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Research Article

Comparison of the Efficacy of Cinnamon Capsule over Cinnamon Infusion on Type 2 Diabetes Mellitus Subjects

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Abstract

Background and Objectives: Functional foods are commonly ingested orally. For efficient bioavailability, a product must be in a form that is easily digestible and thus able to enter the blood stream rapidly. The objective of the study was to compare the effectiveness of *Cinnamomum zeylanicum* infusion and *Cinnamomum zeylanicum* capsules on blood plasma level of type 2 diabetes mellitus subjects.

Materials and Methods: One gram of *Cinnamomum zeylanicum* capsule and 75 mL of infusion were supplemented to 60 subjects with type 2 diabetes mellitus. The effectiveness of the supplements were investigated on serum blood glucose levels after a period of 45 days. The blood parameters assessed were fasting blood glucose, postprandial blood glucose, serum insulin and serum fructosamine. **Results:** Results indicated that there was no significant difference between the capsule ingested group and infusion ingested group indicating that consumption of both forms of cinnamon had the same effect. **Conclusion:** Hence, it was concluded that cinnamon powder when consumed regularly at effective levels has a good impact on blood glucose levels of type 2 diabetes subjects.

Key words: Cinnamon, infusion, capsule, blood glucose, type 2 diabetes, significant, fasting

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

India has been hailed as the diabetes capital of the world and has the greatest number of diabetes patients followed by China and the United States. There is an alarming increase in the number of people detected with diabetes and might result in debilitating complications. Incidence of diabetes is found to be less in rural populations than that of urban population in South Asian countries. In addition to the burden of living with diabetes, the disorder also leads to high rates of morbidity and mortality¹.

Diabetes is a result of rapid urbanization and life style changes in genetically predisposed individuals. The rapid change from traditional way of life to modernized life, energy scarcity to energy abundance, active lifestyle to sedentary lifestyle is occurring in reckless rates. All these factors severely affect insulin resistance leading to early onset of diabetes among the young population. Health systems, battling with the epidemic of diabetes are poorly equipped to handle it. Prevention seems to be the main concern at this moment due to the devastating health impact of this metabolic disease².

Although, contemporary diabetic drugs treat the condition effectively, prolonged usage leads to adverse effects. Interest towards the use of complementary and alternative medicine in controlling diabetes is escalating among the consumers owing to the side effects of modern diabetes drugs. Thus, traditional medicines are gaining worldwide recognition at present. Attempts have been made towards innovating bioactive compounds from plants that are rich in antidiabetic phyto-constituents consuming functional foods as isolated compounds, in the form of tablet or capsule, gives identical health benefits to those observed with the food from which they come³.

As per the ancient adage "spice chest is your pharmacy", the concept of spices being our medicine is acknowledged from historical times, their flavour and properties make them important for culinary and medicinal uses⁴. Cinnamon is used for diverse medicinal therapies such as; stimulants, carminatives, anti-inflammatory, stomachic, antibiotics, digestives, astringents, anthelmintics, expectorants and tonics^{5,6}. Health benefiting property associated with the consumption of cinnamon could be attributed to its polyphenolic constituent. The main polyphenolic compound in cinnamon is a complex polymer proanthocyanidins⁷.

Cinnamon bark powder is used in numerous forms such as; infusions, decoctions, macerations, tinctures, fluid extracts, teas, juices, syrups, poultices, oils, ointments capsules and powders⁸. Numerous factors may explain the differences in outcomes of capsules versus infusions including pharmacokinetic differences, as the rate of absorption plays an

important role inefficacy. The body does not need to break down a liquid extract, allowing more of the medicinal properties to be absorbed into the system. This makes an extract much more powerful than a capsule or tablet. The body uses 98% of our liquid extracts. Capsules or tablets can take from 20-30 min just to break down, before the body can even start to assimilate them. The body only utilizes approximately 39-53% of capsules or tablets⁹. With this background, the objective of the study has been framed as to compare the effectiveness of cinnamon capsule over cinnamon infusion on type 2 diabetes subjects.

MATERIALS AND METHODS

Study area: The study was carried out in five diabetes speciality hospital in Chennai, India, from January, 2015-December, 2017. The study protocol was reviewed and approved by the Independent Institutional Ethics Committee of Women's Christian College, Chennai (Ethical clearance No. WCC/HSC/11EC-2014:02).

Research procedure: For the supplementation intervention, 'within-subjects design' was employed. Within-subjects design¹⁰ intends that the same subject is measured multiple times under different conditions. Statistical power analysis was used to estimate sample size. Total 60 type 2 diabetes mellitus subjects participated in a 15-week study that consisted of 3 parts. According to within subject's design, subjects were assessed at three different periods of time, 15 days of base line study followed by 45 days of control phase and supplementation period consisted of the next 45 days. Thirty subjects selected at random, received 1 g of dried aqueous extract of *Cinnamomum zeylanicum* (AECZ) capsule while the other 30 subjects received 75 mL of infusion containing 1 g of AECZ¹¹. About 5 mL of venous blood was drawn and analyzed for fasting blood glucose level, serum fructosamine, fasting serum insulin and post-prandial levels.

Statistical analysis: Data analysis was done by using latest SPSS version. The t-test was used to find the significance of capsule over infusion.

RESULTS AND DISCUSSION

Functional foods are commonly ingested orally. For efficient bioavailability, a product must be in a form that is easily digestible and thus able to enter the blood stream rapidly. Infusions are more easily absorbed than those given in capsule form.

Table 1: Comparison of mean plasma glucose levels between test groups after supplementation

Blood parameters	Study group	n	Mean	Standard deviation	Mean difference \pm SD	t-value	p-value
Fasting plasma glucose (mg dL ⁻¹)	Test 1	30	-36.93	23.88	-7.83 \pm 4.96	-1.57	0.121 ^{NS}
	Test 2	30	-29.10	12.85			
Postprandial glucose (mg dL ⁻¹)	Test 1	30	-49.13	32.88	-7.80 \pm 7.58	-1.02	0.308 ^{NS}
	Test 2	30	-41.33	24.94			
Fructosamine (mmol L ⁻¹)	Test 1	30	-53.86	136.68	-21.79 \pm 31.12	-0.70	0.487 ^{NS}
	Test 2	30	-32.06	100.23			
Insulin (IU mL ⁻¹)	Test 1	30	1.81	3.28	2.66 \pm 1.83	1.45	0.151 ^{NS}
	Test 2	30	-0.85	9.32			

*Significant at 5%, NS: Not significant

Hence in our present study, the efficacy of capsule and infusion were analyzed after 45 days supplementation between test group I and II, by investigating the metabolic parameters.

A study on the impact of cooking on a number of common culinary herbs and spices, namely *Cinnamomum zeylanicum*, cloves, fennel, ginger, parsley, rosemary, sage and thyme at amounts used in the preparation of food (0.2-1 g) was done¹². Moist heating methods like boiling, microwaving, simmering and stewing increased the antioxidant capacity as a result of heat releasing the antioxidant compounds. In contrast, dry heating techniques like grilling and frying, resulted in a decrease in antioxidant capacity, which was associated with browning and thus may be indicative of the Maillard reaction.

The independent samples t-test results for blood sugar of the test group I and II on 105th day is represented in the Table 1.

Table 1 indicated that there is no significant difference in the glycemic profile between the metabolic profile of *Cinnamomum zeylanicum* capsule and infusion supplemented group. When the results of fasting plasma glucose were compared between test group I and II, p-value was found to be 0.121. Similarly, when the results of postprandial blood glucose were compared, p-value was observed to be 0.308. The serum fructosamine level between the two groups indicated the p-value as 0.486 and for serum insulin levels, p-value was found to be 0.151. It is evident that there is no significant difference between plasma glucose levels of test group I and II after the supplementation of *Cinnamomum zeylanicum* as capsule and infusion indicated that consumption of both the capsule and infusion had the same effect. Ingestion of cinnamon either as aqueous extract or cinnamon powder improves fasting and postprandial glucose level. Doubly linked polyphenol type-A polymers were identified as one of the possible bioactive compounds responsible for this effect¹³.

Cinnamon tea administration (6 g in 100 mL water) reduced plasma glucose level after oral glucose tolerance test. The beneficial effects of this spice on glycaemia were reported after cinnamon powder ingestion where a significant reduction after 30 min of oral glucose tolerance test was observed¹⁴.

Different molecular mechanisms have been suggested for the hypoglycaemic properties of this spice including reducing gastric emptying, insulin-mimetic action, which can lead to cellular glucose uptake and reducing intestinal glycosidase activity. This effect on enzyme decreased breakdown of disaccharides into glucose, allowing a slow absorption of glucose and reducing blood glucose level¹⁵.

In addition to the positive effects of cinnamon on blood glucose regulation, there are studies that supported the beneficial effects of cinnamon on hyperlipidemia. Insulin is very effective in the regulation of lipoprotein in cholesterol metabolism. Cinnamon reduces the level of cholesterol by increasing body metabolism and burning of cholesterol deposited in the blood vessels. Proanthocyanidins increase the catabolism of triglycerides¹⁶.

CONCLUSION

It can be concluded that both the capsule and infusion had the same effect on blood glucose parameters which might be due to the following reasons. Compliance to capsule supplementation would be better than infusion as infusion involves preparation time and may have an unpleasant taste. Capsules are easy to swallow, comfortable to carry and subjects can stick to daily dosage even during travel. The exact dose can be consumed effortlessly. Studies have also shown that liquid extracts have faster absorption rates, higher optimization rates and is more easily digestible. Liquids may have a big advantage over pills when it comes to swallowing. Most of the people, especially the elderly and young children, tend to have more difficulty swallowing capsules.

SIGNIFICANCE STATEMENT

The study that *Cinnamomum zeylanicum* powder when consumed at regular intervals at effective levels can have a significant effect on the blood glucose level of type 2 diabetes subjects irrespective of the mode of administration, as each mode of administration has its own pros and cons. This study will help the researchers to uncover the method by which cinnamon powder can be ingested for treating diabetes. Thus, a new theory on cinnamon powder ingestion may be arrived at.

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