Original Research Article

Effect of Guar Meals and Oilseed Cakes on Carcass Characteristics and Meat Quality Attributes of Beef Cattle

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Received: 24/06/2011; Received in Revised form: 16/09/2011; Accepted: 23/09/20

Abstract

A feeding trial was conducted to evaluate the effect of some oilseed cakes and guar meals on carcass yield, characteristics and beef cattle meat quality. Ninety bulls were used in a feeding trial. Six iso-caloric and iso-nitrogenous diets of protein supplements**:** (25%) guar germ (GGM), guar hull meal (GHM), sunflower cake (SFC), sesame cake (SC), groundnut cake (GNC) and cotton seed cake (CSC) were formulated. Bulls were fattened from an average initial live weight of 200 kg to a target 300 kg. A total of 45 bulls were slaughtered and their carcasses were examined. The results showed that dietary treatments had no affect on carcass components and carcass yield. Lowest percentage omental fat and kidney values were obtained on bulls fed guar based diets compared to other dietary treatments. The dietary treatments tended to show higher roasting rib percent (7.67% of cold side weight) except in bulls fed GHM. The muscle-bone ratio showed significant differences (P<0.05) among dietary treatments. Bulls fed GHM showed a lower percentage bone (24.42%) with a higher muscle-bone ratio (2.51). The percentage bone was 27.03, 28.31, 28.70, 29.10 and 30.02 for SC, SFC, GNC, CSC and GGM, respectively. Dietary treatments resulted in no significant differences in chemical composition of meat. However the meat quality attributes were significantly affected (P<0.05) by different dietary protein sources.

Keywords: oilseeds cake, guar germ, guar hull and beef cattle

Introduction:

Guar (*Cyamopsis tetragonoloba*) is an erect, bushy annual herbaceous legume up to 3 m high, with trifoliate leaves up to 10 cm long, and white or rose flowers. The pods are straight, hairy, pale green, up to 12 cm long and contain 5 to 12 hard seeds (beans) each. However, the plant morphology is highly variable. Guar has a deep tap root system that can find moisture deep below the soil surface [1, 2]. Raw guar meal can constitute up to 25% of cattle rations. Processed meal can be used as the sole protein component of cattle diets [3]. Nutritive values have been determined: N degradability for expanded guar meal is in the 65-75 % range and is influenced by the amount of heat treatment. N degradability for unprocessed meal was 85% [4].

Approximately 88% of the nitrogen content in guar meal was true protein with an Argo content approximately twice that of soybean meal [5, 6]. Although the Methionine and Lysine contents of guar have been reported to be inadequate for optimal growth rate [7]. In growing male buffalo calves, guar meal fed at 50 % of ME intake was found to be a better energy and protein supplement than groundnut meal, with higher digestibilities, body weight and feed conversion efficiency [8, 9]. Guar meal is the main by-product of guar gum production. It is a mixture of germs and hulls at an approximate ratio of 25 % germ to 75 % hull [10]. A protein-rich material containing about 40 % protein, it is used as a feed ingredient but may require processing to improve palatability and remove antinutritional factors. Oilseed cakes and meals are conventional source of proteins produced abundantly in Sudan. Recently, the supply and cost of oilseed by-products is fluctuating in the country which created the need to search for and testing anther protein sources. The objective of this study is to determine the effect of guar meals and oilseed cakes on carcass characteristics and meat quality attributes of cattle.

Materials and Methods:

Slaughter and Carcass Characteristics*:-*

Nine animals from each experimental group were slaughtered at 300 kg live weight. The animals for slaughter were offered water and not food for 14 hours prior to slaughter. The slaughtering procedure used was the local Muslim practice, achieved by severing the jugular veins, carotid arteries, trachea and esophagus using a sharp knife without stunning. A plastic container was placed under the neck at the time of slaughter to collect the blood. The bulls were dressed and eviscerated. The alimentary tract was removed, weighed fill and empty. The offal (heart, liver, spleen, lung and trachea, diaphragm, pancreas, genital organs, omental fat and mesenteric fat) were carefully removed, weighed and recorded. The tail was removed at its base and weighed. The kidneys and knob channal fat were left intact in carcass.

Caress characteristics:-

The carcass was weighed hot and split along the vertebral column into the left and right sides. The left side was chilled for 24 hours at 7°C. The weighed before and after chilling was recorded and used to calculate the degree of shrinkage. Dressing percentage was determined by dividing the hot carcass weight by slaughter weight expressed as percentage. Carcass measurements (carcass length and depth, leg width and depth, humorus length, abdominal circumference, shoulder width plus weight of fore and hind quarter) were recorded. The left side was prepared for dissection.

Wholesale carcass cuts:-

Carcass was splitted into 14 joints (wholesale cuts) according to methods described; by FAO, 1991, [11] for beef carcass. Separation of 9-10 and 11th was done following the procedure described by [11]. The joints were placed on wet towels and using a scalpel and forceps, the subcutaneous layer of fat was removed. Visible blood vessels, nerves and lymph vessels were also removed.

Sample for analysis were taken from the muscle of sirloin of the left half carcass for two purposes, only for meat quality attributes (color, cooking loss %, water holding capacity ratio, connective tissue strength and shearforce.

Chemical analysis and meat quality parameters:-

Samples were taken from *Longissimus drosi* muscle after 24 hours postmortem. Each muscle sample was freed from visible fat and connective tissues and sub-sampled for chemical analysis and quality parameter. Samples for chemical analysis were immediately minced and stored at 10°C. A sample for determination of quality attributes of color was allowed to oxygenate for 2 hours at 4°C prior to determination. Hunter color components L (lightness), a (redness) and b (yellowness) were recorded using Hunter lab tristimulus colorimeter (Model D25 M-2) and subsequently these samples frozen were stored determination of cooking loss and shearforce. Determination of total moisture, ash, total protein and (ether extract) were performed a according to the procedure of AOAC, 2000 [12].

Protein fractionation:-

Samples for protein fractionation were trimmed of excessive subcutaneous connective tissues before mincing. The fractionation procedure was as described by Babiker and Lawrie, 1983.

Water holding capacity (WHC):-

Meat samples (about one gram) from the minced muscle were used to determine WHC. Each sample was placed on humidified filter paper (Whatman No. 1) kept in desiccator over saturated (KCl solution) and pressed between two plexiglass plates for 3 minutes at 25 kg load. The meat film area was braced with a ball pen and then measured after a compensating planimeter.

$$WHC = \frac{\text{loose water area – meat film area}}{\text{Meat film area.}}$$

Cooking loss determination:-

Muscle *L. dorsi* samples were thawed at 5°C for 24 hours and weighed. Samples were cooled in plastic bags in a water bath at 80°C for 90 minutes, cooled in running tap water for 20 minutes, dried from fluids and reweighed. Cooking loss was determined as the loss in weight during cooking and expressed as a percent of pre-cooking weight.

Cooking loss% =

$$\frac{\text{Weight before cooking- wt after cooking} \times 100}{\text{Weight before cooking}}$$

Measurement of tenderness:-

Shearforce and connective tissue strength was determined using an lnstron model 1000 fitted with a Warned Bratzler shear device. Rectangular meal samples having across sectional area of 1 cm^2 were shorn across the muscle fiber to give shear force values of the muscle fibers. Cubical meat samples (1 x 1 x 1 cm) also cut from the cooked meat and were used to determine connective tissues strength by shearing along the muscle fiber. Shearforce and connective tissue strength was taken as the means of several determinations.

Results and discussion:

Carcass yield and characteristics:-

Different protein sources diets had no effect (P>0.05) on carcass yield and carcass characteristics, (Table 1). These results are in agreement with those reported an insignificant differences among experimental animal (zebu calves) fed a variable protein sources with high molasses-urea rations on carcass characteristics and carcass yield [13]. Similarly other researchers found that different dietary protein sources of sesame, sunflower, groundnut and cottonseed cake had no effect on fatted lambs' meat characteristics (14). The similarity in carcass yield and characteristics observed in this study could be attributed to iso-caloric and iso-nitrogenous feeds used and also may be due to similarity of carcass weights.

Table (1): Carcass yield and characteristics of experimental animals

Diets / parameters	GGM	GHM	SFC	SC	GNC	CSC	±SE
Number of animals	9	9	9	9	9	9	
Slaughter weight (kg)	298.88	298.89	299.89	300.00	300.60	301.00	2.21
Hot carcass weight (kg)	143.61	141.15	147.01	148.30	143.49	148.91	2.76
Cold carcass weight (kg)	139.09	139.09	136.57	142.25	143.38	143.28	2.58
Hot dressing percentage %	48.11	47.26	49.18	49.37	49.79	49.50	1.14
Chiller shrinkage %	3.19	3.24	3.24	3.32	3.15	3.51	0.17
L. dorsi area (cm^2)	44.1	45.96	51.25	44.75	45.69	47.88	2.65

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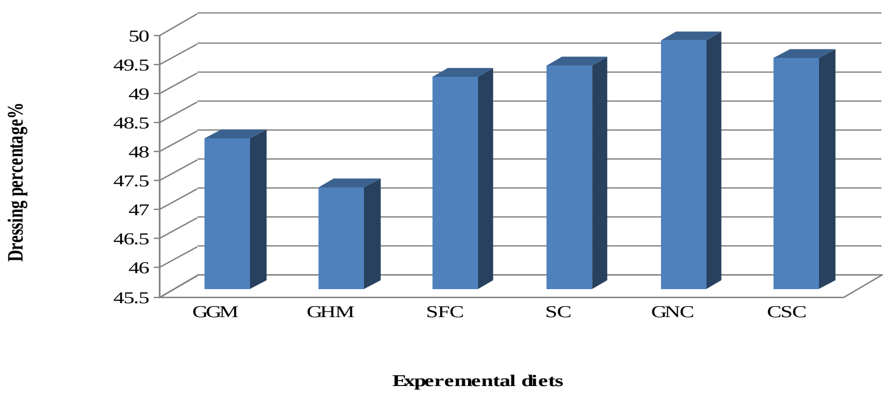
Dressing percentage:-

There was no significant (P>0.05) difference in dressing percentage expressed as percent of live body weight, Table 1 and Figure 2. These comparable results obtained in this study for dressing percentage could be due to equality in slaughter weights [15]. The increase in dressing percentage with the increase of slaughter weight might be attributed to the differences in the maturity of carcass and non-carcass components [16]. Some support of the results obtained similar to the reported that if carcass weight and fat content are held constant, dressing percentage is not affected by plane of nutrition. There were no significant (P > 0.05) differences between the two heavy (325 and 375) and between the two light (225 and 275) groups [17].

The dressing percentage value obtained in this study ranged from 47.26 to 49.5, as obtained earlier [18]. Dressing of 49% for Kenana bulls fed on urea-molasses diet plus 5% groundnut cake was expressed on live weight bases [19]. The dressing percentages observed here were lower than 50-58% reported by [20, 21]. Also an average cold dressing percentage of 48.1 for western Baggara bull kept under feedlot condition were reported [22]. Dressing of 50.2, 48.1 and 46.4 dressing percentage for three groups of western Baggara bulls fed on three planes of nutrition was recorded [23]. The carcass yield is affected by the slaughter weight of the animals and by the type of diet offered. The results in this study indicated that bulls on groundnut cake diet had higher dressing percentage value, then cottonseed cake, sesame cake and sunflower cake in that order.

On the other hand the bulls on guar meals diets recorded a lower (P>0.05) dressing value than those of the oilseed groups. This may be due to the lower fattening efficiency of guar meals compared to oilseeds cake.

Fig (1): The dressing percentage of experimental animals fed different sources of protein



Non-carcass components:-

The non-carcass components of the experimental animals as percentage of live body weight are shown in Table 2. There was no significant (P>0.05) difference among the experimental groups, except for tail which was significantly (P>0.05) lower in bulls fed guar germ meal than those on sesame cake diet

The proportion of the liver was significantly affected (P>0.05) by dietary treatments. Bulls fed diet of guar hulls had higher liver percent than bulls on other dietary groups. This big size of liver in relative with size and body weight was reported by Rust who noted that liver weight of Holstein steers increase as feed intake and body weight increased [24]. Liver percent values obtained in this study were in range with that recorded (1.2, 1.6, 1.6 and 1.7) by [25], [22], [26] and [27], respectively.

No significant differences for head, hide, feet, stomach and intestine (full and empty) genital organs, spleen, heart, pancreas, diaphragm mesenteric fat and kidney fat were observed. Sesame cake diet group had a higher proportion of major non-carcass components 7.6, 5.7, 2.2, 3, 4, 1.6, 1.1, 9, 4, 6.1 and 2 corresponding to hide, head, feet, kidney, heart, liver, lung and trachea, genital organs, tail, empty alimentary tract and pancreas, respectively. Semi-similar results of 7.0, 5.7, 2.3, 0.3, 4, 1.6, 1.2, 0.7, 0.3, 6.7 and 0.4% for the above organs, respectively was obtained by [22].

Table (2): Non-carcass components of the experimental animals (percent of live weight).

Diets / parameters	GGM	GHM	SFC	SC	GNC	CSC	±SE
Number of carcass	9	9	9	9	9	9	-
Blood %	3.09	3.06	3.48	3.39	3.35	3.01	0.16
Head %	5.51	5.49	5.40	5.70	5.47	5.35	0.16
Hide %	7.49	7.28	7.52	7.55	7.26	7.55	0.19
Four feet %	2.18	2.15	2.14	2.14	2.17	2.16	0.05
Stomach weight (full)%	14.54	16.36	13.46	13.24	13.51	13.03	1.12
Intestines weight (full)%	4.72	4.25	4.82	5.28	2.29	4.88	0.40
Stomach weight (empty)%	4.00	3.51	3.78	3.63	3.99	3.44	0.21
Intestines weight (empty)%	2.69	2.17	2.41	2.42	2.23	2.50	0.18
Genital organs%	0.93	0.76	0.84	0.92	0.86	0.91	0.05
Tail%	0.32^{b}	0.36^{ab}	0.34^{ab}	0.37^{a}	0.34^{ab}	0.35^{ab}	0.05
Liver%	1.49^{a}	1.23^{b}	1.53^{a}	1.59^{a}	1.55^{a}	1.46^{a}	0.07
Spleen%	0.32	0.33	0.34	0.36	0.38	0.38	0.03
Lungs and trachea%	1.09	1.01	1.12	1.07	1.06	1.10	0.05
Heart%	0.34	0.31	0.37	0.38	0.38	0.37	0.03
Omental fat%	0.83^{ab}	0.71^{b}	0.75^{ab}	0.92^{a}	0.79^{ab}	0.86^{ab}	0.06
Pancreas%	0.10	0.09	0.9	0.14	0.10	0.09	0.02
Diaphragm%	0.54	0.49	0.52	0.55	0.52	0.52	0.03
Mesenteric fat%	0.55	0.44	0.49	0.56	0.51	0.60	0.06
Kidney%	0.26^{ab}	0.23^{b}	0.29^{ab}	0.32^{a}	0.29^{ab}	0.26^{ab}	0.02
Kidney fat%	0.85	0.61	0.73	0.87	0.80	0.79	0.11

GGM group fed on guar germ; GHM group fed on guar germ hull; SFC group fed on Sunflower cake; SC group fed on Sesame cake; GNC group fed on groundnut cake; CSC group fed on cottonseed cake

a, b means in the same row having the same or no superscripts are not significantly different (P>0.05)

The wholesale cuts:-

The wholesale cuts as percent of cold side weight are shown in Table 3. There was no significant (P>0.05) difference observed among dietary groups for all wholesale cuts except the expanded roasting rib as the percent of cold side weight. Bulls on guar hull meal had a lighter weight of this parameter than those on cottonseed, groundnut cake or guar germ meal. This variation found here agrees with Brungardt and Bray who confirmed such differences [28]. The lower value of extended roasting rib percent obtained in this study from guar hull meal group was 7.7% which was slightly higher than the finding by researcher who reported 7.3% for the western Baggara bulls (280 kg) fed urea-molasses diet [26].

Table (3): Yield of wholesale cuts of the experimental animals as percent of cold side weight

Diets / parameters	GGM	GHM	SFC	SC	GNC	CSC	±SE
Number of carcass	9	9	9	9	9	9	-
Cold carcass weight (kg)	139.09	136.57	142.25	143.80	143.8	143.28	2.58
Leg%	5.00	4.92	4.94	4.74	4.88	4.86	0.09
Thick flank%	6.26	6.02	5.93	5.69	5.36	5.61	0.37
Top and silver%	17.89	17.52	17.13	17.25	17.06	17.07	0.33
Rump%	7.00	7.27	7.28	7.25	7.14	7.26	0.61
Thin flank%	5.34	5.68	5.38	5.54	5.65	5.41	0.29
Sirloin%	7.01	6.62	7.23	6.79	6.65	7.11	0.09
Thick rib%	5.18	5.56	5.23	5.19	5.32	5.54	0.24
Brisket %	7.18	7.56	7.23	7.39	7.46	7.63	0.20
Thin rib%	3.18	3.27	3.09	2.97	3.01	3.03	0.10
Extended roasting rib%	8.43^{a}	7.67^{b}	7.99^{ab}	8.33^{ab}	8.54^{a}	8.53^{a}	0.22
Chuck%	11.65	11.19	10.88	11.32	11.88	12.04	0.39
Shin%	3.36	3.34	3.45	3.14	3.19	3.27	0.11
Cold%	6.72	6.33	6.56	6.11	6.57	6.51	0.24
Neck%	5.45	5.19	5.41	5.31	5.23	5.27	0.22

GGM group fed on guar germ; GHM group fed on guar germ hull; SFC group fed on Sunflower cake; SC group fed on Sesame cake; GNC group fed on groundnut cake; CSC group fed on cottonseed cake
a, b means in the same row having the same or no superscripts are not significantly different (P>0.05)

Carcass measurement:-

The data of carcass measurement are shown in Table 4. There was insignificant (P>0.05) difference among treatments groups, except that for carcass depth (cm). Bulls fed of guar germ meal have a well developed carcass depth (87.33 cm) than that of the other groups. This variation found in this experiment agrees with other study confirmed such differences [28], Which reported 86.3 cm for the same parameter when fed western Baggara bulls finished on urea-molasses diet to slaughter weight of (300 kg) and 88.4 when the bulls fed on urea-molasses diet plus 30% sorghum gluten feed. No significant difference in other carcass measurements parameters was observed when they sorghum gluten add to urea-molasses diets. These results are in agreement with results obtained in this study.

Table (4): Carcass attributes of experimental animals.

Diets / Parameters	GGM	GHM	SFC	SC	GNC	CSC	±SE
Number of carcass	9	9	9	9	9	9	-
Carcass length (cm)	118.11	119.89	121.79	121.89	121.33	120.55	2.44
Abdominal Circumferences (cm)	158.16	154.31	150.11	160.38	157.89	156.71	4.36
Leg length (cm)	41.00	41.17	41.22	41.11	41.78	41.55	1.07
Carcass depth (cm)	87.33^{a}	82.07^{ab}	84.11^{ab}	81.22^{ab}	82.22^{ab}	77.33^{b}	2.65
Fore quarter weight (kg)	35.22	34.58	35.97	36.83	36.42	36.51	0.94
Hind quarter weight (kg)	34.61	34.17	36.08	35.89	36.19	35.91	0.82
Leg width (cm)	87.11	90.11	89.89	88.06	91.00	91.56	1.62
Shoulder width (cm)	37.89	36.94	36.61	35.89	36.67	36.33	1.87
Humours length (cm)	37.33	37.78	38.30	37.83	36.78	38.45	1.14

GGM group fed on guar germ; GHM group fed on guar germ hull; SFC group fed on Sunflower cake; SC group fed on Sesame cake; GNC group fed on groundnut cake; CSC group fed on cottonseed cake
a,b means in the same row having the same or no superscripts are not significantly different (P>0.05)

Carcass composition:-

Bone percent was significantly (P>0.05) affected by experimental group Table 5. Bulls fed on guar germ meal had a higher bone percent than guar hull meal. The latter group also revealed in a significant difference (P>0.05) for muscles: bone ratio.This variation in total bone and muscle: bone ratio was related to genetic and nutritional effect of growth among different breeds [30].

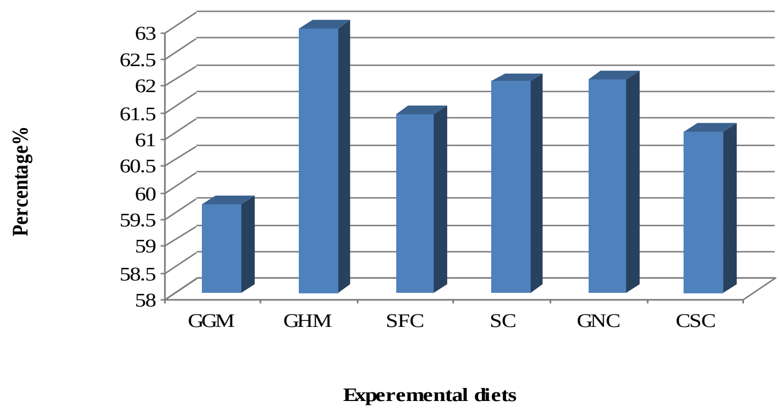
The variation can be attributes to genetic differences between breeds and within breed [31]. Bone percent value reported in this study was similar to the value reported by [16] of 22.7, 24.2 and 25.8 bone percent express as rib cut weight. Bulls fed on guar germ tended to have higher bone content of 30.02 % than those findings in [23]. Estimation of the proportion of bone content in Sudanese cattle was 28% is about equal to bone percent of 28.2 obtained in this study from groups fed oilseed cakes [32]. In the present study muscles: bone ratio was slightly higher in bulls fed on guar hull meal and sesame cake diet than other groups of 2.5 and 2.3, respectively. [33]. 3.0 muscle: bone ratio for western Baggara bulls (300 kg) was reported [27]. Those results tended to be higher than those obtained in this study. Ratio may increase with the increase in live weight and fatness [34]. The variation in these results could be explained as differences in growth rates of muscle and bone induced by the dietary protein energy ratio where high protein and low energy diets, might stimulates a relatively faster growth rate of bone than muscle and fat. The Muscle, Bone and fat percent are stated as diagrams in figure 2, 3 and 4 respectively. No significant difference among experimental groups was recorded for muscles and fat percent.

Table (5): Composition of high priced wholesale cut (9–10 and 11th rib cut)

Diets / parameters	GGM	GHM	SFC	SC	GNC	CSC	±SE
Number of carcass	9	9	9	9	9	9	-
Muscles%	59.66	62.96	61.35	61.95	62.00	61.01	3.79
Bone%	30.02[a]	24.42[b]	28.31[ab]	27.03[ab]	28.70[ab]	29.09[ab]	2.32
Fat%	4.07	5.14	5.30	5.62	4.36	5.46	1.08
Connective tissues	6.06	5.45	4.98	5.27	5.00	4.37	0.88
Muscle: bone ratio	2.02[b]	2.51[a]	2.19[b]	2.30[a]	2.19[b]	2.29[a]	0.14
Muscle: fat ratio	16.27	12.34	11.58	10.99	15.25	11.33	3.17
Muscle: connective tissues ratio	10.79	14.45	12.35	11.93	12.77	13.95	3.06

GGM group fed on guar germ; GHM group fed on guar germ hull; SFC group fed on Sunflower cake; SC group fed on Sesame cake; GNC group fed on groundnut cake; CSC group fed on cottonseed cake
a, b means in the same row having the same or no superscripts are not significantly different (P>0.05)

Fig (2): The muscle% (as percentage of the cut weight)



GGM group fed on guar germ; GHM group fed on guar germ hull; SFC group fed on
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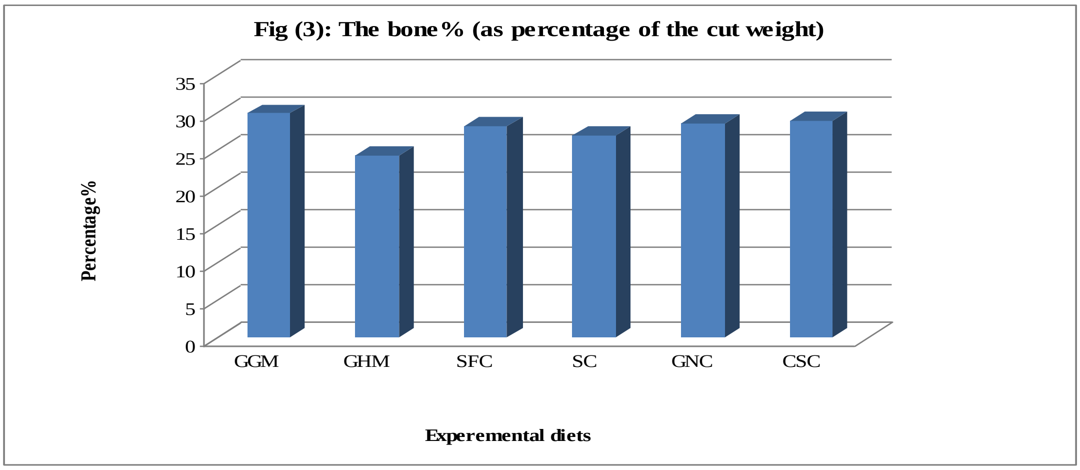

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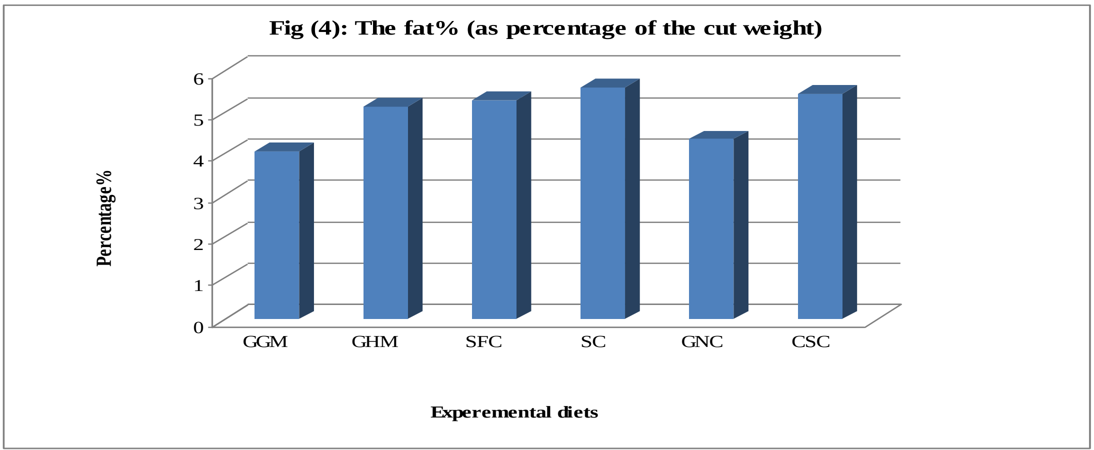

GGM group fed on guar germ; GHM group fed on guar germ hull; SFC group fed on sunflower cake; SC group fed on Sesame cake; GNC group fed on groundnut cake; CSC group fed on cottonseed cake

Carcass quality:-

The results of carcass quality attributes are given in Table 6. There was significant difference (P>0.05) between groups for lightness colour (L), water holding capacity (ratio), shear force (kg/cm²) and connective tissue strength (kg/cm). The meat from guar germ groups tended to have less lightness colour (31.97) and high darker red than meats from other groups. Dark red color could be attributed to less fat content of the muscles. The steers fed on low energy diet produced the lights leanest carcass and had the lowest ratings for lean tenderness [35].

Water holding capacity, shearforce (kg/cm²) and connective tissue strength (kg/cm²) were significantly (P>0.05) different among dietary groups samples. Water holding capacity differs with species and breed (36). Meat from bulls fed sunflower cake, cottonseed and guar germ had slightly (P>0.05) higher water holding capacity that the other groups. Similar result was obtained by [29] of 2.3 and 2.2 W.H.C. ratio from meat of western Baggara bulls fed 70% SGF, while lower value of 1.68 was also recorded [27]. There were correlations between ph and other meat quality. The lower ph values were associated with lower W.H.C., pale color and low glycogen level [36].

Table (6): Meat quality attributes of experimental animals

Diets / Parameters	GGM	GHM	SFC	SC	GNC	CSC	±SE
Number of carcass	9	9	9	9	9	9	-
Colour*							
L	31.97^{b}	34.86^{ab}	36.07^{a}	36.50^{a}	35.23^{a}	35.62^{a}	1.04
A	10.37	9.73	10.97	10.73	10.72	10.76	1.23
B	5.51	6.04	6.57	6.23	6.30	6.29	0.51
W.H.C. ratio	2.51^{a}	2.38^{b}	2.39^{b}	2.68^{a}	2.42^{ab}	2.55^{a}	0.05
Cooking loss %	35.79	34.38	35.26	36.00	34.12	34.84	0.75
Shearforce kg/cm²)	3.39^{b}	3.48^{ab}	3.70^{a}	3.50^{ab}	3.51^{a}	3.46^{ab}	0.49
Connective tissue Strength (kg/cm²)	2.30^{a}	2.28^{ab}	2.07^{c}	2.04^{c}	2.10^{bc}	2.23^{ab}	1.04

* L: degree of lightness. A: degree of redness. B: degree of yellowness.
GGM group fed on guar germ; GHM group fed on guar germ hull; SFC group fed on Sunflower cake; SC group fed on Sesame cake; GNC group fed on groundnut cake; CSC group fed on cottonseed cake
abc means in the same row having the same or no superscripts are not significantly different (P>0.05)

Shearforce (kg/cm²) and connective tissue strength (kg/cm²) were significantly (P>0.05) different among dietary groups samples, Table 6. Groups of sunflower cake had higher shear force value than other groups. This increase in shearforce values in of sunflower group meat coincided with decrease in water holding capacity mentioned before. However, Baggara bull's meat had high shearforce and connective tissue strength values (4.1 and 2.3 respectively) than 50% Friesian bulls [27]. This result tended to be higher for former parameter and about similar for latter parameter obtained in this study which were (3.4 – 3.7 kg/cm²) and (2.1 – 2.3 kg/cm²), respectively. Increased time-on feed was associated with reduced shearforce of meat in both low energy and high energy diet [37]. Differences in lean tenderness and shearforce, tended to reflect differences in carcass mass and fatness [37].

Chemical composition of meat:-

The meat chemical composition was insignificantly (P>0.05) different among treatments groups in moisture, protein % and protein fraction, fat and ash % Table 7. However, the result obtained in this study was similar with the results reported by Elnazir, for moisture, ash, and fat and non-protein nitrogen %, of 73.5, 1.2, 2.9 and 46% for above parameters, respectively. But the value of protein (23.5 %) was slightly higher with less sarco-plasmic protein % (5.1) than that found in this study (22.5 and 6.29%, respectively) [27].

Table (7): Meat chemical composition of experimental animals

Diets / Items	GGM	GHM	SFC	SC	GNC	CSC	±SE
Number of carcass	9	9	9	9	9	9	-
Moisture%	74.27	73.66	73.94	73.59	74.15	73.79	0.56
Protein%	22.51	22.34	22.34	22.33	22.36	22.64	0.14
Fat%	2.69	3.02	3.10	2.76	3.16	2.74	0.27
Ash%	1.35	1.55	1.36	1.28	1.35	1.37	0.29
Sarcoplasmic protein%	6.29	6.47	6.29	6.36	6.50	6.58	0.29
Myofibrillar protein%	11.92	11.54	11.41	11.49	11.45	11.56	0.20
Non-protein nitrogen%	0.44	0.45	0.45	0.45	0.45	0.47	0.07

GGM group fed guar germ; GHM group fed on guar germ hull; SFC group fed on sunflower cake ; SC group fed on Sesame cake ;GNC group fed on groundnut cake ;CSC group fed on cottonseed cake.

Conclusion

Alternative and by product protein sources as oilseed cakes guar meals are provide the total protein supplement for beef cattle. Supplemental proteins sources are often available at a different competitive price in Sudanese market. Guar is one of industrial by-product considered as a cheap protein source for the ruminant and poultry nutrition. It has a potential value as feed to animals with a high protein content ranging between 45–55 percent. The high content of the guar meal protein offers a good source of essential amino acids for beef. The results showed that guar meals comparer to oilseed cakes had no effect on carcass components and carcass yield. So we recommended that an inclusion guar meal till 25 percent of the beef rations as the protein source shouldn't affected carcass dressing percentage and major carcass characteristics.

Authors' contribution

All authors contributed substantially to the conception and design of the study, the acquisition of data, or the analysis and interpretation. They shared to provide final approval of the version to be published.

Dr. Intisar Turki: The work has been conducted and implemented by Dr. Intisar, she was carried out the experiment, included the collection of the preliminary data, data measurements and responses keeping of all study data for later examination.

Professor Omer Elkider**:** Supervised the feeding experiment. In vivo trail was carried out under his supervision included: rations calculation and formulation, performance measurements and he followed-up the obtained results.

Dr. Ahmed Al Amin: He proposed the experimental design and did the statistics analysis of the obtained results.

Dr. Daud El Zuber and Ali Hassabo: Were supervised all the tests and measurements of carcass quality and attributes, meat chemical analysis and meat quality measurements and followed up to obtained results.

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