PRINT: ISSN 0970-9274 ONLINE: 2456-6608
J. Hum. Ecol., 13(6): 449-454 (2002)
DOI: 10.31901/24566608.2002/13.06.07

Nutritional Status and Plasma Lipid Profile in Selected Ischemic Heart Disease (IHD) Patients

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INTRODUCTION

Coronary heart disease is one of the leading cause of death in many countries including India. Many research studies conducted in several countries on the correlation of diet and CHD have indicated, that the onset of such disease is determined by biochemical, clinical alterations due to adverse lifestyles, such as faulty dietary habits, smoking, alcoholism, tobacco chewing and sedentary living (Keys et al., 1986;Ghafoorunnisa, 1994).

Several dietary factors including dietary cholesterol, animal foods and total dietary fat are believed to be linked with the occurrence of CHD (Nissinen and Stanley, 1989). It is now known that the incidence of CHD cannot be related to any single attribute of the diet. The incidence of any chronic disease is an integration of dietary, environmental and population-specific risk factors. Extensive research has documented that diet plays a key role in the pathological processes of atherosclerosis and thrombosis (Ulbricht and Southgate, 1991; Sinclair, 1980). Also, evidence links elevated blood levels of total cholesterol and LDL cholesterol, as important risk factors for cardiovascular disease. Hence, the present study was conducted to analyze the serum lipid profile of IHD patients and examine its relationship with dietary and anthropometric status.

MATERIALS AND METHODS

Selection of Subjects: A total of 52 patients (46 men, 6 women) in the age range of 26-65 years, admitted at the C.S.I Holdsworth Memorial Hospital, Mysore, with Ischemic Heart Disease were selected with the help of the attending physician. The duration of their stay at the hospital ranged from 7 –12 days.

History Taking: Detailed enquiries about the past and present complaints, personal and other habits and about the family history were made, using a formulated questionnaire. Personal histories on such habits as smoking and alcohol consumption were elicited.

Body Size Measures: Height and weight as described by Jelliffe (1966) were recorded twice for each subject. The BMI was calculated (wt/ ht^2 in kg /m^2) as an index of obesity. Skin fold measurements were made using Lange skin-fold calipers, at the biceps, triceps, supra-iliac and sub-scapular levels. Measurements of body circumferences were made at the waist and hip to calculate WHR. In addition, mid-upper arm circumference (MUAC) was also recorded.

Biochemical Analysis: Estimation of serum levels of cholesterol, triglycerides, Cardiac enzymes were carried out using standard diagnostic kits.

Dietary Assessment: Dietary habits, food-frequency data was recorded with the help of a pre-tested questionnaire. Subjects were asked to recall the foods consumed on the previous day. Retrospective dietary intake data was also elicited to obtain information on the actual dietary habits of the subjects. The data from 24 hour recall were analyzed and nutrient intakes were calculated using the Indian food composition tables. (Gopalan et al., 1989). The nutrient intakes were compared against recommended intake (RDI) for ensuring appropriateness of intake of energy, protein and other micronutrient derived based on the recommended dietary allowance (ICMR, 1989).

Statistical Analysis: Mean and standard deviations were calculated for the anthropometric and biochemical data by conventional statistical methods.

RESULTS

Disease History and Personal Data of the Subjects: Socio-economic data of the subjects revealed a moderate educational and economic status.

The age wise distribution was heterogeneous, ranging from 25-69 years. In majority of subjects (35%) the disease occurred after 40 years, the percentage of men being affected was greater

in the age-group of 41-50 and 51-60 years.

The onset of Myocardial infarct (MI) was sudden (within minutes) in 37 and gradual over hours in the rest of the subjects. The symptoms reported were chest pain and sweating (85%), vomiting (42%), loss of consciousness (15%) and radiating pain in the left arm (19%).

The occurrence of MI was interpreted by the attending cardiologist on admission by using routine confirmatory tests such as cardiac enzymes (CK-MB) and ECG. The ECG pattern revealed a positive cardiographic abnormality. It was observed that while 38% of the subjects did not suffer from any other disease before the onset of MI, the rest (62%) were confirmed diabetics and hypertensives. Majority of them led a sedentary life-style and belonged to the non-exercising type. Most men subjects were smokers (67%) and alcoholics (42 %). All subjects were coffee/tea drinkers, while 34 % reported to consume more than 6-8 cups/day.

Somatic Status: Mean anthropometric measurements of the subjects are presented in table 1. BMI of all the subjects was within the normal range for men, while an upward trend was observed in women.

WHR was higher in both men and women. Comparison of MUAC and MUAMC with standards indicate a low protein status in more number of subjects. Women had higher fat mass (36%) compared to men (26%).

Table 1: Anthropometric data of the subjects

Parameters	*Men (n=46)*	*Women (n=6)*
Weight (kg)	65.4 ± 3.3	54.0 ± 3.0
Height (cm)	167.5 ± 2.2	149.5 ± 2.0
BMI	23.0 ± 2.9	24.1 ± 3.1
WHR	0.9 ± 0.2	0.9 ± 0.1
MUAC (cm)	28.0 ± 2.7	27.0 ± 2.1
TSF (mm)	12.1 ± 6.0	17.6 ± 5.7
MUAMC (cm)	15.7 ± 4.6	35.2 ± 3.7
Body fat (%)	26.8 ± 6.1	36.8 ± 6.1

BMI (Body Mass Index) = $\frac{\text{Weight (kg),}}{\text{Height (m)}}$

Normal range > 18.5-25

WHR - Waist to Hip ratio

MUAC (cm) – Mid upper arm circumference, Normal range - Male 29.3, Female 28.5

TSF – Triceps skinfold, Normal – Male 12.5, Female 16.5

MUAMC – (Mid upper arm muscle circumference), Normal – Male 25.3, Female 23.2.

Biochemical Status: The mean lipid profile and other parameters of the subjects are given in table 2. It was observed that the mean total cholesterol was normal on average (211 mg%). The mean HDL-cholesterol was low, while serum triglycerides were higher than the normal range. Significant positive correlations were observed between WHR and serum cholesterol (r =0.94), triglycerides (r = 0.46) at 0.05 level .

Since distribution of adipose tissue is reported to be an important determinant of IHD risk, the available somatic and biochemical data was classified based on WHR (Table 3). The mean body weight, BMI and body fat % were higher in the group with WHR > 0.85. Also, the lipid parameters were higher in subjects with a high WHR, however, the HDL-cholesterol was similar in both groups. Table 4 shows the distribution of subjects with values exceeding the threshold for each single risk factor according to Indian data (Ghafoorunnisa and Krishnamurthy 1991). The classical risk factors like hypertension,

Table 2: Biochemical profile of the subjects ($\bar{X}$ ± SD)

Parameter	*Men (n=46)*	*Women (n=6)*
Total cholesterol (mg%)	203.3 ± 23.3	197 ± 18.8
HDL – cholesterol (mg%)	36.3 ± 7.21	35.2 ± 3.8
LDL - cholesterol (mg%)	103..8 ± 20.7	87.7 ± 10.2
Triglycerides (mg%)	175.3 ± 26.4	198.8 ± 16.7
Haemoglobin (g/L)	13.7 ± 2.6	11.6 ± 1.8
Random Blood Glucose (mg%)	213.6 ± 34.6	164.4 ± 21.2

Table 3: Comparison of data according to WHR*

Parameters	*< 0.85*	*>0.85*
Somatic		
Age (y)	45	50
Body weight (kg)	57	64
BMI	19	23
Body fat (%)	24	28
Biochemical		
Total –cholesterol (mg%)	178.6	225.6
Triglycerides (mg%)	180.7	233.6
LDL-cholesterol (mg%)	93.5	104.5
HDL-cholesterol (mg%)	38.1	36.3

* WHR = Waist to hip ratio

Table 4: Frequency distribution of risk factors

Risk factors	*M+F (%)*	*M (%)*	*F (%)*
Cholesterol (>240 mg%)	10	9	1
Triglycerides (>200 mg%)	21	9	1
Hypertension	21	19	2
Diabetes	21	16	5
Obesity *	12	10	2
WHR (> 0.85)	38	33	5
Smoking	35	35	-
Alcohol consumption	22	21	1

*Obesity grade I , BMI > 25 –30
M = Male, F = Female

diabetes was observed in > 50% of the subjects. Cigarette smoking and alcohol consumption was also very high in all male subjects.

Dietary Pattern and Food Intake of the Subjects: The meal pattern of the subjects was similar to that prevalent in Mysore area consisting of two meals and one breakfast as assessed by the frequency of use of food stuffs by the subjects & their families. The cereals commonly used were rice, ragi, wheat and jowar in the descending order. Among pulses, only red gram dhal was being used daily, while whole grams were used either once or twice a week (23%) and occasionally (35%). Green leafy vegetables were used daily by only 17% of the subjects. Refined sunflower oil (67%) and groundnut oil (33%) was being used by the subjects. Consumption of fruits was2 found to be low (10%). Thus, the diets were predominantly cereal based with little of protective foods like vegetables, specially green leafy which are rich in antioxidants.

Majority of them had the habit of consuming coffee / tea more than 3 cups per day. 32% had the habit of eating out regularly, consuming whatever is available including fast foods. Only 26% had the knowledge of rationale of diet in the development of CHD. Subjects had received diet counseling only after the onset of disease. Subjects with previous history of IHD and diabetes, expressed being advised by doctors to reduce intake of certain foods like sugars, fatty foods.

However, during the hospital stay the subjects were counseled individually by the dietician, and in general were advised to limit the use of salt, sugar, hydrogenated fat / butter and ghee according to their biochemical status. They were advised to include fish, fresh vegetables and citrus fruits in the daily menu. Only a small number (14 %) were interested in obtaining dietary information.

The mean food intake of the subjects is given in table 5. Cereals were the major item of the foods consumed, followed by pulses and milk and its products. Their diets consisted of low amounts of green leafy and other vegetables. The mean intake of all food items, except cereals, was lower when compared to the desirable dietary pattern (DDP). Consumption of fruits was almost negligible as majority of them were diabetics. Dietary intake during hospital stay (Table 5), was much lower than the previous intake, as they were advised to consume, low-calorie and low-fat diet with moderate salt, in frequent small servings.

The nutrient intake is given in Table 6. The contribution of energy from macronutrients was as follows, carbohydrates - 65 %, protein -12 %

Table 5: Mean (±SD) food intake of the subjects

Foods	*Retrospective Intake*		*Present Intake*		*DDP**
	Men (n=46)	*Women (n=6)*	*Men*	*Women*	
Cereals	323 ± 51	300 ± 56	125 ± 24	120 ± 22	240
Pulses	37 ± 15	40 ± 8	25 ± 12	20 ± 5	60
Green Leafy Vegetables	30 ± 5	30 ± 4	12 ± 3	10 ± 5	100
Other vegetables	33 ± 5	34 ± 7	3 ± 2	4 ± 2	50
Roots & Tubers	34 ± 10	32 ± 10	10 ± 2	8 ± 2	50
Milk & Milk Products	154 ± 18	110 ± 15	210 ± 3	200 ± 20	150
Fats & Oils	30 ± 9	32 ± 7	10 ± 3	12 ± 2	30
Sugar & Jaggery	25 ± 15	20 ± 10	15 ± 6	10 ± 5	30
Fruits	18 ± 9	17 ± 4	100 ± 5	110 ± 4	100
Flesh foods	12 ± 3	10 ± 3	±	-	-

*DDP = Desirable dietary pattern–computed based on the RDA for adults with Ideal body weight to give 1800 – 2000 calories and 60g protein per day.

Table 6: Mean nutrient intake of the subjects

Constituents	*Retrospective*		*Present*	
	Male	*Female*	*Male*	*Female*
Energy (Kcal)	1857	1791	968	883
Protein (g)	55	49	34	30
Carbohydrate (g)	303	280	145	132
Fat (g)	35	27	18	21
Calcium (mg)	705	618	500	365
Iron (mg)	26	25	15	13
Retinol (mg)	446	436	268	248
Thiamine (mg)	0.9	0.9	0.3	0.4
Riboflavin (mg)	1.1	1.2	0.4	0.3
Niacin (mg)	12.2	10.1	3.9	3.6
Vitamin C (mg)	26	22	28	30

Retrospective - Before admission,
Present - During hospital stay

and fat- 23 % respectively. Higher intake of cereals reflects the energy and protein intake, the dietary intake met RDI with respect to energy, protein and calcium but fell short of iron, retinol, vitamin C and B complex vitamins. The energy intake during hospital stay, ranged from 800 –1400 k cals.

The intake of total fat in terms of its constituents was also calculated. Mean intake of both total fat and cholesterol was low. The diet consisted of polyunsaturated to saturated fat in the ratio of 1.5. Mean intake of dietary cholesterol was low (42 mg), as consumption of dairy foods and animal products was low and less frequent in majority of subjects.

DISCUSSION

Diet is considered a critical part of the individual's or family's social environment. Likewise, it is related closely to a number of chronic diseases, including diabetes, cancer and hypertension, and it is implicated in coronary heart disease (Nissinen and Stanley, 1989).

As it is seen, dietary pattern of the subjects in the present study was that of high carbohydrate, moderate protein and fat with a P : S ratio of 1.5. However, it was deficient in micronutrients specially retinol, iron and B group of vitamins. It is stated that the deficiency of micro- nutrients such as calcium, iron, vitamin A and C are associated with atherosclerotic cardio-vascular diseases or with derangement in lipid and carbohydrate metabolism (Kurup, 1989; Turner, 1982). It appears that vitamin and mineral deficiencies which are present in young adulthood if carried over with aging will result in the early onset of age–related diseases. In this study group, it is possible that habitual low intake of protective foods coupled with sedentary life-style and smoking habit, over an extended period of time might have contributed to CHD.

The quantity and source of invisible fat and type of oil determine the intake of different fatty acid in the total diet. From the dietary data of the subjects, the intakes of different fatty acids from all the foods were calculated and compared with upper limits of fatty acid for prevention of heart disease. It was observed that although total fat intake was within the recommended range, the P/S ratio was 1.5 which is 'fair' in terms of quality of total fat (Ghafoorunisa 1994). The higher PUFA / SFA ratio maybe due to the use of sunflower oil by majority of subjects. In a well balanced diet, the content of polyunsaturated to saturated fat is expected to be equal, so that P / S ratio of the dietary fat is 1.0. In addition, it is essential that the diets should provide ideal LA/ALNA ratio for prevention of heart disease (Ghafoorunnisa, 1994; Nordoy, 1999). Since most subjects were vegetarians with a low consumption of green leafy vegetables, it is possible that their diets are low in n-3 PUFA which is present in the green tissue of plants.

WHR is an indicator of central obesity and is also proposed as a better predictor of heart diseases (Thompson et al., 1992). Higher WHR has been shown to be associated with increased risk of diabetes and coronary problems (Krottiewski et al., 1983). In the present study, a significant number of subjects with higher WHR (> 0.85, mean 0.9) had higher BMI and body fat content, compared to the respective group with lower WHR. Also, serum total , LDL - cholesterol and triglyceride (TGL), values were higher in subjects with higher WHR. High WHR values have been considered to be responsible for the sharp increase in incidence of CHD in immigrant Asian Indians in the UK (Enas et al., 1992) and inferences are thereby applicable to the Indian population. Similar observations have been reported by other workers (Vijay and Sunitha, 1997). Mean cholesterol and triglycerides levels were significantly and positively correlated with WHR in the present study.

Elevated LDL and total cholesterol are establi-

shed risk factors for coronary heart disease, however, other lipids especially a combination of elevated triglycerides (TGL), elevated LDL and low levels of HDL- cholesterol, known as the atherogenic lipid triad is also important predictor of heart diseases (Tripathy and Shah, 1998). Compared to people in industrialized countries, Indians with heart disease have a distinctive atherogenic lipid profile . Subjects in the present study too, had a similar profile viz., low level of HDL, hyper-triglyceridemia and elevated LDL. Increased TGL is a risk factor for atherosclerosis since it influences the lipid deposition and clotting mechanisms (Ghafoorunisa, 1994; Tripathy and Shah, 1998). The higher TGL levels seen in Indians maybe due to habitual high carbohydrate diets and / or genetic susceptibility (Latheef et al., 1998). It is reported that reducing SFA and increasing MUFA and both PUFA results in a less atherogenic lipid profile than either PUFA or SFA diets (Mata et al., 1992; Mattson and Grundy, 1985; Grundy, 1986; Wardlaw and Snook, 1990). The treatment strategies for dislipidemias therefore, need to be addressed differently in the Indian population.

Development of chronic diseases is the interaction of dietary and other environmental factors with genetic predisposition . Results of follow-up studies on coronary heart disease suggest a synergism between risk factors (Nissinen and Stanley, 1989). Simultaneous presence of several risk factors may increase predisposition to the disease more than would be expected from the sum of the individual risk factors. Similar observations have been made in this study. Majority of the subjects also had diabetes, hypertension, high WHR. In addition, cigarette smoking and alcohol consumption was common. Hence, it is important to know to what extent risk factors occur simultaneously and / or accumulate in a population. Also, emphasis should be placed first on an effective screening program aimed at identifying people with atherogenic lipid profile in the prevention of cardiovascular diseases.

KEY WORDS Somatic Status. WHR. Dietary Intake, Lipid Profile. IHD Patients.

ABSTRACT The nutritional status of 52 (46 men, 6 women) patients with Ischemic heart disease (IHD) was assessed by body size measures, dietary history and plasma lipid profile. The mean age of disease onset was ~ 40 y. Majority of men were indulged in smoking and alcoholism. The study revealed that the food behavior and dietary intake pattern of the patients was similar to the prevailing pattern in the region. The dietaries were predominantly vegetarian type. The nutrient intake profile revealed lower protein consumption compared to recommended dietary intake (RDI). Though the Body Mass Index (BMI) was within the normal range, waist-to-hip ratio (WHR) and body fat % were higher in majority of patients. Biochemical profile revealed normal levels of total cholesterol (211mg%), low HDL-cholesterol and high triglycerides levels. WHR correlated positively with plasma cholesterol and triglycerides. The trends observed with respect to the diet type, WHR and lipid profile, differ from the prevalent view and may indicate trends peculiar to the Indian population.

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