Comparative study on the efficacy of *Cinnamomum zeylanicum* capsule and infusion on serum cholesterol level of subjects with type 2 diabetes

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RESEARCH ARTICLE

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ABSTRACT

There are health claims that liquid forms are better absorbed and they function rapidly than capsules, as the body need not break down a liquid extract, allowing more of the medicinal properties to be absorbed into the system. The present study was carried out to find the efficacy of cinnamon capsules over infusions on serum cholesterol levels of type 2 diabetes subjects sixty type 2 diabetes mellitus subjects were supplemented with one gram of *Cinnamomum zeylanicum* capsule and 75 mL of infusion. The effectiveness of the supplements to decrease serum cholesterol levels after a period of 45 days was investigated. Total cholesterol, serum HDL, serum LDL, serum triglycerides and serum VLDL were assessed. Results indicated that there was a significant difference in serum cholesterol level between the capsule ingested group and infusion ingested group indicating that consumption of cinnamon capsule had a positive effect. As capsules are easy to swallow, does not require preparation time and the exact dosage can be consumed, capsules of *Cinnamomum zeylanicum* when consumed regularly at effective levels, had a good impact on serum cholesterol levels in subjects with type 2 diabetes.

Keywords: *Cinnamomum zeylanicum*, infusion, capsule, serum cholesterol, Diabetes

1. Introduction

Diabetes is a complex, chronic illness requiring continuous medical care with multifactorial risk-reduction strategies beyond glycemic control. Ongoing diabetes self-management education and support are critical to preventing acute complications and reducing the risk of long term complications. (1) Atherosclerotic cardiovascular disease defined as coronary heart disease (CHD), cerebrovascular disease, or peripheral arterial disease, presumed to be of atherosclerotic origin is the leading cause of morbidity and mortality for individuals with diabetes. (2)

For primary prevention of coronary heart diseases, moderate-dose statin therapy is recommended for those 40 years and older, (3-4) though high-intensity therapy may be considered on an individual basis in the context of risk factors. Recent guidelines recommend that in patients with diabetes who are at higher risk, especially those with multiple ASCVD risk factors or aged 50–70 years, it is reasonable to prescribe high-intensity statin therapy. (5)

Although, contemporary drugs treat the condition effectively, prolonged usage leads to adverse effects. Interest towards the use of complementary and alternative medicine in controlling diabetes and heart disease is escalating among the consumers owing to the side effects of modern drugs. Thus, traditional medicines are gaining worldwide recognition at present. Utilization of plants for medicinal purposes in India has been documented long back in ancient literature. (6,7)

Right from its beginning, the documentation of traditional knowledge especially on the medicinal uses of plants, has provided many important drugs of modern day. (8-10) Even today this area holds much more hidden treasure as almost 80% of the human population in developing countries is dependent on plant resources for healthcare. (11) Attempts are being made towards innovating bioactive compounds from plants that are rich in antidiabetic and hypolypedemic 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 come. (12)

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 uses. Cinnamon is used for diverse medicinal therapies such as; stimulants, carminatives, anti-inflammatory, stomachic, antibiotics, digestives, astringents, anthelmintics, expectorants and tonics. (13, 14) 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 proanthocyanidins. (15) Cinnamon bark powder is used in numerous forms such as; infusions, decoctions, macerations, tinctures, fluid extracts, teas, juices, syrups, poultices, oils, ointments capsules and powders. (16)

Numerous factors may explain the differences in outcomes of capsules versus infusions including pharmacokinetic differences, as the rate of absorption plays an important role in efficacy. 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 tablets. (17) With this background, the objective of the study has been framed as to efficacy of Cinnamomum zeylanicum capsule and infusion on serum cholesterol level of subjects with type 2 diabetes.

2. 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 design 10 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 AECZ About 5 mL of venous blood was drawn and analyzed for fasting blood glucose level, serum fructosamine, fasting serum insulin and post-prandial levels. (18)

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

3. Results and discussion

Medical studies have 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 people, especially the elderly and young children, tend to have more difficulty swallowing some pills. Generally, supplements in liquid form are much more readily broken down and absorbed. Additionally, it has been shown that liquids are more completely and quickly absorbed than most capsules and pills. (19)

The Physician's Desk Reference states that 85-90% of nutrients in liquid supplements are absorbed in 22 to 30 seconds. Compare this to hours it takes for the nutrients in pills to be absorbed by the body. Moreover, it has been demonstrated that only 10%-20% of the nutrients in pills actually are absorbed. The National Advisory Board state that 100 mg consumed in tablet form translates into a concentration of only 8.3 mg or 8.3% in the blood. (20)

Table 1. Comparison of serum lipid levels between test groups after supplementation

Blood parameters (mg/dl)	Study Group	N	Mean	Standard Deviation S.D	Mean Difference ± S.D	T value	p value
Total Cholesterol	Test 1	30	-16.5517	12.65923	-11.95172 ± 3.3602	-3.557	0.001*
	Test 2	30	-4.6000	13.13484			
Serum Triglyceride	Test 1	30	-18.8966	15.95383	-9.99655 ± 3.28994	-3.039	0.004*
	Test 2	30	-8.9000	8.24349			
HDL Cholesterol	Test 1	30	1.7586	3.14705	0.99195 ± 0.78252	1.268	0.210 NS
	Test 2	30	0.7667	2.86095			
LDL Cholesterol	Test 1	30	-14.2069	13.43869	-8.60690 ± 2.86767	-3.001	0.004*
	Test 2	30	-5.6000	7.99828			
VLDL Cholesterol	Test 1	30	-3.3793	2.96905	-1.47931 ± 0.63931	-2.314	0.024*
	Test 2	30	-1.9000	1.82606			
	Test 2	30	-0.1256	0.33777			

* Significant at 5 percent **NS** Not Significant

Total cholesterol

The mean difference of the total cholesterol levels of the subjects in test group I and II is presented in the Table. The mean total cholesterol levels of the test subjects before supplementation was 198.48 mg/dl in test group I and 184.36 mg/dl in test group II. It is observed that the total cholesterol level in test group I came down to 181.93 mg/dl and in test group II to 179.76 mg/dl. The decrease in mean difference of total cholesterol levels was found to be significant at 5 percent level.

Results of the present study were similar to the results of Anderson et al., 2016. Total and LDL-cholesterol decreased with cinnamon extract and placebo groups. In conclusion, supplementation with 500 mg of water-extract of cinnamon for two months reduced fasting insulin, glucose, total cholesterol, and LDL cholesterol and enhanced insulin sensitivity of subjects with elevated blood glucose. (21)

Triglyceride levels

Initially, the serum triglyceride levels among test group I and II were found to be in the borderline high category of 204.82 and 194.70 mg/dl. After supplementation, the triglycerides reached a level of 185.93 and 185.80 mg/dl in test group I and II respectively. A remarkable reduction by 20 mg/dl was evident among the test group I which was significant at 5 per cent level.

HDL cholesterol levels

The initial HDL cholesterol level was found to be in the desirable range of 46.10 and 46.73 among the test group subject's I and II respectively. HDL cholesterol level after supplementation in test group subject's I and II had increased to 47.86 and 48.50 respectively. The differences between initial and final HDL cholesterol levels were found to be small in both the groups. The results were not statistically significant for HDL cholesterol.

LDL cholesterol levels

The mean LDL cholesterol levels of subjects before supplementation of cinnamon zeylanicum were 112.31 mg/dl and 100.16 mg/dl respectively in group I and group II. The LDL cholesterol levels decreased in test group I and II were 98.10 and 94.56respectively. The decrease in the LDL cholesterol levels of test

group I was found to be significant at 5 percent level.

VLDL cholesterol levels

The initial serum VLDL cholesterol levels in the test group I and II were 40.07 and 38.96 mg/dl respectively. The VLDL cholesterol level decreased to 37.17 and 37.06 and the decrease was not statiscally significant.

The mechanism involved in cholesterol lowering activity of C. zeylanicum may be the inhibition of lipid absorption or augmented cholesterol and bile acids secretion in faeces. It may be said that C. zeylanicum extract and simvastatin are equi efficacious in the treatment of hyperlipidaemia. (22)

4. Discussion

From the foregoing parameters of lipid profile on subjects with type 2 diabetes, by supplementing cinnamon zeylanicum capsule and cinnamon zeylanicum infusion, it can be seen that the cinnamon zeylanicum capsule supplementation was more effective than the infusion supplementation.

Compliance to capsule supplementation would have been better than infusion as infusion involves preparation time and may have an unpleasant taste. Capsules are easily swallowed and subjects will not feel the unpleasant bitter taste, comfortable to carry and subjects can stick to daily dosage even during travel. The exact dose can be consumed effortlessly. Capsules are coated for ease of swallowing. High-quality supplements usually use inactive ingredients that assist in absorption as does the natural coating of tablets. Moreover capsules are odorless and tasteless. Since all the nutrients are inside a hard gelatin, most capsules have no aroma or taste.

5. Conclusion

The study that Cinnamomum zeylanicum powder when consumed at regular intervals at effective levels can have a significant effect on serum cholesterol 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 dyslipidaemia and diabetes. Thus, a new theory on cinnamon powder ingestion may be arrived at.

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Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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