WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.074
Volume 7, Issue 19, 107-113. Research Article ISSN 2277– 7105

ANTIHYPERGLYCEMIC ACTIVITY STUDIES WITH *MALVA VERTICILLATA* LEAVES

Farhana Akter and Mohammed Rahmatullah*

Department of Pharmacy, University of Development Alternative, Lalmatia, Dhaka-1207, Bangladesh.

Article Received on
01 Oct. 2018,
Revised on 22 Oct. 2018,
Accepted on 12 Nov. 2018
DOI: 10.20959/wjpr201819-13767

***Corresponding Author**
Prof. Dr. Mohammed Rahmatullah
Department of Pharmacy, University of Development Alternative, Lalmatia, Dhaka-1207, Bangladesh.

ABSTRACT

Background: *Malva verticillata*, also known as Chinese mallow and cluster mallow is considered a medicinal herb by traditional medicinal practitioners in Bangladesh The objective of the present study was to evaluate the antihyperglycemic efficacy of methanol extracts of the leaves of the plant (MEMV). **Methods:** Oral glucose tolerance test (OGTT) was done to evaluate antihyperglycemic efficacy. **Results:** In oral glucose tolerance tests, MEMV dose-dependently and significantly reduced blood glucose levels in glucose-loaded mice. At doses of 50, 100, 200 and 400 mg per kg body weight, MEMV lowered blood glucose levels by 20.4, 32.0, 37.2, and 46.6%, respectively, compared to control animals. By comparison, a standard antihyperglycemic drug, glibenclamide reduced blood glucose levels by 45.3% at a dose of 10 mg per kg. **Conclusion:** The leaves can be an effective means for lowering blood glucose in persons with elevated blood glucose levels like people with diabetes.

KEYWORDS: Antihyperglycemic, *Malva verticillata*, OGTT, diabetes.

BACKGROUND

Malva verticillata L. (Malvaceae) is known in English as Chinese mallow or cluster mallow and in Bengali as napa shak. It can grow up to around 5 feet high and is found widely in East Asia. The plant is considered a medicinal plant by traditional medicinal practitioners of Bangladesh. Folk medicinal practitioners in Dhaka city reportedly use leaves and roots of the plant to strengthen heart, liver and stomach functions and for treatment of helminthiasis and piles.[1] Antidiabetic activity has been reported for ethanol extract of seeds of the plant.[2]

Flavonoid 8-*O*-glucuronides have been isolated from aerial parts of the plant, which exhibited significant recovery effect on pancreatic islets of zebrafish larvae damaged by alloxan.[3]

Diabetes is a common disorder in the world and reaching almost epidemic proportions for reasons not completely understood.[4] Because the disease, which is characterized by high blood glucose, cannot be cured, there is always a search for new drugs, which may be more effective in lowering blood glucose and maybe cure the disease itself. Towards discovery of possible antidiabetic drugs from plants, we had been screening various plants of Bangladesh for their blood glucose lowering efficacies for a number of years.[5-25] The objective of the present study was to evaluate the antihyperglycemic activity of methanol extract of leaves of *Malva verticillata* through oral glucose tolerance test (OGTT) in mice.

METHODS

Plant material collection

Leaves of *Malva verticillata* were collected from a vegetable market in Dhaka city. The leaves were identified at the University of Development Alternative by a competent botanist and voucher specimens were deposited with the Medicinal Plant Collection Wing of the University of Development Alternative.

Preparation of methanolic extract of Malva verticillata leaves (MEMV)

For preparation of methanol extract of leaves of *Malva verticillata* (MEMV), leaves were thoroughly cut into small pieces, dried in the shade, and pulverized into a fine powder. 54g of the powder was extracted with 270 ml methanol over 48 hours. Methanol was evaporated at 40^{o}C and the extract was dissolved in Tween 20 prior to administration to mice by gavaging. The final weight of the extract was 2.99g. The extract was maintained in small aliquots at -20^{o}C till use and care was taken not to freeze-thaw the extract vials repeatedly.

Chemicals and Drugs

Glibenclamide and glucose were obtained from Square Pharmaceuticals Ltd., Bangladesh. All other chemicals were of analytical grade. Glucometer and strips were purchased from Lazz Pharma, Bangladesh.

Animals

Swiss albino mice, which weighed between 12-15g were used in the present study. The animals were obtained from International Centre for Diarrhoeal Disease Research,

Bangladesh (ICDDR,B). The animals were acclimatized for three days prior to actual experiments. During this time, the animals were fed with mice chow (supplied by ICDDR,B) and water *ad libitum*. The study was conducted following approval by the Institutional Animal Ethical Committee of University of Development Alternative, Dhaka, Bangladesh. Care was taken that the animals did not suffer from any unnecessary pain during the acclimatization period.

Oral glucose tolerance tests for evaluation of antihyperglycemic activity

Oral glucose tolerance tests (OGTT) were carried out as per the procedure previously described by Joy and Kuttan[26] with minor modifications. Briefly, fasted mice were grouped into five groups of five mice each. The various groups received different treatments like Group 1 received vehicle (1% Tween 20 in water, 10 ml/kg body weight) and served as control, Group 2 received standard drug (glibenclamide, 10 mg/kg body weight). Groups 3-6 received, respectively, MEMV at doses of 50, 100, 200 and 400 mg per kg body weight. The amount of Tween 20 administered was same in both control and experimental mice. Following a period of one hour as described earlier[20,21], all mice were orally administered 2g glucose per kg of body weight. Blood samples were collected 120 minutes after the glucose administration through puncturing heart following previously published procedures.[20,21] Blood glucose levels were measured with a glucometer. The percent lowering of blood glucose levels were calculated according to the formula described below.

Percent lowering of blood glucose level = $(1 – W_e/W_c)$ X 100,

Where W_e and W_c represents the blood glucose concentration in glibenclamide or MEMV administered mice (Groups 2-6), and control mice (Group 1), respectively. Gavaging was done carefully such that injuries do not happen, and no mice fatalities occurred during gavaging. Mice were handled carefully throughout the experiment so that they did not get subjected to any unnecessary pain.

Statistical analysis

Experimental values are expressed as mean ± SEM. Independent Sample t-test was carried out for statistical comparison. Statistical significance was considered to be indicated by a p value < 0.05 in all cases.[10]

RESULTS

In oral glucose tolerance tests, MEMV dose-dependently and significantly reduced blood glucose levels in glucose-loaded mice. At doses of 50, 100, 200 and 400 mg per kg body weight, MEMV lowered blood glucose levels by 20.4, 32.0, 37.2, and 46.6%, respectively, compared to control animals. By comparison, a standard antihyperglycemic drug, glibenclamide reduced blood glucose levels by 45.3% at a dose of 10 mg per kg. The results suggest that at the highest dose tested, MEMV was comparable to glibenclamide in antihyperglycemic activity.

Table 1: Lowering action of MEMV on blood glucose level in hyperglycemic mice following 120 minutes of glucose loading.

Treatment	Dose (mg/kg body weight)	Blood glucose level (mmol/l)	% lowering of blood glucose level
Control	10 ml	6.18 ± 0.39	-
Glibenclamide	10 mg	3.38 ± 0.26	45.3*
(MEMV)	50 mg	4.92 ± 0.31	20.4*
(MEMV)	100 mg	4.20 ± 0.32	32.0*
(MEMV)	200 mg	3.88 ± 0.25	37.2*
(MEMV)	400 mg	3.30 ± 0.23	46.6*

All administrations were made orally. Values represented as mean ± SEM, (n=5); $^{*}P < 0.05$; significant compared to hyperglycemic control animals.

DISCUSSION

As mentioned before[3], aerial parts (that is including leaves) of *Malva verticillata* contain flavonoid glucuronides with alloxan-induced damages pancreatic islets recovery activity. The exact identification of component(s) responsible for the observed antihyperglycemic activity was not done in the present study. However, considering the extent of the antihyperglycemic effect observed, the plant appears to be a promising candidate for such studies.

CONCLUSION

The results suggest that methanolic extract of leaves of *Malva verticillata* can be used for lowering of blood glucose.

Conflicts of interest

The author(s) declare that they have no competing interests.

ACKNOWLEDGEMENTS

The authors thank Md. Sohel and Md. Najmul Hossain for their help in the experiments.

REFERENCES

1. Jahan N, Islam S, Islam R, Onna SN, Tonny TA, Akter S, Islam MT, Das PR, Rahmatullah M. Ethnomedicinal practices of an urban folk medicinal practitioner of Dhaka city, Bangladesh. J Chem Pharm Res., 2015; 7: 414-420.
2. Jeong YT, Song CH. Antidiabetic activities of extract from *Malva verticillata* seed via the activation of AMP-activated protein kinase. J Microbiol Biotechnol, 2011; 21: 921-929.
3. Ko J.-H, Nam YH, Joo S.-W, Kim H.-G, Lee Y.-G, Kang TH, Baek N.-I. Flavonoid 8-*O*-glucuronides from the aerial parts of Malva verticillata and their recovery effects on alloxan-induced pancreatic islets in zebrafish. Molecules, 2018; 23: 833.
4. Kalra S, Kumar A, Jarhyan P, Unnikrishnan AG. Endemic or epidemic? Measuring the endemicity index of diabetes. Indian J Endocrinol Metab, 2015; 19: 5-7.
5. Rahmatullah M, Sultan S, Toma TT, Lucky SS, Chowdhury MH, Haque WM, Annay MEA, Jahan R. Effect of *Cuscuta reflexa* stem and *Calotropis procera* leaf extracts on glucose tolerance in glucose-induced hyperglycemic rats and mice. Afr J Trad Complement Altern Med., 2010; 7: 109-112.
6. Ahmed F, Rahman S, Ahmed N, Hossain M, Biswas A, Sarkar S, Banna H, Khatun MA, Chowdhury MH, Rahmatullah M. Evaluation of *Neolamarckia cadamba* (Roxb.) Bosser leaf extract on glucose tolerance in glucose-induced hyhperglycemic mice. Afr J Trad Complement Altern Med., 2011; 8: 79-81.
7. Shahreen S, Banik J, Hafiz A, Rahman S, Zaman AT, Shoyeb MA, Chowdhury MH, Rahmatullah M. Antihyperglycemic activities of leaves of three edible fruit plants (*Averrhoa carambola*, *Ficus hispida* and *Syzygium samarangense*) of Bangladesh. Afr J Trad Complement Altern Med., 2012; 9: 287-291.
8. Haque ME, Rahman S, Rahmatullah M, Jahan R. Evaluation of antihyperglycemic and antinociceptive activity of *Xanthium indicum* stem extract in Swiss albino mice. BMC Complement Alternat Med., 2013; 13: 296-299.
9. Haque AKMM, Kabir MZ, Rahman S, Rahman MM, Jahan R, Hossan MS, Rahmatullah M. Preliminary phytochemical screening, oral glucose tolerance, analgesic and acute toxicity studies with *Dendrocalamus giganteus* aerial parts. J Chem Pharm Res., 2014; 6: 397-402.
10. Rahmatullah M, Hosain M, Rahman S, Rahman S, Akter M, Rahman F, Rehana F, Munmun M, Kalpana MA. Antihyperglycaemic and antinociceptive activity evaluation of methanolic extract of whole plant of *Amaranthus tricolour* L. (Amaranthaceae). Afr J Trad Complement Altern Med., 2013a; 10: 408-411.

11. Rahmatullah M, Hossain M, Mahmud A, Sultana N, Rahman SM, Islam MR, Khatoon MS, Jahan S, Islam F. Antihyperglycemic and antinociceptive activity evaluation of 'khoyer' prepared from boiling the wood of *Acacia catechu* in water. Afr J Trad Complement Altern Med., 2013b; 10: 1-5.
12. Ghosh D, Mandal I, Rumi JF, Trisha UK, Jannat H, Ahmed M, Rahmatullah M. Effect of *Allium sativum* leaf extracts on glucose tolerance in glucose-induced hyperglycemic mice. Adv Nat Appl Sci., 2014; 8: 66-69.
13. Akter M, Mitu IZ, Proma JJ, Rahman SM, Islam MR, Rahman S, Rahmatullah M. Antihyperglycemic and antinociceptive activity evaluation of methanolic extract of *Trichosanthes anguina* fruits in Swiss albino mice. Adv Nat Appl Sci., 2014; 8: 70-74.
14. Hossain AI, Faisal M, Rahman S, Jahan R, Rahmatullah M. A preliminary evaluation of antihyperglycemic and analgesic activity of *Alternanthera sessilis* aerial parts. BMC Complement Alternat Med., 2014; 14: 169-173.
15. Jahan S, Rahmatullah M. Methanolic extract of aerial parts of *Raphanus sativus* var. *hortensis* shows antihyperglycemic and antinociceptive potential. World J Pharm Pharm Sci., 2014; 3: 193-202.
16. Nahar UJ, Bhuiyan MMR, Rahmatullah M. Antihyperglycemic activity of methanolic extract of *Spilanthes calva* aerial parts. World J Pharm Pharm Sci., 2016; 5: 1648-1654.
17. Akter H, Akter H, Rahmatullah M. Synergistic antihyperglycemic activity of *Coccinia grandis* leaves and *Cuscuta reflexa* stems. World J Pharm Pharm Sci., 2016; 5: 236-243.
18. Islam MH, Mostafa MN, Rahmatullah M. Antihyperglycemic activity of methanolic extracts of corms of *Colocasia esculenta* var *esculenta*. Eur J Pharm Med Res., 2018; 5: 129-132.
19. Ahmed R, Mostafa MN, Rahmatullah M. Oral glucose tolerance test (OGTT) with a combination of *Colocasia esculenta* stems and *Eichhornia crassipes* aerial parts. World J Pharm Pharm Sci., 2018; 7: 207-214.
20. Saha M, Rohani S, Rayhana N, Toma IJ, Rana S, Rahmatullah M. An herbal formulation containing *Zingiber officinale* rhizomes and *Allium sativum* cloves can increase oral glucose tolerance in mice. Biol Eng Med., 2017; 2: 1-3.
21. Jannat K, Morshed MZ, Akter S, Rahmatullah M. Improved oral glucose tolerance with ripe fruit peels of *Musa seminifera* Lour. Arch Nat Med Chem, 2018; ANMC-113, DOI: 10.29011/ANMC-113. 000013.

22. Hossain I, Akter S, Shoma JF, Hossan MS, Rahmatullah M. Antihyperglycemic effect of methanol extract of *Musa sapientum* fruit skins in glucose-challenged mice. World J Pharm Pharm Sci., 2017; 6(12): 159-166.
23. Lopa AF, Jannat K, Hamid A, Rahmatullah M. Improved oral glucose tolerance with methanol extract of *Musa textilis* Nee and synergistic action with glibenclamide. World J Pharm Res., 2018; 7(17): 204-210.
24. Shova NA, Islam MMM, Jannat K, Rahmatullah M. Oral glucose tolerance tests with *Flacourtia jangomas* (Lour.) Raeusch. (Salicaceae) fruits. World J Pharm Res., 2018; 7: 263-269.
25. Al-Mahamud R, Jannat K, Islam M, Shova NA, Jahan R, Hossain MN, Hamid A, Rahmatullah M. Variations in oral glucose tolerance is present in different sub-cultivars of fruit skins of *Musa sapientum* L. (banana). World J Pharm Res, 2018; 7: 192-199.
26. Joy KL, Kuttan RJ. Anti-diabetic activity of *Picrorrhiza kurroa* extract. J Ethnopharmacol, 1999; 67: 143-148.