INFLUENCE OF ESPARTO GRASS (CORTADERIA SELLONA L.) MYRRH COMMIPHORA MYRRHA L., FENUGREEK (TRIGONELLA FOENUM GRAECUM L.) ON REDUCING SERUM GLUCOSE OF ALLOXAN DIABETIC RATS

Nadia Saleh Al-Amoudi*

King Abd Al-Aziz University, Saudi Arabia

Abstract: This work was carried out to evaluate the hypoglycemic effect of fenugreek seeds (Trigonella Foenum Graecum L.) myrrh resin (Commiphora myrrha L.), the wild grown halfa herb – esparto grass (Cortaderia sellona L.) and their blend (using equal amounts of the three herbs) as hypoglycemic agents for alloxan diabetic albino rats. Fenugreek, halfa and blend were added to basal diet at 5 or 10%, while myrrh at 2.5 and 5%. Fenugreek, was the most potent antidiabetic agent, followed by halfa or blend then came the myrrh. Differences between low and high herbs concentration were not marked indicating that no need for the higher level. Hypoglycemic effect showed proximate effect al low herb concentration (43.92–45.70% serum glucose decrease compared to control + group) for fenugreek, halfa and the blend (myrrh showed 37.24% decrease) indicating no synerism was found when the blend was formed and each of fenugreek or halfa alone is enough to reach pronounced hypoglycemic effect. It should be taken into consideration that halfa is a wild grown neglected herb, which is costless. Fenugreek is a common not expensive seeds. Hyperglycemic raised the levels of serum total cholesterol (TC), triglycerides (TG) Low-Density Lipoprotein (LDL) and Very Low-Density Lipoprotein (VLDL) cholesterols, while diets with halfa, fenugreek, myrrh or the blend showed the reverse influence. These diets corrected also the disorders in liver and kidney functions due to diabetes mellitus. Reductions in Body Weight Gain (BWG) and Food Efficiency Ratio (FER) due to diabetes mellitus were corrected by halfa, fenugreek and blend diets. Myrrh seems to be of prospective value for control of overweight and obesity.

Keywords: Halfa(esparto grass); Trigonella foenum; Myrrh resin; hypoglycemic effect; diabetic rats - blend diet; overweight; obesity; serum; glucose - cholesterol; HDl cholesterol.

*Department of Nutrition and Food Science, King Abd Al-Aziz University, Jeddah, Saudi Arabia; e-mail: dr.ns222@hotmail.com

INTRODUCTION

Diabetes mellitus is a worldwide disease, being a major health problem at all ages in different countries. It is powerful risk factor for other diseases as kidney disorder and cardio-vascular disease. The diabetic has a sweet taste in blood and urine; this has been noticed long before in ancient times by Greeks, Chinese, Egyptians and Indians. The plants and herbs provide a potential source of hypoglycemic drugs that treat diabetes mellitus (Mukherjee et al., 2006). Of these medicinal plants fenugreek (Trigonella – foenum – graecum) was found to be involved in antinciception (analgesic), anti-inflammatory, antiulceric and antipyretic, being regulator of hyperthyroidism, carminative, anticarcinogenic and used to treat disorders such as high cholesterol, wounds, gastrointestinal ailments showing also nematicidal activity (Ahsan et al., 1989; Amin, et al., 2005; Javan et al., 1977; Parvispur et al., 2004; Parvizpur et al., 2006; Raju et al., 2004; Sur et al., 2001; Pandian et al., 2002; Tahiliani and Kar, 2003).

Fenugreek as antidiabetic herb attracted attention of many authors and was also reported in folk medicine in India, Egypt, Iran, China, Saudi Arabia and other counties. Remedial effect was found for seeds and leaves as well. It was reported that aqueous extract of Trigonella foenum graecum leaves given both orally and interperitoneally posses a hypoglycemic effect in normoglycaemic and alloxan induced hyperglycemic rats (Abdel-Barry et al., 1997). Also fenugreek seeds powder has been suggested to have potential antidiabetic effects being possible new therapeutic in Type – 1 diabetes (Raju et al., 2001; Thakran et al., 2004). According to these authors, fenugreek powder stabilised free radical metabolic and prevented partially the structural abnormalities in liver and kidneys. Previously, Genet et al. (1999) fenugreek seed powder considered an insulin mimetic agent like insulin and vanadate. All these restored normoglycemia. Fenugreek may be also used as alcoholic extract to treat hyperglycemia indicating that not only the water soluble substances (Zia et al., 2001a,b) but also the alcohol soluble compounds of fenugreek seeds (Sur et al., 2001) are important antidiabetic agents. Soluble Dietary Fibre (SDF) fraction of fenugreek was of pronounced value for curing type 2 model diabetic rats by delaying digestion of sucrose (Hannan et al., 2003). According to Ali et al. (1995) SDF of fenugreek seed showed no effect on the fasting blood glucose levels of non-diabetic or NIDDM model rats, however, showed hypoglycemic effect when fed simultaneously with glucose. As reported by Tahiliani and Kar (2003) Trigonella foenum graecum (fenugreek) and Allium sativam (garlic) extracts may be used individually for regulation of hyperthyroidism in rats, showing no synergistic effect. According to Preet et al. (2006) fenugreek (TSP) and sodium orthovanadate (SOV) each alone controlled ocular histopathogical and biochemical abnormalities associated with experimental Type – 1 diabetes. High doses of vanadate treatment (Mohammed et al., 2004) corrected the altered carbolydrate metabolism and antioxidant status in alloxan diabetic rats, but several toxic effects are produced. Siddiqui et al. (2006) suggested the combined therapy of low vanadate dose and TSP as effective agent for normalisation of diabetic rat status, however, fenugreek alone was also partially effective in restoring diabetes induced alterations.

According to LWD (1983) myrrh (Nees) is a valuable gum resin obtained from small, spiny trees native to Arabia and E-Africa, specially from Commiphora myrrha used medicinally as a tonic and in dentifrices; C. Erythraea, the myrrh of antiquity, still used in incense and perfume. As far as the author was aware, hypoglycemic effect of myrrh and myrrh products did not find much great care by researchers as hypoglycemic agent.

At may be reported, however, that Shaman Pharmaceuticals Inc. (USA) referred about antihy perglycemic furanosesquiterpenes from Commiphora myrrha (Ubillas et al., 1999). Anon (2007a) showed that extracts of myrrh and aloe gums increased glucose tolerance in rats, suggesting that extracts may be a useful therapy in treating non-insulin dependent diabetes mellitus. This was previously reported by Al-Awadi and Gumaa (1987). Lotfy et al. (2006) indicated that combined use of honey, bee propolis and myrrh was successful in healing a deeply infected wound in patient with diabetes mellitus. Al-Awadi et al. (1991) found that the mixture extract comprised of Niglla Sativa (Roman coriander), myrrh, gum Olibanum gum, Asafoetida and aloe lowered the serum glucose, possibly by decreasing the serum glucose, possibly by decreasing the production of the precursors of glucose in liver, suggesting the usefulness of this therapy in treating non-insulin dependent diabetes mellitus.

The medicinal impacts of halfa (esparto grass, cortaderia sellona L., were studied only in one scientific issue (Gharib Wessam et al., 2006), which certainly needs for other investigation to confirm or disagree. At the same time Espato grass is a widespread plant that wild growing (not cultivated) on inlet and outlet water channels at cultivated areas. According to mentioned authors feeding of alloxan of hyperglycemic male albino rats on a diet composed of the basal diet plus 15% dried esparto grass powder for 45 days reduced serum glucose from 195.16 ± 6.30 to 93.33 ± 9.64 mg/100 dl showing 52.18% decrease. The previous review indicates come contradictory results. Fenugreek seeds powder alone has been suggested to have marked antidiabetic effects, being new therapeutic for diabetics (Raju et al., 2001; Tharkan et al., 2004) while many authors recommended to use fenugreek with other herbs (Vats et al., 2002). Data on antiglycemic effect of myrrh alone (not a mixture with other herbs) are actually scant. Moreover, only one study (Gharib Wesam et al., 2006) was found on the esparo grass as hypoglycemic agent. Therefore this study was carried to investigate the anti-hyperglycemic impacts of fenugreek seed, myrrh and asparto grass each alone and in a blend (without vanadate or other herbs) on the alloxan diabetic albino rats.

MATERIALS AND METHODS

Materials: Esparto grass leaves (halfa, Corladenia Sellona L.) were obtained fresh from nature plants, washed, sun-dried, then finely milled. Myrrh resin (Commiphora myrrh L.) and fenugreek (Trigonella foenum graecum L.) were purchased form a spices shop and finely milled (fenugreek firstly washed and sun-dried) Alloxan was pure chemical fine product (BDH) obtained from SIGMA (USA) and used for induction of diabetes mellitus in 54 rats. Animals: Sixty (60) healthy Spragne-Dawley male albino rats. (120–170 weight) were housed in wire cages in a room temperature maintained at 25°C. Animals were kept under healthy conditions and fed basal diet for one week (adaptation).

Diabetes was induced in normal healthy male albino rats via intraperitoneal injection of alloxan 50 mg/kg body weight according to the method described by Desai and Bhide (1985) to obtained diabetic. One week after the injection of alloxan, fasting blood samples were obtained by retro-orbital method to estimate fasting serum glucose. Rats having fasting serum glucose more than 185 mg/kg were considered diabetics (NDDG, 1994).

Biological study: the basal diet consisted of protein 14% as casein, corn oil 4%, choline chloride 0.2%, vitamin mixture 1%, salt mixture 3.5%, fibre 5% and the remainder

was corn starch (Reeves et al., 1993) was provided ad libitum. After the adaptation period rats were divided into 10 groups: The first group (six healthy normal rats) was fed basal diet as control (–) (healthy rats). The second group (six diabetic rats), diabetic fats fed on basal diet control (+) rats. The 3rd and 4th group (six diabetic rats each) were fed on basal diet plus 5 or 10% halfa (esparto grass) powder respectively. The 5th or 6th groups (six diabetic rats each) were fed on basal diet plus 5 and 10% fenugreek seed powder respectively. The 7th and 8th groups (six diabetic rats each) were fed on basal diet with 2.5 or 5% myrrh, respectively. The 9th and 10th groups (six diabetic rats each) were fed on basal diet plus 5 or 10% plants blend (composed of equal amounts of halfa, fenugreek and myrrh), respectively. Diet and water were available ad libitum.

During the experimental period (four weeks), rats were kept separately in well aerated cages. The diet consumed and body weight were recorded every day. At the end of the experimental period, rats were fasted over might before sacrificed. Blood was collected, then centrifuged for serum collection. The separated serum stored at 18°C till analyses.

The Body Weight Gain (BWG%), Food Efficiency Ratio (FER) and internal organs weight were determined according to Chapman et al. (1959) as follows:

$$\text{BWG\%} = \frac{\text{Final weight} - \text{Initial weight} \times 100}{\text{Initial weight}}$$

$$\text{FER} = \frac{\text{Gram gain in body weight}}{\text{Gram food consumed}}$$

$$\text{Internal Organ Weight\%} = \frac{\text{Organ weight} \times 100}{\text{Initial weight}}$$

Internal organs (liver, spleen, lungs, heart and kidneys) of sacrificed rats were carefully removed, washed in cold saline solution, dried with filter paper and weighed (ing) independently.

Analytical methods: Enzymatic determination of plasma glucose was carried out colorimetrically according to the method described by Tietz (1976). Serum samples were used also for determination of total cholesterol (TC) (Allain et al., 1974), triglycerides (TG) (Fossati and Principe, 1982), High Density Lipoprotein (HDL) (Burstein, 1970), while low-density lipoprotein [LDL = TC – (HDL + VLDL)] and very-low density lipoprotein (TG/5) were calculated according to Friedwald et al. (1972). Also kidney function was indicated by determinations of uric acid (Fossati et al., 1980), urea (Malhotra, 2003) and serum creatinine (Chary and Sharma, 2004). Liver function was evaluated by determination of serum, glutamate oxaloacetate transaminase (GOT or AST) (Chawla, 2003) and serum glutamate pyrovate transaminase (GOT or AST) (Srivastava et al., 2002).

Statistical analysis: statistical analysis was carried out by using Statistical Package for Social Science Program (SPSS, 1998). The results were expressed as mean ± SD. Data were analysed by one way Analysis Variance (ANOVA) according to Steel and Torri (1980).

RESULTS AND DISCUSSION

Serum glucose

From results of Table 1 it could be noticed that at the low corn concentration fegugreek showed the greatest reduction of serum glucose, followed by the herbs blend and halfa diets, while myrrh diets 2.5% revealed less pronounced decline of serum glucose. Meanwhile, the decrease of serum glucose due to myrrh diet was also high. Percent

Table 1 Effect of halfa, fenugreek, myrrh and their blends on serum glucose of alloxan diabetic rats

Values / Samples		Mg/dl	% of control(–)	% of control(+)
Control (–)		128.33 ± 1.53		–42.88
Control (+)		224.67 ± 10.02	+75.07	
Halfa	5%	126.00 ± 4.0*	–1.82	–43.92
	10%	117.67 ± 6.03*	–8.31	–47.63
Fenugreek	5%	122.00 ± 10**	–4.93	–45.70
	10%	116.00 ± 112.53**	–9.61	–48.37
Myrrh	2.5%	141.00 ± 42.46	+9.87	–37.24
	5%	137.00 ± 20.42*	+6.76	–39.20
Blend	5%	125.33 ± 5.5**	–2.34	–44.22
	10%	120.00 ± 10.0**	–6.49	–46.59

*(0,05), ** (0,01), ***(0,001).

decrease in relation to control + group were 45.70, 44.22, 43.92 and 37.24%, respectively. At the low herbs concentration serum glucose of fenugreek, herbs blend and halfa diet was less even than control (–) group, percent decreases were –4.93, –2.34 and –1.82%, respectively, but myrrh 2.5% diet showed 9.87% higher serum glucose than the control (–) group, although it was 37.24% less compared to control positive group, indicating that myrrh was also valid as hypoglycemic agent.

At the higher concentration fenugreek was the much greater potent hypoglycemic agent, followed by halfa, herbs blend and finally the myrrh diet. This may indicate that fenugreek was first as hypoglycemic agent followed by (halfa or blend), then came the myrrh. Nevertheless, it may be noticed that differences between the high and the low level or herbs were actually slight, showing that the no need for raising the concentration of fenugreek, halfa and the blend over 5% and myrrh over 2.5%.

Since, fenugreek alone was the highest glycemic agent studied, no synergism effect was found when the blend was formed and tested. It may be concluded due to small difference between serum glucose results, either fenugreek or halfa may be used each alone, taking into consideration that halfa is a costless (free) neglected widely grown herb. Future studies should be directed towards investigation of possible synergism effect when each two of the used herbs are studied together (halfa – fenugreek), (halfa – myrrh) and (fenugreek – myrrh). The present work results agree with that of Abdel-Barry et al. (1997), Ubillas et al. (1999) and Gharib Wesam et al. (2006) who showed that fenugreek, myrrh and halfa may be suggested as hypoglycemic therapy.

Serum lipids

As we expected, hyperglycemia raised pronouncedly (TC), (TG), LDL and VLDL while nearly did not affect HDL. This was also reported by Abd Elbaky (2006). Meanwhile with halfa, fenugreek, myrrh and blend diets the reverse was recorded (with less pronounced changes of HDL). This indicated the favourable impacts of

used plants on serum lipids fraction. In this concern, it could be noticed that the lowest desirable effect was nostly noticed for myrrh, while blend halfa and fenugreek were mostly of much more favourable influence. Nevertheless all studied plants were of value for reducing serum lipids. Some (Table 2) treatments showed values which were better than that of control (–) group.

Liver and kidney functions

It is evident (Table 3) that diabetes mellitus was possibly associated with some function disorders in liver and kidneys as the GOT, GPT, urea, creatinine and uric acid levels were increased. This was also reported by Mohammed Hala (2004) who added that such changes were reversed when rats fed on some legumes and fruits.

From results of Table 3 it could be observed that all treatments specially the blend corrected the disorders in liver and kidney functions; being thereby, of pronounced importance for curing side effects of diabetes mellitus. In most of cases (40% of cases) values recorded for the GOT, GPT, urea, creatinine and uric acid were less than that found for control (–) rats group.

Body weight gain % of final total weight (BWG%), food intake (FI) and FER

It could be observed that diabetes mellitus was accompanied by reduction in BWG (and BWG%) regardless of the increased FI, and this resulted in the decline of FER. Similar trends were reported by Mohammed Hala (2004) for alloxan diabetic rats (Table 4). Meanwhile halfa, fenugreek and the blend diets corrected such changes causing the increase of both BWG occurred regardless of the apparent normal FI, and this resulted in negative values for BWG% and FER. This may call for more studies on the effect of myrrh in reducing the BW and BWG while may help in correction of overweight and obesity. In fact, Omer and Adam (1999) and Omer et al. (1999) reported that myrrh at high doses was lethal for goats and rats and at moderate doses showed some toxicity, but at low doses showed no toxic impacts.

Table 2 Effect of halfa, fenugreek, myrrh and their blends on serum lipids of alloxan diabetic rats (mg/dl)

Means / Samples		Total cholesterol (TC)	Triglyceride (TG)	High-density lipoprotein cholesterol (HDL)	Low-density lipoprotein cholesterol (LDL)	Very low-density lipoprotein cholesterol (VLDL)
Control (–)		86 ± 5.29	71 ± 6.56	39.67 ± 4.93	35.13 ± 5.95	14.20 ± 1.31
Control (+)		158.33 ± 29.01	141.67 ± 2.89	39.00 ± 1.73	91.00 ± 28.62	28.40 ± 0.58
Halfa	5%	85.00 ± 5.29*	80.33 ± 5.51***	39.33 ± 4.51	29.60 ± 6.68*	16.07 ± 1.10***
	10%	78.33 ± 10.41*	70.67 ± 4.04**	40 ± 1.00	24.20 ± 9.99	14.13 ± 0.81**
Fenugreek	5%	130.67 ± 48.09	127 ± 2.65***	36.00 ± 7.81	69.27 ± 44.05**	25.40 ± 0.53***
	10%	118.33 ± 15.01*	110.67 ± 17.00	40.38 ± 8.14	55.87 ± 24.31	22.13 ± 3.40
Myrrh	2.5%	129.67 ± 1.53	129.00 ± 5.29	41.67 ± 0.58	62.20 ± 2.43	25.8 ± 1.06
	5%	88.67 ± 7.77*	73.33 ± 5.77**	39.00 ± 3.61	35.00 ± 12.49*	14.67 ± 1.15**
Blend	5%	88.33 ± 2.31*	70.33 ± 4.51**	38.00 ± 4.0	36.27 ± 1.55	14.00 ± 0.91**
	10%	74.33 ± 4.04*	63.33 ± 2.89***	39.00 ± 1.73	22.67 ± 2.08*	12.06 ± 0.58***

*% decrease (–) or increase (+) related to reference.
**Differences compared to control (+) are significant ($P < 0.05$).
***Differences compared to control (+) are high significant ($P < 0.01$)

Table 3 Effect of halfa, fenugreek, myrrh and their blend on liver and kidneys functions of alloxan diabetic rats

Means / Samples		Liver function (U/L)		Kidney function (mg/dl)		
		GOT	GPT	Urea	Creatinine	Uric Acid
Control (–)		27.67 ± 0.31	25.67 ± 3.21	23.00 ± 2.65	0.63 ± 0.05	2.33 ± 0.31
Control (+)		58.00 ± 1.00	45.00 ± 40	43.00 ± 2.65	1.97 ± 0.12	5.23 ± 0.55
Halfa	5%	46.67 ± 1.53**	27.67 ± 0.58**	22.33 ± 0.58**	1.15 ± 0.3*	2.27 ± 0.15**
	10%	37.33 ± 52**	25.00 ± 4.58	18.33 ± 3.51**	0.79 ± 0.08**	2.23 ± 0.35**
Fenugreek	5%	42.32 ± 2.52**	37.00 ± 8.89*	37.00 ± 2.65	0.91 ± 0.16**	2.50 ± 0.46*
	10%	32.33 ± 2.52**	34.33 ± 12.09	34.33 ± 2.52	0.62 ± 0.09***	2.23 ± 0.25**
Myrrh	2.5%	40.00 ± 1.00**	33.33 ± 5.69	34.00 ± 2.31	0.79 ± 0.004**	1.98 ± 0.42**
	5%	31.67 ± 2.88**	28.33 ± 6.65	29.00 ± 1.00**	0.72 ± 0.06***	1.72 ± 0.35***
Blend	5%	28.32 ± 5.58**	23.67 ± 3.51**	21.00 ± 3.06**	0.60 ± 0.05**	1.93 ± 0.42**
	10%	26.33 ± 3.51**	23.00 ± 1.00**	16.67 ± 2.08**	0.60 ± 0.09***	1.70 ± 0.35**

*Differences compared to control (+) are significant ($P < 0.05$).
**Differences compared to control (+) are high significant ($P < 0.01$).
***Differences compared to control (+) are very high significant ($P < 0.01$).

Table 4 Effect of halfa, fenugreek, myrrh and their blend on BWG%, FI and FER of alloxan diabetic rats

Means / Samples		Initial BW (g)	Final BW (after 28 days) (g)	BWG (in 28 days) (g)	FI/day (g)	FER	BWG%
Control (–)		128.70 ± 21.02	168.37 ± 23.61	39.67 ± 2.60	12.87 ± 2.1	0.110 ± 0.0131	30.82 ± 3.17
Control (+)		139.23 ± 20.33	165.18 ± 24.46	25.95 ± 7.83	14.24 ± 2.17	0.065 ± 0.041	18.63 ± 5.00
Halfa	5%	133.90 ± 10.07	170.03 ± 4.90	36.13 ± 14.70	13.20 ± 1.23	0.098 ± 0.013	26.98 ± 5.55
	10%	133.10 ± 11.40	169.73 ± 19.17	36.63 ± 13.60	13.46 ± 1.11	0.097 ± 0.06	27.52 ± 10.39
Fenugreek	5%	124.23 ± 24.42	159.13 ± 10.61	34.90 ± 20.95	14.83 ± 1.16	0.084 ± 0.01	28.09 ± 4.36
	10%	122.67 ± 24.13	157.83 ± 17.41	35.16 ± 13.80	12.89 ± 0.82	0.097 ± 0.05	28.66 ± 8.14
Myrrh	2.5%	132.50 ± 21.73	122.30 ± 17.53	–10.2 ± 2.99**	13.25 ± 2.17	–0.028 ± 0.04**	–7.70 ± 4.8*
	5%	140.30 ± 3.05	121.30 ± 9.07*	–19.0 ± 2.50	14.05 ± 0.82	–0.048 ± 0.01*	–13.54 ± 6.36*
Blend	5%	122.50 ± 10.31	160.53 ± 19.17	38.03 ± 9.82	14.06 ± 0.31	0.097 ± 0.06	31.05 ± 6.5
	10%	128.87 ± 22.17	171.63 ± 20.75	42.76 ± 3.93	12.81 ± 2.24	0.119 ± 0.01	33.18 ± 8.68

*Differences compared to control (+) are significant.
**Differences compared to control (+) are high significant.

In as much as in present work no diarrhea or other symptoms of toxicity occurred, and only the loss of BW was recorded, detailed studies are needed to decide the benefit of adding myrrh (at suitable doses) for weight control diets. Meanwhile the weight loss may be the result of myrrh on the thyroid activity. Panda and Kar (2005) proved that myrrh stimulated the thyroid function. Moreover, Anon (2007b) used guggul extract to simulate the thyroid gland and to speed up the metabolism. In this case more energy was expended, more calories were burned and body weight was lost.

Weight of internal organs

From results of Table 5 it could be observed that based on weight of final weight, the changes of lungs and liver were not indicative, while certain trend of change was noticed for spleen, heart and kidneys.

Table 5 Effect of halfa, fenugreek, myrrh and their blend, on internal organ weight of alloxan deiabetic rats (g and % of final BW)

Means / Samples		Liver		Spleen		Lungs		Heart		Kidney	
		g	%	g	%	g	%	g	%	g	%
Control (–)		0.63 ± 0.01	0.37	1.30 ± 0.15	0.77	0.73 ± 0.06	0.43	1.30 ± 0.40	0.43	1.30 ± 0.06	0.77
Control (+)		3.87 ± 0.70	2.34	0.37 ± 0.05	0.22	0.80 ± 0.06	0.48	0.57 ± 0.35	0.35	0.93 ± 0.15	0.56
Halfa	5%	4.23 ± 0.40	2.49	0.43 ± 0.05	0.25	1.10 ± 0.05*	0.65	0.67 ± 0.05	0.39	1.20 ± 0.26*	0.71
	10%	4.33 ± 0.23	2.55	0.57 ± 0.05	0.34	1.23 ± 0.05	0.73	0.73 ± 0.05	0.43	1.27 ± 0.05**	0.75
Fenugreek	5%	4.00 ± 0.17	2.51	0.50 ± 0.01	0.31	1.07 ± 0.20	0.67	0.63 ± 0.05	0.40	1.10 ± 0.06	1.69
	10%	4.13 ± 0.15	2.62	0.57 ± 0.11*	0.36	1.20 ± 0.01*	0.76	0.67 ± 0.15	0.43	1.17 ± 0.05	0.74
Myrrh	2.5%	3.13 ± 0.05	2.56	0.32 ± 0.05	0.27	0.80 ± 0.06	0.65	0.47 ± 0.05	0.38	0.73 ± 0.05	0.60
	5%	3.23 ± 0.05	2.66	0.40 ± 0.06	0.33	0.83 ± 0.11*	0.68	0.50 ± 0.06	0.41	0.87 ± 0.05	0.72
Blend	5%	4.33 ± 0.15	2.70	0.50 ± 0.06*	0.31	1.17 ± 0.05	0.69	0.63 ± 0.11	0.39	1.17 ± 0.15*	0.73
	10%	4.67 ± 0.5	2.72	0.63 ± 0.05**	0.37	1.30 ± 0.06**	0.76	0.73 ± 0.05	0.43	1.30 ± 0.06*	0.76

*Differences compared to control (+) are significant ($P < 0.05$).
**Differences compared to control (+) are high significant ($P < 0.01$).

For the last three organs diabetes mellitus resulted in less WT% while with experimental diets some correction occurred. In this concern the least correction was recorded for the myrrh diet.

These results revealed that any of the suggested plant (except the myrrh) could be recommended alone even at the low dose to correct the changes induced by diabetes mellitus. The blend and halfa were best treatments for glucose, LDL and kidney and liver function.

BIOGRAPHY

Dr. NADIA SALEH AL-AMOUDI Associate professor in nutrition and food science in girl's college of home economics and arts at king abd al-Aziz university Jeddah since 2001. My master and doctoral degree in nutrition at year 1986 and 1991 respectively. I earned 12 credit hours in 1996–1997 continuing education program "nutrition and the M.D" from America. At 1997 I had a certificated membership from new York academy of science. I participate in many symposiums and published several research and studies. I discussed many of master and PhD thesis. I am teaching several courses especially clinical nutrition, meal planning and malnutrition disease.

REFERENCES

Abd Elbaky, M.S. (2006) 'Attenuation of hyperglycemic and associated parameters in diabetic rats by dietary supplementation of pomegranate in (Punica granatum) peel powder', *Journal of Home Economics-Minufiya University*, Vol. 16, Nos. 1/2, pp.1–12.

Abdel-Barry, J.A., Abdel-Hassan, I.A. and Al-Hakiem, M.H. (1997) 'Hypoglycemic and antihyperglycemic effects of Trigonella foenum graecum leaf in normal and alloxan induced diabetic rats', *Journal of Ethnopharmacology*, Vol. 58, No. 3, pp.149–155.

Ahsan, S.K., Tariq, M., Ageel, A.M., Al-Yahya, M.A. and Shah, A.H. (1989) 'Effect of Trigonella foenum graecum and Ammi majus on calcium oxalate urolithiasis in rats', *Journal of Ethnopharmacology*, Vol. 26, No. 3, pp.249–254.

Al-Awadi, F., Fatania, H. and Shamte, U. (1991) 'The effect of a plant mixture extract on liver gluconeogenesis in streptozotocin induced diabetic rats', *Diabetes Research*, Vol. 18, No. 4, pp.163–168.

Al-Awadi, F.M. and Gumaa, K.A. (1987) 'Studies on the activity of individual plants of an antidiabetic plant mixture', *Acta Latina*, Vol. 24, No. 1, pp.37–41.

Ali, L., Azad Khan, A.K., Hassan, Z., Mosihuzzaman, M. and Bokeya, B. (1995) 'Characterization of the hypoglycemic effects of Trigonella Foenum seed', *Planta Medica*, Vol. 61, No. 4, pp.358–360.

Allain, C.Z., Poon, L.S. and Chan, C.S.C. (1974) 'Enzymatic determination of total serum cholesterol', *Clinical Chemistry*, Vol. 20, pp.470–475.

Amin, A., Alkaabi, A., Alfalasi, S., Daoud, S. (2005) 'Chemopreventive activities of Trigonella Foenum graecum (fenugreek) against breast cancer', *Cell Bio 1. International*, Vol. 29, No. 8, pp.687–694.

Anon (2007a) *Abnormal Thyroid*, Available at: www.compuslin.com/guggul-weight-loss) (fm-33k).

Burstein, M. (1970) 'HDL cholesterol determination after separation high density lipoprotein', *Lipid Research*, Vol. 11, p.583.

Chapman, D.G., Gastella, R.C. and Campbell, J.A. (1959) 'Evaluation of protein in food-7: a method for the determination of protein efficiency ratio', *Canadian Journal of Biochemistry and Physiology*, Vol. 374, pp.679–689.

Chary, T.M. and Sharma, H. (2004) *Practical Biochemistry for Medical and Dental Students*, New Delhi: Jaypee Brothers Publishers (P) Ltd.

Chawla, R. (2003) *Practical Clinical Biochemistry*, 3rd edition, New Delhi: Jaypee Brothers Medical Publishers (p) Ltd.

Desai, A. and Bhide, M. (1985) 'Hypoglycemic activity of Hanitonia sauvecolens', *Indian Journal of Medical*, Vol. 81, pp.81–91.

Fossati, P. and Principe, L. (1982) 'Triglycerides measurements with colorimetric method', *Clinical Chemistry*, Vol. 28, pp.2077–2078.

Fossati, P., Principe, L. and Berti, G. (1980) 'Enzymatic cororimetric method of determination of uric acid in serum', *Clinical Chemistry*, Vol. 26, No. 2, pp.227–237.

Friedwald, W.T., Leve, R.I. and Fredrichson, D.S. (1972) 'Estimation of concentration of low-density lipoproteins separted by three different methods', *Clinical Chemistry*, Vol. 18, pp.499–502.

Genet, S., Kale, R.K. and Baquer, N.Z. (1999) 'Effects of vanadate, insulin and fenugreek (Trigonella foenum graecum) on creatine Kinas levels in tissues of diabetic rat', *Indian Journal of Experimental Biology*, Vol. 37, No. 2, pp.200–202.

Gharib Wesam, M., Eslam Header, E.A.M., El-Sherif, F.E.A., El-Sayed, M.M. and El-Dashlouty, M.S. (2006) 'Beneficial Effect of Reed, Esparto Grass. Plam Tree Leaves and White Willow on Hyperglycemia, hyperlipidemia and Kidney Inflammatory Disorders in Rats', *Proceedings of Researches Delivered at 10th Arab Conference of Home Economics*, Minufiya University, 2006, pp. 47–62.

Hannan, J.M., Rokeya, B., Farnque, O., Nahar, N., Mosihazzaman, M., Azad Khan, A.K. and Ali, L. (2003) 'Effect of soluble dietary fiber fraction of Trigonella Foenum Graecum on glycemic, insulinemic lipidemic and platelet aggregation status of type 2 diabetic model rats', *Journal of Ethnopharmacology*, Vol. 88, No. 1, pp.73–77.

Javan, N., Ahmadiani, A., Semnanian, S. and Kamalinejad, M. (1997) 'Antinocicpetive effects of Trigonella Foenum Graecum leaves extract', *Journal of Ethnopharmacology*, Vol. 58, No. 2, pp.129–129.

Lotfy, M., Badra, G., Burham, W. and Alenzi, F.Q. (2006) 'Combined use of honey, bee propolis and myrrh in healing a deep, infected wound in a patient with diabetes mellitus', *British Journal of Biochemical Science*, Vol. 63, No. 4, pp. 171–173.

LWD (1983) *The Lexicon Webster Dictionary*, Encyclopedic Edition, Vol. 1, p.631, USA.

Malhotra, V.K. (2003) *Practical Biochemistry for Students*, 4th edition, New Delhi: Jaypee Brothers Medical Publishers(P) LTD.

Mohammed Hala, A.W. (2004) *Biological Effect of Some Legumes and Fruits on Hyperglycemic Rats*, MSc Thesis, Faculty of Home Economics, Minufiya University.

Mohammed, S., Taha, A., Bamezai, R.N., Baser, S.F. and Baquer, N.A. (2004) 'Lower doses of vanadate in combination with Trigonella restore altered carbohydrate metabolism and antioxidant states in alloxan-diabetic rats', *Clinica Chimica Acta*, Vol. 342, Nos. 1–2, pp.105–114.

Mukherjee, P.K., Maiti, K., Mukherjee, K. and Houghton, P.J. (2006) 'Leads from Indian medicinal plants with hypoglycemic potentials', *Journal of Ethnopharmacology*, Vol. 106, No. 1, pp.1–28.

NDDG (Nation Diabetes Data Group) (1994) 'Classification and diagnosis of diabetes mellitus, and other categories of glucose intolerance', *Journal of Diabetes*, Vol. 28, pp.1039–1057.

Omer, S.A. and Adam, S.E. (1999) 'Toxicity of Commiphora myrrha to goats', *Veterinary and Human Toxicology*, Vol. 41, No. 5, pp.299–301.

Oser, S.A., Adam, S.E. and Khalid, M.E. (1999) 'Effect on rats of Commiphora myrrha extract given by different routes of administration', *Veterinary and Human Toxicology*, Vol. 41, No. 4, pp.193–196.

Panda, S. and Kar, A. (2005) 'Guggulu (Commiphora imukul) potentially ameliorates hypothyroidism in female mice', *Phytotherapy Research*, Vol. 19, No. 1, pp.78–80.

Pandian, R.S., Anwradha, C.V. and Viswanathan, P. (2002) 'Gastroprotective effect of fenugreek seeds (Trigonella foenum graecum on experimental gastric ulcer in rats', *Journal of Ethnopharmacology*, Vol. 81, No. 3, pp.393–397.

Parvispur, A., Ahmediani, A. and Kamalinejad, M. (2004) 'Spinal serotonergic system is partially involved in antinociception induced by Trigonella foenum graecum (TFG) leaf extract', *Journal of Ethnopharmacology*, Vol. 95, No. 1, pp.13–17.

Parvizpur, A., Ahmadiani, A. and Kamalinejad, M. (2006) 'Probable role of spinal purinoceptors in the analgesic effect of trigonella foenum graecum (TFG) leaves extract', *Journal of Ethnopharmacology*, Vol. 104, Nos. 1–2, pp.108–112.

Preet, A., Siddiqui, M.R., Taha, A., Badhai, J., Hussein, M.E., Yadava, P.K. and Baquer, N.Z. (2006) 'Long-term effect of Trigonella foenum graecum and its combination with sodium orthovanadate in preventing histopathological and biochemical abnormalities in diabetic rat ocular tissues', *Molecular and Cellular Biochemistry*, Vol. 289, Nos. 1–2, pp.137–147.

Raju, J., Gupta, D., Rao, A.R., Yadava, P.K. and Baquer, N.Z. (2001) 'Trigonella foenum graecum (fenugreek) seed powder improves glucose homeostasis in alloxan diabetic rat tissues by reversing the altered glycolytic gluconeogenic and lipogenic enzymes', *Molecular and Cellular Biochemistry*, Vol. 224, Nos. 1–2, pp.45–51.

Raju, J., Potalla, J.M., Swamy, M.V. and Rao, C.V. (2004) 'Diosgenin, asteroid sapanin of Trigonella foenum graecum (fenugreek), inhibits azoxymethane included aberrant crypt foci formation in F344 rats and induces apoptosis in Ht human colon Cancer cells', *Cancer Epidemiology, Biomarkers and Prevention*, Vol. 13, No. 8, pp.1392–1398.

Reeves, P.G., Nielsen, F.H. and Fahmy, G.C. (1993) 'AIN-93 purified diets for laboratory rodents: final report of the American Institute of Nutrition ad hoc writing committee on the reformation of NIN-76A rodent diet', *Journal of Nutrition*, Vol. 123, No. 11, pp.1939–1951.

Siddiqui, M.R., Moorthy, K., Taha, A., Hussain, M.E. and Baquer, N.Z. (2006) 'Low doses of vanadate and trigonella synergistically regulate Nat/Kt-Atpase activity and GIUT4 Translocation in alloxan-diabetic rats', *Molecular and Cellular Biochemistry*, Vol. 285, Nos. 1–2, pp.17–27.

SPSS (1998) *Statistical Package for Social Science*, London, UK: Computer Software Ver. 10, SPSS Company.

Srivastava, L.M., Das, N. and Sinha, S. (2002) *Essentials of Practical Biochemistry*, CBC Publishers and Distributors.

Steel, R.G. and Torri, J.H. (1980) *Principal and Procedures of Statistical, Biometric Approach*, 2nd edition, New York, USA: Publ. Mc. Grew Hill Book Company.

Sur, P., Das, M., Gomes, A., Vedasiromoni, J.R., Sahu, N.P., Baneree, S., Sharma, R.M. and Gangly, D.K. (2001) 'Trigonella foenum

greacum (fenugreek) seed extract as an antineoplastic agent', *Phytotherapy Research*, Vol. 15, No. 3, pp.257–259.

Tahiliani, P. and Kar, A. (2003) 'The combined effect of Trigonella and Allium extracts in the regulation of hyperthyroidism in rats', *Plytomedicine*, Vol. 10, No. 8, pp.665–668.

Thakran, S., Siddiqui, M.R. and Baquer, N.Z. (2004) 'Trigonella foenum graecum seed powder protects against histopathological abnormalities in tissues of diabetic rats', *Molecular and Cellular Biochemistry*, Vol. 266, Nos. 1–2, pp.151–159.

Tietz, N.W. (1976) *Fundamentals of Clinical Chemistry*, W. B. Saunders, Philadelphia.

Ubillas, R.P., Mendez, C.D., Jolad, S.D., Luo, J., King, S.R., Carlson, T.J. and Fort, D.M. (1999) *Antihyperglycemic furanoses quiterpenes from Commiphora myrrha*, South San Francisco, California, USA: Shaman Pharmaceuticals Inc.

Vats, V., Grover, J.K. and Rathi, S.S. (2002) 'Evaluation of antihyperglycemic and hypoglycemic effect of Trigonella foenum graecum Linn, Ocimum sancta Linn and Pterocarps marsupium Linn in normal and alloxanized diabetic rats', *Journal of Ethnopharmacology*, Vol. 79, No. 1, pp.95–100.

Zia, T., Hasnain, S.N. and Hasan, S.K. (2001a) 'Evaluation of the oral hypoglycemic effect of Trigonell foenum graecum L. (methi) in normal mice', *Journal of Ethnopharmacology*, Vol. 75, Nos. 2–3, pp.191–195.

Zia, T., Siddiqui, I.A. and Hasnain, N. (2001b) 'Nematicidal activity of Trigonella foenum graecum L', *Phytotherapy Research*, Vol. 15, No. 6, pp.538–540.