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EVALUATION OF THE AQUEOUS EXTRACT OF CYPERUS ROTUNDUS FOR ITS ANTI OBESITY ACTIVITY IN OBESE WISTAR RATS

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ABSTRACT

Background: Obesity-associated with Cardio vascular properties is rapidly increasing throughout the world. It is generally recognized that natural products with a long history of safety can modulate obesity. **Aim:** To investigate the development of obesity in response to an atherogenic diet and to estimate the effect of *Cyperus rotundus* linn, on serum lipid profiles in wistar rats. **Method:** Experimental study was carried out using adult Male Wistar rats weighing between 150-170g. Obesity was induced by fed with an atherogenic diet for over a period of 40 days. Animals were divided into 5 groups, 6 rats in each group. The aqueous extract of *Cyperus rotundus* was administered orally in a dose of 50mg/kg, *p.o.* (High dose), 30mg/kg, *p.o.* (Low dose) was administered daily for a treated group over a period of 40 days. Lipid profile was analyzed. **Results:** Data showed that feeding with an atherogenic diet significantly increased triglycerides (TG), total cholesterol, & LDL concentration compared with controls, while significantly decreasing HDL; meanwhile treatment with *Cyperus rotundus* significantly normalized the lipid profile. LDH was significantly higher in an atherogenic diet group compared with normal controls; and administration of *Cyperus rotundus* significantly lessened the effect. **Conclusion:** Treatment with *Cyperus rotundus* extract improved obesity and its associated metabolic problems in different degrees. Moreover *Cyperus rotundus* linn might be a safe drug on the organs whose functions were examined, as a way to surmount the obesity state; and it has a distinct anti-obesity effect.

INTRODUCTION

Obesity is a global problem and it is a chronic, relapsing, stigmatized neuro-chemical disease. Frequency of overweight and obesity has found to be more among urban female then in rural female counterpart, another similar study reported that the prevalence of overweight was high amount urban southern Indian children. [1] In obesity, multiple factors involved that contribute to the development of obesity these may be social, behavioral, environmental, genetics these interaction with each other regulate the body weight, imbalance in either of the factor may be responsible for weight gain. A recent survey, carried out by World health organization, indicates that coronary heart disease alone accounts for more than half of the total mortalities associated with cardiovascular diseases. To reduce the rate of mortality, it is therapeutically recommended to undergo diet or/and drug therapy to lower lipid levels within the normal range. [2] Therapy of hyperlipidemia merits the consideration in the established atherosclerotic state. Allopathic hyperlipidemia drugs are available at large in the market but the side effects and contraindications of these drugs have

blemished their popularity. [3]The herbal hypolipidemics have gained importance to fill the lacunae created by the allopathic drugs. It is also known fact that adulthood obesity depicts many co-morbid conditions such as hypertension, diabetes, and hyperlipidemia. In the traditional system, *Cyperus rotundus* was used both in its fresh and dry form. The plant *Cyperus rotundus* Linn has great medicinal value. With growing interest in herbal therapy for obesity, we have to find the new herbal drug which can be used for obesity with more efficacy and fewer side effects. [4]The main objective of this study is to evaluate the aqueous extract of *Cyperus rotundus* for its anti obesity activity in obese Wistar rats.

MATERIALS AND METHODS

Plant extract:-The aqueous extract of *Cyperus rotundus* was obtained from Pukhraj Herbals, Madhya Pradesh.

Chemicals: Cholesterol (S D fine-chem limited), Cholic acid (LOBA CHEMIE) and Lard oil

Enzyme Diagnostic Kits: Cholesterol, Triglyceride and HDL were procured from Preicugent, Maharashtra.

Dose Selection: In the present study, two doses of the aqueous extracts of *Cyperus rotundus Linn.*, were selected one being the higher dose (50mg /kg body wt) the other being the lower dose(30mg /kg body wt). The doses of extracts were administered by per oral route in morning throughout the study period.

Experimental Design:

Atherogenic diet induced obesity: Experimental study was carried out using adult Male Wistar rats weighing between 150-170g. The approval of Institutional Animal Ethics Committee was taken prior to the commencement of the study. Animals were divided into 5 groups each group consisting of 6 animals.

Group 1: Control (fed with normal pellets chows)

Group 2: Extract (plant extract (50mg/kg b.w.*p.o.*) with normal pellets)

Group 3: Atherogenic diet

Group 4: Atherogenic diet + extract (High dose 50mg/kg b.w.*p.o.*)

Group 5: Atherogenic diet + extract (Low dose 30mg/kg b.w.*p.o.*)

Composition of the atherogenic diet: 1% Cholesterol (SD fine-chem limited), 0.5% Cholic acid (LOBA CHEMIE) and 5% lard oil. These diets were provided in addition to normal pellet chow

Treatment Protocol: Induction of obesity in the experimental animals was carried out by feeding the animals with the atherogenic diet. The Aqueous extract of *Cyperus rotundus* was administered orally in a dose of 50mg/kg, *p.o.* (High dose), 30mg/kg, *p.o*. (Low dose) daily for the entire study period. 24hrs before the sacrifice of the study animals, they were kept on fast but they had access to water. The blood samples were collected in eppendroffs tubes by puncturing the retro orbital plexus for biochemical estimation.

Body weight: The body weight (gm.) was recorded on day 1 and then on alternate days during the study period using an electronic balance.

Organ and fat pad weights: The animals were sacrificed by cervical dislocation and then different organs (kidney, liver, heart, and spleen) and fat pads (mesenteric, left and right perirenal and uterine fat pads) were removed and weighed.

Biochemical parameters: Bio chemical parameters were analyzed by using auto biochemistry analyzer manufactured by Robonik Pvt.Ltd, Mumbai.

Estimation of serum cholesterol: Cholesterol esters in serum are hydrolyzed by cholesterol esterase (CHE). The cholesterol produced is oxidized by cholesterol oxidase (CO) to form cholest-4-en-3-one with simultaneous production of hydrogen peroxide (H_2O_2) which oxidatively couples with 4 aminoantipyrine and phenol in the presence of peroxidase (POD) to yield a red chromphore. The red quinoneimine

dye formed is measured spectrophotometrically at 505nm as an increase in absorbance.

Estimation of serum triglyceride: Triglycerides in the sample are hydrolyzed by lipoprotein lipases (LPL) to give glycerol and fatty acids. The glycerol is phosphorylated by adenosine triphosphate (ATP) in the presence of glycerol kinase (GK) to produce glycerol-3-phosphate. The glycerol -3- phosphate is oxidized by molecular oxygen in the presence of glycerol phosphate oxidase (GPO) to produce hydrogen peroxide (H_2O_2) and dihydroxyacetone phosphate. The H_2O_2 is used oxidatively to couple 4- chlorophenol and 4-aminoantipyine (4 AAP) catalyzed by peroxidase (POD) to form a pink coloured complex. The increase in absorbance at 505nm is proportional to the triglycerides content in the sample.

Estimation of HDL-cholesterol: Dispense 0.5 ml sample in to tubes labelled control, samples, etc. Add 0.5 ml of HDL reagent. Mix well and allow standing at ambient temperature for 10 minutes. Centrifuge at 2000 rpm for 20 minutes or 4000 rpm for 10 minutes. Make certain that supernatant is clear before using in cholesterol assay. If the supernatant is cloudy, dilute the specimen 1:2 with distilled water and repeat the separation. Multiply assay result by 2 to get final answer.

Estimation of LDL: Serum LDL-C was estimated using Frieldwann's equation

$$\text{LDL-c} = \left[\text{TC} - \left(\text{HDL-c} + \left(\frac{\text{TG}}{5}\right)\right)\right]$$

Statistical analysis was performed using the Graph pad prism 5, Graph pad software. One-way ANOVA followed by Dunnett's test was performed.

DISCUSSION

In the present study, the anti obesity activity of aqueous extracts of *Cyperus rotundus* was studied using atherogenic diet fed animal model of obesity as they have been reported to bear close resemblance to human obesity. Atherogenic diets have been previously reported to increase energy intake and cause obesity in humans as well as animals. Further, the composition and variety of atherogenic diet also exert synergistic effects on the development of obesity. [5, 6]Accumulating evidence suggests that metabolic syndrome like obesity and the individual components of the metabolic syndrome such as increased triglycerides, and reduced high-density lipoprotein cholesterol are heightened risk factors for cardiovascular properties. [7,8] The very fact is appreciated in the present study, because of the fact that the experimental animal consumed considerable more food that is the atherogenic diet than the control group animals throughout the experiment. In the current study, rats fed atherogenic diet consumed considerably more food than the control rats throughout the experiment. So their caloric intake was increased and they showed a large increase in perirenal, visceral and adipose tissue mass (Table-3), suggesting that the excess energy led to the buildup of adiposity. [9, 10] It is well known that, obesity is associated with increased adipose tissue accumulation in the body. It is reported that feeding with an atherogenic diet in wistar rats leads to increase in weight of body organs such as liver, heart, spleen and both kidneys. [11, 12] It is also reported that atherogenic diet induces substantial increase in deposition of fat in the mesenteric, perirenal and uterine region in wistar rats. The above facts can be verified by the data provided in table-3., experimental animals fed with atherogenic diet showed increase in the weight of the organs namely liver, heart, spleen and kidneys and also a significant increase in the weight of the mesenteric, perirenal and uterine fat pads. The study also showed that aqueous extract of *Cyperus rotundus* tubers at the dose levels studied, significantly exerts effect on weight gain of the organs viz. liver, heart, spleen and kidneys and greatly influenced the fat deposition process in the fat pads and infact significantly reduced the fat accumulation in mesenteric, perirenal and uterine fatty tissues. This fact again establishes that the aqueous extracts of *Cyperus rotundus* tubers have a definite influence in body fat metabolism.

RESULTS

Body Weight

Table-1: Effect of aqueous extract of *Cyperus rotundus* on body weight

Groups	Control	Atherogenic diet (AD)	CR Extract (50mg/kg)	AD+CR (50mg/kg)	AD+CR (30mg/kg)
% Increased in Body weight	36.487±0.540	85.220±9.297a***	29.000±5.8$_{64}$a ns	45.533±0.481b***	54.493±1.47$_{1}$b**

a=compared with vehicle control. b=compared with Atherogenic diet. CR=Cyperus rotundus

Organ Weight

Table-2: Effect of aqueous extract of Cyperus rotundus on Organ weight

Groups	Organ Weights				
	Spleen (g) Mean ± SEM	Heart (g) Mean ± SEM	Liver (g) Mean ± SEM	Right kidney(g) Mean ± SEM	Left Kidney(g) Mean ± SEM
Control	0.850±0.006	0.857±0.09	5.740±0.006	0.673±0.009	0.650±0.006
Atherogenic diet (AD)	0.923±0.01$_{8}$a*	0.867±0.00$_{9}$ a ns	6.460±0.040a*	0.717±0.020 ^{a} ns	0.673±0.02$_{3}$ a ns
CR Extract (50mg/kg)	0.710±0.01$_{2}$ a***	0.683±0.01$_{8}$ a***	4.660±0.283a***	0.630±0.006 ^{a} ns	0.630±0.01$_{2}$ a ns
AD + CR (50mg/kg)	0.863±0.03$_{2}$b*	0.807±0.00$_{9}$b*	5.467±0.060b**	0.607±0.009^{b} ***	0.600±0.01$_{5}$b*
AD + CR (30mg/kg)	0.907±0.00$_{9}$b ns	0.840±0.01$_{2}$b ns	6.043±0.033b ns	0.697±0.007^{b} ns	0.680±0.00$_{6}$b ns

a=compared with vehicle control. b=compared with Atherogenic diet. CR=Cyperus rotundus

Table-3: Effect of aqueous extract of *Cyperus rotundus* on Fat pad weight

Groups	Fat pad weights (g)		
	Perirenal(g) Mean ± SEM	Mesenteric(g) Mean ± SEM	Uterine(g) Mean ± SEM
Control	1.167±0.042	0.323±0.018	0.750±0.012
Atherogenic diet (AD)	1.227±0.049$^{a\ ns}$	1.497±0.173^{a***}	1.360±0.090^{a***}
CR Extract (50mg/kg)	0.763±0.054 $^{a\ ***}$	0.303±0.012$^{a\ ns}$	0.523±0.024 ^{a*}
AD + CR (50mg/kg)	1.007±0.027^{b*}	0.843±0.038^{b***}	1.107±0.038^{b*}
AD + CR (30mg/kg)	1.077±0.020$^{b\ ns}$	1.093±0.041^{b*}	1.263±0.072$^{b\ ns}$

a=compared with vehicle control. b=compared with Atherogenic diet. CR=Cyperus rotundus

Table-4: Effect of aqueous extract of *Cyperus rotundus* on biochemical estimations

Groups	Mean ± SEM			
	Total Cholesterol (mg/dl)	**Triglycerides (mg/dl)**	**HDL-C (mg/dl)**	**LDL-C (mg/dl)**
Control	79.30±3.09	75.373±0.609	44.917±0.795	19.343±0.056
Atherogenic diet (AD)	166.67±2.88a***	160.67±2.963 a***	39.567±1.658a*	94.567±0.560a***
CR Extract (50mg/kg)	79.217±2.32a ns	77.157±1.248 a ns	43.453±0.522 a ns	20.667±0.239a ns
AD + CR (50mg/kg)	111.653±5.67b***	150.210±2.919 b*	46.650±1.137b**	34.457±0.601b***
AD + CR (30mg/kg)	141.75±5.69b**	155.840±0.380b ns	40.083±1.228b ns	70.670±0.271b*****

a=compared with vehicle control. b=compared with Atherogenic diet. CR=Cyperus rotundus

Epidemiological investigation revealed a positive correlation between the severe degree of atherosclerosis and the concentration of plasma cholesterol as well as LDL. [14-16] In the present study, an atherogenic diet resulted in dyslipidemic changes as illustrated by increasing triglycerides, total cholesterol and low density lipoprotein (LDL) and a decrease in serum level of high density lipoprotein (HDL) in the present investigation .The study suggests that the aqueous extract of tubers of *Cyperus rotundus* shifts the disturbed lipid profile to the normal.

CONCLUSION

Thus the investigation undertaken to study the effect of aqueous extracts of *Cyperus rotundus* tubers were very effective in countering the atherogenic fed obesity The results also indicate aqueous extracts of *Cyperus rotundus* tubers affect the total lipid metabolism and favours the correction of disturbed lipid profile. Further studies are needed to explore the underlying mechanisms.

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