DIET, DIABETES AND SERUM LIPIDS

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Introduction

A strong correlation between diet, plasma cholesterol, platelet function, atherosclerosis and coronary heart disease (CHD) has been established during recent years. Raised serum lipid levels and incidence of atherosclerosis and coronary heart disease (CHD) are usually associated. Various epidemiological studies has shown positive relationship of total cholesterol, low density lipoprotein (LDL), triglyceride with rise of coronary heart disease (CHD), peripheral vascular disease (PVD), Diabetes mellitus etc.[1,2,3] Rise in the incidence of coronary Heart disease (CHD) in United Kingdom has been correlated to the dietetic habit of consuming more of saturated fat[4]. In experimental models comprising of non human primates interesting observations were made in Chicago[5,6,7] that food rich in saturated fat and cholesterol with low P/S ratio as consumed in west responded in elevating plasma cholesterol and causing coronary artery changes similar to that in CHD. Further amongst the population of developing countries such as India a low but increasing incidence of CHD has been observed[8]. Consumption of calories and animal fat is strongly influenced by the Family income. Diet survey in India[9] has shown that an average Indian derives 9 to 13% of this calorific requirement from fat of which visible fat constitutes 13 to 14 gms. Amongst the poor economic group, the amount of consumption of visible fat is almost negligible.

Hence it was considered interesting to assess the diet pattern and to study the effect of total calorie consumption on prevalence of diabetes mellitus and to analyse the serum lipids (cholesterol and triglyceride) in high and low economic groups of an urban population to obtain an adequate contrast.

Material and methods

The investigation was undertaken in Cuttack Town, Orissa, India.

Adults (18 years or above) from families having annual per capita expenditure above Rs. 2100.00 or $ 225.00 on food were included in high economic group. There were some vegetarians and others non-vegetarians in this series.

Families having annual percapita expenditure on food below Rs. 1300.00 or $ 135.00 living in the same area were considered to be in the low economic bracket.

Medical college student volunteers between age group of 19 to 23 years with annual per capita expenditure of Rs. 2000.00 to Rs. 2500.00 ($ 210.00 to $ 253.00) were taken as control.

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Home visit to all families selected for study was done in order to assess family income, food consumption on the day of study and for the week under review and anthropometric measurements (height, weight and body massindex) of the individuals included in the study.

Members of the family were carefully interogated for eleciting history of diabetes mellitus and coronary heart disease (CHD).

Collection of blood samples were done early in the moruing after at least 10 hours of overnight fast for estimation of sugar (Nelson & Somogyi method), total serum cholesterol[10] and serum triglyceride[ll].

Results

Total number of 183 subjects were studicd in the present series. There were 109 males and 74 females amongst the individuals screened. The age group of the individuals. ranged between 19 to 77 years with an average of 34 years.

Per capita expenditure on food is presented in the following table.

	Mean	Range in Rs.	No. of subjects Rs.
	Rs. $		
Volunteers (V)	2430 / 254.00	2000 to 2500	26
Low ineome group (LI)	1000 / 105.00	600 to 1300	41
High income group (HI)	2558 / 270.00	2100 to 3750	116

Body Mass Index (BMI) of different groups of individuals are as follows.

	Mean.	Range
V	19.8	15.8 to 27.2
LI	21.5	13.4 to 28.2
HI	24.8	16.6 to 36.7

Total calorie consumption per day and its break up in diet is represented in the following manner.

Total calorie consumption (per day) :

		Mean	Range
V	-	2280 + 7.9	2088 to 2342
LI	-	2223 + 72.3	1576 to 3175
HI	-	2676 ± 56.6	1847 to 3752

Distribution of calories in diet

	Carbohydrate	Fat	Saturated	Unsaturated
V	1594	342	215	127
LI	1823	241	120	121
HI	1202	1105	795	310

It is evident that more calorie is consumed in the high income (HI) group than the low income (LI) group and the volunters (V). While most of the caloric requirement in LI and V groups comes from carbohydrate, in HI there is proportionately higher rate of consumption of cholestrol (Tc) fats.

The following table compares the mean fasting blood sugar (FBS), total serum triglyceride (Tg) values amongst the volunteers (V), low income group (LI) and high income group (HI).

Mean FBS, Tc and Tg (mg/dl)

	V	LI	HI
FBS	83 ± 1.7	85 ± 3.2	87 ± 1.5
Tc	166 ± 6.1	159 ± 6.4	212 ± 4.3
Tg	93 ± 4.9	87 ± 3.9	125 ± 5.4

While mean fasting blood sugar values are almost similar in all three groups (V, LI and HI), the mean serum cholesterol and triglyceride values are higher in the high income group in comparison to V and LI groups.

Relationship of mean fasting blood sugar (FBS), Te and Tg (mg/dl) has been further analysed in relation to caloric consumption.

Calorie	FBS	Tc	Tg
< 2000	84	186	111
2000 to 2500	87	190	101
2500 to 3000	84	220	117
> 3000	84	211	131

Fasting blood sugar (FBS) value almost remain same at different caloric brackets. Total serum cholesterol (Tc) values are higher above 2500 caloric level than below it. Serum triglyceride (Tg) values increase with rise of caloric consumption and it is distinctly higher above 3000 calories.

Over viewing the data the following incidences of abnormalities were detected.

	No. of diabetics	Hyper cholestero-laemia	HyperCHD triglyce radaemia	
LI (41)	2 (4.8%)	1 (2.5%)	Nil	Nil
HI (116)	10 (8.6%)	38 (33%)	30 (26%)	3
Diabeties (12)	-	6 (50%)	7 (58%)	--
Rest (145)	-	33 (22.7 ;o)	23 (15.8;)	--

In low income group (LI) the incidence of diabetes (4.8%) and hyper cholesterolaemia (2.5%) are extremely low in comparison to HI series. There is no recorded case with hyper triglyceriedaemia and CHD in LI series. On the other hand in high income group (HI) there are 10 reported cases of diabetes mellitus (8.6%) and 3 cases of CHD. The incidences of hypercholesterolaemia and hypertriglyceraedaemia are 33% and 26% respectively. These are very much higher than the corresponding LI series. Amongst the diabetic population (12) incidences of hypercholesterolameia and hypertriglyceraedimia are also higher (50% and 58% respectively) than the rest of the cases studied (145).

Statistical analysis of data for calories, Tc and Tg obtained in respect of volunteers V, Low income group (LI) and High income group (HI) is depicted below. Comparison of Tc and Tg values in cases consuming below 2500 c and above 2500 c are also compared.

	Calories	Tc	Tc
V Vs LI	N.S.	NS	NS
V Vs HI	< 0.001	< 0.001	< 0.001
LI Vs HI	< 0.001	< 0.001	< 0.001
Below Above 2500 c Vs 2500 C	-	NS	< 0.01

N.S = Not significant.

Conclusion

1. Mean caloric intake were signiiicantly higher (P < 0.001) in the HI compared to the LI group. Fat consumption was considerably higher in HI.
2. Of the 12 cases of diabetics, 10 were known and 2 were freshly detected. Ten were from HI (8.6%) and two were from LI (4.8%).
3. Hypercholesterolaemia and hypertriglyceridaemia were subjects of HI compared to 2-5 and 0.0% in LI group.
4. Hyperlipaedaemia was present in 67% of diabetics and 30% of among the rest.
5. Clinical cornary Heart Disease (CHD) was present in 3, all belonging to HI group, one was a diabetic.
6. The higher incidence of diabetes mellitus and hyperlipidaemia in the HI group can be correlated to higher caloric consumption.
7. Both total and fat calories had a positive correlation with Tg levels but the correlation was highly significant in case of fat calories (R=0.38, < 0.001)