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CULLED BUFFALO HEIFERS AS A POTENTIAL SOURCE FOR BEEF PRODUCTION

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ABSTRACT

Culled buffalo heifers as a potential source for meat production was investigated in this research. Eighteen culled buffalo heifers were divided into three similar groups according to their initial age and body weight (37 month and 385 kg) allotted to different finishing periods length of 56, 90 and 118 days. Each group was subdivided into two equal subgroups whereas three subgroups served as control ones. Animals were offered a concentrate mixture plus rice straw, whears, control groups were fed according to the maintenance requirements (NRC, 1988) while finished heifers were feeding according to Ranjhan (1999). During finishing periods, body weight and feed intake were recorded biweekly. Blood samples were taken monthly from all animals. At the end of the finishing periods, twelve animals were slaughtered, then the right side of the carcasses were fabricated into different cuts. The average daily gain (ADG) and feed conversion were significantly ($P< 0.05$) increased in finished groups. Average daily gain and feed conversion decreased by increasing the finishing period length. The performance of heifers fed on 56 days showed the best one followed by those fed on 90 days. Finishing period of 118 days resulted in poor feed conversion and daily gain. Despite minor changes noted, mean concentrations of certain blood constituents were within the normal range. The improvement of carcass characteristics and meat quality were remarkably observed in finished groups, especially those finished for 56 days. Also, finished groups were leaner than control groups. Finishing of culled buffalo heifers for a short finishing period particularly 56 and 90 resulted in increasing of the daily body weight gain and improvement of carcass characteristics and meat quality without any changes in some blood constituents especially cholesterol and total lipids concentrations.

Keywords: Performance, finishing, carcass characteristics, carcass composition, cutability, meat quality, buffalo heifers.

INTRODUCTION

The shortage of animal protein is getting a serious worth in Egypt. It was reported nationally by FAO (2000) that the shortage is about 50 % whilst that the percentage was only 30 % in 1995 (FAO, 1997). It seemed that the shortage was more than doubled considering the overpopulation, fluctuation price, etc. In order to solve this problem, import is not the ideal solution. for the problematic international situation regarding money exchange, prices in foodstuffs, diseases, i.e. madness cows. The madness cows affect many countries is remarkably observed. Consequently, they stopped their exports. On the other hand, buffalo meat has 40 % less cholesterol, 12 % less fat, 55 % less calories, 11 % more protein and 10 % more minerals compared to bovine(Vale, 1994). From the previous discussion, buffaloes are currently an important spot in study and researching for economic contribution.

Relatively high percentage of culled heifers buffaloes (~ 25 – 30) are discarded routinely because of different infertility problems. Most abnormalities found in heifers involved ovaries and oviducts (65 %) and this constitutes the higher percentage in turn, included paraovarian cysts, cystic ovaries, cystic follicles and infantile ovaries. Hydrosalpinx and cervical abnormalities were also observed. (Jansen, 1985, Khalil, 2000, Vanroose *et al.*, 2000 and Eid *et al.*, 2003). Reconsidering such high percentage of culled heifers as an important source in beef production in Egypt is getting necessary important and economically valuable.

In order to benefit from such source culled animals got to be exposed to some finishing periods in this paper, quantitative study of different finishing periods and their effect on final amount beef obtained from such animals are reported.

MATERIALS AND METHODS

This study was carried out at Mehallet Moussa Research Station, Animal Production Research Institute, Agriculture Research Center, Egypt during the period from October 2002 till February 2003.

Field and Laboratory Determination:

I. Animals and Feeding:

Eighteen culled buffalo heifers (Approximately 37 month of age and 385 kg body weight) were divided into three similar groups based on initial age and live body weight and allotted to three periods of finishing (56, 90 and 118 days). Each group was further divided into two similar subgroups, whereas three subgroups remained as control ones as follows:

Items	Experimental Periods					
	56 days		90 days		118 days	
	Finished X ± S E	Control X ± S E	Finished X ± S E	Control X ± S E	Finished X ± S E	Control X ± S E
Initial age, month	37.67 ± 5.78	40.0 ± 6.03	35.33 ± 6.57	36.0 ± 0.58	42.0 ± 2.31	35.33 ± 88
Initial body weight, kg	396.0 ± 41.20	383.0±55.90	391.0 ± 110	382.67±.97	388.0±7.24	378.67± 4.98

Animals were housed in semi-open sheds and offered a concentrate diet and rice straw. The concentrate diet is composed of , 25 % yellow corn, 28 % undecorticated cottonseed meal, 37 % wheat bran, 7 % molasses, 2 % limstone and 1 % common salt. The chemical composition of concentrate mixture and rice straw was determined according to A. O. A. C. (2000) as shown in Table (1). Concentrate diet were offered twice daily at 8.00 am and 2.00 pm. Control heifers were fed under routine feeding system adopted by the governmental research station for breeding. They fed according to the nutritional requirements for maintenance (NRC, 1988), while finished heifers were fed on a higher level of feeding according to Ranjhan (1999) for finishing. Fresh water was available two times daily. All animals were injected by vitamin A throughout the experiment. Mineral blocks were available. Fasted body weight and feed intake were recorded fortnightly. Unfortunately, the last six weeks of the experiment the weather was extremely terrible, very cold, it poured, consequently feed intake was decreased because the wetness.

Table (1): Chemical composition of animal feeds (on % DM basis)

Items	Concentrate mixture	Rice straw
Dry matter	91.56	92.68
Organic matter	92.55	84.55
Crude protein	17.61	4.90
Ether extract	3.78	1.10
Crude fiber	14.65	33.83
N. Free extract	56.51	44.72
Ash	1.54	10.99

II. Blood Sampling:

Before morning feeding, blood samples were collected from jugular vein in heparinized tubes monthly from all animals. Blood was centrifuged at 3,000 rpm for 10 min. immediately after collection. Plasma were separated and frozen at -20 ^{0}C until further analysis. After thawing total cholesterol (mg/dl), total lipids (g/dl) total protein (g/dl) and urea nitrogen (BUN) (mg/dl) was determined by using methods of Zollner and Kirsch (1962); Allain *et al.* (1974); Gornall *et al.* (1949) and Henry *et al.* (1974a) and Henry *et al.* (1974b).

III. Slaughtering :

At the end of finishing periods, a total number of twelve animals (representing nearly the average body weight of each subgroup) were fasted overnight. Live body weight was recorded just prior to slaughter (SW). Immediately after dressing, the internal (liver, spleen, heart, lungs and trachea, kidneys) and the external (head, hide, four legs, full and empty rumen, intestine and tail) offals were weighed. Then hot carcass weight was recorded to calculate the dressing percentage (DP= hot carcass weight / Slaughter weight (SW). All carcasses were split longitudinally into right and left sides and weighed. The right side from each carcass was divided into fore and hind quarters between 8th. and 9th. ribs. Fore quarter was fabricated into Fore shank, neck, shoulder, fore ribs, flat ribs and brisket. While hind quarter was dissected into hind shin, flank, sirloin, fillet and best ribs. The whole joints were weighed. Each of these cuts was dissected into meat and bone then recorded (Khalil, 2000). Percentage of boneless meat was calculated (BM) as a percentage of carcass weight. Best ribs (9, 10 and 11th. ribs) cut was chilled at 4 ^{0}C for 24 hours. Then Eye muscle area (cm^2) was measured at 10th muscle before boneless of chilled *Longissimus dorsi* muscle, using LI-COR Area Meters. Best ribs (9, 10 and 11th ribs) cut was dissected into lean, bone and fat to calculate the ratios of lean / fat and lean / bon.

VI. Meat Quality:

Longissimus dorsi muscles were trimmed until free of covering fat. These muscles were excised and stored at -24 ^{0}C. Then meat quality was studied by chemical and physical analysis. Longissimus dorsi muscle was minced to determine the chemical composition by methods of A. O. A. C.

(2000). Expressible fluid was expressed in weight according to Grau and Hamm (1956). Cooking loss was also measured by boiling about 100 cubes of meat (W1) in water for 45 minutes, then re-weighed (W2). The percentage of cooking loss = (W1 - W2 / W1) X100 (Khalil, 2000).

Statistical Analysis:

Regression of initial age and weight were done in order to neglect its effect. Statistical analysis were performed using the analysis of variance (ANOVA) and Duncan`s New Multiple Range method (Steel and Torri, 1980).

RESULTS AND DISCUSSION

I. Animal Performance:

Results of finishing periods of 56, 90 and 118 days on body weight gain; ADG; DMI and feed conversion of culled heifers are shown in Table (2). As expected, finishing resulted in an improvement of body weight gain and feed conversion. The average daily gain and feed conversion were significantly increased ($P< 0.05$) in finished groups, especially those finished for 56 days.. This is could be attributed to the result of some factors such as feeding more concentrate in finishing, resulting in a high propionate in the rumen along with the improvement of microbial protein synthesis, which in turn improve the balance of absorbed amino acids (MacRae *et al.,* 1993 and 1995 and Scollan *et al.,* 2003). Alterations in endocrine status, i.e. growth hormone, Insulin like growth factor-1 and Insulin are also considered an important determinations driving the differential growth response (Thorp *et al.,* 2000). Heifers fed for 56 days achieved the highest ADG (1.3 kg) compared to those finished for 90 and 118 days (0.937 kg and 0.740 kg, respectively). ADG and feed conversion decreased by increasing the finishing period length. Moreover, finishing period of 118 days resulted in poor feed conversion (11.78), while, 56 days was found to be the most efficient period of feed utilization (7.72). Similar results were reviewed by Jarriage and Beranger (1992), that live body weight gain tends to decrease after 2 months in different breeds. Thus, the present results indicated that finishing period of 56 days is the most economical. In the current study, animals finished for 90 and 118 days were recorded lower feed intake compared to those finished for 56 days. Similarly, the comparison among the control groups. it was noticed that feed intake decreased with the length of finishing period. These results could be a consequence of the extremely rainy weather pointing at the stress which animals were exposed to in this time.

Table (2): The performance of culled buffalo heifers under the different finishing periods.

Items	Experimental Periods					
	56 days		90 days		118 days	
	Finished X ± S E	Control X ± S E	Finished X ± S E	Control X ± S E	Finished X ± S E	Control X ± S E
Initial age, month	37.67 ± 5.78	40.0 ± 6.03	35.33 ± 6.57	36.0 ± 0.58	42.0 ± 2.31	35.33 ± 0.88
Initial body weight, kg	396.0 ± 41.20	383.0 ± 55.90	391.0 ± 110	382.67±7.97	388.0 ± 67.24	378.67 ± 4.98
Final body weight, kg	468.67^{ab}±36.38	433.33^{b}± 61.97	477.33^{a} ±98.99	445.00^{ab} ±8.0	476.0^{ab}± 57.27	437.5 ab ± 7.5
Total weight gain, kg	72.67 ± 13.91	50.67 ± 6.17	86.33 ± 11.89	62.33 ± 6.69	88.0 ± 21.08	55.0 ± 2.0
Average daily gain, kg	1.30^{a} ± 0.25	0.907^{ab} ± 0.11	0.937^{ab} ± 0.13	0.677^{b}±0.07	0.740^{b} ± 0.18	0.465b ± 0.02
Daily DM intake, Kg :						
Concentrate mixture	7.70 ± 1.48	5.4± 0.66	7.01± 0.97	5.40± 0.56	6.61± 1.61	5.54± 0.23
Roughage (rice straw)	2.33± 0.45	2.91 ± 0.35	2.30± 0.32	2.83± 0.29	2.11 ± 0.51	2.82± 0.12
Total DM intake	10.03 ± 1.93	8.31 ± 1.01	9.31 ± 1.29	8.23 ± 0.85	8.72 ± 2.11	8.27 ± 0.35
Daily CP intake	1.47± 0.28	1.09± 0.13	1.35± 0.19	1.09± 0.11	1.27± 0.31	1.11± 0.05
Feed conversion (kg/kg): DM/ Gain	7.72^{b}	9.16^{b}	9.94^{b}	12.16^{ab}	11.78^{ab}	17.78a
Blood Profile:						
Total cholesterol (mg/dl)	86.18±5.44	82.6±8.89	78.52±4.67	85.98±6.81	89.57±4.92	72.98±7.95
Total lipids (g/dl)	0.408±0.06	0.341±0.04	0.274±0.04	0.260±0.03	0.425±0.05	0.363±0.03
Total protein (g/dl)	8.36±0.47	7.65±0.27	8.03±0.36	7.39±0.36	8.32±0.2	8.15±0.31
Urea nitrogen (mg/dl)	16.63±1.60	11.99±1.33	16.34±1.46	11.79±1.35	19.15±0.8	14.59±1.47

In each row means not followed the same letter differ significantly at 5% level

II. Blood chemistry profile:

The normal range was 80-120mg/ dl 0.4 -1.0 g/dl, 5.0 – 8.4 g /dl and 10-30 mg/ dl for total cholesterol, total lipids, total protein and urea nitrogen, BUN, respectively). Mean values of plasma total cholesterol (mg/dl), total lipids (g/dl) total protein (g/dl) and urea nitrogen, BUN (mg/dl) of buffalo heifers fed on 56, 90 and 118 days for finishing are shown in Table (2). Despite minor changes noted, mean concentrations of certain blood constituents were within the normal range suggested that finished heifers were fed adequately. A slight increase in these constituents was observed by finishing, seems, to be of special interest in reference to the daily body weight gain previously recorded. A high significant correlation was revealed between blood cholesterol and body weight gain (Sikka *et al.,* 1994). Blood cholesterol and lipids depends on the quantity of long-chain fatty acids absorbed from alimentary tract (O'Kelly, 1987). In addition, after a long period of high energy feeding, the metabolism of fattening animals was still making adjustment as reflected in levels of some blood constituents especially those most closely related to lipid metabolism.

Concentrations of total cholesterol and total lipids increased with increasing feeding level in female buffaloes (El-Feel *et al.,*1993 and Montemuro *et al.,* 1995). However in study by (O'Kellly, 1973), the plane of nutrition had no influence on total blood cholesterol of British cattle fed low and good quantity food.

Lower values of plasma cholesterol level in all groups were observed. Similar result was reported by El-Masry and Mari (1991); Yeh *et al.* (1993), Khalil (2000) and Khalil *et al.*(2004). So buffalo meat had a potential utilization for healthy food. On the other hand, Allen *et al.* (1977) and Sommer (1975) indicated that blood cholesterol level linked with poor fertility. Contradicted result was observed by Rowlands *et al.* (1980), who suggested that level
of cholesterol was unrelated to the poor fertility but may be related to change in feeding.

Changes in protein metabolism can thus be reliability illustrated by changes in blood protein having a wide variety of natural functions and biological properties. It is therefore suggested that blood protein pattern often reflects the total physiological and chemical state of the animal (Putnam, 1960). The plasma protein have shown a slight increase in finished subgroups which became more efficient in protein utilization (Hicks *et al.,* 1990). The blood constituents level confirmed the above lines of the higher daily body weight gain of finished subgroups. Accordingly the anabolic process are expected to enhance as the feeding level was increased leading to greater body weight gain (El- Feel *et al.,* 1993).

Urea was mainly affected by feeding system more than total protein with higher values on finishing, where animals received more protein. In fact, urea is the main indicator of protein degradation for energetic utilization, could produce high rumen ammonia level and then higher blood urea. Plasma urea concentration was not different among periods and increased with protein intake by finished subgroups (1.47, 1.35 and 1.27 Vs 1.09, 1.09 and 1.11, respectively). Some amino acids were supplied in excess and were

catabolized by the liver in amine groups and hydrocarbon chains. Amine groups were converted into urea and were released in the blood before urinary excretion (Froidmont *et al.*, 2000). In addition, the BUN level depends on absorption of ruminal ammonia which is reflected by ruminal pH (Gupta, *et al.*, 2001). From the results of protein and BUN, there seems to be a protein sparing mechanism during a large part of feeding restriction and elevated efficiency of nitrogen retention during finishing. The blood urea nitrogen (BUN) was found to be higher in finished subgroups than (16.63, 16.34 and 19.15 mg/dl) control ones (11.99, 11.79 and 14.59 mg/dl), respectivly. However, the differences were not significant. These results were in agreement with those found by Yambayamba, *et al.* (1996) in crossbred heifers.

Monitoring of these slight changes using easy to apply metabolic indicators will provide information on their nutrition which may form basis for deciding length of finishing period.

III. Carcass Characteristics:

Data on carcass traits and meat quality of culled heifers under three finishing periods are presented in Tables (3, 4 and 5). It is clear from the present results that most of carcass traits were improved by finishing which were in accordance with Keane (1994); Khalil (2000) and Purchas *et al.* (2002). Even though, the differences among finishing periods were not significant. Furthermore, finishing was associated with increasing eye muscle area (EMA), when it was for 56 days. In addition, greatest values of EMA (48.51 cm^2), BM (79.66 %);M/ B ratio (4.01) and fat thickness (13 mm) were recorded in heifers finished for 56 days (Table 3)

Hot carcass weight, EMA and fat thickness in heifers fed for 90 days showed lower values than values obtained by Khalil (2000) in culled buffalo heifers finished by the natural additves.

Concerning internal and external offals expressed as the percentage of slaughter weight , it was found that finishing period of 90 days resulted in higher total internal offals ($P<0.05$) than the other groups (Table 4).

III. a. Carcass Cuts:

Values of best, medium and inferior quality cuts are illustrated in Table (4). No differences ($P< 0.05$) were found among groups in all cuts when expressed as percentages of carcass weight. Heifers finished for 56 days had the highest wholesale shoulder and shoulder meat ($P< 0.05$) when fabricated into meat and bone as shown in Table (5). Lowest wholesale brisket with highest neck percentage were recorded by heifers finished for 56 days compared to

the others finished for 90 and 118 days. Moreover, lowest percentages of round and sirloin cut yield with highest best ribs were found in heifers finished for 56 days. Similar result was obtained by Apple *et al.* (1999), who indicated that round yield decreased by increasing the body condition class.

Table (3): Effect of finishing period length on carcass characteristics of buffalo heifers.

Items	Experimental Periods					
	56 days		90 days		118 days	
	Finished X ± S E	Control X ± S E	Finished X ± S E	Control X ± S E	Finished X ± S E	Control X ± S E
Initial age, month	32.5 ± 4.5	36.5 ± 8.5	29.0 ± 3.0	36.0 ± 1.0	44.0 ±2.0	34.0 ± 0.5
Slaughter weight, SW	445.0 ± 60.0	367.0 ± 15.0	372.0 ± 68.0	423.5 ± 1.5	449.0 ± 74.0	437.5 ± 7.5
Carcass weight, kg	221.5 ± 26.5	184.0 ± 7.52	196.75 ± 35.25	217.0 ± 6.0	264.0 ± 56.0	23.0 ± 18.0
Dressing percentage,	49.88 ± 0.77	50.05 ± 2.32	52.93 ± 0.20	50.83 ± 2.01	51.15 ± 3.55	52.52±3.22
Boneless meat percentage,	79.66 ± 0.82	78.52 ± 0.63	78.76 ± 0.38	76.70 ± 1.81	78.78 ± 2.85	76.82± 3.19
M / B ratio	4.01 ± 0.29	3.66 ± 0.14	3.71 ± 0.09	3.42 ± 0.23	3.84 ± 0.68	3.41 ± 0.62
Fat thickness, mm	13.0 ± 2.0	3.0 ± 1.00	8.5 ± 1.5	5.0 ± 2.0	10.5 ± 4.5	3.50 ± 1.50
EMA, cm^2	48.51 ± 5.21	34.09±13.60	30.49 ± 6.06	32.20 ± 4.21	37.44 ± 0.11	30.46± 0.24
Meat quality of LD:						
Physical characteristics						
Expressible fluid, %	35.96^{ab} ± 3.31	38.47^{ab}± 1.73	34.39^{ab} ± 4.54	42.21^{a}±0.18	34.34^{ab} ± 3.04	28.39^{b}± 3..5
Cooking loss, %	42.08 ± 1.83	41.26 ± 1.86	39.5 ± 0.32	44.51 ± 1.19	40.79 ± 3.75	45.96± 4.12
Chemical composition, %:						
Moisture	72.87 ± 1.58	71.50 ± 3.13	73.13 ± 1.42	72.33 ± 0.82	71.46 ± 0.09	73.46± 0.30
DM	27.13 ± 1.58	28.51 ± 3.13	26.88 ± 1.42	27.67 ± 0.82	28.54 ± 0.09	26.54± 0.30
CP	20.80 ± 4.05	21.96 ± 1.36	23.76 ± 2.32	23.96 ± 0.75	24.59 ± 0.18	23.03± 0.37
EE	2.53 ± 0.50	1.36 ± 0.04	2.31 ± 0.06	1.94 ± 0.39	2.16 ± 0.19	2.73 ± 0.73
Ash	1.14 ± 0.24	0.93 ± 0.03	0.99 ± 0.08	1.15 ± 0.17	1.13 ± 0.06	1.02 ± 0.01
Carcass composition, %						
Lean	50.85 ± 7.35	54.59 ± 9.63	54.05 ± 7.24	53.51 ± 4.28	46.96 ± 4.47	53.32 ±1.47
Fat	27.36 ± 7.31	15.14 ± 1.46	29.68 ± 2.73	21.47 ± 7.89	24.32 ± 4.60	13.95 ±1.49
Bone	21.79 ± 1.38	30.26 ± 1.49	16.28 ± 4.54	25.03 ± 4.81	28.72 ± 9.92	32.72 ±8.68
Lean: Fat ratio	1.86	3.61	1.82	2.49	1.93	3.82
Lean: Bone ratio	2.33	1.80	3.32	2.14	1.64	1.63

In each row means not followed the same letter differ significantly at 5% level. SW = Slaughter weight, M/B= Meat / Bone ratio, EMA = Eye muscle area, LD= *Longissimus dorsi* muscle.

Table (4): Mean values of offals and different quality cuts of culled buffalo heifers.

Items	Experimental Periods					
	56 days		90 days		118 days	
	Finished X ± SE	Control X ± SE	Finished X ± SE	Control X± SE	Finished X ± SE	Control X ± SE
Initial age, month	32.5 ± 4.5	36.5 ± 8.50	29.0 ± 1.5	36.0 ± 1.0	44.0 ± 2.0	34.0 ± 0.5
Slaughter weight, SW	445.0 ± 60.0	367.0±15.0	372.0 ± 68.0	423.5 ± 1.5	449.0 ± 49.0	437.5 ± 7.5
Carcass weight, kg	221 5 ± 26 5	184.0 ± 0.0	196.75±35.25	217.0 ± 6.0	264.0 ± 560	230.0± 18.0
Internal offals % of SW:						
Liver	1.24 ± 0.01	1.06 ± 0.09	1.28 ± 0.02	1.05 ± 0.04	1.09 ± 0.06	1 13 ± 0 03
Spleen	0.22 ± 0.01	0.22 ± 0.05	0.25 ± 0.05	0.28 ± 0.04	0 22 ± 0.01	0.05 ± 0.02
Heart	0.44 ± 0.08	0.4 ± 0.06	0.48 ± 0.01	0.47 ± 0.0	0.43 ± 0.02	0.48 ± 0.01
Kidneys	$0.30^{b} \pm 0.01$	$0.53^{a} \pm 0.19$	$0.37^{ab} \pm 0.07$	$0.48^{ab} \pm 0.08$	$0.27^{b} \pm 0.02$	$0.28^{b} \pm 0.01$
Lungs + trachea	$1.63^{ab} \pm 0.02$	$1.62^{ab} \pm 0.06$	$2.02^{a} \pm 0.18$	$1.77^{ab} \pm 0.16$	$1.47^{ab} \pm 0.03$	$1.78^{b} \pm 0.13$
Total internal offals	$3.81^{bc} \pm 0.07$	$3.81^{bc} \pm 0.26$	$4.37^{a} \pm 0.14$	$4.04^{ab} \pm 0.01$	$3.46^{c} \pm 0.06$	$3.92^{b} \pm 0.13$
External offals % of SW:						
Head	5.13 ± 0.58	6.0 ± 0.03	5.51 ± 0.06	5.67 ± 0.26	5.31 ± 0.18	5.60 ± 0.02
Hide	$7.95^{b} \pm 0.62$	$8.82^{ab} \pm 0.87$	$8.76^{ab} \pm 0.12$	$8.27^{ab} \pm 0.03$	$8.17^{ab} \pm 0.31$	$9.38^{a} \pm 0.39$
Feet	$2.37^{b} \pm 0.39$	$2.72^{ab} \pm 0.11$	$2.86^{ab} \pm 0.13$	$2.73^{ab} \pm 0.10$	$2.58^{ab} \pm 0.14$	$3.06^{a} \pm 0.25$
FRG	17.57± 2.52	20.16 ± 0.27	17.84 ± 1.03	18.42 ± 0.65	16.71 ± 2.52	19.01 ± 1.93
ERG	8.36 ± 0.75	8.84 ± 1.77	7.31 ± 0.56	6.85 ± 0.10	7.78 ± 0.25	7.21 ± 1.03
Tail	0.28 ± 0.05	0.33 ± 0.05	0.4 ± 0.06	0.33 ± 0.02	0.34 ± 0.05	0.33 ± 0.03
Different quality cuts % of CW :						
Total best quality cuts	46.74 ± 0.83	48.48 ± 2.09	49.93 ± 0.46	49.94 ± 1.21	50.09 ± 1.38	49.24 ± J.13
Meat best quality cuts	38.54 ± 0.79	40.0 ± 2.61	39.93 ± 0.09	40.40 ± 0.07	40.76 ± 2 49	38.32 ± 1.61
Bone best quality cuts	8.92 ± 0.20	9.06 ± 0.53	10.45 ± 0.22	10.11 ± 1.10	10.17 ± 1.31	11.69 ± 1.82
Total medium quality cuts	35.02 ± 0.07	34.98 ± 0.49	31.39 ± 0.48	32.10 ± 1.08	34.57 ± 0.99	32.81 ± 0.48
Meat medium quality cuts	28.52 ± 0.88	27.67 ± 0.97	25.45 ± 0.20	25.09 ± 1.04	28.0 ± 2.07	26.59 ± 0.58
Bone medium quality cuts	6.50 ± 0.81	7.32 ± 0.48	5.93 ± 0.68	7.02 ± 0.05	6.42 ± 1.24	6.62 ± 0.67
Total inferior quality cuts	17.15 ± 1.45	15.36 ± 3.18	18.24 ± 0.17	17.40 ± 0.08	14.51 ± 2.18	16.81 ± 0.30
Meat inferior quality cuts	12.60 ± 0.84	10.24 ± 3.55	13.38 ± 0.10	11.85 ± 0.22	10.03 ± 1.72	11.93 ± 1.01
Bone inferior quality cuts	4.55 ± 0.60	5.12 ± 0.38	4.87 ± 0.08	5.56 ± 0.13	4.48 ± 0.46	4.88 ± 0.71

In each row means not followed the same letter *significantly differ* at 5% level. SW = Slaughter weight, CW= Carcass weight, FRG = Full rumen gastric, ERG= Empty rumen gastric

Table (5): Mean values of cut ability cuts and composition as a percentage of carcass weight of buffalo heifers under finishing periods.

Items	Experimental Periods					
	56 days		90 days		118 days	
	Finished X ± SE	Control X ± SE	Finished X ± SE	Control X ± SE	Finished X ± SE	Control X ± SE
Initial age, mo.	32.5± 4.50±	36.5±8.50	29.0 ±3.0	36.0± 1.0	44.0± 2.0	34.0± 0 5
Carcass weight,kg	221.5±26.50	164.00±16.0	196.75±35.25	217.0±6.00	264.0±56.00	230.0 18.00
Fore shank total	3.36± 0.22	3.64±0.03	3.57±0.10	3.79±0.15	3.26±0.37	3.51±0.38
Fore shank meat	1.88± 0.11	2.08±0.12	2.07±0.13	1.94±0.06	1.86±0.20	1.96±0 13
Fore shank bone	1.48± 0.11	1.76±0.16	1.50±0.03	1.85±0.08	1.41±0 18	1.55±0.26
Neck total	7.52^{ab}±0.27	8.85^{a}±1.08	6.56^{b}±0.04	6.04^{b}±0.93	7.03^{b}±0.41	6.43^{b}±0.35
Neck meat	5.69±0.10	6.62±0.62	5.04±0.21	4.80± 0.77	5.46±0 70	4.84±0.04
Neck bone	1.83^{ab}±0.17	2.23^{a}±0.45	1.52^{ab}± 0.18	1.23^{b}±0.04	1.58^{ab}±0.29	1.99^{ab}±0.003
Shoulder total	15.65^{a}±0.04	15.66^{a}±0.63	14.17^{b}± 0.61	13.71^{b}±0.33	13.24^{b}±0.19	13.84^{b}±0 27
Shoulder meat	13.68^{a}±0.11	12.97^{ab}±0.96	12 02^{abc}±0 6 7	10.06^{oc}±0.52	10 94^{c}±0 07	11 60^{oc}±0 61
Shoulder bone	2.17±0.15	2.69±0.06	2.14 ± 0.06	2.65±0.19	2.14±0.28	2.24± 0 34
Fore ribs total	6.59±1.96	5.80± 0.29	8.78±0.03	8.72±1.29	8.81± 0.23	8.93± 0.15
Fore ribs meat	4.59±1.22	3.81± 0.26	5.97±0.47	8.16±0.51	6.14±0.45	6.12± 0.51
Fore ribs bone	2.00±0.74	1.99± 0 55	2.79±0.51	2.55±0.78	2.68± 0.22	2.80± 0.36
Flat ribs total	6.54±0.41	5.09±0.67	4.81 ±0.53	5.67± 0.66	5.54± 0.06	5.25±0.55
Flat ribs meat	5.26±0.01	3.94±0.70	3.79±0.37	4.38±0.75	4.27±0.16	4.07±0.81
Flat ribs bone	1.28±0.04	1.15±0.03	1.02 ±0.17	1.28± 0.09	1.27±0.22	1.18±0.27
Brisket total	5.10^{b}±0.79	5.38^{b}±0.27	5.85^{b}±0.59	6.69^{ab}±0.18	8.76^{a}±0.84	7.28^{ab}±0.95
Brisket meat	3.88^{b}±0.87	4.13^{b}±0.20	4.60^{ab}± 0.32	4.84^{ab}± 0.17	7.34^{a}±1.28	6.08^{ab}±0 89
Brisket bone	1.22±0.09	1.25±0.07	1.25 ±0.27	1.85±0.02	1.42±0 44	1.21±0.06
Hind shin total	3.82^{b}± 0.52	5.33^{a}±0.89	4.54^{ab}±0.17	4.42^{ab}±0.003	3.93^{b}±0 26	4.39^{ab}±0.40
Hind shin meat	1.61± 0.17	2.99±1.09	2.10±0.007	1 92±0.11	1.90± 0 06	2.10±0.11
Hind shin bone	2.20±0.35	2.34± 0.20	2.44± 0.17	2.51±0.11	2.04± 0.2	2.29± 0 29
Flank total	9.96± 0.71	6.19±2.58	10.13±0.09	9.19±0.07	7.31±1.54	8.90±1.08
Flank meat	9.10± 0.57	5.17±2.58	9.20±0.03	7.98±0.03	8.27±1.46	7.87±1 24
Flank bone	0.86± 0.14	1.02±0.002	0.93±0.06	1.21±0.10	1.03±0.08	1.04±0.16
Round Total	28.35^{b}±0.55	34.04^{a}± 2.13	31.22^{ab}±0.24	31.72^{ab}±0.53	30.88^{ab}±0.15	31.28^{ab}±0.95
Round meat	23.84^{b}±1.10	28.89^{a}±2.20	25.88^{ab}±0.01	26.70^{ab}±0.84	26.19^{ab}±1.04	25.58^{ab}±0.25
Round bone	4.51±0.94	5.15±0.08	5.34±0.26	5.02± 0.32	4.69± 0.89	5.71± 1.20
Fillet	3.00±0.67	2.98±0.19	3.08±0.02	2.51±0.11	3.17±0.38	2.30± 0.09
Sirloin total	6.26^{a}±0.30	4.30^{b}±0.53	4.65^{ab}±0.80	5.30^{ab}± 0.14	5.13^{ab}± 0.38	5.11^{ab}± 0.32
Sirloin meat	4.57±0.55	2.97±0.42	2.78±0.69	3.32± 0.10	3.17± 0 38	2 70± 0.49
Sirloin bone	1.69^{bc}±0.24	1.33±0.11	1.87^{abc}±0.12	1.97^{ab}±0.04	1.96ab±0.003	2 41^{a}± 0 17
Best ribs total	2.54^{a}±0 39	1.35^{c}±0.09	2.22^{ab}±0.16	1.71^{oc}±0.19	2 09^{abc}±0 24	1.61^{oc}± 0.26
Best ribs meat	1.61±0.02	1.06±0.05	1.42±0.03	1 21^{oc}± 0.04	1.38^{abc}±0.03	1.28^{oc}± 0 17
Best ribs bone	0.93 ±0.38	0.29± 0.05	0.79±0.13	0.50± 0.23	0.72± 0.22	0.34± 0 09
Best ribs fat	0 71±0 15	0.58± 0 01	0.45±0.15	0.56±0.05	0.84± 0 20	0.77± 0 09

In each row means not followed the same letter differ significantly at 5 % level.

III. b. Carcass Composition:

Results in Table (3) showed that length of finishing period was significantly affected carcass composition in heifers (Table 3). Fat and lean percentages were increased with longer finishing period (90 days). Similar results were found by Keane (1994) in steers. Also, higher percentages of lean and fat in finished groups reflected on lower lean / fat ratio. This because , *finished groups* fed high level of concentrate. The opposite was true for lean / bone ratio. These results were in agreement with those obtained by Matulis *et al.* (1987) and Apple *et al.* (1999). They reported that cows fed high energy diet, body conformation score and total fat yields increased in response to improve the body conformation. However, heifers finished for 118 days had the lowest fat and lean percentage (24.32 % and 46.96 %, resp.). This result

might be due to lower feed intake recorded by these animals resulting from the terrible weather circumstances.

III. c. Meat Quality:

The chemical and physical characteristics of *Longissimus dorsi* muscle of heifers finished for 56, 90 and 118 days are shown in Table (3). Marbling was improved in finished subgroups by increasing intramuscular fat (EE %) by about 46.25 %, 16.02 and 9.73 %, resp. Also, the percentage of moisture was lowest in heifers fed for 118 days. This was particularly noticeable at the heavier slaughter weight (SW). Similar results were found by Scollan *et al.* (2003).

In addition, water holding capacity was improved when finishing period was 56 and 90 days. Cooking loss percentage did not affected by finishing. However, heifers finished for 90 and 118 days scored lower cooking loss than those finished for 56 days. It could be observed that finishing period of 90 days resulted in lowest cooking loss with low value of expressible fluid (39.5 % and 34.39 %, resp.). This result might be due to that cooking loss was diminished by enhancing water holding capacity (Khalil, 2000).

According to the above mentioned discussion it is obvious that culled buffalo heifers can be used efficiently in meat production.

IMPLICATIONS

Results from this study show that finishing of culled buffalo heifers with average body weight of 380 kg for a short finishing period, particularly 56 and 90 improved the performance and all carcass traits. No changes were obtained concerning blood constituents especially, cholesterol and total lipids. This provide a potential utilization of buffalo meat for healthy food. Considering these results, the economic benefits of the use of culled buffalo heifers in meat production should be questioned.

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عجلات الجاموس المستبعدة كمصدر لإنتاج اللحم

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هدفت هذه الدراسة إلى استخدام عجلات الجاموس المستبعدة كمصدر لإنتاج اللحم واستخدم لذلك عدد ١٨ عجله تم تقسيمها إلى ثلاث مجموعات متساوية على أساس العمر ووزن الجسم (بمتوسط عمر حوالى ٣٧ شهر ووزن الجسم ٣٨٥ كجم) تم تسمينها بثلاثة فترات تسمين مختلفة هى ٥٦ ، ٩٠ ، ١١٨ يوم .

قسمت كل مجموعة إلى مجموعتين فرعيتن متساويتين وبالتالى توجد ثلاثة مجموعات فرعية كونترول (غير مسمنة) . وفى نهاية فترات التسمين المختلفة تم ذبح عدد ١٢ حيوان ، وتم تقطيع جانب الذبيحة الأيمن من كل الذبائح إلى مختلف القطعيات. زاد التسمين من متوسط الزيادة اليومية فى جسم الحيوان وكفاءة تحويل الغذاء معنويا بالمقارنة بعدم التسمين (الكنترول). لوحظ انه بإطالة فترة التسمين انخفض متوسط الزيادة اليومية فى الجسم وكذا كفاءة التحويل الغذائى . حققت العجلات المسمنة لمدة ٥٦ يوم احسن أداء يليها تلك المسمنة لمدة ٩٠ يوم ، بينما فترة التسمين لمدة ١١٨ يوم نتج عنها اقل متوسط زيادة يومية فى الجسم وفى كفاءة تحويل الغذاء . لم تتغير بعض مكونات الدم (الكولسترول الكلى ، الدهون الكلية ، البروتين الكلى ، يوريا الدم) بفترات التسمين على الرغم من بعض الاختلافات الطفيفة إلا أنها جميعا داخل المتوسطات الطبيعية . تحسنت صفات الذبيحة تحسن ملحوظ بالتسمين خاصا عندما كان لمدة ٥٦ يوم . زاد التسمين من نسبة الدهن والعضلات .

نستنتج من ذلك انه يمكن استخدام عجلات الجاموس المستبعدة بمتوسط عمر ٣٧ شهر ووزن حى ٣٨٥ كجم كمصدر لإنتاج اللحم خاصا عندما تسمن لمدة ٥٦ يوم ، ٩٠ يوم حيث أن فترات التسمين القصيرة نتج عنها تحسن فى كل من متوسط زيادة اليومية فى وزن الجسم وكفاءة التحويل وصفات الذبيحة ، وكذلك جودة اللحم بدون أى تغير فى بعض مكونات الدم المختلفة خاصا تركيز الكولسترول والدهون الكلية .