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RESEARCH PAPER

A study on dislipidemic and hyper glycemic activities of Aloe vera

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Abstract : Aloe, a popular plant, has a long history as a versatile folk remedy. The plant can be alienated mainly into two products: gel and latex. Aloe vera gel is the leaf pulp or mucilage, aloe latex, commonly referred to as "aloe juice," is a bitter yellow exudate from the pericyclic tubules just underneath the external skin of the leaves. Extracts of aloe gum efficiently improves glucose tolerance in diabetic rats as well as in normal rats. Treatment of long term however not solitary dose of exudates of Aloe barbadensis leaves impart hypoglycemia in alloxanized diabetic rats. Solitary as well as long term doses of acrimonious component of the same plant also displayed hypoglycemic effect in diabetic rats. This response of Aloe vera and its acrimonious component is by the stimulus of synthesis and/or release of insulin from pancreatic beta cells. Aloe vera also have got the anti-inflammatory potential in a dose reliant way and relieves wound in diabetic mice by healing activity. The current article highlights the biological activities of Aloe Vera.

Key Words : Aloe, Medicinal, Plants, Diabetes

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INTRODUCTION

Medicinal plants are being considered yet again for the cure of diabetes. Many usual drugs have been consequential from prototypic molecules in medicinal plants. Metformin illustrates a worthwhile oral glucose-lowering drug. The development Metformin was rooted upon the use of a plant *Galega officinalis* for treating diabetes. The hypoglycemic component guanidine is richly present in *Galega officinalis*. Since guanidine is highly toxic in terms of its clinical use, the alkyl *biguanides synthalin* A and synthalin B were familiarized as oral anti-diabetic agents in Europe in the 1920s but after the easy and widespread availability of insulin these compounds were discontinued. Nevertheless, experience with guanidine and biguanides encouraged the advent of metformin.

Presently, about 400 traditional plant treatments have been reported for diabetes, however, only a few number of these plant treatments have gained scientific and medical evaluation to measure their effectiveness. The hypoglycemia due to some herbal extracts has been confirmed for type 2 diabetes in human and animal models. The World Health Organization Expert Committee on diabetes has recommended investigation of traditional medicinal herbs useful in treatment of

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diabetic conditions (Dixit *et al.*, 2006).

Hydroalcoholic extracts of this plant displayed anti-hyperglycemic responses in rats treated with streptozotocin and this response is due to elevation in glucose uptake and deposition of glycogen in isolated rat hemidiaphragm (Chattopadhyay *et al.*, 1987). Besides anti-diabetic property, Aloe vera is said to have has anti-bacterial, antimalarial, hepatoprotective, antioxidant effects and antifertility. Another plant *Caesalpinia bonducella* is a plant used by tribal people of India ethnically in order to control blood sugar. This plant is broadly disseminated covering the coastal region of India. Both the aqueous and ethanolic extracts of *Caesalpinia bonducella* also displayed persuasive hypoglycemic activity in chronic type II diabetic models. These extracts also elevate glycogenesis thereby improves liver glycogen content (Chakrabarti *et al.*, 2003).

Diabetes is a persistent ailment of carbohydrate, fats and protein metabolisms described by higher levels of fasting and post prandial blood sugar. The worldwide prevalence of diabetes is predictable to rise, from 4% in 1995 to 5.4% by the year 2025. WHO has expected that developing countries would be under this pressure certainly. Studies conducted from the last decade in India have emphasized that despite of the high prevalence of diabetes, it has been rapidly increasing in the urban population (Ramachandran *et al.*, 2002). It is assessed from India that there are roughly 33 million adults have got the diabetes which is likely to upsurge upto 57.2 million by the year 2025.

Though pathophysiology of diabetes stays to be completely understood, experimental evidences endorse the involvement of free radicals withinside the pathogenesis of diabetes and more prominently in the progression of diabetic impediments (Lipinski *et al.*, 2001). Free radicals are proficient of injuring cellular molecules, DNA, proteins and lipids consequently cellular functions gets altered. Many current research screen that antioxidants able to neutralizing free radicals are effective in stopping experimentally induced diabetes in animal models as well as dropping the severity of diabetic complications (Oberlay *et al*., 1988). For the progression of diabetic complications, the anomalies fashioned in lipids and proteins are the foremost etiologic factors.

The present study investigated the antidiabetic effect and dislipidemic activity of A. vera extract.

MATERIAL AND METHODS

Material :

Wistar rats (150-180 g) were taken as experimental animals and were group (n=6). The animals were provided with controlled conditions of standard 12 hours light/dark phase and temperature and humidity (25±2°C, 55–65%). Rats were also provided with standard rodent chow and water ad libitum.

Rats were subjected to acclimatization in laboratory environments for 7 days of interval before the start of actual experiments. All the experimental work was were done in a noise-free room between 08.00 to 15.00 hours. For each set of experiments separate group (n=6) of rats were used.

The approval for animal studies was taken from the Institutional Animal Ethics Committee (IAEC/CPCSEA/2020), established for the purpose of control and supervision of experimental animals by Ministry of Environment and Forests, Government of India, New Delhi, India.

Materials used in animal studies :

Chemicals: Normal saline and other graded chemicals. Biochemical kits for the estimation of glucose (GOD-POD), total triglycerides (GPO-POD), total cholesterol (CHOD-POD), high density lipoprotein (PEG), and total protein (Biuret) were purchased from Crest Biosystems Kits (India) and other chemicals and solvent were procured from Qualigens, India were used.

Induction of obesity :

After the period of acclimatization, random division of animals into five groups (n=6) was done: one normal control group, one HFD control and remaining III–V as treatment groups. Animals in normal control group were fed with normal diet while the other groups were fed with high fat diet (HFD) ad libitum, throughout the experiment.

Statistical analysis :

In view of the objectives of present investigation the outcomes of all the experiments must be evaluated statistically. Thus, variables of interest from all the experimental data were analyzed using Graph Pad Instant software version 14 for windows XP (Microsoft Corporation). All statistical analysis was expressed as mean ± standard error of the mean (SEM). Data were analyzed by one way ANOVA, where applicable *p.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

This paper contains the result of the experiments dealing with outcomes on biological activity of Aloe vera extract prepared by dosing to Wistar Rat Models for evaluation of dislipidemic and hyper glycemic conditions considering the effect of Aloe vera on obesity.In present experimental design, the reducing power of phytochemical extract of Aloe vera for the level of dyslipidemia and glucose in experimental animal model was evaluated on the basis of biochemical parameters of blood.

High fat diet-induced obesity :

As represented in Table 1 and Fig. 1, body weights of animals in all groups were performed at the initial and end of the study. Body weight of animals was significantly maintained in all treatment groups Orlistat (50 mg/kg p.o.), Extract of Aloe vera (100 and 200 mg/kg/p.o.) (174.81±7.94; 194.27±4.25 and 183.56±4.17) during study as compared to control group (270.31±6.42).

As shown in Table 1 and Fig. 1, Blood glucose level of animals in all groups was recorded at 30th days. Progressive decrease in blood glucose level was found in all treatment groups during study. At the end of experiment Orlistat 50 mg/kg p.o., extract of Aloe vera (100 and 200 mg/kg/p.o) (118.79±3.85; 146.24±4.1 and 124.68±4.47) treated group blood glucose level was decrease significantly ($p<0.05$).

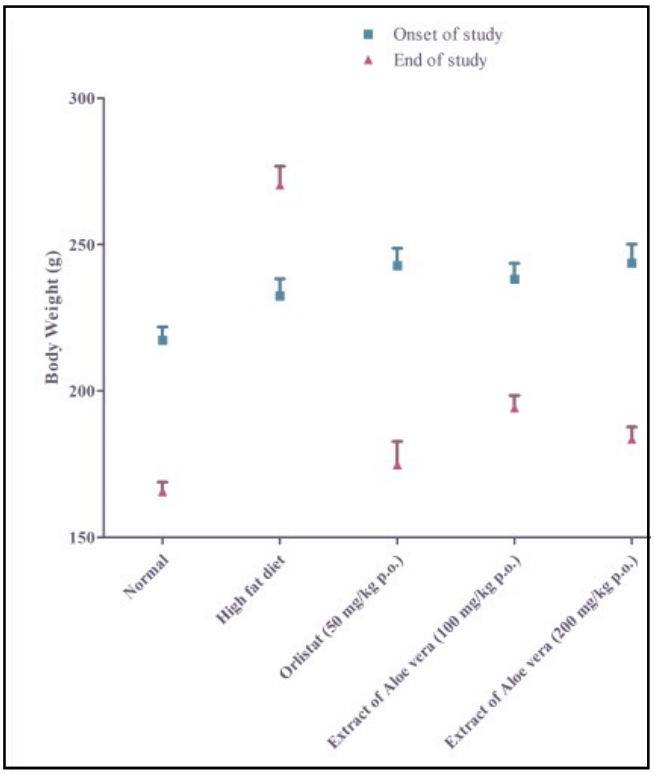

Fig. 1: Mean body weight change

Extract of Aloe vera 100 and 200 mg/kg/p.o (143.76±3.26; 122.19±3.14) treated group total

Table 1 : Mean body weight change

Group	Drug	On set of study (Body wt. in g)	End of study (Body wt. in g)
I	Normal	217.34±4.6	165.67±3.19
II	High fat diet	232.49±5.8	270.31±6.42
III	Orlistat (50 mg/kg p.o.)	242.8±5.95	174.81±7.94***
IV	Extract of Aloe vera (100 mg/kg p.o.)	238.22±5.41 1	194.27±4.25*
V	Extract of Aloe vera (200 mg/kg p.o.)	243.71±6.48	183.56±4.17**

Values are expressed as mean ± S.E.M. (n = 6).Values are statistically significant at $p<0.05$ vs. control group, respectively
(One-way ANOVA followed by Dunnett's test)

Table 2: Antidiabetic activity of extract of Aloe vera on blood glucose level in HFD-induced rats

Group	Drug	Day 0 (Blood Glucose mg/dl)	Day 15 (Blood Glucose mg/dl)	Day 30 (Blood Glucose mg/dl)
I	Normal	89.42±2.14	93.52±3.1	110.52±3.76
II	High fat diet	294±3.5#	398.46±4.31#	401.92±5.95
III	Orlistat (50 mg/kg p.o.)	249.21±3.8	138±3.62**	118.79±3.85**
IV	Extract of Aloe vera (100 mg/kg p.o.)	265.98±4.1	161.73±3.7*	146.24±4.1*
V	Extract of Aloe vera (200 mg/kg p.o.)	253.7±2.7	150.23±3.14*	124.68±4.47**

Values are expressed as mean ± S.E.M. (n = 6).Values are statistically significant at $p<0.05$ vs. negative control group, respectively
(One-way ANOVA followed by Dunnett's test)

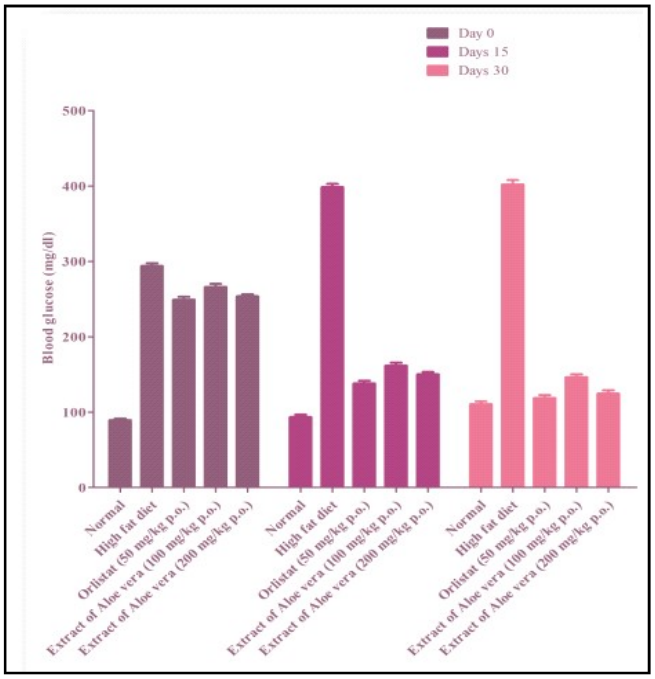

Fig. 2: Antidiabetic activity of extract of Aloe vera on blood glucose level in HFDinduced rats

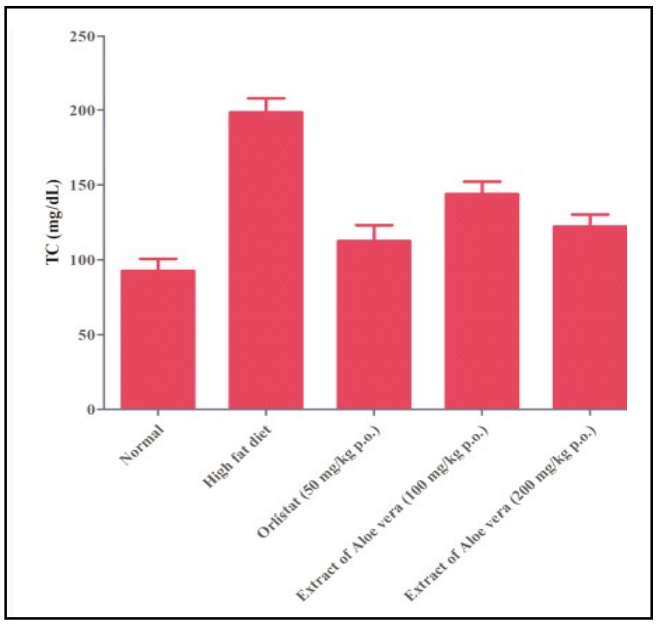

Fig. 3: Effect of extract of Aloe vera on total cholesterol level in HFD-induced diabetic rats

cholesterol also decreased significantly ($p< 0.05$). In 50 mg/kg Orlistat (112.36±4.14) treated group total cholesterol decreased significantly ($p< 0.05$), respectively as compared with control group (198.41±3.67), as shown in Table 2 and Fig. 3.

Extract of Aloe vera (100 and 200 mg/kg/p.o.) (106.37±4.51 and 94.16±3.65) treated group triglyceride also decreased significantly ($p<0.05$). In 50 mg/kg Orlistat (90.29±4.17) treated group triglyceride decreased significantly ($p<0.05$).

As shown in Table 5 and Fig. 5, in extract of Aloe vera 100 and 200 mg/kg/p.o (95.27±2.42; 65.63±2.67) treated group LDL also decreased significantly ($p<0.01$). In 50 mg/kg p.o.Orlistat (57.25±2.51) and treated group LDL was significantly decreased ($p<0.001$), respectively as compared with control group (167.41±2.5).

As shown in Table 6 and Fig. 6, in extract of Aloe vera (100 and 200 mg/kg/p.o.) (45.61±2.38 and

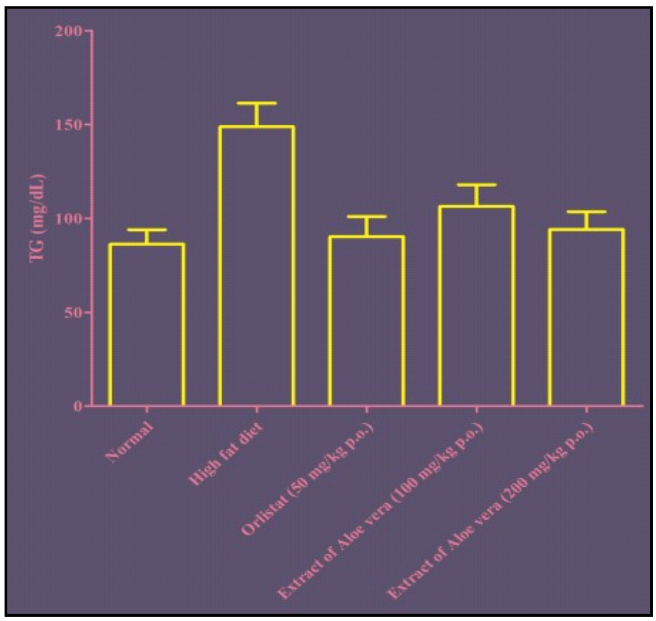

Fig. 4: Effect of extract of Aloe vera on triglyceride level in HFD-induced diabetic rats

Table 3: Effect of extract of Aloe vera on total cholesterol level in HFD-induced diabetic rats

Group	Drug	Total cholesterol (mg/dl)
I	Normal	92.41±3.18
II	High fat diet	198.41±3.67
III	Orlistat (50 mg/kg p.o.)	112.36±4.14***
IV	Extract of Aloe vera (100 mg/kg p.o.)	143.76±3.26**
V	Extract of Aloe vera (200 mg/kg p.o.)	122.19±3.14***

Values are expressed as mean ± S.E.M. (n = 6).Values are statistically significant at $p<0.05$ (One-way ANOVA followed by Dunnett's test)

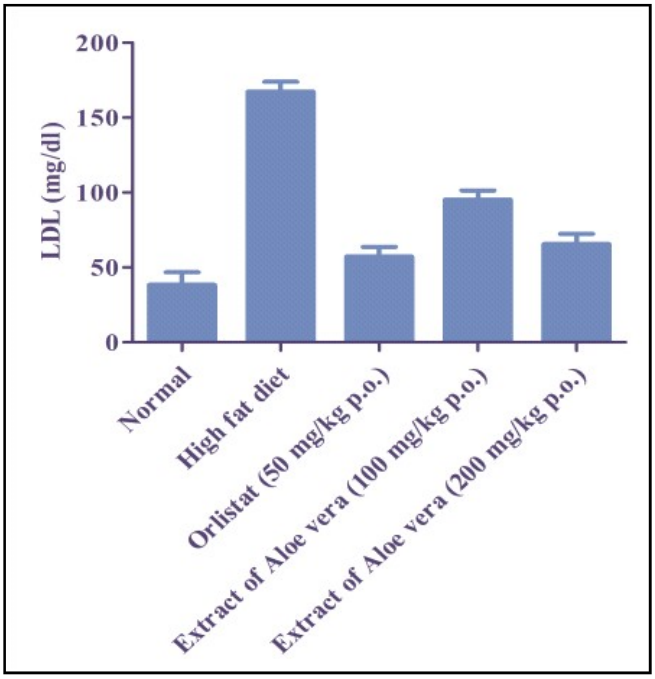

Fig. 5 : Effect of extract of Aloe vera on LDL in HFD-induced diabetic rats

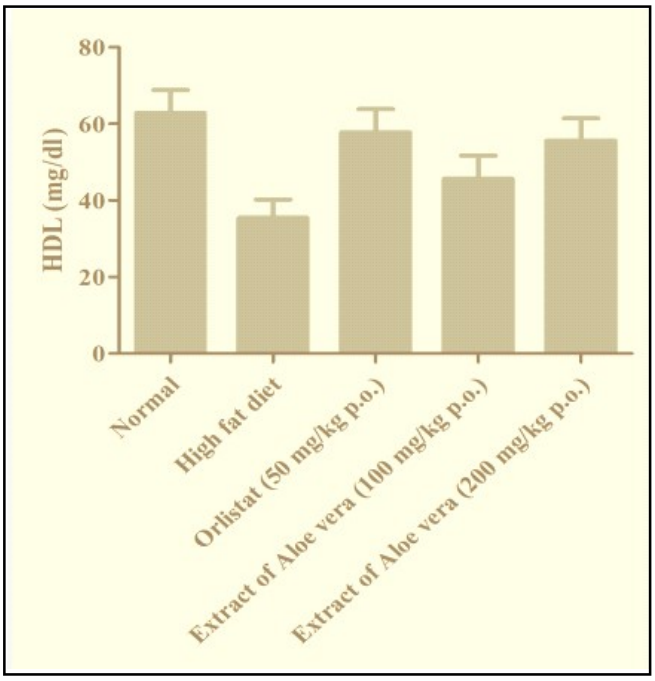

Fig. 6 : Effect of extract of Aloe vera on HDL in HFD-induced diabetic rats

Table 4: Effect of extract of Aloe vera on triglyceride level in HFD-induced diabetic rats

Group	Drug	Triglyceride (mg/dl)
I	Normal	86.34±2.98
II	High fat diet	148.82±4.87
III	Orlistat (50 mg/kg p.o.)	90.29±4.17**
IV	Extract of Aloe vera (100 mg/kg p.o.)	106.37±4.51*
V	Extract of Aloe vera (200 mg/kg p.o.)	94.16±3.65**

Values are expressed as mean ± S.E.M. (n = 6).Values are statistically significant at $p<0.05$ (One-way ANOVA followed by Dunnett's test)

Table 5: Effect of extract of Aloe vera on LDL in HFD-induced diabetic rats

Group	Drug	LDL (mg/dl)
I	Normal	38.41±3.24
II	High fat diet	167.41±2.5
III	Orlistat (50 mg/kg p.o.)	57.25±2.51***
IV	Extract of Aloe vera (100 mg/kg p.o.)	95.27±2.42*
V	Extract of Aloe vera (200 mg/kg p.o.)	65.63±2.67**

Values are expressed as mean ± S.E.M. (n = 6).Values are statistically significant at $p<0.05$ (One-way ANOVA followed by Dunnett's test).

Table 6: Effect of extract of Aloe vera on HDL in HFD-induced diabetic rats

Group	Drug	HDL (mg/dl)
I	Normal	62.84±2.34
II	High fat diet	35.44±1.86
III	Orlistat (50 mg/kg p.o.)	57.75±2.37***
IV	Extract of Aloe vera (100 mg/kg p.o.)	45.61±2.38*
V	Extract of Aloe vera (200 mg/kg p.o.)	55.64±2.26**

Values are expressed as mean ± S.E.M. (n = 6).Values are statistically significant at $p<0.05$ (One-way ANOVA followed by Dunnett's test)

55.64±2.26) treated group HDL also increased significantly ($p< 0.001$). In 5 mg/kg p.o. Orlistat (57.75±2.37) treated group HDL increased significantly ($p<0.001$), respectively as compared with control group (35.44±1.86).

In terms of present study undertaken, the body weights of animals in all groups were performed at the initial and end of the study. Body weight of animals was significantly ($p<0.05$) maintained in all treatment groups Orlistat (50 mg/kg p.o.), Extract of Aloe vera (100 and 200 mg/kg/p.o.) (174.81±7.94; 194.27±4.25 and 183.56±4.17) during study as compared to control group (270.31±6.42).

Blood glucose level of animals in all groups was recorded at 30th days. Progressive decrease in blood glucose level was found in all treatment groups during study. At the end of experiment Orlistat 50 mg/kg p.o., extract of Aloe vera (100 and 200 mg/kg/p.o) (118.79±3.85; 146.24±4.1 and 124.68±4.47) treated group blood glucose level was decrease significantly ($p<0.05$).

The hypoglycemic effects of Aloe vera have been investigated by various researchers (Chempakam *et al.*, 1993 and Yoshikawa *et al.*, 1996). Ethanolic extracts of Aloe vera administered to Wistar albino rats with shoot up levels of blood glucose resulted in a noteworthy shrinkage in the level of plasma glucose of the rats (Pari, *et al.*, 2004). Moreover, when Aloe arborescens from the Aloe genus was administered to mice in a powdered form, increases in the blood sugar levels of mice that received a basal diet were significantly suppressed compared with those of the control group (Satheesh *et al.*, 2004) In this study, we investigated the antidiabetic and antioxidant effects of different Aloe vera extracts in streptozotocin (STZ)-induced type 2 diabetic model rats.

Extract of Aloe vera 100 and 200 mg/kg/p.o (143.76±3.26; 122.19±3.14) treated group total cholesterol also decreased significantly ($p < 0.05$). In 50 mg/kg Orlistat (112.36±4.14) treated group total cholesterol decreased significantly ($p< 0.05$), respectively as compared with control group (198.41±3.67). There is a significant correlation between fasting blood glucose with cholesterol, triglycerides, LDL and HDL, which suggested an association between glycemic status and dyslipidaemia in DM type 2 sufferers. Aloe vera gel contains glucomannan, water-soluble fibre which has the effect of decreasing glucose.

Low HDL level is associated with increased risk of cardio-vascular disease in person both with and without diabetes. Treatments with Aloe vera extract for 15 days significantly decrease the atherogenic index in diabetic rats which indicates potential antihilperididemia.

Extract of Aloe vera (100 and 200 mg/kg/p.o.) (106.37±4.51 and 94.16±3.65) treated group triglyceride also decreased significantly ($p < 0.05$).

In 50 mg/kg Orlistat (90.29±4.17) treated group triglyceride decreased significantly ($p<0.05$), respectively as compared with control group (148.82±4.87),at the same time Extract of Aloe vera 100 and 200 mg/kg/p.o (95.27±2.42; 65.63±2.67) treated group LDL also decreased significantly ($p<0.01$).

In 50 mg/kg p.o.Orlistat (57.25±2.51) and treated group LDL was significantly decreased ($p<0.001$), respectively as compared with control group (167.41± 2.5) extract of Aloe vera (100 and 200 mg/kg/p.o.) (45.61±2.38 and 55.64±2.26) treated group HDL also increased significantly ($p < 0.001$).

In 5 mg/kg p.o. Orlistat (57.75±2.37) treated group HDL increased significantly ($p<0.001$)), respectively as compared with control group (35.44±1.86).

Conclusion:

During experiments, the animals were divided into six groups of six animals: Group I: Normal rats fed with normal diet throughout the course of study. Group II: Obese control rats fed with HFD for 30 days. Group III: Obese rats given orlistat suspension prepared with saline 50mg/kg, p.o. for 30 days. Groups IV: Obese rats given extract of Extract of Aloe vera (100 mg/kg p.o.). for 30 days. Groups V: Obese rats given extract of Extract of Aloe vera (200 mg/kg p.o.) for 30 days. The grouping and dosing of used animal models in this ways resulted into clear and understandable analytical parameters which were easily elicited statistically.

For blood glucose determination, blood was withdrawn by tail snipping technique. For various lipid profile and biochemical parameters estimation, blood was collected from ophthalmic venous plexus by retro-orbital bleeding technique. Body weight of animals was significantly ($p<0.05$) maintained in all treatment groups. Progressive decrease in blood glucose level was found in all treatment groups during study.

Triglyceride and LDL values decreased significantly ($p<0.01$). Triglyceride and LDL values decreased significantly ($p<0.001$). Maximum activity was observed at dose of 1000 mg/kg. Thus, it can be considered as an

effective treatment in management of obesity owing to its potential anti-obesity effect.

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