBW increased with age at fattening, except lungs, spleen, kidneys and heart with no significant differences.

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