Egyptian J. Anim. Prod. (1996) 33 (2): 79 -88

RESPONSE OF GROWING BUFFALO CALVES TO FAT CONTAINING RATIONS

T.M. El-Bedawy, Sabbah M. Allam, A.F. El-Kholy and A.K. Basiony

Deptartment of Animal Production, Faculty of Agriculture, University of Cairo, Giza, Egypt

SUMMARY

In 28 week experiment, eighteen weaned, 6-month old buffalo calves were randomly divided into three groups of initial average body weight of 122.2, 128.2 and 128.2 Kg for group 1, 2 and 3, respectively. Three experimental rations were formulated, a control ration contained no fat supplement, ration 2 in which yellow corn was partially replaced on energy basis by dietary fat and ration 3 in which dietary fat was added as a surplus to the control ration. The ether extract percentages were 4.93, 9.41 and 11.80 % for rations 1, 2 and 3, respectively. The used dietary fat was feed grade yellow grease of poultry collected from poultry slaughterhouse.The experimental rations were iso-nitrogenous whereas protein content of the fat containing rations was adjusted by changing the proportions of the ingredients. Control ration and 2 were iso- caloric but ration 3 was formulated to contain more energy by adding surplus dietary fat.

Fat substitution or supplement significantly decreased water intake and had no significant effect on nutrient digestibilities. Calves fed fat containing rations showed higher ($P<0.05$) VFA's concentrations but lower molar percentage of acetate than control. The average daily weight gain (ADG) and feed conversion were better in calves fed fat. The ADG was 648, 701 and 873 g/day; dry matter conversion ratio was 8.085, 7.595 and 6.937; the TDN/ unit gain was 5.135 4.291 and 4.809 and the DCP/gain unit was 646, 598 and 496 g/Kg for calves in groups 1, 2 and 3, respectively.

It was concluded that buffalo calves showed positive response to high fat rations in terms of feed utilization and growth.

Keywords: Buffalo calves, dietary fat, nutrient utilization, growth.

INTRODUCTION

Supplementation of dietary fat to beef cattle rations is now common feeding practices in many countries. In Egypt, pre-weaned buffalo calves are raised on high energy-high-fat diet as buffalo milk contains about 7% fat. If daily milk intake averaged 4 Kg/day, daily fat intake could be about 300 g/day throughout the entire suckling period. In most cases, weaned buffalo calves are raised on low fat starter and forage which almost results in loss of body weight associated with roughened hair and scaly skin. These symptoms could be attributed to deficiency in fat and / or fat soluble vitamins like vitamin A .

Deuel (1955) reported that when high-fat diets are consumed over an extended period, animals established a definite enzyme patterns to utilize fat as non specific source of energy. Therefore, the hypothesis tested in this study was that the previously adapted pre-weaned buffalo calves for high milk fat intake, can efficiently utilize high dietary fat as a non-specific source of energy post-weaning.

The objectives of the present study were to compare fat and carbohydrate as source of energy in iso- caloric rations and to evaluate the effect of feeding surplus dietary fat on growth performance and nutrient utilization of post-weaned buffalo calves.

MATERIALS AND METHODS

Eighteen weaned, 6-month old buffalo calves were randomly divided into three groups of initial average body weight of 122.2, 128.2 and 128.2 Kg for group 1, 2 and 3, respectively. Animals were fed one of three rations: control, fat substituted ration or fat supplemented ration.

Control ration was formulated according to the allowance of Ghoneim (1967). Yellow corn in the control ration was partially substituted by dietary fat on energy basis in ration 2 to compare fat versus carbohydrate as a source of energy for growth of buffalo calves. Moreover, fat was added as a surplus to the control ration DM in ration 3 to evaluate the effect of increasing energy intake from fat on the growth performance and nutrient utilization by post-weaned buffalo calves (Table 1).

Feed grade yellow grease extracted from the processing of poultry in the slaughterhouse was used in the present experiment. Protein content of the fat containing rations was adjusted by changing the proportions of the ingredients. The three rations were formulated to be iso-nitrogenous and rations 1 and 2 were calculated to be iso- caloric but ration 3 was formulated to have more energy due to fat supplement. The calculated TDN and DCP values of the experimental rations are shown in Table 1.

Feed and chemical composition of the experimental rations are presented in Table 1. Total intake was biweekly adjusted to the increase in body weight according to the allowance of Ghoneim (1967). Average dry matter and water intakes are shown in Table 2.

Animals were fed individually twice daily at 8.00 am and 3:00 p.m. Water was available during day time. Water intake was measured once a week for all animals.

Calves were weighed once a week during an experimental period of 196 days (28 weeks) before morning feeding and body weight gain was recorded.

Digestion trial, rumen fluid sampling and blood sampling were carried out at the end of the experimental period. Fecal samples were collected from the rectum three times per day from all animals for successive 7 days for the determination of nutrient digestibilities by the acid insoluble ash (AIA) method according to Van Keulen and Young (1977). Chemical composition of feed and feces were determined according to A.O.A.C. (1984) methods.

Rumen samples were collected using stomach tube from all animals before and 4 h after feeding to determine ruminal pH, total VFA's concentration (Kromann *et al.*, 1967), ammonia- nitrogen concentration (Conway 1963) and molar proportions of VFA's (Erwin *et al.*, 1961).

Blood samples were withdrawn from the left jugular vein of all animals before and 4 h post-feeding in heparinized tubes being spent at 5.000 rpm. Plasma total lipids, triglycerides and cholesterol were determined according to Schalm *et al.* (1975).

Data collected were statistically analyzed as one-way analysis of variance (SAS 1990) according the following model:

$$X = \mu + X_i + E_{ij}$$

where i= 1-3, 1, control, 2 fat substitution and 3 fat supplementation. Significant differences among treatment means were detected using Duncan's procedure.

RESULTS AND DISCUSSION

Fat substitution allowed to use high proportion of berseem hay in ration 2 (28.48%) than the control (18.26%) and to reduce the proportion of corn from 45.46% to 19.62%. Proportion of concentrate feed mixture which consisted of about 70% cereal by-product was increased from 36.26% to 46.71% to adjust the crude protein content of ration 2. The differences in feed formulation and chemical composition between ration 3 and control was due to supplementary fat addition. Crude protein was 15.54, 16.84 and 14.40% of ration dry matter for rations 1, 2 and 3, respectively. The corresponding ether extract percentages were 4.93, 9.41 and 11.80. The higher CF and ash but lower NFE contents in ration 2 were related to its high berseem hay content (Table 1).

Table 1. Formulation and chemical composition of the experimental rations

Item	Control	Fat substitution	Fat supplement
Ingredients, %			
Berseem hay	18.26	28.48	16.98
Concentrate feed mix.	36.28	46.71	33.44
Yellow corn	45.46	19.62	42.51
Grease	0.00	5.19	7.07
Chemical composition, %			
DM,%	86.97	86.89	87.82
DM composition, %			
OM	90.83	88.33	91.49
CF	14.04	17.69	13.02
EE	4.93	9.41	11.80
CP	15.54	16.84	14.40
NFE	56.32	44.39	52.27
Ash	9.17	11.67	8.51

Daily dry matter and water intakes are shown in Table 2. Calves fed fat substituted rations ate less yellow corn but higher berseem hay and concentrate feed mixture than the control. However, the intake from yellow corn and total DM by group 3 were higher than control or group 1.

Fat substitution or supplement significantly decreased drinking water intake as L/Kg $W^{0.82}$ or L/Kg DM intake (Table 2). The relation between dietary fat and drinking water intake have not been previously studied. However, the lower water intake of fat fed calves could be an indirect effect of the low heat increment of fat containing ration.

Table 2. Average dry matter and drinking water intake

Item	Control	Fat substitution	Fat supplement	SE
Dry matter intake, Kg/day				
Berseem hay	0.949	1.520	1.026	-
Concentrate feed mix[1].	1.885	2.491	2.022	-
Yellow corn	2.363	1.045	2.572	-
Vit.-min. premix	0.011	0.010	0.010	-
Grease	0.000	0.277	0.427	-
Total	5.208	5.343	6.057	-
Drinking water intake				
L/h/day	33.75	32.75	31.31	1.12
L/Kg $BW^{0.82}$	0.465^{a}	0.430^{a}	0.384^{b}	0.015
L/Kg DM intake	6.48^{a}	6.13^{a}	5.17^{b}	0.20

a,b Means in the same row having different superscripts differ ($P<0.05$)

1 Concentrate feed mixture composed of 25% undecorticated cotton seed meal, 30 yellow corn, 35% wheat bran, 4% rice bran, 3% molasses, 2% limestone and 1% common salt.

The lower ($P<0.05$) digestibilities of DM and OM of ration 2 than the control or fat supplemented rations could not be attributed to fat substitution but it was a result of the high proportion of hay of relatively lower digestibility of NFE. Digestion of EE, CP and CF did not significantly differ among the experimental rations (Table 3). The low CF digestibility of the experiment rations could be attributed to their low roughage content but it is interesting to note that dietary fat in the present study had no significant effect on fiber digestibility by post-weaned buffalo calves. Bendary *et al.* (1994) found a depression in CF digestibility by feeding ration containing 8.2% EE to elder buffalo bullock weighing 350 Kg. However, Zinn (1992) found no effect of addition of 5% yellow grease on total tract digestion of OM, ADF and starch by beef cattle. Effects of added fat on nutrient digestibilities depend on source and content of fiber in the ration (Davison and Woods 1963; Devendra and Lewis 1974), type and level of fat (Huffman *et al.* 1992; El-Bedawy *et al.* 1994a; Elliot *et al.* 1995). The lower TDN value of ration 2 was due to its lower OM digestibility. No significant difference in DCP content was found among the experimental rations.

The 4 h post-feeding ruminal pH was lower but ammonia-N and VFA's concentrations were higher than before feeding (Table 4). Effect of sampling time on basic pattern of rumen fermentation was much greater than effect of dietary treatments.

Table 3. Nutrient digestibilities and nutritive value of the experimental rations.

Item	Control	Fat substitution	Fat supplement	SE
Digestibility, %				
DM	60.88[a]	51.06[b]	59.84[a]	4.12
OM	63.97[a]	52.09[b]	61.16[a]	3.79
CP	51.38	46.83	49.61	4.98
CF	27.43	29.76	30.20	7.80
EE	87.94	89.09	90.65	1.29
NFE	74.43[a]	55.15[c]	65.38b	2.78
Nutritive value, %				
TDN	63.51[ab]	56.50[b]	69.33[a]	3.53
DCP	7.99	7.88	7.15	0.78

a,b,c Means in the same raw having different superscripts differ (P<0.05)

Table 4. Rumen liquor parameters ofof buffalo calves fed fat containing rations.

Sampling time (h)	Control	Fat substitution	Fat supplement	Mean effect of sampling time
pH (SE=0.07)				
0 time	5.90[bc]	6.10[ab]	6.19[a]	6.06
4 h.	5.75[c]	5.83[c]	5.91[bc]	5.83
Total VFA's ,m. eq. /100 ml (SE=0.37)				
0 time	3.91[c]	6.05[b]	6.38[ab]	5.45
4 h.	4.33[c]	6.44[ab]	7.38[a]	6.05
Ammonia-N, mg/100 ml (SE=0.28)				
0 h.	5.38[b]	5.99[b]	6.12[b]	5.82
4 h.	7.21[a]	7.63[a]	7.08[a]	7.31
Acetate, % (SE= 2.67)				
0 h.	45.25[a]	40.19[ab]	35.38[bc]	40.27
4 h.	39.41[ab]	35.33[bc]	30.51[c]	35.09
Propionate, % (SE=1.36)				
0 h	25.96[c]	30.46[ab]	30.92[ab]	29.11
4 h.	27.61[bc]	33.20[a]	33.99[a]	31.60
Butyrate (SE= 2.03)				
0 h	23.32[ab]	20.11[b]	26.06[ab]	23.16
4 h.	28.56[a]	22.51[ab]	25.72	25.60
Iso-butyrate, % (SE=1.12)				
0 h.	2.17	4.64	5.64	3.82
4 h.	2.88	4.53	3.78	3.73
Valerate, % (SE=0.87)				
0 h	1.59	2.57	2.22	2.12
4 h.	0.76	3.45	4.60	2.94
Iso-valerate (SE=0.44)				
0 h	1.72	1.72	0.60	1.35
4 h.	0.63	0.97	1.39	0.99

a,b,c Means in the same row or column within each parameter having different superscripts differ (P<0.05)

No significant differences between fat substitution and fat supplement in measured rumen parameters were recorded but calves fed fat containing rations (groups 2 and 3) showed higher ($P<0.05$) VFA's concentrations than the control which is in contrary with those reported by White *et al.*(1992), El-Bedawy *et al.* (1994b) and Maiga *et al.* (1995) that fat feeding resulted in minor changes in ruminal pH or concentrations of VFA's and ammonia. Results in Table 4 also showed that molar proportion of acetate decreased but propionate, butyrate and minor ruminal volatile fatty acids increased by feeding fat containing rations specially with fat supplemented ration (group 3). Higher ruminal molar proportions of propionate but lower acetate was found at 4 h post-feeding than that before feeding. White *et al.* (1992) found linear decrease in ruminal acetate and linear increase in propionate with increasing fat level in finishing steer rations.

Plasma total lipids, cholesterol and triglycerides increased by fat feeding specially with the group fed surplus fat. The 4 h post-feeding Concentrations of plasma total lipids and total cholesterol were significantly lower than those before feeding. However, sampling time had no significant effect on plasma triglycerides. El-Bedawy *et al.* (1994a) found no significant differences in before and 4 h post-feeding plasma lipids of sheep fed fat supplemented diets. The higher blood plasma lipids might be due to the inhibition in lipogenic enzyme activities by liver and adipose tissues of animals fed fat containing rations (Storry 1981).

Table 5. Blood plasma lipid constituents of buffalo calves fed the experimental rations.

Item	Control	Fat substitution	Fat supplement	Mean effect of sampling time
Total lipids, g/l (SE= 0.29)				
0 h	2.10d	4.11ab	4.18a	3.64
4 h.	1.53d	3.15c	3.79bc	2.82
Triglycerides , mg/l (SE= 4.29)				
0 h	35.29d	58.82b	77.94a	57.35
4 h.	42.65cd	47.06bcd	54.41ab	48.04
Total cholesterol, mg/l (SE= 5.06)				
0 h	87.12c	140.15b	190.15a	139.14
4 h.	65.91d	101.52c	141.67b	103.03

[a,b,c,d] Means in the same row or column within each parameter having different superscripts differ ($P<0.05$)

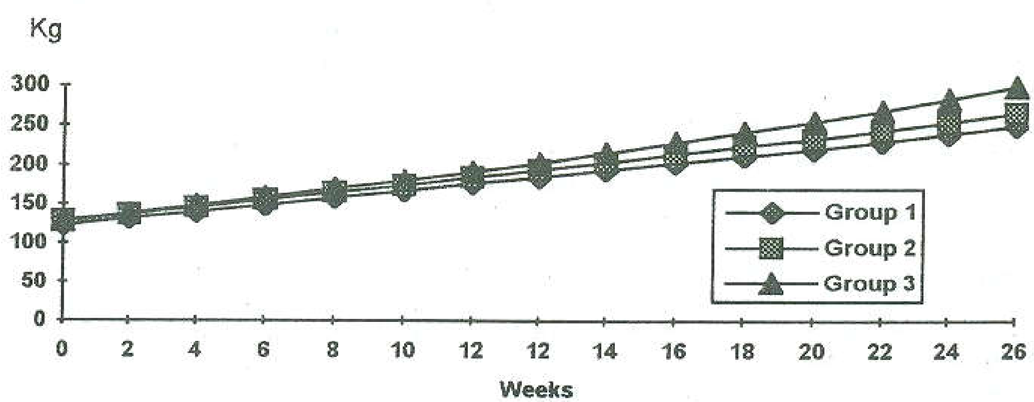
Results in Table 6 showed that the average daily gain in weight (ADG) of calves fed fat supplemented ration (group 3) was higher ($P<0.05$) than that of either control or group 2 and ADG of calves in group 2 tended to be higher than that of control. However, no significant differences were detected in dry matter, TDN and DCP intakes between group 1 and 2. The ADG was 648, 701 and 873 g/day for calves in group 1, 2 and 3, respectively.

Calves in the three groups showed comparable increase in body weight during the early weeks of the experiment, then calves fed fat supplemented ration showed the highest body weight and control group showed the least while calves fed fat substituted ration maintained intermediate body weight (Fig. 1). The TDN intake was comparable between group 1 and group 2 being less than that by group 3. No significant difference was found in DCP intake among the experimental groups (Table 6).

Table 6. Growth performance of buffalo calves fed the experimental rations.

Item	Control	Fat substitution	Fat supplement	SE
No. of calves	6	6	6	
Initial body weight, Kg	122.2	128.2	128.2	8.15
Final body weight, Kg	249.5[b]	265.7[ab]	299.3[a]	13.7
Experimental period (day)	196	196	196	
Gain , Kg	127.3[b]	137.5[b]	171.1[a]	6.5
Average daily gain, g/day	648[b]	701[b]	873[a]	33
DM intake	5.198[b]	5.333[b]	6.048[a]	0.220
TDN intake	3.301[b]	3.013[b]	4.193[a]	0.134
DCP intake	415.3	420.3	432.1	17.3
Feed conversion ratio				
DM	8.085[a]	7.595[a]	6.937[b]	0.19
TDN	5.135[a]	4.291[b]	4.809[a]	0.12
DCP	646[a]	598[b]	496[c]	15

[a,b,c] Means in the same row or column within each parameter having different superscripts differ (P<0.05)



Control: no added fat, 1: fat replacing group, 2: fat supplementation group

Figure 1. Effect of fat replacing or supplementation on the development in body weight of buffalo calves.

Calves in group 2 showed better ($P<0.05$) energy conversion ratio as total TDN required for gain unit. But, DCP conversion ratio was better for group 3 (496 g) than the other two groups (646 and 598 g) which might imply that dietary fat have sparing effect on dietary protein in growing post-weaned buffalo calves. Deuel (1955) reported that the beneficial effects of high fat diets on pregnancy, lactation and possibly on growth can probably be largely, if not entirely, ascribed to the improved caloric efficiency resulting from the associative dynamic effects or the sparing action of fats on certain phases of protein metabolism. However, these functions are not necessarily functions of the essential fatty acids of added fat.

The relatively higher ADG and lower TDN intake and consequently better energy conversion ratio shown by group 2 compared with group 1 (control) might indicate that post-weaned buffalo calves utilized supplementary fat more efficiently than carbohydrates as source of energy probably because of that added fat lowers the heat increment of fat containing ration and hence results in greater energy efficiency for a given calorie intake.

The significant higher ADG associated with the higher TDN intake for group 3 could indicate the positive response in growth and higher potentiality of buffalo calves to high dietary fat as non specific source of energy. This high response could be related to the high fat consumption from suckling milk of 7% fat for 4 month pre-weaning period followed by feeding high fat ration post-weaning. Deuel (1955) reported that some of beneficial effects of fat are undoubtedly to be traced to the establishment of definite enzyme patterns when high fat diets are consumed over an extended period.

REFERENCES

A.O.A.C., 1984. Association of Official Analytical Chemists. Official Methods of Analysis. 14 th ed. Assoc. Offic. Anal. Chem., Washington, D.C.

Bendary, M.M., I.A. Abou-Selim, M.R.M. Moustafa, A.M. Mahmoud and A.E.M. Khinizy, 1994. Performance of fattening buffalo calves fed different levels of fat for two different periods. Egypt. J. Anim. Prod., 31(Suppl.): 613-626.

Conway, E.J., 1963. Microdiffusion Analysis and Volumetric Error, pp 90-101. London: Crosby Lockwood & Son.

Davison, K.L. and W. Woods, 1963. Effect of calcium and magnesium upon digestibility of a ration containing corn oil. J. Anim. Sc. 22:27.

Deuel, H.J., 1955. "Fat as a Required Nutrient of the Diet," Proc. Fed. Am. Soc. for Exp. Biol., XIV, no. 2: 639.

Devendra, C. and D. Lewis, 1974. The interaction between dietary lipids and fiber in sheep. Anim. Prod. 13:67.

El-Bedawy, T.M., A.M. Abd El-Gawad, M.A. Gabra and F.A. Scander, 1994b. Full fat sunflower seeds or oil as fat supplement for dairy cows. Egypt. J. Anim. Prod., 31(Suppl.): 147-160.

El-Bedawy, T.M., H.M. El-Husseini, Sabbah M. Allam and F.H. Shahin, 1994a. Effect of dietary fat and calcium supplements on *in vivo* digestibility, rumen fermentation and some blood constituents of sheep. Egypt. J. Anim. Prod., 31(Suppl.): 59-73.

Elliott, J.P., J.K. Drackley, G.C, Fahey and R.D. Shanks, 1995. Utilization of supplemental fat by dairy cows fed diets varying in content of nonstructural carbohydrates. J. Dairy Sci. 78:1512.

Erwin, E.S., G.J. Marco and E.M. Emery, 1961. Volatile fatty acids analysis of blood and rumen fluid by gas chromatography. J. Dairy Sci. 44:1788.

Ghoneim, A., 1967. "Animal Nutrition". Arabic Textbook. Anglo-Egyptian Book Store, Cairo, Egypt.

Huffman R.P., R.A. Stock, M.H. Sindt and D.H. Shain, 1992. Effect of fat type and forage level on performance of finishing cattle. J. Anim. Sci. 70:3889.

Kromann, R.P., J.H. Meyer and W.J. Stielu, 1967. Steam distillation of volatile fatty acids in rumen ingesta. J. Dairy Sci. 50:73.

Maiga, H.A., D.J. Schingoethe and F.C. Ludens,1995. Evaluation of diets containing supplemental fat with different sources of carbohydrates for lactating dairy cows. J. Dairy Sci. 78:1122.

SAS, 1990. SAS User's guide: Statistics. SAS Inst., Inc., Cary NC.

Schalm, O.W., N.C. Jain and E.J. Corroll, 1975. "Veterinary Hematology". 3 rd Ed., Lea & Febiger, Philadelphia, USA.

Storry, J.E., 1981. The effect of dietary fat on milk composition. Recent Advances in Animal Nutrition (W. Haresign, Ed.) pp 3-33. Butterworths, Woburn, MA.

Van Keulen, J. and A. Young, 1977. Evaluation of acid-insoluble ash as a natural marker in ruminant digestibility studies. J. Anim. Sci. 44:282.

White, T.W., L.D. Bunting, L.S. Sticker, F.H. Hembry and A.M. Saxton, 1992. Influence of fish meal and supplemental fat on performance of finishing steers exposed to moderate or high ambient temperature. J. Anim. Sci., 70: 3286.

Zinn, R.A.,1992. Comparative feeding value of supplemental fat in steam-flaked corn and steam-flaked wheat-based finishing diets for feedlot steers. J. Anim. Sci.:70:2959.

إستجابة عجول الجاموس النامية للتغذية على العلائق المحتوية على دهون

طه محمد البداوى، صباح محمود علام ، أحمد فريد الخولى وأحمد كمال بسيونى

قسم الإنتاج الحيوانى، كلية الزراعة، جامعة القاهرة، الجيزة ، مصر

فى تجربة استمرت لمدة لمدة ٢٨ أسبوع لدراسة استجابة العجول الجاموسى لاضافة الدهـون فـى العليقـة ، وزعت فيها ثمانية عشر عجل جاموس عمرها سته اشـهر عشـوائيا الـى ثـلاث مجموعـات متوسـط أوزانهـا الإبتدائية ١٢٢,٢، ١٢٨,٢ ، ١٢٨,٢ كجم للمجموعة الإولى والثانية و الثالثة على الـترتيب. كمـا تـم تكوين ثلاث علائق الأولى لاتحتوى على دهن إضافى (الكنترول) والعليقة الثانية استبدل جـزء مـن الـذرة الصفـراء بالدهن على اساس الطاقة وفى الثالثـة أضيف الدهن زيـادة عـن مكونـات عليقـة الكنـترول. وكـان الدهـن المستخدم فى هذه الدراسة شحوم صفراء (درجة غذاء حيوانـى) مستخلص مـن مخلفـات مجـازر الدواجـن. وقدر محتوى العلائق الثلاث من مستخلص الإثير فكان ٤,٩٣، ٩,٤١، ١١,٨٠٪ على أساس المادة الجافة

وقد تم ضبط نسبة البروتين فى العلائق الثلاث لتكون متساوية فى البروتين بالتغير فى نسـب مـواد العلـف. ومن ناحية الطاقة فإن عليقة الكنترول و العليقة الثانية كانتا متساويتان فـى الطاقـة أمـا العليقـة الثالثـة فكـان محتواها من الطاقة أعلى بسبب زيادة بنسبة الدهن المضـاف.

وأوضحت النتائج ان أحلال الدهن جزئيا محل الذرة على أساس الطاقة أو إضافة زيادة من الدهن لـم يؤثـر معنويا على معاملات هضم المركبات الغذائية . وقد اظهـرت العجـول المغـذاة علـى العلائـق المحتويـة علـى دهون تركيزات أعلى من الأحماض الدهنية الطيارة فى الكرش مع إنخفاض فى نسبة الأستيات.

كما أوضحت النتائج أيضا أن معدل الزيادة اليومية فى الوزن وكفاءة التحويل الغذائى كانتا أفضـل للعجـول المغذاة على العلائق المحتوية على الدهن، فكان معدل الزيادة اليوميـة ٦٤٨، ٧٠١، ٨٧٣ جـم يوميـا ومعـدل التحويل الغذائى ٨,٠٨٥، ٧,٥٩٥ ، ٦,٩٣٧ كجم مادة جافة مأكولة لكل كجم زيـادة فـى الـوزن وهـى تقـابل ٥,١٣٥، ٤,٢٩١، ٤,٨٠٩ كجم مركبات غذائية مهضومة كلية لكل كجم زيادة فى الوزن، بينمـا بلـغ معـدل تحويل البروتين الخام المهضوم ٦٤٦، ٥٩٨، ٤٩٦ جـم لكـل كجـم زيـادة فـى الـوزن فـى المجموعـة الأولـى والثانية والثالثة على الترتيب. وقد استنتج من نتائج هذه الدراسـة أن اسـتجابة العجـول الجاموسـى فـى هـذه المرحلة العمرية للتغذية على علائق عالية الدهن جيدة من حيث الإستفادة الغذائية والنمو.