International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

*Original Research Article*

# A Comparative Study of the Anti Diabetic Effect of Oral Administration of Cinnamon, Nutmeg and Peppermint in Wistar Albino Rats

**Kumar Sai Sailesh[1], Padmanabha[2]**

[1]Assistant Professor, Dept of Physiology, Travancore Medical College, Kollam, Kerala.
[2]Asst. Professor, Dept. of Physiology, Jazan University, Saudi Arabia.

Corresponding Author: Kumar Sai Sailesh

*Received: 15/12//2013* *Revised: 15/01/2014* *Accepted: 28/01/2014*

## ABSTRACT

Oral administration of cinnamon, nutmeg and pepper mint extracts was known to produce anti diabetic effects. The present study was undertaken with an objective to compare effectiveness of oral administration of cinnamon, nutmeg and peppermint extracts to hyperglycemic rats was investigated using alloxan injected male and female Wister rats. Blood glucose was estimated by GOD-PAP method using diagnostic kit supplied by Agappe diagnostics, Maharashtra. The present experimental study provides further evidence that oral administration of Cinnamon, Nutmeg, and peppermint extracts for 21 days produced a significant decrease in the blood glucose level in the model of alloxan induced diabetes in rats. As compared to Cinnamon and Nutmeg extracts, Peppermint extract exhibits weak anti diabetic activity. From this study, we can conclude that the oral administration of Cinnamon, Nutmeg, and peppermint extracts have beneficial effects on blood glucose levels. However further pharmacological and biochemical investigations will clearly elucidate the mechanism of action and helpful in projecting these plant extracts as a therapeutic target in diabetes research.

***Key words:*** Anti diabetic effect, Cinnamon extract, Nutmeg extract, Pepper mint extract.

## INTRODUCTION

Diabetes (diabetes = overflow, mellitus = honeyed) was one of the first diseases described, with an Egyptian manuscript, mentioning "too great emptying of the urine." [1] Diabetes mellitus is a group of metabolic diseases in which a person has high blood sugar, either because the pancreas does not produce enough insulin, or because cells do not respond to the insulin that is produced.[2]

Therapeutic agents like sulfonyl urea, biguanides etc are used to control blood glucose level in diabetic patients. However chronic usage of most of these agents produces side effects. [3] In addition,

increase in the cost of the treatment and increase in failure rates made difficult to use these agents for prolonged period. Hence there is a need of a treatment which is having low side effects and affordable by general population.

Plants have been used for the treatment of diabetes since 1550 BC. [4] Spices have been used since ancient times not only for increasing the flavor of foods but also for their preservative and medicinal properties. A number of spices and herbs have a long history of traditional use in treating elevated blood sugar levels.[5] Cinnamon is one of the traditional folk herbs used in Korea, China and Russia for diabetes mellitus.[6] Cinnamon extract decreases blood glucose in Wistar rats [7] and cinnamon increase the insulin sensitivity and glucose uptake in adipocytes.[8]

Myristica fragrans and is widely used as spice and also to flavor many kinds of baked goods and vegetables. Nutmeg possesses antifungal, hepatoprotective [9] and antioxidant properties.[10] Recent studies indicate that it is useful against damage caused by gamma radiation [11] and also in the improvement of memory. [12] Anti-inflammatorym, [13] antidysentric, [14] analgesic and hypotensive [15] activities of nutmeg have also been reported, in addition to its insulin-like biological activity. [16]

Peppermint (Mentha × piperita, also known as M. balsamea Willd.[17] is a hybrid mint, a cross between watermint and spearmint. Peppermint is commonly used to soothe or treat symptoms. Examples would be nausea, vomiting, abdominal pain, indigestion, irritable bowel, and bloating. It is also used in aroma therapy.[18,19] It was suggested that Peppermint may have radioprotective effects in patients undergoing cancer treatment.[20] The aroma of peppermint has been found to enhance memory and alertness [21,22] although other research contests this.[23]

The present study was undertaken with an objective to compare anti diabetic effect of oral administration of cinnamon, Nutmeg and peppermint.

## MATERIALS AND METHODS

*Experimental Animals:* Thirty adult male and female Wistar rats, weighing 150-200g, and 60 days of age were selected for this study. All rats were housed in polypropylene cages (30x22x14cm) and fed with commercial pellet rat chow and water and standard laboratory conditions are maintained with 12 :12 h light : dark cycle with a room temperature of 28±4°C.

***Materials***

Collection and preparation of plant extracts

***Nutmeg Extract***

Nutmeg extract (Sample no: NT-631A) was received as a gift from KANCOR-Ingredients Limited, Ingredient solutions partnership,Oleoresin Manufacturer and pioneers of spice extraction industry, Manufacturing & Export Kancoor Road, Angamaly South, Kerala, India.

Nutmeg extract is prepared by combining 2.5 gms of finely grounded nutmeg with 15 mL of diethyl ether and the mixture is gently heated for 45 minutes. The mixture is filtered and nutmeg residue in the filter paper is washed with ether. Ether is evaporated from the filtrate and product is recrystalized and allowed to dry.

***Cinnamon extract***

Cinnamon extract (Sample No: Cad-202A) was received as a gift from KANCOR-Ingredients Limited, Ingredient solutions partnership, Oleoresin Manufacturer and pioneers of spice extraction industry, Manufacturing & Export Kancoor Road, Angamaly South, Kerala, India. Cinnamon extract is prepared by soaking 50 gm of grinded cinnamon in 150 ml hot water

(88°C) in water bath for 6 h. Then filtered by capron silica cloth and the filtrate were stored in dark bottles in the refrigerator at (4°C).

***Mentha piperita Extraction***

Mentha piperita leaves were washed, weighed (100g/L), and triturated with water in a blender for 7 minutes. The juice was filtered and frozen in an amber flask. Each flask was thawed daily at ambient temperature two hours prior to administration.

***Chemicals and reagents***

***Alloxan***

Alloxan (S D Fine- Chem, India) is used in this study. Alloxan is a urea derivative which causes selective necrosis of the β-cells of pancreatic islets. In addition, it has been widely used to produce experimental diabetes in animals such as rabbits, rats, mice and dogs with different grades of disease severity by varying the dose of alloxan used .[23,24] Diabetes was induced in the rats by injecting alloxan intraperitonially (I.P) in a single dose of 150mg/kg of body weight.

***Experimental design***

Rats were divided into five groups containing six animals each. All animals were fasted eight hours before treatment. Diabetes was induced in the rats by injecting alloxan intraperitonially (I.P) in a single dose of 150mg/kg of body weight and the plant extracts are administered orally.

***Control Group***

Served as normal control and did not receive either alloxan or plant extract.

***Hyperglycemic Group***

Served as diabetic control and received alloxan only.

***Nutmeg Group***

Alloxan + Nutmeg extract

***Peppermint Group***

Alloxan + peppermint extract

***Cinnamon group***

Alloxan + Cinnamon extract

After four hours of administration of alloxan, blood samples are collected from all the groups including control group for blood glucose estimation. This is considered as zero time. Blood glucose was estimated by GOD-PAP method using diagnostic kit supplied by Agappe diagnostics, Maharashtra. Oral administration of Cinnamon extract, Nutmeg extract, peppermint extract to corresponding groups for 3 weeks to treat hyperglycemia.

Blood samples were collected from all the groups at the end of every week for the estimation of blood glucose. Blood glucose levels were compared in all the groups. All the blood samples were collected from the caudal vein using butterfly needle to reduce the infection and hemorrhage.

***Data analysis***

Two Sample t- test, One way ANOVA are used for data analysis.

## RESULTS

Mean blood glucose levels in control group rats (pair = Pair of blood glucose readings) are presented in table no-1. Mean blood glucose levels of alloxan induced rats are presented in table no:2. Single intraperitoneal administration of alloxan 150mg/kg elevated blood glucose level. Mean blood Glucose level of Alloxan induced diabetic rats treated with Cinnamon are presented in table no;3. Cinnamon significantly decreased blood glucose levels. (P value <0.001). Mean blood Glucose level of Alloxan induced diabetic rats treated with Nutmeg are presented in table no;4. Nutmeg significantly decreased blood glucose levels. (P value <0.001). Mean blood Glucose level of Alloxan induced diabetic rats treated with Peppermint are presented in table no;5. Peppermint significantly decreased blood glucose levels. (P value <0.001).

Table 1:- Mean blood glucose levels in control group rats (pair = Pair of blood glucose readings).

| | | Mean blood glucose (mg%) | P value |
|---|---|---|---|
| Pair 1 | Zero time | 88.00±4.77 | .611 |
| | After 1 week | 87.16±6.40 | |
| Pair t 2 | Zero time | 88.00±4.77 | .829 |
| | After 2 week | 88.50±4.84 | |
| Pair 3 | Zero time | 88.00±4.77 | .749 |
| | After 3 week | 88.50±4.84 | |
| Pair 4 | After 1 week | 87.16±6.40 | .629 |
| | After 2 week | 88.50±4.84 | |
| Pair 5 | After 1 week | 87.17±6.40 | .249 |
| | After 3 week | 88.50±4.84 | |
| Pair 6 | After 2 week | 88.50±4.84 | 1.000 |
| | After 3 week | 88.50±4.84 | |

Table 2:- Mean blood glucose levels of alloxan induced rats. (pair = Pair of blood glucose readings).

| | | Mean blood glucose (mg%) | P value |
|---|---|---|---|
| Pair 1 | Zero time | 211.33±6.95 | .163 |
| | After 1 week | 205.83±8.38 | |
| Pair 2 | Zero time | 211.33±6.95 | <0.001 |
| | After 2 week | 173.16±3.43 | |
| Pair 3 | Zero time | 211.33±6.95 | <0.001 |
| | After 3 week | 161.00±5.51 | |
| Pair 4 | After 1 week | 205.83±8.38 | <0.001 |
| | After 2 week | 173.16±3.43 | |
| Pair 5 | After 1 week | 205.83±8.38 | <0.001 |
| | After 3 week | 161.00±5.51 | |
| Pair 6 | After 2 week | 173.16±3.43 | .007 |
| | After 3 week | 161.00±5.51 | |

Table 3:- Mean blood glucose level of alloxan induced diabetic rats treated with Cinnamon (pair = Pair of blood glucose readings).

| | | Mean blood glucose (mg%) | P value |
|---|---|---|---|
| Pair 1 | Zero time | 211.83±5.60 | <0.001 |
| | After 1 week | 176.33±3.01 | |
| Pair 2 | Zero time | 211.83±5.60 | <0.001 |
| | After 2 week | 145.16±3.54 | |
| Pair 3 | Zero time | 211.83±5.60 | <0.001 |
| | After 3 week | 130.33±3.93 | |
| Pair 4 | After 1 week | 176.33±3.01 | <0.001 |
| | After 2 week | 145.16±3.54 | |
| Pair 5 | After 1 week | 176.33±3.01 | <0.001 |
| | After 3 week | 130.33±3.93 | |
| Pair 6 | After 2 week | 145.16±3.54 | <0.001 |
| | After 3 week | 130.33±3.93 | |

Table 4:- Mean blood glucose level of alloxan induced diabetic rats treated with Nutmeg (pair = Pair of blood glucose readings).

| | | Mean blood glucose (mg%) | P value |
|---|---|---|---|
| Pair 1 | Zero time | 209.33±5.08 | <0.001 |
| | After 1 week | 155.00+4.47 | |
| Pair 2 | Zero time | 209.33±5.08 | <0.001 |
| | After 2 week | 128.33±2.58 | |
| Pair 3 | Zero time | 209.33±5.08 | <0.001 |
| | After 3 week | 103.33±3.01 | |
| Pair 4 | After 1 week | 155.00±4.47 | <0.001 |
| | After 2 week | 128.33±2.58 | |
| Pair 5 | After 1 week | 155.00±4.47 | <0.001 |
| | After 3 week | 103.33±3.01 | |
| Pair 6 | After 2 week | 128.33±2.58 | <0.001 |
| | After 3 week | 103.33±3.01 | |

Table 5:- Mean blood glucose levels of alloxan induced diabetic rats treated with Peppermint (pair = Pair of blood glucose readings).

| | | Mean blood glucose (mg%) | P value |
|---|---|---|---|
| Pair 1 | Zero time | 209.16±5.84 | <0.001 |
| | After 1 week | 187.83±5.07 | |
| Pair 2 | Zero time | 209.16±5.84 | <0.001 |
| | After 2 week | 164.00±3.46 | |
| Pair 3 | Zero time | 209.16±5.84 | <0.001 |
| | After 3 week | 138.83±4.21 | |
| Pair 4 | After 1 week | 187.83±5.07 | <0.001 |
| | After 2 week | 164.00±3.46 | |
| Pair 5 | After 1 week | 187.83±5.07 | <0.001 |
| | After 3 week | 138.83±4.21 | |
| Pair 6 | After 2 week | 164.00±3.46 | <0.001 |
| | After 3 week | 138.83±4.21 | |

One way ANOVA is presented in table no: 6. The anti-diabetic effect of Cinnamon, Nutmeg, and peppermint extracts on diabetic rats was significant. The zero time, after 1 week, after 2 week and after 3 week of these five groups compared by using a one way ANOVA indicates a significant difference with p <0.001 is observed between the groups and within groups.

## DISCUSSION

Management of diabetes with the agents devoid of side effects is still a challenge to the medical system. This concern has led to an increased demand for natural products with anti-diabetic activity, having fewer side effects.

It was reported that plant extracts causes anti diabetic effect by promoting regeneration of beta cells or by protecting these cells from

destruction. Plant extracts may activate insulin receptors or affects beta cells to release insulin.[25,26] Administration of cinnamon decreases the sugar level in normal and diabetic rats.[27- 29] Oral administration of pepper mint showed anti diabetic property.[30] Myristica fragrans possesses anti diabetic activity.[31]

**Table 6: One way ANOVA**

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| Zero time | Between Groups | 71965.533 | 4 | 17991.383 | 553.695 | <0.001 |
| | Within Groups | 812.333 | 25 | 32.493 | | |
| | Total | 72777.867 | 29 | | | |
| After 1 week | Between Groups | 50653.533 | 4 | 12663.383 | 381.504 | <0.001 |
| | Within Groups | 829.833 | 25 | 33.193 | | |
| | Total | 51483.367 | 29 | | | |
| After 2 week | Between Groups | 26945.667 | 4 | 6736.417 | 506.497 | <0.001 |
| | Within Groups | 332.500 | 25 | 13.300 | | |
| | Total | 27278.167 | 29 | | | |
| After 3 week | Between Groups | 19894.200 | 4 | 4973.550 | 258.501 | <0.001 |
| | Within Groups | 481.000 | 25 | 19.240 | | |
| | Between Groups | 19894.200 | 4 | 4973.550 | | |
| | Within Groups | 481.000 | 25 | 19.240 | | |
| | Total | 20375.200 | 29 | | | |

The present experimental study provides further evidence that oral administration of Cinnamon, Nutmeg, and peppermint extracts for 21 days produced a significant decrease in the blood glucose level in the model of alloxan induced diabetes in rats. As compared to Cinnamon and Nutmeg extracts, Peppermint extract exhibits weak anti diabetic activity.

## CONCLUSION

From this study, we can conclude that the oral administration of Cinnamon, Nutmeg, and peppermint extracts have beneficial effects on blood glucose levels. However further pharmacological and biochemical investigations will clearly elucidate the mechanism of action and helpful in projecting these plant extracts as a therapeutic target in diabetes research.

## REFERENCES


1. Ripoll, Brian C. Leutholtz, Ignacio. Exercise and disease management (2nd ed.). Boca Raton: CRC Press.2011; p. 25.
2. Shoback, edited by David G. Gardner, Dolores. Greenspan's basic & clinical endocrinology. New York: McGraw-Hill Medical. 2011; 9th edition: pp. Chapter 17.
3. Chaudhary SK. Quintessence of Medical Pharmacology, 2nd edition. Kolkata: New Central Book Agency (P) Ltd; 2001; 707
4. Gray, A.M. and Flatt, P.R. 'Pancreatic and extra-pancreatic effects of the traditional anti-diabetic plant, Medicago sativa(lucerne)', British Journal of Nutrition 1997; Vol. 78, pp.325–334.
5. World Health Organization. Diabetes mellitus: Report of a WHO Study Group. WHO Technical Report Series. 1985; pp. 727.
6. Bailey, C.J. and Day, C. 'Traditional plant medicines as treatment for diabetes',Diabetes Care. 1989; Vol. 12: pp.553–564.
7. Qin, B., Nugasaki, M., Ren, M., Bajotto, G., Oshida, Y. and Sato, Y. (2003) 'Cinnamon extract (traditional herb) potentates in vivo insulin-regulated glucose utilization via enhancing insulin signaling in rats', Diabetes Research and Clinical Practices. 2003; Vol. 62: pp.139–148
8. Khan A, Safdar M, Khan MA, Khattak KN, Anderson RA. Cinnamon improves glucose and lipids of people with type 2

diabetes. Diabetes Care.2003; 26:3215-18.
9. Tatsuya M, keiko J, Hirokazu K, Yasushi A, Hiroyuki S, Takahiro I, Kimio S. Hepatoprotective Effect of Myristicin from Nutmeg (Myristica fragrans) on Lipopolysaccharide/D-Galactosamine- Induced Liver Injury. J. Agric. Food Chem. 2003; 51: 1560−1565.
10. Hyun Sook Kwon, Min Jung Kim, Hyung Jae Jeong, Min Suk Yang, Ki Hun Park, Tae Sook Jeong, Woo Song Lee. Low-density lipoprotein (LDL) antioxidant lignans from Myristica fragrans seeds. Bio organic&Medicinal Chemistry Letters. 2008; 18:194-198.
11. Sharma M, Kumar M. Radioprotection of Swiss albino mice by myristica fragrans houtt. J. Radiat. Res. 2007; 48: 135-141.
12. Parle M, Dhingra D, Kullkarni SK. Improvement of mouse memory by Myristica fragrans seeds. JMed Food, 2004; 7(2): 157-161.
13. Olumayokun Olajide A, Franklin Ajayi F, AmbroseI khelar E,.Olubusayo Awe S, Modupe Makinde J, Akinola Alada AR. Biological Effects of Myristica fragrans (Nutmeg) Extract. Phytother. Res. 1999; 13:344-345.
14. Nandakarni AK, In: Dr. KM Nandakarni's Indian Materia and Medica. Popular prakashan pvt. Ltd., Mumbai. 2002; 3rd edition.: pp 830-834.
15. Grover JK, Khandkar S, Vats V, Dhunnoo Y, Das D. Pharmacological studies on Myristica fragrans--antidiarrheal, hypnotic, analgesic and hemodynamic (blood pressure) parameters. Experimental Clinical Pharmacol. 2002. 24(10); 675-80.
16. Leigh Broadhurst C, Marilyn M. Polansky, Richard A. Anderson. Insulin-like Biological Activity of Culinary and Medicinal Plant Aqueous Extracts in vitro. J. Agric. Food Chem. 2000; 48: 849−852.
17. WHO Monographs on Selected Medicinal Plants: Volume 2. Geneva: World Health Organization. 2002. ISBN 92-4-154537-2. Retrieved October 29, 2010.
18. Harley, R. M. Mentha L. In: Stace, C. A. Hybridization and the flora of the British Isles. 1975; page 387.
19. Heather Boon; Michael Smith, Bob Hilderley. The Complete Natural Medicine Guide to the 50 Most Common Medicinal Herbs. Canada: Robert Rose. 2004; 2nd ed: pp. 227–229.
20. Baliga, M. S.; Rao, S. "Radioprotective potential of mint: A brief review". J Cancer Res Ther.2010; 6 (3): 255–262.
21. Moss, Mark; Hewitt, Steven; Moss, Lucy; Wesnes, Kieth. "Modulation of cognitive performance and mood by aromas of peppermint and ylang-ylang". The International journal of neuroscience. 2008; 118 (1): 59–77.
22. On the scent of a better day at work", New Scientist, 2 March 1991, p. 18
23. Essential oils are not so essential after all", Claire Ainsworth, New Scientist, 21 April 2001, p. 16.
24. Etuk EU. Animals models for studying diabetes mellitus. Agric Biol J N Am 2010;1:130-4.
25. Iranloye BO, Arikawe AP, Rotimi G,Sogbade AO. Anti-diabetic and antioxidant effects of Zingiber Officinale on alloxan-induced and insulin-resistant diabetic male rats. Niger J Physiol Sci. 2011; 26:89-96.
26. Jadhav JK, Masirkar VJ, Deshmukh VN. Antihyperglycemic effect of Diospyros melanoxylon (Roxb.) bark against Alloxan-induced diabetic rats. International Journal of PharmTech Research 2009; 1:196-200.
27. Abdulrahim Al-Jamal, Imad Naji Rasheed. Effects of cinnamon on diabetic rats. African Journal of Food Science Vol. 4(9), pp. 615 - 617, September 2010.

28. Soheir N.Abd El. Rahman, Amal M H Abdul-Haleem, Hessa M AL Mudaffar. Anti diabetic effects of cinnamon power and cinnamon aqueous extract on serum glucose of rats. International Journal of Food, Nutrition and Public Health.2010; Vol. 3, No. 2: 183-197.
29. Joanna Hlebowicz, Gassan Darwiche, Ola Bjorgell, Lars-olof Almer. Effect of cinnamon on postprandial blood glucose, gastric emptying, satiety in healthy subjects. Am J Clin Nutr. 2007; 85(6): 1552-1556.
30. R.S. Somani, A.K. Singhai. Hypoglyceamic and anti diabetic activities of seeds of Myristica Fragrans in normoglyceamic and alloxan-induced diabetic rats. Asian J. Exp. Sci., Vol. 22, No. 1, 2008; 95-102.
31. Sandra M. Barbalho, Débora C. Damasceno, Ana Paula Machado Spada, Vanessa Sellis da SilvaKarla Aparecida Martuchi, Marie Oshiiwa, Flávia M. V. Farinazzi Machado, and Claudemir Gregório Mendes.Metabolic profile of offspring from diabetic Wistar rats treated with mentha piperita. Evid Based Complement Alternat Med. 2011: 430237.

How to cite this article: Sailesh KS, Padmanabha. A comparative study of the anti diabetic effect of oral administration of cinnamon, Nutmeg and peppermint in wistar albino rats. Int J Health Sci Res. 2014;4(2):61-67.

**********