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Research Article

EFFECT OF CARALLUMA FIMBRIATA EXTRACT ON APPETITE, BODY WEIGHT &LIPID PROFILE IN CAFETERIA DIET- INDUCED OBESITY IN RATS

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ABSTRACT

Objectives: To study the effect of *Caralluma fimbriata* extract (CFE) on appetite, body weight & lipid profile in cafeteria diet –induced obesity in rats.

Methods: Wistar rats were randomly divided into three groups (n=30 each); i) Control, ii) Obese and iii) Obese + CFE. Obesity was induced by cafeteria diet (CD). CFE was administered at 100 mg/kg/day p.o. for 50 days. Food intake, animal's bodyweight, blood glucose, serum lipid levels were measured –at baseline, every 10 days and at term. Liver Function Tests & Renal Function Tests were measured at baseline and at term.

Results: Treatment with CFE at a dose of 100 mg/kg/day significantly (P <0.05) reduced the increase in body weight and lipid profile levels as compared to the untreated obese group.

Conclusions: *Caralluma fimbriata* extract reduced gain in body weight and alterations in lipid profile caused by Cafeteria Diet. Hence, this agent may be useful in treatment of obesity.

Keywords: Cafeteria diet (CD), Appetite, *Caralluma fimbriata* extract (CFE), Lipid profile.

INTRODUCTION

Obesityis associated with various diseases, including cardiovascular diseases, type II diabetes, stroke, certain types of cancer, and osteoarthritis[1]. Losing even 5 to 10 percent of body weight can delay or prevent some of these diseases. However, there is scarcity of effective drugs for treatment of obesity in modern medicine. In traditional medicine various herbal extracts have been found useful in management of obesity; but they have not been evaluated scientifically.

Obesity may be induced in experimental animals by variety of methods, eg; neuroendocrine, dietary or genetic changes[2].They enable us to obtain answers in a short duration of time. *Caralluma fimbriata* extract (CFE) of the whole plant is claimed to be useful in the treatment of obesity. Hence, we decided to study its anti-obesity action in diet induced obesity in rats.

MATERIALS & METHODS

Animals (Wistar rats)were obtained from the Central Animal House, BLDEU's Sri BM Patil Medical College Hospital & Research Center, Bijapur, India, were used in the study. They were housed in quarantine room individually in polypropylenecages for one week of acclimation before the experiment started. The study was approved by the Institutional Animal Ethics Committee(IAEC).

The *Caralluma fimbriata* extract (30% dry extract) was donated by Digvijay Pharmaceuticals (I) Ltd, Thane (W), Maharashtra, India.

(i) Hypercalorie/Cafeteria diet[3,4]

It consisted of 3 variants; i) condensed milk + bread + peanuts + pellet chow (4:1:4:1), ii) chocolate + biscuits + dried coconut + pellet chow (3:2:4:1), and iii) cheese + boiled potatoes + pellet chow (4:2:1). The different variants were fed on alternate days throughout the treatment period.

(ii) Experimental Design

A total of 90 animals were included in the study. Among these 30 rats weighing 180-240g either sex used as i) control group. The remaining 60 rats were fed cafeteria diet to induce obesity (diet induced obesity) from the time of weaning and included in the study at the age of 19 weeks[5] and were randomly divided into ii) Obese and iii) Obese +CFE treated groups (n=30 each).

Rats in the control group were fed pellet chow, while rats in theobese and obese +CFE treatment groups received both pellet chow and cafeteria diet. CFE was administered in the dose of 100 mg/kg/day p.o. for 50 days. The appetite suppressing activity of CFE was calculated by monitoring food intake and animal's body weight(at baseline, every 10 days and at term).Laboratory parameters included blood glucose, serum lipid profile including cholesterol, triglycerides and high density lipoprotein, which were measured –at baseline, every 10 days and at term. In addition, liver function and renal function were assessed by SGOT, SGPT, Alkaline phosphatase, Serum creatinine, Uric acid and Blood urea levels. These tests were done at baseline and at term.

Data Analysis

All the values were analyzed by one-way analysis of variance(ANOVA) using the Brown-Forsythe statistic followed byGames-Howell post hoc comparisons tests to study the differences between groups. The level of statistical significance was set at p<0.05.

RESULTS

(i) Food intake

Food intake was found to be significantly (p<0.001) increased in both obese groups compared to control group(Fig. 1). Concurrent administration of CFE with cafeteria diet prevented the increase in food intake significantly (p<0.001) compared to obese group.

(iii) Body Weight

Animals in the all the groups gained body weight (Table 1). However, this weight gain in CFE treated obese group was significantly (p<0.001) less comparedto that in obese group over 50 days.

(iv) Serum lipid profile

Feeding of cafeteria diet produced a significant increase in serum total cholesterol, triglycerides, VLDL and LDL levels in both obese groups compared to those in untreated control group. These levels were reduced significantly (Total cholesterol & VLDL: p<0.001, TG & LDL: p<0.05) in CFE treated group (Fig.2a & 2b) at day 50. On the other hand, HDL levels decreased in obese rats, while CFE treatment ameliorated this effect (Table 2).

(v) Blood glucose level

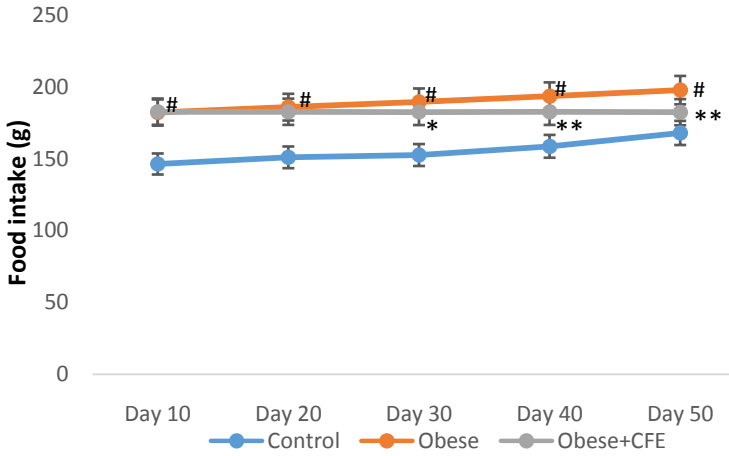
There was a significant (p<0.05) rise in blood sugar levels in both obese groups in comparison with untreated control. Treatment with CFE for 50 days reduced blood glucose levels significantly (p<0.01) compared to untreated obese group(Fig. 3).

(vi) Liver Function Tests

The levels of SGOT, GPT and ALP were raised significantly (p<0.001) in both obese and CFE treated obese group. Administration of CFE significantly (p<0.001) reversed in SGOT and ALP levels. However there was no significant change in SGPT levels in all the groups (Table 3).

(vii) Renal Function Tests

In both CFE treated and untreated obese rats, there was significant (p<0.05) rise in serum creatinine and uric acid levels and significant decrease (p<0.05) in blood urea levels at day 50. CFE treatment abrogated these changes (Table 4).



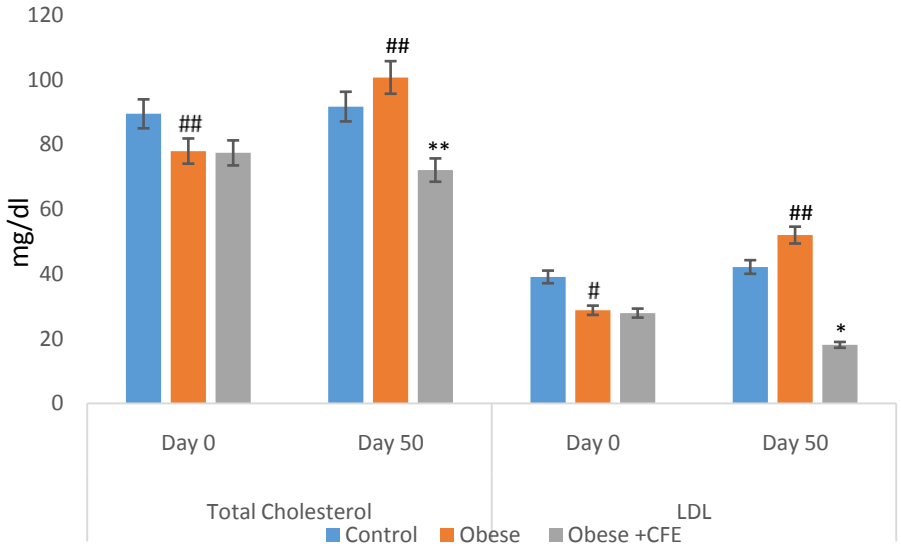
#p<0.001 Compared to control group, *p<0.05, **p<0.001 Compared to cafeteria diet (CD) group

Fig. 1: Food intake in grams (g) in different experimental groups over 50 days

Table 1: Gain in body weight in grams in different experimental groups over 50 days

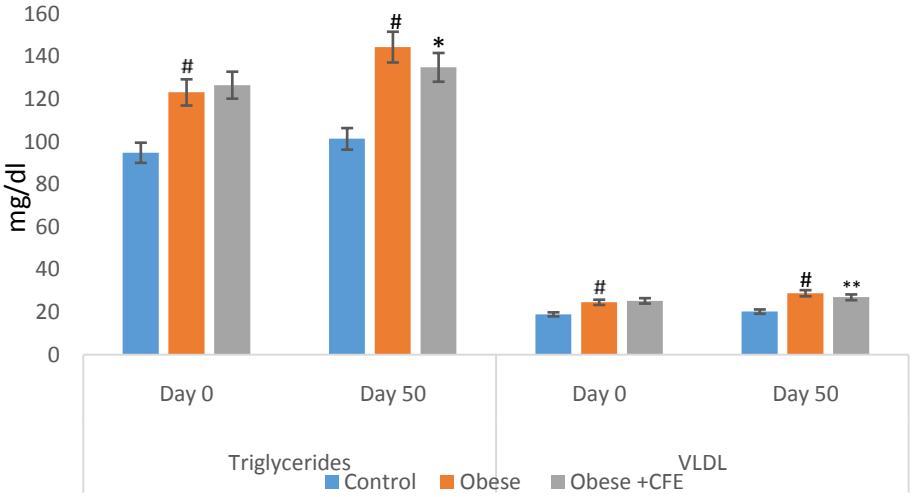
Group (n=30)	Day 0 (g)	Day 10 (g)	Day 20 (g)	Day 30 (g)	Day 40 (g)	Day 50 (g)
Control	206.37±5.52	215.13±5.73	222.33±5.87	228.80±5.62	235.27±5.68	241.47±5.93
Obese	322.07±2.25#	330.97±2.16#	336.43±2.01#	341.37±1.82#	345.67±1.61#	349.33±1.59#
Obese+CFE	319.17±1.70	325.03±1.74	330.73±1.82	333.03±1.82*	332.83±1.87**	331.67±2.00**

#p<0.001 compared to control, *p<0.05, **p<0.001 compared to obese group.



*p<0.05, **p<0.001 Compared to obese group, #p<0.01, ##p<0.001 Compared to control group

Fig. 2a: Total Cholesterol & LDL levels in different groups at day 50



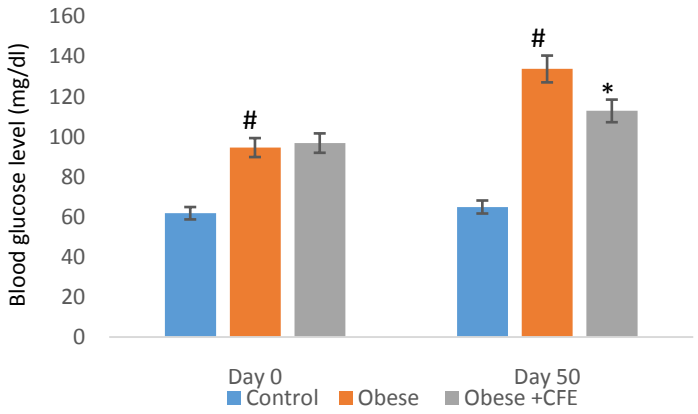
*p<0.05, **p<0.001 Compared to obese group, #p<0.001 Compared to control group

Fig. 2b: Triglycerides & VLDL levels in different groups at day 50

Table 2: HDL levels in different groups at day 50 (Mean±SEM)

Group (n=30)	HDL (mg/dl)		
	Control	Obese	Obese +CFE
Day 0	31.4±0.25	24.5±0.60#	24.2±0.66
Day 50	29±0.31	19.8±0.60#	27±0.64*

#p<0.001 compared to control,*p<0.001 compared to obese group.



#P<0.001 compared to control group, *P<0.001 compared to obese group.

Fig. 3: Blood glucose levels in different groups at day 50

Table 3: Liver function testsin various experimental groups

Group (n=30)	SGOT		SGPT		ALP	
	Day 0	Day 50	Day 0	Day 50	Day 0	Day 50
Control	23.2±0.69	52.6±1.32	18.4±0.50	51.8±1.34	216.5±5.81	306.8±3.06
Obese	53.3±3.69#	93.5±3.52#	43.6±2.84#	58.7±1.88	285.2±8.80#	390.3±7.00#
Obese +CFE	51.8±3.60	73.5±3.75**	42.9±2.90	52.6±2.72	287.6±11.24	350±10.78*

#p<0.001 compared to control, *p<0.01, **p<0.001 compared to obese group.

Table 4: Renal function tests in various experimental groups

Group (n=30)	Serum Creatinine		Blood Urea		Uric Acid	
	Day 0	Day 50	Day 0	Day 50	Day 0	Day 50
Control	0.79±0.02	0.73±0.02	49.70±1.31	52.87±1.07	3.07±0.03	2.81±0.06
Obese	0.87±0.02#	1.01±0.03##	41.53±1.84#	32.67±2.06##	3.37±0.11#	3.96±0.10##
Obese +CFE	0.88±0.04	0.90±0.02*	43.13±2.57	40.2±2.20*	3.50±0.11	3.56±0.10*

#p<0.05, ##p<0.001 compared to control, *P<0.05 compared to obese group.

DISCUSSION

Cafeteria diet induced obesity (DIO) is a widely accepted model for obesity as high fat diet inevitably causes hyper-phagia resulting in increased body weight. It simulates clinicalobesity. This gain in body weight is largely due to increased fat mass as a result of pre-adipocyte proliferation and differentiation and, accumulation of lipids in the liver, to some extent[6,7].

Our results show that administration of CFE has appetite suppressant and anti-obesogenic effects in this model. These effects were reflected in the intake of food, bodyweight and serum lipid profile in the obese rats treated with CFE. This reveals that concurrent administration of CFE with cafeteria diet reduces the development of obesity in rats. Previous studies have shown that concurrent administration of CFE with cafeteria diet prevented rats becoming obese[3,8]**.** The anti-obesity effect of CFE was observed in two clinical trials[9,10].The exact mechanism of action of this effect is not well established. Pregnane glycosides present in CFE may act via multiple mechanisms. The decline in food intake may reflect direct intervention in appetite control at the level of the hypothalamus, where the pregnane glycosides are known to act[11]. There is also evidence that they act directly on adipose tissue, by inhibiting adipocyte proliferation and differentiation[12-14]. *Caralluma fimbriata* contains pregnane glycosides which are believed to block the activity of citrate lyase. By blocking this enzyme, *Caralluma fimbriata* may block the formation of fat by the body. Further, *Caralluma fimbriata* also blocks another enzyme called Malonyl Coenzyme A. By blocking this enzyme, fat formation is further blocked and the body is forced to burn its fat reserves. This might accelerate the rate of fat loss by the body. An alternative hypothesis is that CFE may down regulate ghrelin synthesis in the stomach and subsequently neuropeptide-Y in the hypothalamus, with ultimately the same effect of appetite suppression[15-18].

CONCLUSION

The *Caralluma fimbriata* extract reduced gain in body weight and alterations in lipid profile in experimentally induced obesity in rats. It may be useful in treatment of obesity, as shown in preliminary clinical studies. However, further studies are necessary to confirm its anti-obesity effect and to find its exact mode of action.

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