



Evaluation of Anti-hyperlipidaemic Potential of Gum Arabic in Experimentally Induced Hyperlipidaemia in Donkeys

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Abstract

Hyperlipaemia is a pathophysiological response to prolonged negative energy balance associated with gross lipaemia. This study was designed to determine whether treating with gum Arabic would lower plasma lipids in a group of donkeys with experimentally induced hyperlipidaemia. Three groups each of six male donkeys were subjected to four days fasting to induce hyperlipidaemia and then they were randomly assigned to receive either 25 or 50 g/day of gum Arabic for seven successive days or left untreated. Following fasting triglycerides level was increased significantly ($P < 0.05$) in the plasma of donkeys in the three groups. Simultaneous increase in Plasma level of cholesterol, urea, creatinine and albumin was also observed in the three groups following fasting. No significant difference was observed in total protein and glucose concentration as well as AST and ALT activities.

Treatment of donkeys with gum Arabic with 25mg/day resulted in significant decrease in the plasma level of triglycerides, cholesterol, urea and creatinine. The level of triglycerides in the group treated with 50g/day exhibited no significant decrease and remained at high level up to the end of the experiment. The concurrent decrease in urea and creatinine may indicate a further positive effect in kidney function.

Here it is to be concluded that gum Arabic at dose rate of 25g/day for seven successive days has positive effect in lowering plasma triglycerides level in donkeys with experimentally induced hyperlipidaemia; and that the increase in the gum Arabic dose was not necessary to affect the level of triglycerides in donkeys.

Keywords: Lipid profile, hyper-triglyceridaemia, gum Arabic, donkeys

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Introduction

There is a flow of data supporting the health benefits of dietary fibre. It has been documented that dietary fibre enhances the bowel health, has lipid lowering effect,

reduces cardiovascular risks, and improves blood sugar control in diabetics. Gum Arabic (GA) is an edible, dried, gummy exudates from the stems and branches of *Acacia senegal* and *Acacia seyal*. The exudate is a non-viscous liquid, rich in soluble fibres

(Williams and Phillips, 2000). GA is used in a wide range of industrial sectors mainly in the food and pharmaceuticals industry. GA enhanced renal function (Bliss and Settle 1991; Little and Trafford 1991) and reported to have lipid lowering effect (Ross *et al.*, 1983 and Sharma, 1985) and hypotriglyceridaemic effect (Annison *et al.*, 1995). In Middle Eastern countries GA is employed in the treatment of patients with chronic renal disease and end stage renal failure (Al Majed, 2002). Several biological properties of GA were recently documented including: the metabolism of lipids (Tiss *et al.*, 2001), as an antioxidant (Trommer and Neubert, 2005; Ali and Al Moundhri, 2006) positive contribution in treating kidney (Matsumoto *et al.*, 2006; Ali *et al.*, 2008), and gastrointestinal diseases (Wapnir *et al.*, 2008).

The effects of GA on lipid metabolism are variable. Feeding rats with 5 percent GA has significantly decreased the absorption of dietary cholesterol; increased cholesterol biosynthesis in rats fed a cholesterol-containing diet, but had no effect in rats on a cholesterol-free diet (Kelly and Tsai, 1978). Ross *et al.*, (1983) reported reduction of total serum cholesterol by 6 percent when subjects received 25 g/day GA for period of 21 days. Sharma (1985) reported reductions of total serum cholesterol; confined only to low density lipoprotein (LDL) and very low density lipoprotein (VLDL), with no effect on high density lipoprotein (HDL) and triglycerides (TGC). In the other hand Topping *et al.*, (1985) has shown that plasma cholesterol concentration was not affected by feeding GA, but plasma triacylglycerols were significantly lower than in controls.

Hyperlipaemia is a disorder of lipid metabolism occurs primarily in pony breeds of horse and donkeys (Schotman and Wagenaar, 1969, Fowler, 1989) as a response to a negative energy balance due to feed

withholding (but not water) leading to lipid mobilization and initial release of free fatty acids and glycerol from adipose tissue followed by a rise in serum triglycerides, fatty infiltration of body tissues leading to organs dysfunction (Naylor *et al.*, 1980; Watson and love, 1994). Hyperlipaemia in equine has been thoroughly reviewed elsewhere (Hughes *et al.*, 2004; Mckenzie, 2011).

Hyperlipaemia is a life-threatening condition in horses, ponies, and donkeys (Dunkel and McKenzie, 2003, Hughes *et al.*, 2004). If left undetected or untreated, hyperlipaemia may progress to hepatic lipidosis and liver failure with multi-systemic complications (Mogg and Palmer, 1995). The disease is well described in donkeys (Mair, 1995) with mortality rate ranging from 86% to 95%, higher than that in ponies (Fowler, 1989). Recently, hyperlipidaemia in donkeys was experimentally induced by subjecting male donkeys to four or five days fasting (Bulldan *et al.*, 2013).

This study was conducted to evaluate the lipid lowering potential of two different doses of Gum Arabic, if any, in experimentally induced hyperlipidaemia in donkeys.

Materials and Methods

Site of study:

This study was conducted in Khartoum state, at the farm of the College of Veterinary Medicine, Sudan University of Science and Technology (SUST), Hillat Kuku, Khartoum North, Sudan.

Ethical approval:

The study protocol was approved by the College of Veterinary Medicine Research Board as well as the Scientific Research Deanship, Sudan University of Science and Technology.

Experimental Animals:

Eighteen male donkeys 4-10 years of age were purchased from the local market in East

Nile locality. Upon arrival donkeys were clinically examined and they were treated with an anthelmintic (Paramectin® Pharma Swede, Egypt) at dose rate of 0.2 mg/kg/bwt by the SC route; and antibiotic ((Penstrept 400® Interchemie Werken, Holland - 200,000 procaine penicillin G + 200mg dihydrostreptomycin/ml) at dose rate of 1ml/20 kg/bwt, by the IM route for three successive days; as prophylactic measurement. Donkeys were kept in pens and provided with free access to water and fresh *Abo sabeen* ad libitum and a calculated amount of Dura maize for two weeks as adaptation period prior to the experiment.

Gum Arabic:

A fine pure powder of gum Arabic (Active-Acacia®) was obtained from the Sudanese limited company of the gum Arabic and was used as received. Two different doses (50mg and 25mg) of gum Arabic were measured using a sensitive balance (AND GR. 200-EC from A and D instrument, Japan) and the doses were dissolved in 500 ml drinking water.

Experimental design:

Hyperlipidaemia was induced by subjecting all donkeys to four days fasting according to Bulldan *et al.*, (2013). Following induction of hyperlipidaemia, the animals were randomly divided into three groups each of six. Following induction of hyperlipidaemia, animals in the three groups were either: (TG1) received an oral dose of 25g/day once daily for seven successive days or, (TG2) received an oral dose of 50g/day of gum Arabic once daily for seven successive days or; (C) kept untreated as control group.

Blood samples collection:

Blood was withdrawn from the jugular vein and transferred into blood containers coated with fluoride oxalate. The containers were gently inverted several times and placed in ice and immediately transported to the

laboratory. Plasma was harvested following centrifugation, and kept at -20°C until analysed.

Sampling schedule:

Blood samples were collected before fasting (baseline value) and then daily during fasting (F) “induction of hyperlipidaemia” (F1, F2, and F3), and day after day (T1, T2, and T3) during the treatment (T) period and after the end of the treatment period samples were collected at the 10th (Post T1) and 15th (Post T2) day of the treatment.

Plasma analysis procedures:

Plasma biochemical parameters were measured using commercial kits (Vitro Scient-Egypt) according to standard spectrophotometer methods as follows: Triglycerides according to Stein and Myers, (1995). Cholesterol following the method of Tietz, (1995); Glucose according to Barham and Trinder (1972); Total plasma proteins (Doumas *et al.*, 1981); albumin (Doumas *et al.*, 1971); The creatinine according to Bartels *et al.*, (1972); Blood urea following the method described by Fawcett and Scott, (1960). Aspartate aminotransferase (AST) and Alanine aminotransferase (ALT) were measured according to Reitman and Frankel (1957).

Statistical analysis:

Data were analyzed using GraphPad Prism 5.0 (GraphPad Software). Means of fasting days were compared with the baseline value, while that of the treatment were compared with the last day of fasting. The post treatment values were compared with the adaptation period. Differences were analyzed by the student t-test. The significance level was set as $p < 0.05$.

Results

At the start of the study, the baseline level of triglycerides in donkeys in the three groups was within the reference normal values

(Table 1). Following fasting, triglycerides level gradually increased in all experimental groups. Statistically significant ($P < 0.05$) increased values were obtained in the second and the third day following fasting. In the control, group triglycerides concentration increased to reach 4.51 mmol/l by the end of fasting period (p value 0.032). Following re-feeding the concentration dropped to 0.58 ± 0.37 mmol/l by the end of the experiment (p value 0.027). The decrease in triglycerides concentrations was statistically significant.

In treatment group 1 (TG1) there was significant increase ($P < 0.05$) in triglycerides concentration at the end of fasting period (p value 0.033). After two days re-feeding accompanied with GA supplementation the concentration dropped to 0.37 mmol/l (p value 0.038). In the second treatment group (TG2) there was slight decrease in triglycerides concentration that is considered statistically ($P > 0.05$) insignificant.

Table 1: Plasma triglycerides concentration (mmol/l) in donkeys at baseline, during four days fasting, one -week treatment with 0, 25, and 50 g/d gum Arabic, and after gum Arabic drenching

Days	Control		TG1 (25g/day)		TG2 (50g/day)	
	Mean \pm SD	P value	Mean \pm SD	p value	Mean \pm SD	p value
Baseline	0.33 \pm 0.13		0.38 \pm 0.23		0.37 \pm 0.30	
F ₁	0.96 \pm 0.67	0.180	0.38 \pm 0.26	0.40	1.70 \pm 1.91	0.17
F ₂	2.58 \pm 1.41*	0.029	1.91 \pm 1.61*	0.042	2.16 \pm 1.85*	0.04
F ₃	4.51 \pm 2.85*	0.032	2.97 \pm 2.38*	0.033	2.57 \pm 2.58*	0.03
T ₁	1.06 \pm 0.61a	0.034	0.37 \pm 0.22a	0.038	2.44 \pm 2.71	0.54
T ₂	0.81 \pm 0.57a	0.033	0.72 \pm 0.82a	0.044	2.16 \pm 2.50	0.54
T ₃	0.51 \pm 0.19a	0.042	0.47 \pm 0.12	0.052	1.13 \pm 1.73	0.15
Post T ₁	0.49 \pm 0.16*	0.040	0.53 \pm 0.17	0.057	0.64 \pm 0.53	0.15
Post T ₂	0.58 \pm 0.37*	0.027	0.52 \pm 0.20*	0.049	1.27 \pm 1.59	0.16

Values are expressed as Mean \pm standard deviation.

Means with asterisk in the same column were significantly different with baseline value

Means with letter in the same column were significantly different with F3 value

Cholesterol baseline level was within the reference normal values in the three different groups. Following fasting there was statistically insignificant slight increase in cholesterol level in the control and TG2 group.

In TG1 group the increase in cholesterol level is statistically (p value 0.01) significant by the end of the fasting period. Following treatment for seven successive days cholesterol level in TG1 group dropped to statistically significant level (p value 0.001) and the level in the control group also decreased to statistically significant level (p value 0.01) when compared with the level

reached at the last fasting day. In TG2 there was slight insignificant decrease of cholesterol level (p value 0.20) at the end of treatment period (Table, 2).

Plasma creatinine increased significantly only in TG1 following fasting while the other two groups exhibited no significant increase. Following treatment, statistically significant decrease in TG1 group was observed during and after the end of the treatment period, in TG2 group this significant decrease appeared after the end of dosing. In the control group the decrease didn't reach a significance level (Table 3).

Table 2: Plasma cholesterol concentration (mmol/l) in donkeys at baseline, during four days fasting, one -week treatment with 0, 25, and 50 g/d gum Arabic, and after gum Arabic drenching

Days	Control		TG1 (25g/day)		TG2 (50g/day)	
	Mean ±SD	P value	Mean ±SD	p value	Mean ±SD	p value
Baseline	1.94±0.23		1.73±0.55		2.13±0.46	
F ₁	2.02±0.44	0.96	2.09±0.48*	0.02	2.71±1.05	0.30
F ₂	2.12±0.63	0.77	2.08±0.67	0.34	2.13±0.81	0.82
F ₃	2.96±0.98	0.09	2.52±0.65a	0.01	2.68±1.11	0.34
T ₁	1.34±0.35a	0.017	1.60±0.57a	0.005	2.45±1.28	0.46
T ₂	1.67±0.28a	0.02	1.67±0.63a	0.0008	2.13±1.13	0.19
T ₃	1.57±0.28a	0.01	1.28±0.30a	0.001	1.92±0.78	0.09
Post T ₁	1.66±0.29*	0.02	1.38± 0.31*	0.002	1.91±0.69*	0.02
Post T ₂	1.33±0.18*	0.01	1.26±0.29*	0.0007	1.73±0.83	0.056

Values are expressed as Mean ± standard deviation.

Means with asterisk in the same column were significantly different with baseline value

Means with letter in the same column were significantly different with F3 value

Table 3: Plasma creatinine concentration (mmol/l) in donkeys at baseline, during four days fasting, one -week treatment with 0, 25, and 50 g/d gum Arabic, and after gum Arabic drenching

Days	Control		TG1 (25g/day)		TG2 (50g/day)	
	Mean ±SD	P value	Mean ±SD	p value	Mean ±SD	p value
Baseline	123.4 ±51.0		111.2 ±43.8		105.9 ±33.9	
F ₁	108.0 ±47.3	0.2	97.1 ±36.7	0.7	90.34 ±21.2	0.6
F ₂	124.8 ±51.8	0.08	105.0 ±58.8	0.5	99.01 ±24.5	0.8
F ₃	144.6 ±119.7	0.8	262.1 ±76.7*	0.02	161.5 ±88.4	0.2
T ₁	128.5 ±53.4	0.7	177.2 ±104.7	0.1	96.06 ±42.4	0.2
T ₂	112.3 ±60.3	0.4	109.0 ±78.4a	0.02	125.5 ±66.9	0.8
T ₃	86.1 ±39.7	0.3	73.7 ±47.0a	0.005	63.12 ±39.3	0.08
Post T ₁	48.6 ±19.2	0.1	65.7 ±45.0*	0.008	76.73 ±50.0*	0.03
Post T ₂	53.4 ±22.2	0.2	42.1 ±19.1*	0.0008	65.24 ±60.4*	0.04

Values are expressed as Mean ± standard deviation.

Means with asterisk in the same column were significantly different with baseline value

Means with letter in the same column were significantly different with F3 value

Plasma urea level increased significantly following induction of hyperlipidaemia in the control and TG1 group and there was no significant increase (P>0.05) in TG2 group (Table 4). Following treatment with gum

Arabic the urea level in TG1 group decreased significantly below the level of the baseline value. Although there was decrease in the level of urea in TG2 group by the end of the experiment when compared with baseline

value, but still the reduction was not significant (p value 0.06).

Table 4: Plasma urea concentration (mmol/l) in donkeys at baseline, during four days fasting, one -week treatment with 0, 25, and 50 g/d gum Arabic, and after gum Arabic drenching

Days	Control		TG1 (25g/day)		TG2 (50g/day)	
	Mean ±SD	P value	Mean ±SD	p value	Mean ±SD	p value
Baseline	2.93 1.3		4.01 1.1		3.80 1.1	
F ₁	4.02 1.4	0.10	5.55 1.5	0.10	4.86 2.1	0.40
F ₂	5.38 2.2	0.06	6.12 1.5*	0.02	5.43 2.6	0.30
F ₃	8.71 3.6*	0.03	6.27 1.0**	0.009	6.77 2.8*	0.02
T ₁	2.64 1.2a	0.01	3.37 1.2a	0.004	4.21 3.2	0.30
T ₂	2.33 1.5a	0.01	2.63 0.9a	0.0006	3.37 2.2	0.20
T ₃	2.05 1.4a	0.01	2.35 0.2a	0.0001	5.53 0.9	0.07
Post T ₁	1.44 0.4*	0.008	2.53 1.1*	0.0001	2.57 0.9	0.06
Post T ₂	1.79 0.6*	0.009	2.67 0.9*	0.0001	2.42 0.4	0.06

Values are expressed as Mean ± standard deviation.

Means with asterisk in the same column were significantly different with baseline value

Means with letter in the same column were significantly different with F3 value

As shown in Figure (1), following induction of hyperlipaemia there was no significant change in glucose concentration in all groups (P>0.05). Treatment with the two doses of gum Arabic did not affect glucose level significantly, after the end of treatment period there was significant decrease in glucose level in TG1 treated group (p value 0.004).

Four successive days fasting caused no significant (P>0.05) increase in total protein concentration in all groups. During and post treatment period total protein concentration decreased significantly (P<0.05), but in the

control group the decrease didn't reach significant level (Figure 2).

Albumin concentration increased significantly (P<0.05) by the end of the fasting period in all treatment groups, during re-feeding albumin decreased gradually in all groups but the decrease wasn't significant (P>0.05) in the group treated with 50 mg/day GA (TG2 group) as shown in Figure (3).

As illustrated in Figures (4 and 5), there was a slight increase during fasting followed by slight decrease after treatment in AST and ALT activities but these changes didn't reach significant levels.

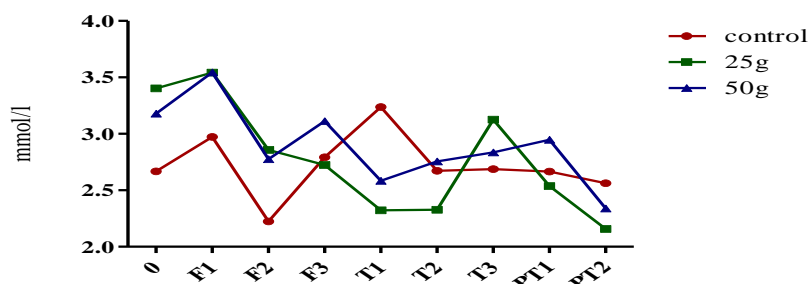


Figure 1: Plasma glucose concentration (mmol/l) in donkeys at baseline, during four days fasting, one -week treatment with 0, 25, and 50 g/d gum Arabic, and after gum Arabic drenching

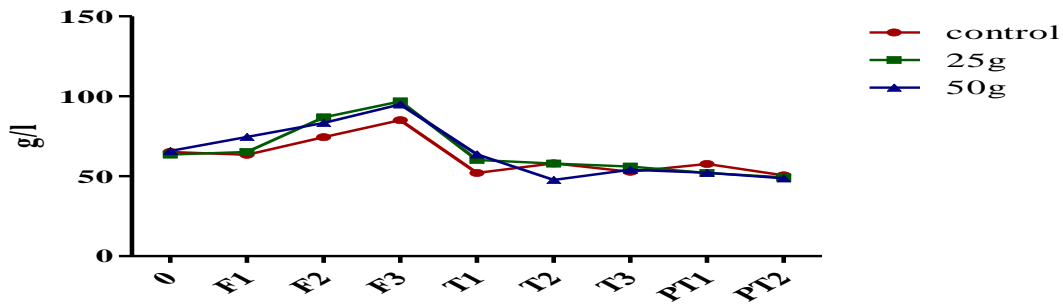


Figure 2: Plasma total proteins concentration (g/l) in donkeys at baseline, during four days fasting, one -week treatment with 0, 25, and 50 g/d gum Arabic, and after gum Arabic drenching

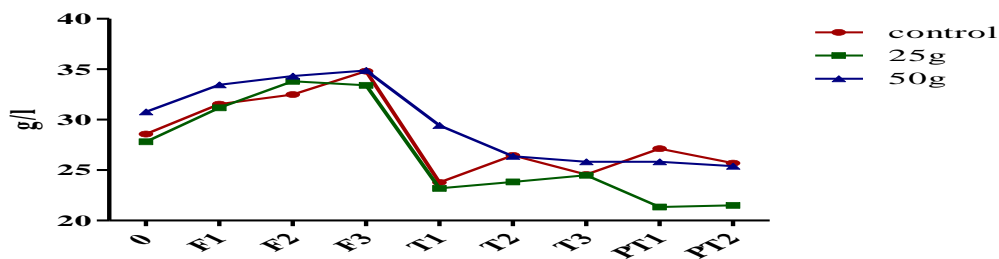


Figure 3: Plasma albumin concentration (g/l) in donkeys at baseline, during four days fasting, one -week treatment with 0, 25, and 50 g/d gum Arabic, and after gum Arabic drenching

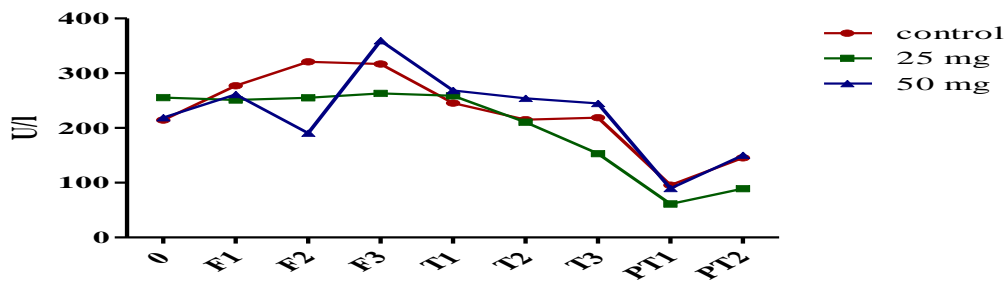


Figure 4: Plasma AST activity (U/l) in donkeys at baseline, during four days fasting, one -wk treatment with 0, 25, and 50 g/d gum Arabic, and after gum Arabic drenching

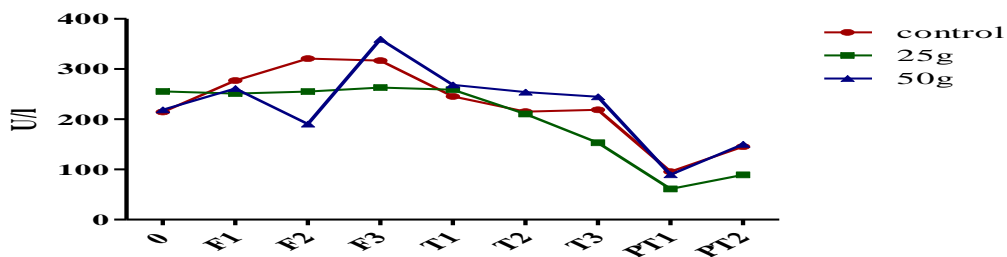


Figure 5: Plasma ALT activity (U/l) in donkeys at baseline, during four days fasting, one -week treatment with 0, 25, and 50 g/d gum Arabic, and after gum Arabic drenching

Discussion

The most characteristic change in the blood of equine with hyperlipaemia is the increased level of plasma triglycerides (TG). Animals in the current study expressed significant increase in TG concentration following four days fasting. This finding was in agreement with that obtained by Buldan *et al.*, (2013) in donkeys subjected to four or five days fasting. They reported that there was significant increase in TG during the post fasting period.

The plasma total triglyceride concentration measured in the present study were lower than the values reported previously, with a range 0.33 ± 0.13 - 4.51 ± 2.85 (Forhead *et al.*, 1994). This could be attributed to the fact that most of the animals in this experiment had body score ranging from fair to good. The degree of increase in plasma triglyceride (TG) appears to differ substantially among equids with similar primary causes and clinical presentation leading to hypertriglyceridaemia/hyperlipaemia.

Experimental induction of hyperlipaemia by starving (fasting) of healthy animals results in only a moderate increase of plasma total triglycerides. The values reported (4.24 ± 0.56 mmol/l) for fasted healthy donkeys (Forhead *et al.*, 1994) were in agreement with our results. In naturally occurring hyperlipaemia, the elevation of total triglycerides exceeds the values obtained from fasting normal animals (Dunkel and Mckenzie, 2003).

Treatment with gum Arabic with the dose rate of 25g/day for seven continued days significantly decreased the level of triglycerides, while animals in the second treatment group (TG2) exhibited no significant decrease. Triglycerides level in the control group also decreased significantly with re-feeding of animals, with slow rate when compared with TG1. This result was in agreement with that of Topping *et al.* (1985)

who reported that plasma triglyceride concentration in plasma was significantly lower in rats fed with GA than in controls. Abd-Razig *et al.*, (2010) reported significant decrease in triglyceride concentration in the serum and egg yolk of hens supplemented with 5% or 7% gum Arabic for three months. It is worth of mention that the plasma triglycerides level in the second treatment group (TG2) exhibited no significant ($P > 0.05$) decrease. Annison *et al.*, (1995) reported that plasma triacylglycerol concentrations were higher in rats fed Gum Arabic, whereas liver triacylglycerol were lower in rats fed the gums.

Following fasting there was statistically insignificant slight increase in cholesterol level in the control and TG2 treated group. In TG1 the increase in cholesterol level is statistically (p value 0.01) significant by the end of the fasting period. A result that supported the finding obtained by Buldan *et al.*, (2013) who indicated significant increase in total cholesterol concentration in the group that was subjected to five days fasting.

Following treatment for seven successive days cholesterol level in TG1 group dropped to statistically significant level (p value 0.001). A daily intake of 25 and 30 g of GA for 21 to 30 days was reported to reduce total cholesterol by 6 and 10.4% in humans, respectively (Ross *et al.*, 1983, Sharma 1985). Furgał-Dierżuk (2004) reported that LDL-Cholesterol and Triglycerides level in serum were significantly ($P \leq 0.01$) lower in pigs supplemented with guar gum. However, Topping *et al.* (1985) and Annison *et al.*, (1995) reported that plasma cholesterol concentration was not affected by the supply of GA.

The mechanism involved is clearly linked with the increased bile acid excretion and faecal neutral sterol or a modification of digestion and absorption of lipids (Moundras *et al.*, 1994). Various mechanisms have been

proposed to explain the hypocholesterolemic effect of GA (Annison *et al.*, 1995; Tiss *et al.*, 2001). Some studies have suggested that the viscosity of fermentable dietary fibre contributes substantially to the reduction of lipids in animals and humans (Gallaher *et al.*, 1993; Moundras *et al.*, 1994).

In donkeys, with naturally occurring hyperlipidaemia/hyperlipaemia, a positive correlation between plasma insulin and STG concentration has been reported (Forhead *et al.*, 1994). Activities of lipoprotein lipase and hepatic lipase are higher in hypertriglyceridemic, feed-deprived horses than in fed horses (Frank *et al.*, 2003). This suggests that overproduction of triglycerides, possibly complicated by defective catabolism, is the predominant cause of hypertriglyceridemia (Watson *et al.*, 1992b).

Following induction of hyperlipidaemia, there was prominent increase in plasma creatinine and urea concentration in the three groups. Treatment with gum Arabic resulted in reduction in urea and creatinine level below the baseline values. Similar results were obtained by Bulldan *et al.*, (2013) who reported significant increase in urea, total bilirubin and creatinine level as well as AST activity, during the fasting period. Bilirubin and creatinine continued to increase significantly at post fasting. In the second group where animals were subjected to five days fasting, urea, AST and bilirubin exhibited non significant ($P>0.05$) change, while, creatinine showed significant increase during the fasting period (Bulldan *et al.*, 2013). Tarrant *et al.*, (1998), reported increase in urea (31.2 mg/dl) and decrease in AST (270 UI). Azotaemia has been associated with hypertriglyceridaemia in several reports. A statistically significant association has been found between serum creatinine and serum triglycerides (STG) in horses (Naylor *et al.*, 1980) and ponies with hyperlipaemia (Watson *et al.*, 1992a). Eight

horses had an elevated serum creatinine (mean 0.46 mmol/l) concurrent with peak STG measured; 12 horses had an elevation of the serum creatinine concentration at least once during their hospitalization (Dunkel and McKenzie, 2003). Bliss *et al.*, (1996), reported significant decrease in serum urea nitrogen level during supplementation with gum Arabic (50g/day) in chronic renal failure (CRF) subjects compared with low protein diet (LPD) or supplementation with pectin; a result that supports our finding. The decrease in serum urea nitrogen during the gum Arabic supplementation period is consistent with previous observations of a decrease in serum urea nitrogen in CRF patients consuming a fiber supplemented LPD (Rampton *et al.*, 1984; Little and Trafford 1991).

Induction of hyperlipidaemia in donkeys resulted in no significant ($P>0.05$) change in glucose and total protein concentration as well as AST and ALT activities in all groups. Samia *et al.*, (2006) indicated that 5% Gum Arabic have some positive effect on decreasing glucose level in the blood stream of the animals studied. Albumin concentration increased significantly ($P<0.05$) by the end of the fasting period in all treatment groups. Treatment with the two doses of gum Arabic did not affect glucose level significantly. During re-feeding albumin decreased gradually in all groups but the decrease wasn't significant ($P>0.05$) in the group treated with 50 mg/day GA (TG2 group). Physiologically, these results could be attributed to the reduction in water intake during fasting resulting in haemo-concentration, and following re-feeding the animals tend to drink water as usual, resulting in haemo-dilution.

Four days fasting, resulted in no significant ($P>0.05$) decrease in the total protein concentration, but the level increased significantly following re-feeding. While, in the donkeys subjected to five days fasting

there was significant decrease in total protein and albumin concentration (Bulldan *et al.*, 2013). The fluctuation in total protein and albumin concentration could be attributed to negative energy balance where animals tend to use protein as source of energy. Tlak *et al.*, (2008) reported significant lower total protein concentration as a result of a six-day fasting period in Peking duck ducklings. Also, significantly lower AST activity was found after the 5th day of fasting, and lower ALT activity after the 4th day of fasting in the same trial. The low concentrations of total proteins over the entire trial period as well as reduced activities of the aforementioned enzymes were probably a consequence of reduced protein regeneration in the body due to the deficiency of amino acids from the gastrointestinal tract during fasting (Tlak *et al.*, 2008).

Conclusion and application

It is to be concluded that the use of gum Arabic at 25 g/day in donkeys with experimentally induced hyperlipidaemia resulted in significant decrease in triglycerides level, while the use of GA at 50g/day had no significant effect on triglycerides level. The concurrent decrease in urea and creatinine level may indicate an added effect in the kidney functions.

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تقويم امكانية استخدام الصمغ العربي في علاج ارتفاع الدهون المحدث تجريبيا في الحمر

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ارتفاع الدهون في الدم هو استجابة مرضية وظيفية عند حدوث توازن سالب للطاقة لفترة طويلة من الزمن. اجريت هذه الدراسة من اجل تقويم قدرة الصمغ العربي على تقليل (انقاص) ارتفاع الدهون المحدث تجريبيا في الحمر. تم احداث ارتفاع الدهون في ثلاثة مجموعات من الحمر (كل مجموعة تتكون من ست حيوانات) و ذلك من خلال التصويم لمدة أربعة ايام و من ثم تم تقسيمها عشوائيا ليتم علاجها باعطائها 25 جم/في اليوم أو 50 جم/ في اليوم لمدة سبعة ايام متواصلة، او تركت من غير علاج. عقب التصويم حدث ارتفاع ذو دلالة احصائية (معنوية) في بلازما الدم في كل الحمر. و حدث ايضا ارتفاع متزامن في مستوى الكولسترول، اليوريا، الكرياتنين و الزلال في بلازما الحيوانات في المجموعات الثلاثة. لم يكن هناك فرق ذو دلالة احصائية معنوية في تركيز الجلوكوز و البروتين الكلي و لا في فعالية انزيمي الالانين امينوترانسفيريز و لا الاسبارتيت امينو ترانسفيريز. علاج الحمر باستخدام الصمغ العربي بالجرعة 25 جم/في اليوم ادى الى حدوث انخفاض ذو دلالة احصائية معنوية في مستوى الجلوسيدات الثلاثية، الكولسترول، اليوريا و الكرياتنين. بينما مستوى الجلوسيدات الثلاثية في المجموعة التي تم علاجها بالجرعة 50 جم/ في اليوم اظهرت انخفاضا لم يصل الى درجة معنوية. الانخفاض في تركيز اليوريا و الكرياتنين قد يشير الى تاثر ايجابي على وظائف الكلية. تخلص الدراسة الى ان الصمغ العربي بجرعة قدرها 25 جم/ في اليوم لمدة اسبوع يعمل علي انقاص مستوى الجلوسيدات الثلاثية في الحمر المحدث فيها ارتفاع الدهون تجريبيا. ليس هناك حوجة الى زيادة جرعة الصمغ العربي لاحداث هذا الاثر.