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The Effect of Ginger and Thyme on Some Biochemical Parameters in Diabetic Rats

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Abstract: *Diabetes mellitus (DM) is one of the chronic metabolic diseases. The present study was carried out to investigate the effect of ginger and thyme on some biochemical parameters in diabetic rats. Fifty-six male albino rats were divided into eight groups; 7 rats each. Negative control, positive control and other six groups were fed standard diet with 0.5%, 1% and 5% ginger and 2%, 5% and 10% thyme respectively for six weeks. Plasma samples were separated for different biochemical analysis. Livers were kept in 10% formalin for histological study. Hemoglobin was increased in 5% ginger and 10% thyme while total protein was increased only in 5% ginger compared with diabetic group. Rats fed 5% ginger and 10% thyme showed decrease in glucose level, total cholesterol, triglycerides, LDL-C, VLDL-C, uric acid, creatinin and urea nitrogen and increase in HDL-C compared with diabetic control. Liver functions were improved in diabetic groups when they fed (5%) ginger and (10%) thyme. It could be seen that there was statistically more significant improvement in (5%) ginger than (10%) thyme in glucose and HDL-C.*

Keywords: *Diabetes, Ginger, Glucose, Histology, Thyme*

I. Introduction

International Diabetes Federation (IDF) estimated that there were 34.6 million people with diabetes mellitus (DM) in the Middle East and North Africa, a number that will almost double to 67.9million by 2035 if concerted action is not taken to tackle the risk factors fuelling the epidemic of diabetes throughout the Region [1]. The global prevalence of DM in the year 2010 among adults has been estimated to be 6.4%. It is estimated that by the year 2030, Egypt will have at least 8.6 million adults with diabetes [2].

DM is known to impair many physiological functions. Some reports claim that medicinal plants can reduce these alterations caused by DM.

Ginger (Zingiber Officinale Roscoe, Zingiberaceae), is one of the most widely used herbs in Asian countries and now in Egypt as a commercial commodity. Ginger ethanolic extract possesses analgesic, anti-inflammatory and hypoglycemic properties in animal study [3].

Researches showed that ginger significantly lowered lipid peroxidation by maintaining activities for the antioxidant enzymes; Super oxide dismutase, catalase and glutathione peroxidase in rats [4]. [5] revealed a protective role of ginger on the diabetic brain via reducing oxidative stress, apoptosis, and inflammation.

Thyme (Thymus vulgaris L.), is an aromatic plant of the Mediterranean flora commonly used as spices and for medicinal purposes. Like other various species, thyme is traditionally used for its antiseptic, antispasmodic, and antitussive effects. Furthermore, thyme possesses antimicrobial, antifungal, antioxidative, and antiviral properties [6].

The essential oil derived from thyme is a mixture of monoterpenes and one of the main compounds of this oil is a natural terpenoid thymol [7]. Thymol exhibits multiple biological activities including antioxidant [8], and free radical scavenging properties [9]. Thymus vulgaris aqueous-methanol extract have remarkable potential to counteract DM-caused alterations, probably through their antioxidant and free radical-defusing effects [10].

II. Aim Of The Study

The present study was carried out to investigate the effect of each of ginger and thyme on some biochemical parameters in diabetic rats.

III. Materials And Methods

1 Materials:

Fifty-six male albino rats weighting (160+10g) of Sprague Dawley Strain were obtained from Vaccine and Immunity Organization, Helwan farm, Cairo, Egypt. Powdered dried Chinese ginger root and dried Libyans thyme were purchased from Agricultural Seed, Spices and Medicinal Plants Co. (Harras), Cairo, Egypt.

2 Methods:

2.1 Experimental diet:

Standard diet was prepared per 100 gm from the following ingredients: sunflower oil 10%, salt mixture 4% [11], vitamin mixtures 1% [12], DL methionine 0.3%, cellulose 5 % and cholin chloride 0.2 %. Casein was added to represent 14% protein according to [13]. The protein was added at the expense of starch.

2.2 Experimental design:

Fifty six male albino rats of Sprague- Dawley strain weighting (160± 10g) were divided into eight groups; 7 rats each. Feed and water were provided ad libitum. The first group (7 rats) was fed standard diet only as negative control. The other seven groups (49 rats) were rendered diabetic by subcutaneous injection of freshly prepared alloxan monohydrate in saline 150 mg/kg body weight according to [14]. Immediately after injection, animals were received 5% glucose solution over night to overcome drug-induced hypoglycemia [15]. After five days, blood glucose was analyzed by a drop of blood obtained from tail vein and subjected to a strip of hemogluco test to ensure occurrence of diabetes in rats. Rats with fasting blood sugar > 126 mg/dl were considered diabetic according to [16]. Then one group (7 rats) was fed on standard diet as a positive control (Diabetic control) for 6 weeks. The other six groups were fed standard diet with 0.5%, 1% and 5% ginger and 2%, 5% and 10% thyme respectively for six weeks.

At the end of the experimental period, all rats were sacrificed under ether anesthesia after overnight fasting. Blood samples were taken from the hepatic portal vein in heparinized tubes. Blood was centrifuged at 3500 r.p.m. for 15 min., plasma samples were separated and stored frozen at – 20◦c for different biochemical analysis.

2.3 Biochemical analysis:

Blood hemoglobin and Blood total protein were determined according to [17 and 18] respectively. Blood glucose was determined using hemogluco test. Plasma triglycerides (TG), total cholesterol (TC) and high-density lipoprotein-cholesterol (HDL-C) were determined according to the methods of [19, 20 and 21] respectively. Estimation of serum low-density lipoprotein cholesterol LDL-cholesterol was done according to the [22] equation. Plasma uric acid, Urea Nitrogen and Creatinine were determined according to the methods described by [23, 24 and 25] respectively. Aspartate amino transferases (AST) and Alanine amino transferases (ALT) were measured according to the method described by [26].

The results were analyzed statistically using computer statistical package software SPSS windows according to the method described by [27].

IV. Results And Discussion

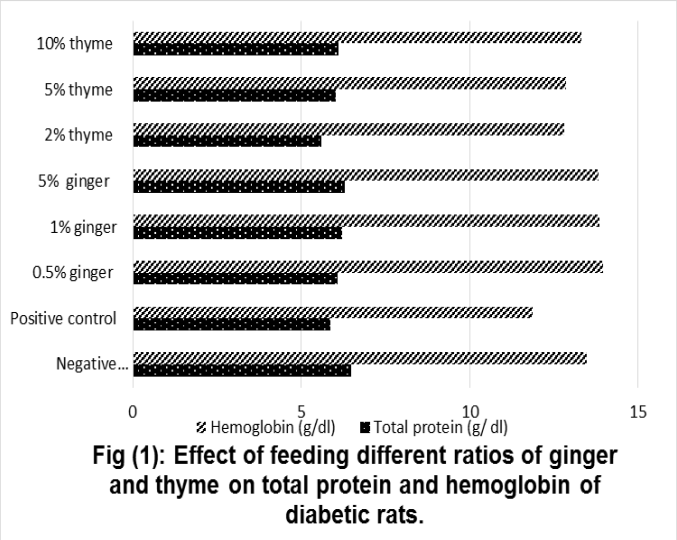


Fig (1): Effect of feeding different ratios of ginger and thyme on total protein and hemoglobin of diabetic rats.

Results presented in "Fig." (1) revealed that the plasma total protein was significantly lower in positive control and in rats fed (2 %) thyme group compared with negative control. However, there was a highly significant increase in (1% and 5%) ginger groups compared with positive control. These results were in agreement with that obtained by [28, 29 and 30]. The blood hemoglobin was significantly lower in positive control than negative control group. However, there was a significant increase in (0.5%, 1% and 5%) ginger groups and in rats fed (10%) thyme group compared with positive control groups.

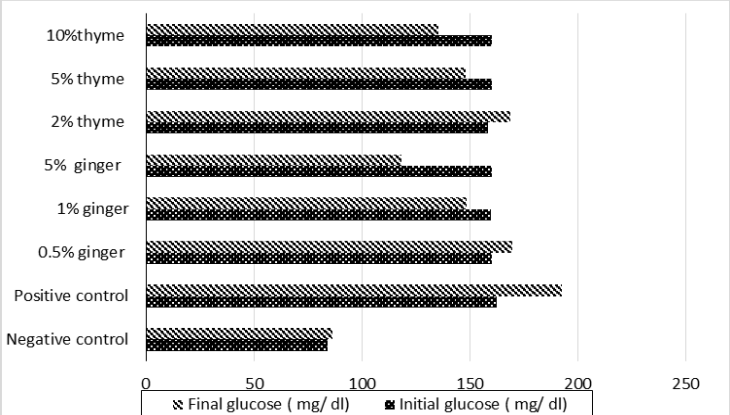


Fig (2): Effect of feeding different ratios of ginger and thyme on blood glucose of diabetic rats

Data presented in "Fig." (2) clarified that injection with alloxan caused highly significant increase in blood glucose in positive control, 0.5%, 1% and 5 % ginger groups and 2%, 5% and 10% thyme groups as compared with negative control. Rats fed with 1% and 5 % ginger groups and 5 and 10 % thyme showed significant reduction in glucose as compared with positive control. These results were in agreement with [31, 32 and 33]. [34] concluded that dietary ginger has hypoglycaemic effect, enhances insulin synthesis in male rats and has high antioxidant activity.

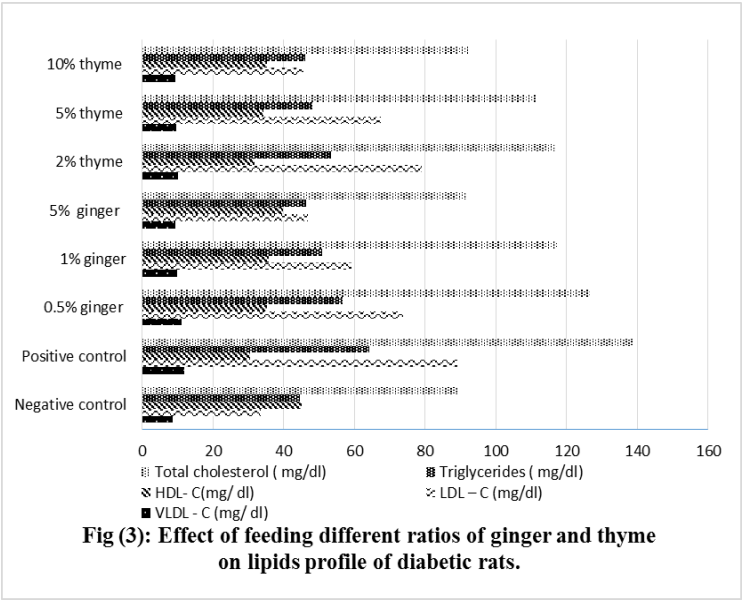


Fig (3): Effect of feeding different ratios of ginger and thyme on lipids profile of diabetic rats.

Results presented in "Fig." (3) revealed that injection with alloxan significantly raised plasma total cholesterol and triglycerides in positive control, 2 % and 5% thyme group as compared with negative control. Plasma total cholesterol and triglycerides were significantly decreased in (0.5%, 1% and 5 %) ginger group and 2%, 5% and 10 % thyme groups rats compared with positive control group. These results were in agreement with [35, 36 and 37]. [38] investigated that TG accumulation in tissues causes insulin resistance and induces impairment of pancreatic beta-cell function. A reduction in TG led to reductions in body weight and intra-abdominal fat weight, decreases in plasma TG, insulin and glucose levels and decrease in the TG secretion, decreases in the TG content in the liver, pancreas and muscles, improvement of the glucose infusion rate (GIR) and an improvement of pancreatic beta-cell function. HDL-C of positive control, 0.5% and 1% ginger and 2% and 5% thyme fed rats groups was significantly decreased as compared with negative control. It was observed that plasma HDL-C significantly increased in (5%) ginger and 10% thyme groups as compared with positive control. These results were in agreement with [39, 40 and 31]. Plasma LDL– C was significantly increased in positive control, 0.5%, 1.0% and 5% ginger, 2% and 5% thyme groups and VLDL – C was significantly increased in diabetic and 0.5% and 1% ginger groups and 2% and 5% thyme groups as compared with negative

control. However, it was observed that plasma LDL– C and VLDL – C were significantly decreased in 1% and 5% ginger and 2 %, 5% and 10% thyme fed groups as compared with positive control. The results were in the line with [41 and 42]. [10] found that the lipid profile was ameliorated especially by supplementations of Thymus vulgaris on diabetic rats.

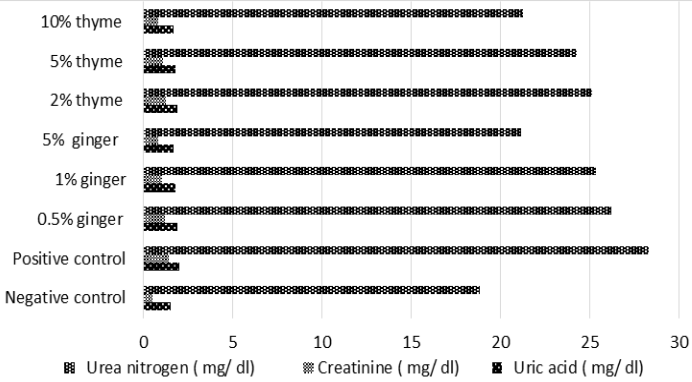


Fig (4): Effect of feeding different ratios of ginger and thyme on kidney functions of diabetic rats.

Results clarified in "Fig." (4) showed that plasma uric acid significantly increased in positive control, (0.5 %) ginger group and 2 % thyme group as compared with negative control. However, there was significant decrease in (1% and 5 %) ginger groups and 10 % thyme group as compared with positive control. [43] observed that, accelerated gluconeogensis and rates of protein degradation with negative nitrogen balance and muscle wasting occur in diabetic rats. Moreover, [44] found that, the correlation between glycaemic control and decline in renal function and a low urinary albumin excretion indicates that poor glycemic control can accelerate the loss of renal function in diabetic nephropathy. Creatinine level showed highly significant increase in positive control, 0.5%, 1% and 5 % ginger, 2%, 5% and 10% thyme fed groups as compared with negative control. While it was significantly decreased in 5% ginger and 10% thyme fed groups as compared with positive control. In addition, plasma urea was significantly increased in positive control, 0.5% and 1% ginger and 2% and 5% thyme fed groups as compared with negative control. It was significantly reduced in 5% ginger and 2 %, 5% and 10% thyme group as compared with positive control. These results were in agreement with that reported by [45, 46 and 10].

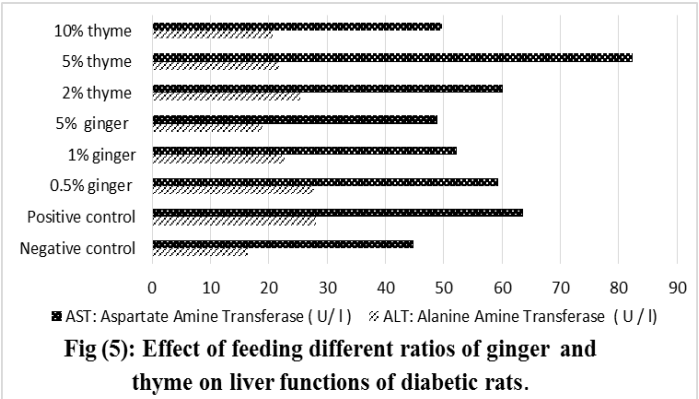
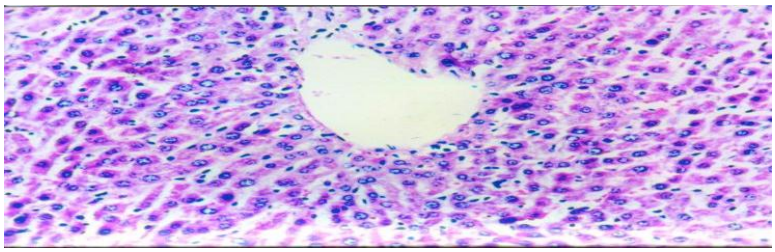


Fig (5): Effect of feeding different ratios of ginger and thyme on liver functions of diabetic rats.

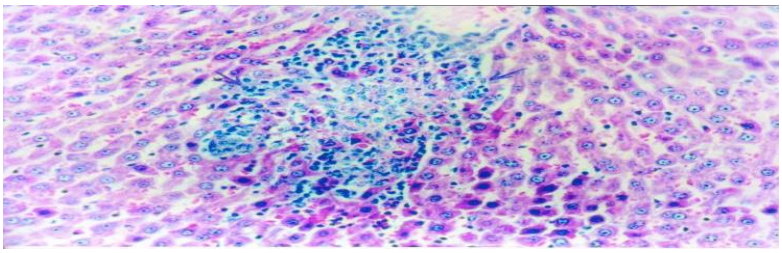
Results given in "Fig." (5) indicated that plasma ALT and AST was significantly increased for positive control, 0.5% and 1% ginger and 2 % and 5% thyme groups as compared with negative control while showed significant reduction in 1% and 5% ginger and 5% and 10% thyme as compared with positive control. These results were in agreement with [47 and 48].

When comparing ginger (5%) and thyme (10%) there was statistically more significant improvement in (5%) ginger than (10%) thyme in serum glucose and HDL-C.

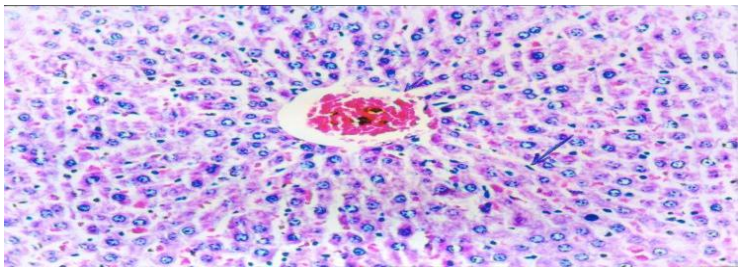
Histopathological studies on liver:



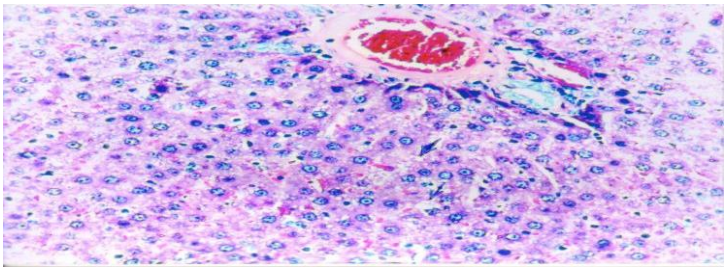
"Fig." (6) Liver of negative control rat showing the normal histological structure of hepatic lobule (Hand E X 200).



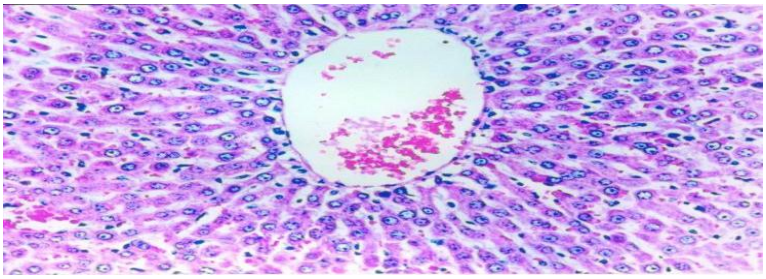
"Fig." (7) Liver of positive control rat showing focal area of hepatic necrosis completely replaced by leucocytic cells infiltration and focal hepatic hemorrhage (Hand E X 200).



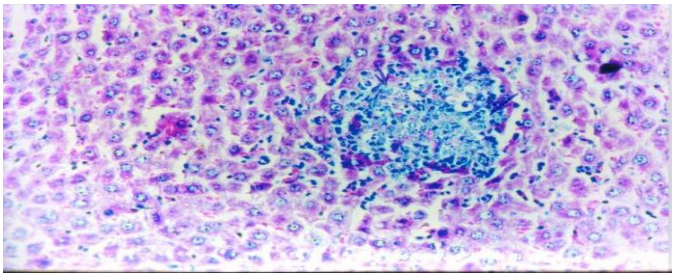
"Fig." (8) Liver of rat from (0.5%) ginger group showing congestion of central vein and activation of kupffer cells and focal hepatic hemorrhage (Hand E X 200).



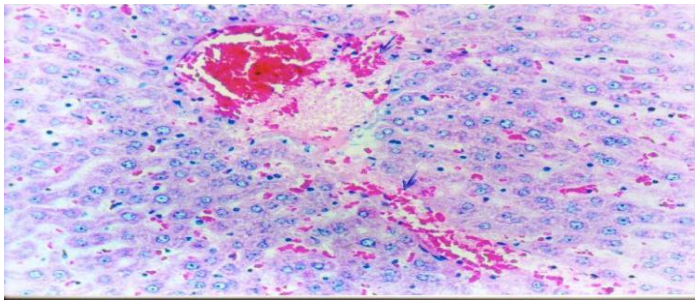
"Fig." (9) Liver of rat from (1%) ginger group showing vacuolar degeneration of hepatocytes and focal area of hepatic necrosis completely replaced by leucocytic cells infiltration (Hand E X 200).



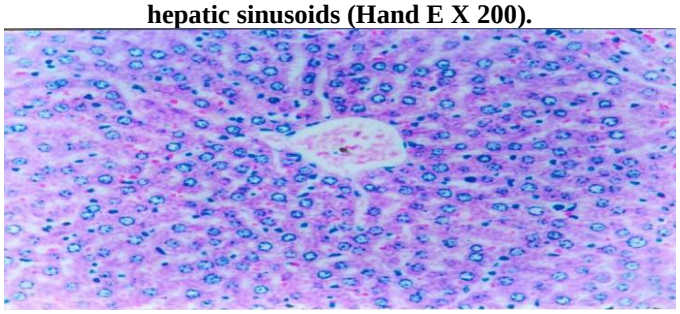
"Fig." (10) Liver of rat from (5%) ginger group showing no histopathological changes (Hand E X 200).



"Fig." (11) Liver of rat from (2%) thyme group showing focal area of hepatic necrosis completely replaced by leucocytic cells infiltration. (Hand E X 200).



"Fig." (12) Liver of rat from (5%) thyme group showing dilatation and congestion of central vein and hepatic sinusoids (Hand E X 200).



"Fig." (13) Liver of rat from (10%) thyme group showing no histopathological changes (Hand E X 200).

These results were in agreement with, [49] who found that, raised ALT reflects fatty change in the liver and that this in turn reflects pathophysiological changes predating the development of type II diabetes. While, [50] showed that, treatment with 1% dietary ginger for 4 weeks in rats may have protective role against the vacuolar degeneration of hepatocytes and focal area of hepatic necrosis completely replaced by leucocytic cells infiltration.

V. Conclusion

According to the results of the present study, it was preferred to use 5% ginger and 10% thyme for their importance in diabetics in reduction of serum glucose and lipid profile levels, increase HDL-C and hemoglobin levels and improve liver and kidney functions. Diabetic patients could use ginger and thyme as spices on meat, beans, pizza etc or in other forms as fresh ginger, or decoction as tea.

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