

Contents lists available at ScienceDirect

Asian Pacific Journal of Tropical Disease

journal homepage:www.elsevier.com/locate/apjtcm



Document heading

Anti-obesity and hypoglycemic effect of ethanolic extract of *Murraya* koenigii (L) leaves in high fatty diet rats

Sachin V. Tembhurne*, Dinesh M. Sakarkar

Department of Pharmacology, Sudhakarrao Naik Institute of Pharmacy, Nagpur road Pusad. Dist: Yavatmal (M.S), 445204 India

ARTICLE INFO

Article history:
Received 5June 2012
Received in revised from 5 July 2012
Accepted 7 Octoberr 2012
Available online 28 October 2012

Keywords: High fat diet Anti-obesity Antidiabetics Body weight

ABSTRACT

Objective: To evaluate the hypoglycemic and anti-obesity activities of of *Murraya koenigii* leaves. Method: The study was performed in high fatty diet induced obesity rats. After 15 days baseline period the treatments animals were received ethanolic extract of *Murraya koenigii* leaves (300 and 500 mg/kg) in high fatty diet rats. All the treatments were given for one month. On 30th day all the fasted animals received an intraperitoneal injection of glucose (1 g/kg) for glucose tolerance test. At the end of study body weight, total cholesterol, triglycerides, and blood glucose level were measured. Results: The results demonstrate clearly that repeated oral administration of *Murraya koenigii* leaves evoked a potent anti-hyperglycaemic activity in high fat diet obese rats. Postprandial hyperglycaemic peaks were significantly lower in plant-treated experimental groups. In other hand, high fatty diet group increased the both total cholesterol and triglycerides levels as compared to control group. While administration of *Murraya koenigii* leaves significantly decreased in both cholesterol as well as triglycerides. Conclusions: We can conclude that *Murraya koenigii* leaves evokes potent anti-hyperglycaemic and anti-obesity effects. This fact could support their use by the diabetes patient for controlling body weight as well as maintains the glycemic level.

1. Introduction

Obesity is a medical condition involving an excess accumulation of body fat. The main cause of obesity is an imbalance between intake and outflow of fat. Obesity leads to hypertension and diabetes, myocardial infarction, and peripheral vascular disease. Obesity therapies include reducing nutrient absorption and applying anorectic drugs, thermo-genic drugs or drugs that affect lipid mobilization and utilization. Upon termination of therapy with these drugs, weight is rapidly regained in many cases[1]. Many anti-obesity drugs have adverse effects, so many trials have been recently conducted to find and develop new antiobesity drugs through herbal medicines that would minimize the side effects. Numerous animal studies and clinical studies with various herbal medicines have been performed, and some studies reported significant improvements in controlling body weight without any noticeable adverse effects[2-4].

In our previously study we observed that the fruit juice

Tel: ₊91– 08975757387 Fax: ₊91– 07233247308 E-mail: stembhurne@gmail.com of Murraya koenigii reduces the body weight in repeated dose (28 days) toxicity study[5] as well as in 6 months toxicological study (unpublished data). The main approach of the present study was to evaluate the effects of ethanolic extract of Murraya koenigii on obesity induced by high fatty diet and on intraperitoneal glucose tolerance test in wistar rats. In high fat diet (HFD) rats, feeding of a hypercaloric diet leads to obesity and metabolic abnormalities, such as hyperglycemia, glucose intolerance and hyperinsulinemia that phenotypically resemble human type 2 diabetes. Murraya koenigii commonly is known as Karry tree or Meethi neem in India. The leaves extensively used as a flavoring agent in curries and chutneys. Almost every part of this plant has a strong characteristic odour and used traditionally as antiemetic, antidiarrhoeal, febrifuge and blood purifier[6]. The people of the plains, particularly of southern India, use the leaves of this plant as a spice in different curry preparations^[6]. Several biological activities of Murraya koenigii leaves have been reported for its antihypercholesterolemic, antidiabetic[7,8] as well as its efficacy against colon carcinogensis[8]. It is also reported for antimicrobial, antioxidant, retention of GIT transit and etc[9-12].

2. Material and methods

^{*}Corresponding author: Mr. Sachin V. Tembhurne, Assistant Professor, Department of Pharmacology and Toxicology, Sudhakarrao Naik Institute of Pharmacy, Pusad, Dist: Yayatmal (M.S.) 445204 India.

2.1. Plant Extract

The fresh leaves of *Murraya koenigii* (Linn.) were collected from its natural habitat at Sakoli village in Nagpur region, Maharashtra, India. The plant was authenticated by Dr. N. M. Dongarwar of Botany Department; RTM Nagpur University, Nagpur India. A voucher specimen (No: 9439) was deposited at Herbarium, Department of Botany, RTM Nagpur University Nagpur. The collected leaves of *Murraya koenigii* were dried under shade, undergone crushing in electric blender to form powdered and was subjected to extraction by using soxhlet's extractor. The extract was administered in the form of suspension using 0.5% carboxymethyl cellulose using tween 20 (0.2% v/v) as a suspending agent.

2.2. Animals

All the experiments were carried out in male Wister rat (180–220 g). These animals had free access to food and water, and they were housed in a natural light-dark cycle. The experimental protocol was approved by the Institutional Animal Ethics Committee and the care of laboratory animals was taken according to the guidelines of CPCSEA, Ministry of Forests and Environment, Government of India (registration number 729/02/a/ CPCSEA).

2.3. High fatty diet induced obesity

Experimental model of obesity was induced by feeding high fatty diet [Vanspati ghee (25%), cow ghee (15%), corn oil (50%), lard oil (50%), and peanut oil (15%)] in standard laboratory chow of Amruit Food Sangali. After 15 days baseline period the animals were randomized into four groups (6 rats each). Group 1 as normal control group received standard laboratory chow only. Group 2 as a high fatty diet group. Group 3 and 4 received 300 and 500 mg/kg of ethanolic extract of *Murraya koenigii*. All the treatments were given for one month.

2.4. Glucose tolerance test

On 30th day all the fasted animals received an intraperitoneal injection of glucose (1 g/kg) for glucose tolerance test. Blood serum glucose was determined with a glucose estimation kit (Global Diagnostic, Italy). The body weight (g) was recorded on day 0 of treatments and then on alternative to weekly for 31 days in each group. At the end of study (day 31) level of total cholesterol and triglyceride in serum sample were measured using the biochemical estimation kits (Biolab kits Mumbai).

2.5. Statistical analysis

Data was expressed as mean \pm standard deviation (SD) for each group (n=6). Statistical analysis was performed by Student unpaired 't' test and one—way analysis of variance (ANOVA) followed by dunnet test. It was considered as significant difference as P<0.05. Graph Pad Prism (version 5) software was used for statistical analysis.

3. Results

There was significant (P < 0.05) increase in body weight of animals fed with high fatty diet when compared to control group. Treatment with $Murraya\ koenigii\ (300\ and\ 500\ mg/kg)$ caused significant (P < 0.05) decrease in body weight dosedependently when compared to HFD group (Figure 1).

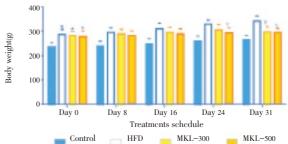


Figure 1. Effect of Murraya koenigii leaves on body weight in HFD rats.

★Weights of animals were increased after feeding of HFD compared to control. Ψ Repeated oral administration of *Murraya koenigii* leaves significantly reduced the body weight compared with HFD of respective group (ANOVA followed by Dunnet test).

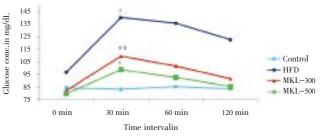


Figure 2. Effect of *Murraya koenigii* leaves on glucose intolerance in HFD rats.

* Significant increased in the level compared to control. ** Repeated oral administration of *Murraya koenigii* leaves significantly reduced the level compared with HFD group.

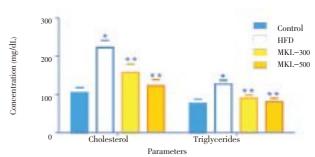


Figure 3. Effect of *Murraya koenigii* leaves on level of cholesterol and triglycerides in HFD rats.

★ Significant increased in the level compared to control. ★★ Repeated oral administration of *Murraya koenigii* leaves significantly reduced the level compared with HFD group.

The results of glucose intolerance in HFD revealed that the percentage increase in serum glucose level was lowest at both doses of Murraya koenigii leave 300 mg/kg (32.97%) and 500 mg/kg (23.69%) at 30 min which was significant compared to HFD group (45.07%) at their 0.0.min reading. The Murraya koenigii leave at both doses were found to decrease maximum blood glucose level after 120 min. Moreover, percentage increase in serum glucose level was lowest at the dose of 500 mg/kg (6.96%) which was comparable to vehicle control group at 120 minute than 300 mg/kg (11.2%) (Figure 2). In high fatty diet group there was found significant (P < 0.05) increase in both total cholesterol and triglycerides levels

as compared to control group. Administration of *Murraya koenigii* leave (300 and 500 mg/kg p.o.) significantly (P < 0.05) decreased in both cholesterol as well as triglycerides respectively (Figure 3).

4. Discussion

The present study was carried out in order to investigate the hypoglycemic and body weight reducing activities of the ethanolic extract of *Murraya koenigii* in HFD Wister rats. This animal model is considered as the adequate model for studying pathophysiology of human type 2 diabetes. In this animal model, development of obesity and glucose intolerance are tightly associated with genetic predisposition and environmental factors^[13].

Our results clearly demonstrate that repeated oral administration of ethanolic extract of *Murraya koenigii* leaves for 30 days can improve the glucose tolerance and decrease the body weight in highly glucose intolerant HFD rats. This finding is in concordance with our previous work of fruit juice and leaves extract of *Murraya koenigii* which has demonstrated a potent hypoglycemic activity in alloxan and streptozotocin induced diabetic animals[14–16]. Several metabolic abnormalities have been reported to be associated with the development of glucose intolerance and diabetes in HFD rats. These abnormalities include decrease in glucose transport and oxidation rate, decrease in glycogen synthesis[17]. The results obtained in this study clearly demonstrate that *Murraya koenigii* leaves treatment was associated with a potent improvement of glucose intolerance.

Scientific records revealed insulin sensitizing activities of various plants such as *Panax ginseng*^[2,3] and *Salix matsudana*^[4] in nutrition induced obese animals. A similar mechanism may operate in the plant extracts—treated HFD rats to improve glucose homeostasis in present study. Another possible action site for *Murraya koenigii* leaves to exert its postprandial hypoglycemic effect is in the gastrointestinal tract.

Obesity is associated with insulin resistance and cardiovascular diseases risk factors[1]. Therapeutic agents with both antidiabetic and anti-obese effects are therefore particularly beneficial. Our results show that HFD rats treated with *Murraya koenigii* leaves extract underwent a time-dependent reduction in body weight and cholesterol, triglycerides as well as controlling the glycemia reflecting anti-obesity and hypoglycemic activity in *Murraya koenigii*. The plant may exert their antidiabetic and anti-obesity effects through actions that improve insulin sensitivity and the balance between food intake and energy expenditure.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgements

We would like to thank wholeheartedly to Chairman, Sudhakarrao Naik Institute of Pharmacy Pusad for supporting and providing the research facility for this work.

References

- Robert WS, Yolanda EB. Stemming the obesity-diabetes epidemic: lifestyle changes and therapeutics. Nat Rev Nephrol 2008; 4: 486-487.
- [2] Xiong Y, Shen L, Liu KJ, Tso P, Xiong YQ, Wang GJ, et al. Antiobesity and antihyperglycemic effects of Ginsenoside Rb1 in rats. *Diabetes* 2010; 59(10): 2505–2512.
- [3] Christine L, Chichioco H, Finella MG. Weight-lowering effects of *Caesalpinia pulcherrima*, *Cassia fistula* and *Senna alata* leaf extracts. *J Med Plants Res* 2011; **5**(3): 452–455.
- [4] Han LK, Sumiyoshi M, Zhang J, Liu MX, Zhang XF, Zheng YN, et al. Anti-obesity action of *Salix matsudana* leaves (Part 1). Antiobesity action by polyphenols of *Salix matsudana* in high fatdiet treated rodent animals. *Phytotherapy Res* 2003; 17: 1188–1194.
- [5] Tembhurne SV, Sakarkar DM. Biochemical and physiological responses of fruit juice of *Murraya Koenigii* (L) in 28 days repeated dose toxicity study. *Int J Pharm Tech Res* 2009; 1(4): 1568-1575.
- [6] Anonymous. The wealth of India. New Delhi: Council of Scientific and Industrial Research; 1998.
- [7] Achyut NK, Gupta RK, Watal G. Hypoglycemic effects of Murraya koenigii on normal and alloxan-diabetic rabbits. J Ethnopharmacol 2005; 97: 247.
- [8] Khan BA, Abraham A, Leelamma S. Murraya koenigii and Brassica juncea alterations on lipid profile in 1-2 dimethylhydrazine induced colon carcinogenesis. Investigational New Drugs 1996; 14: 365.
- [9] Deshmukh SK, Jain PC, Agarwal SC. Antimicrobial activity of the essential oil of the leaves of *Murraya koenigii* (Linn) Spreng (Indian curry leaf). *Fitoterapia* 1986; 57: 295.
- [10] Baliga MS, Jagetia GC, Rao SK, Babu K. Evaluation of nitric oxide scavenging activity of certain spices in vitro: a preliminary study. Nahrung 2003; 47(4): 261.
- [11] Tembhurne SV, Sakarkar DM. Effect of Murraya koenigii leaves extracts on gastrointestinal motility: involving calcium channel innervation in mice. Arch Pharm Res 2009; 1(2):189–193.
- [12] Tembhurne SV, Sakarkar DM. Effect of Murraya koenigii (L) leaves extract on gastrointestinal motility in streptozotocin induced diabetic rats. J Chinese Integr Med 2011; 9(8): 913-919.
- [13] Hamza N, Berke B, Cheze C, Le Garrec R, Lassalle R, Agli AN, et al. Treatment of high fat diet induced type 2 diabetes in C57BL/6J mice by two medicinal plants used in traditional treatment of diabetes in the east of Algeria. J Ethnopharmacol 2011; 133(2): 931–933.
- [14] Tembhurne SV, Sakarkar DM. Hypoglycemic effects of fruit juice of Murraya koenigii (L) in alloxan induced diabetic mice. Int J Pharm Tech Res 2009; 1(4):1589–1593.
- [15] Tembhurne SV, Sakarkar DM. Influence of *Murraya koenigii* on experimental model of diabetes and its progression of neuropathic pain. *Res Pharm Sci* 2010; **5**(1): 41–47.
- [16] Tembhurne SV, Sakarkar DM. Protective effect of Murraya koenigii (L) leaves extract in streptozotocin induced diabetics rats involving possible antioxidant mechanism. J Med Plant Res 2010; 22(4): 2418–2423.
- [17] Ritchie IR, Gulli RA, Stefanyk LE, Harasim E, Chabowski A, Dyck DJ. Restoration of skeletal muscle leptin response does not precede the exercise-induced recovery of insulin-stimulated glucose uptake in high-fat-fed rats. Am J Physiol Regul Integr Comp Physiol 2011; 300(2): 492-500.