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Effect of Inclusion of Alfalfa Cubes Hay as a Main Source of Protein in Buffalo Calves Diet

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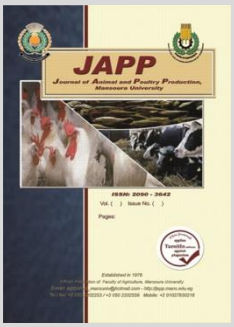

ABSTRACT

This study was conducted to evaluate the possibility of using alfalfa cubes hay (ACH) as a protein source in the buffalo calves diet for replacing cotton seed meal (CSM) through growth and finishing periods. Twenty male calves weighting 276±9.24Kg were divided into two similar groups (ten calves each) using randomized complete block design. The growing period extended to 85 – d, which the control group (CSM - diet) was fed the concentrate feed mixture (CFM) including CSM as a source of protein and rice straw ad lib. The tested group (ACH - diet) was fed the same diet with replacing CSM by ACH. While, the finishing period lasted for 45 – d, where animals in both groups were fed a high energy diet by adding maize grains. All diets formulated to be an isonitrogenous and isocaloric state. During the growing period, results indicated that the most nutrients digestibilities were significantly (P≤0.05) higher and NFE digestibility was significantly (P≤0.05) lower in ACH - diet. While, there was insignificant difference in EE digestibility between them. While during the finishing period, there were insignificant differences among groups in most nutrients digestibilities, except EE and NFE digestibility were significant (P≤0.05) higher with ACH - diet. During the whole experimental period, growth performance and some blood parameters were insignificantly affected by replacing. Economic efficiency of calves fed ACH – diet was better compared with CSM – diet. It could be concluded that the ACH could be used successfully and economically as a main protein source in the calves' diet.

Keywords: Alfalfa cubic, cottonseed mail, buffalo calves, digestibility, daily gain, economic efficiency.

INTRODUCTION

Dietary protein sources or its supplementation in livestock diets play an effective role in enhancing productive performance and economic profits (Karlsson and Martinsson, 2011 and Xu *et al.*, 2017). It is well known that, cotton seed meal is a main source of protein that commonly used for formulating the diets of ruminants and might be leading relatively increasing the cost of feeding (Osti and Pandey, 2006). Due to the high cost of conventional feed, nutritionists have been forced to search about protein sources alternatives to formulate the cost effective rations, especially those drived from leguminous forage species. So, the sources of high -quality roughage can play a vital role in the ruminant's diet and affect positively on palatability and digestibility of the diet (Chriyaa *et al.*, 1997 and Booth, 2003), thereby reducing production costs, (Ben Salem *et al.*, 2004), and improving the stability of production systems (Roggero *et al.*, 1996). Cubic or pelleted Alfalfa hay is one of the inexpensive sources of protein and could be performed better than those of oilseed meals in ruminants diet (Cochran *et al.*, 1986; DelCurto *et al.*, 1990a) and also improved growth rate and maintain animals health (Waghorn *et al.*, 2012). Moreover, alfalfa hay is characterized by very palatable taste, high crude protein, and excellent source of both vital minerals and vitamins content which enhancement the utilization of animals diets (McDonald *et al.*, 2011 and He *et al.*, 2017), and additionally it also has considered a good energy content compared with other forage species (Zhu *et al.*, 2013 and Alhidary *et al.*, 2016). Several published studies have shown that feeding alfalfa hay can enhance the DMI and DM digestibility (Burns and Fisher, 2013) and improve the performance of lactating dairy cows' (Zhu *et al.*, 2013). On the other hand, scientists in the literature, have been reported that physical treatments (either chopping, grinding or pelleting) are considered as an effective method to improving DMI, nutrients digestibilities and daily gain of cattle (Sundstol *et al.*, 1978; Berger *et al.*, 1994 and Yang and Beauchemin, 2005), and consequently improving ruminants production compared to the non - pelleted form alfalfa hay (Ishaq *et al.*, 2019).

Data on use of alfalfa cubic hay as a protein source in ruminant diets is scarce, therefore the purpose of this study was to assess the effect of use of alfalfa hay cubic as a major protein source in substitution of cottonseed meal on feed intake, nutrient digestibility, some blood parameters, growth performance and economical efficiency of growing and finishing buffalo calves.

MATERIALS AND METHODS

This research work was carried out at Al- Qanater Al- Khairia, Animal Production Station, that belonging to the Production Sector, Agriculture Research Center, Ministry of Agriculture, Kaluabeya Governorate, Egypt. A feeding trial was carried out to study the effect of alfalfa

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cubes hay (ACH) as a replacement with cotton seed meal (CSM) as a protein source in the diet of buffalo calves on their productive performance during growing and finishing period.

Animals and diets

Twenty buffalo male calves with an average 276±9.24Kg live body weight (LBW) and aged 18 months were divided into two similar groups (ten calves each) according to their live body weight using randomized complete block design, in which animals were fed by individual feeding regimen. The feeding trial was consisted of two periods, the first period was designed to be considered as a growing period that continued for 85 – days, where the control group (CSM - diet) was fed the conventional concentrate feed mixture (CFM) that including 35% CSM as a main source of protein and given to calves at 2% of their live body weight (LBW), according to Shehata standards (1970), plus rice straw as a sole roughage which fed *ad libitum* level. While the tested group (ACH- diet) was fed the same diet but including 33% alfalfa cubes in replacing to CSM as a main source of protein. The second period was assigned for the finishing period lasted for 45 – days, where the animals on both groups were fed on a high energy diet that fortified with certain percent of maize grains with a shift in components of concentrate feed mixture as well as alfalfa cubic hay in substitution of cottonseed meal shown in Table 2. Over the whole experiment period, the experimental diets were formulated to be an isonitrogenous and isocaloric state.

Calves were weighted over 2 consecutive days at the beginning and the end of the trial and biweekly after overnight withdrawal period of feed and water during the whole experimental. The amounts of offered concentrate and rice straw were changed biweekly according to body weight adjustment. During the feeding trial, amount of feeds and its residues for each calf, were recorded daily to determine the actual amount of feed consumed. Water and mineral blocks were freely available. All calves were vaccinated and treated in accordance of the established routine of the feedlot and also they were injected with vitamins AD3E to cover their optimal requirements.

Digestibility trials

Two in vivo digestibility trials were conducted with mature rams (three for each) to evaluate the digestion coefficients and feeding values of the growing diets.

Animals were placed in metabolic cages and weight at the start and end of each trial. Each trial lasted 21-days including 14- days as preliminary period followed by 7-days as collection one. The same feeding regime management during the growing period of buffalo calves was also used in the digestibility trial. Water was available continuously. Over the collection period, daily amounts of feed consumed of each animal and residue were accurately weighed and recorded. Meanwhile, feces were quantitatively collected once a day before feeding weighed and recorded. Representative sample of feed and feces were taken daily and immediately frozen at – 30 ºC. At the end of the collection period, a composite sample of feed and feces from each ram were prepared and dried in a drying oven at 60 ºC for 48 hrs and then grinding and stored in suitable jar for proximate analysis. Also, digestibility trials of the finishing period were conducted to determine digestion coefficient and feeding values of the finishing diets. The same procedures of the pervious digestibility trails of growing period were conducted.

Blood samples

Blood samples from the jugular vein were taken once from three calves in each group before feeding in the morning at the end of the growing and finishing stages and these samples were instantly centrifuged at 4000 rpm for 20 minutes. Blood serum was separated and stored at -25°C until the time of chemical analysis determined.

Laboratorial Analysis

Feeds and feces samples were taken and dried at 70oC for 24 hrs, grounded to 1mm screen and chemical composition determined according to (AOAC 2000).

Blood serum was separated from the whole blood to determine some blood serum parameters using commercial kits of Bio-Merieus, Lab, France, following the same steps described by manufactories as the total protein, according to Armstrong and Carr (1964), albumin was analyzed according to Doumas (1971) and globulin was calculated by subtracting the albumin value from total protein one. The activities of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) were analyzed according to Reitman and Frankal, (1957).

Statistical analysis

All data were analyzed using the general linear models producer of SAS (2003). The model used was $Y_{iJ} = \mu + T_i + E_{iJ}$ Where: Y_{iJ} = the observation of the parameter measured, μ = the overall means, T_i = the effect of dietary treatment, E_{iJ} = the experimental random error. Treatments means indicating significant differences ($P<0.05$) were testing using T test.

RESULTS AND DISCUSSION

Chemical composition of the ingredients and diets:

Chemical compositions of the experimental ingredients and diets (on DM basis) are presented in Table (1 and 2). The ACH in this study had a higher contents of CF and ash and pronounced lower contents of EE and NFE when compared with those of CSM while CP content was slightly lower in ACH than that of CSM. The values for ACH were 85.20, 21.78, 2.31, 30.69 and 30.50%, for OM, CP, EE, CF and NFE, respectively versus 92.37, 24.72, 3.84, 21.72, and 42.09% for the CSM. Evidently, the ACH was considerable performed as a good protein source (21.78% CP %) for all ruminant animals rations in corresponding to that depending on most oil seed cake like CSM (24.72% CP%). In comparisons with the previous studies Cochran *et al.*, (1986) and Hadjipanayiotou and Economides, (1999), they found that CP content in ACH was much higher and closer to the values that listed by NARO, (2010) where CP content in alfalfa hay has been recorded between 19.1% and 21.8%. According to Sunagawa *et al.*, (2015) the chemical composition of cubic alfalfa hay showed that values of DM, CP, EE and CF were 86.30, 15.40, 2.40 and 26.50%, respectively. While, Ishaq *et al.*, (2019) reported that the content of CP in pelleted alfalfa hay was 20% vs. 16% for long stem alfalfa hay. Whereas, the long stem alfalfa hay, dehydrated alfalfa pellets and sun-cured alfalfa pellets had a crude protein content of about 20.1, 20.9 and 20.6 % on DM basis, respectively (lintzenich *et al.*, 1995). On the other hand,

these results appeared that the chemical compositions of CSM are within the wide range obtained by (CLFF, 2001).

Table 1. Chemical composition of feed ingredients (% on DM basis).

Feedstuff	Chemical composition, %					
	OM	CP	EE	CF	NFE	Ash
Maize grain	96.89	8.67	4.65	4.43	79.36	3.11
Wheat bran	92.57	13.58	3.32	11.01	64.66	7.43
Cotton seed meal	92.37	24.72	3.84	21.72	42.09	7.63
Alfalfa cubic hay	85.20	21.78	2.31	30.69	30.50	14.80
Rice straw	85.38	4.83	1.20	39.61	39.74	14.62

The chemical composition of the experimental diets (calculated) during growing and finishing periods are presented in Table (2). During the growing period, CP content showed a slight difference between the two diets, because of the adjustment of CP to be in an isonitrogenous state according to the design of the experiment. According to NRC (2000), the CP requirement for growing beef cattle to achieve the optimal growth (ADG) is approximately about 13.8% on DM basis. Although, the CP was slightly higher with CSM- diet than that of ACH- diet, but both values were higher than that required to support acceptable ruminal microbial activity and the maintenance requirement for protein of the host ruminant (McDonald *et al.* 2002). Also, these data revealed that the substitution of CSM by ACH in buffalo diets would be associated with a higher proportion of CF in the ACH- diet (15.60%) than that of CSM one (12.30%). Moreover, the NFE content was slightly decreased in tested diet compared with that of control one (CSM- diet). While, during the finishing period, a slightly differences respecting the contents of DM, OM, CP, EE, CF and NFE were recorded between the two diets. Also, the content of CF tended to be decreases in the two diets after fortified with certain amount of maize grain and reduced the content of ACH in the formula of CFM. As the experimental planned dietary treatments to be perform as an isocaloric and isonitrogenous during the growing and finishing periods, therefore the CP and NFE contents are appeared to be comparable.

Nutrients digestibility and feeding values

Data of digestion coefficients and feeding values of the experimental diets during growing and finishing periods are presented in Table 3. During growing period, results showed that overall digestibilities of DM, OM, CP and CF were significantly (P<0.05) higher but NFE digestibility was significantly (P<0.05) lower in ACH - diet than those of control one (CSM- diet), while the digestibility of EE did not significantly affected by the dietary treatments. The previous study by (Haddad, 2000) pointed out an improvement in digestibility of DM, OM and CP with increasing supplementation of alfalfa hay in Awassi ewes diet by (0, 150, 300, and 450 g) than those of diets that supplemented with 1% urea or the control one.

The present results are favorably in agreement with the findings of Burns and Fisher, (2013) stated that DM digestibility was significantly higher with use of alfalfa hay as a replacement for switch grass as well as protein supplements in steers diet. In contrast, Wang *et al.*, (2019) found that digestibility of DM, DM, CP and EE decreased with increasing the level of alfalfa hay from 15 to 30% as substitution for concentrate feed in the rations of crossbred dry ewes. While, Phillips and Rao, (2001) revealed that digestion coefficients of DM and CP did not significantly affect when using the different protein sources as alfalfa hay pellets or CSM in the rations of lambs. On the other hand, the higher CF digestibility with calves fed the diet included ACH might be due to slower passage rate in the rumen (Van Soest, 1982) and increase cellulolytic activity of rumen microbes (El- Bedawi *et al.*, 1994), and thus this action strong positive relationship with CF digestibility.

The same improvement was obtained by Mostafa *et al*., (2019) who stated that CF digestibility was markedly increased with increasing the CF level in the diets. On the other hand, calves fed CSM- diet recorded a higher EE digestibility than those of ACH- diet without significant differences between them and this might be attributed to the higher dietary EE content in CSM- diet (Palmquist and Conrad, 1978), resulting in limited by the effects on rumen microbial activity and digestibility of CF (Palmquist, 1988).

Table 2. Ingredients and calculated chemical composition of the experimental diets.

Experimental diets				
Phase	**Growing period**		**Finishing period**	
Item	**CSM-diet**	**ACH – diet**	**CSM-diet**	**ACH – diet**
Maize grain	35	40	63	63
Wheat bran	25	22	24	20
CSM	35	0	8	0
ACH	0	33	0	12
Common salt	1	1	1	1
Mineral mixture	1	1	1	1
Limestone	2	2	2	2
Powder yeast	0.7	0.7	0.7	0.7
Sodium bicarbonate	0.3	0.3	0.3	0.3
Rations (% on DM):				
DM	100	100	100	100
OM	90.80	91.30	91.10	90.40
CP	14.20	13.90	10.60	10.10
EE	3.20	2.60	2.70	3.10
CF	12.30	15.60	8.80	8.30
NFE	61.10	59.20	69.00	68.90
Ash	9.20	8.70	8.90	9.60

During the finishing period, results showed that most of the nutrient digestibilities were higher in ACH- diet than those of the CSM- one, but with no significant differences between them, while EE and NFE digestibilities were significantly (P<0.05) higher with ACH - diet than those of CSM - one. Our findings indicated that all nutrients digestibilities were higher in the finishing period compare with those of the growing one. In support to the current results, Sayed, (2009) indicated that nutrient digestibilities were increased with increasing levels of energy in lamb's diet. In another trial, Pesonen *et al.*, (2013) showed that increased the values of digestion coefficients for all feed nutrients, except CF increased with increasing the concentrate feed mixture level in bull's diet. Nevertheless, Rashid *et al.*, (2015) found that the nutrient digestibilities did not affect by increasing concentrate levels when Brahman Crossbred calves fed isonitrogenous diets'. Finally, these favorable findings may be explained by the good-quality ACH that affect positively on rumen environment and consequently increasing the feed utilization efficiency as well as the nutrient digestibilities.

The feeding values (%) of the experimental diets which expressed as TDN and DCP are presented in Table (3). Results demonstrated that the values of TDN and DCP did not significantly affect by the dietary treatments during growing and finishing periods. This greatly might be due to the isonitrogenous and isocaloric state where the experimental diets were formulated according to the experimental design over the two experimental phases.

Table 3. Nutrients digestibility and feeding values of the experimental diets.

	Experimental diets			
Phase	**Growing period**		**Finishing period**	
Item	**CSM- diet**	**ACH –diet**	**CSM- diet**	**ACH –diet**
Digestion coefficients (%):				
DM	67.00^{b}±0.34	71.84^{a} ±0.95	72.53±1.25	74.56±0.81
OM	70.30^{b}± 0.45	75.32^{a}±0.65	76.42±0.67	77.21±0.54
CP	69.41^{b}± 0.45	73.21^{a}±0.34	72.86±0.55	73.96±1.18
EE	76.42 ±0.15	74.67±0.98	73.78^{b}±0.34	76.53^{a}±0.12
CF	65.38^{b}± 0.23	67.45^{a}±0.85	69.45±1.10	68.45±0.98
NFE	68.74^{a}± 0.75	66.56^{b}± 0.14	73.52^{b}±0.17	76.43^{a}±0.63
Feeding values (%):				
TDN	65.40±1.02	64.47±0.62	69.04±1.14	71.15±0.60
DCP	9.86±0.33	10.18±0.12	7.72±0.21	7.47±0.54

a ,b and c Means in the same row with different superscripts differ (P<0.05).

Productive performance:

Data of daily feed intake, total live body gain, daily gain and feed conversion ratio of calves fed the experimental diets during the growing and the finishing periods are presented in Table (4).

Feed intake and Feed conversion:

Data in Table (4) showed that daily DMI, TDNI and DCPI of the calves fed CSM - diet were slightly higher compared with those fed ACH - diet during the growing, finishing and whole periods, with no significantly differences between them. On underlying Ahmad *et al.*, (2002) demonstrated that the differences in DMI may be related to the age and size of animals as well as nutritional management and environmental conditions. Definitely, Sarwar *et al.*, (1991) reported that an inverse relationship among dry mater intake and the digestibility value of any feed for cattle. Also, the slightly lower DMI with calves fed ACH - diet during growing period might be due to high crude fiber content that could be reduces the rate of digesta passage and in turn increases the retention time, thereby reducing feed intake as concluded by (Van Soest, 1994 and McDonald *et al.*, 2011). The present results are in agreements with those recorded by many investigates who worked with alfalfa hay, where Phillips and Rao, (2001) stated that inclusion of alfalfa hay pellets or CSM as protein source of the lamb's diet had no effect on daily dry matter intake. Also, similar results were obtained, when using alfalfa hay instead of concentrate feed mixture in the rations of both dry ewe or Chinese Simmental calves (Kobayashi *et al.*, 2017 and Wang *et al.*, 2019). Otherwise, these results are in disagreement with the findings obtained by DelCurto *et al*., (1990b) who reported that dehydrated alfalfa pellets as supplemental protein sources for beef cattle consuming tall grass – prairie forage had positive effect on DMI in comparison with those fed long-stem alfalfa hay or soybean meal/sorghum grain as supplement ones. Also, other authors have reported an improvement of DMI with alfalfa hay as a source of protein supplementation for steers diet (Burns and Fisher, 2013), or when increasing the level of alfalfa hay in growing lambs diet (Wang *et al.*, 2008 and Mircea *et al.*, 2013). Likewise, Madruga *et al.*, (2019) found that feeding finishing beef heifers on diets including 19% alfalfa hay had significantly (P<0.05) higher daily feed intake compared with the control one. On the other hand, the insignificant differences among the dietary treatments in this study in respect of DMI may be attributed in part to the isonitrogenous and isoenergetic diets, which being in match with the findings obtained by Rashid *et al.*, (2015) and Omar *et al.*, (2019).

Results of feed conversion that expressed as kg DM and TDN per kg gain during the growing, finishing and whole periods are summarized in Table (4). There was no significant (P>0.05) differences in feed conversion between treatments during the growing, finishing and whole periods. These results are in consistent with those obtained by Madruga *et al.*, (2019) who recorded that feed conversion as DM/gain did not differ with buffalo heifers fed TMR diet contained 19% alfalfa hay or 10% barley straw. However, other studies have shown improved in feed conversion with decreased levels of alfalfa hay in growing lamb's diet (Papi *et al.*, 2011), but Mircea *et al.*, (2013) stated that increasing alfalfa hay levels in the growing lamb's ration contributed to an improved in feed conversion. Also, Alhidary *et al.*, (2016) who fed growing Naemi lambs on TMR alone or with adding varying amount of alfalfa hay at (0, 100, 200 and 300g) they found that feed conversion as kg feed/kg gain was 6.51, 6.96, 6.82 and 6.75.

Live body weight and live body gain

Data in Table (4) showed that initial live body weight, final live body weight, and daily weight gain in calves did not differ significantly (P<0.05) between the treatments during the growing, finishing and the whole periods. Results in respect of total weight gain and daily gain were insignificantly higher for calves fed ACH - diet than those fed CSM-diet during the growing period. The improvement of growth performance of ACH - diet during the growing period might be due to the higher nutrients digestibilities that in turn increased the total body weight gain and feed conversion as well as ADG compared with those of CSM - diets. While, during the finishing period, total body weight gain and daily weight gain of calves fed CSM - diet were insignificantly higher than the corresponding values of those fed ACH – diet. The more consumption of feed (DMI) in tested treatment as well as the compensatory growth phenomenon could be positively affected on these growth values in this phase of the trial. These findings are in agreement with the results that obtained by Judkins *et al.*, (1987) who reported that supplemented alfalfa pellets and cottonseed cake to yearling heifers diet had significantly higher in average daily gain than that of un-supplemented one, while average daily gain did not differ between alfalfa pellets and cottonseed cake supplemented to yearling heifers diet. In addition, studies of, Cochran *et al.*, (1986) did not found any significant differences in body weight gain and daily weight gain when alfalfa cubes or cottonseed meal-barley cake supplemented as source of protein for in beef cows grazing fall – winter range. Results here are in harmony with the other researchers where Alhidary *et al.*, (2016)

stated that daily gain of growing Naemi lambs fed on TMR basal diet was significantly (P<0.05) higher with alfalfa hay supplementation than that of un-supplemented one. Numerous studies have indicated that using alfalfa hay as a source of protein in steers diet (Burns and Fisher, 2013) or the incorporating of alfalfa hay levels in the diet of both in lambs and buffalo heifers (Papi *et al.,* 2011, Mircea *et al.,* 2013 and Madruga *et al.,* 2019) can improve the growth performance of these animals. Like a positive effect of some protein sources supplementation on productive performance was noted previously using cottonseed cake for rang cattle Parker *et al.,* (1974), a corresponding positive effect were observed by Smith, (1981) and CIanton, (1982) who used other oilseed meal cakes and alfalfa supplements. Some variations in the results among some studies respecting the influence some different of sources of protein (alfalfa cubic hay or cotton seed cake) on growth performance may be due to differences in the experimental conditions.

Table 4. Performance of buffalo calves during growing, finishing and whole experimental periods.

Phase / Item	Experimental diets					
	Growing period		Finishing period		Whole period	
	CSM-diet	ACH- diet	CSM-diet	ACH- diet	CSM-diet	ACH- diet
Duration period (days)	85	85	45	45	130	130
Total intake (on DM basis) (kg/h/d):						
CFM	6.57	6.65	8.19	8.33	7.15	7.20
Rice straw	4.26	2.86	4.10	3.48	4.20	3.07
Daily feed intake (kg) as:						
TDMI	10.83±0.18	9.51±0.85	12.29±0.13	11.81±0.26	11.35±0.30	10.27±0.96
TDNI	7.08±0.12	6.13±0.35	8.49±0.23	8.40±0.21	7.79±0.38	7.27±0.24
DCPI	1.07±0.02	0.97±0.01	0.95±0.01	0.88±0.04	1.01±0.05	0.95±0.01
Body weight gain						
Initial weight (Kg)	276.6±10.23	276.1±8.25	380.3±6.64	389.2±4.45	276.6±10.23	276.1±8.25
Final weight (Kg)	380.3±6.64	389.2±4.45	438.8±4.27	443.4±6.58	438.8±4.27	443.4±6.58
Total gain (Kg)	103.7±6.89	113.1±6.51	58.5±3.23	54.2±4.15	162.2±4.45	167.3±4.21
Daily gain (kg)	1.220±0.100	1.330±0.03	1.300±0.04	1.200±0.08	1.25±0.02	1.29±0.01
Feed conversion						
Kg DM/ kg gain	8.88±0.55	7.15±0.65	9.45±0.22	9.84±0.10	9.08±0.13	7.96±0.55
Kg TDN/kg gain	5.80±0.02	4.61±0.65	6.53±0.070	7.00±0.37	6.23±0.02	5.64±0.06

Blood parameters:

There are positive correlation between dietary protein and serum protein concentration (Kumar *et al.,* 1980). Data in Table 5 showed that no significant effect on all blood serum parameters during the growing and finishing periods due to sources of protein in the calves' diet. All findings appeared that all the values of measured blood constituents were within the normal range as described by (Kaneko *et al.,* 1997). Similarly, the results from previous studies (Nelson and Watkins, 1967) reported that protein sources did not significantly influence in blood metabolism. Other study that concluded by Wang *et al.,* (2008) demonstrated that total protein and albumin did not affect with different levels of alfalfa hay supplementation to sheep diets. Such present potentially confirmed the observation previous findings on other ruminants by Sun *et al.,* (1997), Parra *et al.,* (1999) and He *et al.,* (2017) and did not negatively affect the blood metabolites concentrations.

Table 5. Some blood serum constituents of buffalo calves fed the experimental diets.

Phase / Item	Experimental diets			
	Growing period		Finishing period	
	CSM – diet	ACH – diet	CSM – diet	ACH – diet
Total protein (g/dl)	7.51±0.22	7.58±0.05	7.53±0.12	7. 55±0.05
Albumin (g/dl)	4.23±0.09	4.21±0.05	4.27±0.09	4.26±0.03
Globulin (g/dl)	3.28±0.07	3.37±0.12	3.26±0.12	3.30±0.10
ALT (Iu/L)	17.52±0.30	17.54±0.21	17.55±0.04	39.06±0.98
AST (Iu/L)	39.02±0.2	40.58±0.75	17.51±0.90	40.55±1.65

Economic efficiency:

Results of economic evaluation during the whole experimental period (130 - d) are presented in Table 6.

Results indicated that feed cost per Kg gain was 38.92 and 30.65 LE for diets CSM - diets and ACH - diets, respectively. The ACH group had the lowest feed cost per kg gain by 21.25% compared with to that of control group. The values for economic efficiency were 1.61 and 2.10 for CSM and ACH diets', respectively being the best efficiency was associated with the ACH diet and also the improvement of economic efficiency based on control one was 130.43% for the ACH - diet. In line with our findings, a study conducted by Cochran *et al.,* (1986) indicated that alfalfa cubes hay addition as protein source for beef cows grazing fall-winter range could be used more beneficially and economically than that of cottonseed meal-barley cake supplementation. These findings are in agreement with the results of the previous work on alfalfa cubes hay as partial replacement for protein sources and conventional roughages in lactating Chios ewe and Friesian cow diets by (Hadjipanayiotou and Economides, 1999). Also, Alhidary *et al.,* (2016) recommended that the supplementing 300g alfalfa hay every three days to Naemi lambs fed TMR as a basal diet resulted in improving the dry matter intake, nutrients digestibility, feed conversion, and daily gain had a potentiality to be economically profitable. Moreover, Kobayashi *et al.,* (2017) who showed that the cost of feeding to produce one kg of gain was lower for crossbred Simmental calves diet contained 22% of alfalfa hay compared with that of contained 44% of alfalfa hay and control diet. Recently, using more alfalfa hay as a substitute for a portion of concentrates in ruminant diets is certainly as an alternate strategy for lower feeding cost (Wang *et al*., 2019). In contrast, Rong *et al.,* (2014) concluded that increasing the alfalfa hay level in the diets growing lambs result in higher feeding costs.

Table 6. Economical efficiency of buffalo calves fed the experimental diets during the growing finishing periods and whole experimental.

Phase / Item	Experimental diets					
	Growing period		Finishing period		whole period	
	CSM - diet	ACH –diet	CSM- diet	ACH- diet	CSM- diet	ACH- diet
Daily feed intake as fed (kg/h):						
CFM	7.22	7.36	9.12	9.27	8.20	8.33
R.S	4.72	3.17	4.54	3.14	4.64	3.17
Daily gain (kg/d)	1.22	1.33	1.300	1.200	1.25	1.29
Price of daily gain, L.E	61.00	66.50	65.00	60.00	62.50	64.50
Total daily feed cost (LE/day)	37.93	26.72	38.74	34.66	38.92	30.66
Economic efficiency*	1.61	2.49	1.68	1.73	1.61	2.10
Improvement of economic efficiency (%)	100	154.66	100	102.98	100	130.43

Price of Feedstuffs (L.E.): CFM were 4600LE/Ton for CSM-diet and 3200 ACH- diet during growing period, 3750 and 3400 LE/Ton of CSM - diet and ACH- diet, respectively.
During finishing period and rice straw =1000 LE/Ton. Live body weight: 50 LE/kg
***Economic efficiency = money output/money input*100.**

CONCLUSION

It could be concluded that alfalfa cubic hay can successfully used as a protein source instead of cotton seed cake in rations formulation of buffalo calves with positive on nutrient digestibilities, feeding values (as TDN and DCP), daily gain with the best feed conversion and economic efficiency. Thus, it should be recommended to use alfalfa hay cubic as low protein cost in buffalo calves ration.

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تأثير إدخال مكعبات دريس البرسيم الحجازى كمصدر رئيسي للبروتين في علائق عجول الجاموس

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الهدف من هذه الدراسة هو تقييم إمكانية استخدام مكعبات دريس البرسيم الحجازى كمصدر رئيسي للبروتين بديلا عن كسب بذرة القطن فى علائق العجول الجاموس خلال فترة النمو والتسمين. تم تقسيم عشرين من عجول الجاموس بمتوسط 10.05 ±276 كجم وعمرها 18 شهرًا إلى مجموعتين متماثلتين (عشرة عجول لكل منهما) وفقًا لوزن الجسم الحي باستخدام تصميم الكتلة العشوائية الكاملة حيث تم تغذية العجول بشكل فردى. نفذت التجربة على فترتين، الفترة الأولى (فترة النمو ، 85 يومًا) حيث تم تغذية المجموعة الكنترول (T1) على العلف المركز التقليدي والذى يحتوى على كسب بذرة القطن كمصدر رئيسي للبروتين بنسبة 2 ٪ من وزن الجسم الحي بالإضافة إلى قش الأرز كمصدر وحيد للعلف الخشن وتتم التغذية عليه حتى الشبع. وتم تغذية المجموعة المختبرة (T2) بنفس النظام الغذائي مع ادخال مكعبات دريس البرسيم الحجازى كمصدر رئيسي للبروتين بديلا عن كسب بذرة القطن. وفي الفترة الثانية (التسمين) التي استمرت 45 يومًا، حيث تم تغذية حيوانات كلا من المجموعتين على نظام غذائي عالي الطاقة حيث تم تدعيمه بنسبة من حبوب الذرة مع تغير مكونات العلف المركز ومع استبدال كسب بذرة القطن دريس البرسيم الحجازى. خلال مرحلتى التجربة كانت جميع العلائق متساوية فى الطاقة والبروتين. أشارت النتائج خلال فترة النمو ، إلى أن معاملات الهضم العناصر الغذائية لـ المادة الجافة والمادة العضوية ،البروتين الخام والألياف الخام كان أعلى معنويا ($P < 0.05$) في عليقة دريس البرسيم الحجازى عن تلك التي تحتوي على كسب بذرة القطن , وبخلاف ذلك ، كان معامل هضم المستخلص الخالى من الأزوت أقل معنوية ($P < 0.05$) مع المجموعة المختبرة مقارنة بمجموعة الكنترول , ولكن لا توجد فروق معنوى في معامل هضم الدهن فيما بينهما. وخلال فترة التسمين ، لم تكن هناك فروق ذات دلالة إحصائية فيما يتعلق بمعامل هضم لـ المادة الجافة والمادة العضوية ،البروتين الخام والألياف الخام بين المعاملتين الغذائيتين، باستثناء معامل هضم الدهن والمستخلص الخالى من الأزوت اللتين كانتا أعلى بشكل معنوية ($P < 0.05$) مع نظام دريس البرسيم الحجازى مقارنة بالنظام الغذائي لكسب بذرة القطن. ولم يكن هناك أى تأثير معنوى لاستبدال كسب بذرة القطن دريس البرسيم الحجازى فى علائق العجول على المادة الجافة المأكولة,المركبات الكلية المهضومة,البروتين الخام المهضوم المأكول , وايضا الكفاءة التحويلية الذي تقدر كيلو جرام الغذاء / كيلو جرام نمو سواء فى صورة مادة جافة أو مجموع المركبات الكلية المهضومة كذلك نتائج مماثلة فيما يتعلق بمعدل النمو وبعض مقاييس الدم خلال التجربة. وجد تحسن فى الكفاءة الاقتصادية المعتمدة على عليقة الكنترول (100٪) بنسبة 130.43٪ للعجول التي تم تغذيتها على العلائق المحتوية دريس البرسيم الحجازى - خلال التجربة. على وجه التحديد، من النتائج التي تم الحصول عليها يمكن استخدام دريس البرسيم المكعب كمصدر رئيسي للبروتين بدلاً من كسب بذور القطن في النظام الغذائي لعجول الجاموس مع لما له من تأثير إيجابى على معاملات الهضم ، والقيم الغذائية ، والأداء الإنتاجي والكفاءة الاقتصادية .