Original Article

Effect of petroleum ether extract of *Cedrus deodara* on body weight in diabetic rats

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Abstract

Background and Aim: Overweight and obesity are the strong risk factors for diabetes. The present study aims to find out whether petroleum ether extract of *Cedrus deodara* (PEECD) reduces body weight in alloxan-induced diabetic rats.

Materials and Methods: A total of 36 rats (6 normal rats and 30 alloxan-induced diabetic rats) were included in the study and they were divided into six groups of six animals each. PEECD at three different doses of 100 mg/kg, 200 mg/kg, and 400 mg/kg was administered on 0th, 7th, 14th, and 21st days and then the body weight was estimated using a weighing machine. Statistical analysis was performed by one-way ANOVA.

Results: On the 14th and 21st days of PEECD administration at doses of both 200 mg/kg and 400 mg/kg, the body weight decreased significantly ($P < 0.05$) in alloxan-induced diabetic rats when compared with the control group. However, this decrease in body weight was also statistically significant ($P < 0.05$) when compared with the standard on the 21st day of PEECD administration at a dose of 400 mg/kg. There was a statistically significant decrease ($P < 0.05$) in body weight when compared with the control group on the 21st day of administration of PEECD at a dose of 100 mg/kg.

Conclusion: From the above findings, we conclude that PEECD is capable of reducing body weight in alloxan-induced diabetic rats. Hence, further studies should be done to confirm the weight-reducing property of PEECD extract on diabetic rats so that it could be added to the list of traditional plants which are effective in reducing the body weight.

Key words: Body weight, *Cedrus deodara*, diabetic rats

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INTRODUCTION

The global prevalence of overweight and obesity is increasing rapidly over the past three decades with marked variations across the countries. Moreover, not a single country has been able to reduce the prevalence over the past 33 years significantly.[1] Obesity is the most common public health problem in both developed and developing countries according to the World Health Organization (WHO).[2] Both overweight and obesity are strong modifiable risk factors for diabetes.[3-5] Increase in the prevalence of obesity was mirrored by increase in the incidence of diabetes.[6] Therefore, weight loss is a key therapeutic goal for both prevention and management of type 2 diabetes.[7]

A previous study by Tandon and Yadav has reported that the indigenous system of medicine and the plant drugs could promise to provide both the concepts of therapy as well as therapeutic agents. These initiatives are also in favor of the WHO advocating herbal medicine as a valid alternative therapy.[8-10] Our previous publication has reported that the petroleum ether extract of *Cedrus deodara* (PEECD) which belongs to the family *Pinaceae* reduces the serum glucose level in diabetic rats.[11] Therefore, in the present work, we would like to study

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the effect of the same PEECD on body weight in diabetic albino Wistar rats.

MATERIALS AND METHODS

Drugs and chemicals

Glibenclamide tablet (Aventis Pharma Ltd., Mumbai, Maharashtra, India) and Tween-80 (Rankem Ranbaxy Fine Chemicals Ltd., New Delhi, India) were used in this study. All the other solvents and chemicals used for extraction and phytochemical investigation were purchased from S D Fine Chemicals Pvt. Ltd., Mumbai, Maharashtra, India.

Collection of plant material

Heartwood of *C. deodara* was collected from Sugandh Kesari Depot, Mamulpet, Bengaluru, Karnataka, which was authenticated from the Department of Botany, GKVK University, Bengaluru, Karnataka, India.

Plant extraction

Eighty gram of air-dried powdered plant materials was successively extracted using Soxhlet apparatus with 60%–80% petroleum ether for 72 h and then the extract was preserved for the study.

Phytochemical investigation

The PEECD has been subjected to various qualitative tests for the identification of various chemical constituents.[12-14]

Experimental animals

Adult male albino Wistar rats (150–200 g) were procured from Bioneeds, Nelamangala, Tumkur. The animals were acclimatized at the animal house of PES Institute of Medical Sciences and Research, Kuppam (Andhra Pradesh), for 7 days under standard husbandry conditions. The approval of the Institutional Animal Ethical Committee, Andhra Pradesh, was taken prior to the experiments, and all the experiments were conducted according to the guidelines of the Committee for the Purpose of Control and Supervision of Experiments on Animals.

Acute toxicity studies

Acute oral toxicity test was carried out according to the Organisation for Economic Co-operation and Development guideline number 425 (up and down procedure). PEECD was safe up to 500 mg/kg and was lethal at 2000 mg/kg dose. The lethal dose, 50%, of PEECD was 1098 mg/kg.[15]

Collection of serum samples

Blood was drawn from the retro-orbital plexus of the rats under light ether anesthesia on 0th, 7th, 14th, and 21st days. The blood samples were allowed to clot for 30 min at room temperature, and the serum samples were collected immediately for the biochemical analysis.

Biochemical analysis

Blood glucose level (BGL) was estimated colorimetrically by glucose-oxidase-peroxidase method using a glucose estimation kit (Span Diagnostic Ltd., Surat, Gujarat, India).

Preparation of test sample

The petroleum ether extract of heartwood of *C. deodara* was suspended in water in the presence of 3% v/v Tween-80 solution. Each time, the fresh preparations of the extracts were prepared as when required.

Preparation of glibenclamide solution (standard)

Glibenclamide tablet of 5 mg was dissolved in 10 ml of distilled water to give 0.5 mg/ml solution. This solution was administered at a dose of 5 mg/kg body weight.

Induction of diabetes

Diabetes was induced in 16 h fasted rats by single intraperitoneal injection of 125 mg/kg of freshly prepared alloxan solution in normal saline. After alloxan injection, 10% w/v glucose solution was given in feeding bottles for the next 24 h to prevent hypoglycemia. After 7 days, rats with marked hyperglycemia (fasting BGL >200 mg/dl) were selected for the study. Animals belonging to Group 1 (nondiabetic healthy rats) were not treated with alloxan.

Assessment of body weight

A total of 36 rats (6 normal rats and 30 diabetic rats) were used and divided into six groups of six animals each. Group 1 (nondiabetic healthy rats) received 10 ml/kg of distilled water (control) and Group 2 received 2 ml of 3% v/v Tween-80 in water (vehicle control); a vehicle control is used in studies in which a substance (e.g. saline or mineral oil) is used as a vehicle for a solution of the experimental compound. Group 3 received 5 mg/kg of glibenclamide (standard), Groups 4, 5, and 6 received 100, 200, and 400 mg/kg of PEECD, respectively. The body weight was estimated using a standard weighing machine.

Statistical analysis

The statistical analysis was done by the software SPSS Statistics Developer 21.0.0 (IBM, Chicago, IL, USA). The values were expressed as mean ± standard deviation, and the effect was compared using one-way ANOVA and *post hoc* analysis by Tukey's test. $P < 0.05$ was considered statistically significant.

RESULTS

Table 1 shows the effect of drugs on body weight in alloxan-induced diabetic rats. The PEECD dose of 100, 200, and 400 mg/kg and glibenclamide did not show any

Table 1: Effect of drugs on body weight in alloxan-induced diabetic rats (*n*=6) in each group

Treatment group	Dose	Changes in body weight (g)			
		Day-0	Day-7	Day-14	Day-21
Distilled water, control (ml/kg)	10	200.50±2.84	201.83±1.04	203.00±1.06	205.83±1.49
Vehicle control (ml)	2	205.50±4.88	202.33±8.16	199.33±2.51	197.83±1.72
Glibenclamide, standard (mg/kg)	5	206.66±2.23	198.00±1.50	195.16±2.48#	192.0±3.96#
PEECD (mg/kg)	100	205±2.03	200.49±2.57	198.34±3.32	193.55±4.02#
	200	202.48±1.97	197.41±2.01	191.56±4.98#	185.43±3.87#
	400	206.83±2.07	195.16±1.70	190.16±3.62#	188.16±2.78*,#

Values represented as mean±SD. Analysis of data was done by one-way ANOVA and *post hoc* by Tukey-Kramer test. *Significant differences (P<0.05) as compared to standard, #Significant differences (P<0.05) as compared to control. P<0.05 was considered statistically significant. PEECD: Petroleum ether extract of *Cedrus deodara*, SD: Standard deviation

significant change in body weight on 0th and 7th days. However, on the 14th and 21st days, glibenclamide and PEECD of 200 and 400 mg/kg showed a significant reduction in body weight ($P < 0.05$) as compared with that of the control. On the other hand, PEECD at a dose of 100 mg/kg showed a significant fall in body weight ($P < 0.05$) on the 21st day, but there was no change in body weight on the 14th day when compared with that of the control. The PEECD of 400 mg/kg produced a significant fall in body weight ($P < 0.05$) on the 21st day when compared with that of the standard.

DISCUSSION

Our study found that PEECD at a dose of 400 mg/kg significantly reduces body weight on the 21st day in alloxan-induced diabetic rats which was comparable to both the standard (glibenclamide) as well as control. This could be due to the presence of certain chemical constituents in the extract of *C. deodara*. These constituents act both peripherally and centrally. Peripherally acting mechanisms include lipase inhibition, adipogenesis downregulation, thermogenesis, and lipid metabolism. The centrally acting mechanisms include neuropeptide signaling modulators and monoamine neurotransmitters.[16] A previous study has reported that *C. deodara* extract has antihyperlipidimic activity and possesses antiobesity properties in monosodium glutamate-induced obese neonatal rats.[17] However, another study has reported an increase in body weight in streptozotocin-induced diabetic mice, the results of which are controversial to the results of the present study and previous studies by others.[18] Based on a review in Ayurveda, there are many plants described for weight management, but till now, no systematic study has been done in herbal products for weight loss[16] and moreover, literature has concluded that intake of single medicinal plant may give a higher degree of safety and efficacy than combination of medicinal plant preparation.[19] This literature is in favor of our study, because in the present study, we have chosen the extract of a single plant (PEECD) and our results suggest that PEECD has an ability to reduce the body weight and it also has antidiabetic activity which has already been reported in our previous publication.

Limitations of the study

We have not explored the details of chemical constituents of *C. deodara* extract and its mechanism of action by which it reduces the body weight. In addition, lipid profile was not assessed.

CONCLUSION

From the present study, we conclude that PEECD reduces the body weight in diabetic rats. Hence, this plant can be used as folklore medicine to reduce the prevalence of obesity and overweight in diabetic patients because of its antidiabetic as well as antiobesity effects. Further studies should be done to explore and confirm its potential benefits.

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Conflicts of interest

There are no conflicts of interest

REFERENCES

1. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, *et al*. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: A systematic analysis for the Global Burden of Disease Study 2013. Lancet 2014;384:766-81.
2. Obesity: Preventing and managing the global epidemic. Report of a WHO consultation. World Health Organization. World Health Organ Tech Rep Ser 2000;894:i-xii, 1-253.
3. Kahn SE, Hull RL, Utzschneider KM. Mechanisms linking obesity to insulin resistance and type 2 diabetes. Nature 2006;444:840-6.

4. Shang X, Li J, Tao Q, Li J, Li X, Zhang L, *et al.* educational level, obesity and incidence of diabetes among Chinese adult men and women aged 18-59 years old: An 11-year follow-up study. PLoS One 2013;8:e66479.
5. Abdullah A, Peeters A, de Courten M, Stoelwinder J. The magnitude of association between overweight and obesity and the risk of diabetes: A meta-analysis of prospective cohort studies. Diabetes Res Clin Pract 2010;89:309-19.
6. Obesity and Overweight. Fact Sheet No. 311. Geneva, Switzerland: World Health Organization International. Available from: http://www.who.int/mediacentre/factsheets/fs311/en/index.html.
7. Inzucchi SE, Bergenstal RM, Buse JB, Diamant M, Ferrannini E, Nauck M, *et al.* Management of hyperglycemia in type 2 diabetes, 2015: A patient-centered approach: Update to a position statement of the American Diabetes Association and the European Association for the Study of Diabetes. Diabetes Care 2015;38:140-9.
8. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). UK Prospective Diabetes Study (UKPDS) Group. Lancet 1998;352:837-53.
9. Fonseca V, McDuffie R, Calles J, Cohen RM, Feeney P, Feinglos M, *et al.* Determinants of weight gain in the action to control cardiovascular risk in diabetes trial. Diabetes Care 2013;36:2162-8.
10. Tandon N, Yadav SS. Contributions of Indian Council of Medical Research (ICMR) in the area of medicinal plants/traditional medicine. J Ethnopharmacol 2016. pii: S0378-874130492-5.
11. Podder S, Pradhan G, Mahapatra SC. Evaluation of petroleum ether heartwood extract of *Cedrus deodara* in healthy and diabetic rats. Int J Clin Exp Physiol 2016;3:72-6.
12. Khandelwal KR. Techniques and experiments. In: Practical Pharmacognosy. 2nd ed. Pune, India: Nirali Prakashan Publications; 2000. p. 149-55.
13. Kokate CK. Techniques and experiments. In: Practical Pharmacology. 4th ed. New Delhi, India: Vallabh Prakashan; 1993. p. 110-1.
14. OECD Guidelines for the Testing of Chemicals, Acute Oral Toxicity – Up-and-Down-Procedure (UDP). Environmental Health and Safety Monograph Series on Testing and Adjustment No. 425. Available from: http://www.ntp.niehs.nih.gov/iccvam/suppdocs/feddocs/oecd/oecdtg425.Pdf.
15. Serrano-Martín X, Payares G, Mendoza-León A. Glibenclamide, a blocker of K + ATP channels, shows antileishmanial activity in experimental murine cutaneous leishmaniasis. Antimicrob Agents Chemother 2006;50:4214-6.
16. Chandrasekaran CV, Vijayalakshmi MA, Prakash K, Bansal VS, Meenakshi J, Amit A. Herbal approach for obesity management. Am J Plant Sci 2012;3:1003-14.
17. Patil S, Prakash T, Kotresha D, Rao NR, Pandy N. Antihyperlipidemic potential of *Cedrus deodara* extracts in monosodium glutamate induced obesity in neonatal rats. Indian J Pharmacol 2011;43:644-7.
18. Singh P, Khosa RL, Mishra G. Evaluation of antidiabetic activity of ethanolic extract of *Cedrus deodara* (*Pinaceae*) stem bark in streptozotocin induced diabetes in mice. Niger J Exp Clin Biosci 2013;1:33-8.
19. Kazemipoor M, Radzi CJ, Cordell GA, Yaze I. Potential of traditional medicinal plants for treating obesity: A review. Int Conf Nutr Food Sci 2012;39:1-6.