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EFFECTS OF ENERGY SOURCES SUPPLEMENT FOR CAMELS FED BERSEEM HAY ON:
1. FEED INTAKE, NUTRIENTS DIGESTIBILITY AND CONCENTRATION OF SOME BLOOD CONSTITUENTS.

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ABSTRACT

An experiment was planned and conducted in order to study the effect of barley grains and date stones as energy-source supplements with Berseem hay on the voluntary feed intake and digestibility as well as concentration of some blood components of camels. Three one humped female camels (avg. BW 467 kg) were used in 3 x 3 Latin Square design. Three diets (H, B and BD) were tested throughout the whole experiment. The first diet H; sole Berseem hay was offered *ad lib*. B; camels were given a calculated amount of barley to provide supplementation as 100 percent of maintenance energy requirements (Farid *et al.,* 1990) and BD; supplementation was 50 percent from each barley and crushed date stones. Both of camel groups B and BD were given Berseem hay *ad lib*. The results showed that, average body weight changes (ABWC) were almost comparable for the camels fed B and their pair-fed mates offered BD diets (311 *vs*. 263 g/h/d, respectively) and were higher ($P< 0.05$) than camels fed diet H (211 g/h/d). Daily total dry matter intake averaged 5.8, 8.56 and 7.49 kg for the three treatments, respectively. Supplementation with high dietary energy sources was significantly ($P < 0.05$) increased digestibility of DM, OM, EE and NFE but it had no effect on CP and CF digestibility. Total digestible nutrients (TDN %) was significantly ($P<0.05$) higher for diets BD and B (70.72 *vs.* 70.02%, respectively) than for diet H (57.86%). But the opposite trend was found for digestible protein percentage. The highest values of nitrogen balance (NB) were obtained when barley grains (as a readily fermentable carbohydrate) represented 50% of the total energy supplement (diet BD) followed by diet B and being low in diet H, the values were 10.0, 10.95 and 7.5 g/d, respectively. Types of energy supplement did not show significant ($P< 0.05$) effect on all studied blood parameters except glucose and total lipids concentrations.

Keywords: Camels, energy sources, Date seeds, Digestibility, Nitrogen balance, Blood constituents.

INTRODUCTION

Foraging behavior of the camels were affected by many factors; climate, season, watering intervals, forage quality and availability, and the physiological functions of the animals (Wardeh, 1998). It is essential to know the quantity and the quality of the diet actually consumed by an animal. These two factors are largely depended upon the available feed resources and the environmental stress (Kearl, 1982). Palatability of the feedstuffs will

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influence the amount consumed. Moreover, dry matter intake may drop significantly when animal are subjected to grazing dry forage, as it is the case in arid zones (Karue, 1971). Yacout and El-Badawi (2001) showed that dromedary have higher demand to dietary energy rather than protein.

The annual production of dates in Egypt is estimated by 1,113,270 ton (Ministry of Agriculture, 2002). Moreover, it was reported (El-Kassas, 1986) that date pits (seeds) comprise about 10% of fruit weight of some cultivars. Hence, significant amount of date seeds (about 111,327) can be available annually as a by-product. Al-Yousef *et al*. (1994) have shown that date pits had a high value of TDN (73.91%). But the high hardness of date seeds limits its use as animal feed unless physical treatments e.g. grounding are applied.

In Egypt, barley is grown as a main crop in the north western coastal region in about 63.000 ha under rain-fed condition and in about 55.000 ha in the Nile Valley under irrigation system (FAO, 1990). Barley is considered as one of the most suitable crops that can be grown over a wide range of adverse environment, i.e., drought, low fertility, saline soil, high or low temperature, moister stress and weed competition, than many other grain crops. It grows on under dry condition as in Sinai and the north western coastal region of Egypt. It can be used for several purposes, but in Egypt it is mainly used for animal feeding including both grain and straw and bread making either alone or mixed with wheat or rye by some people (Bedouins) who live in the dry areas in the desert, as well as in the malt industry.

One possible factor contributing to the wide range of responses measured with energy supplements is variation in forage quality. Horn and McCollum (1987) suggested that supplementation-induced depressions in forage intake were greater with increasing forage quality. However, few reports detail interactions between forage quality and supplemental energy. Although Matejovsky and Sanson (1995) tested for such interactions, their work was conducted with sheep and did not evaluate effects of supplemental energy source.

So, this study was conducted to investigate the effects of some energy sources; barley as 100% maintenance energy requirements and partial substitution of barley by ground date seeds at 50%, on feed intake, nutrients digestibility, nutritive value and some blood constituents for camels fed Berseem hay as a basal diet which represent grass plants that available within green season for camels in Egypt.

MATERIALS AND METHODS

The present investigation was carried out through June to October 2004, at Maryout Desert Research Station of the Desert Research Center, situated some 35 Km south of the city of Alexandria. Traditionally, it represented the eastern boundaries of the western coastal rangelands of Egypt.

Animals and experimental diets

Three healthy female camels (*C. Dromedarius)* averaged 467 ± 29.06 Kg live body weight and seven years old were used in arrangement of 3 X 3 Latin square design. The animals were housed individually in confined pens for the whole experimental period. Each period consisted of 45 days as an adjustment period followed by 13 days for digestibility trials. Three diets (H, B. and BD) were tested throughout the whole experiment.

The tested diets were as follows:

1- Berseem hay *ad lib* as a sole feed……. (diet H).
2- Barley grains as 100 % of maintenance energy requirements (MER) according to Farid *et al*. (1990) + Berseem hay *ad lib*. ……. (diet B).
3- Barley grains as 50 % of MER+crushed date stones as 50 % of MER + Berseem hay *ad lib.* ……. (diet BD).

All animals were offered their experimental diets once daily at 09.00 a.m. and any feed refusals were collected next day, and then weighed to determine the actual voluntary feed intake. Representative composite samples from the offered feed ingredients were collected and kept for analyses. The composition of experimental ingredients and experimental diets are presented in Table (1). Fresh water was offered free choice for each animal twice daily and water intake was determined. The changes in live body weight were recorded for each camel as they were weighed biweekly before the morning feeding and the body weights were recorded.

Digestibility trials

Three digestibility trials were conducted to determine the nutrient digestibility, nutritive value and nitrogen balance for the tested diets. During the digestibility trials, camels were housed in separate metabolic cages (Kewan, 2003) for one week as an adaptation period then followed by a 6 – day total collection period. Camels equipped with a metal funnel (Shawket, 1976) fitted around the female genitalia to collect urine in a container supplied with 100 ml H_2SO_4. Urine samples were taken (5%) and composite samples were kept for nitrogen determination. Total feces were collected daily and 5% was sampled, dried at 60 ºC over night, then ground and kept for chemical analyses.

Blood constituents

Blood samples were collected before feeding from the jugular vein for each animal at the end of the total collection period; serum was obtained and kept for further biochemical analyses.

Analytical methods

The proximate constituents of feed ingredients, feces and total nitrogen in urine were determined according to AOAC (1996). Serum samples were tested for glucose (Trinder, 1969), total protein (Henry, 1964); albumin (Doumas *et al.*, 1971); globulin (calculated by difference); Total lipids (Jacobs and Henery, 1962); Creatinine (Henry, 1974); urea (Patton and Crouch, 1977) and Alanine Aminotransferase (ALT or GPT) and Aspartate Aminotransferase (AST or GOT) according to the procedure of Reitman and Frankel (1957).

Statistical Analyses

Data were tested statistically using **SAS (1988).** Mean differences were compared by Duncan New Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical composition

Chemical composition of Berseem hay, barley grains and crushed date seeds are summarized in Table (1). Concerning the energy feed sources, although barley grains (BG) and crushed date seeds (CDS) attained around 11% CP, the concentrations of CF and ash were greatly lower than those of Berseem hay**.**

Table (1): Chemical composition (on DM basis) of the experimental feedstuffs and the experimental diets.

Item	Experimental feeds*			Experimental diets		
	H	BG	DS	(H)	B	BD
DM %	89.89	89.47	91.55	89.89	89.71	90.81
OM %	87. 40	96.69	98.62	87. 40	91.48	93.14
CP %	12.43	9.46	9.99	12.43	11.12	11.16
CF %	28.03	6.84	12.82	28.03	18.72	19.09
EE %	2.78	2.22	7.78	2.78	2.53	3.91
Ash %	12.60	3.31	1.38	12.60	8.52	7.54
NFE %	44.16	78.17	68.03	44.16	59.11	58.97
GE,MJ/kg DM**	17.14	18.19	19.93	17.14	17.60	18.22

*** H: Berseem hay; BG: Barley grains; DS: Date seeds.**
**** Calculated according to Maff (1975), using the following equation:**
GE, MJ/kg DM = 0.0226 CP + 0.0407 EE + 0.0192 CF + 0.0177 NFE.

Voluntary feed intake (VFI)

Results in Table (2) indicated that camels fed hay supplemented with barley grains and or crushed date seeds ($P<0.05$) consumed less hay than those of camels fed hay without supplementation.

These reductions were 17.79 and 35.07% as a percent of hay intake for group H. Maloiy (1972) indicated that the camels select the more nutritive parts of the straw. They seemed to prefer more nitrogen-rich parts. Such behavior has been reported for camels on pasture. Feed supplement resulted in the highest ($P<0.05$) total dry matter intakes for camels given B and BD comparing to those fed the H diet. Daily total dry matter intake averaged 5.84, 8.56 and 7.49 kg for the three treatments, respectively. These results were in agreement with that estimated by Gauthier-Pilters (1969) who found that DMI ranges from 1.4 to 12.5 kg/day depending on season and nature of the available plant species. Using older camels could have led to higher intake as reported by Farid *et al*. (1980) when camels weighing 538 kg ate 3.6 kg of a diet consists of straw and legume hay. Furthermore, Maloiy (1972) found daily intakes by stall-fed camels weight averaging between 190 and 460 kg varying from 1.3 to 5.3 kg DM of poor chopped hay from a mixed pasture containing mainly star grass (*Cynodon dactylon*). Relative to metabolic body size, the corresponding values were 53.88, 79.62 and 71.04 g/kg $W^{0.75}$. Dry matter intake as a percentage of body weight gradually decreases as the animal metabolic body size increases. However, this is subject to type of forage, its physical form and its caloric density (Wardeh, 1998). Results of total dry matter intake as a percent of live body weight were different ($P<0.05$) being 1.13, 1.68 and 1.51% for the three treatments, respectively. All these values were lower than that reported by Yacout and El-Badawi (2001) who cleared that camels had a limited feeding capacity, being satisfactory from 1.72 to 1.80 DM of body weight for their appetite, regardless of the feed quality. On the other hand, it were higher than value (1.0%) that reported by Guerouali and Wardeh (1998) when camels fed a ration composed of 2/3 of barley grain and 1/3 Lucerne hay corresponding to their maintenance energy requirements. Voluntary feed intake is often considered to be an excellent integrated measure of overall forage quality (Reid, 1961). Using un-supplemented intake as an index, forage quality was slightly greater for H than for B or BD.

Table (2): Voluntary feed intake (VFI) for camels fed diets supplemented with different energy sources.

Item	Experimental diets			SEM	Sig.
	H	B	BD		
MBW, $kg^{0.75}$	108.1	107.6	106.0	2.59	NS
Ingredients VFI (on DM basis):					
Hay: kg/d	5.828^{a}	4.791^{b}	3.784^{c}	0.323	*
g/kg $w^{0.75}$	53.88^{a}	44.63^{b}	35.65^{c}	2.88	*
% BW	1.13^{a}	0.94^{ab}	0.76^{b}	0.06	*
% TDMI	100^{a}	56.04^{b}	50.01^{c}	7.91	*
Barley: g/d	-	3758	1878	546	-
Date Seeds: g/d		-	1877	318	-
Total dry matter and nutrients intake:					
DM, g/d	5828^{b}	8549^{a}	7488^{a}	428	*
g/kg $W^{0.75}$	53.88^{c}	79.62^{a}	71.04^{b}	3.93	*
%BW	1.13^{b}	1.68^{a}	1.51^{a}	0.09	*
MJ/d	99.9^{b}	150.5^{a}	135.6^{a}	8.05	*
MJ/kg $w^{0.75}$	0.92^{b}	1.40^{a}	1.29^{a}	0.06	*
MJ/kg DMI	17.14^{c}	17.60^{b}	18.10^{a}	0.14	*
TDNI, kg/d	3.37^{b}	5.99^{a}	5.30^{a}	0.41	*
TDNI g/kg $w^{0.75}$	31.15^{b}	55.75^{a}	50.24^{a}	3.35	*
DCPI, g/d	384.7^{b}	505.7^{a}	438.0^{ab}	21.92	*
DCPI, g/kg $w^{0.75}$	3.56^{c}	4.70^{a}	4.15^{b}	0.14	*

H: Hay *ad lib*., B: Barley 100% of MER + Hay *ad lib.,* BD: Barley 50% of MER + Date seeds 50% of MER + Hay *ad lib.;* SEM: Standard error mean; NS: Not significant.
[a, b, c] Means followed by different letters within each same row are significantly different ($P< 0.05$).
***: $P < 0.05$**

The decrease in forage intake with energy supplementation is typical of other studies in which energy supplements have been fed (Martin and Hibberd, 1990 and Elizalde *et al*., 1998). Fieser and Vanzant (2004) indicated that depressions in intake with energy supplementation were greater with higher-quality forages. Energy intake expressed in Mcal ME/ kg $w^{0.75}$ was about 52.17 and 40.22 % for B and BD camel groups, respectively, being greater than in H group. The digestible crude protein intake was 384.7, 505.7 and 438.0 g/d in diets H, B and BD, respectively. It was obvious that DCP in diet B exceeded diet H by 31.45 % and diet BD by 13.85%. Digestible crude protein intake (DCPI), and total digestible nutrient intake (TDNI) values were significantly (P<0.05) affected by the types of the experimental diets (Table 2). The greatest DCPI and TDNI values were obtained by camels fed barley and/or date seeds diets. This finding may have been due mainly to the highest TDMI and TDN percent. Therefore, energy supplementation confirmed again the earlier discussed results of body weigh changes of camels which recorded the highest gain in groups fed supplementations. The values of DCP intake as g/d were significantly different between experimental groups; they are within the range that reported by Shawket (1999) for growing camels fed on rations with different sources of energy being from 451 to 551 g/d. Nagpal *et al.* (1998) indicated that DCP requirement for camel calves was 4.87 g/kgw$^{0.75}$. In another study, Dabiri *et al.* (2003) indicated that a diet containing 12.6% CP was the most suitable for native growing camels. Bhattacharya *et al*. (1988) indicated that, when yearling camels fed on Lucerne hay (LH) with incorporating 500/kg coarsely ground barley grains in place of LH lead to increasing (P<0.05) TDN intake as g/kg body weight.

Live body weight changes

Table (3) summarizes the data of initial and final live body weights of animals in the three treatment groups, and the daily weight changes during the experimental period.

Table (3): Body weight changes for camels fed diets supplemented with different energy sources.

Item	Experimental diets*			SEM	Sig.
	H	B	BD		
Initial BW , kg	510.2	505.8	494.7	16.41	NS
Final BW, kg	519.7	517.7	508.7	16.61	NS
ABWC, gm/d	211^{b}	263^{a}	311^{a}	17.23	*

*** H: Hay *ad lib.;* B: Barley 100% of MER + Hay *ad lib*.; BD: Barley 50% of MER + Date seeds 50% of MER + Hay *ad lib*.; SEM: Standard error mean; NS: Not significant.**
$^{a, b, c}$ Means followed by different letters within each same row are significantly different (P< 0.05).
*: P < 0.05

Average body weight changes (ABWC) were almost comparable for the camels fed the tested diet B and their pair-fed mates offered BD diet (311 vs. 263 g/h/d, respectively) and higher (P< 0.05) than camels fed diet H (211 g/h/d). Camels given hay as sole roughage showed positive daily gain being 211 g/d; it means apparently that, Berseem hay was good quality palatable roughage. However, this gain improved when the camels were fed hay supplemented with barley alone or mixed with date seeds; they recorded the highest daily gain (P<0.05) as a result of increasing total feed intake. However, it would be cleared that use B and D as a mixture energy supplement improved the daily weight gain. Moreover, it would reduce the cost of feeding due to the lower prices of date seeds compared to that of barley grains. The improvement of weight gain for groups B and BD to those H are 24.64% and 47.39%, respectively. Those values of ABWC were lower than values which were reported by Shawket (1999) for growing camels fed on saltbush with different sources of energy. The results were in agreement with that reported by Kandil *et al*. (1985) and Sooud *et al*. (1989). It was observed that increasing energy supply increases the efficiency of amino acids use (Gerrits *et al*., 1996).

Digestion coefficient and nutritive value

Results in Table (4) show that supplementing the diets with dietary energy sources increased ($P<0.05$) digestibility of DM, OM, EE and NFE but it has no significant effect on CP or CF digestibility. In other words, camels that received barley supplementation showed best utilization as digestion coefficient improved ($P<0.05$) for DM, OM and NFE followed by BD and H groups, respectively; whereas, that received barley with date seeds supplementation was the best ($P<0.05$) for EE digestion coefficient comparing to the other experimental groups. The increase ($P<0.05$) in digestibility of EE and NFE with supplementing with energy source might have been due to the content of grains as a source of energy (barley / date seeds) in diet B and BD comparing to diet H. The improvement of various digestibility may have been due to the associative effect (Abd El-Baki *et al.*, 1984).

Table (4): The effect of experimental diets on nutrients digestibility and nutritive value.

Item	Experimental diets*			SEM	Sig.
	H	B	BD		
Nutrients digestibility %:					
DM	65.02^{c}	73.43^{a}	69.35^{b}	1.29	*
OM	63.62^{c}	73.67^{a}	69.97^{b}	1.53	*
CP	53.12	53.93	54.95	0.52	NS
CF	64.35	69.03	64.83	0.90	NS
EE	64.99^{c}	75.02^{b}	81.17^{a}	2.41	*
NFE	66.02^{b}	78.25^{a}	73.77^{a}	1.94	*
Nutritive value:					
TDN%	57.86^{b}	70.02^{a}	70.72^{a}	2.12	*
DCP%	6.60^{a}	5.91^{b}	5.84^{b}	0.13	*

*** H: Hay *ad lib.;* B: Barley 100% of MER + Hay *ad lib.;* BD: Barley 50% of MER + Date seeds 50% of MER + Hay *ad lib*.; SEM: Standard error mean; NS: Not significant.**
[a, b, c] Means followed by different letters within each row are significantly different ($P< .05$).
***: $P < 0.05$**

It was observed that, energy source did not affect ($P<0.05$) neither CP nor CF digestibility, and this finding may have been due to CP content for the experimental feedstuffs only fibrous feed. Voligura and Zemlyokova (1983) reported negative relationship between CF and energy content. Takahashi *et al.* (1989) noticed that DM and digestible nutrient intake increased and CF digestibility which was almost comparable, and also the free choice for camel that has high selectivity behavior to consume high quality feeds from the available feeds; that led to a decrease in feed intake of hay as a fibrous source for both B and BD camel groups. Also, it may have been due to priority requirement of energy than protein for camels (Yacout and El-Badawi, 2001). Dry matter digestibility averaged 61.6% in camels fed barley and Lucerne hay (Guerouali and Wardeh 1998). Abdouli and Kraiem (1990) showed that CF digestibility was higher being 66.0 and 63.0% for camels fed long or chopped straw supplemented with 0.5 kg concentrate feed mixture, respectively. It is believed that apparent discrepancy could be due to the fact that the higher percentage level of grains to replace Berseem hay lead to a decrease in CF% in the ration and increasing concentration of readily variable carbohydrates which were more utilizable by rumen microflora than Berseem hay crude fiber which has a lesser apparent digestibility than grains. Depression of fiber digestibility may be due to depressions in ruminal pH with both starch- and fiber-based supplements (Vanzant *et al*., 1990), although low ruminal *p*H can decrease fiber digestion, it does not appear to be a primary factor in many practical situations in which energy supplements are added to forage-based diets. A second potential mechanism for negative associative effects involves competition for available nutrients. Other possible mechanisms by which rapidly fermented carbohydrate may decrease fiber digestion include end-product inhibition of cellulase activity (Huang and Forsberg, 1990), decreased microbial attachment to fibrous substrate (Piwonka and Firkins, 1993), induction of shifts in microbial populations away from cellulolytic species (Piwonka *et al*., 1994), or direct toxic effects of excess carbohydrate (Russell, 1998). It could be noted from Table (4) that the higher the energy the higher the digestibility. This was mainly due to that diets B and BD more highly degradable and digestible ingredients (barley and date seeds) than H which contain decreased with increasing energy in ration of sheep. With high-quality forages, this typically involves the addition of energy supplements to the diet. However, feeding starch-based energy supplements such as cereal grains has been shown to cause depressions in forage intake as well as negative associative effects on fiber digestibility (Pordomingo *et al*., 1991). Energy supplements high in digestible fiber, such as soybean hulls, have shown potential to reduce or alleviate these negative associative effects (Martin and Hibberd, 1990). Comparisons the effects of starch- vs. fiber-based energy supplements on forage intake have resulted in either little difference between supplement types (Garces-Yepez *et al*., 1997 and Elizalde *et al*., 1998) or a greater depression in forage intake with fiber-based supplements (Galloway *et al*., 1993 and Garces-Yepez *et al*., 1997). Total digestible nutrients percentage (TDN%) was higher ($P<0.05$) for diets BD and B (70.72 *vs.* 70.02%, respectively) than for diet H (57.86%). But the opposite trend was found for digestible protein percentage. In case of TDN%, these results may have been due to highly fermentable carbohydrates in energy supplements on one hand and to the high content of ash for hay on the other hand but in case of DCP, the results may have been due to the high content of non-protein nitrogen for H diet than for both B and BD diets (Kewan, 2003). Similar results of nutrients digestibility were obtained by Mohamed (2006), Shawket *et al.* (2007), and Khorchani et al. (2009).

Nitrogen utilization

Data in Table (5) pointed out that nitrogen intake (NI), fecal N- and urinary N- excretion for all camels were affected ($P<0.05$) by supplements. The maximum NI was obtained for camels fed B followed by group BD and H, respectively. It was due to the highest dry matter intake recorded by these camels (Table, 3).

Table (5): Nitrogen utilization of camels fed diets supplemented with different energy sources.

Item	Experimental diets*			SEM	Sig.
	H	B	BD		
Mean BW, kg	520.5	518.7	509.8	17.6	NS
Mean $BW^{0.75}$	109.0	108.6	107.1	2.79	NS
Hay N g/d	116.0^{a}	95.3^{b}	74.3^{c}	6.31	*
Barley N, g/d	-	56.7	28.3	8.23	
Date N, g/d	-	-	30.00	5.07	
Total nitrogen intake:					
g/d	116.0^{b}	152.3^{a}	132.7^{ab}	5.99	*
$g/kgw^{0.75}$	1.08^{c}	1.43^{a}	1.27^{b}	0.05	*
Fecal nitrogen:					
g/d	54.3^{b}	70.0^{a}	59.7^{b}	2.51	*
$g/kgw^{0.75}$	0.50^{b}	0.66^{a}	0.57^{ab}	0.03	*
NI %**	46.88	46.07	45.05	0.52	NS
Digested nitrogen:					
g/d	61.3^{b}	82.3^{a}	73.0^{ab}	3.72	*
$g/kgw^{0.75}$	0.57^{b}	0.77^{a}	0.70^{a}	0.03	*
NI%	53.12	53.93	54.95	0.52	NS
Urine nitrogen:					
g/d	54.0^{b}	72.0^{a}	62.0^{ab}	3.29	*
$g/kgw^{0.75}$	0.50^{c}	0.68^{a}	0.59^{b}	0.03	*
NI %	46.60	47.34	46.69	0.51	NS
Total nitrogen excretion:					
g/d	108.3^{b}	142.0^{a}	122.0^{b}	5.65	*
$g/kgw^{0.75}$	1.01^{c}	1.33^{a}	1.17^{b}	0.05	*
NI%	93.48^{a}	9.41^{a}	91.75^{b}	0.33	*
Nitrogen balance:					
g/day	7.50^{b}	10.00^{a}	10.95^{a}	0.54	*
$g/kgw^{0.75}$	0.07^{b}	0.10^{a}	0.10^{a}	0.01	*
NI%	6.52^{b}	6.59^{b}	8.25^{a}	0.33	*
ND%***	12.26^{b}	12.24^{b}	15.04^{a}	0.57	*

*** H: Hay *ad lib*; B: Barley 100% of MER + Hay *ad lib*; BD: Barley 50% of MER + Date seeds 50% of MER + Hay *ad lib* SEM: Standard error mean; NS: Not significant.**
**** NI%: as a percent of total nitrogen intake. *** ND%: as a percent of nitrogen digested.**
[a, b, c] Means followed by different letters within each same row are significantly different (P< 0.05). *: P < 0.05.

Similar results were obtained by Bhattacharya *et al*., (1988) for camels. The data presented in Table (5) clearly demonstrated the direct relationship between changes in intake and observed changes in fecal output, apparent absorption and urinary excretion. The experimental camels tended to excrete various amounts of nitrogen through urine and feces, appeared to be significantly varied ($P<0.05$). Therefore, all values (in terms of g/day or g/ Kg $W^{0.75}$) of N intake, excreted and retained varied significantly among camels fed the tested diets. However, results of nitrogen excretion when expressed as percentage of NI were not different. The results presented herein may have been due to the great influence of the type of diets on N utilization by camels. Such results are in harmony with those obtained by Shawket and

Ahmed (2001). Schroeder *et al*. (2006) observed that growing steers increased protein deposition in response to increased energy supplementation. It can be noticed that excreted nitrogen in both feces and urine was significantly larger in diet B than diets BD and H. The highest values of both NB and nitrogen digested (ND) were obtained when barley grains (as a readily fermentable carbohydrate) represented 50% of the total energy supplement (diet BD) followed by diet B and being low in diet H. Similar improvement was obtained in NB as a percentage of N intake, N digested as a result of dietary energy supplement.

Blood constituents

All values of blood biochemical parameters of camels under this study (Table, 6) were within the normal values reported by Afzal and Hussain (1995), Ismail et al. (2006), Kabir and Vazir (2006). The glucose level of blood ranged from 27.6 mg/dl in adult camels (Mehrotra and Gupta, 1989) to 214.37 mg/dl in 7 day old calves (Elias and Yagil, 1984). Chiericato *et al*. (1986) did not observe any significant difference in concentration of glucose in females (94.0 mg/100 ml). Types of energy supplement did not show significant ($P<0.05$) effect on all studied blood parameters except glucose and total lipids concentrations (Table 6). However, probably because of large standard deviation within groups nevertheless, these differences are considered biologically significant.

Table (6) Concentrations of blood biochemical constituents of camels fed diets supplemented with different energy sources.

Item	Experimental diets*			SEM	Sig.
	H	B	BD		
Glucose, mg/dl	88.83[c]	109.4[b]	162.5[a]	12.62	*
Total lipids, g/dl	1.57[b]	2.03[b]	2.87[a]	0.22	*
Total protein, g/dl	5.47	5.57	6.17	0.21	NS
Albumin, g/dl	2.30	2.47	2.57	0.09	NS
Globulin, g/dl	3.17	3.10	3.60	0.13	NS
Albumin / Globulin ratio	72.56	79.68	71.39	-	-
Urea, mg/dl	83.83	86.13	98.67	3.38	NS
Creatinine, mg/dl	1.23	1.34	1.44	0.05	NS
ALT (or GPT), IU/l	2.67	2.33	2.33	0.17	NS
AST (or GOT), IU/l	10.67	9.67	11.0	0.53	NS

*** H: Hay *ad lib*; B: Barley 100% of MER + Hay *ad lib.;* BD: Barley 50% of MER + Date seeds 50% of MER + Hay *ad lib.;* SEM: Standard error mean; NS: Not significant.**
[a, b, c] Means followed by different letters within each same row are significantly different ($P< 0.05$).
***: $P < 0.05$**

Total protein concentration was not significantly different and ranged between 5.47 to 6.17 g/100ml of which 42.05% to 41.65% is albumin. It is known that change in albumin level reflect the change in liver function because the liver is the site of albumin synthesis, but globulin is formed by lymphatic tissue, in addition, the decrease in A/G ratio indicated a decrease in production of albumin by liver, (Keay and Doxey, 1984).

In Indian camels the total serum protein was 6.40 ± 0.55 g/dl (range 5.6 – 9.3 g/dl) in adult camels (Kumar *et al*., 1961 and Ghodsian *et al*., 1978).

Azwai *et al*. (1990) analyzed 142 blood samples from dromedaries aged 3 months to 25 years belonging to both sexes and reported overall mean concentration of blood urea as 31.72 (range 21.82 – 78.12 mg/dl).Mohamed *et al*. (1990) observed urea concentration was 45.7 and 39.2 mg/dl on the 15th and 60th day after the cessation of rainfall. They mentioned that the probable cause of difference in the two periods was attributed to availability and quality of forages. There were no differences in ALT (GPT) and AST (GOT) among groups fed different experimental rations.

GPT values ranged between 2.33 and 2.67 IU/l but GOT values ranged between 9.67 and 11.0 IU/. These results were lower than that observed by Kewan (2003). Generally no abnormal values regarding the blood parameters were detected to feeding the experimental rations. Sarwar and Majeed (1997) mention that, serum ALT activity was positively correlated with serum globulin and total protein levels, whereas AST activity was negatively correlated with globulin levels.

IMPLICATIONS

In conclusion, from the present data, it could be concluded that, supplementation either by barley grains alone or barley grains with crushed date seeds at 100 percent of energy maintenance requirements plus Berseem hay was superior and more effective than feeding on sole roughage to enhance nutrients utilization in camels.

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تأثير إضافة مصادر طاقة إلى علائق الإبل المغذاة على دريس برسيم كعليقة أساسية على:
1- المأكول ، معامل هضم العناصر الغذائية وبعض مكونات الدم.

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استخدم في هذه البحث ثلاث نوق مزودة بفستيولا الكرش في نظام مربع لاتيني 3 × 3 بهدف دراسة تأثير إضافة حبوب الشعير ونوى البلح المجروش كمصادر طاقة رخيصة الثمن في علائق الابل التي تغذى على دريس برسيم كعليقة أساسية ومدى تأثير ذلك على المأكول وهضم العناصر الغذائية وبعض مكونات الدم. غذيت الابل على ثلاث علائق الأولى (المقارنة) دريس برسيم للشبع ، العليقة الثانية حبوب شعير مجروش تغطي 100% من الاحتياجات الحافظة من الطاقة للحيوان بالإضافة إلى دريس برسيم للشبع أما العليقة الثالثة فهي نفس العليقة الثانية مع إحلال 50% من الشعير بنوى البلح المجروش. وأوضحت النتائج وجود انخفاض معنوي (على مستوى 5%) في كمية المأكول من الدريس في كلتا مجموعتي الإضافة مقارنة بمجموعة المقارنة. أدت مصادر الطاقة إلى زيادة معنوية (على مستوى 5%) في معامل هضم كل من المادة الجافة والمادة العضوية والمستخلص الاثيرى والكربوهيدرات الذائبة بينما لم يتأثر هضم البروتين أو الألياف الخام بنوع مصدر الطاقة. أدت إضافة مصادر الطاقة إلى تحسن معنوي (على مستوى 5%) للقيمة الغذائية في صورة مجموع المركبات الغذائية المهضومة مقارنة بعليقة المقارنة التي تفوقت معنويا على كلتا نوعي الإضافة من حيث البروتين المهضوم. أظهرت مجموعتي الإبل المغذاة على مصادر طاقة ميزان نيتروجين أعلى معنويا عن تلك في مجموعة المقارنة. أدت إضافة مصادر الطاقة إلي اختلاف معنوي فقط في كل من تركيز الجلوكوز واللبيدات الكلية في الدم.

من هذه الدراسة يمكن التوصية باستخدام مخلوط الشعير ونوى البلح كمصدر جيد لسد الاحتياجات الحافظة من الطاقة بجانب الدريس حتى الشبع أدى إلى تحسين الاستفادة من العناصر الغذائية لعلائق الإبل.