Effect of Fenugreek Supplementation on Physiological Functions and Milk Traits of Heat Stressed Lactating Baladi Goats

A. A. El-Tarabany, F. E. I. Teama and M.A.A Atta

Department of Biological Applications, Radioisotopes Applications Division, Nuclear Research Center, Atomic Energy Authority, Cairo, Egypt

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ABSTRACT

This experiment was conducted to study the importance of supplementary fenugreek to the diet of lactating local goats in Egypt for ameliorative their some blood biochemical components, milk production and some milk components. Forty two lactating goats were used in the present study which lasted 5 months. The animals were divided randomly into three equal groups, the 1st group was fed basic ration without supplement (control), while the 2nd and the 3rd groups of animals were fed on the same basic ration with supplemented fenugreek at the rate of 50 and 100 g/head/day.

Blood samples were withdrawn at the end of experiment to assess blood concentrations. Also, milk yield and some milk components were determined.

The results showed that the addition of fenugreek at the rate of 100g/head/day to the diet of lactating goats significantly increased the concentrations of total proteins, albumin, globulin, T4 hormone, total antioxidants and hemoglobin (Hb), red blood cells (RBC) and led to a significant decrease in the levels of total cholesterol, triglyceride, wight blood cells (WBC) and T3 hormone in blood, while significantly increased milk yield and some milk components. It can be concluded that the addition of fenugreek at the rate of (100g/h/day) to heat stressed lactating Baladi goats led to modification of all blood components studied herein and led to amending these traits, milk production and some milk components. Therefore, the use of the fenugreek in lactating stages can be recommended.

Keywords: Fenugreek/ Blood components/ Hematological traits/ Milk composition/ Lactating goats

INTRODUCTION

Thermal stress redistributes the body resources inclusive protein and energy at the cost of decreased growth, reproduction, production and health. Goats are relatively resistant to harsh environmental conditions. Thermal stress stimulates sort of complex responses which are fundamentals in the preservation of cell survival (IPCC, 2001). The use of natural additives helps in improving animal productivity and increasing milk production (Khattab et al., 2010a). Productivity of lactating animals can be improved by medicinal plant seeds and hormonal alert effects as circulating levels of prolactin and growth hormone increases in the body. Fenugreek is a member of a legume family that is cultivated in various parts of the world (Shapiro and Gong, 2002). Fenugreek is one of the oldest known medicinal plants in the recorded history. Fenugreek seeds powder exhibits anti-diabetic properties (Devi et al., 2003), hypo-cholesterolaemic effect (Vats et al., 2003), and has an effect on thyroxine- induced hyperglycaemia (Devasena and Menon, 2003). Fenugreek, as other legumes, is a good source of dietary protein 20-30%, for consumption by animals. It contains fatty acids ranging from 5-10%, which are mainly linoleic, linolenic, oleic and palmitic acids ranging from 45 - 65%, and total carbohydrates with 15% of galactomannan (Schryve 2002). It is a good source of minerals and vitamins (Michael and Kumawat, 2003). It is also possible that saponins found in Fenugreek lowers lipids because these saponins are transformed in the gastrointestinal tract into sapogenins (Smith, 2003). Diocin is a natural saponin found in Fenugreek and has a structural similarity to oestrogen, which leads to an increased release of growth hormone (GH) by binding to the...
receptors on pituitary cells that recognize the GH releasing hormone and this, in turn, results in an increase in milk secretion (Graham et al., 2008). Fenugreek has been shown to have a positive effect on lactation performance in ruminants such as dairy cows, water buffaloes and dairy goats (El-Alamy et al., 2001). Researches done on Fenugreek are not well known and the mechanism by which Fenugreek increases milk yield still remains unclear. There is still further research needed to better understand the mechanism by which Fenugreek exerts its effect on milk production.

The objective of this study was focused on the importance of adding fenugreek as antioxidant in diets of lactating goats to improve some blood components, milk yield and growth performance under hot summer season.

MATERIALS AND METHODS

1- Animals and Feeding

The experiment was carried out in the Experimental Farms Project (Goats Farm), Nuclear Research Center, Atomic Energy Authority, Egypt. The experimental animals were healthy and clinically free of external and internal parasites and were fed basal ration of concentrate feed mixture (CFM) according to the allowances of (NRC, 2001) of goats. The CFM composed showed in Table 1. Feed mixture was offered once daily at 10 am, 3.5% of body weight. Clover hay was offered ad libitum. Fresh drinking water was available at all time.

2- Experimental Design

Forty two lactating female goats aged four years with average initial body weigh 35 ± 2.5 kg were randomly divided into three equal groups. Animals in the 1st group were fed on basal ration without any additives (control), while the 2nd and the 3rd groups were fed basal ration supplemented with 50 and 100g fenugreek /head /daily. The does reared under hot summer conditions, since the averages of ambient temperature (AT) and relative humidity (RH %) were 37.4°C and 65.2%, respectively from 1st day of June to the last day of August, 2015.

Table (1): Ingredients of the concentrate feed mixture and chemical compositions of the feedstuffs that used in the lactating does feeding during the experimental period

<table>
<thead>
<tr>
<th>Ingredients and chemical compositions</th>
<th>Feedstuffs</th>
<th>Concentrate</th>
<th>Clover hay</th>
<th>Rice straw</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ingredients of the concentrate (%):</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crushed yellow corn</td>
<td>25.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat bran</td>
<td>20.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugar beet bulb</td>
<td>30.40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soybean meal</td>
<td>7.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undecorticated cotton seed meal</td>
<td>15.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dicalcium phosphate</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium chloride</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mineral mixture*</td>
<td>0.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin AD3E</td>
<td>0.10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chemical composition of the feedstuffs</strong> (on dry matter basis), %:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry matter</td>
<td>88.31</td>
<td>89.00</td>
<td>92.30</td>
<td></td>
</tr>
<tr>
<td>Organic matter</td>
<td>87.11</td>
<td>82.66</td>
<td>83.52</td>
<td></td>
</tr>
<tr>
<td>Crude protein</td>
<td>17.68</td>
<td>14.20</td>
<td>3.20</td>
<td></td>
</tr>
<tr>
<td>Crude fiber</td>
<td>15.50</td>
<td>25.10</td>
<td>32.40</td>
<td></td>
</tr>
<tr>
<td>Ether extract</td>
<td>2.87</td>
<td>2.60</td>
<td>1.30</td>
<td></td>
</tr>
<tr>
<td>Nitrogen-free extract</td>
<td>47.28</td>
<td>34.60</td>
<td>36.60</td>
<td></td>
</tr>
<tr>
<td>Ash</td>
<td>6.00</td>
<td>12.50</td>
<td>18.80</td>
<td></td>
</tr>
</tbody>
</table>

*According to A.O.A.C. (1990)
3- Blood Sampling and Biochemical Analysis

Blood samples were collected in two vacuum tubes at the end of the experiment, one sample without anticoagulant and the other with anticoagulant (heparin) to obtain serum and plasma respectively by centrifugation at the rate of 3000 rpm for 20 minutes and stored at -20°C until analysis. Serum was used to determine total protein, total cholesterol and Triiodothyronine (T3) hormone while plasma samples were used to determine total antioxidants.

These blood parameters were determined using commercial kits manufactured by Bio-Diagnostic Company, Egypt. Triiodothyronine (T3) hormone concentration was determined by RIA technique using solid phase coated tubes kits purchased from Diagnostic Systems Laboratories (Inc., Webster, Texas, USA).

4- Collection of Milk Samples and Measurement of Milk Composition

Daily milk yield of individual goats was recorded throughout the study; however, milk composition was evaluated weekly. Animals were hand-milked once daily (08:00 h) with two skillful milkers who have relatively the same efficiency (speed, gentle handling, and efficient evacuation of the udder). After hand milking, yield of each goat was determined by weighing the milk. Milk samples (approximately 100 ml) were collected, protected by means of Broad Spectrum Microtabs II, and preserved at 4 °C until analysis of the milk gross composition: protein, fat, and lactose contents (MilkoScan 6000; Foss Electric A/S, Hillerød, Denmark). Milk solids were determined according to Cipolat-Gotet et al. (2013).

5- Statistical Analysis

The data were expressed as means ± standard error. The differences between the mean values of treatment groups and control were tested using one way ANOVA according to statistical analysis system software program (SAS, 2001).

RESULTS AND DISCUSSION

Effect of Fenugreek Supplemented on:

1- Blood Biochemical Traits

Daily supplementation of the fenugreek by 50 or 100g to the diet of goats induced a significant (p<0.001) increase in serum total protein concentrations by 7.6 and 12.5% and in globulin concentrations by 13.7 and 22.8%, respectively. In addition, glucose level decreased in serum of animals fed on fenugreek by 11.78 and 13.86%, respectively as shown in Table (2).

Total serum proteins are highest in animals fed fenugreek seeds. Albumin/globulin ratios showed a similar trend. This reflects the better quality of prepared fenugreek proteins. Changes in the concentrations of free amino acids of serum also reflects the dietary protein quality (Whitehead and Dean, 1964).

A significant increase in serum total protein concentration was observed in rabbits with the time of fed fenugreek. These results may reflect the effect of fenugreek seeds extract by stimulating glucose attached insulin secretion from the pancreatic beta cells (Hannan et al. 2007). This increase in insulin concentration may lead to decrease protein catabolism, amino acids degradation and increase the protein synthesis (Moller, and Nair, 2008).

Fenugreek seeds are a dietary supplement that is promising in this regard. Insulin stimulates cellular glucose uptake in muscle and adipose tissues by stimulating the translocation of glucose transporter-4 (Glut-4) from an intracellular pool to the plasma membrane (Mohammad et al. 2006 b).

The significant attention of the glucose tolerance curve and improvement in the glucose induced insulin response; hypoglycaemic effect may be mediated through activating insulin producing beta-
cells of the Islets of Langerhans (Baquer et al. 2009). Yadav et al. (2008) also suggested that fenugreek seeds, more precisely the water extract, act as an insulin secretor, but regrettably, they did not monitor insulin levels. Devi et al. (2003) observed an increase of insulin secretion on feeding fenugreek seeds. Further, Vijayakumar et al. (2005) also reported that hypoglycaemic effect of fenugreek seeds, on the modulation of insulin secretion. The effect of fenugreek on feed intake may be related to its well documented ability to excess insulin sensitivity (Gad et al., 2006). Insulin sensitivity and glucose metabolism are participatory in the complex endocrine regulation of feeding behavior (Hannan et al., 2007). However, Ajabnoor and Tilmisany, (1988) excluded the sharing of gastrointestinal action of fiber to explain the hypoglycemic effect. Devi et al., (2003) found that the ability of fenugreek seeds to modulate key glucose metabolizing enzymes like hexokinase (glycolysis), glucose-6-phosphatase or fructose-1,6- bisphosphatase (gluconeogenesis) was also considered as a possible mechanism.

Table (2): Effect of fenugreek supplement to the diet on blood biochemical traits of lactating Baladi goats

<table>
<thead>
<tr>
<th>Blood biochemical traits</th>
<th>Experimental groups</th>
<th>p- value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Fenugreek (50g)</td>
</tr>
<tr>
<td>Total protein (g/dl)</td>
<td>6.53±0.08</td>
<td>7.03±0.08</td>
</tr>
<tr>
<td>Albumin (g/dl)</td>
<td>3.25±0.05</td>
<td>3.30±0.05</td>
</tr>
<tr>
<td>Globulin (g/dl)</td>
<td>3.28±0.08</td>
<td>3.73±0.10</td>
</tr>
<tr>
<td>Glucose (mg/dl)</td>
<td>70.07±2.3</td>
<td>58.29±0.78</td>
</tr>
<tr>
<td>Cholesterol (mg/dl)</td>
<td>149.6±2.16</td>
<td>117.2±1.56</td>
</tr>
<tr>
<td>Triglyceride (mg/dl)</td>
<td>137.9±1.43</td>
<td>131.5±1.98</td>
</tr>
</tbody>
</table>

a, b and c...Means for each parameter in the same raw with different superscript are significantly different (P<0.00).

Supplementation of daily fenugreek by 50 or 100g to the diet of goats caused a significant decrease (p<0.01) in the concentrations of total cholesterol by 21.6 and 23.3% and triglyceride by 4.6 and 13.8 % respectively (Table 2). Fenugreek seeds include a large amount of fiber galactose and mannosate constitute the main composition of gum. The latter compounds are correlating with reduced cholesterolemia (Roberts, 2011). The inhibitory effect of fenugreek on plasma total cholesterol might be due to the inhibitory effect on the cholesterol synthesis. Sharma et al. (1990) found that the fenugreek contains biologically significant level of saponins. A similar explanation was proposed by many researchers who suggested that saponin would increase fecal excretion of bile acids and subsequent increase of conversion of cholesterol to bile salts and could lower plasma cholesterol concentration (Ribes et al. 1986). Moreover, Sharma (1986b) proposed that the protein in fenugreek is 26% so it might exert a lipid lowering effect. Also, James, (2004) stated that the quality and quantity of protein in the diets have a direct action on the levels of cholesterol. Hannan et al. (2007) showed that hypolipidemic action could also be a result of the retardation of carbohydrate and fat absorption due to the presence of bioactive fiber in the fenugreek. However, Ribes et al., (1986) found that the lipid lowering effect of Trigonella might also be assigned to its estrogenic constituent, indirect increasing thyroid hormone (T4). Another author also has shown that it stimulates the hepatic lipogenic enzymes, which cause the cholesterol to be decreased (Raju et al 2001). On the other hand, Abou El-Soud et al. (1988) showed that the cause of alteration in lipid profile is the normalize rate of lipogenesis by fenugreek extract in a way similar to the effect of insulin in the lipid metabolism.
2- Blood Hematological Parameters

Table (3) shows that when the lactating goats were daily supplemented with 50 or 100g of fenugreek, the concentrations of Hb, RBC and WBC significantly increased (p<0.05) in the first and treatment by 0.9 and 8.3% in Hb, 6.1 and 6.7% in RBC and 3.1 and 6.8% WBC, respectively as compared with non-supplemented goats.

The Fenugreek seeds treatment boost the erythropoiesis as shown by the significant increase in the RBCs, Hb concentration and PCV%. This improvement in erythropoiesis may be related to the enhancement of antioxidant activity in RBCs (Jain, 1989). Metabolic activities of the RBCs produce free radicals that destroy Hb which precipitated as Heinz bodies and causes the hemolysis of RBCs (Taha, 2008). Jain (1989) showed that, the experimentally – induced oxidative stress causes a deterioration in antioxidant status as represented in the reduction of glutathione (GSH ) and the elevation of malondialdehyde ( MDA ). On the other hands, Taha (2008) revealed that fenugreek seeds possess antioxidant activity which increases the stability of RBC membranes through the formation of fatty complexes in the cell membranes that prevent or reduce the free radicals effects. This was reflected in an increase in the RBCs ,and also in an increase in Hb and PCV% due to the presence of a significant positive correlation between these parameters ( Erin et al.1984).

3- Antioxidant Parameters

As for antioxidant parameters, total antioxidant capacity significantly increased (p<0.001) by 11.6 and 15.1% in the first and second treatment, respectively as compared with non-supplemented goats, and catalyze enzyme significantly increased (p<0.001) by 27.2 and 56.5% in the first and second treatments, respectively, as compared with non-supplemented goats (Table 3).

Bukhari et al. (2008) noticed that fenugreek seeds extract with methanol, ethanol, dichloromethane, acetone, hexane and ethyl acetate has a radical scavenging activity. Bhatia et al. (2006) convey protective effect of fenugreek, on lipid peroxidation and on enzymatic antioxidants. Naidu et al. (2010) reported that the proximate composition of fenugreek seeds, husk and cotyledons had the highest saponin and protein content. In contrast, husk had higher total polyphenols. Fenugreek seeds, extracts of husk and endosperm existent 72%, 64%, and 56% antioxidant activities respectively by free-radical scavenging activity. Fenugreek seeds are rich in polyphenols, which promote the antioxidant capacity polyphenols, especially flavonoids which are among the most powerful herbal antioxidants (Mitchell et al.1973). Polyphenols can form complexes with reactive metals like iron, zinc and copper and reduce their absorption (Nwanna and Oboh, 2007). High levels of these elements (metal cations) in the body can lead to the production of free radicals and cause oxidative damage in cell membranes and DNA (Okafor et al. 2011). Furthermore, polyphenols function as free radical scavengers and neutralize these elements before they damage the cells (Ara and Nur, 2009). Kaviarasan et al. (2007) estimated the antioxidant activity of fenugreek methanol extract using various in vitro assay systems and referred that fenugreek seed extract exhibited scavenging of hydroxyl radicals (OH) and inhibition of hydrogen peroxide-stimulate lipid per-oxidation in rats livers mitochondria. Dietary administration of (1 and 2%) fenugreek seeds resulted in an increase of the glutathione S-transferase (GST) activities in the liver homogenate of rats and have no ratable change in superoxide dismutase (SOD) and catalase (Choudhary et al., 2001).

4- Hormonal Levels

T₃ hormone levels significantly decreased with change 22.9 and 27.55% in the both treatments, but T₄ level significantly increased with change 47.4 and 51.1% in the both treatments as compared with non-supplemented goats, respectively (Table 3).
Table (3): Effect of fenugreek supplement to the diet on hematological traits, antioxidant parameters and hormonal levels of lactating Baladi goats

<table>
<thead>
<tr>
<th>Items</th>
<th>Control</th>
<th>Fenugreek (50g)</th>
<th>Fenugreek (100g)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hematological traits values:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hb (g/dl)</td>
<td>8.94±0.14</td>
<td>9.02±0.12</td>
<td>9.68±0.29</td>
<td>0.036</td>
</tr>
<tr>
<td>RBC (*10^6)</td>
<td>9.76±0.25</td>
<td>10.36±0.21</td>
<td>10.42±0.09</td>
<td>0.05</td>
</tr>
<tr>
<td>WBC (*10^3)</td>
<td>9.23±8.8</td>
<td>8.94±8.6</td>
<td>8.60±8.1</td>
<td>0.045</td>
</tr>
<tr>
<td>Antioxidant parameters concentrations:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total antioxidant capacity (mM/dl)</td>
<td>6.17±0.06</td>
<td>6.89±0.0006</td>
<td>7.10±0.07</td>
<td>0.001</td>
</tr>
<tr>
<td>Catalyze enzyme (U/L)</td>
<td>268.6±7.9</td>
<td>341.6±7.12</td>
<td>420.3±10.43</td>
<td>0.001</td>
</tr>
<tr>
<td>Hormonal levels:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T₃ (nmol/ml)</td>
<td>1.96±0.02</td>
<td>1.51±0.05</td>
<td>1.42±0.02</td>
<td>0.001</td>
</tr>
<tr>
<td>T₄ (nmol/ml)</td>
<td>21.7±3.0</td>
<td>32.0±4.0</td>
<td>32.8±3.0</td>
<td>0.01</td>
</tr>
<tr>
<td>Cortisol (ng/ml)</td>
<td>12.8±0.9</td>
<td>12.2±0.93</td>
<td>11.9±0.93</td>
<td>0.20</td>
</tr>
</tbody>
</table>

a, b and c...Means for each parameter in the same raw with different superscript are significantly different (P<0.05 or 0.001)

T₃ and T₄ hormones are absolutely required for normal physiology in animals. Increasing levels of supplementation of fenugreek seeds on diets resulted in decrease serum T₃, while increasing T₄ level, this may be due to meet the highly metabolic demand of milk synthesis, milk is very metabolically expressive commodity, it extract 80% of the total circulation nutrient to the milk glands to synthesis milk, this result agrees with a result obtained by Issi et al. (2011). The increase of T₄ level might be due to a concentrate ration used in the experiment.

The increase of plasma T₄ levels in lactating ewes may be attributed to estrogenic compound that presents in fenugreek seeds which indirectly increased T₄ level (Sauvaire et al., 1991). Also the increase of T₄ and the decrease in T₃ level may be due to the fact that the fenugreek seeds extract impaired peripheral conversion of thyroid hormones resulted in a significant decrease in serum T₃, with a concomitant increase in T4 levels (Thahilian and Kar, 2000). Panda et al.,(1999) reported that administration of fenugreek seeds extract to both mice and rats exposes its effect on thyroid hormone that fenugreek inhibits the synthesis of triiodothyronine concentration estimated by a decrease in serum triiodothyronine concentration and T₃/T₄ ratio and consequently increased thyroxine levels.

5- Milk Yield and Components

Supplementation of daily fenugreek 50 or 100g to the diet of goats caused a significant increase in both of the total milk yield with change 8.5 and 34.2% and protein % change 12.3 and 17.4% .However, there was a significant decrease in the fat % with change 5.2 and 14.68% respectively. No significant effects of the lactose, total solid and solids not fat when using fenugreek seeds in the ration (Table 4).
Table (4): Effect of fenugreek supplement to the diet on milk traits of lactating Baladi goats

<table>
<thead>
<tr>
<th>Milk yield and components</th>
<th>Control</th>
<th>Fenugreek (50g)</th>
<th>Fenugreek (100g)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total milk yield (L)</td>
<td>141.92±4.58</td>
<td>154.03±2.85</td>
<td>190.5±1.67</td>
<td>0.001</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>3.61±0.03</td>
<td>3.42±0.08</td>
<td>3.08±0.08</td>
<td>0.001</td>
</tr>
<tr>
<td>Protein (%)</td>
<td>3.16±0.05</td>
<td>3.55±0.08</td>
<td>3.71±0.09</td>
<td>0.001</td>
</tr>
<tr>
<td>Lactose (%)</td>
<td>3.99±0.04</td>
<td>4.01±0.03</td>
<td>4.02±0.02</td>
<td>0.23</td>
</tr>
<tr>
<td>Total solids (%)</td>
<td>11.39±1.01</td>
<td>11.38±0.9</td>
<td>11.40±1.0</td>
<td>0.16</td>
</tr>
<tr>
<td>Solids not fat (%)</td>
<td>7.78±0.98</td>
<td>7.96±0.91</td>
<td>8.32±1.1</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Table (4): Effect of fenugreek supplement to the diet on milk traits of lactating Baladi goats

a, b and c...Means for each parameter in the same raw with different superscript are significantly different (P< 0.001)

Results were associated with those reported by Abdul khaliq (2012) who found that show that supplementation of fenugreek to lactating goat’s significantly increased milk yield, while the other milk components were an inconsistent pattern. Increasing of milk yield indicates that prolactin hormone might be a possible candidate as a mediator of fenugreek influence on milk production (Balgess et al. 2013). The increase in prolactin hormone levels represents a possible endocrine mechanism for the galactopoietic action of fenugreek (Abdul khaliq, 2012). The increase in milk production may be due to the presence of phytoestrogens which are plant chemicals similar to the female sex hormone estrogen which is a key compound to increase milk flow (Balgess et al., 2013). This finding was similar to those of other previous studies and may be attributed to the stimulatory action of fenugreek seeds on enhancing appetite and feed intake, resulted in an increase in milk production or to the stimulation of endogenous hormone secretion (El-Alamy, 2001). Similar results were obtained by many researchers (Sayed et al., 2005) who found that fenugreek seeds contain a chemical compound (diosgenin) that has a similar role to the female sex hormone estrogen, which has been experimentally proved to increase milk flow, this hormone promote development of milk glands. Also, the ability of fenugreek seeds to increase milk might be due to the fact that this herb contains rich source of essential fatty acids (Mowrey, 1986).

Milk fat content was significantly lower in treated animals compared with control group; there is an inverse relationship between yield and fat percentage. The lower fat content of both treated groups can be justified by the higher milk yield secured by both groups. This result agrees with El alamy et al. (2001), who found that feeding fenugreek seeds to buffaloes increase milk yield, but without any effect on milk composition except for a tendency of lower fat content.

Milk lactose was not affected by supplementing different level of fenugreek seeds. This result is similar to the results obtained by Kholif et al., (2001) who found that there was insignificant different on lactose content between all treated and control groups.

The progressive increase of feeding of fenugreek seeds to the experimental animals resulted in an increase in insulin hormone secretion; this may be due to the presence of the amino acid 4, hydroxyisoleucine in fenugreek seeds. This amino acid appeared to act on pancreatic beta cells to enhance insulin production. This result agrees with Baquer et al. (2009) who reported that fenugreek seeds contain amino acid called 4 hydroxy iso leucine, which appears to increase the body's production of insulin. Also Yadav et al., (2008) found that the extract of the whole seed of fenugreek seeds, stimulate pancreatic insulin secretion. Moreover, the effect of fenugreek on feed intake is related to its well-documented ability to increase insulin sensitivity because fenugreek interferes with intestinal glucose absorption as a result of local effects at the gastro-intestinal level fundamentally due to dietary fibers contained in fenugreek seeds (Gad et al. 2006).

The reason that the type of fatty acids in the food have an impact on the quality and quantity of fat in milk, and fenugreek seeds contain saponins substance that increases propionic acid, which in
turn, reduces the concentration of beta butyric hydroxide acid which is the source of the fatty acids in milk and reduces the acetic acid, leading to a decline in the percentage of milk fat (Hart et al. 2007). The present result agrees with (Atta et al. 2013) who showed a lower fat percentage in the milk when adding 5, 10 and 15% fenugreek seeds in the ration compared with control, and agrees with (El-Rawi, 2012) when added 6 and 12% of fenugreek seeds in the ration. There was a negative correlation between lactose, total solid material and solid non-fat in the milk when added fenugreek seeds in the ration of hamdani ewes. The present result agrees with Al-Kudsi et al. (2011) who found that the lactose in the milk significantly decreased when feeding the goats on a 10% fenugreek seeds in the ration. However, the result disagrees with El-Rawi (2012) who found that no significant effects of the lactose, solid non-fat and total solid material when using (6, 12%) fenugreek seeds in the ration.

CONCLUSION

From the results, it can be complemented that supplementation of fenugreek to the diet modifies some blood metabolites, T4 level and most milk components in lactating Baladi goats. So this fenugreek diet provides a base for future studies exploring the qualitative and quantitative contributions of specific nutrients that are essential for more animal diets.

REFERENCES


