SUMMARY
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Diabetes mellitus comprises a group of common metabolic disorders that share the phenotype of hyperglycemia, dyslipidemia and hyperlipidemia, a consequence of disorder in carbohydrate and lipid metabolism. Usually it is associated with accelerated atherosclerosis and prothrombic state, markedly increasing the risk of Myocardial infarction (MI). WHO has already declared India as the global capital of diabetes and predicted number of diabetes in India to be nearly 366 million by 2030. In which Type-2 diabetes is the most common form of diabetes accounting for up to 95% of all diabetic cases. Diabetes is the cause of about 3% of premature mortality most often because of IHD. It has been firmly established that the diet can play a major role in the incidence and progression of the diseases.

Ischaemic heart diseases (IHD) may also lead to "sudden" Cardiac death – the cause of death for some 2.5 lacs U.S. adult each year and it is estimated that 14 million people in the U.S.A. have IHD. As many as same numbers of IHD patients are expected in India also because of increasing trend of DM-Type-2 diseases and change in dietary habits and lack of exercise. Consequently, diabetes mellitus are chief culprits in the promotion of heart diseases. The cause of Diabetes mellitus and IHD is not fully understood. Recently, increasing evidences suggest that free radical formation is involved in the pathogenesis and the development of diabetic complications and IHD.

Diabetes initiate atherosclerotic lesions without involving inflammatory cells. First, diabetes associated hyperlipidemia and dyslipidemia are expected to accelerate LDL-C deposition in the arterial wall, while hyperglycemia promotes the formation of the high Amaduri products in both LDL and callogen. Hyperglycemia also leads to the conversion of methylglyoxal to carboxyethyl lysine (CEL). All these processes occurs non-oxidatively. Oxidation of PUFA in LDL is mediated by high glucose driven superoxide formation by mitochondria and NADH oxidase, will yield glyoxal, a potent precursor of N-Carboxymethyl-lysine(CML). Indeed CML has been detected immunochemically in early atheromatous lesions, based on findings of elevated CEL in diabetic tissues. A currently favoured hypothesis is that oxidative stress, through a singly unifying mechanism of hyperglycemia-catalysed/induced superoxide formation from mitochondrial and cytoplasmic sources are expected to initiate the lipoxidation cascade and release of glyoxal, a potent CML precursor PUFA, is the common pathogenic factor(s) leading to insulin resistance, β-cell disfunction, impaired glucose tolerance (IGT) and ultimately to Type-2 DM and IHD. In Type-2 DM. there is an accelerated rate of atherosclerosis, which is thought to be due, in part, to the irreversible formation and deposition of molecules known as advanced glycation end products (AGEs). Elevated blood glucose levels contribute to the glycation of proteins and lipids, resulting in the formation of AGEs. Receptors for AGEs (RAGE) are expressed in many different tissues and cell types, including endothelial cells, vascular smooth muscle cells and Macrophages. The binding of AGEs to RAGE leads to the intracellular generation of ROS and as a consequence of NG-kB activation, expression of a variety of cytokines is increased, including Tumour necrosis factors (TNF-α and TNF-β), interleukins (IL) 1,6,8 and 18 and inferno-γ.
Oxidative stress during Ischaemia and especially upon reperfusion results from the excessive generation of radicals and the deficiency of protection by enzymes and scavengers. These sources include enzymes, such as xanthin oxidase, cytochrome oxidase, cyclo-oxygenase and the oxidation of Catecholamines. During Ischaemia xanthin dehydrogenase is converted, probably by an increase of cytosolic calcium by limited proteolysis, or by the oxidation of thiol group to the oxidase form. At the same time, ATP is degraded to hypoxanthin, which accumulate in ischemic tissues. The ischemia and reperfusion induced calcium overload activate phospholipases thus releasing arachidonic acid from the membrane, leading to the lipid peroxidation. The auto-oxidation of Catecholamines, which are abundantly released from the ischemic myocardium, could provide through the formation of adrenochrome oxygen free radicals.

Therefore, free radicals cause increased oxidative stress levels leading to cause several diseases including diabetes mellitus and Ischemic diseases. Oxidative stress appears to play a key role in endothelial dysfunction which may contribute to a increased risk of cardiovascular event. Antioxidants are highly divers in source, effect and use and protect against damage from free radicals by preventing the formation of excess free radicals, scavenging them after they are formed and before they damage other molecules and repairing or replacing damaged molecule. These anti-oxidants can be found in hundreds of naturally occurring substances and forms, which in turn mitigate the risk of developing chronic diseases. Scientists are discovering that there is a tighter link between diet and health. Antioxidant properties are a strikingly common feature in phytochemicals; they play an important role in inhibiting the disease progression or process related to oxidative damage caused by free radicals. In the last few years there have been a constantly rising interest in the anti-oxidative constituents of various medicinal plants, due to their potential in controlling the levels of free radicals and the process of lipid peroxidation.

Many natural anti-oxidants have been discovered in which many of them are now in current use and practice as a supplement in dietary modifications in the diseases. Cinnamon, recently, got attention for its curative and anti-oxidant properties. Almost every part of Cinnamon zeylium have been used and it is described to be efficacious in many diseases including diabetes. It has been described to possess many Health Benefits such as fight tooth decay clears us urinary tract infections, allows diabetics to use less insulin, possessed anti-oxidant capacity, helps in lowering cholesterol, a good source of calcium and fibre, possessed anticlotting action and antibacterial activity, boosts brain functions and helps in fighting against allergy. It is believed that a half teaspoon of Cinnamon each day can reduce stroke risks. It is also shown that Cinnamon, like onions, garlic, Korean ginpeng and flax seeds, effectively removed artery-damaging free radicals from the blood and improved functions of small blood vessels. Oils and extracts of Cinnamon possess a distinct antioxidant activity, especially attributed to the presence of phenolic and polyphenolic substances. Recent, research has demonstrated a number of benefits resulting from Cinnamon supplementation. These include improvement in blood sugar improvement in cardiovascular parameters and substantial antioxidant properties.

Therefore, in the present study, 3g Cinnamon bark powder preparations (1) A drug (3.0 g powder + 150 ml Tea liquor) (2) B-drug (150 ml of Tea liquor prepared by boiling 3g Cinnamon powder at least 5-6 minutes with tea) (3) Placebo (150 ml Tea liquor alone),
were selected for a 30 day trial. Further, to see that the effect of above preparation is sustained one or not, the effect of Cinnamon administration on various parameters under study was observed at 15th day after the drug withdrawal i.e. from 30th day of trial. Thus total trial period was of 45 days.

In light of above, the effect of Cinnamon bark powder preparation (separately A and B) and placebo of 150 ml Tea liquor (C) were observed on the parameters related to the diabetes, IHD and Diabetics having IHD as well as these parameters in Normal subjects also. Four major groups (1) Normals (2) diabetic (3) IHD and (4) Diabetics having IHD, received above three treatments separately and continuously for 30 days and accordingly three sub groups A,B and C of all the major four groups were formed as 1. Normals-1A, 1B and 1C 2. Diabetics-2A, 2B and 2C 3. IHD-3A, 3B and 3C and 4. Diabetics with IHD-4A, 4B and 4C. Their basal value (initial values) of parameters-fasting glucose, glycated hemoglobin, MDA (lipid peroxidation), Total antioxidant power (TAP), GR (glutathione reductase), GPx (glutathionperoxidase), CAT (catalase), SOD (superoxide desmutase), T-C (total cholesterol), TG (triglyceride), HDL-C (high density lipoprotein-cholesterol), VLDL-C (very low density lipoprotein-cholesterol) and LDL-C (low density lipoprotein-cholesterol) were determined as at 0 day then at 30th day of trial and at 15th day after withdrawal of Cinnamon administration.

1. EFFECT ON PLASMA GLUCOSE LEVELS

1 - IN NORMAL SUBJECTS:

The mean ± SD, mg/dl plasma glucose levels were found to be 93.7±22.0, 75.1 ± 0.34 and 80.90 ± 19.1 at initial day 0, 30th day of drug trial and 15th day after drug withdrawal respectively. From the initial day i.e. 0 day, a highly significant decline in plasma glucose levels were found by 19.8% at the 30th day of trial and 17.7% after 15th day of drug withdrawal. Observation suggested that Cinnamon administration with tea have shown statistically significant hypoglycemic properties in the normal subjects. As compared to plasma glucose levels at 0 day of 92.6 ± 12.5 mg/dl, mean ± SD, upon administration of 150 ml tea prepared with Cinnamon powder, a highly significant lowering of 14.5% at 30th day of trial and 13.5% after 15 days of drug withdrawal were observed in the plasma glucose levels of Normal individuals.

When 150ml tea alone as placebo was given to the normal subjects significant change were observed in the plasma glucose levels towards the end of the trial period. However, a 10% change (p<0.05) could be observed at 30th day of continuous tea administration.

2. IN DIABETIC SUBJECTS:

Diabetic subjects taking drug preparation A had 204 ± 38.41 mg/dl, mean ± SD plasma glucose levels at 0 day, upon Cinnamon administration a highly significant decline of 19.6% was observed at 30th day and 13.5% after 15th day of drug withdrawal. In this group, at 0 day of drug trial, plasma glucose level was found to be 206 ± 37.41 mg/dl, mean ± SD which subsequently declined highly significantly by 20% on 30th day of trial and 13% at 15th day after drug withdrawal. In diabetic group both types of Cinnamon drug preparations exhibited almost similar type of hypoglycemic properties. Upon
administration of tea alone as placebo in this group of diabetics have shown no significant change at 30th day of trial and at 15th day after placebo withdrawal in the plasma glucose levels.

3. **HEART GROUP (IHD)**

In the initial day (0 day), the Heart (A) group people had the plasma glucose level of 111.8 ± 6.69 mg/dl, mean ± SD. After 30th day of taking drug (3gm Cinnamon powder with tea) the plasma glucose level was decreased to 88.7 mg/dl at 30th day by 20.5%. After 15 days of stopping the delivery, the plasma glucose level was found to increase from 88.7 mg/dl to 98.57 mg/dl by 11.7%. These changes were found to be statistically highly significant. In the initial day (0 day), the Heart (B) group subjects had the plasma glucose level of 117.8 mg/dl. After 30th day of taking drug (150 ml tea 3g Cinnamon powder) the plasma glucose level was found decreased to 97.83 mg/dl by 20.5%. Thereafter, at 15th day of stopping the delivery, the plasma glucose level was found to increase from 97.83 mg/dl to 111mg/dl. The percent change were found to be statistically highly significant. At 0 day, the Heart (C) group people had the plasma glucose levels of 104.63 ± 63 mg/dl mean ± SD which subsequently declined by 13% at 30th day and 2.2% at 15th day after drug withdrawal during the placebo treatment. Observation suggested that cinnamon drug preparations have shown the hypoglycemic efficacy in IHD patients also.

4. **DIABETICS WITH IHD etc.**

Upon administration of Cinnamon drug preparation to subjects caused maximum highly significant decline in the plasma glucose level by 21% from 202.69 ± 56.80 mg/dl, mean ± SD at 0 day to 159.46 ± 53.63 mg/dl, mean ± SD at 30th day, and by 12% to 176.73 ± 55.94 mg/dl mean ± SD at 15th day after drug withdrawal. As compared to plasma glucose levels at 0 day of 186.04 ± 43.83 mg/dl mean ± SD, upon administration of 150 ml tea prepared with Cinnamon powder, a highly significant decline of 22% at 30th day of drug trial and of 10.7% at 15th day of drug withdrawal were observed in the plasma glucose levels of this group. The hypoglycemic effects observed is almost similar to subgroup –A preparation of Cinnamon. When 150 ml tea alone as a placebo was given to this group of subjects no highly significant change were not observed in the plasma glucose levels towards the end of the trial period; however, a 11% change (p<0.05) could be observed at 30th day of continuous tea administration where mean ± SD, mg/dl plasma glucose level of 168.66 ± 57.64 at 0 day was marginally declined to 149.87 ± 56.33 at 30th day of placebo treatment.

2. **EFFECT ON GLYCATED HEMOGLOBIN (Hb) cl**

1. **IN NORMALS**

In normal subjects at 0 day glycated hemoglobin level was found to be 5.02 ± 1.07 % mean ± SD. Upon administration of A, B and C drug preparations i.e. 3g Cinnamon powder + 150 ml Tea, 150 ml tea prepared by boiling 3g Cinnamon powder and 150 ml of tea alone as placebo respectively have caused almost no change in glycated hemoglobin levels.
2. DIABETICS:

However in diabetic subjects as compared to the normals, the glycated hemoglobin level were found to be appreciably raised and it was 8.92 ± 1 %, mean ± SD. About 0.4 to 1.8% decrease in levels were observed upon treatment of diabetic subjects with A, B and C drug preparations at 30th day of trial period.

3. HEART PATIENTS (IHD):

As compared to normals, the glycated hemoglobin level were found to be slightly elevated as 5.52 ± 0.79, 5.93 ± 0.80 and 5.96 ± 1.00 percentage, mean ± SD in C, B and A subgroups respectively at 0 day i.e. before drug/placebo delivery. Non-comparable, insignificant change were observed after drug/placebo administration and after 15th day of their withdrawal.

4. DIABETIC + IHD SUBJECTS:

Compared to normals and IHD patients, the glycated hemoglobin levels were found to be appreciably increased in these subjects. At 0 day of drug trial A, B and C it was observed to be 9.19 ± 1.37, 9.48 ± 1.35 and 9.02 ± 0.95 percent, mean ± SD respectively; and at 30th day of trial it was found to be 8.97 ± 1.21, 9.46 ± 1.34 and 9.00 ± 0.95 percent, mean ± SD correspondingly. Similar to diabetic subject (group - 2) almost no significant change in glycated Hemoglobin levels could be observed upon drug and placebo delivery and after the drug withdrawal. Both diabetic and diabetic + IHD group subjects have been found to possess almost twice the glycated hemoglobin levels than the levels of normal. It could be because of hyperglycemic conditions in the subjects of these groups. Drug administration to these subjects have shown no appreciable change/decline in glycated hemoglobin probably because of 120 days of RBC life and in comparison to it the drug trial period was maximum to 30 days. It is possible that more longer trial period of Cinnamon for more than 4-5 months could result in desired / or required effects of Cinnamon on glycated hemoglobin.

3. EFFECT ON LIPID PEROXIDATION (MDA)

1. Normals:

Normal subjects, received A drug preparation (3g Cinnamon powder + 150 ml tea) at 0 day of trial have shown 2.47 ± 0.65 µmole/l, mean ± SD malonyldialdehyde levels (MDA), a indicator of lipid peroxidation. Upon drug delivery, a considerable decline in MDA level by 34.4% at 30th day of trial and 31% at the 15th day of drug withdrawal was observed. These changes were found to be statistically highly significant. As compared to MDA level of 2.7 ± 0.13 µmole/l, mean ± SD at 0 day, B drug preparation (150 ml Tea prepared with 3g Cinnamone powder) administration have caused highly significant lowering of MDA level by about 41% towards the end of drug delivery (30th day)and 15th day of drug withdrawal.

Administration of (C) placebo (150 ml tea alone) to the normal subjects have also shown antioxidant properties by decreasing MDA levels by 25 and 20 % at 30th day of drug
delivery and after 15th day of drug withdrawal from its initial value (0 day) of 2.0 ± 0.13 µmole/l, mean ± SD respectively. However, this decline in MDA level is low as compared to the effect of Cinnamom drug preparations in tea (Table -3 and figure – 3).

2. Diabetics :

Diabetic subjects have shown almost two fold increase in levels of MDA as compared to the normals. At the 0 day of (initial) trial period, the lipid peroxidation level was found to be 5.02 ± 1.27µmole/l, mean ± SD. Which subsequently declined by 17.7% and 12.9% upon 30th day of drug delivery and at 15th day of drug withdrawal respectively (A drug preparation). These changes were observed to be statistically highly significant. Extent of decrease in MDA level in diabetic subjects upon drug delivery have been found to be less comparably to the normal subjects (A). Because of excessive generation of ROS that is induced by persistent hyperglycemia in diabetics.

Almost similar trend of decline in MDA levels were observed in Diabetic subjects received B drug preparation (150 ml Tea prepared by boiling 3g Cinnamon powder). In this group (2B) the changes in MDA levels were statistically highly significant. Diabetic subjects (Group 2C) received the placebo of 150 ml tea had MDA level of 4.29 ± 1.45 µmole/l, mean ± SD at initial day of trial (at 0 day), upon placebo (Tea 150 ml) administration, MDA level declined by 20%, a highly significant change, and almost no significant change in the level were found after 15 days of placebo withdrawal.

3. IHD (Heart group) :

Heart subjects (IHD), group 3A at initial day of trial possessed elevated lipid peroxidation level (MDA) of 6.15 ± 1.59 µmole/l, mean ± SD which was even greater than the levels at 0 day of diabetic subjects; revealed greater peroxidation in IHD subjects as compared to diabetics. Drug preparation A (3g Cinnamon powder + 150 ml tea) administration have caused a highly significant change of 17.7% and 10.9% at 30th day of trial and at 15th day after drug withdrawal respectively. At initial day of drug trial period in group 3B IHD subjects (received 150 ml tea repared by 3g Cinnamon powder) the lipid peroxidation level was observed to be 6.27 ± 1.49 µmole/l, mean ± SD. Which subsequently lowered to 5.37 ± 1.43 and 5.91 ± 1.49 µmole/l, mean ± SD by 14 and 5.7% at 30 day and at 15th day after drug withdrawal during the trial period correspondingly. These changes were statistically highly significant. Lipid peroxidation level in group 3C, IHD patients received placebo of 150 ml Tea alone have shown as 4.58 ± 1.31 µmole/l, mean ± SD at 0 day which was found to be slightly lowered to mean ± SD 4.48 ± 1.31 µmole/l at 30th day and 4.48 ± 1.31 µmole/l after 15th day of stopping placebo by 6% and 2.1% but found to be statistically significant. Observation suggested that tea of one brand administered to the subject as placebo have also shown antioxidant properties.

4. Diabetics with IHD :

Group 4A (diabetics with IHD etc diseases) subjects, like diabetics (2A) and IHD (Heart group 3A), have also shown abnormally elevated levels of 5.15 ± 1.27 µmole/l, mean ± SD lipid peroxidation (MDA). At 30th day of trial (A drug preparation) and at 15th day after drug withdrawal MDA levels were lowered to mean ± SD 4.42 ± 1.26 and 4.63 ±
1.25 µmole/l by 14 and 10 percent correspondingly. Changes were found to be statistically highly significant. When B drug preparations were given to group 4B subjects lowering in lipid peroxidation were observed by 15 and 7% from its initial value (0 day) of mean ± SD 4.55 ± 1.56 µmole/l, an almost similar trend of lowering as observed in group 4A subjects. Placebo treatment by 150 ml alone in group 4C subjects have also shown antioxidant properties where MDA levels declined by 9.7 and 5% at 30th day of trial and after 15th day of drug withdrawal respectively from its initial value of 5.41 ± 1.36 µmole/l, mean ± SD. In the present study, the lowering of lipid peroxidation, in all the major groups and its subgroups (1 to 4 groups and their subgroups A, B and C) upon drug delivery and placebo (150 ml tea alone), have been observed. Therefore, it could be expected that if Cinnamon is taken with tea will have more beneficial antioxidant effects.

4. EFFECTS ON TOTAL ANTIOXIDANT POWER (TAP;FRAP)

1. NORMAL SUBJECTS:

Total antioxidant power (TAP) in normals was found to be 2.17 ± 0.40 µmole/l, mean ± SD, the administration of A drug preparation (3g Cinnamon powder taken with 150 ml tea) have caused highly significant increase of 14.5% in TAP levels at 30th day of trial period, which was found to be remained elevated by 12.5% even at 15th day after drug withdrawal. These changes were found to be statistically highly significant. When 150 tea prepared by boiling 3g Cinnamon powder was administered to the normal subjects (drug-B), the TAP was found to be elevated to 2.5 ± 0.11 µmole/ml, mean ± SD at 30th day of drug delivery from its 2.2 ± 0.08 µmole/ml, mean ± SD levels at initial day (0 day) of trial period by 12%. This effect of Cinnamon was remained sustained one for 15 days even after drug withdrawal. These changes were found to be highly significant. When placebo of 150 ml tea was given to the normal subjects for 30 days and after 15 days of placebo withdrawal almost no change in TAP levels were observed. However, statistically insignificant change of about 4% have been found upon placebo delivery at 30th day.

2. DIABETICS:

Considerably lowered TAP levels of mean ± SD, 1.52 ± 0.49 µmole/ml was found in the diabetic subjects (Group 2-A) as compared to the normals initial day of trial. However, upon drug A administration to the diabetic subjects, an increase of 10.5% at 30th day of trial and 6.7% at 15th day of drug withdrawal were observed in TAP levels, which was found to be mean ± SD 1.70 ± 0.44 and 1.63 ± 0.46 µmole/ml respectively. The changes were found to be statistically significant. Similarly group 2B subjects also possessed considerably low TAP levels as compared to normal subjects at 0 day of trial. Compared to group 2A subjects, slightly more elevation in TAP levels were observed upon delivery of B drug preparation (150 ml tea of 3.0 g Cinnamon powder). In this group 2B drug caused highly significant 12.5% and 10% elevation in TAP levels from its initial day (0 day) value of mean ± SD 1.53 ± 0.49 µmole/ml. When placebo of 150 ml of tea was given to the diabetic subjects (Group 2C), statistically significant change of 10% increase in TAP levels was observed from its initial value of mean ± SD 1.45 ± 0.42 µmole/ml. However, upon withdrawal of placebo at 15th day insignificant change of 0.68% was
observed in TAP level. Result showed that tea of one kind (brand) also possessed some anti-oxidant properties.

3. IHD PATIENT (HEART GROUP):

Similar to diabetic patients (group 2), Heart group patients have also shown lowered TAP levels; compared to the normals. At initial day ‘0’ of drug trial, TAP level was found to be 1.51 ± 0.32 µmole/ml, mean ± SD. Upon drug A delivery at 30th day, TAP level was found to be raised by 15% and at 15th day of drug withdrawal the increase was by 8.5%. These changes were also found to be statistically highly significant. Drug B preparation administration in IHD have caused 13.7% and 8.7% elevation in TAP levels at 30th day of drug delivery and at 15th day after drug withdrawal respectively. When placebo of 150 ml tea was given to the IHD subjects of group 3C about 9.3% elevation in TAP level was observed at 30th day of trial from its initial value of 1.46 ± 0.34 µmole/ml, mean ± SD which was found to be statistically significant. However, upon withdrawal of placebo (tea) at 15th day insignificant (p>0.05) 2% elevation was observed. The elevation in TAP level at 30th day of placebo treatment may be because of known anti-oxidant properties of tea and slightly greater more change in Cinnamon treated group 3A and 3B may be because of combined anti-oxidant effect of tea + Cinnamon drug preparation under study.

4. DIABETIC + IHD:

Subjects of this group-4 have been found to possess the lowest TAP levels of mean ± SD 1.26 ± 0.33 µmole/ml at 0 day of trial when compared to its level in normals, Diabetic and Heart patients. When Cinnamon drug preparation (drug A) was administered to the subjects continuously for 30 days, it caused highly significant 16.5% at the end of trial and 10.6% at 15th day after drug withdrawal. Group 4B subjects have also been found to possess lowered TAP level of mean ± SD 1.25 ± 0.25 µmole/ml at 0 day of trial, almost similar to group 4A and compared to its levels in normals, Diabetics and Heart patients. When drug B preparation was administered to this group it caused highly significant 12.5% and 6.7% elevation in TAP levels at 30th day of drug trial and at 15th day of withdrawal of drug respectively. However, upon placebo treatment of 150 ml tea alone to group 4C subjects have shown / caused mild elevation in TAP level at 30th day (p<0.001) and insignificant elevation (>0.05) of 3.8% at 15th day after placebo withdrawal. Mild elevation may be because of established / known anti-oxidant effect of Tea.

5. EFFECTS ON (ANTI-OXIDANT ENZYMES SYSTEM) : ON GPx LEVELS

1) NORMALS (Groups -1A, 1B and 1C):

In the initial day (0 day) of normals group 1A the GPx activity was found to be mean ± SD 14.58 ± 2.87 units/gm Hb which after 30th day of drug administration (3g Cinnamon powder + 150 ml tea) increased to 15.88 ± 3.14 units/gm Hb, mean ± SD by 8% and after 15 day of drug trial the GPx level was also observed to be remained elevated to 15.27 ± 2.98 units/gm Hb by 4.5%. These changes were found to be statistically significant (p<0.001 & <0.01). In the normal subjects at 0 day of B drug trial, the GPx level was observed to be 14.8 ± 1.04 units/g Hb which subsequently got elevated highly significantly to 15.9 ± 1.28 units/g Hb mean ± SD by 8.1% and 4.8% at 30th day of trial
and at 15 days after drug withdrawal respectively. On placebo treatment of 150 ml tea alone to group -1C subjects, GPx activity was not altered from its initial (0 day) value of 15.7± 1.13 units / gm Hb, mean ± SD. Hence, whatever the effect on GPx activities were observed in Group 1A and Group 1B may be because of Cinnamon alone.

2. DIABETIC SUBJECTS (GROUP -2 A, 2B and 2C):

As compared to the normals (group 1A, 1B and 1C) the diabetic subjects have been found to possess lower GPx activities of mean ± SD, 10.23 ± 1.25 units/gm Hb at initial day ‘0’. Administration of drug A caused highly significant elevation in GPx activities by 7% and 3.7% at 30th day of trial and at 15th day of after drug withdrawal respectively. Group 2B diabetic subjects before drug B trial had mean ± SD, 9.89 ± 1.51 µmole/mlGPx activity. On drug delivery the level got elevated highly significantly by 8% at 30th day of trial and by 5.21% at 15th day after drug withdrawal respectively. The elevation of GPx activities in this group were slightly more than in group 1A, probably because of augmented effect of tea prepared by boiling 3g Cinnamon. When group 2C subjects were treated with the placebo of 150 ml tea, a slight but statistically significant elevation of 4.6% at 30th day of trial and 0.6% after 15th day of placebo stop have been observed in GPx levels from its initial value of mean ± SD 9.90 ± 1.54 µmole/g Hb at 0 day of trial (Table -6 and graph -5). Slight changes in this group -2C may be because of known anti-oxidant properties of Tea and a maximum change / elevation in GPx levels in group -2A and group -2B might be because of cumulative effects of tea and Cinnamon.

3. HEART GROUP (IHD):

Subjects of this group -3A had 11.3 ± 2.38 units/g Hb, mean ± SD GPx levels at 0 day of trial (initial value). Administration of A drug Cinnamon preparation have caused slight but significant elevation in GPx activities by 7% and 3% at the end of the drug trial (30th day) and at 15th day after drug withdrawal respectively. When B Cinnamon drug preparation were administered to IHD group -3B subjects, it caused significant 6.3% and 2% elevation in GPx activities at 30th day and after 15th day of drug withdrawal respectively. However, upon placebo treatment of 150 ml of tea to the IHD subjects of group -3C has caused about 4% elevation in GPx level at 30th day only which subsequently declined to 0.30% elevation at 15th day of placebo withdrawal.

4. DIABETIC WITH IHD (Heart Patients):

Subjects of this group (group 4A) before start of Drug A (3g Cinnamon powder + 150ml tea) have been found to possess the GPx activity of mean ± SD 9.21 ± 1.39 units/g Hb. When drug was delivered to them continuously for 30 days, substantially highly significant up regulation of GPx activities by 10.5% had been observed (at 30th day). This up regulated GPx activity was found to be sustained one and remained elevated by 6.4% even at 15th day of Cinnamon preparation withdrawal. When drug preparation B (150ml Tea of 3g Cinnamon powder) was administered to these subjects of group -4B, comparable to group -4A a slightly less but significant up regulation in GPx activities were observed at 30th day of trial by 8% and 6% at 15th day of withdrawal. Placebo treatment of 150 ml Tea alone to these subjects of group -4C have also been found to cause significant elevation in GPx activity by 6% (p<0.001) at 30th day of trial. However,
upon withdrawal of the placebo at 15th day statistically insignificant (p>0.05) elevation of 0.9% in GPx activity could be observed. Thus, because of known antioxidant properties of tea a minor up regulation in GPx activity was found. In groups -4A and 4B more changes / upregulation in GPx activities might be possibly because of cumulative antioxidative effects exerted by tea and Cinnamon powder.

6. EFFECT ON GLUTATHIONE REDUCTASE (GR) ACTIVITIES

1. NORMARLS:

Normal subjects before start of drug A have been found to possess 16.54 ± 3.13 units/ml Hemolysate, mean ± SD GR activities. After 30 days of continuous cinnamon administration, a highly significant elevation of 7.4% and at 15th day after drug withdrawal by 4% in GR activities were observed. Highly significant elevation of GR activities of 6% and 4% at 30th day of Cinnamon administration (drug-B) and at 15th day after its withdrawal were observed. When placebo of 150 ml tea alone were given to the normal subjects statistically (NC) no change in GR activities could be observed. Observation suggested that whatever up regulation in GR activities were observed in group -1A and group -1B had been due to the effect (antioxidant properties) of Cinnamon preparations alone.

2. DIABETICS:

Diabetic subjects of group -2A, 2B and 2C before start of drugs (A,B and C) have been found to possess mean ± SD, GR activities of 11.98± 1.57, 13.01± 1.21 and 12.36 ± 2.02 units/ml hemolysate respectively ranging in between 12 to 13 units approximately. Compared to the corresponding values of Normals, the GR activities in Diabetic subjects have been observed to be highly down regulated.

After 30 days of drug and placebo A, B and C administration the GR activities were found to be elevated highly significantly by 8.5, 7.0 and 3.7 percents in groups -2 A, 2B and 2C respectively. However, after their withdrawal at 15th day, it were found to be elevated by 4.7, 4.8 and 0.48 percents in group-2A, 2B and placebo (150 ml tea alone) 2C respectively. The change in 2A, 2B were highly significant (p<0.001) and insignificant (p>0.05) in 2C (placebo group). Therefore, the observation revealed that diabetic subjects had lowered or down regulated GR activities, may be because of hyperglycemia induced increased oxidative stress. Upon Cinnamon preparations administration to these subjects caused elevation/up regulation in GR activities which even persisted at 15th day of these drug withdrawal. Placebo treatment of 150 ml tea alone to diabetic subjects (group 2C) had also shown a slight increase in GR activities which after 15 days of its withdrawal it decreased almost to its basal value (0 day). Thus, it could be evident that Cinnamon possessed strong antioxidant properties.

3. IHD:

This group of subjects at 0 day of trial have been found to possess GR activities of mean ± SD 11.45 ± 2.23, 11.78 ± 1.84 and 13.42 ± 1.59 units/ml hemolysate in groups -3A, 3B and 3C respectively. Like diabetic subjects, IHD patients had also shown depressed GR
activities in the range of 11.45 to 13.42 units compared to its basal values in normals. When Cinnamon drug preparations (A and B) and placebo 150 ml Tea alone (C) were administered separately to IHD subjects of groups -3A, 3B and 3C at 30th day of its trial caused 9, 6.8 and 2.0 percent significant elevation in GR activities respectively; however upon withdrawal of above treatments/delivery at 15th day the GR activities were found to be elevated by 4.0 (p<0.001), 2.3 (p<0.05) and 0.37 (p>0.05) percents correspondingly.

4. DIABETIC WITH IHD:

Subjects of this groups -4A, 4B and 4C, before the delivery of drugs A, B and placebo (C) at initial day (0 day) of trial, have been found to possess mean± SD GR activities of 13.07± 1.89, 10.99± 2.16 and 13.27± 2.47 units/ml hemolysate respectively. Compared to the GR activities in normal subjects (GR in the range of 16.54 to 16.64 units/ml hemolysate), the diabetic subject with heart ailments have been observed to possess it in the range of 10.99 to 13.27 units/ml hemolysate which was substantially low may be due to the increased oxidative load because of diabetes and IHD. Administration of A, B Cinnamon preparations and placebo of 150 ml tea alone (C) have caused significant elevation in GR activities by 6,9 and 6 percents at 30th day of trial respectively. At 15 days after withdrawal of the delivery of above preparations, GR activities were observed to be significantly raised by 4, 6 percent in group 4A and group 4B who received Cinnamon respectively, but group 4C subject had shown no change in GR levels after the withdrawal of placebo (Tea 150 ml alone).

7. EFFECT ON CATALASE (CAT) ACTIVITIES

1. NORMALS:

Before drug delivery the catalase activities in groups-1A, 1B and 1C were observed to be mean ± SD 129.70± 25.57,129.3 ± 10.54 and 129.90 ± 10.66 µmole/min/gm Hb, respectively. Drug administration of A, B and (placebo) C separately continuously for 30 days have been found to cause the highly significant elevation in the Enzyme levels by 8, 7.5 and 6.8 percent respectively at 30th day of the trial period. Upon withdrawal of all treatments at 15th day, the catalase activities were observed to be remained elevated significantly by 4.6, 3.3 and 3 percents in group -1A, 1B and 1C respectively. Results obtained suggested that both Cinnamon and Tea alone effected in CAT activities up regulation and Cinnamon preparations with Tea seem to have more profound effects.

2. DIABETICS:

Highly depressed CAT activities were observed in Diabetics as compared to normals. In Diabetics (2A, 2B and 2C) the CAT activities were observed in the range of 62 to 70 µmole/min/g Hb whereas in the corresponding groups of normals it was in the range of 129.3 to 129.90 µmole/min/g Hb. Before Cinnamon and placebo delivery, the CAT activities were found to be mean ± SD 69.96± 13.09, 62.28± 13.24 and 61.92± 14.95 µmole/min/g Hb; almost half of the CAT activities of normals in group -2A, 2B and 2C correspondingly. Observation suggested that depressed activities of CAT in diabetic subjects is probably by a mechanism of hyperglycemia induced oxidative stress. As it is supported with the findings of increased oxidative stress (MDA) levels in these subjects.
Administration of Cinnamon preparations A, B and placebo of 150 ml tea separately continuously for 30 days have caused 6.2, 9.7 and 2.9% highly significant elevation in CAT activities in groups -2A, 2B and 2C respectively; after 15 days of withdrawal of drugs/placebo, elevation in CAT activities persisted by 3.6, 6 and 1 percent correspondingly. The changes in group 2A and 2B were significant (p<0.001) but in group 2C it was insignificant (p>0.05).

3. IHD (Heart groups 3A, 3B and 3C):
CAT activities in subjects of this groups have been observed in the range of 63 to 65 µmole/min/g Hb which were comparably lower than normals by almost half (50%). At initial day 0 i.e. before start of drugs, the CAT activities were found to be mean ± SD 63.43 ± 14.69, 65.03 ± 15.37 and 64.46 ± 15.13 µmole/min/g Hb in groups 3A, 3B and 3C respectively. When drugs A, B and Placebo C separately were given continuously for 30 days to the subjects of three groups have caused significant up regulation in CAT activities by 11, 6 and 1.86 percents respectively. However, upon withdrawal of these drugs, the effect could be retained but of lowered magnitude by 6.5, 2.6 and 0.26 percent correspondingly. These changes at 15th day of withdrawal have been observed to be significant in groups 3A and 3B and insignificant in group 3C. Results obtained suggested that subjects who received Cinnamon + tea had profound effect in upregulation of CAT activities as compared to the subjects who received placebo of 150 ml Tea alone. The effects of Cinnamon on CAT persisted even after its withdrawal but tea had not shown their such effects after withdrawal.

4. DIABETICS WITH IHD:
Compared to the normals, the subjects of these groups like diabetics and IHD subjects have also been observed to possess very low CAT activities. At initial day CAT activities were observed to be mean ± SD 61±14.96, 63.83±15.58 and 71.48±15.86 µmole/min/g Hb in groups 4A, 4B and 4C respectively. Administration of drugs A, B and placebo of 150 ml tea alone separately continuously for 30 days have caused significant elevation in CAT activities by 6.0, 5.0 and 2.3 percents by the respective treatments; however, upon withdrawal of treatment at 15 day, the changes were found to be declined and were observed to be 3.4 (p<0.001), 3.0 (p<0.001) and 1.25 (p>0.05) percents correspondingly. Result of this group have revealed that diabetics with IHD etc ailments have under greater degree of oxidative stress, thus, the treatment by Cinnamon + tea and tea alone have not shown much desired effects as it showed in other groups studied. However, it is evident that Cinnamon preparations have antioxidant properties and efficacious for these group of subjects also.

8. EFFECT ON SUPEROXIDE DESMUTASE (SOD):

1. NORMALS (Groups -1A, 1B and 1C):
In the normal subjects SOD activities before start of trial i.e. at initial day ‘0’ (basal value) was observed in the range of 3.6 to 3.64 units/mg proteins; in groups – 1A, 1B and 1C activities were observed to be 3.64±0.67, 3.60±0.16 and 3.60±1.6 units/mg proteins, mean ± SD respectively. Upon drug delivery continuously for 30 days have caused significant increase in SOD activities in groups -1A, 1B and 1C by 5.4,5.0 and 2.7
percents respectively; however, after 30 days of trial and at 15th day of drug withdrawal, still the effect persisted but slightly of lowered magnitude by 3.4, 5.0 and 2.7 percents correspondingly. All the changes were highly significant (p<0.001). When compared with placebo of 150 ml, the Cinnamon drugs A and B possessed more profound effect in upregulation of SOD activities.

2. DIABETICS (Group – 2A, 2B and 2C):

Compared to the SOD activities in the normals, the subjects of Diabetic groups had shown considerably lowered activities in the range of 1.80 to 1.87 units/mg proteins; before start of drug i.e. at 0 day of trial in groups – 2A, 2B and 2C SOD levels were found to be mean ± SD 1.87 ± 0.44, 1.80± 0.47 and 1.84 ± 0.46 units/mg protein respectively. When drugs and placebo (A, B and C) were separately administered continuously for 30 days a slight elevation in SOD levels were found in group -2A, 2B and 2C by 1.5, 1.6 and 1.6 percent respectively, statistically calculated on the basis of degree of freedom, these changes in 2A and 2B were significant but in 2C it was on insignificant change. Observations revealed that only Cinnamon preparations (A and B) have shown little but significant effect of upregulating SOD but not the Tea alone. However, in the normal subjects the effects on SOD was exhibited more by all the three preparations [Cinnamon-A and B and placebo Tea (C)]. It could be because of maximum overloading of oxidative stress in diabetic subjects and the 3.0 g amount of Cinnamon might not be sufficient to overcome the excessive load of oxidative stress in diabetic subjects.

3. IHD:

IHD patients, similar to diabetic subjects, had also been found to possess down regulated SOD activities in the range of 1.74 to 1.83 units/mg proteins, might be due to the overburdent oxidative stress (MDA). Before start of trial SOD activities in groups 3A, 3B and 3C subjects were observed to be as mean ± SD 1.83 ± 0.25, 1.74 ± 0.47 and 1.78 ± 0.28 units/mg proteins respectively; which were quite low as compared to the levels of SOD in normals. When, Cinnamon powder, A and B and placebo of 150 ml Tea alone (C) was supplemented separately and continuously for 30 days in groups 3A, 3B and 3C have resulted in minor elevations in SOD activities by 2.0, 3.8 and 0.55 percents respectively. The changes in groups 3A and 3B (received Cinnamon powder) of SOD were found to be statistically significant but in group 3C (received placebo) it was insignificant (p>0.05). However, upon withdrawal of Cinnamon drug preparations, at 15th day, the effect on SOD activities persisted significantly but with less values of 1.0 and 2.7 percents in groups 3A and 3B respectively.

4. DIABETIC + IHD:

Similar to the diabetics (group 2) and IHD (group 3) subjects, the diabetics suffering with with IHD diseases etc. have also been found to possess lowered SOD activities in the range of 1.80 to 1.85 units/mg proteins. Before drugs delivery the SOD activities were observed to be as mean ± SD 1.80 ± 0.44, 1.80 ± 0.46 and 1.85 ± 0.29 units/mg proteins in groups 4A, 4B and 4C respectively. At 30th day of trial of SOD activities were found to be appreciated significantly by 1% and 1.6% in 4A and 4B groups respectively. Where as
administration of placebo of 150 ml tea alone to group 4C have resulted insignificant effect on SOD activities (NC). However, withdrawal of Cinnamon (A, B) at 15th day of trial also have not shown any effect on SOD activities.

9. EFFECT ON BLOOD LIPID PROFILE IN FOUR MAJOR GROUPS:

1. IN NORMAL SUBJECTS:

Administration of 3.0 g Cinnamon along with 150 ml Tea have caused significant decline in T-C, TG, VLDL-C and LDL-C levels by 16,18,17.8 and 27 percent at 30th day of trial respectively; these changes were from its initial value at 0 day of trial, which were observed to be as mean ± SD levels of 168.51± 34.90 (TC), 146.45± 33.06 (TG), 29.29± 6.61 (VLDL-C) and 88.80± 25.29 (LDL-C) mg/dl correspondingly. These changes were found to be significantly persistent even after 15 days of Cinnamon withdrawal in the normal subject but it was slightly less as compared to the values found at 30th day of trial. In the normal subjects at 0 day HDL-C levels was 50.41± 9.84 mg/dl, mean ± SD. Upon administration of Cinnamon continuously for 30 days and after 15 days of its withdrawal, highly significant elevation of HDL –C levels by 3.7 and 2.3 percent were found respectively. Results suggested that Cinnamon preparation (A) possessed hypocholesterolemic and hypotriglyceridemic effects. Thus it lowered the CAD/CVD/CHD/hypertension risk factors T-C, T-G, VLDL-C and LDL-C and caused the elevation of HDL-C, a cholesterol scavenger, provided an ideal condition for prevention of arteriosclerosis progression. However, treatment of Normal subjects with B drug Cinnamon preparation (150 ml Tea of 3.0 g Cinnamon powder) have also shown almost the similar effect as exerted by drug preparation A but with a milder degree. From its initial value at 0 day T-C, TG, VLDL-C and LDL-C levels were found to be declined by 12.8, 15.7, 20.7 and 15.9 percent at 30th day of trial and 4.0,6.0,6.2 and 6.5 percent at 15th day after withdrawal of drugs correspondingly. These changes were found to be highly significant. The effect on HDL-C level were found to be of milder nature as at 30th day it got elevated by 2.3% only (p<0.001) but upon withdrawal of drug insignificant (p>0.05) change in HDL-C levels were observed. Results obtained with Cinnamon preparation (B) have also revealed that this drug preparations like drug A also possessed hypolipidemic properties but of milder nature. Placebo treatment of Normal subjects by giving 150 ml Tea alone have shown the effect on T-C, TG and LDL-C only and no effect on VLDL-C and HDL-C. From its initial values at 0 day of placebo treatment T-C, TG and LDL-C were lowered by 5.0, 2.4 and 7.6 percent at 30th day respectively, after placebo withdrawal at 15th day there were no effect on T-C and TG but LDL-C was found to be significantly lowered by 2.3%. Evidently results suggested that Tea possessed the LDL-C lowering properties which could be because of its anti-oxidant properties.

2. DIABETICS (Groups -2A, 2B and 2C):

As compared to normals, the diabetics subjects were observed to possess slightly higher blood lipid profile. At 0 day i.e. before drug A (Cinnamon 3g powder along Tea 150 ml) delivery, T-C, TG, HDL-C, VLDL-C and LDL-C levels were found to be as mean ± SD 214.32 ± 42.37, 215.96 ± 50.0, 41.44 ± 6.85, 43.19 ± 9.99 and 128.69 ± 48.54 mg/dl respectively; and after continuous delivery of drug A at 30th day T-C,T-G, VLDL-C and LDL-C declined significantly by 18, 20,20 and 24 percent respectively. Whereas HDL-C
got elevated withdrawal, by 6.8%. At 15th day after drug, the effect was found to be persistent but of lesser degree; T-C, T-G, VLDL-C and LDL-C were significantly found to be lowered by 11,11,11 and 16 percents respectively and HDL-C was observed to be elevated by 4.7%. Group 2B diabetic subjects received 3.0 g Cinnamon Tea (drug B). At initial ‘O’ day the T-C, TG, HDL-C, VLDL-C and LDL-C levels were found to be as mean ± SD 214.36± 42.24, 215.96± 50.0, 41.44 ± 6.73, 43.19 ± 9.99 and 128.69 ± 48.54 mg/dl respectively. T-C, TG, VLDL-C and LDL-C, a risk markers for CVD/CHD, declined appreciably and significantly by 18,20,21 and 24.6% respectively and HDL-C, a scavenger, got elevated significantly by 6.8%. The lipid lowering properties of Cinnamon was observed even at 15th day after withdrawal, T-C, T-G, VLDL-C and LDL-C were lowered by 11, 10.9, 10.9 and 15.6 percents and HDL-C was elevated by 4.7% respectively. These changes were found to be lowered when compared to the change observed at 30th day of trial and also proportions of change were also smaller but statistically significant. Observation suggested that drug B also possessed hypolipidemic properties as well as improved the cholesterol scavenger levels (HDL-C). Administration of 150 ml Tea alone as placebo have also resulted in slight lowering in T-C, TG, VLDL-C and LDL-C levels and mild increase in cholesterol scavenger HDL-C by 12.8, 14, 13 and 14 and 4.8 percents at 30th day of trial and at 15th day after placebo withdrawal the changes were observed to be 2.1,6.1,7.0,35 and 1.1 percents correspondingly. The changes at 30th day were observed to be highly significant but at 15th days of withdrawal it were significant for T-C, T-G, HDL-C and VLDL-C and insignificant for LDL-C. Similar to observations in Normals, the Tea have also shown mild degree of hypolipidemic effects in diabetic subjects as long as placebo was administered probably because of its anti-oxidant properties.

3. IHD (Heart Groups -A, 3B and 3C):

Compared to diabetic groups, the IHD subjects (Heart groups 3A, 3B and 3C) have been observed to possess remarkably elevated blood lipid profile. At ‘O’ day of trial the risk factors T-C, T-G, VLDL-C and LDL-C levels were found as mean ± SD 257.8 ± 53.54, 237.6 ± 51.46, 47.53 ± 10.30 and 168.58 ± 53.88 mg/dl respectively; after drug (A) delivery in group 3A at 30th day of trial, these levels were found to be declined remarkably by 24, 27, 27 and 30.6 percents correspondingly. In HDL-C levels, a cholesterol scavenger, there were 6.6% appreciation. All changes were calculated to be statistically highly significant. Observations suggested strong hypolipidemic properties of Cinnamon which even exhibited after its withdrawal by 15, 14, 14 and 17 percents in T-C, TG, VLDL-C and LDL-C respectively. HDL-C level was found to be elevated by 4.5%. Changes are highly significant (p<0.001).

As compared to the effect of drug A preparation in group 3A, the drug B (150 ml Tea of 3.0 g Cinnamon powder) administration in Group 3B have shown slightly lower hypolipidemic properties. At ‘O’ day of trial (initial value), the levels of T-C, TG, HDL-C, VLDL-C and LDL-C were observed to be mean ± SD 259.8 ± 57.89, 236.93 ± 56.17, 39.6 ± 8.52, 47.73 ± 11.17 and 165.13 ± 52.93 mg/dl respectively; which were found to be declined/elevated by 20↓, 18↓, 3.6↑, 20↓ and 22.4↓ percents correspondingly. These changes were calculated to be highly significant but slightly lowered one as compared to the effect of drug A in group 3A. Almost similar drug effects were observed with diabetic groups 2A and 2B. Upon 15 days after drug withdrawal, the effects of Cinnamon could
be retained but observed to be slightly lowered as compared to 30th day of trial. These were found to be 14, 8.8, 2.7, 10 and 12 percents for T-C, TG, HDL-C, VLDL-C and LDL-C respectively. All changes were found to be statistically highly significant. Observations suggested that both Cinnamon preparations (A and B) possessed hypolipidemic properties and moderately to mild degree could elevate the HDL-C levels (scavenger of cholesterol). Thus, Cinnamon administration in IHD subjects may improve the conditions of IHD patients and can ameliorate their sufferings. Placebo of 150 ml tea alone treatment to IHD group –3C subjects have also resulted in lowering/elevation of the blood lipid parameters but of very low magnitude as compared to the effects exhibited by Cinnamon drugs A and B. Treatment caused 9.0, 9.7, 9.8 and 13 percents decline in T-C, TG, VLDL-C and LDL-C levels from its initial value (at 0 day) of 212.46 ± 28.11, 204.8 ± 42.30, 40.96 ± 8.46 and 132.27 ± 28.06 mg/dl, mean ± SD at 30th day of trial respectively, however, upon withdrawal of placebo treatment after 15 days little effect could be retained by 2.3, 1.7, 1.7 and 3.4 percents correspondingly. Tea alone had shown very little effect in appreciating HDL-C levels by 4.3% at 30th day of trial. These changes were found to be statistically significant (p<0.001 to p<0.05). With HDL-C, upon withdrawal of tea after 15 days, no effect could be observed.

Present observations suggested that tea also possessed the properties to alter the blood lipid profile parameters but effects observed was very low as compared to the effects exhibited by Cinnamon preparations (drug A and B). Therefore, the overall effects observed with Cinnamon preparation might be because of cumulative actions/properties of both Tea and Cinnamon drug A and B.

4. DIABETICS + IHD (Groups -4A, 4B and 4C):

Subjects of this groups had also shown the dyslipidemia/hyperlipidemia like of groups 2 and 3 (A,B and C). Administration of drug A (3.0 g Cinnamon powder along with Tea 150 ml) to the patients of group -4A continuously for 30 days have resulted in decline in the levels of risk factors T-C, T-G, VLDL-C and LDL-C from its initial value by 19, 21.0, 21.0 and 25.0 percents at 30th day of trial respectively; at 15th day after drug withdrawal the extent of lowering in the levels of risk factor was observed to be slightly less but contained one by 9.9 and 12 percents from its initial value (at 0 day of trial). The initial value of T-C, TG, VLDL-C and LDL-C were observed to be 213.28 ± 45.72, 211.38 ± 57.84, 42.27 ± 11.56 and 131.19 ± 49.42 mg/dl, mean ± SD respectively. Changes were found to be highly significant. Drug A have been found to be less effective on HDL-C levels which was found to be elevated by 4.6% during the 30 days of trial (at 30th day). At 15th day after drug withdrawal, the drug effect was contained by 3.3%. Observation suggested that administration of drug A (3.0 g Cinnamon powder + 150 ml Tea) have effectively corrected the dyslipidemia/hyperlipidemia state/conditions of DM+IHD patients and to a some extent improved the HDL-C level (Scavenger). Administration of Drug -B (150 ml Tea prepared with 3.0 g Cinnamon powder) to DM+IHD group -4B have resulted in almost similar effects on various lipid profile parameters as the effects exerted by drug A (3.0 g Cinnamon + 150 ml Tea) to group -4A). Risk factors T-C, TG, VLDL-C and LDL-C were observed to be declined by 19, 23.7, 23 and 25.6 percents at 30th day of continuous drug delivery from its initial value (at 0 day) respectively; Drug effects were observed to be moderately contained even after drug withdrawal at 15th day by 10,10, 13 and 15 percent correspondingly. Changes were
calculated to be statistically significant (p<0.001). Drug B have not much effect on HDL-C levels, at 30th day of trial and at 15th day after withdrawal of drug, it increased by 6 and 2 percents respectively. However, the changes were found to be significant (p<0.01). Like drug A, Drug B have also been found to be equally effective in altering / correcting the dyslipidemic state of DM+IHD. Administration of 150 ml tea as placebo to DM+IHD group -4C patients have also caused alterations in blood lipid profile. However, the effects observed were of quite low magnitude as compared to the effects exhibited by Cinnamon drugs A and B. At 30th day of placebo treatment T-C, T-G, VLDL-C and LDL-C were found to be significantly lowered by 11, 12, 12 and 15 percents from its initial value (at 0 day of trial) respectively (p<0.001). At 15th day after placebo withdrawal T-C, T-G, VLDL-C and LDL-C levels were also found to be declined by 1.3, 1.9, 2.1 and 2.43 percents respectively. Changes were also found to be significant (p<0.01 to p<0.05). These minor changes in the levels of risk factors after withdrawal of placebo indicated that some anti-oxidants of tea was contained. Very little 3.0% significant elevation in HDL-C was observed at 30th day of placebo treatment which upon its withdrawal almost no change in HDL-C could be observed. Some effect of tea observed on lipid profile might be due to its anti-oxidant properties and the maximum/more changes observed on lipids of group -4A and 4B was possibly because of cumulative/augmented effect of Cinnamon drugs (A and B) preparations and Tea.

Present study confirmed and revealed that Cinnamon possessed hypoglycemic, anti-oxidant and hypolipidemic properties. But its regular supplementation hyperglycemia, dyslipidemia/hyperlipidemia may be corrected in the DM, IHD and DM+IHD subjects: regular inclusion of Cinnamon improved TAP of plasma, probably by quenching free radicals/reducing lipid peroxidation and by upregulating anti-oxidant defuse enzyme system in the diseased slate. Such similar effects of Cinnamon was also observed with the normal subjects; therefore, it may have preventive role also.