Lipid lowering effect of *Cinnamomum zeylanicum* in hyperlipidaemic albino rabbits

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Abstract: The purpose of the present study was to investigate the lipid lowering effect of *Cinnamomum zeylanicum* (Cinnamon) in hyperlipidaemic albino rabbits. For this purpose, forty eight albino rabbits were randomly divided into eight equal groups; untreated control on normal routine feed, untreated control on butter and cholesterol, treated control on synthetic cholesterol lowering drug simvastatin (Tablet survive® 20 mg), three treated groups on three respective doses of *C. zeylanicum* bark powder and two treated groups on water and methanol extracts of *C. zeylanicum* bark powder. Butter *ad lib* and cholesterol powder 500 mg/kg body weight were used to induce experimental hyperlipidaemia in all groups except untreated control group. The results suggested that *C. zeylanicum* bark powder at the rate of 0.50 g/kg, 0.75 g/kg and methanol extract equivalent to 0.75 g/kg powder produced respective percent reductions in total lipids by 45, 49 and 64; triglycerides by 38, 53 and 60; total cholesterol by 53, 64 and 69 and LDL-cholesterol by 50, 59 and 62. However, at these dosage levels HDL-cholesterol showed respective percent increase of 42, 48 and 53. Nonetheless, *C. zeylanicum* bark powder at the level of 0.25g/kg and *C. zeylanicum* extract in water could not significantly reduce lipid profile indicators. Based on these studies, it can safely be said that *C. zeylanicum* bark powder methanol extract equivalent to 0.75g/kg bark powder and simvastatin (0.6 mg/kg b. wt.) were equieffective in treating hyperlipidaemia.

Keywords: Lipid lowering effect, *Cinnamomum zeylanicum*, Hyperlipidaemic albino rabbits.

INTRODUCTION

Hyperlipidaemia is characterized by elevated serum total cholesterol, low-density lipoprotein cholesterol, very low-density lipoprotein cholesterol and decreased high-density lipoprotein cholesterol levels (Harris *et al*., 1998; Javed *et al*., 2009). Many studies have established a clear relationship between high cholesterol level in serum and cardiovascular disease (Bays *et al*., 2001). Cardiovascular ailment has been recognized as major death toll accounting for 16.7 million deaths per year all over the world (Anonymous, 1999). In Pakistan one out of every four middle-aged persons is suffering from coronary artery disease (Raza *et al*., 2004). Cardiovascular events and related mortalities may be reduced by decreasing total cholesterol (Stein, 2002).

As reported in literature synthetic drugs may be having serious side effects (Javed *et al*., 1994; Bhandari *et al*., 2002). Statins, being used frequently as lipid regulating drug, may produce asymptomatic rise in serum transaminase and myopathy (Alzira *et al.* 2004). Statins may also be associated with some other rarely occurring side effects like nausea, abdominal pain, dyspepsia, diarrhoea or constipation and flatulence (Ballantyne *et al*., 2003; Newman *et al*., 2003). Medicinal plants, on the other hand, have been reported safer as compared to pharmaceutically derived remedies (Murphy, 1999; Javed *et al*., 2009).

Cinnamomum zeylanicum (cinnamon) is an ancient spice and due to its sweet bark, has been referred as sweet wood (Willis, 1973). It is a medicinal tree native to Siri Lanka,South-West India and Burma (Barceloux, 2009). After being granted GRAS (Generally Recognized As Safe) status by the United States Food and Drug Administration, cinnamon has become the subject of intense research (Ziegenfuss *et al*., 2006). As it is having stimulatory effects on the secretion of insulin, it is being used as a remedy in treating type 2 diabetes (Onderoglu *et al*., 1999; Broadhurst *et al*., 2000; Khan *et al*., 2003). It is also used in the treatment of diarrhea (Skidmoreroth, 2003), diseases of respiratory tract (Singh 1995; Huang *et al.,* 2001), loss of appetite and dyspepsia (Blumenthal, 1998). Though not thoroughly investigated, the use of cinnamon bark powder after making paste with honey and applying this paste on bread instead of jelly or jam to save ischemic heart diseases has also been reported (Anonymous, 2010). Keeping in view these facts, the pharmacological evaluation of *Cinnamomum zeylanicum* for its antihyperlipidaemic efficacy was carried out in albino rabbits.

MATERIALS AND METHODS

Forty-eight healthy adult male albino rabbits produced

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and maintained under similar managemental conditions in animal room of department of Physiology and Pharmacology, University of Agriculture, Faisalabad, Pakistan. The rabbits were housed in individual iron cages at ambient temperature with a 12/12 h period of light/dark. Rabbits were randomly divided into eight equal groups (Average weight of all groups ranged from1.35 kg to 1.55 kg); untreated control on normal routine feed, untreated control on butter and cholesterol, treated control on synthetic cholesterol lowering drug, three treated groups on three respective doses of *C. zeylanicum* bark powder and two treated groups on water and methanol extracts of *C. zeylanicum* bark powder. Metallic ear tags were used for identification purpose. The rabbits were provided *Alfa alfa* (Lucern) as normal routine feed till the completion of the experiment. The feed was made available twice a day, usually in morning and evening. However drinking water was available throughout 24 hours. Except untreated control group, which was kept on normal routine feed, the rest of the groups were also fed butter *ad libitum* and cholesterol powder (Cholesterol 90 % E. Merck, Darmstadt, Germany) at the rate of 500 mg/kg body weight in 5 ml coconut oil as vehicle for 0-90 days. Butter and cholesterol were used to produce experimental hyperlipidaemia in albino rabbits (Javed *et al*., 2006; Javed *et al*., 2009) (fig. 1).

Bark of *C. zeylanicum* was procured from department of Botany, University of Agriculture, Faisalabad, Pakistan. The bark was washed thoroughly with distilled water to remove the dust or any other extraneous material and was dried in the shade and finely powdered with an electric grinder. Simvastatin (Tablet survive® 20 mg) was used as a synthetic lipid lowering agent. Three powdered doses of *C. zeylanicum* bark at dose rate of 0.25, 0.50 and 0.75 g/kg body weight were administered to three respective treated groups for 90-180 Days. Water and methanol extracts equivalent to 0.75g/kg body weight *C. zeylanicum* bark powder were administered to two respective treated groups from 90-180 days. The feeding and drugs administration schedule has been summarized in table 1.

In individual animals of each group, blood samples were drawn from 0-180 days at 30 days interval. For the collection of blood samples jugular vein, located on either side of the neck, was used. The area of the neck was shaved, cleaned with antiseptic solution and then the blood samples were drawn. The samples were allowed to clot for 20 minutes at refrigeration temperature and then were centrifuged at 4000 rpm for five minutes. Serum was separated to small clean bottles. The bottles were stored at freezing temperature till analysis.

Lipid profile parameters including total lipids, triglycerides, total cholesterol, high density lipoprotein cholesterol (HDL-cholesterol) and low density lipoprotein cholesterol (LDL-cholesterol) were determined in serum of rabbits with reagent kits (Randox, Randox Laboratories Ltd., UK). The data thus obtained was expressed as mean lipid profile parameters ± standard error of means (SEM). Mean ± SEM lipid profile parameters at post cholesterol feeding day 90 were taken as pre-treatment values while those on 120,150 and 180 days as post-treatment values. The significance of the differences between the pre-treated and post-treated values was tested using student's 't'-test with software Statistical Package for the Social Sciences (SPSS 17). The reduction and percentage reduction (Mean ± SEM) of these values on post treatment days 120, 150 and 180 were also calculated.

Table 1: Feeding and drugs administration schedule in albino rabbits during the experimental period of 0 to 180 days.

Group I: Untreated control on normal routine feed	Normal routine feed 0 to 180 days + 5 ml distilled water
Group II: Untreated control on butter *ad lib* and cholesterol	Normal routine feed + butter *ad lib* + cholesterol powder 500 mg/kg body weight in 5ml coconut oil as vehicle 0 to 90 days, normal routine feed 90 to 180 days
Group III: Treated control on synthetic cholesterol lowering drug; Tablet survive® (simvastatin)	Normal routine feed + butter *ad lib* + cholesterol powder 500 mg/kg body weight in 5 ml coconut oil as vehicle 0 to 90 days, normal routine feed + Tablet survive® (simvastatin, 20 mg) 0.6 mg/kg in 5 ml water in water 90 to 180 days
Group IV: *C. zeylanicum* bark powder	Normal routine feed + butter *ad lib* + cholesterol powder 500 mg/kg body weight in 5 ml coconut oil as vehicle 0 to 90 days, normal routine feed + *C. zeylanicum* bark powder 0.25 g/kg in 5 ml water 90 to 180 days
Group V: *C. zeylanicum* bark powder	Normal routine feed + butter *ad lib* + cholesterol powder 500 mg/kg body weight in 5 ml coconut oil as vehicle 0 to 90 days, normal routine feed + *C. zeylanicum* bark powder 0.50 g/kg in 5 ml water 90 to 180 days
Group VI:*C. zeylanicum* bark powder	Normal routine feed + butter *ad lib* + cholesterol powder 500 mg/kg body weight in 5 ml coconut oil as vehicle 0 to 90 days, normal routine feed + *C. zeylanicum* bark powder extract in water equivalent to 0.75 g/kg b. wt. powder in 5 ml water 90 to 180 days
Group VII: *C. zeylanicum* bark powder water extract	Routine feed + butter *ad lib* + cholesterol 500 mg/kg in 5 ml coconut oil as vehicle 0 to 90 days, routine feed + *C. zeylanicum* bark powder water extract equivalent to 0.75 g/kg b. wt. powder in 5 ml water 90 to 180 days
Group VIII: *C. zeylanicum* bark powder methanol extract	Routine feed + butter *ad lib* + cholesterol 500 mg/kg in 5 ml coconut oil as vehicle 0 to 90 days, routine feed + *C. zeylanicum* bark powder extract in methanol equivalent to 0.75 g/kg b. wt. powder in 5 ml water 90 to 180 days

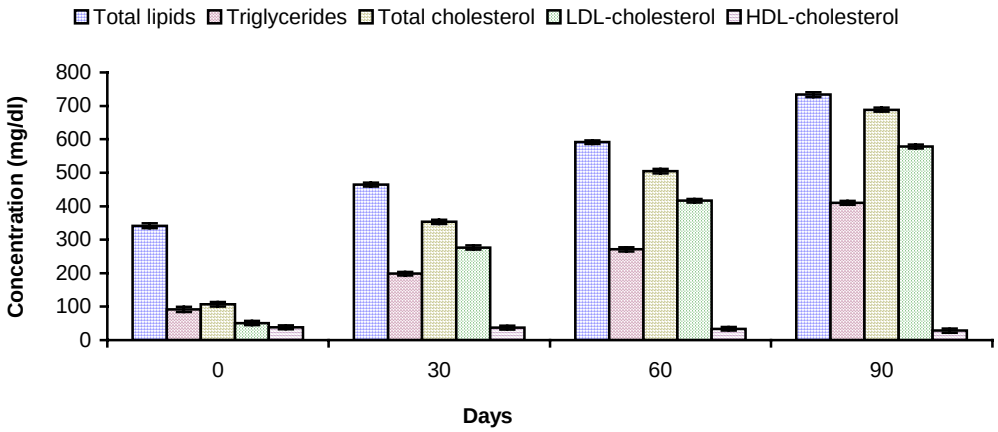

Fig. 1: Mean ±SE concentration of serum lipid profile parameters in rabbits fed with butter and cholesterol 500 mg/kg body weight.

RESULTS

Hyperlipidaemia was induced in albino rabbits as a result of feeding butter *ad libitum* and cholesterol powder at rate of 500 mg/kg body weight for 0-90 days along with the normal routine feed. The serum lipid profile parameters have been presented in Fig. 1. Antihyperlipidaemic efficacy of *Cinnamomum zeylanicum* bark powder at the dose rate of 0.25, 0.50 and 0.75 gm/Kg body weight and extracts in water and methanol, equivalent to 0.75 gm/Kg body weight powder has been shown in Tables 2-6.

DISCUSSION

It is apparent from Fig 1 that there was 2.15 to 11.34 times increase in lipid profile parameters at day 90 as compared to their respective values at day 0 while HDL-cholesterol showed 1 to 1.63 times decreasing trend. However, 3.5 to 9 times increase in these parameters in albino rabbits fed with atherogenic diet for 120 days was observed by Purohit and Daradka (2001). Cholesterol feeding in rabbits caused a significant increase in the serum lipid profile parameters, establishing a clear correlation between dietary lipids and hyper-lipidaemia (Prasad, 2005; Vijaimohan *et al.,* 2006; Jain *et al*., 2007; Javed *et al*., 2009).

It can be seen that *C. zeylanicum* bark powder at the level of 0.25 g/kg and *C. zeylanicum* water extract did not produce significant reductions (P>0.05) in lipid profile indicators (Tables 2-6). However, *C. zeylanicum* bark powder at the level of 0.50 g/kg, 0.75g/kg and its methanol extract equivalent to 0.75 g/kg powder significantly lowered (P<0.05) lipid profile indicators including total lipids by 45, 49 and 64%; triglycerides by 38, 53 and 60%; total cholesterol by 53, 64 and 69% and LDL-cholesterol by 50, 59 and 62%, respectively, at post treatment day 180. Moreover, at these dosage levels HDL-cholesterol increased by 42, 48 and 53%, respectively. However, *Trachyspermum ammi* seed powder at the dosage level of 2 g/kg reduced total lipids 49 %, triglycerides 53 %, total cholesterol 71 %, LDL-cholesterol 63 % and increased HDL- cholesterol 62 % at post-treatment day 135 in hyperlipidaemic albino rabbits (Javed *et al*., 2009). Further, *C. zeylanicum* methanol extract equivalent to 0.75g/kg powder and simvastatin (0.6 mg/kg b. wt.) showed non- significant (P>0.05) difference in treating hyperlipidaemia. In another study, similar results were shown when *Trachyspermum ammi* seed powder extract in methanol equivalent to 2 g/kg seed powder and simvastatin (0.6 mg/kg b. wt.) were administered in albino rabbits suffering from hyperlipidaemia (Javed *et al*., 2006).

Recent research has revealed that a 4-5% decrease in LDL-cholesterol results in a 5-10% decrease in the occurrence of coronary heart disease (CHD) (Katan *et al*., 2003). Similarly elevated serum triglycerides are thought to be as an independent risk factor for cardiovascular disease (Asia Pacific Cohort Studies Collaboration, 2004). In present studies, marked reduction (P<0.05) in LDL-cholesterol (62%) and triglycerides (60%) after administration of *C. zeylanicum* methanol extract suggest its importance in preventing CHD. Similar results have been reported as a significant (P<0.05) reduction in serum total cholesterol, LDL-cholesterol and triglycerides along with a marked increase (P<0.05) in HDL-cholesterol level after the administration of 5% *C. zeylanicum* oil in the diet for the period of 7 weeks in streptozotosin diabetic rats (Zari and Al-logmani, 2009). Lipoprotein fractions present in apo-B are considered to be responsible for deposition of cholesterol in atherosclerotic plaques (Choi *et al.,* 1991). It clearly reflects that elevation in HDL-cholesterol level and decease in LDL-cholesterol level would be lucrative in

Table 2: Mean ± SEM values of total lipids (mg/dl) and their percent reductions in the serum of hyperlipidaemic rabbits (n=6) after treatment with *Cinnamomum zeylanicum* bark powder, water extract, methanol extract and simvastatin

Medication	Dosage (oral)	Post cholesterol feeding day 90	Post treatment days			Percent reduction on post treatment days		
			120	150	180	120	150	180
Untreated control on normal diet	-	338.98 ±3.83	343.1 ±1.99	343.4 ±3.45	334.6 ±2.84	–	–	–
Untreated control on butter + cholesterol	500 mg/kg	726 ±4.94	690.22 ±4.06	681.62 ±5.14	667.34 ±3.16	–	–	–
Treated control on Simvastatin	0.6 mg/kg	736.49 ±3.02	399.04 ±4.08*	305.1 ±5.03*	242.4 ±4.83*	45.82 ±3.10	58.57 ±4.10	67.09 ±3.18
C. zeylanicum bark powder	0.25 g/kg	727.8 ±5.25	674.57 ±3.16	627.18 ±4.26	572.99 ±5.96	7.31 ±4.28	13.83 ±5.35	21.27 ±4.42
C. zeylanicum bark powder	0.50 g/kg	706.94 ±5.97	507.77 ±6.58	465.18 ±4.56*	390.46 ±3.90*	28.17 ±5.78	34.20 ±4.12	44.77 ±5.30
C. zeylanicum bark powder	0.75 g/kg	759.4 ±4.11	510.99 ±3.09*	430.11 ±5.33*	383.97 ±4.11*	32.71 ±3.37	43.36 ±4.35	49.44 ±4.16
C. zeylanicum water extract	Equivalent to 0.75 g/kg bark powder	757.15 ±5.27	659.41 ±4.68	638.45 ±4.72	607.01 ±5.62	12.91 ±2.29	15.68 ±5.27	19.83 ±4.24
C. zeylanicum methanol extract	Equivalent to 0.75 g/kg bark powder	722.08 ±4.38	470.97 ±4.31*	366.18 ±3.42*	262.94 ±5.17*	34.78 ±3.08	49.29 ±5.13	63.59 ±4.26@

n = Number of animals in each group. * = Significantly less (P≤0.05) than the pretreatment value at 90 days
@ = Non-significantly (P>0.05) different from respective value obtained with simvastatin

Table 3: Mean ± SEM values of triglycerides (mg/dl) and their percent reductions in the serum of hyperlipidaemic rabbits (n=6) after treatment with *Cinnamomum zeylanicum* bark powder, water extract, methanol extract and simvastatin.

Medication	Dosage (oral)	Post cholesterol feeding day 90	Post treatment days			Percent reduction on post treatment days		
			120	150	180	120	150	180
Untreated control on normal diet	-	93.64 ±4.23	91.52 ±2.40	87.16 ±4.48	91.05 ±3.22	–	–	–
Untreated control on butter + cholesterol	500 mg/kg	393.27 ±3.04	379.55 ±3.99	360.95 ±4.41	345.48 ±3.31	–	–	–
Treated control on Simvastatin	0.6 mg/kg	381.81 ±3.86	221.97 ±2.90*	189.4 ±4.36*	138.1 ±5.38*	41.86 ±3.08	50.39 ±2.89	63.83 ±3.73
C. zeylanicum bark powder	0.25 g/kg	418.5 ±6.94	378.27 ±4.12	364.28 ±4.83	335.41 ±5.90	9.61 ±3.67	12.96 ±4.34	19.85 ±4.15
C. zeylanicum bark powder	0.50 g/kg	430.05 ±5.25	364.72 ±3.80	289.74 ±2.24*	250.35 ±4.15*	15.19 ±4.31	29.14 ±4.28	38.30 ±5.12
C. zeylanicum bark powder	0.75 g/kg	409.03 ±4.17	320.2 ±4.70	271.75 ±3.89*	193.19 ±5.15*	21.72 ±4.09	33.56 ±2.78	52.77 ±3.38
C. zeylanicum water extract	Equivalent to 0.75 g/kg bark powder	422 ±3.54	387.72 ±4.19	364.91 ±3.13	340.85 ±5.04	8.12 ±3.24	13.53 ±4.85	19.23 ±5.21
C. zeylanicum methanol extract	Equivalent to 0.75 g/kg bark powder	414.12 ±4.91	308.84 ±5.10*	234.81 ±4.04*	167.75 ±5.18*	25.42 ±5.12	43.30 ±3.54	59.49 ±4.71@

n = Number of animals in each group. * = Significantly less (P≤0.05) than the pretreatment value at 90 days
@ = Non-significantly (P>0.05) different from respective value obtained with simvastatin

Table 4: Mean ± SEM values of total cholesterol (mg/dl) and their percent reductions in the serum of hyperlipidaemic rabbits (n=6) after treatment with *Cinnamomum zeylanicum* bark powder, water extract, methanol extract and simvastatin.

Medication	Dosage (oral)	Post cholesterol feeding day 90	Post treatment days			Percent reduction on post treatment days		
			120	150	180	120	150	180
Untreated control on normal diet	-	107.02 ±3.32	105.15 ±3.71	107.37 ±2.87	111.35 ±4.74	–	–	–
Untreated control on butter + cholesterol	500 mg/kg	655.69 ±3.77	635.21 ±3.79	613.03 ±4.45	595.47 ±4.21	–	–	–
Treated control on Simvastatin	0.6 mg/kg	684.88 ±3.65	378.84 ±4.23*	265.67 ±3.21*	205.34 ±5.41*	44.69 ±5.28	61.21 ±3.19	70.02 ±4.34
C. zeylanicum bark powder	0.25 g/kg	708.44 ±5.05	645.68 ±4.37	596.71 ±5.01	564.2 ±5.78	8.86 ±3.24	15.77 ±5.34	20.36 ±4.78
C. zeylanicum bark powder	0.50 g/kg	664.94 ±4.95	523.42 ±5.68	375.49 ±4.31*	315.69 ±5.01*	21.28 ±2.87	43.53 ±4.12	52.52 ±3.21
C. zeylanicum bark powder	0.75 g/kg	734.93 ±5.93	552.73 ±6.16	331.23 ±5.89*	265.37 ±3.91*	24.79 ±3.28	54.93 ±3.91	63.89 ±4.72
C. zeylanicum water extract	Equivalent to 0.75 g/kg bark powder	666.01 ±5.01	615.76 ±5.75	592.27 ±3.98	564.13 ±4.92	7.54 ±3.68	11.07 ±3.51	15.30 ±4.12
C. zeylanicum methanol extract	Equivalent to 0.75 g/kg bark powder	705.45 ±6.27	512.42 ±6.35	301.26 ±3.24*	219.87 ±5.22*	27.36 ±3.12	57.30 ±2.15	68.83 ±3.18@

n = Number of animals in each group. * = Significantly less (P≤0.05) than the pretreatment value at 90 days
@ = Non-significantly (P>0.05) different from respective value obtained with simvastatin

Table 5: Mean ± SEM values of LDL-cholesterol (mg/dl) and their percent decrease in the serum of hyperlipidaemic rabbits (n=6) after treatment with *Cinnamomum zeylanicum* bark powder, water extract, methanol extract and simvastatin.

Medication	Dosage (oral)	Post cholesterol feeding day 90	Post treatment days			Percent reduction on post treatment days		
			120	150	180	120	150	180
Untreated control on normal diet	-	46.06 ±2.11	44.4 ±2.49	51.65 ±3.10	52.31 ±2.26	–	–	–
Untreated control on butter + cholesterol	500 mg/kg	548.7 ±3.41	529.06 ±3.35	503.96 ±1.94	492.46 ±2.63	–	–	–
Treated control on Simvastatin	0.6 mg/kg	579.94 ±4.07	374.97 ±4.96*	252.78 ±3.73*	182.91 ±5.80*	35.34 ±3.87	56.41 ±3.41	68.46 ±3.78
C. zeylanicum bark powder	0.25 g/kg	592.63 ±5.25	533.53 ±5.02	490.02 ±4.85	468.07 ±5.47	9.97 ±3.47	17.31 ±4.31	21.02 ±4.28
C. zeylanicum bark powder	0.50 g/kg	548.76 ±4.93	404.27 ±5.87	331.38 ±4.53*	275.33 ±2.99*	26.33 ±4.91	39.61 ±4.28	49.83 ±5.31
C. zeylanicum bark powder	0.75 g/kg	628.15 ±5.36	414.75 ±5.69*	338.69 ±3.89*	254.78 ±5.92*	33.97 ±4.08	46.08 ±2.19	59.44 ±3.41
C. zeylanicum water extract	Equivalent to 0.75 g/kg bark powder	553.18 ±5.49	495.17 ±5.19	464.34 ±4.89	441 ±5.02	10.49 ±4.75	16.06 ±4.24	20.28 ±3.58
C. zeylanicum methanol extract	Equivalent to 0.75 g/kg bark powder	595.78 ±3.41	373.78 ±4.11*	275.38 ±5.15*	225.13 ±2.98*	37.26 ±5.12	53.78 ±3.54	62.21 ±4.18@

n = Number of animals in each group. * = Significantly less (P≤0.05) than the pretreatment value at 90 days
@ = Non-significantly (P>0.05) different from respective value obtained with simvastatin

Table 6: Mean ± SEM values of HDL-cholesterol (mg/dl) and their percent increase in the serum of hyperlipidaemic rabbits (n=6) after treatment with *Cinnamomum zeylanicum* bark powder, water extract, methanol extract and simvastatin.

Medication	Dosage (oral)	Post cholesterol feeding day 90	Post treatment days			Percent reduction on post treatment days		
			120	150	180	120	150	180
Untreated control on normal diet	-	42.24 ±2.19	42.45 ±2.98	38.3 ±3.37	40.82 ±2.84	–	–	–
Untreated control on butter + cholesterol	500 mg/kg	28.34 ±3.71	31.24 ±2.70	33.88 ±2.85	35.92 ±3.82	–	–	–
Treated control on Simvastatin	0.6 mg/kg	27.24 ±1.03	37.47 ±1.15*	40.01 ±1.60*	43.81 ±1.17*	37.56 ±3.12	46.88 ±5.25	60.83 ±5.41
C. zeylanicum bark powder	0.25 g/kg	32.11 ±1.24	33.49 ±1.29	35.34 ±1.22	37.05 ±1.01	4.30 ±4.99	10.06 ±3.02	15.38 ±5.31
C. zeylanicum bark powder	0.50 g/kg	29.18 ±1.55	33.2 ±1.84	39.16 ±1.08*	41.29 ±1.29*	10.01 ±5.14	34.20 ±6.77	41.50 ±3.18
C. zeylanicum bark powder	0.75 g/kg	24.98 ±1.41	29.95 ±1.71	34.2 ±1.02*	36.96 ±1.06*	19.90 ±5.42	36.91 ±3.77	47.96 ±4.32
C. zeylanicum water extract	Equivalent to 0.75 g/kg bark powder	28.43 ±1.82	30.05 ±1.68	31.95 ±1.65	32.96 ±1.08	5.70 ±4.20	12.38 ±5.17	15.93 ±4.19
C. zeylanicum methanol extract	Equivalent to 0.75 g/kg bark powder	26.85 ±1.56	32.88 ±1.60	37.92 ±1.18*	41.19 ±1.72*	22.46 ±5.14	41.23 ±4.78	53.41 ±3.84@

n = Number of animals in each group. * = Significantly less (P≤0.05) than the pretreatment value at 90 days
@ = Non-significantly (P>0.05) different from respective value obtained with simvastatin

treatment and prevention of atherosclerosis. Atherogenic index (total cholesterol/HDL-cholesterol) is used to indicate the extant to which treatment is effective for its antihyperlipidaemic effect. In present study, from post cholesterol feeding day 90 to after treatment day 180, *C. zeylanicum* bark powder at the dose rates of 0.50 and 0.75 gm/Kg body weight was able to reduce atherogenic index from 22.79 to 7.65 and 29.42 to 7.18, respectively. However, respective reduction in atherogenic index produced by C. *zeylanicum* methanol extract and simvastatin was 26.27 to 5.34 and 25.14 to 4.69. Based on the results, it may safely be said that *C. zeylanicum* methanol extract and simvastatin are equi efficacious in the treatment of hyperlipidaemia. The mechanism involved in cholesterol lowering activity of *C. zeylanicum* may be the inhibition of lipid absorption (Goyal and Grewal, 2003) or augmented cholesterol and bile acids secretion in faeces (Agarwal and Chavan, 1988).

Based upon responsible isolated ingredients, further chemical and pharmacological investigations will be imperative to highlight the accurate mechanism of these effects.

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