

## EFFECT OF DIETARY ADDITION OF LUPIN AND/OR FENUGREEK SEEDS ON THERMO-RESPIRATORY RESPONSE AND SOME BLOOD CONSTITUENTS OF RAHMANI SHEEP

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### SUMMARY

This study was conducted to investigate the influence of dietary addition of lupin and /or fenugreek seeds on thermo-respiratory response and some blood constituents of Rahmani sheep. Twenty Rahmani lambs of about 3.5 to 4 months old and body weight of  $18.8 \pm 0.5$  kg were distributed in four experimental groups. The control group (C) was fed concentrate feed mixture (CFM), termis (Lupin) group (L) was fed CFM supplemented with 4 % lupin seeds, fenugreek (F) group was fed CFM supplemented with 8% fenugreek seeds and lupin with fenugreek (LF) group was fed CFM supplemented with 2% lupin seeds and 4% fenugreek seeds. Respiration rate and rectal, skin ear and wool temperatures were tested biweekly and blood samples were taken monthly for determination of some blood constituents. The experimental period was extended for 150 days. The data were statistically analyzed using GLM procedures of SAS (1996). The results indicated that the respiration rate, rectal temperature and skin, ear and wool temperatures tended to increase in animals fed L and LF seeds and there were no significant differences among L, F and LF diets. There were no significant differences in average value of hemoglobin and PCV, % among lambs fed lupin and/or fenugreek diets. Ration supplemented with L and F had the lowest value of serum glucose concentration in Rahmani lambs compared to the other diets. In particular, lupin diet tended to decrease serum glucose particularly during the second month of experimental period. Animals fed on LF tended to have higher values of serum total protein. Lambs fed on a diet containing F seeds tended to have less serum total proteins than other treatments. Fenugreek feeding tended to decrease serum cholesterol. Serum triglyceride levels were significantly differed among different rations and periods. Serum triglycerides decreased by about 16 and 15% due to L and F feeding at 1<sup>st</sup> month of the experimental period, the corresponding values at 4<sup>th</sup> month of the experimental period were 10 and 11%, respectively. The overall means of serum urea-nitrogen concentrations were lower ( $P < 0.05$ ) in lambs fed LF seeds than those fed control diet. However, feeding L or F tended to increase serum urea- nitrogen of lambs. The overall means of serum creatinine were not significant among animals fed L, F and LF seeds. The overall means of serum AST and ALT concentrations were not significantly affected by feeding L and F seeds. In conclusion: Lupin or fenugreek seeds tended to have hypoglycemic effects, fenugreek seeds tended to decrease serum cholesterol and feeding both lupin and fenugreek seeds had no deleterious effects on kidney or liver function.

**Keywords:** lupin, fenugreek, thermo-respiratory response, blood constituents, sheep

### INTRODUCTION

Legumes as a source of plant protein are suitable crops having good potential in the Egyptian agriculture. In recent years, there is an increased interest in the use of the seeds of temperate grain legumes such as lupin and fenugreek as animal feed supplements. Several studies in animal nutrition showed that adding some spices or medicinal and aromatic plants to the diets of sheep, goats, rabbits, chicken, cows and buffaloes had favorable effects on live weight gain, feed intake, feed efficiency and nutrient digestibility (Hanafy, 1995; Karaly 1995; Gaber *et al.*, 1996; Mir *et al.*, 1998; Youssef *et al.*, 1998; Abol-Fotouh *et al.*, 1999; Allam *et al.*, 1999; El-Ayek *et al.*, 1999 and El-Saddany *et al.*, 1999). Moreover, lupin and fenugreek seeds may have some effects on blood constituents. Clinical and experimental studies have documented antidiabetic and antiatherosclerotic effects (Ajabnoor and Tilmisany, 1988; Sharma and Raghuram, 1990). However, due to high content of quinolizidine alkaloids, which make the seeds

bitter may have some effects on liver and kidney functions, particularly high levels of such seeds. Therefore, this study was conducted to examine the effect of lupin (*Lupinus termis*) and fenugreek (*Trigonella foenum graecum*) seeds on thermo-respiratory response and some blood parameters in Rahmani lambs.

### MATERIALS AND METHODS

This study was carried out in the Experimental Farm of Animal Production Department, Faculty of Agriculture, Al-Azhar University, Assiut Branch. The present work aimed to study the effect of lupin and /or fenugreek seeds supplemented rations on thermorespiratory response and some blood constituents of Rahmani lambs.

#### **Animals and Management:**

A total number of 20 Rahmani lambs of about 3.5 to 4 months old and their live body weight averaged  $18.8 \pm 0.5$  Kg were divided into four treatment groups similar in body weight. A control group (C) was fed concentrate feed mixtures (CFM), termis (Lupin) group (L) was fed CFM supplemented with 4 % lupin

seeds, fenugreek (F) group was fed CFM supplemented with 8% fenugreek seeds and lupin with fenugreek (LF) group was fed CFM supplemented with 2% lupin seeds and 4% fenugreek seeds. The animals were fed 80% concentrate and wheat straw *ad libitum*. Animals were fed in groups two times daily (at 8:00 a.m. and 6:00 p.m.). Water

was offered three times daily at 8:00 a.m., 12:00 noon and 6:00 p.m. The formulation of CFM with additives are shown in Table (1) while the chemical analysis of rations are shown in table (2). Rations were formulated to be isonitrogenous (16% CP) and isocaloric / isoenergetic (74% TDN).

**Table 1. Formulation of the concentrate feed mixtures**

Ingredient (%)	Rations			
	C	L	F	LF
Uncorticated cotton seed cake	40	25	29	27
Corn	22	27	24	25
Wheat	35	41	36	39
Lupin	-	4	-	2
Fenugreek	-	-	8	4
Limestone	2	2	2	2
Sodium chloride	1	1	1	1

C= control diet, L= 4% lupin seeds of C diet, F= 8% fenugreek seeds of C diet and LF= 2% lupin with 4% fenugreek seeds of C diet.

**Table 2. Chemical (%) of rations on DM basis**

Item	Rations			
	C	L	F	LF
DM	92.6	91.95	92.18	92.1
CP	18.6	18.1	18.15	18.00
CF	12.7	13.92	11.3	9.7
EE	3.11	3.10	2.7	2.9
NFE	58.89	59.28	62.65	63.25
OM	93.4	94.4	94.8	93.85
Ash	6.6	5.6	5.2	6.15

DM: Dry Matter, OM: Organic Matter, CP: Crude Protein, CF: Crude Fiber, EE: Ether extract and NFE: Nitrogen free extract. C= control diet, L=4% lupin seeds of C diet, F= 8% fenugreek seeds of C diet and LF= 2% lupin with 4% fenugreek seeds of C diet.

#### **Thermo respiratory response parameters:**

Maximum and minimum air temperatures and relative humidity throughout the experimental period were 35, 12°C and 80, 51%, respectively. The THI were 84.63 and 49.20 %, respectively according to the following equation after Han *et al.*, 2003,  $THI = ((TDB * 1.8) + 32) - ((0.55 * (RH/100))) * (((TDB * 1.8) + 32) - 58)$ . Where: TDB Respiration rate (RR), rectal temperature (RT), skin temperature (ST), ear temperature (ET) and wool surface temperature (WST) measurement were recorded once weekly.

Respiration rate (RR) was expressed as the number of respiration per minute (r.p.m) and was measured by counting the flank movements. Rectal temperature (RT) was measured using clinical thermometer. Skin temperature (ST), ear temperature (ET) and wool Surface temperature (WST) were measured using tele-thermometer.

#### **Blood sampling and analysis:**

Blood samples were obtained from all animals at 9:00 am every month. Blood samples (8 ml sample) were collected by jugular vein puncture of each lamb at 2 hrs after the morning feeding and divided into two vials, one dry clean glass vials containing heparin while the other dry clean 10 ml centrifuge tube. Blood samples were allowed to clot at room temperature, serum was then separated by centrifugation at 3000 r.p.m for 15 minutes, then

serum was decanted into clean dry glass vials and stored at 20°C until subsequent analyses. Various chemical analyses were determined using commercial kits optical density by spectrophotometer (SP6-55 UV/vis, made in England). Packed cell volume (PCV, %) in blood samples was measured according to a standard method of hematology (Schalm, 1986). The concentration of hemoglobin (Hb) and urea nitrogen, aspartate aminotransferase (AST), alanine aminotransferase (ALT), creatinine and serum glucose were determined using kits supplied by Diamond Diagnostics (Egypt). Serum cholesterol, total protein concentrations, Albumin and Triglyceride were determined by using kits of Biocon (Germany). Serum globulin concentration was calculated as a difference between serum total protein and serum albumin. Albumin/globulin ratio (A/G) was also calculated.

Statistical analysis: The data were statistically analyzed using GLM procedures of SAS (1996) according to the following Statistical model.  $Y_{ijk} = \mu + T_i + M_j + T M_{ij} + E_{ijk}$ , Where,  $Y_{ijk}$  = experimental observation.  $\mu$  = general mean,  $T_i$  = the effect of treatment,  $i = C, L, F$  and  $LF$ .  $M_j$  = the effect of months,  $j = 1, 2, 3, 4, 5$  months.  $T M_{ij}$  = the interaction effect of treatment and months.  $E_{ijk}$  = the errors related to individual observation. The significance differences among treatment means were

tested by Duncan Multiple Range Test (Steel and Torrie, 1980).

## RESULTS AND DISCUSSION

### *Effect of feeding termis and fenugreek seeds on respiration rates and rectal, skin, ear and wool surface temperatures of Rahmani lambs:*

The overall means of respiration rate, rectal temperature and skin, ear and wool temperatures were insignificantly affected by feeding lupin and/or

fenugreek seeds. With the exception that respiration rate and skin, ear and wool temperatures, which tended to increase in animals fed lupin and lupin with fenugreek seeds (Table 3). Such differences may be related to feed intake and/or protein intake in the relevant diets (Soliman *et al.*, 2016). Bianca (1968) and Ulberg (1971) found that rectal temperature was increased due to the increase of feed intake.

**Table 3. Effect of feeding lupin and fenugreek seeds on thermo- respiratory response of Rahmani lambs**

Item	Diet *			
	Control ©	Lupin (L)	Fenugreek (F)	LF
Respiration rates, breath/min.	22.88 ± 0.59 <sup>ab</sup>	22.61 ± 0.56 <sup>ab</sup>	21.80 ± 0.71 <sup>b</sup>	23.93 ± 0.72 <sup>a</sup>
Rectal temperatures, °C	39.29 ± 0.04 <sup>a</sup>	39.30 ± 0.04 <sup>a</sup>	39.27 ± 0.04 <sup>a</sup>	39.37 ± 0.04 <sup>a</sup>
Skin temperature, °C	36.75 ± 0.10 <sup>ab</sup>	36.95 ± 0.11 <sup>ab</sup>	36.72 ± 0.10 <sup>b</sup>	37.04 ± 0.08 <sup>a</sup>
Wool surface temperature, °C	29.84 ± 0.57 <sup>b</sup>	31.31 ± 0.44 <sup>a</sup>	29.67 ± 0.66 <sup>b</sup>	30.96 ± 0.54 <sup>a</sup>
Ear temperature, °C	30.45 ± 0.52 <sup>b</sup>	31.80 ± 0.42 <sup>a</sup>	30.11 ± 0.62 <sup>b</sup>	31.33 ± 0.48 <sup>a</sup>

\* values are LSM means ± standard error of LSM. <sup>a, b</sup> means within the same column or row having different superscripts (P<0.05). C= control diet, L= 4% lupin seeds of C diet, F= 8% fenugreek seeds of C diet, LF= 2% lupin with 4% fenugreek seeds of C diet

### *Effect of feeding termis and fenugreek seeds on some blood constituents of Rahmani lambs.*

Feeding either termis or fenugreek containing diets had no significant (P>0.05) effects on hemoglobin and PCV,% (Table 4). Similarly, Yones (2005) used lupin seed meal in feeding fish (*Sparus aurata*) and found no significant effect on hematocrite and hemoglobin values. Also, Tomar *et al.* (1996) found no effect of feeding fenugreek seeds on hemoglobin in buffaloes.

The overall means of serum glucose concentration in blood of lambs fed lupin and/or fenugreek seeds had no significant differences among treatments (Tables 4 and 5). However, feeding lupin tended to decrease serum glucose during most experimental periods. Serum glucose decreased by 17, 26 and 7% at 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> experimental periods (Figure 1). Similar results were found, but to less extent with fenugreek feeding. The hypoglycemic effect of lupin is not found in the literature, However, several investigators reported that fenugreek seeds

had hypoglycemic effects (Matsuo *et al.*, 1996, Rashwan, 1998 and Saito *et al.*, 1999). Fenugreek seeds are reported to have hypoglycemic and hypocholesterolemic effects (Madar and Shomer, 1990). In addition, Khosla *et al.* (1995) found that oral administration of fenugreek at a levels of 2 and 8g/ Kg to normal and alloxan diabetic rats decreased (P<0.05) blood glucose. Accordingly, fish (Nile tilapia) fed different levels 2, 4, 6 and 8%, of fenugreek had serum glucose concentrations of 43.8, 38.1, 35.4 and 30.0 mol/dl, respectively (Shalaby, 2004). In buffaloes, serum blood glucose decreased (39.1 vs. 44.4mg/dl) as a result of feeding fenugreek seeds by 200g/day (Tomar *et al.*, 1996). Teleni *et al.* (1989) reported that propionate production in the rumen increased when lupin was included in the ration. Hypoglycemic effect of either lupin or fenugreek seeds needs further investigation on the levels of insulin and its receptors and/or intestinal absorption of glucose.

**Table 4. Effect of feeding lupin and fenugreek seeds on some blood constituents of Rahmani lambs**

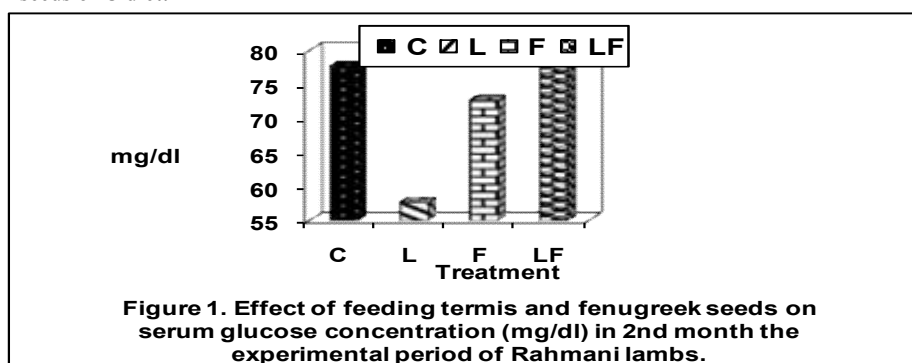
Item	Diet *			
	Control ©	Lupin (L)	Fenugreek (F)	LF
Packed cell volume, PCV%	35.4 ± 1.65 <sup>a</sup>	34 ± 2.5 <sup>a</sup>	34.87 ± 1.88 <sup>a</sup>	32.87 ± 2.70 <sup>a</sup>
Hemoglobin, g/dl	16.74 ± 0.80 <sup>a</sup>	15.07 ± 1.06 <sup>a</sup>	16.38 ± 0.79 <sup>a</sup>	15.96 ± 0.77 <sup>a</sup>
Glucose, mg/dl	75.88 ± 2.17 <sup>a</sup>	66.87 ± 2.5 <sup>a</sup>	74.19 ± 1.33 <sup>a</sup>	76.79 ± 1.92 <sup>a</sup>
Total protein, g/dl	6.98 ± 0.29 <sup>a</sup>	6.69 ± 0.28 <sup>a</sup>	6.47 ± 0.35 <sup>a</sup>	7.14 ± 0.38 <sup>a</sup>
Albumin, g/dl	2.68 ± 0.12 <sup>a</sup>	2.74 ± 0.12 <sup>a</sup>	2.60 ± 0.09 <sup>a</sup>	2.90 ± 0.14 <sup>a</sup>
Globulin, g/dl	4.31 ± 0.26 <sup>a</sup>	3.96 ± 0.23 <sup>a</sup>	3.86 ± 0.35 <sup>a</sup>	4.23 ± 0.33 <sup>a</sup>
A/G ratio	0.66 ± 0.04 <sup>a</sup>	0.72 ± 0.04 <sup>a</sup>	0.75 ± 0.05 <sup>a</sup>	0.74 ± 0.05 <sup>a</sup>
Cholesterol, mg/dl	181.03 ± 8.4 <sup>ab</sup>	190.8 ± 0.60 <sup>a</sup>	169.7 ± 3.43 <sup>b</sup>	177.6 ± 5.26 <sup>ab</sup>
Triglycerides, mg/dl	151.53 ± 5.65 <sup>a</sup>	150.70 ± 5.73 <sup>a</sup>	138.98 ± 3.05 <sup>a</sup>	153.83 ± 5.24 <sup>a</sup>
Urea nitrogen, mg/dl	7.73 ± 0.25 <sup>a</sup>	8.03 ± 0.45 <sup>a</sup>	8.3 ± 0.59 <sup>a</sup>	5.81 ± 0.31 <sup>b</sup>
Creatinine, mg/dl	1.29 ± 0.10 <sup>a</sup>	1.4 ± 0.06 <sup>a</sup>	1.32 ± 1.24 <sup>a</sup>	1.43 ± 0.70 <sup>a</sup>
AST, u/l	22.00 ± 2.79 <sup>a</sup>	24.5 ± 1.23 <sup>a</sup>	24.8 ± 2.06 <sup>a</sup>	19.13 ± 2.10 <sup>a</sup>
ALT, u/l	23.8 ± 2.89 <sup>a</sup>	23.65 ± 2.39 <sup>a</sup>	21.00 ± 1.62 <sup>a</sup>	22.33 ± 2.60 <sup>a</sup>

\* Values are LSM means ± standard error of LSM. <sup>a, b</sup> means within the same column or row having different superscripts (P<0.05). C= control diet, L= 4% lupin seeds of C diet, F= 8% fenugreek seeds of C diet, LF= 2% lupin with 4% fenugreek seeds of C diet.

**Table 5. Effect of feeding lupin and fenugreek seeds on serum glucose concentration (mg/dl) in Rahmani lambs**

Month	Treatment			
	Control (C)	Lupin (L)	Fenugreek (F)	LF
1	83.56±7.26 <sup>a</sup>	69.04±5.47 <sup>a</sup>	78.41±4.43 <sup>a</sup>	81.59±5.97 <sup>a</sup>
2	77.77±6.71 <sup>a</sup>	57.69±5.60 <sup>b</sup>	72.77±7.32 <sup>a</sup>	78.23±7.76 <sup>a</sup>
3	72.08±1.34 <sup>a</sup>	67.02±2.40 <sup>a</sup>	70.41±3.16 <sup>a</sup>	70.33±2.97 <sup>a</sup>
4	73.26±7.20 <sup>a</sup>	68.30±6.64 <sup>a</sup>	74.17±4.06 <sup>a</sup>	78.63±4.24 <sup>a</sup>
5	72.77±7.85 <sup>a</sup>	72.33±5.04 <sup>a</sup>	75.19±7.95 <sup>a</sup>	75.17±9.48 <sup>a</sup>
Overall mean	75.88±2.17 <sup>a</sup>	66.87±2.5 <sup>a</sup>	74.19±1.33 <sup>a</sup>	76.79±1.92 <sup>a</sup>

\* Values are LSM means ± standard error of LSM. <sup>a, b</sup> means in the same column or row with different superscripts are significant different ( $P < 0.05$ ). C= control diet, L= 4% lupin seeds of C diet, F= 8% fenugreek seeds of C diet, LF= 2% lupin with 4% fenugreek seeds of C diet.



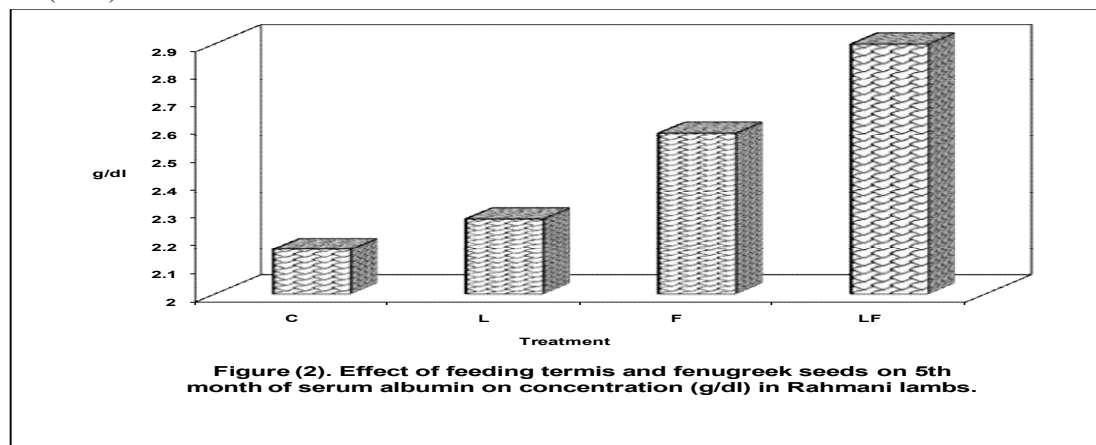
**Figure 1. Effect of feeding termis and fenugreek seeds on serum glucose concentration (mg/dl) in 2nd month the experimental period of Rahmani lambs.**

The overall means of serum total protein concentration had no significant ( $P > 0.05$ ) differences among treatments. However, lambs fed on a diet containing fenugreek seeds tended to have less serum total proteins than other treatments (Table 5). Also, Rashwan (1998) found similar decrease ( $P < 0.01$ ) in serum total protein in rabbits fed diet containing fenugreek seeds. However, animals fed on termis with fenugreek tended to have higher values of serum total protein, but such differences were not significant (Table 4).

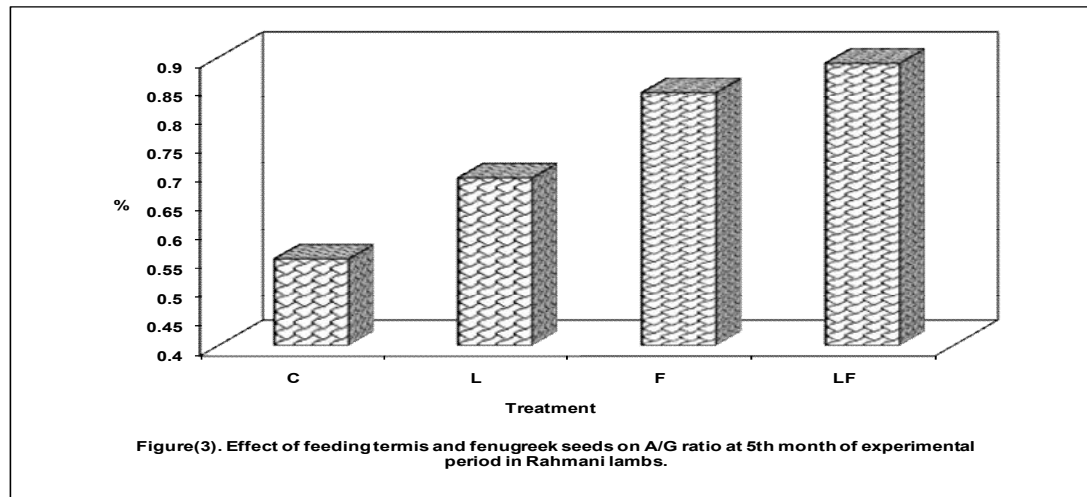
Also, serum albumin and globulin concentrations were not significantly affected by treatments (Tables 4). Dietary lupin and/or fenugreek tended to increase serum albumin at 5<sup>th</sup> month of the experimental period (Figure 2). Such results were mainly related to the increase of albumin concentration in blood of these animals, which attributed to difference in feed intake (Al-Khateb, 2008). He found that, feed intake increased by about 16, 8% and 30% due to feeding lupin, fenugreek and lupin with fenugreek diets, respectively, compared to the control diet. Similarly, Harper (1975) indicated that serum albumin is

synthesized in the liver from amino acids. The increase in these parameters may be attributed to the increase in protein digestibility coefficient (Fouad, 2001), improved nitrogen absorption (Kornegay *et al.*, 1997), increased amino acids synthesis in liver (Moonsie-Shageer and Mowat, 1993) and /or improved immunity function (Habeeb *et al.*, 2001). Hallford *et al.* (1982) found that high protein intake increased serum albumin concentration. Values of A/G ratio during different experimental periods are shown in table 5. A/G ratio tended to increase in blood of animals fed on lupin and/or fenugreek seeds (Figure 3). However such differences were not significant.

The overall means of serum cholesterol concentration of lambs were not significantly affected by dietary lupin and lupin with fenugreek. However, fenugreek feeding tended to decrease serum cholesterol. Serum cholesterol concentration decreased by about 7 and 15% due to fenugreek feeding at 1<sup>st</sup> and 3<sup>rd</sup> periods of the experimental period (Tables 4 & 6).



**Figure (2). Effect of feeding termis and fenugreek seeds on 5th month of serum albumin concentration (g/dl) in Rahmani lambs.**



**Table 6. Effect of feeding lupin and fenugreek seeds on serum cholesterol constituents of Rahmani lambs**

Period, month	Treatment*			
	Control (C)	Lupin (L)	Fenugreek (F)	LF
1	181.63 ± 9.74 <sup>a</sup>	191.53 ± 11.90 <sup>a</sup>	168.83 ± 3.54 <sup>b</sup>	167.63 ± 15.69 <sup>b</sup>
2	195.00 ± 2.88 <sup>a</sup>	189.66 ± 7.65 <sup>a</sup>	165.43 ± 3.12 <sup>b</sup>	180.03 ± 7.51 <sup>a</sup>
3	166.46 ± 3.41 <sup>b</sup>	191.36 ± 4.66 <sup>a</sup>	174.90 ± 5.35 <sup>a</sup>	185.13 ± 7.53 <sup>a</sup>
Overall mean	181.03 ± 8.4 <sup>ab</sup>	190.8 ± 0.60 <sup>a</sup>	169.7 ± 3.43 <sup>b</sup>	177.6 ± 5.26 <sup>ab</sup>

\* Values are LSM means ± standard error of LSM. <sup>a, b</sup> means in the same column or row with different superscripts are significant different (P<0.05). C= control diet, L= 4% lupin seeds of C diet, F= 8% fenugreek seeds of C diet, LF= 2% lupin with 4% fenugreek seeds of C diet.

Similarly, Sharma *et al.* (1990) found hypocholesterolemic effect of dietary fenugreek. Such effect may be related to the galactomannan effect in seeds (Madar and Shomer, 1990), and/or stimulation effect of fenugreek on adrenal steroids (Suresh- Babu and Srinivasan, 1993). Due to its diosgenin, a steroidal saponin belonging to the group of triterpene, is of great interest in the pharmaceutical industry since it has an estrogenic effect on the mammary gland, plays an important role in the control of cholesterol metabolism (Ortuno *et al.*, 1999). Stark and Madar (1993) showed that reduction in plasma cholesterol levels ranged from 18 to 26% and a tendency for lower concentrations of liver cholesterol was observed. It appears that saponins interact with bile salts in the digestive tract. Serum cholesterol showed significant (P<0.01) reduction with dietary fenugreek addition to rabbits diets (Rashwan, 1998). He found that the administration of saponins also induces a significant reduction of serum cholesterol (P<0.01) and reported that these aglycones effect cholesterol metabolism in liver, saponins inhibit cholesterol absorption from intestine (Newman *et al.*, 1957). Saponins are present in fenugreek seeds in the form of glycosides, such as diosgenin and gigtogenin (CSIR, 1976). Negulesco *et al.* (1985) determined the effect on plasma total cholesterol and triglycerides, when capsaicin is administered at the dose of 8 mg/animal/day to young female rabbits maintained on a 0.5% cholesterol diet over a five week experimental period. The data

indicated that mammals fed cholesterol rich diets and supplemented with capsaicin show decreased plasma total cholesterol and triglyceride. The mechanism of this effect is probably due to decreased intestinal absorption of the lipids. Sharma (1986) reported that fenugreek seeds were found to be effective in lowering elevated serum cholesterol levels as well as in preventing an elevation when fed together with a hypercholesterolemia inducing diet. The effects of fenugreek seeds were due to both the fiber and the saponins. Also, fenugreek seed have hypoglycemic effect (Table 5) and since hypercholesterolemia is secondary to diabetes, fenugreek seed or its defatted seed fraction may be useful in the treatment of diabetes. Interestingly, defatted seeds are not bitter in taste and contain a good amount of protein (25%). They can be exploited commercially as therapeutically useful foods for hypercholesterolemic and diabetic patients. The overall means of triglyceride levels ranged between 138.98 and 153.83 mg/dl in animals fed fenugreek. However, serum triglycerides concentration tended to decrease in animals fed termsis or fenugreek at 1<sup>st</sup>, 2<sup>nd</sup> and 4<sup>th</sup> months of experimental periods. Serum triglycerides decreased by about 16 and 15% due to lupin and fenugreek feeding at 2<sup>nd</sup> month of the experimental period, the corresponding values at 4<sup>th</sup> month of the experimental period were 10 and 11%, respectively (Table 7).

**Table 7. Effect of feeding lupin and fenugreek seeds on serum triglycerides constituents in Rahmani lambs**

Period, month	Treatment*			
	Control©	lupin(L)	fenugreek(F)	LF
1	165.10±11.17 <sup>a</sup>	137.60±6.52 <sup>a</sup>	140.73±25.26 <sup>a</sup>	173.10±16.91 <sup>a</sup>
2	145.03±22.56 <sup>a</sup>	143.13±9.02 <sup>a</sup>	129.00±6.72 <sup>a</sup>	156.07±5.80 <sup>a</sup>
3	144.83±10.60 <sup>a</sup>	154.17±17.79 <sup>a</sup>	143.83±15.10 <sup>a</sup>	147.10±18.13 <sup>a</sup>
4	164.83±11.94 <sup>a</sup>	147.83±18.95 <sup>a</sup>	145.87±16.45 <sup>a</sup>	149.90±17.37 <sup>a</sup>
5	137.90±19.76 <sup>a</sup>	170.80±20.86 <sup>a</sup>	135.50±14.56 <sup>a</sup>	143.00±31.74 <sup>a</sup>
Overall mean	151.53± 5.65 <sup>a</sup>	150.70±5.73 <sup>a</sup>	138.98±3.05 <sup>a</sup>	153.83±5.24 <sup>a</sup>

\* Values are LSM means ± standard error of LSM. <sup>a, b</sup> means in the same column or row with different superscripts are significant different (P<0.05). C= control diet, L= 4% lupin seeds of C diet, F= 8% fenugreek seeds of C diet, LF= 2% lupin with 4% fenugreek seeds of C diet.

Serum urea-nitrogen concentrations were significantly (P<0.05) lower in lambs fed lupin with fenugreek seeds than those fed the control diet. However, feeding lupin or fenugreek tended to increase serum urea- nitrogen of lambs. But such differences were not significant. This result indicates that, feeding either lupin or fenugreek seeds had no effect on kidney function (Table 4). Kaneko (1981) found that the normal range of urea nitrogen concentration were 17 to 43 mg/dl. The overall means of serum creatinine concentrations tended to be higher in animals fed lupin and/or fenugreek seeds. However, such differences among treatments were not significant (Table 4). Blood creatinine is a product of nitrogen metabolism, the rate of blood creatinine production may be considered as an index of endogenous protein catabolism (Patrick *et al.*, 1998) or kidney functions. The present result means no deleterious effect of feeding either lupin or fenugreek on kidney function. Similar result was found by Rashwan (1998). He reported that serum creatinine (1.10mg/dl) was not significantly affected by feeding 12g fenugreek seeds/kg diet in New Zealand white doe rabbit.

The overall means of serum AST and ALT concentrations were not significantly affected by feeding either lupin or fenugreek seeds (Table 4). In other words, the values of AST and ALT in the present study falls within the normal physiological values and feeding either lupin or termis had no deleterious effect on liver function. However, Nakhla *et al.* (1991) reported that AST activity was elevated by fenugreek crude seed saponins diets for broiler chicks. However, this result may be related to constituents such as trigonelline and saponins alkaloids which cause the bitter taste of fenugreek. Mohamed (1996) found that fenugreek could be developed to be the most attractive plant cultivated as a source of diosgenin and trigonelline alkaloids. Therefore, fenugreek seeds contain saponins used for medicinal steroid synthesis and isognino lizidene alkaloid. Accordingly, Muralidhara *et al.* (1999) indicated that debitterized fenugreek powder does not produce any significant effect on the levels of AST and ALT.

## CONCLUSION

Lupin or fenugreek seeds tended to have hypoglycemic effects, Fenugreek seeds tended to

decrease serum cholesterol and Feeding both lupin and fenugreek seeds had no deleterious effects on kidney or liver function.

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## تأثير التغذية بحبوب الترمس والحلبة على الإستجابة الحرارية- تنفسيه وبعض مكونات الدم في أغنام الرحمانى

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تم دراسة تأثير العلائق المضاف إليها الحلبة والترمس على الإستجابة الحرارية والتنفسية وبعض مكونات الدم في اغنام الرحمانى. قسمت عشرون من حملان أغنام الرحمانى عند عمر ٣.٥ شهر الى ٤ شهور و متوسط وزن  $18.8 \pm 0.5$  كجم الى أربعة مجاميع (٥ حيوانات لكل مجموعة) متشابهه فى وزن الجسم. المجموعه الكنترول غذيت على مخلوط علف مركز، مجموعه الترمس غذيت على مخلوط العلف المركز مضاف إليه ٤% من حبوب الترمس ، مجموعه الحلبة غذيت على مخلوط العلف المركز مضاف اليه ٨% من حبوب الحلبة و مجموعه الحلبة والترمس غذيت على مخلوط العلف المركز مضاف اليه ٢% من حبوب الترمس و ٤% من حبوبا لحلبة. تم تسجيل التنفس وحراره المستقيم والجلد والأذن والصوف كل أسبوعين. تم أخذ عينات دم شهريا لتحليل بعض مكونات الدم واستغرقت التجريه ١٥٠ يوم. حلت النتائج احصائيا باستخدام برنامج SAS(1996). دلت النتائج على ان معدل التنفس وحرارة المستقيم والجلد والأذن والصوف كانت تميل الى الزيادة غير المعنويه فى الحيوانات المغذاه على الترمس والمغذاه على الحلبة والترمس معا. لم تكن هناك فروق معنويه فى متوسط قيم الهيموجلوبين وحجم المكونات الخلويه فى الدم للحيوانات المغذاه على الترمس والحلبة. أظهرت الحيوانات المغذاه على الحلبة والترمس تملك اقل معدل للجلوكوز فى الدم خاصه المغذاه على الترمس كانت قيم الجلوكوز منخفضه طوال فتره التجريه مقارنة بقيه المعاملات. كما أظهرت الحملان المغذاه على الحلبة تملك اقل محتوى من بروتين السيرم. التغذية على الحلبة ادى الى انخفاض فى الكوليسترول بالسيرم. كما أنخفض التراى جلسرايد فى السيرم انخفاض بمقدار ١٦% و ١٥% نتيجة التغذية على الترمس والحلبة فى الشهر الاول من التجريه. كانت القيم المقابله فى الشهر الرابع ١٠% و ١١% على التوالي. كان متوسط اليوريا نيتروجين فى السيرم منخفض معنويا ( $P < 0.05$ ) فى الحملان المغذاه على مخلوط الحلبة والترمس مقارنة بالكنترول. ولكن التغذية على الحلبة أو الترمس ادى الى ارتفاع اليوريا نيتروجين فى السيرم. لم تظهر النتائج فروق معنويه فى محتوى السيرم من الكرياتينين وكذلك انزيمات الكبد (AST, ALT) نتيجة للتغذية على الحلبة والترمس. والخلاصه: التغذية على الحلبة والترمس قد تؤدي الى خفض مستوى السكر فى الدم. الحلبة قد يكون لها تأثير مخفض للكوليسترول فى الدم. التغذية بالحلبة أو الترمس ليس لهما تأثير ضار على وظائف الكبد والكلى.