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Use of Dry Bean Vines (*Phaseolus lunatus)* in Goats Feeding

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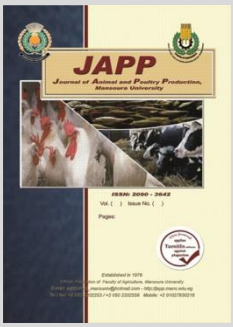

ABSTRACT

Twenty four lactating Damascus goats were used in a comparative feeding trial to investigate the effect of replacing clover hay (CH) by dry bean vines (DBV) in their diets on nutrient digestibilities, productive performance and economic efficiency. Does were chosen with an average body weight 40±1.50 kg and 3-4 milk seasons. Goats were divided into four groups (6 animals each). The first group T0 was served as control and fed concentrated feed mixture and clover hay at rate of (50: 50). The tested groups T1, T2, and T3 were fed on rations contained DBV (50, 75 or 100%) as replacement of CH in control ration. Results showed that digestibility and feeding values of most nutrients were significantly higher with T2 and insignificant higher with T1 than those of T3 and control T0. While, insignificant difference in digestibility of CP were observed among the dietary treatments, being the highest in T2. Milk composition, feed intake and most blood parameters did not affected significantly by the tested rations. Actual milk and 4%-FCM yields were significantly higher with T2 and insignificant higher with T1 than those of T3 and T0. Feed conversion was improved with T1 and T2, while, the poorest value was occurred with T3 or T0. Economical efficiency was marked improved in T2 compared with the other treatments. It could concluded that replacing clover hay in the diet of lactating goats by dry bean vines up to 75% could led to significant improvement of digestibility, productive performance of goats and profitability.

Keywords: Goats, dried bean vines, digestibility, milk production, Rumen, economic efficiency.

INTRODUCTION

The shortage of feeds in general and protein in particular attracted the attention of many research workers to use the field crop residues as un-traditional feed ingredients for cost effective ration formulation for ruminants. Crop residues are mainly fibrous materials almostly containing relatively low percentage of protein. In Egypt there are about 32 million tons of agricultural residues, which could be used as animal feeds in an effective way Ministry of Agriculture, Egyptian Ministry of Agriculture (2014). Ruminants occupy an important niche in modern agriculture because of their unique ability to digest certain feedstuffs, especially roughages, efficiently. In future, the direct demands for grain by human beings will make efficient utilization of roughages increasingly important. A basic understanding of ruminant digestion is essential for good management and nutrition of beef cattle, sheep and goats (Visser, 2005). Vegetables vines contain amounts of essential amino acids, minerals, vitamins, soluble carbohydrates, and readily digestible NDF fraction as good energy and protein sources for microorganisms in the rumen (Mohamed *et al*., 2012). Substantially, alternative feed resources such as crop wastes and agro-industrial by-products have become an increasingly important way of the ruminants feed (Kayouli 1997). In the extensive Mediterranean production system, fibrous feed, particular cereal straws and stubbles are the most important diet ingredients for ruminants. A wide variety of arable legume crops is grown on Upper Egypt, where they have a potential wastes which can form an important resource of animal feeds following grain harvest

The cultivated area of green bean (GB) in Egypt which represents about 2.4% of the total cultivated area in the world produce about 3.5 % of the total production in the world (El-Noemani *et al*., 2010). In Egypt, crop of GB increased to 257 tones yearly in the last 3 decades (Agriculture Economics and Statistics, 2014). The residue of GB may be useful to solve the shortage problem in feedstuffs and decreasing the environmental pollution. The dry bean vines (DBV) are rich in aspartic and glutamic acids as essenitial amino acids. These acids are converted into glucose and help in maintaining the balance between acid an alkaline (Christy, 2010). Different Phaseolus beans contain lysine (1.69-2.42%), tryptophan (0.14-0.22%) and thiamin (0.77-1.34 mg/100g) Tandon *et al*. (1957). The chemical composition of GB residues depends on the proportions of stems, pod husks and leaves (Sharasia *et al*., 2017). Crop of GB straws could be use in animal feeing in fresh or ensiled forms. Also, it can be mixed with grains to elevate the protein percentage in the silage (Linn *et al*., 2002). Wastes and agro-industrial by-product must be searched as non-conventional feed resources to fill the gap and reduce the feeding cost (Zaza, 2005). The objective of this study to evaluate the effect of clover hay replacement with dry bean vines in the diet, on nutrient digestibility, milk production, some blood biochemicals, ruminal parameters and economic feed efficiency of Damascus dairy goats.

MATERIALS AND METHODS

The present study was carried out at El Gemaza Animal Production Research Station that belonging to Animal production Research Institute (APRI), Agricultural Research Center (ARC), Giza, Egypt. Dry bean vines by-

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products were obtained from Gemaza village during the interval from October and November, 2019

Feeding and management

Twenty four lactating Damascus dairy goats with average live body weight 40 ±1.50 kg at the third and fourth lactation birth seasons. The goats were chosen and divided randomly according to their body weight and milk production into four similar groups (6 animals each) and used to study the effect of partial replacement of clover hay with dried bean veins (DBV) in rations of Damascus dairy goats on digestibility, milk yield and composition, some blood parameters and rumen fermentation. The first group T0 was served as control and fed concentrated feed mixture (CFM) and clover hay (CH) at rate (50: 50), the tested groups (T1, T2 and T3) were supplemented with DBV at rate of 50, 75, and 100% levels in replacing of CH in control ration, respectively. Does were fed twice daily at 8 a.m and 6 p.m. and fresh water was freely available along the day round as well as mineral salts were available through the entire experimental period to cover the production requirements. The CFM amount was fixed to provide goats with 50% of their requirement according NRC (1986). The experimental animals were in good healthy condition and free from external and internal parasites. The experimental feeding period lasted three months of late gestation and the first two months of lactation period

Milk yield

Does were milked twice a day at 6 a.m and 6 p.m then milk yield was recorded weekly. After separation of dams from offspring for day, does were hand milked completely and milk yield was determine, till stripping the udder through two successive days during milking period. The total milk yield was recorded by summation of milk over the whole experimental period. Samples from milk were taken to analyzing milk contents of fat, protein, total solids and lactose by milko-scan (Foss 120Milko-scan, Foss Electric, Hillerod, Denmark)**.** Ash content in milk was determined by methods of A.O.A.C..(2000)

Feed conversion as DM, TDN and DCP intakes per kg milk was estimated. Economic feed evaluation was calculated for the experimental rations at the end of experiment according to the prevailing price of CFM ingredients and milk yield during of experimental period

Digestibility trial

At the end of the experimental period, four digestibility trials were conducted simultaneously (3 animals from each group) to determine the digestion coefficients and feeding values of the experimental rations. Acid insoluble ash (AIA) was used as natural internal marker. The procedure of AIA was done according to the method described by Van Keulen and Young (1977). Goats were fed individually twice daily in metabolic cages and feed intake was recorded daily. Fecal samples of nearly 100 g were taken from the rectum twice daily at 8a.m and 8p.m during the 7-consecutive days as a collection period. The daily samples of feces for each animal were immediately frozen at -20 ^{o}C until the end of the collection phase and then composited samples for each goat was prepared for laboratory analysis. Representative samples of feedstuffs, CFM, CH, DBV and feces samples were dried in oven at 70 ^{0}C for 24 hrs. and then ground to pass through 1mm screen and its chemical composition were determined according to A.O.A.C. (1999). Solution of 10% H_2So_4 was added to the representative feces samples before drying. Fiber fraction (NDF, ADF, and ADL) were detected according to Van Soest*et al*., (1991), hemicelluloses and cellulose were calculated by difference. Samples of rumen fluids were collected from each animal at 4 hr. post feeding by stomach tube at the end of the digestibility trials

Blood Samples

At the end of feeding period, blood samples were taken from the jugular vein of four animals in each group before morning feeding (at 8 a.m.). Blood samples were collected into clean sterile tubes containing heparin (anticoagulant agent). After blood centrifuged (3000 rpm for 20 min), blood plasma was separated, and frozen stored at -20^{o}C till analyses. In blood plasma, concentration of total proteins (Biuret method according to Henry *et al*., 1974), albumin (Doumas *et al*., 1971), total cholesterol **(**TC, Allian *et al*. 1974) and urea,(Fawcett and Scott, 1960) were determine. Globulin concentration was computed by the difference between total protein and albumin concentrations. Also in blood plasma, aspartate (AST) and alanine (ALT) aminotransferase activities were determined according to Reitman and Frankel (1957). All blood biochemical constituents were determined using spectrophotometer (Spectronic 21 DUSA) and commercial diagnostic kits (Combination, Pasteur Lap.)

Statistical Analysis

The obtained data were statistically analyzed using one-way analysis of variance procedure (SAS, 2000) computer program using the following fixed model

$$Yi = \mu + Ti + ei$$

Where

Yi = The individual observation; μ = Overall mean; Ti = Effect of treatments. (i = 1, 2 and 3); ei= Random error component assumed to be normally distributed. Significant differences between treatment means were determined at P<0.05 by Duncan's multiple-range test (Duncan 1955)

RESULTS AND DISCUSSION

Chemical composition of feedstuffs and rations

Chemical composition of different feedstuffs and calculated composition of rations are presented in Table 1. It is of interest to not that the chemical composition of both CH and DBV are practically similar for CP content. Concerning the cell wall constituents, no clear differences were found between CH and DBV respecting the values of NDF, ADF and ADL and this lead to slight differences among the experimental rations in its values (Table 1). Similar results are obtained by (Hussien, 2009), who evaluated some vegetable crop wastes with rabbits. The marked differences were found in OM, EE, NEE and ash percentages. These results are in agreement with those reported by Preston (2002) and Mekasha *et al*. (2002), who investigated the nutritive value of some agro-industrial by-products. Results also showed slightl differences among the experimental rations (T0 up to T3) in their percentages of DM, CP and EE, with the highest values of CF and CP (26.34 and 13.25%, respectively) in ration T3. On other hand, the percentages of OM, EE and NFE were not affected significantly by dietary treatments with slightly differences among them respecting the mentioned nutrients. Contrary, CF content was markedly increased with all tested rations in comparison to that of control one, being the highest in T3-ration (26.34%). The chemical composition of CFM was appeared to be within the normal rang that published in the literature

Table 1. Chemical analysis and cell wall constituents of the concentrate feed mixture (CFM), CH, DBV and the experimental ration (% on DM basis)

Item	CFM	CH	DBV	T0	T1	T2	T3
DM	88.95	85.87	86.16	86.14	86.80	86.18	86.57
OM	93.32	92.30	83.40	89.80	88.90	89.14	89.91
CP	15.88	13.28	9.50	13.18	13.20	13.25	13.16
CF	16.72	30.75	30.20	21.18	23.68	23.14	26.34
EE	2.83	1.15	2.60	3.18	3.15	3.10	3.18
NFE	57.89	47.12	41.10	52.26	48.87	49.65	47.23
Ash	6.68	7.70	16.60	10.20	11.10	10.86	10.09
NDF	24.92	46.45	45.35	45.35	45.70	45.90	46.10
ADF	12.32	31.38	32.49	32.18	32.14	32.52	33.40
ADL	9.56	8.14	8.80	8.17	9.16	9.90	10.20
Hemicellulose	12.59	15,07	12.86	13.17	13.56	13.38	12.70
Cellulose	2.77	23.24	23.69	24.01	22.98	22.62	23.20

***Ingredients (CFM): 31.5 yellow corn, 24.0 cotton seed meal, 40.00 wheat bran, 3.0 molasses, 0.5 mineral premix and 1% salt (as fed), calculated according to feed Composition**

Control T0 = (100% CH), T1 (50 CH : 50% DBV), T2 = (25 CH : 75 DBV%) and T3 = (100% DBV)

Results of the chemical composition cleared that dry vines (DBV) are rich in most nutrients and appeared to be in close comparable to those of CH that is considering one of the most valuable for ruminants

Nutrient digestibility and feeding values

Results in Table 2 showed that nutrient digestibility of all nutrients, except CP, were increase significantly in T2 than in T0 (control) and T3 (100% DBV). Nutrient digestibility of most nutrients insignificantly increased in T2 than in T1. In other words, T2 showed the highest values of all nutrient digestibilities, while T3 showed the lowest values. The differences in CP digestibility among the tested ration were not significant, being the highest in T2. The feeding values were nearly similar among the dietary treatments (59.28 to 63.17 for TDN and 8.19 to 8.78 for DCP). The significant differences among treatments respecting TDN and DCP values were found in term of highest values in T2 and the lowest in T3

The replacement of CH by DBV at a level of 100% (T3) showed significantly the lowest digestibility of all nutrients and feeding values. This may be attributed to the presence of some anti-nutrition factors in DBV (phytate, phytic acid, oxalate, tannins and saponin). These anti-nutritional factors were recorded to be 1.13, 1.04, 10.98, 2.01 and 8.2 g/100g DM in GBVH, respectively (Hussien, 2009; Abou El-Fadel *et al*., 2018)

Table 2. Digestion coefficients and feeding values as affected by feeding experimental ration

Digestibility (%)	Treatment				±SE
	T0	T1	T2	T3	
DM	64.11 ^{c}	66.35 ^{ab}	68.25 ^{a}	64.04 ^{c}	±0.542
OM	67.69 ^{b}	69.71^{a}	70.87 ^{a}	66.53 ^{b}	±0.556
CP	63.28	65.60	66.22	62.23	±0.718
CF	54.58 ^{b}	55.99 ^{b}	58.52 ^{a}	53.92 ^{b}	±0.601
EE	69.74 ^{c}	72.80 ^{b}	73.92 ^{a}	70.32 ^{c}	±0.536
NFE	74.71 ^{b}	76.98 ^{ab}	77.68 ^{a}	73.36 ^{b}	±0.586
Feeding values (%):					
TDN	61.16 ^{b}	61.83 a ^{b}	63.17 ^{a}	59.28 ^{c}	±0.467
DCP	8.34 $^{a\,b}$	8.66 $^{a\,b}$	8.78 ^{a}	8.19 ^{b}	±0.099

Means bearing different letter superscripts (a, b and c) within the same row are significantly (P ≤ 0.05)

Definitely, most the untraditional by-products from vegetables could be favorable a replacement of good quality fodder (clover hay) up to 50%. However, increasing the whole replacement (100%) resulted in a marked reduction in feed utilization and nutrient digestibility. The best feeding value of T2 75% DBV might be use to the synergistic interaction between the nutrients that released from the two suitable levels of both roughage kinds in this rations. It is also well known nutritionally as a kind of positive associated effect that potentially affect positively on feed utilization and consequently on productive performance of ruminant animals (Huhtanen, 1991). Furthermore, in many circumstances two feeds may be of similar nutritive value but of differing feeding value, because of their effects on feed intake or their synergistic or antagonistic interaction with other feeds in the ration (Thomas, 1990). These results are in harmony with those obtained by Salem and Abd El-Galil (2014) who demonstrated that digestibilities of all nutrients were significant (P<0.05) higher for tested rations containing mixed clover and bean forage waste silage than those of the control ration that free from this mixture for lactating buffaloes. On the other hand, Chanthakhou *et al*. (2001) revealed that apparent digestibility of CP and OM was linearly increased (P<0.05), while, DM, NDF and ADF digestibilities were not affected by increasing *Phaseolus calcaratus* hay incorporation at rate of 300, 600 and 900 g DM/h/d for swamp buffaloes. Also, Khayyal *et al*. (2018) showed that the inclusion of green bean vines (GBV) at rate of 10, 20, 30 and 40% in the diet of rabbits had no effect (P>0.05) on digestibilites of all nutrients and feeding values in terms of TDN and DCP values. The lowest impact of the high level of GBV (40%) may be due to the negative impact of oxalate as an anti-palatability factor in dried GBV. In this respect Oke (1969) mentioned that oxalates effect on metabolism of magnesium and calcium, and form complexes by reaction with proteins. This complex inhibits the peptic digestion. The nutritional value of feedstuffs may be decreased by tannins in non-ruminants by decreasing retention time of protein, metabolic rate of gross energy and digestibility of dry matter, and inhibition of activity of digestive enzymes (Li and Zhang, 1998). Therefore, the increase in replacement rate of up to 100% decreased the

feed utilization and digestibility of T3. Ultimately, the partial replacement of clover hay by good quality DBV in order to not more than 75% could be considering as potential replacement rate

Milk yield and composition

Data of daily milk yield and its composition are presented in Table (3). Results illustrated that actual milk yield was significantly higher with feeding T2 and insignificant higher with T1 than with control ration. These results revealed that the highest level of 100% DBV in T3 insignificant decreased the amount of actual milk yield compared with the of control one (T0). Feeding T2 recorded the highest (P<0.05) daily 4%-FCM yield followed by T1, while T3 and T0 showed the lowest values. Improving the digestion coefficients of most nutrients and feeding values with the tested ration T1 and T2 were favorably reflected on more actual and 4% FCM yields. Regarding chemical composition of milk, most milk constitutes were not significantly affected by dietary treatments. Only the percentage of solids not fat (SNF) were significantly lower in T1than the control one (T0). Despite fat and protein contents had non-significant differences among treatments in fat content were markedly increased, while, protein content decreased in milk by increasing the replacement of CH with DBV in the tested ration. In agreement with the present findings, Abou El-Fadel *et al*. (2018) revealed that milk yield a actual or 4% FCM was significantly increased with ration containing 75% green bean vines hay GBVH and 25% clover hay. Also milk yield increase insignificantly with T1 and T2 than T0, while T3 had produced the lowest amount of milk. Also, they showed that fat percentage was increased (P<0.05) significantly with increasing levels of GBVH compared with those fed the control diet, while an opposite trend was observed with the percentage of milk protein among treatments. Othewise, Salem and Abd El-Galil (2014) mentioned that buffaloes fed diets containing 50 % CFM+25 % clover silage (CS) and 25% bean forage waste silage BS rations led to significant increases (P<0.05) in the percentages of fat, SNF, lactose and ash, while the content of protein increased (P<0.05) significantly with rations containing 50% CFM+50 % BS compared with the control ration. The increasing fat content with rations may be due to the higher fermentation of its fiber content and quality into volatile fatty acids in rumen which naturally converting to fat in milk. In the present work SNF % were significantly decreased in T1 and insignificant decreased with T3 compared with that of control ration (T0). These results are in agreement with those reported by Abou El-Fadel *et al*. (2018). Meanwhile, slightly improvement respecting milk TS was observed with the most tested rations compared with control diet with significant difference between the tested rations that having 50 and 100% DBV in replacing with CH in diets. Regarding milk fat yield (Table 3), it was significantly higher with T2 than (T0) (41.85 vs. 30.23 g/h/d), while ,it was insignificantly higher with the other tested rations than the control one. Milk protein yield in T2 was insignificant higher than inT1 and significantly higher than in the other tested rations.

Table 3. Milk yield and milk composition of goats fed the experimental rations

Item	Experimental ration				±SE
	T0	T1	T2	T3	
Body weight (kg)	37.00 ^{b}	40.88 ^{ab}	42.63 ^{a}	40.38 ^{ab}	±0.846
Milk yield, (g/h/ d)	997 ^{bc}	1100 ^{ab}	1199 ^{a}	963 ^{c}	±32.19
4% FCM, Yield, (g/h/d)	852 ^{b}	980 ^{ab}	1103 ^{a}	922 ^{ab}	±37.50
Milk composition,%					
Fat%	3.03	3.27	3.45	3.72	±0.115
Total solids (TS),%	11.13 ^{ab}	10.76 ^{b}	11.33 ^{ab}	11.79 ^{a}	±0.143
Solid not fat (SNF),%	7.93 ^{a}	7.28 ^{b}	7.67 ^{ab}	7.85 ^{a}	±0.102
Protein%	3.39	2.70	3.21	2.80	±0.140
Lactose%	3.91	4.12	3.80	4.54	±0.153
Ash%	0.81	0.68	0.88	0.73	±0.053
Yields of milk components, (g/h/d)					
Fat	30.23 ^{b}	36.0 ^{ab}	41.58 ^{a}	35.77 ^{ab}	±1.80
Total solids	110.9 ^{b}	118.3 ^{b}	135.7 ^{a}	113.4 ^{b}	±3.41
Protein	33.74 ^{b}	29.44 ^{ab}	38.36 ^{a}	26.95 ^{b}	±1.68
Lactose	38.94	45.47	45.47	43.72	±1.703

a, b and c means with different superscripts within same row are significantly different (P<0.05).
4% FCM yield = 0.4× milk yield + 15 × fat yield

Virtually, nutritional strategies that optimize rumen function can be considerably maximize milk production and its composition, however, there are many strategies that producers can be use to increasing rumen functions and consequently maximizing milk yield and its components. Nutritional strategies that positively impact milk components includes adequate level of forage NDF and adequate rumen degradable protein in the diet especially for early lactation cow (Vargand Ishler, 2007). In this line, Bachman (1992) and Varga and Isher (2007) cleared that concentration of fat in milk can vary over a range of about 3 % units through diet manipulation. In contrast, minerals, lactose and the other solid contents of milk are not responsive; meanwhile the protein % can be varied about 0.6 units. Salem and Abd El-Galil (2014) showed similar milk yield and composition when they tested the effect of mixing the clover with bean forage waste silage at different levels in the rations of lactating buffaloes. In general, GBV is a potentially attractive by-product in lactating goat feeding (Lui *et al*., 2004)

Feed intake, feed conversion and economic evaluation of goat fed the experimental rations

Results of dry matter intake (DMI), feed conversion (FC) and economic efficiency of the experimental ration are presented in Table (4). Feed intake as DM was insignificantly the highest with T3 in comparison with the control and the other tested diets. Also, TDNI did not significant affected by all tested

rations compared with control one, being the highest with T2-ration (575.0 g/h/d), but T3 recorded the lowest value (540.0 g/h/d).This result is in agreement with those obtained by Abd El-Galil *et al*. (2011) showing no significant differences in total DMI among the groups of goats that fed diets containing bean straw untreated or treated with (*Ruminococcus albus* or *Bacillus sp*.) as a (Biological treatments) comparing with the (control) one. In contrary these results are in disagreement with those obtained by Chanthakhou *et al*. (2001) who revealed that total DM intake was linearly increased (P<0.05) with increasing *Phaseolus calcaratus* hay incorporation at rate of 300, 600 and 900 g DM/h/d for swamp buffaloe rations. Also, Salem andAbd El-Galil (2014) revealed that lactating buffaloes fed the control ration that formulated as 50% CFM and 50% clover silage showed the highest (P<0.05) total DMI, while those fed 50% CFM+25% CS and 25% bean forage waste silage had the highest (P<0.05) TDN intake. Unmistakably the variations in feed intake may be attributed to the differences in the palatability of different feedstuffs by animals, as well as the feeding system that applied. The tested rations had significant effect on DCPI g/h/d with the highest value (80.0 g/h/d) with T2 and the lowest value (76.0 g/h/d) with T0. In perspective, the feed conversation expressed as kg DMI/FCM kg milk was improved with the tested ration which formulated with 50 and 75% DBV ingredient (P>0.05), while, the poorest value were occurred with either those received100% DBV ration (T3) or those of control-ration (T0). These findings are similar to those obtained by Abd El-Galil *et al*. (2011) who showed that feed efficiency (kg gain/kg DMI) were significantly (P<0.05) higher for diet of goats contained bean straw treated with *Ruminococcus albus* or *Bacillus sp*. As a (biological treatments) than that contained untreated or control diet. Also in matching with the present results, Hussien (2009) found that feed conversion was improved by replacing 25 or 50% green bean vines instead of clover hay in the ration of rabbits compared to control one. Similar trends among dietary treatments to that of (DMI:FCM) were observed by both items of (TDNI:FCM) and (DCPI:FCM) as feed efficiency traits.

Data of economic efficiency revealed that daily feeding cost and feed cost of kg 4% FCM was the highest for T0, followed by T1 and T2, while T3 showed the lowest one. On the other hand, the best economic efficiency relative to the control ration was recorded in T2 (168.65%). This trend revealed that diets containing DBV could be related to the high feed conversion, and has positive effects on feeding value with decreasing feeding cost

Table 4. Feed intake, feed conversion and economic evaluation of goat fed experimental rations

Item	Experimental ration				
	T0	T1	T2	T3	±SE
Feed intake (kg /head/day):					
DMI (g/head/day)	909.1	909.8	910.2	910.6	±0.167
TDNI (g /head/day)	556.0	563.0	575.0	540.0	±3.816
DCPI (g /head/day)	76.0 ^{c}	79.0 ^{b}	80.0 ^{a}	75.0 ^{d}	±0.62
4% FCM (kg/h//d)	852 ^{b}	980 ^{ab}	103 ^{a}	922 ^{ab}	±37.50
Feed conversion (kg/kg):					
Kg DMI / FCM/ (kg milk)	1.07 ^{a}	0.94 ^{b}	0.83 ^{c}	0.99 ^{b}	±0.021
Kg TDNI / FCM (kg milk)	0.720 ^{a}	0.637 ^{b}	0.578 ^{c}	0.644 ^{b}	±0.013
g DCPI/ FCM (g milk)	0.983 ^{a}	0.891 ^{b}	0.803 ^{c}	0.890 ^{b}	±0.017
Economic evaluation:					
Daily feed cost, L.E	3.64	3.08	2.80	2.52	-
Cost of 1kg 4% FCM (LE)	4.27	3.14	2.54	2.74	-
Price of daily milk yield, L.E	8.52	9.8	11.03	9.22	-
Economic return, L.E	4.88	6.72	8.23	6.69	-
Economic return, (h/d)%	100	137.70	168.65	137.09	-

a, b and c means in the same row with different superscripts are significantly (P ≤ 0. 05) different

Calculation based on the following price in Egyptian pound (L.E.) per ton at 2017, concentrate feed mixture (CFM) =4500 L.E/ton, berseem=2500 L.E/ton, bean veins=350 L.E/ton, one kg of raw milk=10 L.E

Blood biochemical Parameters

Results of blood plasma when using DBV incorporation in goat diets (Table 5) showed no significant (P>0.05) effect due to dietary treatments on most studied parameters such as concentrations of total protein, albumin, globulin, urea, AST and ALT activities (P>0.05). The insignificant effects of the tested diets observed on most blood biochemicals may be attribute to the similarity in nutrients contents especially CP a daily requirement for the does. Generally, concentrations of total proteins and albumin in blood plasma is directly responsive to intake and quality of protein in the diet (Onifade and Abu, 1998). These results are on line with those obtained by Salem and Abd El-Galil (2014) who demonstrated that blood total protein and globulin were non-significantly for lactating buffaloes fed rations containing different levels of mixed clover and bean forage waste silage in comparison with those of the control one. These results are opposite to those reported by Abd El-Galil *et al*., (2011) who found that the highest (P<0.05) blood plasma total protein concentration was occurred with goats fed diet contained bean straw untreated or treated with *Ruminococcus albus* or *Bacillus sp*. (biological treatments), while the lowest value was recorded with control ration that being free from this crop-by product. Basically, Singh and Jha (2009) observed that concentrations of total proteins and its fraction are a biological reflection of animal health and performance. Concerning liver enzymes results of the present study indicated normal liver function with no

effect of the tested diets on activity of plasma AST and ALT. In relation to this point Abdel-Magid (2005) used chickpea straw, pea straw or kidney bean straw instead of clover hay did not found any adverse effects on the activities of AST, ALT and albumin concentrations for growing rabbits. Otherwise, earlier results conducted by Salem and Abd El-Galil (2014) have been revealed that the activities of AST enzyme was increased (P<0.05) and ALT was decreased (P<0.05) with increasing clover and bean forage waste silage for lactating buffaloe ration compared with the control one that free from waste by-product ration. Results of current work, also showed that blood plasma urea concentration was slightly (P>0.05) decreased with increasing the levels of dried DBV in the doe diets compared with those of the control one as observed in Tables (5). These results are in consistent with those obtained by Chanthakhou *et al*. (2001) who recorded that the increasing of *Phaseolus calcaratus* at rate of 300, 600 and 900 g DM/h/d in the diets of swamp buffaloes did not adversely affect (P>0.05) on blood urea N concentrations due to these changes of their diets. On the other hand, measurement of total cholesterol concentration was affected significantly (P<0.05) by dietary treatments, being the lowest value (99.55) was occurred with T2 ration and the highest value (142.02) was associated with the control (T0) one. In the meantime, total cholesterol concentration was significantly (P<0.05) lower with diet contained 75% DBV (T2) in replacing with clover hay than that of control (T0) and other tested rations T1 and T3. Concentration of blood biochemicals studied are within the normal range of rabbits fed the vegetable crop wastes. The positive effects of GBV feeding on blood total proteins, globulin, urea, and cholesterol was reported by Hussien (2009). General, feeding practice, climate and management were found to affect the enzymes which are related to metabolic processes (Young *et al.*, 1969). Additionally, dietary protein and energy levels are the most effective factors related to the blood plasma picture (Singh *et al*., 2013).The values obtained in this work respecting blood constituents indicated that normal physiological and healthy status of all goats groups

Table 5. Blood parameters as affected by feeding the experimental rations.

Item	Experimental ration				
	T0	T1	T2	T3	±SE
Total protein (g/dl)	7.81	8.05	8.32	7.90	±0.74
Albumin (g/dI)	2.24	2.45	2.56	2.35	±0.22
Globulin (g/dI)	5.57	5.60	5.76	5.55	±0.80
ALT (U/L)	22.14	22.80	24.17	21.90	±2.00
AST (U/L)	35.18	37.19	39.01	36.14	±3.90
Urea (mg/dl)	35.09	31.40	30.10	29.04	±3.80
Total cholesterol(mg/dl)	142.02 [a]	130.50 [a]	99.55 [b]	125.09 [a]	±21.20

Means bearing different letter superscripts (a, b and c) within the same row are significantly (P ≤ 0.05).

Rumen fluid parameters

Rumen parameters recorded in Table (6) revealed that ruminal pH values were within the normal range with no significant differences among the dietary treatments. As the nutritionist well known, ruminal pH value is considering one of the most improvement factors that potentially affecting positively on microbial fermentation in the rumen that also considered the key and vital process of feed utilization.

Table 6. Rumen fluid parameters of goats fed the experimental rations.

Item	Experimental ration				±SE
	T0	T1	T2	T3	
pH value	6.13	6.35	6.42	6.38	±0.248
TVFA,s(meq/100ml)	9.44 [b]	10.98 [a]	11.77 [a]	10.45 [ab]	±0.300
Ammonia nitrogen (mg/100ml)	20.56 [a]	18.75 [a]	16.21 [b]	18.52 [a]	±0.533

Means bearing different letter superscripts (a and b) within the same row are significantly (P ≤ 0.05).

These findings are in agreement with those reported by Chanthakhou *et al*. (2001) who revealed that *Phaseolus calcaratus* hay incorporation at rate of 300, 600 and 900 g DM/h/d had no effect on rumen pH for swamp buffalo rations. Also, Hussien (2009) revealed no significant effect on pH values due to fed rabbits on GBV-diets based on control one free from GBV ingredient. Basically, celluolytic bacteria are more sensitive to low pH than those utilizing starch or sugar. Fiber digestion in the rumen has been reported to be totally inhibited when pH is reduced below 6.0- 6.1 (Mould and Orskov, 1983). Otherwise, concentration of volatile fatty acids (TVFA´s) was significantly increased (P<0.05), but ammonia concentration was significantly decreased for does fed T2 diet compared with that of control one that free from this residue. While the other tested rations mostly did not differ significantly from control one, respecting both later items. This is may be due to the increase in all nutrient digestibilities than that of control ration (Table 2) and this are in agreement with the findings of Hussien (2009) in rabbits and Rangel *et al*. (2017) in lambs, they demonstrated that lambs fed cull pinto beans *Phaseolus vulgaris* led to an increase in the volatile fatty acids. Also, Chanthakhou *et al*. (2001) showed that VFA,s especially propionic acid and acetic acid concentrations in the rumen were maximized (P<0.05) when ration of swamp buffaloes contained 600 g /h/d *Phaseolus calcaratus* hay in comparison with those fed rations included 0.00, 300 or 900 g /h/d of such hay. Nutritionally, Van Houtert (1993) indicated that relatively large amounts of propionic acid are reported when easily digestible substrates are supplied to rumen microbes. While, Khayyal *et al*. (2018) showed that concentrations of ammonia-N and pH values in caecum

contents of rabbits were slightly lowered by increased the dietary level of DGBV. Ammonia and amines production is quite common during the ruminal fermentation due to protein hydrolysis. However, Chanthakhou *et al*. (2001) observed no effect on ruminal NH3-N by incorporation of *Phaseolus calcaratus* hay in the diet of swamp buffaloes. Pointedly, Huhtanen (1991) mentioned that the dietary energy utilization is depending not only on nutrients the profile; but also from nutrients made available from other feeds that introduced in the diets. It is well known that TVFA,s are the main products of microbial fermentation of carbohydrates, consequently, their concentration in the caecum and other fermentative areas can be used as an indirect tool for monitoring the rumen environment.

CONCLUSION

From the results obtained in this study, it could be concluded that dry bean veins are favorably used as partially replacement of clover hay up to 75% in the diet for good productive performance and profitability of lactating goats

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إستخدام عروش الفاصوليا الجافة فى تغذية الماعز

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استخدم فى هذة الدراسة 24 عنزة دمشقى حلابة لمعرفة مدى تأثير إستبدال دريس البرسيم بعروش الفاصوليا الجافة على معاملات الهضم وانتاج وتركيب اللبن وبعض القياسات للخصائص الفسيولوجية للدم وأيضا الكفاءة الإقتصادية. وكان متوسط وزن الجسم 40 كجم±1,50كجم فى موسم الولادة الثالث والرابع حيث تم تقسيم الماعز عشوائيا بالتساوى إلى أربعة مجاميع متشابهة (6 حيوانات لكل مجموعة). الأولى مجموعة مقارنة ت 0 وتتكون من العلف المركز ودريس البرسيم بنسبة (50:50%) بينما العلائق المختبرة كانت كاللآتى :(ت1،ت2،ت3) علائق محتوية على (50، 75 و100%) عروش فاصوليا جافة كإستبدال من دريس البرسيم فى العليقة المقارنة على التوالى. أظهرت النتائج أن معظم نسب معاملات الهضم والقيمة الغذائية إرتفعت معنويا مع المجموعة التي تغذت علي ت2 وكان الإرتفاع غير معنوي مع المجموعة ت1 مقارنة بالمجموعتين الاخرتين ت 3 وت 0, ولكن البروتين المهضوم الكلي لم يتأثر معنويا بالمعاملات الغذائية المختلفة وسجلت المجموعة ت 2 أعلي القيم.وأشارت النتائج أنه لاتوجد اختلافات (P>0.05) معنوية فى التركيب الكيماوى للبن وفى كميات المأكول اليومي وأيضا فى معظم تركيزات الخصائص الفسيولوجية للدم بين المعاملات المختلفة ومجموعة الكنترول.ووجد أن محصول اللبن واللبن المعدل لنسبة 4% دهن أرتفع معنويا مع ت 2 وكان الأرتفاع غير معنوي مع المجموعة ت 1 مقارنة مع المجموعات ت 3 و ت 0. ودلت النتائج ايضا إلى وجود تحسن ملحوظ (P<0.05) فى معدل التحويل الغذائي فى العليقة ت 1 و ت 2 بينما كانت أقل القيم كانت مع المجموعات ت 3 و ت 0. كما أظهرت النتائج أن الكفاءة الأقتصادية كانت الأعلي في المعاملة ت 2. وفى النهاية يمكن إستنتاج أنه يمكن إستبدال دريس البرسيم بعروش الفاصوليا الجافة حتى 75%.