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RESEARCH ARTICLE

AQUEOUS EXTRACT OF *INDIAN COSTUS* ROOTS EFFECTS ON A DIET-INDUCED HYPERCHOLESTEROLEMIA IN MURINE MODEL.

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Abstract

The present study was designed to investigate the effects of aqueous extract of *Indian costus* roots on lipid profile in a diet-hypercholesterolemic mice. The subjects were randomized into 3 groups: Group A (Normal Control); Group B (Hypercholesterolemic Control); Group C (Hypercholesterolemic + *Indian costus* treated). Hyperlipidemia was induced by feeding high fat diet. After 3 weeks of hypercholesterolemic diet, body weights, blood cholesterol level, triglycerides, Plasma enzyme ALT, AST and ALP levels were measured. The oral administration of aqueous extract of *Indian costus* roots shows reduction in total cholesterol, triglycerides and Plasma enzyme ALT, AST and ALP levels in hypercholesterolemic mice compared to normal group. The findings of this study indicated that the administration of *Indian costus* improved level of lipid profile and decreased in the Plasma enzyme ALT, AST and ALP levels in hypercholesterolemic mice.

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Introduction:-

In humans or Animals feeding of fat-rich diet straight affects the serum cholesterol level and the fatty acids composition. The metabolism of serum cholesterol counting high density lipoprotein (HDL), intermediate density lipoproteins (IDL), low density lipoprotein (LDL), very low density lipoprotein (VLDL) and triglycerides. Hypercholesterolemia characterized by high serum LDL cholesterol or a combination of high levels of LDL cholesterol and triglycerides, which has emerged as a strong risk factor for development of coronary artery disease. Shew WH et al., (2001) reported that, Hypercholesterolemia accompanied with diabetes, causative to the high pervasiveness of accelerated atherosclerosis and coronary heart disease. For a long time, several medicinal plants or their extracts have been used for treatment the diabetics disease and Hypercholesterolemia on the folklore medicine (Akhtar and Ali, 1984). Moreover, the search for more effective and safer Hypercholesterolemia agents has continued to be an important spot of active research.

Indian costus roots are the dried rhizome of *costus speciosus* (Hansel et al., 1994). *Indian costus* is species of the *Zingiberaceae* family which found extensively in north west and north east sub Himalayan regions. It is one of the medicinally important and ornamental plants used to cure different diseases like asthma, inflammatory diseases, ulcers and stomach problems (Pandey et al., 2007). The rhizomes of these plants possess several biologic activities like antibacterial and antifungal activity (Duraipandiyan et al., 2012). In addition the hexane extract of dried *Indian*

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costus roots are used for treatment of cancer because it has anti-cancer (Robinson et al., 2008). Aqueous extract of *Indian costus* rhizome have significant hypoglycemic effects (Daisy et al., 2008). Rajesh et al., (2009) has evaluated the antidiabetes activity of chloroform, methanolic, petroleum ether and aqueous extracts of *costus speciosus* rhizomes on Streptozotocin (STZ) induced diabetic rats. Moreover, Eliza et al., (2009) reported that the administration of *costunolide* (which isolated from *costus speciosus*) increased the level of serum HDL-cholesterol and decreased the levels of total cholesterol, triglycerides and LDL-cholesterol. Also, treatment of the diabetic rats with *costunolide* caused reduction in the activity of AST, ALT, LDH, ALP and ACP enzymes in plasma compared to the diabetic group. Therefore alleviated liver damage caused By STZ-induced diabetes.

The present study was designed to investigate the effects of aqueous extract of *indian costus* roots on lipid profile of adiet-hypercholesterolemia in murine model.

Materials and Methods:-

Plant material

The indian *costus* roots were collected from numerous herb stores in Albeida-Libya. They were washed, shade dried and ground into a powder.

Extraction of Plant Material:-

About 10 g of dried *costus* roots were added to 100 ml of boiling distilled water and soaked for 2 hour. Then, slurry is filtered and stored at 4°C. The final concentration of the aqueous extract was 10 %.

Experimental animals:-

Healthy albino male mice 5 to 6 weeks old, weighing 20-25 g were procured from the small animal house of Faculty of Veterinary Medicine -Omar Al-mukhtar University -Elbeida-Libya. The experimental mice were divided into Three groups (n = 7 mice): group-A which kept as normal control group was fed on standard diet only; group-B was fed on standard diet with 30 % animal fat for 3 weeks to be hypercholesterolemic; group-C was fed on standard diet with 30 % animal fat and treated using single dose [10 µl] of aqueous extract of *Indian costus* roots every day through oral administration for 3 weeks. The water was provided for each cage.

The body weight of the albino mice were measured before and after high fat diet and after giving the treatments.

Collection of samples:-

The mice were sacrificed at the end of the experiment (3 weeks). The collected blood samples were sent to the laboratory for biochemical analysis.

Biochemical analysis:-

The Serum total cholesterol, triglycerides and Plasma enzyme like alanineaminotransferase (ALT), aspartateaminotransferase (AST) and alkaline phosphatase (ALP) levels were measured by a Hitachi 902 automated blood analyzer (Hitachi Science Systems Ltd., Ibaraki, Japan)..

Statistical analysis:-

The data are expressed as Mean ± SEM. The results of the study was analyzed using one-way ANOVA. Differences were considered significant when $p < 0.05$ and $p < 0.01$.

Results:-

After 3 weeks of hypercholesterolemic diet the effect of aqueous extract of *indian costus* on body weights, cholesterol level, triglycerides and Plasma enzyme ALT, AST and ALP levels in group A, B and C were measured.

Effect of aqueous extract of *indian costus* on changes of body weight (gr) in normal and hypercholesterolemic mice:-

Table 1 presents the effect of aqueous extract of *Indian costus* in body weights of normal and hypercholesterolemic mice. There was a significant increase in body weights of hypercholesterolemic mice when compared to normal group. The oral administration of aqueous extract of *Indian costus* significantly decreased the body weights compared to untreated hypercholesterolemic mice.

Table 1:-Effect of aqueous extract of *indian costus* on changes of body weight (gr) in normal and hypercholesterolemic mice

body weight (gr)	control group	hypercholesterolemic	hypercholesterolemic + <i>indian costus</i>
	23.4 ± 1.2	26.0 ± 0.61*	24.14 ± 0.67*

Values are expressed as mean ± SEM., n = 7., *(P) < 0.05

Effect of aqueous extract of *indian costus* on cholesterol level (mg/ dl) and triglycerides (mg/ dl) in normal and hypercholesterolemic mice:-

There was a significant increase in the levels of total cholesterol and triglycerides in hypercholesterolemic mice when compared to normal group. Administration of aqueous extract of *indian costus* brought back the levels of serum lipids to near normal, these results showed a highly significant at (P) < 0.01, when we compared with control values (Table 2).

Table 2:-Effect of aqueous extract of *indian costus* on cholesterol level (mg/ dl) and triglycerides (mg/ dl) in normal and hypercholesterolemic mice

	control group	hypercholesterolemic	hypercholesterolemic + <i>indian costus</i>
Total cholesterol Level (mg/ dl)	177.28 ± 3.5	246.85 ± 13.7*	209.42 ± 5.7**
Triglycerides (mg/ dl)	94.0 ± 3.3	127.0 ± 6.6 **	98.85 ± 5.8**

Values are expressed as mean ± SEM., n = 7., *(P) < 0.05., ** (P) < 0.01

Effect of aqueous extract of *Indian Costus* on plasma enzymes AST, ALT and ALP levels (U/L) in normal and hypercholesterolemic mice:-

The activities of plasma enzymes AST, ALT and ALP significantly increased in hypercholesterolemic mice when compared to normal controls. Oral administration of aqueous extract of *indian costus* in hypercholesterolemic mice for 21 days significantly restored the enzyme levels to near normal (Table 3).

Table 3:-Effect of aqueous extract of *indian costus* on plasma enzymes AST, ALT and ALP levels (U/L) in normal and hypercholesterolemic mice.

	control group	hypercholesterolemic	hypercholesterolemic + <i>indian costus</i>
AST (U/L)	331.71 ± 6.2	424.71 ± 15.8 *	343.42 ± 10.1*
ALT (U/L)	81.14 ± 4.2	95.42 ± 4.0 *	88.42 ± 3.2*
ALP (U/L)	114.71 ± 2.7	145.28 ± 2.6 **	129.57 ± 2.8**

Values are expressed as mean ± SEM., n = 7., *(P) < 0.05.,** (P) < 0.01

Discussion:-

The aim of the present study was to evaluate the effect of aqueous extract of *indian costus* roots on lipid profile of hypercholesterolemic murine model. The results of the study showed that Induction of hypercholesterolemia with a diet is associated with the characteristic excess of body weight. Rise in the body weight of the untreated hypercholesterolemic mice could be because of the increasing in the total serum cholesterol. Mogill and Mott 1976 reported that the individuals with excess cholesterol in their blood are more possible to have more fatty deposits in their tissues. Oral administration of the aqueous extract of *indian costus* improved the body weight of hypercholesterolemic mice, this results suggest that the *indian costus* has antioxidant activity. Our results were in agreement with Eliza et al., (2009) and Nehete et al., (2010).

A diet-hypercholesterolemia causes an increase in the cholesterol level and triglycerides. High levels of total cholesterol and more importantly LDL-cholesterol in the blood are major coronary risk factors. The high concentration of serum lipids in the hypercholesterolemic mice is at most consequent to the increase in the mobilization of free fatty acids from the peripheral fat depots. The administration of the aqueous extract of *indian costus* decreased the levels of total cholesterol and triglycerides. The decrease in serum cholesterol level after administration of the aqueous extract of *indian costus* may be due to erasing of LDL-cholesterol from plasma by

increasing LDL-receptor activity (Lin et al., 2004). Colca (2006) reported that the increased of HDL levels after *costus.speciosus* ethanolic extract administration, might be due to the increase in the activity of lecithin cholesterol acyl transferase, which may contribute to the regulation of blood lipids. In addition, the reduced of the triglycerides in the blood might be due to the activity of lipoprotein lipase (LPL) which decrease of synthesis of triglycerides in the liver (Anderson 2003). Our results were in agreement with the result of Revathy et al., (2014) and the result of Bavarva et al., (2008).

Changes in the activities of plasma AST, ALT and ALP are the well known indicators of liver damage (Renugadevi and Prabu 2010; El-khishin and Amer 2010). Hepatic damage induced by adiet-hypercholesterolemia has been reported (Buysens, et al., 1996; Nanji et al., 1997). Previous studies confirmed that high cholesterol diet on rats and rabbits have demonstrated severe lipids accumulation in hepatic tissues (Buysens et al., 1996; Del Moral et al., 1997). In hypercholesterolemic rats excessive storage of lipids in the liver effects on liver functions and resulted liver damage (Mhamed et al., 2005; Yadav et al., 2009).

In our study, the significant increases in AST, ALT, and ALP levels by untreated hypercholesterolemic mice might be induced due to liver dysfunction. This results agree with studies were reported that high cholesterol diet resulted increase of liver enzyme levels (Nanji et al., 1997). On the other hand, treatment of the hypercholesterolemic mice with aqueous extract of *indian costus* caused reduction in the activity of these enzymes in plasma when compared to the normal control group which alleviated liver damage caused by diet- hypercholesterolemia. These results are in agreement with those obtained by Eliza et al., (2009) in rats. Results of present study indicate that the aqueous extract of *indian costus* could be used as a drug to bring about hypocholesterolemic effect.

Conclusion:-

In conclusion our study demonstrated that oral administration of *indian costus* extract for 3 weeks may be had ameliorating effects on the hyperlipidemia. The total cholesterol, triglycerides and some biochemical variables were reversed by treatment with this plant extracts.

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