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GROWTH RATE, LEPTIN AND IGF-1 CONCENTRATIONS, CARCASS AND MEAT CHARACTERISTICS OF EGYPTIAN BUFFALO MALE CALVES IN RELATION TO FAT SUPPLEMENTED RATION

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SUMMARY

This study comprised two experiments (Exp); the first to study the growth curve of the Egyptian buffalo calves, and the second to study the effect of supplying fattening ration with protected fat on growth and carcass traits.

In the 1st Exp., 10 growing buffalo male calves (8 months of age) with initial body weight of 115.0 ± 4.0 kg were used. Calves were fed concentrate feed mixture (CFM) and rice straw (RS) based on their weights. Monthly weighing were executed to plot the growth curve and to determine the average daily gain (ADG). Blood samples were collected every three months to determine the concentration of IGF-1 and Leptin. In the 2nd Exp., another eight buffalo calves (about 256 kg) were divided into two equal groups. The 1st (G1) was served as a control fed on CFM and RS, while the 2nd group (G2) was fed similar ration of G1 supplemented with commercial calcium salts of fatty acids (0.13% of the BW) to calculate ADG, fattening period (FP) and final BW (FBW). Blood samples were collected monthly to determine IGF-1 and Leptin hormones. At BW of approximately 400 kg calves were slaughtered for studying carcass traits and meat quality. Best ribs (9, 10 and11th ribs) were separated from the left side of the carcass to calculate bone, lean, fat tissues (%) and to determine chemical and physical traits of meat.

Results of the 1st Exp indicated that BW of buffalo calves increased from 115.0 ± 4.0 to 357 ± 2.7 kg throughout the period from 8 to 24 month of age. ADG increased gradually up to the 23rd month of age before decreasing to 0.433 kg at the 24th month. IGF-1 concentration increased with age progress (from 41.0 ± 2.8 ng/ml to 368.0 ±10.0 ng/ml) before decreasing to 273.0 ±63.0 ng/ml at the 24th month of age. Leptin concentration between the 8th and 20th month of age was 3.4 ± 0.3 ng/ml increased to 5.08 ±1.01 ng/ml between the 20th and 24th month of age.

In the 2nd Exp, BW and FP were similar in G1 and G2 being 385.0 ±7.3 vs. 397.0 ± 4.9 kg and 243.0 ± 6.0 vs. 252.0 ± 11.0 day. Feeding buffalo calves on diet supplemented with fat had no significant effect on ADG (0.508 ±0.01 vs. 0.564 ± 0.03 kg) and feed conversion (13.1 ±1.16 vs. 11.9± 0.4 DM/Kg gain) being similar in G1 and G2, respectively. During fattening period IGF-1 in G1 was insignificantly higher (255.7 ± 29.0 ng/ml) than of G2 (204.2 ± 17.0 ng/ml). Meanwhile, Leptin concentration was higher (P<0.05) in G2 (5.0± 0.6 ng/ml) than in G1 (3.9± 0.8 ng/ml). There were no significant differences between G1 and G2 concerning hot carcass weight (197.0±4.9 vs. 197.0± 6.5 kg), dressing percentage (51.2±0.3 vs. 49.8±1.1 %) and boneless meat percentage (35.6 ±0.8 vs. 38.3±1.4 %), respectively.

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Physical and chemical traits of meat were similar in both groups, except intramuscular fat which was higher (P<0.05) in G2.

In conclusion growth curve of Egyptian buffalo calves between 8 and 24 months showed exponential increase up to 23rd month of age before showing descending trend. This was accompanied with high level of IGF-1 concentration, while Leptin concentration in the peripheral blood started to increase from the 20th month of age. Supplying ration with protected fat during fattening period (256 to 400 kg) had no effect on growth, carcass, and meat traits.

Keywords: Buffalo calves, growth, IGF-1, Leptin, carcass traits, physical and chemical traits of meat

INTRODUCTION

Growth rate of ruminants is the main factor determines the total gain and red meat yield. Total body gain is a combination of increasing of lean mass and fat deposition. Lean mass is affected by genotype (Rehfeldt *et al*., 2004), micro environment (Te-Pas *et al*., 2004), sex (Tokuda *et al*., 2007), age (Appa Rao *et al.,* 2009), nutrition (Owens and Gardner, 1999) and the balance among hormones control metabolism (Squires, 2003).

Role of IGF-1 in growth process is well defined. Increasing IGF-1 concentration is associated with the increase in body weight and growth rate in cattle and sheep (Cronje, 2002 and Barkawi *et al.,* 2009). IGF-1 regulate growth of skeletal muscle and multiple tissues (Brandt *et al.,* 200ᵛ) by stimulating amino acids uptake of muscle cells (Shimizu *et al.,* 1986), inhibiting proteolysis (Fryburg, 1994) and improving efficiency of feed utilization (Yilmaz *et al.,* 2004). These actions are supported by the findings of Anderson *et al*. (1988) who reported a positive relationship between IGF-1 and area of *Longissimus dorsi* muscle.

In ruminants, increasing Leptin concentration in the peripheral blood plasma stimulates fat accumulation (Chilliard *et al.,* 2005, Nkrumah *et al*., 2007 and Tokuda *et al*., 2008). Leptin concentrations starts to increase significantly with puberty- hood (Zieba *et al.*, 2005). Leptin acts as a regulator of lipid reserves via its effect on food intake and energy metabolism (Agrawel *et al.,* 2009), which affects increasing body weight and body composition (Chilliard *et al*., 2005 and Zieba *et al*., 2005).

Buffaloes play a considerable role in bridging the gap of red meat in Egypt. Egyptian buffaloes were reported to have lower average daily gain compared to cattle (El-Naggar, 1998), leading to higher cost of producing 1 kg gain. Improving obtained ADG of buffaloes could be achieved through nutritional and management manipulations. Supplementing fat to beef cattle and sheep rations can be an effective strategy to increase energy density of the animal's diet (Hess *et al*., 2008). Increasing energy intake is expected to increase growth rates (Nour El-Din *et al.,* 2009), and to improve carcass characteristics (Gigli *et al.,* 1993) of ruminants.

Many trials were conducted to study the effect of replacing part of the concentrate mixture with protected fat (El-Bedawy *et al*., 2004 and Abo-Donia and Ibrahim, 2008) to improve growth and meat quality traits, while the results indicated no effect on studied traits. On the other hand, feeding buffalo calves on protected fat (Ca-SFA) as a source of energy during the finishing period improved meat production and quality (Abo-Donia and Ibrahim, 2008). Access of energy also contributes in

increasing boneless meat percentage (Gigli *et al.,* 1993 and; Bendary *et al.*, 1994) and increasing fat deposition, which may have impact on the economics of producing 1 kg gain.

Up to the knowledge of the authors there is lack of data describing the profile of IGF-1 and Leptin hormones throughout the growth stages of Egyptian buffaloes, and there are few studies concerning the effect of supplementing ration with protected fat on growth and carcass traits.

In the light of the available data, the present work aimed at: 1- studying the growth curve of buffalo male calves in relation to IGF-1 and Leptin concentrations and studying the effect of supplementing rations of fattened male buffalo calves with protected fat on the growth features, carcass and meat traits, in relation to IGF-1 and Leptin hormones in peripheral blood plasma.

MATERIALS AND METHODS

This study was conducted at the Agriculture Experimental Station, Faculty of Agriculture, Cairo University during the period from January 2008 to May 2009.

Experimental Design:

The present study comprises two experiments, the 1st to describe the growth features of buffalo male calves in relation to IGF-1 and Leptin hormonal profile, and the 2nd to study the growth and carcass traits in relation to IGF-1 and Leptin concentrations during fattening period.

The first experiment (Growing phase):

Data of growth of 10 growing buffalo male calves were collected to plot the growth curve from 8 to 24 month of age. The initial body weight of the experimental calves was 115.0 ± 4.0 kg. Calves were housed tied in a semi open yard and fed on concentrate feed mixture (CFM) and rice straw (RS) based on their live body weight (BW) (NRC requirements, 2000). Concentrate feed mixture (14% protein) composed of 50% yellow corn, 20% wheat bran, 20% cotton seed cake, 5% soybean cake, 5% salts and minerals mixture. Feeding and watering were practiced twice daily. Throughout the course of the experiment, calves were weighed monthly after about 16 hr fasting to plot growth curve and determine average daily gain (ADG).

The second experiment (Fattening phase):

Another eight buffalo male calves were divided into two equal groups. The body weight of the two groups was differed non-significantly being 256.0 ± 3.5 and 255.7 ± 2.7 kg for the first (G1) and second (G2) groups, respectively. G1 was served as a control, where fed according to their BW on CFM and RS, while G2 was fed similar to G1 in addition to commercial calcium salts of fatty acids (CSFA, Ibelac® IBEX international, Egypt). The amount of offered CSFA was 0.13% of the BW as recommended by Villalobos *et al.* (2007). The residual feed was weighed daily to calculate the feed conversion. Around 400 kg BW calves were slaughtered according to the Islamic rules to study carcass traits and meat quality.

Slaughter Procedure:

Calves were slaughtered after fasting period of 18 hr. After bleeding and removing hide, head and legs, calves were eviscerated and section down through

vertebral column into two halves. The left side of each carcass was separated between the 8th and 9th rib into two quarters; fore and hind. Both quarters were weighed before dissecting into wholesale cuts (bone and meat). The fore quarter was separated into six primal cuts (Fore shank, shoulder, fore ribs, flat ribs, brisket and neck), while hind quarter was separated also into six cuts including hind shank, round, sirloin, thin-flank, and thick flank and fillet according to German meat cuts (Weniger *et al*., 1963) to record weights of each cut. Best ribs (9, 10 and11*th* ribs) were separated from the left side and weighed fresh. Best ribs were chilled at 4ºC for 24 hr, afterwards; they were weighed again before dissecting into bone, lean and fat tissues. L-dosi samples were stored at -20ºC till the time of chemical and physical analyses.

Physical and Chemical Traits:

Chemical analysis of the rib cut samples was performed using food Scan ™ Pro meat analyzer (Foss Analytical A/S, Model 78810, Denmark). According to the manufacturers ™ instructions about 50 -100 gm of raw meat (obtained from the 9th rib) were minced and put in the meat analyzer cup to determine the percentages of moisture, protein, fat and collagen.

Cooking loss was determined using two cubes of meat (about 100 gm, W_1). The samples were boiled in saline (0.09% Nacl) for 45 minutes, then left to cool at room temperature. Sample was re-weighed (W_2) to calculate the cooking loss percentage as the difference between two weights divided by W_1 multiplied by 100 (Sami, 2001)**.** The cooked samples were used to determine the shear force values (kg). Samples were kept in refrigerator at 4-5°C for about 12 hr, before estimating shear force using Instron Universal Testing Machine (Model 2519-105, USA). According to the manufacturer's instructions, six cores from each sample were taken using cylinder of 0.5 inch in diameter. Cores were removed parallel to the longitudinal orientation of muscle fibers. The machine was adjusted at crosshead speed of 200 mm/min according to the recommendation of Shackelford *et al*. (1999).

Meat color was measured using Chroma meter (Konica Minolta, model CR 410, Japan) calibrated with a white plate and light trap supplied by the manufacturer. Color was expressed using the CIE L*, a*, and b* color system (CIE, 1976).

Blood Sampling and Hormonal Assay:

In the 1st Exp, 10 ml of blood samples were collected from the jugular vein in heparinized tube every three months up to the end of the experiment (24 months old), while in the 2nd experiment blood samples (10 ml) were collected monthly to determine IGF-1 and Leptin hormones in the peripheral blood plasma. Before morning feeding and watering, samples were collected, then centrifuged for plasma separation for 15 minutes at 3500 rpm. Harvested plasma was stored at -20ºC till the time of hormonal assay.

Leptin determination was performed by ELISA reader (BIO TEK ELX808), using Leptin ELISA kit sandwich (DRG Instruments GmbH, Germany) according to the manufacturer's guideline. The standard curve was between 0 and 100 ng/ml. The sensitivity of the curve was reported to be 1.0 ng/ml. The cross reaction of the antibody was found to be 100% with human Leptin, <0.2% with rat and mouse Leptin and not detectable with other hormones.

IGF-1 was assessed by radioimmunoassay technique (RIA) using readymade kits (Immunotech SAS -130 av. kit, France). The standard curve was between 0 and 1200 ng/ml. The analytical sensitivity was reported to be 2 ng/ml. The cross reaction of the antibody with other hormones was found to be extremely low .The samples were determined in one run and the intra-assay variation coefficient was 6.3%.

Statistical Analysis:

In experiment 1, all values were expressed as means and standard errors (mean ± S.E.), using the tabulate procedure of the statistical package for social science (SPSS 17.0). The Pearson's correlation test (between means) was used to calculate correlations between Leptin, IGF-1, and some growth traits. In experiment 2, data in percentages were transformed to the arcsine square-root to normalize error before analysis. The following model was used:

$Y_{ij} = \mu + T_i + e_{ij}$

Where

Y_{ij}= the measured trait,

μ = the overall mean,

T_i = effect of feeding (i= 1, 2; 1 feed on CFM and 2=CFM plus protected fat),

e_{ij} = Random error.

RESULTS AND DISSCUSION

Experiment 1:

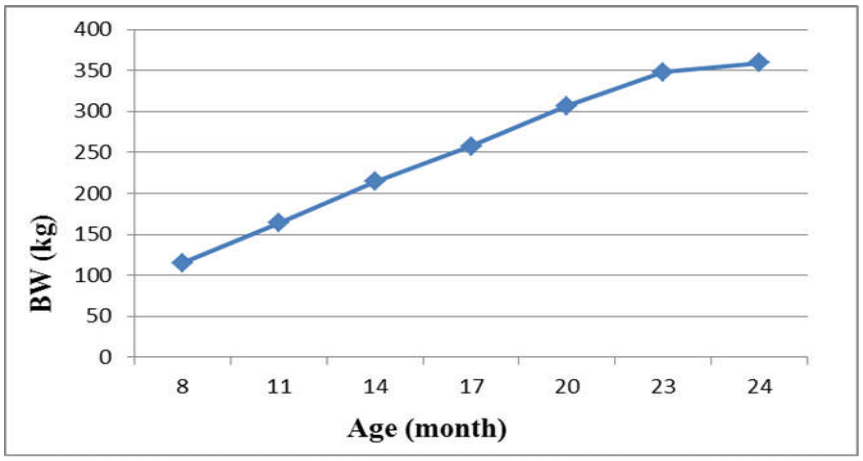
Growth features of growing phase:

Buffalo male calves showed an exponential increase in their BW from the 8th to 23th month of age, before showing a decrease trend during the last month of the experiment. During the course of the experiment, BW of the calves increased 2.3 times (from 115.0 ± 4.0 kg to 357 ± 2.7 kg) (Fig. 1). The decrease in growth by the 24th month of age may be due to approaching puberty of the experimental calves and starting the 2nd phase of the growth curve (Sigmoid phase). This conclusion is supported by the findings of Abd El-Aziz (2006) on the Egyptian buffalo bulls reporting an increase in testosterone concentrations in blood plasma starting 19-20 month of age.

Average daily gain (ADG) showed a parallel trend to the growth curve; except the unexplainable decrease observed between 14 and 17 months of age. ADG increased gradually from 0.479 to 0.515 kg throughout the period from the 8th to the 23rd month of age and then decreased to 0.433 kg (about 90% of the initial ADG) during the 24th month of age (Fig.1).

The obtained higher ADG during the period from 8 to 23 month of age compared to the 24th month agrees with the results of Bendary *et al.* (1994) reporting similar trend. Also, came close to the previous reports of El-Ashry *et al.* (1996) and Bassiouni *et al*. (2000) reporting ADG between 494 and 529 g within the same age period.

The present result of growth curve agree with the findings of Mandal *et al*. (2003) and Nada (2003) indicating that the initial of sigmoid part of Buffaloes' growth curve occurred between 350 and 360 kg BW.



Age interval (month)	8-<11	<11-14	>14 – 17	>17-20	>20-23	>23-24
ADG (kg)	0.479±0.03	0.522±0.03	0.480±0.04	0.516±0.03	0.515±0.04	433.0±0.05

Figure 1. Growth curve and average daily gain (mean±SE) of growing buffalo calves from 8 to 24 months of age

Hormonal profile:

IGF-1 concentration:

Concentration of IGF-1 during the experimental period averaged 170.9 ± 33.0 ng/ml with a range of 41.4 to 368.3 ng/ml. The curve of IGF-1 concentration showed similar trend to the growth curve of the experimental calves. IGF-1 concentration increased gradually from the 8th (41.0 ± 2.8 ng/ml) to the 23th month (368.0 ± 10.0 ng/ml) of age. Afterwards, IGF-1 concentration decreased to reach a value of 273.0 ± 63.0 ng/ml at the 24th month of age (Fig.2).

The present results indicated a positive correlation between body weight and IGF-1 ($P<0.05$) and negative correlation between IGF-1 and ADG (Table 1). The obtained correlation between IGF-1 and body weight (0.775) was higher than that reported by Baker *et al*. (1991) (0.38). Increasing IGF-1 concentration with age progress came in agreement with the findings of Lee *et al*. (1990) on bulls and steers of Belgian Blue and Holstein Friesian.

The obtained negative correlation between IGF-1 and ADG is supported by the findings of Connor *et al*. (2000) on Black Angus bulls reporting that high level of IGF-1 exhibited slower rate of gain. The authors reported that correlation coefficients between ADG and IGF-1 decreased with age progress being between -0.32 and 0.3. Negative correlation between IGF-1 and ADG may be due to fat deposition rather than protein synthesis, which observed with age progress (Shimizu *et al.,* 1986).

The positive correlation between IGF-1 and BW is due to the role of IGF-1 in the regulation of growth of skeletal muscle and efficiency of feed utilization (Yilmaz *et al.,* 2004).

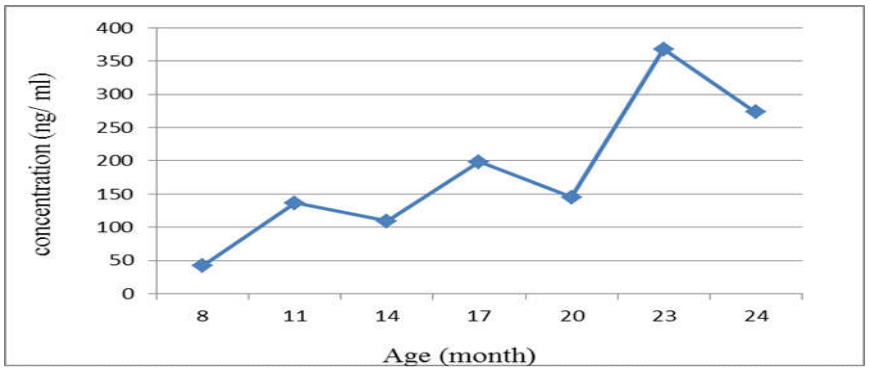


Figure 2. IGF-1 concentration (ng/ml) in the preipheral blood plasma of the Egyptian buffalo calves between 8 and 24 months of age

Leptin concentration :

Concentration of Leptin across the experimental period showed two distinct phases (Figure 3). The 1st was between the 8th and 20th month of age, in which plasma Leptin was less than 4.0 ng/ml with an overall mean of 3.4 ± 0.3 ng/ml. During this period concentration of Leptin had almost constant trend. The 2nd phase was between the 20th and 24th month of age, where Leptin concentration showed an exponential increase reaching 7.8 ± 0.9 ng/ml with an average of 5.1 ±1.01 ng/ml.

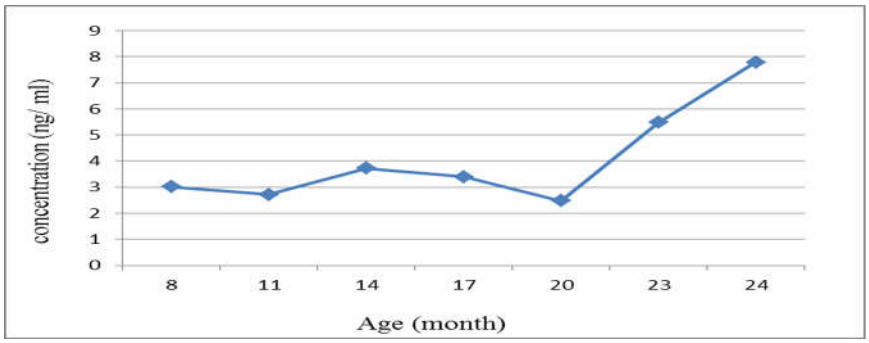


Figure 3. Concentration (ng/ml) of Leptin in the preipheral blood plasma of the Egyptian buffalo calves between 8 and 24 months of age

The increase in plasma Leptin concentration with advancement of age may reflect the increase of fat deposition due to approaching maturation (Block *et al*., 2003). This suggestion is supported in the light of the findings of Ragab *et al.* (1966) who reported that fat tissues in Egyptian buffalo bulls increased with age progress and started to increase from the 18th month of age. Kawakita *et al*. (2001) also reported that increase in Leptin concentration was related to the deposit fat mass, which may be due to puberty approaching. This conclusion is supported by the findings of Thomas *et al*. (2002) reporting positive correlation between Leptin and testosterone in growing bulls.

The obtained results of Leptin concentration during the first growing phase (8-20 months of age) came close to the results of Thomas *et al*. (2002) and Daix *et al*.

(2008) on growing Angus bulls, who found that the concentration of Leptin between 8 and 17 months of age was between 3.0 and 3.4 ng/ml.

Correlation coefficients:

The present results indicated that there was a positive correlation between plasma Leptin and body weight, but negative with ADG (Table 1). The obtained positive correlation between body weight and serum concentration of Leptin came in agreement with the findings of Thomas *et al. (*2002) and Nkrumah *et al*. (2007). Also the negative relationship between Leptin and ADG agreed with findings of Altmann *et al*. (2006) on lambs, but disagreed with the findings of Nkrumah *et al*. (2007) who reported no correlation between Leptin and ADG.

The positive correlation between IGF-1 and Leptin agrees with the findings of Thomas *et al*. (2002) and Leon *et al*. (2004), while disagree with the findings of Brandt *et al.* (2007) who reported negative correlation between these two hormones.

Table 1. Correlation coefficients among BW, ADG, circulating concentrations of Leptin and IGF-1 in Egyptian buffalo calves from 8th to 24th of age

Variables	B.W(kg)	ADG(g)	Leptin (ng/ml)	IGF-1 (ng/ml)
BW (kg)	1	-0.119	0.550	0.775*
ADG (g)		1	-0.390	-0.099
Leptin (ng/ml)			1	0.696*
IGF-1 (ng/ml)				1

*The correlation was significant (P<0.05)

Experiment 2:

Growth features during fattening period:

The obtained results indicated that there were no significant differences between G1 (control) and G2 (fed protected fat supplemented ration) regarding ADG, BW, FP and feed conversion. However, ADG and feed conversion was better in G2 than in G1. It is also of interest to point out that the total energy intake of G2 was non-significantly higher than G1 (Table. 2). This may be due to the higher level of Liptin (Figure 5), which primary decreased appetite and feed intake (Chilliard *et al*., 2005),

Table 2. Growth traits of Egyptian buffalo calves under control (G1) and fat supplementation feed (G2) (n=4/ group)

Traits	G1	G2	P value
Growth traits			
Initial body weight (kg)	256.0 ±3.5	255.7± 2.7	0.958
Final body weight (kg)	385.0 ±7.3	397.0± 4.9	0.223
Fattening period (day)	243.0 ± 6.0	252.0±11.0	0.581
ADG (kg)	0.508 ±0.01	0.564±0.03	0.212
Feed intake / FP*			
Concentrate feed mixture (CFM) (Kg)/ FP	1548.3± 19	1251.5±50.0	0.052
Protected fat (kg)/ FP.		119.2±3.6	
Rice straw (kg)/ FP.	471.5 ± 102	531.9 ±15.0	0.303
Energy intake and feed conversion:			
Total energy kcal/calf/day.	24134.9±128.0	25493.6±1129	0 .227
Feed conversion (DM/ kg gain)	13.1± 1.1	11.9±0.4	0.253

*FP: Fattening period

These results agreed with the findings of El-Bedawy *et al.* (1996) who found that supplementing the ration of Baladi bulls with 5% or 7.5% fat had no effect on BW. Also, agreed with the findings of Gassman *et al.* (2000) reporting no differences in growth efficiency between the control and calves fed ration supplemented with 2.5% rumen-protected CLA salt. Moreover, results of Nada (2003) and Gillis *et al.* (2004) indicated that ADG, dry matter intake and gain to fed ration did not affected by supplementing diets with 2-10% fats. On the contrast, El–Bedawy *et al.* (2004) reported that replacing part of energy of fattened calves with 4 and 8% ca-SF, improved ADG and final body weight.

The non-significant difference in ADG, BW and feed conversion in G1 and G2 may be due to the insignificant difference between the two studied groups in total energy intake. This is most probably attributed to the high residue in feed daily allowance in G2 compared to G1. Unexpected lower energy intake of G2 may be due to high energy content per feed unit (CFM+ CSFA), which represents heat load of animals when consuming all diet allowance.

Results of feed conversion agreed with the findings of Nada (2003) reporting that feeding buffalo calves on ration contained 10% fat had no effect on feed conversion, while disagreed with the findings of El-Bedawy *et al.* (1996) reporting better feed conversion of Baladi bulls fed on fat as a part of ration compared to those fed on the regular ration. .

IGF-1 concentration:

Plasma concentration of IGF-1 was non-significantly less in G2 than in G1 (Figure 4). The overall mean of IGF-1 concentration during fattening period was 255.7 ± 29.0 ng/ml and 204.2 ± 17.0 in G1 and G2, respectively. However the difference between the two groups was not significant (50 ng/ml). The non-significant difference may be attributed to the low number of the samples and the wide variation among individuals within group.

The low concentration of IGF-1 in G2 than in G1 may be due to increasing Leptien concentration (Figure 5), which had a negative correlation with IGF-1 (Table 3).

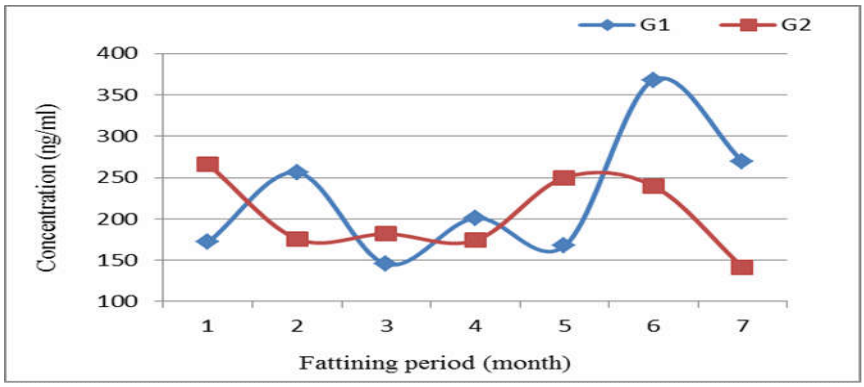


Figure 4. IGF-1 concentration (ng/ml) in buffalo calves fed on concentrate feed mixture (G1) and concentrate feed mixture supplemented with protected fat (G2)

The trend of the present results is in agreement with the results of Garcia *et al.* (2003) who reported that serum IGF-1 concentrations were less in heifers and lactating cows, fed on diet containing fat. On the opposite, Villalobos *et al*. (2007) revealed that feeding feedlot steers on fat supplemented diet had no effect on IGF-1 concentration compared to a control group. Increasing feed intake from rice straw in G2, however being insignificant, may be to keep rumen pH low for partial disassociation of calcium soaps before completing dissociated in the acidic condition of the abomasums (Jenkins and Palmquist, 1984).

Leptin concentration:

During fattening period Leptin concentration increased with age progress in both groups, but it showed higher trend in G2 than in G1. The overall mean of Leptin concentration during this period was lower ($P<0.05$) in G1 (3.9 ± 0.8 ng/ml) than in G2 (5.0 ± 0.6 ng/ml). Pattern of Leptin concentration was almost similar in both studied groups, except in G2 where, Leptin concentration started to be decreased by the end of the experiment while, continued increasing in G1 (Figure 5). This trend in both experimental groups agreed with the findings of Kawakita *et al*. (2001) on Japanese Black steers.

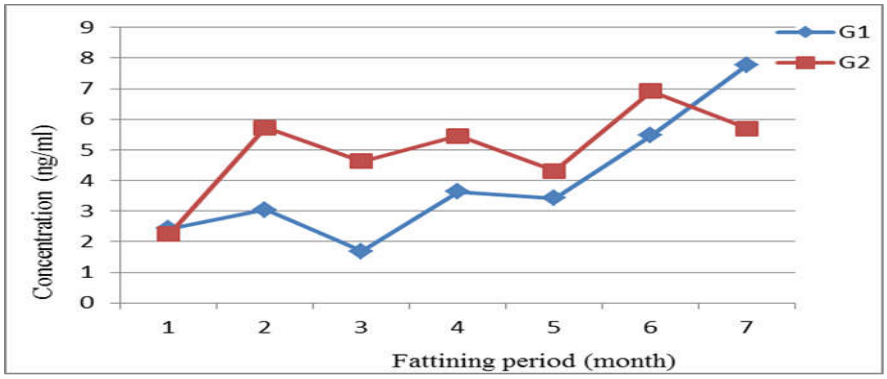


Figure 5. Leptin concentration in buffalo calves fed on concentrate feed mixture (G1) and concentrate feed mixture supplemented with protected fat (G2)

The relation between feeding on diets containing fats and Leptin concentration showed wide variation among the previous works. However, the present result came in agreement with the findings of Gillis e*t al*. (2004) and Tokuda *et al*. (2008) who reported that Leptin concentration was higher in plasma of calves fed on diet containing fat compared to control group, but it is contradicted with the findings of Block *et al*. (2003); Garcia *et al.* (2003) and Villalobos *et al.* (2007) who reported that feeding growing beef heifers on diet containing up to 7% fat had no effect on peripheral blood concentration of Leptin.

Increasing Leptin concentration in G2 may be due to the stimulating effect of fat diet on plasma insulin (Williams and Stanko, 1999), which positively stimulates plasma Leptin secretion (Wegner *et al*., 2001 and Tokuda *et al.,* 2008) to regulate energy homeostasis.

Correlation Coefficients:

Correlation coefficients among some of the studied traits differed between G1 and G2 in trend and values. Correlation coefficient between Leptin and IGF-1 was positive in G1, while it was negative in G2. A reverse trend was observed between IGF-1 and ADG, which was negative in G1 ($P < 0.05$), while positive in G2. Correlation values between Leptin and ADG as well as BW and ADG were negative in both studied groups (Table 3).

The significant difference ($P<0.05$) in correlation coefficient between Leptin and BW may be due to the higher concentration of Leptin in the peripheral blood plasma of G2 compared to G1 (Figure 5). Negative correlation between Leptin and ADG in both groups (Table 3) during is supported by the findings of Altmann *et al*. (2006), who recorded negative relationship between Leptin and average daily gain. IGF-1 and Leptin in G2, came in agreement with the findings of Garcia *et al*. (2003) and Brandt *et al*. (2007) in cattle, who referred this trend to either the negative correlation between Leptin and both of GH and IGF-1 or inhibiting effect of Leptin on hepatic IGF-1 secretion. There are another reason, which may be due to the stress effect of fat on liver function that leads to decrease of IGF-1 secretion (Villalobos *et al*., 2007).

Positive correlation coefficient between IGF-1 in G1 and the negative corresponding value of G2, may be resulted from the negative correlation between IGF-1 and Leptin in G2.

Table 3. Correlation coefficients among BW, ADG, circulating concentrations of Leptin and IGF-1 of G1 and G2 of Egyptian buffalo calves during fattening period

Variable	Group	Leptin (ng/ml)	IGF-1 (ng/ml)	ADG (kg)	BW (kg)
Leptin (ng/ml)	G1	1	0.681	-0.568	0.836*
IGF-1 (ng/ml)			1	-0.762*	0.524
ADG (kg)				1	-0.269
BW (kg)					1
Leptin (ng/ml)	G2	1	-0.489	-0.406	0.658
IGF-1 (ng/ml)			1	0.494	-0.357
ADG (kg)				1	-0.018
BW (kg)					1

*Correlation was significant ($P<0.5$)

Carcass traits:

There are no significant differences between G1 and G2 concerning slaughter weight, empty body weight, hot carcass, weight dressing percentage, boneless meat percentage, offal percentage, proportion of hind and fore quarters, while there was a significant difference between the two studied groups concerning the percentages of high priced cuts, which was higher ($P<0.01$) in G2 than in G1 (Table 4).

The present result of dressing percentage (DP) agrees with the findings of Nada (2003); Abd Al-Rahman (2005) and Abo-Donia and Ibraheim (2008) reporting DP

between 47.1 and 58.6 % with no effect of feeding fat diet on this trait. Percentage of boneless meat of buffalo bulls reported by Nada (2003) and Abd Al-Rahman (2005) ranged between 36.28 and 43.0% calculated out of slaughter weight. These results were higher than that reported in the present study, which may be due to lower slaughter weight in the present study, which may lead to higher percentage of bone. Meanwhile, it is close in trend with the finding of Nada (2003), reporting fed Egyptian buffalo bulls on protected fat supplemented diet had no effect on boneless meat percentage.

Table 4. Carcass traits (Mean±SE) of Egyptian buffalo calves fed concentrate mixture (G1) and concentrate feed mixture supplemented with protected fat (G2) (n=4 / group)

Trait	G1	G2	P- value
Slaughter weight (kg)	385.0±7.4	397.0±4.9	0.223
Empty body weight (kg)	343.0 ± 3.7	357.0± 4.5	0.052
Hot carcass weight (kg)	197.0±4.9	197.0± 6.5	0.937
DP (%)[1]	51.17±0.3	49.78±1.14	0.289
BLM (%)[1]	35.6 ±0.8	38.3±1.4	0.145
High priced cuts*[1] (%)[٢]	23.78±.24	25.75±.49	0.012
Expletive fat** (%)[١]	1.96 ±.08	2.10±.16	0.478
Offal (%)[١]	29.07± 0.38	29.20±0.16	0.735

1 Calculated as a proportion of slaughter weight, 2 proportion of hot carcass weight. * calculated as sum of round, fillet, sirloin and fore ribs, ** calculated as sum of heart fat, kidney fat, intestinal fat, abdominal and other fat

The obtained significant increase (P= 0.012) in high priced cuts of G2 than G1 is in accordance with the findings of Abo-Donia and Ibraheim (2008), while contradicted with the results of Nada (2003) who reported no effect of feeding ration contained Ca-SFA on high priced cuts percentage.

The insignificant difference between the two groups concerning expletive fat percentage is in agreement with the findings of Garcia *et al*. (2003) in beef heifers and Nada (2003) in buffalo bulls. This however disagrees with the finding of El-Bedawy *et al.* (2004) recording higher total body fat for Baladi bulls fed fat ration. Abd Al-Rahman (2005) and Abo –Donia and Ibrahim (2008) found that kidney fat were significantly higher with feeding Ca-SFA than control group. Differences in this respect among authors most probably attributed to the difference in slaughter weights.

Meat Traits:

Obtained results of the physical traits indicated no significant difference between the two studied groups in respect to percentages of bone, meat and fat. The non-significant difference between the two groups is extended also to color density, cooking loss% and shear force values (Table 5). Moreover, no significant difference was observed between the two groups in chemical analysis except in chemical fat percentage which was higher (P=0.04) in G2 relative to G1.

Table 5. Physical and chemical characteristics (mean ± SE) of *Longissimus dorsi* muscle in Egyptian buffalo calves under control (G1) and fat supplement (G2) feed (n=4/group)

Trait	G1	G2	P- value
Physical traits			
Best ribs components %			
Lean	59.72±1.4	57.1760±6.1	0.702
Fat	16.63±3.9	13.32±3.3	0.542
Bone	26.62±1.4	26.30±2.7	0.922
Color density			
Brightness (L*)	37.9±1.3	36.16±.97	0.329
Redness (a*)	17.01±.36	17.05±.75	0.965
Yellowness(b*)	4.31±.37	3.82±.58	0.506
Cooking loss (%)	45.06±.46	43.44±1.2	0.256
Shear force (kg/ f/ 0.5 inch)	4.03±.32	4.72±.51	0.300
Chemical composition (%)			
Moisture	76.28±.59	75.50±.46	0.339
Protein	21.21±.16	20.91±.27	0.395
Fat	1.13±.14	1.60±.10	0.040
Collagen	1.66±.07	1.24±.19	0.095

L* (0= black, 100= white; a* redness/greenness (positive values= red, negative values= green; b* yellowness/blueness; (positive values= yellow, negative values= blue).

Results of physical components of best ribs are in agreement with the findings of Nada (2003) and Abo-Donia and Ibraheim (2008) under feeding Egyptian buffalo bulls on ration supplemented with fat. Meanwhile, results of chemical analysis disagree with the finding of Nada (2003), Garcia *et al*. (2003) and Abo-Donia and Ibraheim (2008) reporting that feeding heifers or buffalo bulls on diet contained fat had no effect on dry matter and fat percentage of eye muscle contents *vs.* decreasing in protein content.

Increasing intramuscular fat content of eye muscle in G2 most probably attributed to increasing in plasma Leptin concentration (Kawakita *et al*., 2001; and Gillis *et al.*, 2004), which may resulting in improving marbling score (Mcfadin *et al*., 2003) of meat.

CONCLUSION

In conclusion, growth curve of Egyptian buffalo calves between 8 and 24 months showed exponential increase up to 23rd month of age before showing descending trend. This was accompanied with high level of IGF-1 concentration, while Leptin concentration in the peripheral blood started to increase from the 20th month of age. Supplying ration with protected fat during fattening period (256 to 400 kg) had no effect on growth, carcass, and meat traits.

REFERENCES

Abd Al-Rahman S. A.M., 2005. Performance of buffalo calves fed rations containing different sources and levels of full fat seeds. M.Sc. Thesis. Faculty of Agriculture, Cairo University, Egypt.

Abd El-Aziz N.A.E., 2006. Effect of using some growth stimulators and Vitamin C on growth and reproductive performance of Egyptian Buffalo calves under different climatic Conditions. Ph.D. Thesis, Faculty of Agriculture, Al-Azhar University, Egypt.

Abo-Donia F.M. and S. A. Ibraheim, 2008. Effect of feeding different levels of calcium salts of fatty acids on digestibility, body dimension and carcass characteristics of fattening Buffalo bulls. Egyptian Journal of Animal Production, 45: 171 -186.

Altmann M., H. Sauerwein and E. von Borell, 2006. Plasma Leptin in growing lambs as a potential predictor for carcass composition and daily gain. Journal of Meat Science, 74: 600–604.

Anderson P. T., W. G. Bergen, R. A. Merkel, W. J. Enright, S. A. Zinn, K. R. Refsal, and D. R. Hawkins, 1988. The relationship between composition of gain and circulating hormones in growing beef bulls fed three dietary crude protein levels. Journal of Animal science, 66:3059 –3067

Appo Rao V., G. Thulasi and S. Wilfred Ruban, 2009. Meat quality characteristics of non descript buffalo as affected by age and sex. World Applied Science Journal 6 (8):1058-1065.

Baker R. L., A. J. Peterson, J. J. Bass, N. C. Amyes, B. H. Breier, and P. D. Gluckman, 1991. Replicated selection for insulin-like growth factor-I and body weight in mice. Theor. Appl. Genet. 81:685-692.

Barkawi A.H., Amal. K. El-Asheeri, Y.M. Hafez, M.A. Ibrahim and M.M. Ali, 2009. Growth and carcass characteristics of lambs in relation to plasma IGF-1 and some histological traits of *Longissimus dorsi* and *Biceps femoris* as affected by breed and age at slaughter. Journal of Livestock Science, 124, 9-14.

Bassiouni M.I., E.M. Abd El-Raouf, and M.K. Mohsen, 2000. Performance of growing buffalo calves supplemented with fishmeal or soybean and/or molasses. Proc.3rd all Africa conf. Anim. Agric. &11th conf. Egyptian Soc. Anim. prod., Alexandria. Egypt, 6-9 November, 229-236.

Bendary M.M., I. A. Abu-Selim, M.R.M. Moutafa, A. M. Mahmoud and A.E.M. Khinizy, 1994. Performance of fattening Buffalo calves fed different levels of fat for two different Periods. Egyptian Journal of Animal Production, 31:613 - 626.

Block S.S., J.M. Smith, R.A. Ehrhardt, R. P. Diaz, M. E. Rhoads, M. E. Amburgh and Y. R. Boisclair, 2003. Nutritional and developmental regulation of plasma Leptin in dairy cattle. Journal of Dairy Science, 86: 3206–3214.

Brandt M. M., D. H. Keisler, D. L. Meyer, T. B. Schmidt and E. P. Berg, 2007. Serum hormone concentrations relative to carcass composition of a random allotment of commercial-fed beef cattle. Journal of Animal Science, 85:267-275.

Chilliard Y., C. Delavaud and M. Bonnet, 2005. Leptin expression in ruminants: nutritional and physiological regulations in relation with energy metabolism. Journal of Domestic Animal Endocrinology., 29: 3-22.

CIE (Commission International de l'E´clariage), 1976. official recommendations on uniform colour spaces. Colour difference equations and metric colour terms, Suppl. No. 2. CIE Publication No. 15 Colourimetry, Paris.

Connor E. E., S. M. Barao, A. S. Kimrey, A. B. Parlier, L. W. Douglass and G. E. Dahl, 2000. Predicting growth in Angus bulls: the use of GHRH challenge, insulin-like growth factor-I, and insulin-like growth factor binding proteins. Journal of Animal Science, 78:2913-2918.

Cronje P.B., 2002. Ruminant physiology, digestion, metabolism, growth and reproduction. CABI, USA, P 178-202.

Daix M., C. Pirotte, J.L. Bister, F. Wergifosse, C. Cuvelier, J.F. Cabaraux, N. Kirschvink, L. Istasse and R. Paquay, 2008. Relationship between leptin content, metabolic hormones and fat deposition in three beef cattle breeds. The Veterinary Journal, 177: 273-278.

El-Ashry M. A., A. Z. El-Basiony, H.S. Soliman and H.M. El-Sayed, 1996. Effect of feeding inedible wheat flour and pasta industry waste in combination with broiler on the performance and blood serum parameters of buffalo calves. Egyptian Journal of Animal Production, 41: 91-102.

El-Bedawy T. M., I. A. Gommaa, S. M. Allam and F. M. Abo-Donia, 2004. Production of calcium salts of fatty acid from soap-stock on semi industrial scale and its use in finishing rations of Frisian bulls. Egyptian Journal of Animal Production, 41: 61 -71.

El-Bedawy T.M., M.A.I. Salem and E.A. Bader, 1996. Effect of dietary fat on growth performance and carcass characteristics of finishing bulls. Egyptian journal of Animal Production, 3: 103-111.

El-Naggar A. S. A, 1998. Metabolic profile and hormones in blood of buffaloes and cattle in relation to growth patterns. Ph.D. Thesis. Faculty of Agriculture, Cairo University, Egypt.

Fryburg D. A. 1994. Insulin-like growth factor I exerts growth hormone and insulin-like actions on human muscle protein metabolism. Journal of Animal Physiology, 267: 331-336.

Garcia M. R., M. Amstalden, C. D. Morrison, D. H. Keisler and G. L. Williams, 2003. Age at puberty, total fat and conjugated linoleic acid content of carcass, and circulating metabolic hormones in beef heifers fed a diet high in linoleic acid beginning at four months of age. Journal of Animal science, 81:261-268.

Gassman K. J., D. C. Beitz, F. C. Parrish and A. Trenkle, 2000. Effects of feeding calcium salts of conjugated linoleic acid to finishing steers. Journal of Animal Science, 78(Suppl. 1):275–276. (Abstr.)

Gigli S., A. Carreta, S. Failla and F. Napolitano, 1993. Meat production in Italian male buffaloes reared with two nutritive levels and slaughtered at 4 different ages. IN VITA performance carcass characteristics and meat quality. Prospects of buffalo production in the Mediterranean and the Middle East European Ass. Journal of Animal Production. No.62, p. 124.

Gillis M. H., S. K. Duckett, J. R. Sackmann, C. E. Realini, D. H. Keisler and T. D. Pringle, 2004. Effects of supplemental rumen-protected conjugated linoleic

acid or linoleic acid on feedlot performance, carcass quality, and leptin concentrations in beef cattle. Journal of Animal science, 82:851-859.

Hess B. W., G. E. Moss and D. C. Rule, 2008. A decade of developments in the area of fat supplementation research with beef cattle and sheep. Journal of Animal Science, 86:188-204.

Jenkins T.C. and D. L. Palmquist. 1984, Effect of fatty acids or calcium soaps on rumen or total nutrition digestibility of dairy rations. Journal of Dairy Science,. 67:971.

Kawakita Y., H. Abe, K. Hodate, A. Iguchi, M. Kobayashi, T. Mori, K. Kasai, Y. Tanai, Y. Kanbe, H. Mashiyama, T. Asadaand and T. Miyashige, 2001. The relation between plasma leptin concentrations and carcass lipid contents in Japanese Black steers. Journal of Livestock Production Science, 73: 25–34.

Lee C. Y., D. M. Henricks, G. C. Skelley and L. W. Grimes, 1990. Growth and hormonal response of intact and castrate male cattle to trenbolone acetate and estradiol. Journal of Animal Science, 68:2682–2689.

Leon H.V., J. Hernandez-Ceron, D.H. Keisler and C.G. Gutierrez, 2004. Plasma concentration of leptin, insulin-like growth factor-I, and insulin in relation to changes in body condition score in heifers. Journal of Animal Science,82:445-451

Mahmoudzadeh H., H. Fazaeli, I. Kordnejad and H.R. Milzaei, 2007. Response of male buffalo calves to different levels of energy and protein in finishing diets. Journal of Biological Science, 10(9): 1398- 1405.

Mandal A.B., S.S. Paul and N.N. Pathak, 2003. Nutrient requirements and feeding of buffaloes and cattle. International book distributing co, India, 209 pp.

Mcfadin E.L., D.H. Keisler, T.B. Schmidt, C.L. Lorenzen and E.P. Berg, 2003. Correlations between serum concentrations of Leptin and beef carcass composition and quality. Journal of Muscle Foods, 14: 81-87.

Nada S. M. A., 2003. Effect of some feeding regimes on meat production of Buffalo calves. M.Sc. Thesis, Faculty of Agriculture, Cairo University, Egypt.

Nkrumah J. D., D. H. Keisler, D. H. Crews, Jr., J. A. Basarab, Z. Wang, C. Li, M. A. Price, E. K. Okine and S. S. Moore, 2007. Genetic and phenotypic relationships of serum Leptin concentration with performance, efficiency of gain, and carcass merit of feedlot cattle. Journal of Animal Science, 85:2147-2155.

Nour El-Din A.N.M., S.Z. El-Zarkouny, H. Ghobashy, E.I. Abdel-Gawad and D.J. Kesler, 2009. Growth, haematological and biochemical responses of growing lambs injected with growth hormone and supplemented with calcium soaps of fatty acids. South African Journal of Animal Science, 39:65- 68.

NRC, 2000. Nutrient Requirement of beef cattle. National Research Council, National Academy, Seventh Revised Edition: Update 2000.Cited in http://www.nap.edu/catalog/9791.html.

Owens F. N. and B. A. Gardner, 1999. A review of the impact of feedlot management and nutrition on carcass measurements of feedlot cattle. Proceedings of the American Society of Animal Science.1-18.

Ragab M.T., M.Y.H. Darwish and A.G.A. Malek, 1966. Meat production from Egyptian buffaloes, 1- developmental changes and dressing percentage in a group of buffalo males. Journal of Animal Production. U.A.R., 6: 9-30.

Rehfeldt, C; I. Fieder, and N. C. Stickland, 2004. Number and size of muscle fibres in Relation to Meat Production. In: "Muscle development of livestock animals" (Te Pas, M.F.W.; Everts, M.E. and Haagsman, H.P.), CABI, USA, pp: 1- 32.

Sami A.S. 2001. Performance of fattening bulls fed diets supplemented with protected fat. Ph.D. Thesis, Faculty of Agriculture, Cairo University, Egypt.

Shackelford S.D., T.L. Wheeler and M. Koohmaraie, 1999. Tenderness classification of beef: ii. Design and analysis of a system to measure beef *Longissimus* shear force under commercial processing conditions. Journal of Animal Science, 77:1474-1481.

Shimizu M., C. Webster, D.O. Morgan, H.M. Blau and R.A. Roth. 1986. Insulin and insulin like growth factor receptors and response in cultured human cells. American Journal of Physiology, 251: 611-615.

Squires E. J. 2003. Applied animal endocrinology. CABI, USA, 230 pp.

Te-Pas M.F.W., M.E. Everts and H.P. Haagsman. 2004. Muscle development of livestock animals, CABI, USA, 399 pp.

Thomas M.G., R.M. Enns, D.M. Hallford, D.H. Keisler, B.S. Obeidat, C.D. Morrison, J.A. Hernandez, W.D. Bryant, R. Flores, R. Lopez and L. Narro. 2002. Relationships of metabolic hormones and serum glucose to growth and reproductive development in performance-tested Angus, Brangus, and Brahman Bulls. Journal of Animal science, 80: 757-767.

Tokuda T.; E.A. Orden, A.N. Barrio, R.M. Lapitan, C. Delavaud, Y. Chilliard, T. Fujihara, L.C. Cruz, H. Homma and Y. Kanai. 2007. Effects of species and sex on plasma hormone and metabolite concentrations in crossbred Brahman cattle and crossbred water buffalo. Journal of Livestock Science, 107: 244–252.

Tokuda T. B., C. Delavaud, Y. Chilliard and T. Fujihra. 2008. Plasma Leptin, feed intake and body fat accumulation in fattening castrated male and female lambs. Animal Science Journal, 79:58-67.

Villalobos B. D., I. G. Tornad, G. Shroeder, E. E. Salado, G. Gagliostro, C. Delavaud, Chilliard, Y. and Lacau-Mengido, I. M. 2007. Effect of fat supplementation on leptinLeptin, insulin-like growth factor I, growth hormone, and insulin in cattle. The Canadian Journal of Veterinary Research, 71:218-225.

Wegner, J., P. Huff, P., C. P. Xie, F. C. P., Schneider, F., F. Teuscher, P. S. F., Mir, Z. P. S., Mir, E. C. Z., Kazala, E. C., R. Weselake, R. and K. Ender, K. 2001. Relationship of plasma Leptin concentration to intramuscular fat content in beef from crossbred Wagyu cattle. Candian . Journal of Animal Science, 81: 451–457.

Weniger J., D. Sfeinhauf and G.H. Pahl. 1963. Muscular topography of carcasses. BLV. Verlagsgessellschaft, Muenche, Germany. 143pp.

Williams, G. L. and R. L. Stanko,. 1999. Dietary fats as reproductive nutraceuticals in beef cattle. Proceedings of the American Society of Animal Science, 1-12.

Yilmaz A., M. E. Davis and R. C. M. Simmen, 2004. Estimation of (co)variance components for reproductive traits in Angus beef cattle divergently selected for blood serum IGF-1 concentration. Journal of Animal Science, 82:2285-2292.

Zieb D.A., A.M. Amstalden and G.L. Williams. 2005. Regulatory roles of Leptin in reproduction and metabolism: A comparative review. Domestic Animal Endocrinology, 29: 166–185.

معدل النمو ، تركيزهرمون اللبتين و عامل النمو شبيه الانسولين- I ، صفات الذبيحة واللحم لعجول الجاموس المصرى وعلاقتهم بإضافة الدهن المحمى إلى العليقة.

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اشتملت هذه الدراسة على تجربتين : التجربة الاولى لدراسة منحنى النمو فى ذكور عجول الجاموس المصرى من (٨-٢٤ شهر) ، والثانية لدراسة تاثير اضافة الدهون المحمية على العجول الجاموسى خلال فترة التسمين .

فى التجربة الاولى تم استخدام ١٠ عجول جاموسى نامية (عمر شهور٨) ، بمتوسط وزن البداية ١١٥.٠ ± 4.0 كجم . غذيت على خليط من العلف المركز و قش ارز طبقا لوزن الجسم. تم وزن العجول شهريا لرسم منحنى النمو وحساب متوسط معدل النمو اليومى . ثم جمع عينات الدم كل ثلاث شهور لتقدير تركيز عامل النمو شبيه الانسولين- I وهرمون اللبتين. فى التجربة الثانية تم استخدام ٨ عجول جاموسى بمتوسط وزن (256 كجم) تم تقسيمهم الى مجموعتين متساويتين (كل مجموعة =٤). المجموعة الاولى (ج١) عوملت كمجموعة مقارنة (غذيت طول التجربة على خليط العلف المركز و قش ارز)، بينما المجموعة الثانية (ج٢) تم تغذيتها مثل المجموعة الاولى بالاضافة الى الدهون المحمية (بمتوسط 0.13% من وزن الجسم) :تم حساب متوسط معدلات النمو اليومية، فترة التسمين و الوزن عند نهاية التجربة. تم ذبح الحيوانات على وزن حوالى ٤٠٠ كجم لدراسة صفات الذبيحة وجودة اللحم. تم فصل العضلة العينية (الضلوع ٩، ١٠ و ١١) من الجانب الايسر من الذبيحة لحساب نسبة العظم ، اللحم و الانسجة الدهنية و لدراسة الخصائص الكيميائية والفيزيائية للحم. جمعت عينات الدم شهريا لتقدير تركيز عامل النمو شبيه الانسولين- I و هرمون اللبيتن.اظهرت نتائج التجربة الاولى زيادة وزن الجسم للعجول الجاموسى من ١١٥.٠± ٤.٠ الى ٢.٧±٣٥٧ كجم من عمر ٨ الى 24 شهر.متوسط الزيادة اليومية زاد تدريجيا حتى عمر ٢٣ شهر قبل الانخفاض الى 0.433 كجم (عمر ٢٤). تركيز IGF-1 زاد من ٢.٨±٤١.٠ الى ٣٦٨.٠± ١٠.٠ نانو جرام / مل مع تقدم العمرحتى ٢٣ شهر ثم انخفض الى ٢٧٣.٠ ± ٦٣.٠ نانو جرام / مل (عمر ٢٤ شهر). اما متوسط تركيز هرمون اللبتين خلال الفترة من ٨ الى ٢٠ شهر (٣.٤± ٠.٣) ثم ارتفع الى (٥.٠٨±١.٠١) نانو جرام /مل) من ٢٠ الى ٢٤ شهر.

أظهرت نتائج التجربة الثانية أن كلا من وزن الجسم ، متوسط الزيادة اليومية وفترة التسمين كانوا متماثلين فى كل من المجموعتين لتكون ٧.٣±٣٨٥.٠ & ٣.٦±٣٩٥.٥ كجم ;٠.٠١±٠.٥٠٨ & ٠.٠٥٦٤±٣ ٠.٠ كجم و ٢٤٣.٦± ٦ & ٢٥٢.٠± ١١ يوم، بالترتيب. تغذية العجول الجاموسى على الدهون المحمية المضافة إلى الغذاء كان له تاثير غير معنوى على كفاءة التحويل بمتوسط ١٣.١٣± ١.٠٦ و ١١.٨٥± ٠.٤٤ مادة جافة/ كجم زيادة. المتوسط العام لتركيز عامل النمو شبيه الانسولين- I انخفض بمستوى غير معنوى فى ج٢ (٢٥٥.٧ ±٢٩.٠ نانو جرام / مل) عن ج١(٢٠٤.٢ ± ١٧.٠ نانو جرام / مل). بينما مستوى هرمون اللبتن ارتفع بمستوى معنوى (P<0.05) فى ج٢ (٠.٥±٠.٦ نانو جرام / مل) عن ج١ (٣.٩± ٠.٨ نانو جرام / مل).

خصائص الذبيحة أشارت إلى أنه لا توجد فروق معنوية بين المجموعتين فى كلا من وزن الذبيحة الدافئ (6.5± 197.0 & 4.9±197.0 كجم)، نسبة التصافى (0.3±51.17 & 1.14±49.78 %) و نسبة اللحم (0.8± 35.6 & 1.4±38.3 %)، بالترتيب. الخصائص الفيزيائية والكيميائية للعضلة العينية كانت متشابهة فى المجموعتين، فيما عدا نسبة الدهن بين الألياف ارتفعت (P=0.04) فى المجموعة الثانية.

وتخلص الدراسة إلى أن نمو ذكور الجاموس المصرى من عمر٨-٢٤ شهر مرتبط بتركيز كل من عامل النمو شبيه الانسولين-I وهرمون اللبتين فى الدم. إضافة الدهون المحمية الى الغذاء خلال فترة التسمين ليس له تاثير معنوى على النمو و خصائص الذبيحة واللحم.