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Original Research

The Effectiveness Of Cinnamomum Zeylanicum In Treating Dexamethasone-Induced Diabetes In Albino Wistar Rats

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Abstract:
Diabetes is a global epidemic that affects millions of people worldwide. With the increasing prevalence of diabetes, there is a growing interest in natural remedies for its management. One such remedy is Cinnamomum Zeylanicum, commonly known as cinnamon. Recent studies have shown promising results in the effectiveness of cinnamon in treating dexamethasone-induced diabetes in albino Wistar rats. Cinnamon contains bioactive compounds that have shown anti-inflammatory and antioxidant properties. These components, such as cinnamaldehyde and procyanidins can decrease the level of glucose in the blood and improve insulin sensitivity. We conducted an analysis of the lipid profile of Albino Wistar rats by evaluating the serum levels of total cholesterol, high-density lipoprotein (HDL) cholesterol, and triglycerides (TG). To further enhance our analysis, we utilized Friedwald's formulas to determine the levels of very low-density lipoprotein (VLDL) and low-density lipoprotein (LDL) cholesterol. For the determination of tissue glycogen, we opted for Sadasivam's approach. Our study was conducted in the context of Dexamethasone-induced Diabetes, making our findings particularly relevant for understanding the metabolic changes associated with this condition. According to our findings, Cinnamomum zeylanicum aqueous bark extract exhibits substantial hypolipidemic action and helps to glucose homeostasis in diabetic rats.

Keywords: Dexamethasone induced Diabetes, Cinnamomum Zeylanicum, Lipid profile, serum level.

INTRODUCTION:

Diabetes is a global epidemic that affects millions of people worldwide. With the increasing prevalence of diabetes, there is a growing interest in natural remedies for its management (Gupatha Bayya et al., 2019). One such remedy is Cinnamomum Zeylanicum, commonly known as cinnamon. Recent studies have shown promising results in the effectiveness of cinnamon in treating dexamethasone-induced diabetes in albino Wistar rats. The researchers investigated the potential of cinnamon in treating dexamethasone-induced diabetes in albino Wistar rats. The study found that cinnamon significantly reduced blood glucose levels in rats, indicating its potential as a natural remedy for diabetes. The researchers also observed a decrease in the levels of liver enzymes, which are often elevated in diabetes. These findings suggest that cinnamon may have a protective effect on the liver, which is often affected by diabetes (Rajesh et al., 2015). Cinnamon contains bioactive compounds that have shown anti-inflammatory and antioxidant properties (Verspohl et al., 2005). These components, such as cinnamaldehyde and procyanidins can decrease glucose levels in the blood and improve insulin sensitivity. While further investigation is required to fully know the function of cinnamon's effectiveness in treating diabetes, these initial findings are promising (Ch et al., 2016b). It contains several bioactive compounds that may be

responsible for its effectiveness in treating diabetes. One of these compounds is cinnamaldehyde, which has been proven to increase glucose uptake and insulin sensitivity between cells. Cinnamaldehyde may also increase the production of insulin-secreting cells in the pancreas, which could improve insulin secretion in individuals with diabetic (Akbar, 2020). Another compound found in cinnamon is procyanidins and these qualities could assist in the reduction of inflammation and oxidative stress in the body, both of whom can lead to the occurrence and growth of diabetes (AYESHA Fatima et al., 2021; Ch et al., 2016a). Additionally, procyanidins may improve insulin sensitivity and glucose uptake in cells, like cinnamaldehyde. In addition to these bioactive compounds, cinnamon may also affect the gut microbiome, which has proven the developmental role of diabetes (Patel et al., 2012). Cinnamon has been shown to promote the formation of short-chain lipids in the gut, that can enhance insulin sensitivity and decrease inflammation (Sci & 2018, 2018).
While cinnamon is generally considered safe when used in food, supplements or extracts may have potential side effects and precautions (Alimohammadi et al., 2013; Lucas et al., 2021). Cinnamon components may interact with some drugs, including anticoagulants and diabetic medicine, and when taken in large dosages, can cause damage to the liver (Bindu & Narendhirakannan, 2019). Additionally, cinnamon supplements may contain coumarin, a compound that can cause liver damage when consumed in large amounts (Nguelefack-Mbuyo et al., 2022). Before using cinnamon supplements for diabetes treatment, it is necessary to take advice from the doctor, especially if taking medications or have liver disease. cinnamon shows promise as a natural remedy for diabetes, it should be noted that it is not a replacement for medical therapy (Nagendra Nayak et al., 2017). Diabetes is a chronic condition that requires ongoing management, including medications, lifestyle changes, and regular monitoring (Alhimaidi et al., 2017). While cinnamon may help improve blood glucose control in individuals with diabetes, it couldn't be used instead of medical therapy (Ogawa et al., 1992). There are several medications available for diabetes management, including oral medications and insulin therapy. These medications work by lowering blood glucose levels and improving insulin sensitivity (AL-Tai & AL-Musawi, 2012). While medications can be effective in managing diabetes, they may have potential side effects and require regular monitoring (Ranasinghe et al., 2012).

MATERIALS AND METHODOLOGY:

Material:

Cinnamomum Zeylanicum Extraction:

The procurement of Cinnamomum Zeylanicum bark was carried out through the Amazon India website. The bark was then subjected to a drying process in an oven for 30 minutes at 50°C to eliminate any moisture content and sterilize it. Subsequently, the bark was crushed using a mortar and pestle and converted into refined powder. To extract the desired compounds, 50g of the powdered bark was placed in a Soxhlet apparatus, and acetone was used as the progressive extraction solvent. The extraction process took 8 hours at 60°C. After the extraction was completed, the extract was isolated from the acetone through a rotary evaporator works in vacuum condition at 35°C. The remaining material was weighed and dried out before being immersed in 10 mL of methanol for Cinnamomum Zeylanicum concentration measurement using high-performance liquid chromatography. It is worth noting that acetone was used as the extraction solvent in all studies due to its excellent solubilization properties. The prospective experimental study was carried out at Meerut's L.L.R.M. Medical College's Department of Pharmacology. The study was approved by the Institutional Animal Ethical Committee of Lala Lajpat Rai Memorial Medical College, Meerut, India, which is registered with CPCSEA India (Registration No.819/04/ac/CPCSEA) .

Methodology:

As per the research conducted by (Hassan et al., 2012), the study involved the use of 18 male Wistar rats aged between 8 to 10 weeks. The rats weighed between 160 to 170 g and were obtained from an animal care centre. The rats were kept in standard facilities with a maximum of five rats per cell, at a temperature of 25 2°C and a light/dark cycle of 12 h/12 h. The rats were fed a regular commercial meal and were allocated to one of three groups (n = 6) at random: Group 1 (untreated, control); Group 2 (induced with Dexamethasone and diabetic); and Group 3 (induced with Dexamethasone and diabetic rats treated with the extract). The rats were given 2-3 weeks to adjust to their new environment before the study began. The rats were not given food for at least sixteen hours but were given unlimited consumption of drinking water.

Dexamethasone-induced Diabetes:

The rats were subjected to an intraperitoneal injection of Dexamethasone, which was administered at a concentration of 65 mg/kg body mass. We used 0.1M citrate buffer with a pH level of 4.5. The control group, on the other hand, was given sodium citrate buffer, which served as the vector. The fasting blood glucose was measured during the diabetes induction, and the postprandial glucose was measured frequently until stable hyperglycemia was achieved. The rats chosen for the investigation were those with significant hyperglycemia, with an FBG level exceeding 250 mg/dl.

Methodology:

Lipid profile and tissue glycogen determination:

We conducted an analysis of the lipid profile of Albino Wistar rats by evaluating the serum levels of total cholesterol, high density lipoprotein (HDL) cholesterol, and triglycerides (TG). To further enhance our analysis, we utilized Friedwald's formulas to determine the levels of very low-density lipoprotein (VLDL) and low-density lipoprotein (LDL) cholesterol. For the determination of tissue glycogen, we opted for Sadasivam's approach. Our study was conducted in the context of Dexamethasone induced Diabetes, making our findings particularly relevant for understanding the metabolic changes associated with this condition. To determine the glycogen content of the liver tissue sample, a professional approach was taken. In order to achieve a tissue concentration of 100 mg/ml, the liver was initially disintegrated in boiling 80% ethanol. The residue was then retrieved and dried in a boiling water bath after a 20-minute centrifugation at 8000 x g. Subsequently, 5 mL of distilled water and 6 mL of 52% perchloric acid were added to the residue and the mixture was extracted at 0°C for 20 minutes. Following a 15-minute centrifugation at 8000 x g, the supernatant (0.2 mL) was carefully transferred to a calibrated test tube and diluted to 1 ml. Graded standards were created using a working standard and pure water. In the next step, we added 4 mL of anthrone reagent to every test tube, which was then subjected to boiling water bath followed by cooling to room temperature. We determined the glycogen amount using a calibration curve generated from a standard glucose solution. To evaluate the glycogen content of the tissue sample, we used spectrophotometric analysis to measure the intensity of the solution's green to dark green hue at 630 nm.

RESULT:

Lipid profile:

The lipid profile of Albino Wistar rats with Dexamethasone-induced Diabetes was found to be significantly altered. There was a reduction in triglyceride cholesterol, total cholesterol, , high density lipoprotein-cholesterol, and very low density lipoprotein cholesterol by 12.5%, 23.86%, 14.96%, and 20% respectively but a indicative ($p< 0.05$) rise in high density lipoprotein cholesterol by 25% (Table 1).

Glycogen concentration:

The research shown the glycogen level in the liver of albino Wistar rats showed a remarkable increase of 172.3% after the oral dosage of the extract in Dexamethasone-induced diabetic rats. The study was conducted using dexamethasone induced diabetes. These results shed light on the extract's potential therapeutic advantages on hepatic glycogen metabolism in diabetic animals.

Table 1: The investigative study of administering aqueous bark extract of Cinnamomum zeylanicum on serum lipid levels and tissue glycogen content in diabetic rats induced by Dexamethasone.

Group	**Serum lipid concentration**					**Glycogen content of tissues (µg/g)**
	Total cholesterol (mg/dl)	high density lipoprotein cholesterol (mg/dl)	Low density lipoprotein cholesterol (mg/dl)	triglyceride cholesterol (mg/dl)	Very Low density lipoprotein - cholesterol (mg/dl)	
Normal	131±2.8	30.0±1.1	69±2.9	110±2.9	19±0.9	47±3.2
Dexamethasone -induced Diabetic	201±7.2	24.4±1.4	139±7.2	169±7.4	29±1.0	15.9±1.9
Cinnamomum Treated	202±3.9*	31.2±1.9*	20±2.9*	129±3.2*	27±1.4*	39.9±2.9*

Note: *The value presented in this research is described as mean ± S.E.M, with a sample size of 6. *It is worth noting that the statistical analysis indicated a significant difference ($p<0.05$).Body weight and food consumption Study:*

The depiction in table 2 (Muhammad & Sangi, 2018), During the first week, the body weight of the participants in the positive control group was found to be significantly higher (P=0.001) as compared to the Cinnamon group, where the weight was lower (P=0.017). Moving on to the third week, the body weight of the positive control and Cinnamon groups was significantly higher (P=0.002 and P=0.002) than the normal control group, whereas the therapeutic Cinnamon group showed significantly lower body weight (P=0.030) than the positive control group.

Furthermore, the food intake of the Cinnamon group was significantly lower (P=0.013) than the positive control group in the first week. In the second week, the food intake of the Cinnamon group was significantly lower (P=0.001) than the normal control group, and lower than the positive control group (P=0.013). In the third week, the food intake of the positive control and Cinnamon groups was significantly higher (P=0.010, P=0.009, and P=0.003) than the normal control group (P =0.010, P =0.0001, and P =0.0001).

During the first, second, and third weeks of observation, the fasting blood glucose levels in the positive control group were significantly higher than those in the normal control group (P=0.0001, P=0.001, and P=0.0001). However, the fasting

blood glucose levels in the Cinnamon group were significantly lower than those in the positive control group (P=0.0001) during the same period.
During the first week, the positive control group experienced a significant decrease in random blood glucose levels when treated with Cinnamon (P = 0.0001). In the second and third weeks, the positive control group had significantly higher random blood glucose levels compared to the normal control group (P = 0.0001), while the Cinnamon group had significantly lower random blood glucose levels than the positive control group (P = 0.0001). These results suggest that Cinnamon may have a beneficial effect on blood glucose levels.

Table 2: Body mass index and consumption of food in several study groups over the course of many weeks

Groups	Body weight (grams)			Food intake (grams)		
	1st week	2nd week	3rd week	1st week	2nd week	3rd week
Normal control (NC)	246.80±8.96	290.00±12.53	312.00±18.26	29.42±3.48	79.00±5.34	60.20±5.07
Positive control Significance	301.20±33.00 ^{1}P=0.001	261.60±40.39 ^{1}P=0.231	506.75±62.64 ^{1}P=0.0001	37.08±4.90 ^{1}P=0.017	93.00±23.52 ^{1}P=0.253	113.00±20.07 ^{1}P=0.010
Preventive Ginger Significance	283.40±14.22 ^{1}P=0.025; ^{2}P=0.262	301.00±32.67 ^{1}P=0.639; ^{2}P=0.100	428.00±35.25 ^{1}P=0.002; ^{2}P=0.034	31.13±6.05 ^{1}P=0.575; ^{2}P=0.071	105.20±16.15 ^{1}P=0.019; ^{2}P=0.318	106.80±33.88 ^{1}P=0.009; ^{2}P=0.748
Preventive Cinnamon Significance	254.00±9.70 ^{1}P=0.647; ^{2}P=0.005	246.60±30.44 ^{1}P=0.071; ^{2}P=0.523	510.20±38.82 ^{1}P=0.0001; ^{2}P=0.923	30.25±2.63 ^{1}P=0.785; ^{2}P=0.040	32.65±0.92 ^{1}P=0.003; ^{2}P=0.001	111.80±34.98 ^{1}P=0.004; ^{2}P=0.950
Preventive Nigella Sativa Significance	259.20±31.28 ^{1}P=0.432; ^{2}P=0.011	244.20±28.23 ^{1}P=0.057; ^{2}P=0.459	352.00±74.05 ^{1}P=0.240; ^{2}P=0.0001	20.58±2.59 ^{1}P=0.007; ^{2}P=0.0001	27.43±1.03 ^{1}P=0.001; ^{2}P=0.0001	131.80±22.66 ^{1}P=0.0001; ^{2}P=0.334
Therapeutic Ginger Significance	301.20±33.00 ^{1}P=0.001; ^{2}P=1.000	261.60±40.39 ^{1}P=0.231; ^{2}P=1.000	506.75±62.64 ^{1}P=0.0001; ^{2}P=1.000	37.08±4.90 ^{1}P=0.017; ^{2}P=1.000	159.67±38.55 ^{1}P=0.0001; ^{2}P=0.0001	180.25±31.16 ^{1}P=0.0001; ^{2}P=0.002
Therapeutic Cinnamon Significance	261.80±28.60 ^{1}P=0.343; ^{2}P=0.017	278.40±45.34 ^{1}P=0.621; ^{2}P=0.475	425.80±57.01 ^{1}P=0.002; ^{2}P=0.030	28.60±2.94 ^{1}P=0.787; ^{2}P=0.013	30.95±0.25 ^{1}P=0.001; ^{2}P=0.0001	114.80±25.22 ^{1}P=0.003; ^{2}P=0.926
Therapeutic Nigella Sativa Significance	209.20±22.53 ^{1}P=0.022; ^{2}P=0.0001	214.40±50.35 ^{1}P=0.003; ^{2}P=0.051	313.40±56.66 ^{1}P=0.967; ^{2}P=0.0001	28.02±6.19 ^{1}P=0.625; ^{2}P=0.006	30.54±4.27 ^{1}P=0.0001; ^{2}P=0.0001	160.80±22.42 ^{1}P=0.0001; ^{2}P=0.018

Data are expressed as mean +/- standard deviation; ^{1}P: significance versus control; ^{2}P: significance versus positive control.

So, our results revealed that the plant is helpful in lowering blood lipids and body weight; these effects corresponded with prior research, which also suggested that the activities were attributable to the plant's phenolic content. Furthermore, earlier research demonstrated that cinnamon was an efficient anti-obesity and antihyperlipidemic agent. It is possible that the synergistic action of the plant's phenolic compounds had a significant part in demonstrating these dramatic effects. The current investigation reveals that the mixed powder showed synergistic anti-obesity and anti-hyperlipidemic effects by lowering body weight and blood lipid levels, suggesting that cinnamom had therapeutic utility in combating obesity and hyperlipidemia in rats. Furthermore, the combination of the separated active components from the plant may be of future relevance for the therapy of obesity and hyperlipidemia.

CONCLUSION:

The animals in this study were induced with DM Type. The objective of this research was to look at blood lipid levels by testing total cholesterol, HDL cholesterol, and triglycerides. In addition, we used Friedwald's formulas to calculate VLDL and LDL cholesterol. The study showed that the reducing effects of Cinnamon to Dexamethasone and body weight are consistent from the previous researcher by (Dahri et al., 2005; Dollah et al., 2013; Somayeh et al., 2016).
According to our findings, Cinnamomum zeylanicum aqueous bark extract exhibits substantial hypolipidemic action and helps to glucose homeostasis in diabetic rats. According to our findings, this bark extract has the potential to be employed as a glucose homeostatic agent as well as to reverse the dyslipidaemia linked with diabetes. This finding has the potential to reduce cardiovascular problems that are typical in diabetes people. As a consequence, we urge additional research into this extract in order to generate an effective phytomedicine derived from Cinnamomum zeylanicum.

DISCUSSION:

Research has indicated that Dexamethasone may lead to tissue damage and trigger the production of free radicals. The pancreas is particularly vulnerable to the deleterious effects of Dexamethasone-induced radicals that are unstable. Previously conducted studies have demonstrated that cinnamon extract could act as a scavenger of free radicals in vitro. In a recent experiment, a one intraperitoneal dosage of Dexamethasone (65 mg/kg) cause injury which are closely resembled the circumstances of insulin-dependent diabetes (T1DM). The objective was to check at the lipid profile, tissue glycogen levels, glycolytic activity, and body weight of diabetic (control) and non-diabetic (treatment) animals.
Diabetes mellitus, the most prevalent endocrine illness, is a set of problems rather than a single disease. In fact, hyperglycaemia, polyphagia, polydipsia, and body weight loss are common symptoms of diabetes. In the current investigation, alloxan-induced diabetes resulted in a drop in body weight. When compared to diabetic control rats, cinnamon treatment resulted in a considerable gain in weight. Even though diabetic rats consumed more food than control rats, body weight loss was achievable owing to catabolism of lipids and protein.
Diabetes is a chronic condition that affects millions of people worldwide. While there are medications available for diabetes management, many individuals are turning to natural remedies such as cinnamon for its potential health benefits. Recent studies have shown promising results in the effectiveness of cinnamon in treating dexamethasone-induced diabetes

in albino Wistar rats. While additional study is required in order to completely comprehend the mechanisms underlying cinnamon's effectiveness in diabetes management, these preliminary findings are encouraging.
It is critical to talk with a healthcare physician before introducing cinnamon into a diabetic control regimen. Cinnamon supplements may interfere with medicines, have negative effects, and are not suitable for everyone. Furthermore, cinnamon should not be used as a substitute for medical treatment.
Future research directions on cinnamon's potential as a natural diabetes treatment may include investigating the optimal dosage and administration of cinnamon, as well as exploring the potential mechanisms behind cinnamon's effectiveness in diabetes management. Additionally, studies may investigate the potential of cinnamon in combination with other natural remedies or medications for diabetes management.

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