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# A Comparative Study of Lipid Profile in Vegetarians and Fish eaters of Selected Areas in Coastal Karnataka, India

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Fish diet, Vegetarians, Cholesterol, Lipoproteins, Triglycerides, Cardiovascular diseases

**A B S T R A C T**

Dietary intake of fish is associated with reduced risk of cardiovascular disease. However, the contradictory statements on the beneficial effect of fish are the main rationale of this study. The study was conducted on general population consuming vegetarian diet and fish diet. The lipid parameters of 32 vegetarian and 30 fish eating population of age group 25-40 years were studied by estimating Total Cholesterol (TC), HDL- Cholesterol (HDL-C) and Triglycerides (TG). LDL- Cholesterol (LDL-C), Non HDL-C and the risk ratios TC: HDL-C, LDL-C: HDL-C and Non HDL-C: HDL-C was calculated. Lipid parameters between two groups were compared using statistical tests. Significant difference was observed between HDL-C, TG, Non HDL-C, TC: HDL-C, LDL-C: HDL-C and Non HDL-C: HDL-C. The levels of TC and LDL-C were decreased in fish eating population. The study concludes that fish diet has a definite beneficial effect over the vegetarian diet in the age group of 25-40 years.

## Introduction

Cardiovascular diseases (CVD) are the major contributors to the global burden of chronic diseases. The burden of CVD is predicted to increase significantly in developing counties by the year 2020. Major causes of the increase in disease are raising rate of hypertension, dyslipidemia, diabetes, overweight, obesity, physical inactivity, tobacco use, rapid urbanization and change in life style (Reddy *et al.*, 2006; Krishnan, 2012; Tsutsumi, 2015; Najafi and Sheikhvatan 2013). India is experiencing a process of rapid epidemiological transition in terms of patterns of health and disease as communities transform their social and economic structures. There have been marked changes in the diet and lifestyle characteristics of Indian people, resulting in a rapid emergence of CVD (Bulliyya, 2002).

Lipid abnormalities are associated with cardiovascular diseases. Low HDL Cholesterol (HDL-C), high LDL-Cholesterol (LDL-C) and abnormal triacylglycerol (TAG) are associated with a high risk of cardiovascular disease (Lozano *et.al.*, 2008). The assessment of lipid ratio is very essential even in normal individuals. High serum cholesterol, LDL-C, decreased HDL-C, hypertension, diabetes, smoking and family history are the risk factors of coronary artery disease (Kumar and Sivakansan, 2008; Kondreddy, *et al.*, 2012; Upadhyaya, 2015).

Fish and fish oil contain ω-3 fatty acids which protect the individuals from coronary heart disease. The reduction in sudden cardiac death is due to the antiarrythmic activities, reduction of thrombic and inflammatory process and serum triacylglycerol level (Minihane, 2013; Roatz *et .al.* 2013;Begg *et al*.,2012).

Fish diet is also recommended to the people with pre-existing coronary artery disease and high triglyceride level (Chowdhury, 2012). ω-3 PUFA reduces the CVD risk by regulating the lipoprotein metabolism and reduces the cardiac mortality and morbidity (Ooi, *et al*., 2015, McLennan. 2014) Consumption of food sources that provide omega-3 fatty acids, especially the long chain fatty acids from marine sources in the diet shows anti inflammatory mechanism and reduces the CVD risk significantly (Xin, *et al.*, 2012*).* Thus, an attempt has been made to compare the lipid profiles in vegetarians and fish eaters of selected areas of coastal regions in Karnataka.

## Materials and Methods

After obtaining the institutional ethical clearance, thirty two vegetarians and thirty fish eating volunteers in the age group of 25-40 years were chosen for the study. The inclusion criteria were - vegetarians: subjects consuming purely lacto vegetarian diet and fish eaters: subjects consuming minimum of 5 fish meals per week along with vegetables and occasionally other meats. The exclusion criteria for both groups were subjects who were smokers, alcoholics, diabetics or hypertensive. Informed consents were taken from the volunteers. Age, height, weight and waist circumference were recorded. Food habits of the subjects were obtained using a questionnaire.

### Collection of Sample

Five ml of venous blood was collected after an overnight fasting of 10-12 hours. Total Cholesterol (TC), High density lipoprotein-cholesterol (HDL-C) and Triglycerides (TG) parameters were estimated in the serum by using Bio Lis 24i fully automated analyzer-

Serum total cholesterol was estimated by CHOD-PAP method. (Allain *et al.*, 1974). HDL-Cholesterol was estimated by CHOD-PAP method (Williams *et al*., 1979). Estimation of plasma triglycerides was done by GPO-PAP method. (Jacobs *et al*., 1960). LDL-C was calculated using Friedwald's formula (Kanel et *al*., 2011) which assumes that VLDL-C is present in a concentration equal to $l/5^{th}$ of the triglyceride concentration. LDL-C = TC – (TG /5 + HDL-C)

Non HDL cholesterol is defined as the difference between TC and HDL-C and includes all the cholesterol present in lipoprotein particles considered to be atherogenic (Austin, 1991). Risk ratios were calculated as TC/HDL-C, LDL-C/HDL-C and Non HDL-C/HDL-C.

### Statistical Analysis

Two sample independent ‘t’ test was used to compare 2 independent groups.

## Results and Discussion

Anthropometric data of the two groups are presented in Table 1. Both the groups are comparable in age, Body Mass Index (BMI) and Waist Circumference (WC). The lipid parameters TG, HDL-C, Non- HDL-C and atherogenic risk ratios, TC: HDL-C, LDL-C: HDL-C, NonHDL-C: HDL-C has shown significant difference between two groups (Table 2). TC and LDL-C levels were decreased in fish eating population, but not statistically significant. TG and HDL-C values were within the normal limit in both the groups and marginal increase in TC, LDL-C and Non HDL - C were observed in vegetarians. TC>200mg/dL (ormal range:120-200mg/dL), TG<165(40-165mg/dL), LDL- C >130mg/dL, (40-130mg/dL) HDL-C>40mg/dL (40-88mg/dL), Non HDL-C <160mg/dL). The risk ratio calculated as TC/HDL-C, LDL-C/HDL-C, and Non HDL-C/HDL-C were decreased in fish eating population.

**Table.1** Anthropometric Data of Two Study Groups (Mean ±Sd)

| Parameters | Fish eaters (n=30) | Vegetarians (n=32) | P value |
|---|---|---|---|
| Age | 32±4.24 | 33±4.83 | P>0.05 |
| BMI | 21.8±6.9 | 24.0±4.0 | P>0.05 |
| WC | 80.75±10.45 | 84.17±11.7 | P>0.05 |
| n= number of subjects<br>BMI = Body Mass Index<br>WC = Waist Circumference | | | |

**Table.2** Lipid Profiles of Vegetarians and Fish Eaters (Mean ±Sd)

| Parameters | Fish eaters (n=30) | Vegetarians (n=32) | P value |
|---|---|---|---|
| TC mg/dL | 188±41.5 | 201±35.4 | P>0.05 |
| TG mg/dL | 118±44.1 | 154±35.4 | P<0.05* |
| HDL-C mg/dL | 49.5±8.4 | 43.8±5.0 | P<0.05* |
| LDL-C mg/dL | 113±36.69 | 134.6±23.6 | P>0.05 |
| Non-HDL-C mg/dL | 135±40.70 | 165± 34.5 | P<0.05* |
| TC: HDL-C | 3.85±1.0 | 4.67±0.81 | P<0.05* |
| LDL-C: HDL-C | 2.33±0.84 | 3.09±0.54 | P<0.05* |
| Non-HDL-C: HDL-C | 2.83±1.00 | 3.83±0.60 | P<0.05* |
| n= number of subjects<br>* Statistically significant<br><br>TC = Total Cholesterol<br>TG = Triglyceride<br>HDL -C = High Density Lipoprotein Cholesterol<br>LDL –C = Low Density Lipoprotein Cholesterol | | | |

In this study, the effect of regular dietary intake of fish on the lipid profile was investigated. Results of the study showed significant difference in TG, HDL-C, Non HDL-C and atherogenic risk ratios such as TC: HDL, LDL: HDL and Non HDL-C: HDL-C between vegetarians and fish eaters. Decreased TC, LDL-C, observed in fish eaters compared to vegetarians. Elevated levels of serum TG have long been associated with the risk of CHD (Austin, 1991; Hokanson and Austin 1996). In the present study, 33% of vegetarians and 20% of fish eaters showed TG levels above the cut off limit of 165 mg/dl. Significant difference in the TG of the two groups is consistent with the literature findings which show that Omega-3 fatty acids, which are found abundantly in fish oil lowers the plasma TG (Qi *et al.*, 2008).

HDL-C has an inverse relation to the risk of CHD. Persons with HDL-C levels below 35mg/dL have a CHD incidence rate of more than 8 times compared to persons with HDL-C levels greater than 65mg/dL or above (Tavia *et al*., 1997). In our study, significant difference in HDL-C levels was observed in the two groups, 27% of vegetarians and only 7% of fish eaters had HDL-C levels less than 40 mg/dL. Lower HDL-C values in young men aged 20 and above in whom a CHD subsequently developed (Gofman *et al.*, 1996). Lower HDL-C levels in men aged 40 and above in whom CHD developed later (Goldbourt and Medali, 1997). A hypothetical 1mg/dL increment in HDL-C is associated with 2.3% decrement of CHD risk (Gordon *et al.*, 1989). The use of non HDL-C has been suggested as a better index of CHD risk and treatment (Frost and Havel, 1998). In this study 46% of the vegetarians and only 27% of the fish eaters had a non-HDL-C greater than 160 mg/dL. The study concludes that consumption of fish in the regular diet improves the lipid status and thereby has a preventive role in CVD. The results of the present work were limited by the sample size. A large sample size study may be able to give a better insight.

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