

**THE EFFECT OF TRIGONELLA FOENUM-GRAECUM (FENUGREEK) ON THE BLOOD GLUCOSE, LIPID PROFILE AND  $\alpha$ -AMYLASE FOR DIABETIC ALBINO RATS COMPARED WITH GLIBENCLAMIDE DRUG.**

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**ABSTRACT**

**Background:**

Diabetes is a metabolic syndrome characterized by hyperglycemia, hyper cholesterolemia and hyper triglyceridemia, *Trigonella foenum-graecum* (fenugreek) seeds have been documented as a traditional plant treatment for diabetes.

**Objective:** This study aimed to compare the hypoglycemic effect of antidiabetic drug (glibenclamide) and *Trigonella foenum graecum* aqueous extract.

**Materials & Methods:** Twenty four albino rats were used in this experiment. Rats were assigned to 4 groups (N=6). All groups were fasted for 18 hrs. Group (1) was administered with glibenclamide (10 mg/kg b.w.), 3 groups were orally administered with different doses of *Trigonella foenum graecum* (fenugreek) seeds aqueous extract respectively, Blood samples were obtained to assess blood glucose, lipid profile and  $\alpha$ -amylase concentrations.

**Results:** Obtained results from this study indicated that *Trigonella foenum graecum* (fenugreek) aqueous extract significantly decreased blood glucose level in treated groups received (200 and 400 mg/kg b.w.). Compared with glibenclamide which reduced blood

glucose level below normal level. At the dose of 400 mg/kg b.w. of *Trigonella foenum graecum* (fenugreek) aqueous extract, the activity of  $\alpha$ -amylase was higher than control group which had been treated with glibenclamide. All groups registered low concentrations of cholesterol, triglycerides and HDL .

**Conclusion:** It can be concluded from this study that the best dose was (200mg/kg-b.w) *Trigonella foenum graecum* (Fenugreek), aqueous extract have a hypoglycemic effect by reducing both blood glucose and  $\alpha$ -amylase enzyme.

**Keywords:** Diabetes mellitus, *Trigonella Foenum Graecum* (Fenugreek), glibenclamide, antihyperglycemic.

## INTRODUCTION

The term diabetes mellitus describes as metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrates, fats and protein metabolism resulting from defects in insulin secretion, or insulin resistance or both. (Fracchiolla *et al*; 2007, Zimmer *et al*; 2011). It occurs throughout the world, but is more common (specially type 2) in the more developed countries. The greatest increase in prevalence is, however, expected to occur in Asia and Africa, (Wild *et al*; 2004). The effects of diabetes mellitus include long-term damage, dysfunction and failure of various organs. Complications categorized as cardiovascular conditions, cerebrovascular conditions, nephropathy, neuropathy, ocular lesions, and diabetic foot problems (Liu *et al*; 2010) It had been proven that medicinal plants have potential effectiveness against diabetes and play a major role in the management of diabetes, there are a number of plants which have the capacity to reduce the glucose production, induce the utilization of glucose and combat

with secondary complications (Pranav *et al*; 2008), *Trigonella foenum graecum* (Fenugreek) is one of medicinal plants known used in folk medicine for its anti-ulcer, anti-inflammatory, cicatrizing activities and to treat various pain-related physiological conditions (Laroubi *et al* 2009).The seed extract has shown antinoceptic (Biswal, *et al*; 2003), antidiabetic (Mondal, *et al*; 2004), antioxidant (Dixit; 2005), hypoglycemic (Thakran and Baquer; 2005, Puri, *et al*; 2002), antiulcer and gastroprotectivity (Pandian, *et al*; 2002) anti-hyperlipimedic activity (Venkatesan, *et al*; 2003). *Trigonella foenum-graecum* (Fenugreek) seeds have previously been shown to have hypoglycemic and hypocholesterolemic effects on type 1 and type 2 diabetes mellitus patients and experimental diabetic animals. *Trigonella foenum-graecum* (Fenugreek) extract has now been investigated for its effects on general properties, blood glucose and blood lipid, and haemorheological parameters in experimental diabetic rats

(Xue, *et al*; 2007) so the objectives of this study to compare the antidiabetic effect of *Trigonella foenum graecum* (fenugreek) with antidiabetic drug Glibenclamide.

Glibenclamide is a type of medicine called a sulphonylurea. It is used to help control blood sugar levels in people with type 2 diabetes. It had many side effects such as Disturbances of the gut such as diarrhea, constipation, nausea, vomiting or abdominal pain and Low blood glucose level (hypoglycemia).

## **MATERIALS & METHODS**

**Study Area:** Medicinal and Aromatic Plants Research Institute, National centre for Research, Khartoum, Sudan.

### **Data collection:**

Data collected from diabetic patients-using a questionnaire which resulted 44.6% of Sudanese diabetic patients used *Trigonella foenum graecum* (Fenugreek)

### **Plant Material:**

*Trigonella foenum graecum* (Fenugreek) seeds.

### **Animals and Induction of diabetes**

Twenty four Wistar albino rats of either sex weighing (135-250 g) and aged two months were used in this experiment. Rats used were kept on a fixed diet so as to stabilize the fasting plasma glucose level which was fixed at 70-110 mg/dl level for 3 days, as an

adaptation period. All groups were fasting for 18 hours then loaded with 5% glucose 2mg/kg –b.w. (Konuklugil *et al*; 1997) to induce diabetes. The fasting blood glucose (FBG) was measured. The rats with a FBG level higher than 120 mg/dl were included in the study.

### **Treatment experiment**

Twenty four albino rats of either sex weighing (135-250g) and aged two months were used. Rats were assigned to 4 groups (N=6). (Group 1) was administered with glibenclamide (10 mg/kg b.w.), and served as control, the induced diabetic rats, groups (2, 3 and 4) were administered with different concentrations (200,400 and 800mg/kg-b.w.) of *Trigonella foenum graecum* (Fenugreek) aqueous extract respectively. 1-2 ml of blood were drawn out by capillary tubes in fluorinated test tubes from the orbital plexus of rats according to (Khana, 1992) and centrifuged at 3000 r.p.m. for 5 minutes to separate plasma. The plasma prepared was used to estimate: blood glucose,  $\alpha$ -amylase, cholesterol, high density lipoprotein (HDL) and triglycerides concentrations.

SPSS was used for the analysis of the data using Independent-sample T-test (Snedecor and Cochran, 1989).

## **RESULTS**

Figure (1) shows blood glucose level, of fasting animals groups (1, 2, 3 and 4) was very low at zero hour (73, 62, 86.7 and

67.8mg/dl) respectively. After loading with glucose, animals (group 1) has treated with glibenclamide (10 mg/kg b.w.), blood glucose level after 2hs and 4hs was (62.7 and 59.7mg/dl) respectively below normal level, comparing with (group 2) which has been administered with (200 mg/kg-body weight) of *Trigonella foenum graecum* (Fenugreek) aqueous extract, blood glucose level, increased significantly to (101.8,

108.3 mg/dl) within the normal range after two and four hours ( $p \leq 0.05$ ). And then with the dose (400 mg/kg-body weight) (group 3) blood glucose level was (131.93 and 108.31mg/dl) after two and four hours ( $p \leq 0.05$ ) at high dose (800mg/kg-b.w) *Trigonella foenum graecum* (Fenugreek) aqueous extract, (group 4) blood glucose level increased to (131.6 and 127.4 mg/dl) slightly above the normal level.

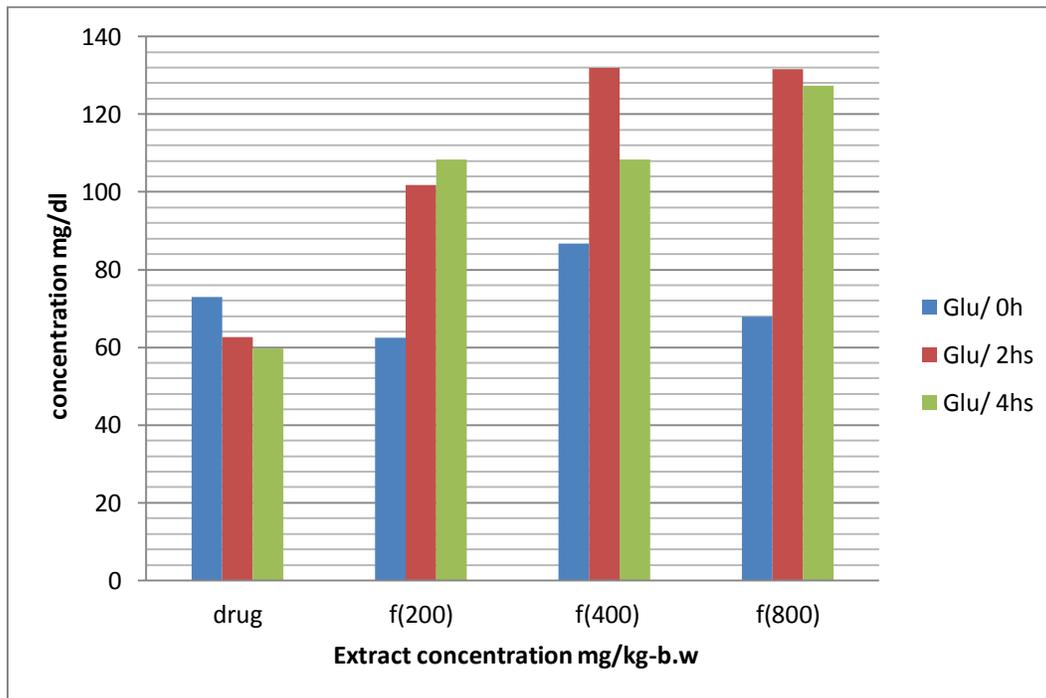
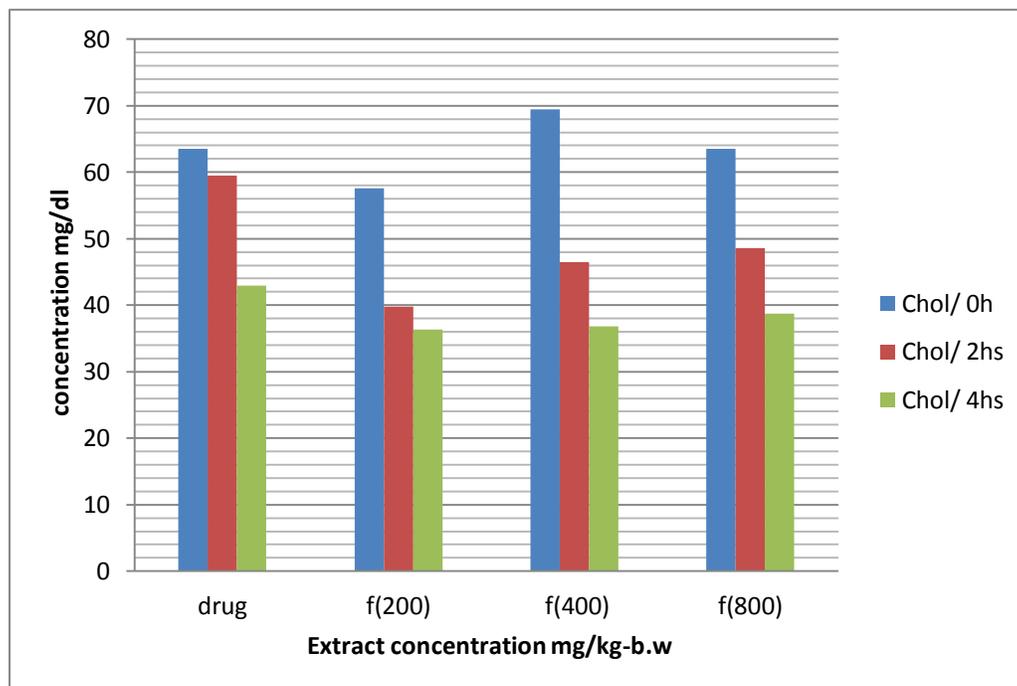


Figure (1): Effect of administration of different doses of *Trigonella foenum graecum* aqueous extract and Glibenclamide on blood glucose to induced-diabetic rats.

Figure (2) shows Blood cholesterol level, of fasting animals groups (1, 2, 3 and 4) was very high at zero hour (63.4, 57.5, 69.4 and 63.5mg/dl) respectively. After loading with glucose animals (group 1) has treated with glibenclamide (10 mg/kg b.w.), cholesterol level decreased to (59.4mg/dl) after 2 hours, and reduced to (42.9mg/dl) after 4 hours. comparing with treating groups (2, 3 and 4)

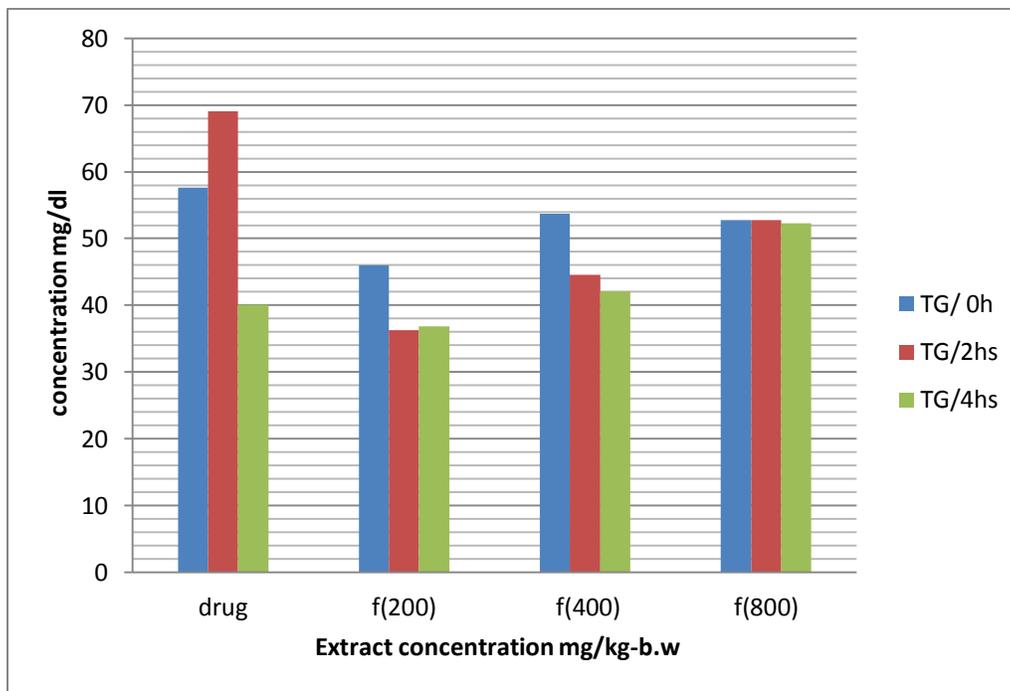
which had been administered with (200, 400 and 800mg/kg-b.w) *Trigonella foenum graecum* aqueous extract, cholesterol level reduced to (39.7, 46.5 and 48.5mg/dl) respectively after 2 hours ( $p=0.04$ ) and then to (36.3, 36.8 and 38.7mg/dl) respectively after 4 hours there was no significant difference ( $p>0.05$ )



**Figure (2): Effect of administration of different doses of *Trigonella foenum graecum* aqueous extract and Glibenclamide on blood Cholesterol to induced-diabetic rats.**

Figure (3) shows blood triglycerides level, of fasting animals groups (1, 2, 3 and 4) was slightly high at zero hour (57.5, 45.9, 53.7 and 52.7mg/dl) respectively. After loading with glucose (group 1) has treated with glibenclamide (10 mg/kg b.w.) triglycerides level increased to (69.1mg/dl) after 2hours, and reduced to (40.1mg/dl) after 4 hours. Comparing with treating group (2) which had been administered with (200mg/kg-b.w) *Trigonella foenum graecum* aqueous extract, triglycerides level reduced to (36.2mg/dl)

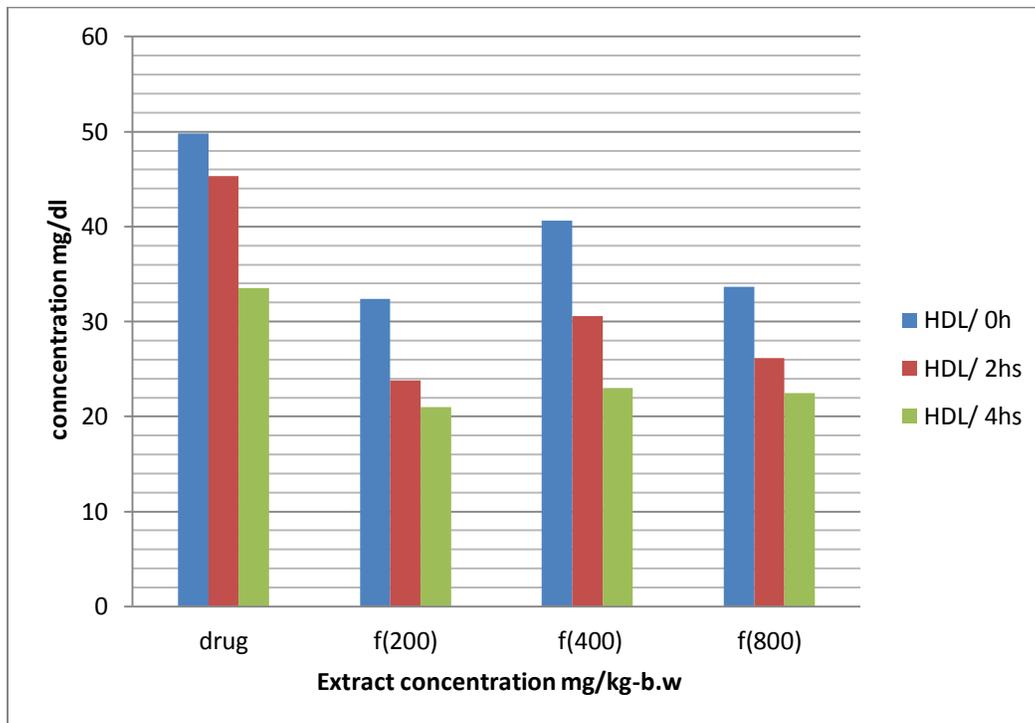
after two hours ( $p \leq 0.05$ ), and (36.8mg/dl) after four hours ( $p \leq 0.05$ ), (group 3) which had been administered with (400mg/kg-b.w) triglycerides level was (44.6 mg/dl) ( $p \leq 0.05$ ) then reduced to (42.09mg/dl) ( $p \leq 0.05$ ), comparing (group 4) which had been administered with (800mg/kg-b.w) *Trigonella foenum graecum* aqueous extract, with group (1) triglycerides was (52.7 versus 69.09mg/dl) ( $p \leq 0.05$ ) after two hours, and (40.07 versus 52.3mg/dl) ( $p \leq 0.05$ ),



**Figure (3): Effect of administration of different doses of *Trigonella foenum graecum* aqueous extract and Glibenclamide on blood triglycerides to induced-diabetic rats.**

Figure (4) shows blood HDL concentration of fasting animals. Groups (1, 2, 3 and 4) was very high at zero hour (49.8, 32.4, 40.6 and 33.6mg/dl) respectively. After loading with glucose animals (group 1) has treated with glibenclamide (10 mg/kg b.w.), HDL level decreased to (45.3mg/dl) after 2hours, and then to (33.5mg/dl) after 4 hours, comparing with treating group (2) which had been administered with (200 mg//kg-b.w) *Trigonella foenum graecum* aqueous extract, HDL level reduced after 2 hours to

(23mg/dl) and to (21mg/dl) after 4hours ( $p \leq 0.05$ ), (group 3) which had been administered with (400mg/kg-b.w) HDL level was (30.6 mg/dl) ( $p \leq 0.05$ ) then reduced to (30mg/dl) ( $p \leq 0.05$ ), comparing (group 4) which had been administered with (800mg/kg-b.w) *Trigonella foenum graecum* aqueous extract, with group (1) triglycerides was (26.1mg/dl versus 45.3mg/dl) ( $p \leq 0.05$ ) after two hours, and (23.5mg/dl versus 23mg/dl) there was no significant difference between two groups.



**Figure (4): Effect of administration of different doses of *Trigonella foenum graecum* aqueous extract and Glibenclamide on blood high density lipoprotein (HDL) to induced-diabetic rats.**

Figure (5) shows blood  $\alpha$ -amylase enzyme concentration (mg/dl). The enzyme concentration level, of fasting animals group (1) was very high (1419.8mg/dl) at zero hour. After loading with glucose and treating with glibenclamide (10 mg/kg b.w.), the enzyme concentration increased to (1445mg/dl) after 2hours, and then reduced to (1057.6mg/dl) after 4 hours, comparing

with treating group (2) which had been administered with (200mg/kg-b.w) *Trigonella foenum graecum* aqueous extract, the enzyme concentration was (1224.6mg/dl) at zero hour then increased to (1453mg/dl) after 2 hours there was no significant difference ( $p>0.05$ ) and slightly decreased to (1448.1mg/dl) after four hours ( $p\leq 0.05$ ), (group 3)

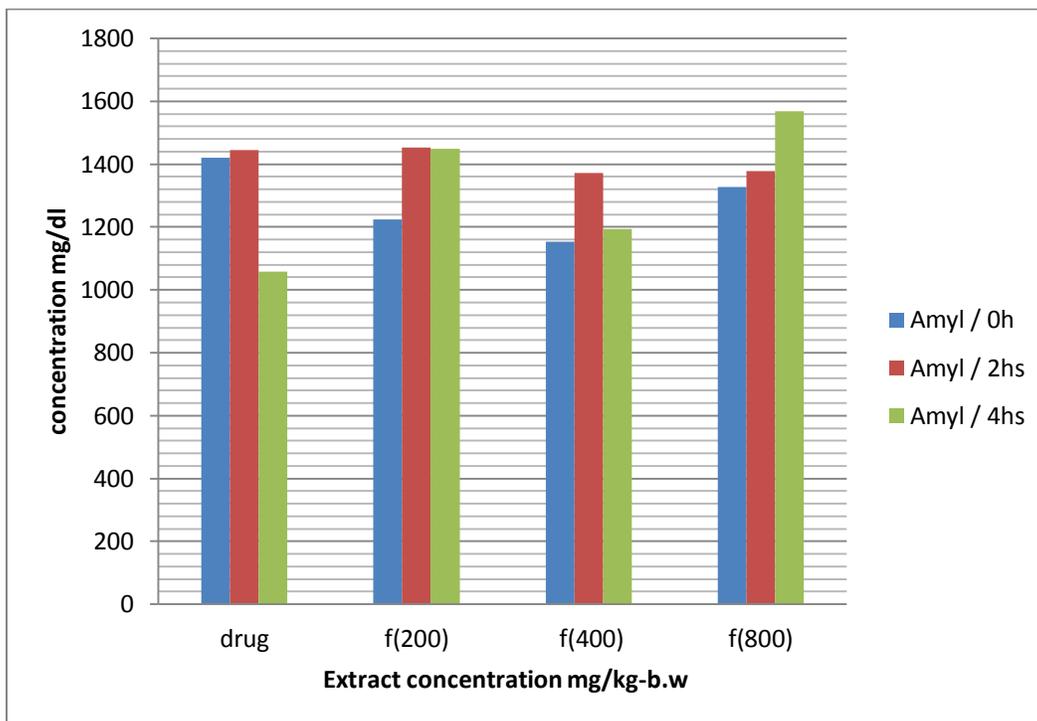


Figure (5): Effect of administration of different doses of *Trigonella foenum graecum* aqueous extract and Glibenclamide on blood  $\alpha$ - amylase to induced-diabetic rats.

(2,3) which had been administered with (200,400mg/kg-b.w) *Trigonella foenum graecum* aqueous extract, the enzyme concentration was (1224.6 and 1115.6mg/dl) at zero hour then increased to (1453 and 1371.6mg/dl) after 2 hours, and reduced to (1448.1 and 1194.1mg/dl) after 4 hours. Group 4 which had been administered with (800mg/kg-b.w) the enzyme concentration was (1327mg/dl) at zero hour then increased to (1377.6 and (1568.1mg/dl) respectively after 2 and 4 hours.

## DISCUSSION

Traditionally herbal treatments for diabetes have been used in patients with insulin-dependent and non-insulin dependent diabetes, this study compare the antidiabetic effect of medicinal plant *Trigonella foenum graecum* which known with its hypoglycemic effect with antidiabetic drug glibenclamide.

In the current study different doses (200, 400 and 800 mg/kg-b.w) of *Trigonella foenum graecum* (Fenugreek) seeds aqueous extract reduced blood glucose level to the normal range, this agreed with Vijaya kumar and his colleges (2005) who demonstrated that in *vitro* and in *vivo* clinical studies, that among the herbs for diabetes fenugreek hypoglycemic action had been discovered. Our findings also agreed with previous studies Xue and his college (2007) who demonstrated that *Trigonella foenum-graecum* (Fenugreek) extract has effects on blood glucose and blood lipid in

experimental diabetic rats. Plasma lipids of diabetic albino rats were tested; the results were agreed with Samia *et al* (2000) who represent that Fenugreek seeds lower serum triglycerides, total cholesterol and low-density lipoprotein.

Our study showed that *Trigonella foenum graecum* Fenugreek reduced  $\alpha$ -amylase concentration with increasing of the dose, this agreed with Arpita (2012) who identified that  $\alpha$ -amylase inhibitory effect of *Trigonella Foenum Graecum* in his project.

## CONCLUSION

Our study concluded that *Trigonella foenum graecum* Fenugreek seeds aqueous extract tolerate blood glucose to the normal level with the doses of (200 and 400mg/kg-b.w) when glibenclamide reduced it below the normal level (hypoglycemia), the tested plant also reduced  $\alpha$ -amylase concentration and had a benefit effect on lipid profile.

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