Original Article

The Effect of Nano-Cinnamomum Capsule on Blood Glucose, And Lipid Profile in Type 2 Diabetic Male Rats

Zahida Miran Hussein*
The Environmental Research and Pollution Unit,College of Science,Al-Qadisyah University
Email: zahida16.mh@gmail.com.

Abstract

Objective: High blood sugar caused by problems with insulin secretion, action, or both, or insulin resistance characterizes diabetes mellitus. Cinnamon inhibits NF-B signaling. This study examines Nano-effects Cinnamomum's on diabetic rats' HbA1C, fasting blood sugar, and lipid profile.
Materials and Methods: The experiment fed rats HFD for 4 weeks. After that, they were injected with 35 mg/kg STZ to cause T2DM. After 4 weeks of Se-NPs and MET, synergistic effects on diabetic complications were examined. We ran molecular and biochemical tests on insulin sensitivity, oxidative mediators, and inflammatory markers.
Results: Mean age, BMI, FBG, total cholesterol, triglycerides, LDL, HDL, HbA1c, and sex were the same at the start. Comparing results before and after treatment (p 0.05), the Nano-Cinnamomum group had lower HbA1C, FBG, TG, and BMI.
When values before and after treatment were compared, it was clear that HbA1c, eAG, LDL-C, and BMI had changed (p0.05).
Conclusion: These results show that Nano-Cinnamomum may lower HbA1c in people with type 2 diabetes. It may also partially lower serum LDL-C and BMI.

Keywords: antioxidant enzymes; Nano-Cinnamomum; Fragaria; cholesterol; HbA1c.

Introduction

At the beginning, both groups had the same mean age, BMI, FBG, total cholesterol (TC), triglycerides (TG), LDL, HDL, HbA1c, and sex. When the results of each person before and after treatment were compared (p = 0.05), it was found that HbA1C, FBG, TG, and BMI all went down in the Nano-Cinnamomum group.
When the values for each group before and after treatment were compared, it was clear that HbA1c, eAG, LDL-C, and BMI had changed a lot (p0.05)1. 7.8 percent of the U.S. population, or 23.6 million adults and children, have diabetes. Nearly a quarter (5.7 million) of the approximately 17.9 million people who have been diagnosed with diabetes are unaware that they have the disease. Researchers estimate that over 1.5 million Iranians suffer from diabetes2.

Access this article online

Quick Response Code:

Website: www.pnrjournal.com

DOI: 10.47750/pnr.2022.13.03.107

The serine kinase pathway may be activated by free fatty acid metabolites. Signaling by insulin and action of insulin receptors are both impacted by this pathway (Figure 1)3.
Cinnamomum's The name of this substance is (1E, 6E) -1, 7-bis (4-hydroxy-3-methoxyphenyl) One, Six-Hexadiene -3, 5-dione or di(3-ethylthiophene)methane 3 Cinnamon has anti-inflammatory, anti-cancer, and anti-free radical properties. 4 It can modulate numerous aspects of cellular communication and has no obvious negative effects 5.
One of the major cellular and molecular mechanisms by which inflammation occurs is the Nuclear Factor B (NF-B) signaling pathway.

Address for correspondence: Zahida Miran Hussein, The Environmental Research and Pollution Unit,College of Science,Al-Qadisyah University
E-mail: Zahid16.mh@gmail.com

How to cite this article: Hussein Z M, The Effect of Nano- Cinnamomum Capsule on Blood Glucose, And Lipid Profile In Type 2 Diabetic Male Rats, J Pharm Negative Results 2022;13:709-714.

In order for cells to communicate with one another, cytokines and molecules are secreted. Molecular research shows that cinnamon inhibits the NF-B signaling pathway. This has the potential to alter immune response and cytokine production. Gene activation is inhibited by cinnamon, particularly in the case of cytokines. Reduced C-reactive protein levels may result from cinnamon consumption6.

Asthma, bronchitis, inflammatory bowel disease, rheumatoid arthritis, stabilization of atherosclerosis plaque, diabetes mellitus, obesity, fatty liver, metabolic syndrome, depression, cancer, and allergies are just some of the conditions that respond well to cinnamon7.

8 The risk of developing type 2 diabetes in those with pre-diabetes was reduced when cinnamon was administered to this population, according to the study's authors (T2DM). Cinnamon, Nanoscale. Each soft gel of Nano-Cinnamomum, in the form of nano-micelles, contains 80 milligrams of cinnamon. Cinnamon has a hard time being absorbed by the mouth because it doesn't like water. However, when ingested, nano-cinnamomum is far more effective than ground cinnamon9.

Nano micelle Cinnamomum was compared to a placebo in this study on HbA1C, fasting blood glucose, and lipid profile in diabetics.

Methodology

Design of the study and who took part

Group A received a standard diet and served as the positive control, Group B received STZ intraperitoneally (IP) at a dose of 35 mg/kg, Group C received STZ at the same dose but in the form of nano-micelles (80 mg/day), and Group D received STZ at the same dose but in the form of subcutaneous (SC) insulin (4 international units).

In a randomized, double-blind clinical trial, 18 diabetic rats were randomly assigned to receive either Nano-Cinnamomum (eg, nano-micelle 80 mg/day) or placebo for 30 days.

Inclusion Animals

At the research center, male rats that were 3 months old and kept at a standard temperature of 35–37°C and fed on a standard schedule with good ventilation were used to choose the animals.

Laboratory tests

After an overnight fast, blood samples were taken early in the morning. Blood samples (10 ml) were taken from people who had been fasting for lipid profile and HbA1C. Blood was put into VacutainerTM tubes with fluoride-oxalate to figure out fasting blood glucose 10

The plasma was separated from the blood using a centrifuge (4000 RPM, 4 min). A Cobas auto-analyser system from ABX Diagnostics in Montpellier, France, was used to measure total cholesterol, low density lipoprotein cholesterol, high density ipoprotein, cholesterol, and glucose..11.

Using the criteria of the American Diabetic Association, the results of the fasting blood sugar (FBS) of 110 mg/dl were interpreted as follows: Normal values are between 110 and 126 mg/dl, and values over 126 mg/dl are called impaired fasting glucose (IFG) and diabetes, respectively.12.

Statistical analysis

SPSS for WindowsTM 11.5 was used for all statistical analyses (SPSS Inc., Chicago, IL, USA). To begin, we started by making sure our data was normal using Kolmogorov-Smirnov tests. For normally distributed parameters, we provided the mean and standard deviation; for otherwise irregularly distributed parameters, we provided the median and interquartile range (IQR). Sample T-Test and Mann-Whitney U tests were used to compare the two sets of data (in case of non-normally distributed data). Each side's p-value had to be less than 0.05 for statistical significance.

Results

Age, sex, BMI, smoking history, blood pressure, hypertension, fasting blood glucose, hemoglobin A1c, and estimated average glucose are matched at baseline. Body mass index, fasting blood glucose, hemoglobin A1c, estimated average glucose (eAG), total cholesterol, low density lipoprotein cholesterol, high density lipoprotein cholesterol, and triglyceride were compared between the two groups in Table 2. No discernible statistically significant difference existed between the two groups (Tables 1).

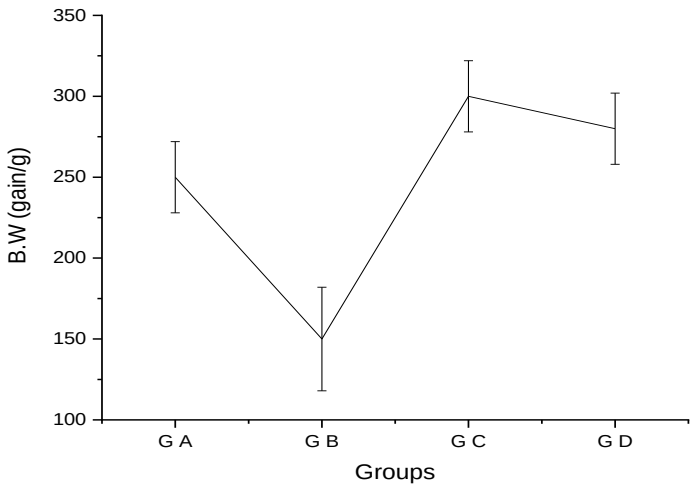

Fig.1: It shows the estimated weight between aggregates, there is a standard variance between group C Nano-Cinnamomum (eg nano-micelle 80 mg / day) and aggregates

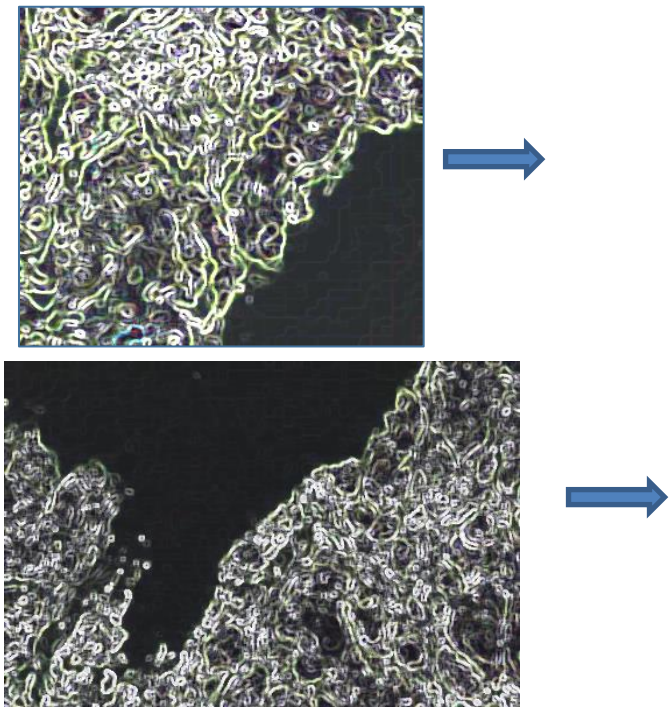

Fig.2 . It shows the pancreatic tissue between groups, there is a standard variance between group C Nano-Cinnamomum (eg nano-micelle 80 mg / day) and aggregates

Table 1. Serum biochemical parameters and some other characteristics of study groups after clinical trial.

Groups	*G A*	*G B*	*G C*	*G D*
FBG(mg/dl)	*145.5±55.83a*	*13.8±41.35 c*	*135.5±61.37 a*	*125.5±44.23 b*
HbA1c (%)	7.69±1.34 a	3.59±1.14 c	7.59±1.74 a	6.59±1.34 a
TC (mg/dl)	65.7±0.4c	12.0±4.6a	54.97±1.55c	24.18±1.23a
LDL (mg/dl)	96.57±33.94 a	19.78±30.33 c	91.04±28.72 b	84.00±12.59 b
HDL (mg/dl)	54.40±14.12 a	10.35±15.96 c	60.95±15.68 b	55.00±11.09 a
BMI (kg/m2)	26.82±2.61 a	17.27±3.59 b	25.57±2.71 a	27.50±3.38 a

Body Mass Index, or BMI, FBG stands for fasting blood sugar, Total cholesterol, or TC, HDL-C stands for high density lipoprotein cholesterol.

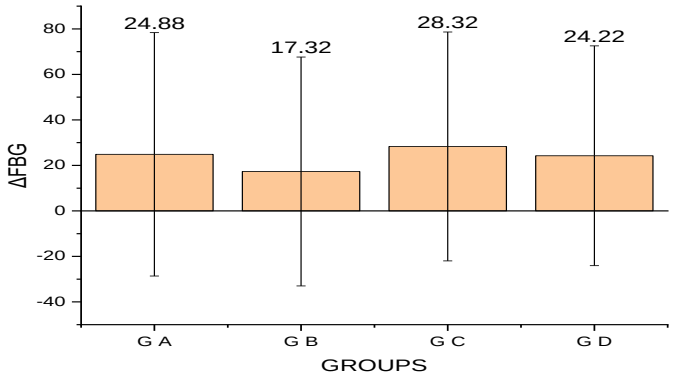

Fig.3: Figure (ΔFBG) how some variables changed Statistical change

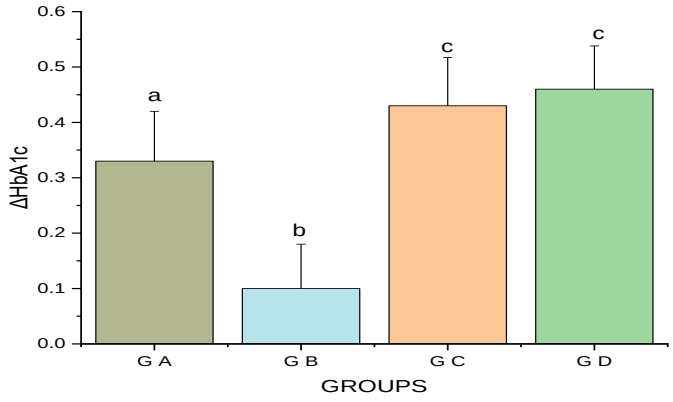

Fig.4: Figure (ΔHbA1) how some variables changed Statistical change

subsequent to the intervention. When compared to a placebo, cinnamon significantly lowers fasting glucose, hemoglobin A1c, body mass index, and eAg, but does not affect HDL, LDL, triglycerides, or total cholesterol (Table 2). fasting blood sugar, hemoglobin a1c, end-arterial glycosylated, triglyceride, total cholesterol, low-density lipoprotein, and high-density lipoprotein levels were compared before and after the intervention. The Cinnamomum treatment group showed statistically significant changes in all of the aforementioned variables between baseline and follow-up (p0.049, p0.001, p0.018, p0.01, p0.014, and p0.001, respectively). Between baseline and endpoint, the placebo group did not show a statistically significant (p0.05) change in fasting blood glucose, hemoglobin A1c, eag, triglycerides, total cholesterol, low-density lipoprotein cholesterol, or high-density lipoprotein cholesterol (Table 1).

Discussion

Due to Cinnamomum's low toxicity, a lot of research has been done on its physicochemical properties and pharmacological effects on diseases like heart disease, diabetes, cancer,

rheumatoid arthritis, Alzheimer's, and inflammatory bowel disease (IBD).13. Cinnamon has been shown to affect enzymes involved in transcription, kinases, growth factors, cytokines, and other cellular processes when they are exposed to it.1415. Other studies have shown that cinnamon can help diabetics. 16.

T2DM is mostly caused by insulin resistance (IR). 16; IR could be broken by cinnamon, it was said (Neerati et al. 2014). Cinnamon could also make PPAR- work more of the time17. PPAR- activity turns off Low-density lipoprotein (LDL) receptors. This could be used to treat high cholesterol. 18.

Cinnamon may help prevent microvascular and macrovascular complications of diabetes mellitus. 19.

Cinnamomum is a polyphenolic compound that has been shown in multiple studies to be poorly absorbed by the body because of the way it is made. Considering that this is a big problem that needs to be fixed 20. It is also not well absorbed by the body, has a fast metabolism, and leaves the body quickly.

SinaCurcumin®, a registered Cinnamomum product, was made into nano-micelles that contain Cinnamomum to make up for the fact that Cinnamomum is not very bioavailable. You can eat or drink these nano-micelles. The GRAS form of curcumin and GRAS pharmaceutical excipients are used to make these nano-micelles (generally recognized as safe). Each of these nano-micelles is about 10 nm in size, and it holds almost all of the cinnamonomum in the sample21. Because of these things, when nano-Cinnamomum is taken by mouth, it is much more bioavailable than Cinnamomum powder. There is a thin layer of water that doesn't move on the surface of intestinal epithelial cells, so it makes sense that drugs could get through this layer22. This is an impossible problem for molecules like curcumin that like to stick to fat. Bile salts help the body absorb water-soluble nutrients like lipophilic vitamins, lipids, fatty acids, and cholesterol23, In the same way, nano-micelles made of cinnamon have the same properties. When Nano-Cinnamomum is taken by mouth, the soft gel dissolves in the stomach and moves through the digestive tract to the small intestine in less than 15 minutes. This product's bioavailability is better than that of competing products.24.

In this randomized, placebo-controlled clinical trial, nano-cinnamomum was shown to lower fasting blood glucose and hemoglobin A1c levels after 3 months of treatment. Also, it has the potential to improve the lipid profile and eAG parameters in a big way. Insulin resistance and Type 2 diabetes are more likely to happen if you are overweight25. In this study, the cinnamonomum helped the body mass index of the diabetic rats. Other research has shown that cinnamon can help diabetics 26.

In most cases, type 2 diabetes can be traced back to insulin resistance (IR). 27; Cinnamon's purported ability to inhibit IR has been widely discussed. 27. Additionally, cinnamon may increase the efficiency of PPAR 28. To lower cholesterol levels, PPAR- activity could be used to inhibit LDL receptors. 29.

Microvascular and macrovascular complications of diabetes mellitus may be averted by cinnamon. 30.

Several analyses of the chemical structure of the polyphenolic compound Cinnamomum have shown that this is a big problem that needs to be fixed. It was also found that obese people could lower their triglyceride levels by taking 1 gram of cinnamon every day for a month..25.

The Framingham Heart Study shows that having a high HbA1c level is a strong predictor of having type 2 diabetes.. 27.

There was also evidence that a small amount of cinnamon helped lower bad cholesterol (LDL-C) and total cholesterol (TC)26. In the Nano-Cinnamomum group, there were statistically significant differences between the levels of TC, TG, LDL-C, and HDL-C in the serum before and after treatment.

Conflict of interest

The authors have nothing to say about a conflict of interest.

Conclusion

These findings point to the possibility that Nano-Cinnamomum can reduce levels of HbA1c in people who have type 2 diabetes. Additionally, it has the potential to reduce serum LDL-C and body mass index.

Compliance with Ethical Standards

Conflicts of interest The authors declare that they have no conflict of interest.

Ethical approval Ethical approval for this research was obtained from the Al-Qadisiyah University Local Committee

REFERENCES

Alwi I, Santoso T, Suyono S, et al. The effect of curcumin on lipid level in patients with acute coronary syndrome. Acta Med Indones. 2008;40(4):201-210.

Anand P, Kunnumakkara AB, Newman RA, Aggarwal BB. Bioavailability of curcumin: problems and promises. Mol Pharm. 2007;4(6):807-818.

Association AD. The prevention or delay of type 2 diabetes. Diabetes Care. 2002;25(4):742-749.

Chainani-Wu N. Safety and anti-inflammatory activity of curcumin: a component of tumeric (Curcuma longa). J Altern Complement Med. 2003;9(1):161-168.

Chuengsamarn S, Rattanamongkolgul S, Luechapudiporn R, Phisalaphong C, Jirawatnotai S. Curcumin extract for prevention of type 2 diabetes. Diabetes Care. 2012;35(11):2121-2127.

Freitas AC de, Pinheiro AL, Miranda P, Thiers FA, Vieira AL. Assessment of anti-inflammatory effect of 830nm laser light using C-reactive protein levels. Braz Dent J. 2001;12(3):187-190.

Gao B, Bataller R. Alcoholic liver disease: pathogenesis and new therapeutic targets. Gastroenterology. 2011;141(5):1572-1585.

Ghorbani Z, Hekmatdoost A, Mirmiran P. Anti-hyperglycemic and insulin sensitizer effects of turmeric and its principle constituent curcumin. Int J Endocrinol Metab. 2014;12(4).

Gupta SC, Patchva S, Aggarwal BB. Therapeutic roles of curcumin: lessons learned from clinical trials. AAPS J. 2013;15(1):195-218.

Hatcher H, Planalp R, Cho J, Torti FM, Torti S V. Curcumin: from ancient medicine to current clinical trials. Cell Mol life Sci. 2008;65(11):1631-1652.

Howles PN. Cholesterol absorption and metabolism. In: Mouse Models for Drug Discovery. Springer; 2010:157-179.

Hsu C-H, Cheng A-L. Clinical studies with curcumin. Mol targets Ther uses curcumin Heal Dis. Published online 2007:471-480.

Kakarala M, Brenner DE, Korkaya H, et al. Targeting breast stem cells with the cancer preventive compounds curcumin and piperine. Breast Cancer Res Treat. 2010;122(3):777-785.

Kang Q, Chen A. Curcumin suppresses expression of low-density lipoprotein (LDL) receptor, leading to the inhibition of LDL-induced activation of hepatic stellate cells. Br J Pharmacol. 2009;157(8):1354-1367.

Kazemi-Bajestani SM, Ghayour-Mobarhan M, Ebrahimi M, Moohebati M, Esmaeili H-A, Ferns GA. C-reactive protein associated with coronary artery disease in Iranian patients with angiographically defined coronary artery disease. Clin Lab. 2007;53(1-2):49-56.

Abolghasemi R, Sedaghat M. The patient's attitude toward type 2 diabetes mellitus, a qualitative study. J Relig Health. 2015;54(4):1191-1205.

Liu J, Chen S, Lv L, Song L, Guo S, Huang S. Recent progress in studying curcumin and its nano-preparations for cancer therapy. Curr Pharm Des. 2013;19(11):1974-1993.

ZIBAEINEZHAD MJ, Ghanbari P, Shahryari B, AGHA SK. C-Reactive Protein in Angiographically Documented Stable Coronary Disease. Published online 2009.

Mohammadi A, Sahebkar A, Iranshahi M, et al. Effects of supplementation with curcuminoids on dyslipidemia in obese patients: a randomized crossover trial. Phyther Res. 2013;27(3):374-379.

Muthenna P, Suryanarayana P, Gunda SK, Petrash JM, Reddy GB. Inhibition of aldose reductase by dietary antioxidant curcumin: mechanism of inhibition, specificity and significance. FEBS Lett. 2009;583(22):3637-3642.

Hermansen K, Kipnes M, Luo E, et al. Efficacy and safety of the dipeptidyl peptidase-4 inhibitor, sitagliptin, in patients with type 2 diabetes mellitus inadequately controlled on glimepiride alone or on glimepiride and metformin. Diabetes, Obes Metab. 2007;9(5):733-745.

Neerati P, Devde R, Gangi AK. Evaluation of the effect of curcumin capsules on glyburide therapy in patients with type-2 diabetes mellitus. Phyther Res. 2014;28(12):1796-1800.

Nishiyama T, Mae T, Kishida H, et al. Curcuminoids and sesquiterpenoids in turmeric (Curcuma longa L.) suppress an increase in blood glucose level in type 2 diabetic KK-Ay mice. J Agric Food Chem. 2005;53(4):959-963.

Ko TC. Identification of High-Risk Subjects for Type 2 Diabetes Mellitus: Studies on Risk Factors Associated with the Development of Diabetes in Hong Kong Chinese. The Chinese University of Hong Kong (Hong Kong); 2005.

Pettitt DJ, Talton J, Dabelea D, et al. Prevalence of diabetes in US youth in 2009: the SEARCH for diabetes in youth study. Diabetes Care. 2014;37(2):402-408.

Rahimi HR, Jaafari MR, Mohammadpour AH, et al. Curcumin: reintroduced therapeutic agent from traditional medicine for alcoholic liver disease. Asia Pacific J Med Toxicol. 2015;4(1):25-30.

Rahimi HR, Kazemi Oskuee R. Curcumin from traditional Iranian medicine to molecular medicine. Razavi Int J Med. 2014;2(2):e19982.

Saini V. Molecular mechanisms of insulin resistance in type 2 diabetes mellitus. World J Diabetes. 2010;1(3):68.

Sandur SK. Pandey MK, Sung B, Ahn KS, Murakami A, Sethi G, Limtrakul P, Badmaev V, Aggarwal BB. Curcumin, demethoxycurcumin, bisdemethoxycurcumin, tetrahydrocurcumin turmerones Differ Regul Anti-inflamm anti-proliferative responses through a ROS-independent Mech Carcinog. 2007;28:1765-1773.

Santel T, Pflug G, Hemdan NYA, et al. Curcumin inhibits glyoxalase 1—a possible link to its anti-inflammatory and anti-tumor activity. PLoS One. 2008;3(10):e3508.