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## Serum butyrylcholinesterase and lipid profile in pre and “post-menopausal” women

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### ABSTRACT

Coronary artery disease (CAD) is the most important cause of death and disability among older women’s; by the year 2015 cardiovascular mortality is likely to rise to 90% in female in India. High circulating serum total cholesterol (TC), low density lipoproteins (LDL) and triglyceride (TG) are major risk factors of this disease. Butyrylcholinesterase is a serum esterase which is synthesized primarily in the liver, increased serum butyrylcholinesterase activity is found to be associated with altered lipid metabolism such as hyperlipoproteinemia, obesity, and diabetes. “Post-menopausal” women are known to have altered lipid profile; hence present study is designed to estimate serum butyrylcholinesterase and correlate with lipid profile in pre and “post-menopausal” women. The study was conducted on 60 normal female volunteers with no history of hypertension and diabetes. The volunteers were divided into “pre-menopausal” (n: 30) and “post-menopausal” women (n: 30). Serum butyrylcholinesterase was determined on semiautomatic biochemical analyser using a commercial kit with butyrylthiocholine as a substrate. Concentrations of serum TC, TG, LDL-C, high density lipoprotein- cholesterol (HDL-C) were determined on semiautomatic biochemical analyzer using enzymatic colorimetric kit. There was significant increase in Serum butyrylcholinesterase, TC, LDL-C, TG, ( $p < 0.01$ ) and significant decrease in HDL-C ( $P < 0.01$ ) in postmenopausal women compared to premenopausal women. Serum TC, LDL-C, TG correlated positively with serum butyrylcholinesterase ( $p < 0.01$ ) and negatively with HDL-C ( $p < 0.01$ ) in “post-menopausal” women. This suggests that female sex steroids in “pre-menopausal” women has plasma cholesterol lowering action as well as depresses hepatic synthesis and release of butyrylcholinesterase. Hence “post-menopausal” women are more prone for coronary artery disease compared to premenopausal women.

**Key words:** Butyrylcholinesterase, HDL-C, LDL-C, Total Cholesterol (TC), Triglyceride (TG), VLDL-C.

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## INTRODUCTION

Butyrylcholinesterase is a serum esterase which is primarily synthesized in the liver [1] and released into plasma immediately following its synthesis. This enzyme is also found in the small intestine, smooth muscle, adipose tissue, brain and other tissues, but it is not known whether this enzyme originates only from blood, or whether it can be synthesized in those tissues as well. The true physiological function of butyrylcholinesterase has not yet been identified. It was suggested that it is a precursor of acetylcholinesterase in the nervous system, with an important role in the regulation of slow impulse conduction in the nervous system and that it is involved in the hydrolyses of ingested esters from plant sources [2, 3]. On the other hand, the clinical importance of butyrylcholinesterase is well known. It hydrolyses muscle relaxant succinyl choline and local anaesthetics like procaine and tetracaine hydrochloride [4, 5]. When plasma butyrylcholinesterase activity is low, as a result of inadequate hepatic synthesis or in the case of abnormal genetic variants the metabolism of succinyl choline is reduced resulting in the increase in the duration of muscular relaxation and prolonged respiratory paralysis. Because butyrylcholinesterase activity in plasma can reflect the rate of its formation in hepatocytes, quantitative determination of the catalytic activity of butyrylcholinesterase in serum and plasma may be used as a biomarker to identify liver disorders. A decrease in butyrylcholinesterase activity in plasma is an indicator of pesticide poisoning. Results of some investigators have shown that butyrylcholinesterase is probably involved in lipid metabolism. Clitherow et al (1963) suggested that butyrylcholinesterase might hydrolyse butyrylcholine possibly formed during fatty acid metabolism [6]. Ballantyne and Bunch (1967) showed that butyrylcholinesterase occurred in the sebaceous gland and adipose tissue and suggested that butyrylcholinesterase took part in lipid metabolism [7, 8]. An increased serum butyrylcholinesterase activity is usually observed in conditions associated with altered lipid metabolism such as hyperlipoproteinemia, obesity and diabetes [3, 9-17]. Thus increased activity of butyrylcholinesterase was found when triglyceride (TG), very low density lipoprotein (VLDL or low density lipoprotein (LDL) concentrations were increased in animal model of diabetes and obesity [9-11]. Cardiovascular disease is a leading cause of death among women in the developed world. Multiple risk factors have been identified as contributory to the development of CAD. They include cigarette smoking, hypertension, diabetes mellitus and hypercholesterolemia. The activity of butyrylcholinesterase is found to be higher in older women compared to younger women [18]. Hence the present study is designed to evaluate the butyrylcholinesterase levels and to correlate lipid profile in pre and "post-menopausal" women.

## MATERIALS AND METHODS

The study was conducted on 60 normal female volunteers with no history of hypertension and diabetes. The volunteers were divided into premenopausal (n: 30) and "post-menopausal" (n: 30). Under aseptic conditions blood samples (5 ml) were drawn into plain vacutainers from ante-cubital veins. The collected blood was allowed to clot for 30 minutes, and then centrifuged at 2000 g for 15 minutes for clear separation of serum. All assays were performed immediately after serum was separated. Serum butyrylcholinesterase was

determined on semiautomatic biochemical analyser using commercial kit with butyrylcholine as a substrate (Agappe system reagent cholinesterase). Concentrations of serum TC, TG, LDL-C, HDL-C, were determined on semiautomatic biochemical analyser using enzymatic colorimetric kit (Agappe diagnostic kit).

**STATISTICAL ANALYSIS**

All the values are expressed as mean  $\pm$  SEM. A p value less than 0.05 was considered as significant. Statistical analysis was done using SPSS (statistical package for social sciences, SPSS-10, Chicago, USA). Independent sample t test was used to compare mean values. Pearson’s correlation was used to correlate between the parameters.

**RESULTS**

**Table I.** Serum Butyrylcholinesterase and lipid profile in pre and “post-menopausal” women (expressed in mean  $\pm$  SD).

Parameters	“pre-menopausal” women (n = 30)	“post-menopausal” women (n = 30)
SerumButyrylcholinesterase (U/L)	7582 $\pm$ 1532	13809 $\pm$ 3266
Serum Total cholesterol (mg/dl)	179 $\pm$ 20.6	198 $\pm$ 29.6
Serum LDL-C (mg/dl)	117 $\pm$ 21	119.0 $\pm$ 24.9
Serum Triglycerides (mg/dl)	136.7 $\pm$ 47.8	255.1 $\pm$ 110
Serum HDL-C (mg/dl)	39.5 $\pm$ 2.5	35.4 $\pm$ 4.6

\*P value < 0.01 compared to healthy controls

Figure 1- Correlation between serum butyrylcholinesterase and total cholesterol

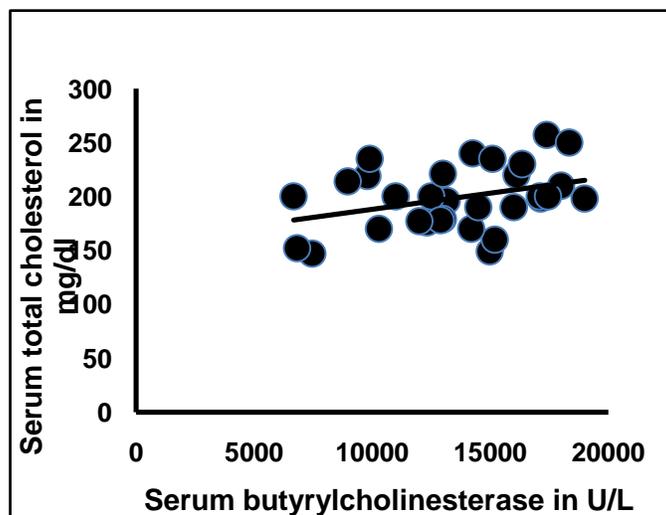


Figure 2- Correlation between serum butyrylcholinesterase and triglycerides.

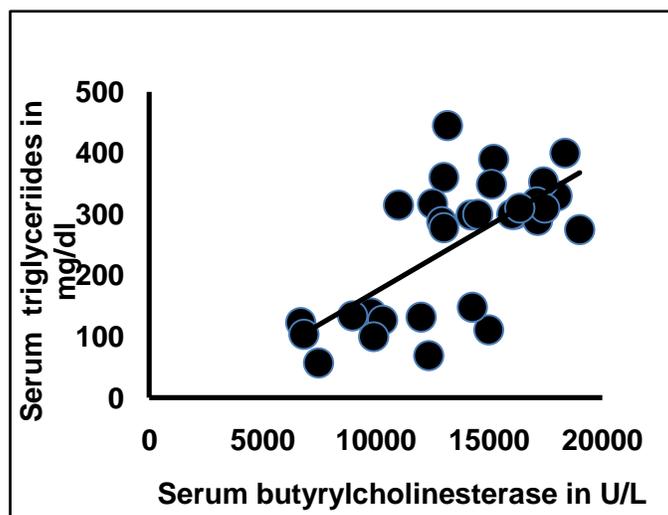
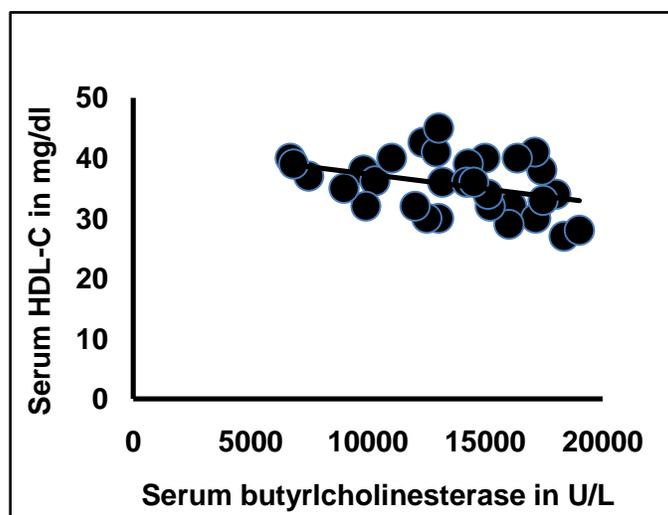


Figure 3- Correlation between serum butyrylcholinesterase and HDL-C



As depicted in Table 1, there was significant increase in Serum butyrylcholinesterase, TC, LDL-C, TG, ( $p < 0.01$ ) and significant decrease in HDL-C ( $P < 0.01$ ) in postmenopausal women compared to premenopausal women. Serum TC (Fig-1), TG (Fig-2) correlated positively with serum butyrylcholinesterase ( $p < 0.01$ ) and negatively with HDL-C ( $p < 0.01$ ) (Fig -3) in “post-menopausal” women.

### DISCUSSION

The results presented in this study demonstrates that serum total cholesterol, LDL cholesterol, triglyceride were markedly increased and HDL cholesterol was markedly decreased in “post-menopausal” women compared to premenopausal women, which is in accordance

with the previous study [18]. The marked increase in serum butyrylcholinesterase in our study in “post-menopausal” women compared to “pre-menopausal” women is also in line with a previous study [19]. But there is paucity in the literature regarding the correlation of serum butyrylcholinesterase and lipid profile in pre and “post-menopausal” women. In our study we found a significant positive correlation of serum total cholesterol and triglyceride and negative correlation of HDL-C with serum butyrylcholinesterase in “post-menopausal” women compared to “pre-menopausal” women. Hypercholesterolemia is a key factor in the pathophysiology of atherosclerosis [20]. Studies have shown that women are at less risk of developing CAD than their male counterparts but this gets abolished after 60 years of age [21,22]. After menopause, there is loss of ovarian function, metabolism, body fat distribution, coagulation, fibrinolysis and vascular endothelial dysfunction [23]. The changes that occur in the lipid profile after menopause are associated with increased cardiovascular disease risk.

Estrogen is a female sex hormone that has plasma cholesterol lowering action. It also produces vasodilatation [24]. Apart from maintaining friendly lipid profile, estrogen changes the vascular tone by increasing nitrous oxide production. It stabilizes the endothelial cells, enhances antioxidant effects and alters fibrinolytic protein. These actions reduce atherogenesis; decrease the incidence of myocardial infarction and other complications of atherosclerotic valvular disease in premenopausal women. All these cardio protective mechanisms are lost in menopause. The circulating levels of estrogen are considerably lower in “post-menopausal” women along with increase in serum total cholesterol, triglycerides, LDL cholesterol and decrease in HDL cholesterol [25, 26]. As estrogen levels are low in “post-menopausal” women, the lipid lowering action as well as the decreased hepatic synthesis of butyrylcholinesterase is lost, thus leading to increased serum lipid along with increase in serum butyrylcholinesterase. There is no doubt from this study that the changes that occur in the lipid profile along with butyrylcholinesterase after menopause is not friendly for the cardiovascular health of women. Hence “post-menopausal” women with dyslipidaemia along with increased serum butyrylcholinesterase could be more prone for coronary artery disease compared to “pre-menopausal” women.

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