

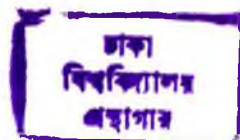
COMPARISON OF CHOLESTEROL LEVEL BETWEEN NORMAL AND PATIENTS HAVING MYOCARDIAL INFARCTION ON DIET CONTAINING BEEF, FISH, VEGETABLE AND MIXED DIET

**A dissertation submitted to The University of Dhaka in partial
fulfillment of the requirements for the degree of
Master of Philosophy in Nutrition**

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**Dedicated to
my
beloved parents**

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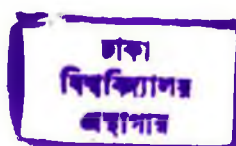
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Dr. Badrul Alam

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ABSTRACT

Myocardial Infarction is the second major cause of deaths in our country. High cholesterol level is common among the M.I. patients. Animal foods are rich in cholesterol. Our diet includes beef, fish, vegetables etc. But what is mean level of cholesterol in those eating beef, fish, vegetables or mixed diet are needed to be known for a healthy dietary practice to avoid heart disease. The objectives of the study were to estimate the cholesterol level of M.I. subject and to compare the cholesterol pattern of beef, fish, vegetable and mixed meal eating subjects and measure the effect after dietary advice. A cross section study was conducted on 125 subjects who attended the clinic.

The study was carried out between January 1998 to December 1998. Among the 3600 patients 125 subjects selected on the basis of inclusion criteria. Both male and female subjects age range between 24 - 72 yrs, myocardial infarction of any aetiology, blood pressure normal or hypertensive controlled with drug, dietary advice and medication. Anthropometric indices (weight, height), clinical examination and biochemical analysis of the blood sample were done. Diet counseling was given to all subjects after dividing into groups like fish, beef, vegetable, mixed meal and M.I. subjects. After 3 and 6 months interval cholesterol level were estimated by standard method. Finally the findings of these groups were compared.

Mean age of the subjects of different groups were 42, 45, 48, 44 and 52 years. Sixty eight % of the subjects were male. Except vegetable group all had higher educational background. Majority of the subjects were business people. More than 35% of the subjects had a monthly income of Tk. 20,000/-. About 62% had normal nutritional status and 33% were over weight. Among the beef eating population 56% were over weight while in M.I. subjects about 64% were over weight. After diet counseling in fish eating population there was no significant change in cholesterol. In beef eating group there was a gradual fall of cholesterol after 3 and 6 months. The vegetable group did not show any change. Mixed meal eating group also showed no change. In M.I. Subject showed a change in cholesterol at 3 & 6 months interval.

Dietary advice is a method for lowering cholesterol level in beef eating population and the subjects suffering from M.I.

Abbreviations

AFIP :	Armed Forces Institute of Pathology
AMI :	Acute Myocardial Infarction
BMI :	Body Mass Index
BP :	Blood Pressure
CHD :	Coronary Heart Disease
HDL :	High Density Lipoprotein
LDL :	Low Density Lipoprotein
LDH :	Lactose Dehydrogeac
MI :	Myocardial Infarction
PEM :	Protein Energy Malnutrition
TC :	Total Cholesterol
TG :	Triglyceride

INTRODUCTION

Bangladesh is the largest delta in the world. Three major rivers The Padma, The Meghna and The Jamuna drain the Himalayan ranges and pass to the Bay of Bengal through this small country. Annual flood, heavy rainfall, cyclone, tidalbore are the regular phenomenon in our country. Over 120 million people lives in 56 thousand sq. miles of land, who fight for existence against these natural disasters round the year.

Poverty and illiteracy are main obstacle to make people health consciousness. The nutritional problems of public health significance are Protein Energy Malnutrition (PEM), Micro-nutrient deficiencies like Vitamin-A, Iron, Iodine etc. In addition, the prevalence of diet related chronic disorders such as Cardiovascular diseases, Diabetes Mellitus, Hypertension, Stones, etc. seem to be increasing. . In Bangladesh MI is considered as the second major cause of death¹.

Besides this, Cardiovascular disease plays key role because of death from Acute Myocardial Infarction (AMI). Myocardial Infarction (MI) is a global health problem that primarily affects the adults of any age. The problem of Myocardial Infarction is dramatic and has gained little attention over the past years, inspite of the fact that its reduction is one of the goals of the Govt. Health programmes.

Myocardial infarction occurs when there is a critical reduction or cessation of blood flow to myocardial tissue for long enough to cause cell necrosis. In most cases M.I. is caused by occlusion of coronary artery by thrombosis in relation to an atherosclerotic plaque². This has severely restricted the ability to conduct epidemiological studies of sufficient size to look at etiological

factors. A number of studies, however, has shown that age, sex, smoking, Diabetes, Hypertension and raised serum cholesterol level are important risk factors for Myocardial Infarction among adults of any age³.

It is widely recognized that elevated cholesterol levels constitute a major risk factor for the development of Coronary Heart Disease (CHD). The incidence of hypercholesterolaemia involved patients who had other concurrent risk factor like Myocardial Infarction⁴.

In a survey of cholesterol levels in 1084 healthy New Orleans males a baseline cholesterol data was made. In this study population healthy & non obese males were elected to determine the prevalence of hypercholesterolaemia⁴. Increased cholesterol levels (>200 mg/dl) were found in 25.2% of healthy subjects. These findings help to confirm the presence of a potentially serious public health problem existing among otherwise healthy, relatively young men in the community.

In Netherlands a 12 year follow-up study suggest that death from any disease also influenced mostly by cardiovascular risk factor⁵.

Consequently, favourable changes in these characteristics might lead to an increase in life expectancy and decreases sufferings. To meet this grave situation of M.I. the effects of antioxidant rich foods as adjuncts to a prudent diet were compared for 12 weeks in a randomized, single blind and controlled trial in patients with Myocardial Infarction were carried out in India. The result suggest that as antioxidant rich food inhibits the rise of Lactose Dehydrogenase (LDH) cardiac enzyme and its protective influence was observed in Myocardial Infarction subjects. Patients showing

reduction in mortality also had a lesser rise Low Density Lipo-protein [LDL] and greater reduction in serum lipids, as well as blood glucose and blood pressure. Anti oxidant rich foods also caused a significant decrease in blood lipids with a lower decrease in High Density Lipoprotein (HDL) cholesterol in the patients⁶. Several epidemiologic evidences suggest that low levels of HDL cholesterol are strongly associated with an increase risk of coronary heart disease (CHD)⁷. Another study in Finland showed very high cholesterol level (>8.0 mmol/L) among women was responsible for higher occurrence of M.I. These findings emphasize the importance of HDL cholesterol measurement as a part of the assessment of the lipid profile as risk factor profile in patients with M.I.⁸.

In developed countries a reduction in the high average intake of fat, especially saturated fatty acids and cholesterol has been recommended for the prevention of cardiovascular diseases for the general population.

Because of about 2,50,000 deaths from M.I. in a year is a great public health problem in USA thus they carried out different studies for several decades. A study in the USA suggest the avoidance of fatty meat and meat products, reduction of fatty food products and increase intake of whole grain cereal, potatoes, vegetables help to prevent the incidence of M.I.⁹. A Dutch study also support that normal mixed diet causes a little cholesterol oxidation thus prevents the risk of M.I.¹⁰

In such a study showed that intravenous infusion of n-3 poly-unsaturated Fatty acid (PUFA) from fish oil prevents the ventricular fibrillation¹¹.

A number of studies had been carried out on trans fatty acid intake and risk of M.I. Intake of trans fatty acids was estimated after immediate hospitalization using a previously validated food frequency questionnaire. It was found that intake of trans fatty acids was directly related to risk of Myocardial Infarction¹²

Another study stressed on increased fish consumption that help in hypertension patients which is considered as a risk factor for M.I¹³.

Consumption of beef & other red meat has a relation with Myocardial Infarction. The two component of beef products are beef protein and beef fat, can potentially impart cholesterol raising properties. Protein has minimal effects on cholesterol concentrations in humans, but studies suggest that beef fat raises serum cholesterol concentration¹⁴.

Nutrition and health problem have attracted increasing interest during the last few decades in most countries. Malnutrition is still the major health problem of the world of today. Apart from the nutritional deficiency diseases there is also a close relationship between malnutrition and infection as well as M.I.

So, pattern of serum cholestrol of beef, fish and vegetables eating population and to compare the same pattern with Myocardial Infarction subjects eating fish, vegetables and mixed meal us is a need based study.

The present study will therefore, explore the risk of Myocardial Infarction and its variations with food habits and cholesterol level as well as nutritional status, socio-economic condition, age, race, sex, sanitation and rural urban distribution .

OBJECTIVES:

a) General:

To study the cholesterol level of vegetables, beef, fish and mixed meal eating population and to compare the same with myocardial infarction patients eating beef, fish, vegetables and mixed meal and its relation with diet.

b) Specific:

1. To estimate the cholesterol pattern among the Myocardial infarction patient and cholesterol pattern on beef, fish, vegetable and mixed meal eating population.
2. To find out the incidence of Myocardial Infarction in patient eating fish, beef, vegetable and mixed meal.
3. To measure the dietary pattern of M.I. patients
4. To observe the variation of M.I. incidence in aspects of nutritional status, hygienic condition, age, sex, sanitation, dietary habit, education, occupation and rural urban distribution.
5. To determine the trend of M.I. in relation to cholesterol pattern and their dietary pattern.

MATERIALS & METHODS

Study Population :

A total number of 125 patients were selected from their dietary habits like Vegetable eating, Beef eating, Fish eating and Mixed diet eating population. The cholesterol pattern of each group were compared with the same among myocardial infarction subjects.

Study Period and Place:

The study was carried out between January 98 and December 1998, at the K.C. Memorial Clinic, Magbazer, Dhaka . The clinic is supported with all modern technology. Most of the patients are reffered cases from different registered medical practitioners, all over the country.

Study Size:

On the basis of dietary habit 100 patients were categorised in different dietary groups and 25 subjects with the histroy of MI.

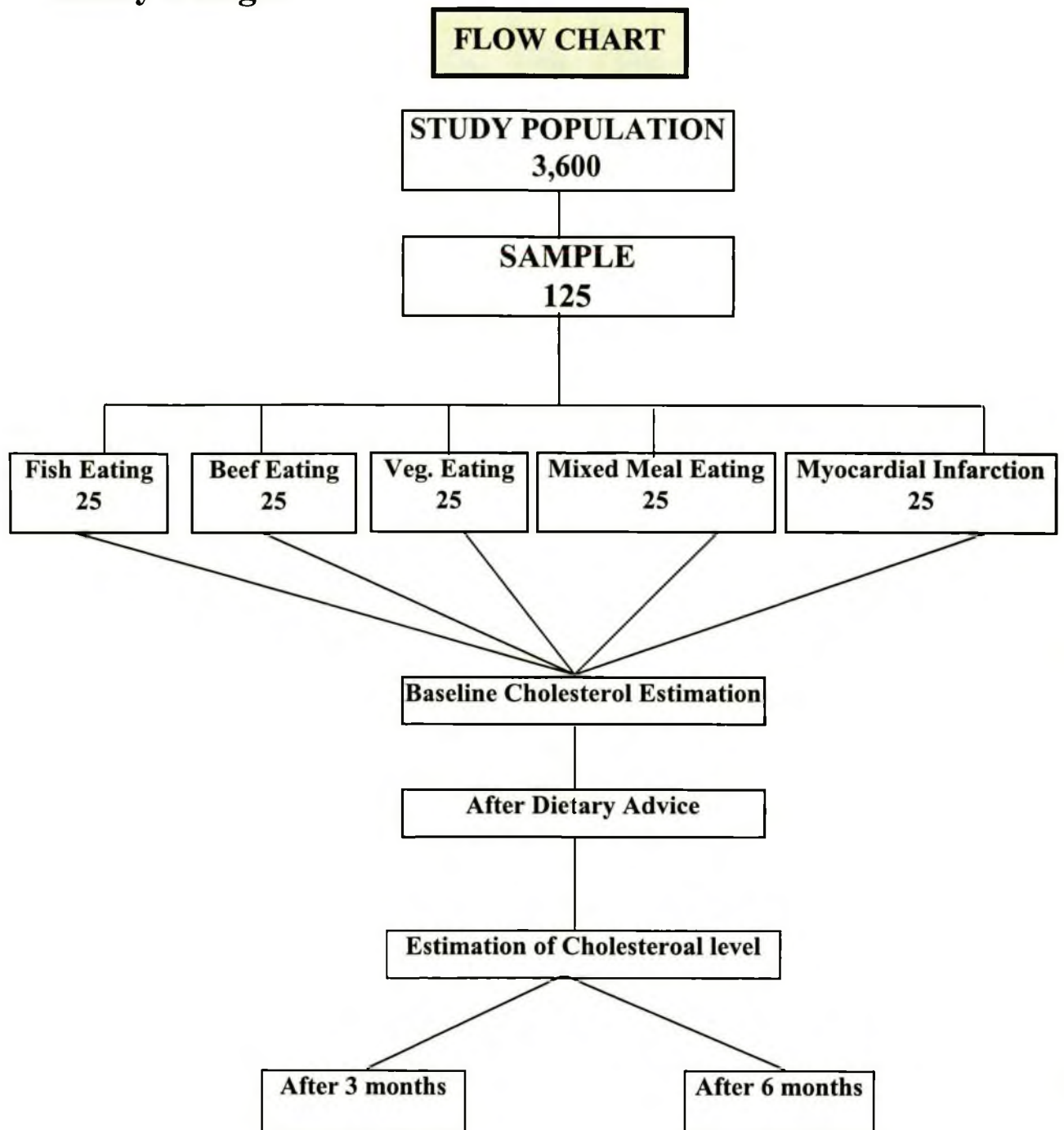
Exclusion Criteria:

Patients with evidences of malignancies and systemic disorders like Chronic liver disease, Chronic renal disease, Diabetes mellitus were excluded from the study.

Selection Criteria

1. Age range between 24-72 yrs.
2. Myocardial Infarction of any aetiology
3. Willing to accept dietary advice and medication if needed
4. Blood pressure normal or hypertensive controlled with drug
5. Absolute hisstory of taking fish, beef, vegetable and mixed meal

Study Design:



Collection of Information:

The history of each patient about their weekly dietary pattern and the last 24 hrs. dietary history was taken. For raising the change of cholesterol pattern in vegetable and fish eating subjects were asked to take milk, egg and red meat everyday. On the otherhand beef eating patient were advised to avoid red meat egg and milk. Among the mixed meal eating population egg and milk advised to avoid inspite of taking beef. Their blood pressure measured as a part of routine examination. One hundred subjects were examined at the end of 3 months and 6 months after initial contact. Their total cholesterol were measured in each time. The 25 MI subjects were interviewed about their dietary pattern and were adivsed to avoid beef, mutton, egg yolk, prawn, milk and milk products instead of taking vegetables and fish everyday. M.I. patients were followed up at 3 months and 6 months interval. Cholesterol pattern were studied during each consultation at 3 and 6 months interval. In addition to that the lipid profile - Low Density Liprotin [LDL], High Density Lipoprotein [HDL], Triglycerides [TG]) of the M.I. patients were estimated.

With the history of heart attack dietary pattern before M.I. were asked. Cholesterol measured at initial contact. Dietary advise was given to avoid red meat, milk, egg and prawn, on the other hand to add vegetables and fish everyday.

For the analysis of the nutritional status and the effect of adequate dietary support on biochemical parameters of the fish, beef, vegetables, mixed meal eating population and the M.I. subjects. The following methods were adopted.

1. Dietary history and diet counseling (through questionnaire)
2. Anthropometric incides (Age, height, weight and BMI) adopted by Jelliff
3. Clinical findings (Blood pressure, Oedema, E.C.G)
4. Biochemical analysis of
 - a) Serum cholesterol
 - b) Lipid profilewere done by standard method .

Study Drugs:

1. Nifedipine
2. Atenolol
3. Diltiazem
4. Frusemide
5. Aspirin
6. Anti oxidant like Vitamin E and C.

A thoroughly structured and pre-coded questionnaire was used for this purpose. Using standardized methodology, information has been collected on the dietary intake, weight, height, personal hygiene, socio economic condition, education, occupation, immunization practice in family, health and performance in 125 patients from January ' 98 to December' 1998.

Sample Collection:

After obtaining informed consent from all patients, a brief clinical history was recorded. Weight (kg) of the patient were taken as well as the Height (meter). Then blood pressure at the right arm in lying position were measured and 2.c.c. of blood sample collected from each patient for

estimation of total cholesterol. Among 25 M.I. patients LDL, HDL & TG were estimated.

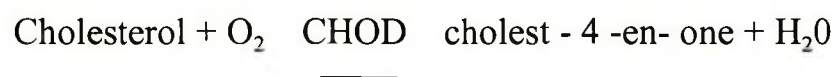
ESTIMATION OF CHOLESTEROL AND LIPID PROFILE:

METHOD :

Enzymatic - colorimetric Test (CHOD-PAP)

PRINCIPLE :

Cholesterol and its esters are released from lipoproteins by detergents. Cholesterol esterase hydrolyzes the esters and H_2O_2 is formed in the subsequent enzymatic oxidation of cholesterol by cholesterol oxidase according to the following equations.



The quantity of the red dye Quinonimine formed is proportional to the cholesterol concentration.

REAGENTS:

Reagent	I	Pipes pH 6.9	90 mmol/l
		Phenol	26 mmol/l
Reagent	II	Peroxidase	1250 U/L
		Cholesterol Esterase	300 U/L
		Cholesterol Oxidase	300 U/L
		4- Aminophenazone	0.4 mmol/L

CALCULATION:

$$\text{Cholesterol Concentration} = \frac{\text{Extinction of Sample} \times \text{Conc. Standard}}{\text{Extinction of standard}}$$

$$\text{mg/dl} \times 0.0258 = \text{mmol/l}$$

$$\text{Conc. Standard} = 200 \text{ mg/dl}$$

Reference values¹⁵ :

Normal : upto 200 mg/dl [5.2 mmol/l]

Suspected case : > 220 mg/dl [5.7 mmol/l]

Increased Risk subject : 260 mg/dl [6.7 mmol/l]

ESTIMATION OF HDL & LDL:

Principle : Low Density Lipoproteins [LDL] are specifically precipitated by phosphotungstic acid and magnesium ions and then can be removed by centrifugation. High Density Lipoprotein (HDL) remain in the supernatant. Determination of HDL cholesterol is performed using the clear supernatant.

REAGENTS:**Reagent A:**

	Phosphotungstic Acid	14 mmol /l
(Prep. Reagent)	Magnesium Chloride	2 mmol/l

Reagent B:

Cholesterol Reagent.

Calculation :**1. HDL - Cholesterol**

HDL - Cholesterol (mg/dl)= Extinction of Sample x 320 at 505 nm.

HDL - Cholesterol (mg/dl) = Extinction of Sample x 475 at 546 nm.

2. LDL cholesterol**According to the Friedewald Formula;**

$$\text{LDL Cholesterol} = \text{Total Cholesterol} - \frac{\text{Triglyceride}}{5} - \text{HDL Cholesterol}$$

Reference Values : ¹⁶

According to **Ass Mann** the following HDL & LDL Cholesterol value currently considered as guide lines.

HDL - cholesterol

Favorable Prognosis : Women > 65 (mg/dl) = 1.7 mmol/l

Men > 55 (mg/dl) = 1.4 mmol/l

Suspected Risk: Women 45 - 65 (mg/dl) = 1.2 - 1.7 mmol/l

Men 35 - 55 (mg/dl) = 0.9 - 1.4 mmol/l

Increased Risk:	Women	<45 (mg/dl)	= 1.2 mmol/l
	Men	<35 (mg/dl)	= 0.9 mmol/l

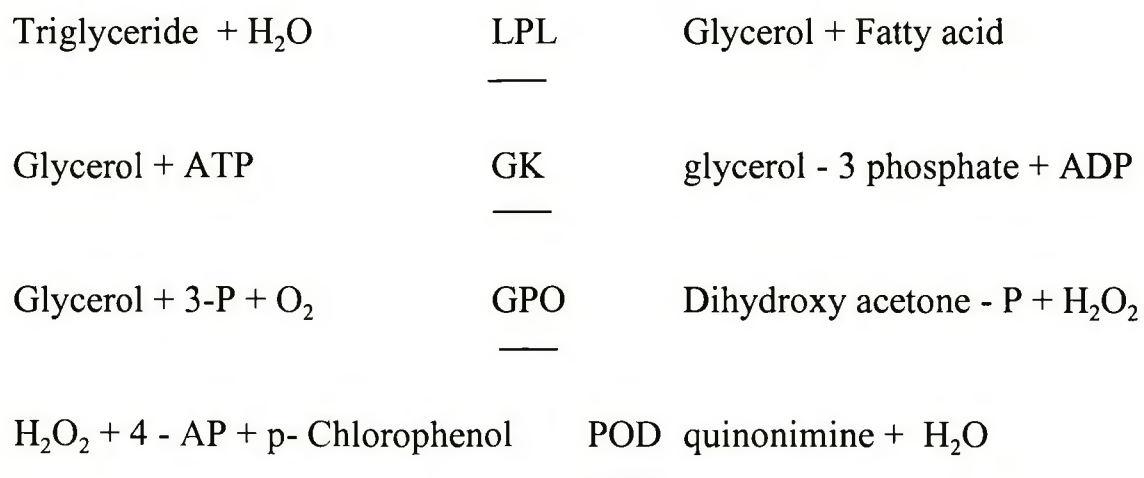
LDL - Cholesterol:

Suspected above = 150 (mg/dl)

Increased above = 190 (mg/dl)

ESTIMATION OF TRIGLYCERIDE (TG):**Principle :**

The triglycerides are enzymatically hydrolyzed to glycerol and free fatty acids. The glycerol liberated reacts with glycerol kinase and glycerol 5 - phosphate oxidase yielding H_2O_2 . The H_2O_2 concentration is determined through the Trinders reaction.



Reagents:**Reagent I**

Good Buffer p ^H 7.5	50 mmol/l
p - Chlorophenol	2 mmol/l

Reagent II

Lipoprotein lipase	150000 U/L
Glycerol Kinase	500 U/L
Glycerol - P - Oxidase	2500 U/L
Peroxidase	440 U/L
4 - Aminophenazone	0.1 mmol/l
ATP	0.1 mmol/l

CALCULATION:

$$\text{Sample Conc:} \quad \frac{\text{Extinction of Sample}}{\text{Extinction of standard}} \times \text{Standard Conc.}$$

$$\text{mg/dl} \times 0.0113 = \text{mmol/l}$$

$$\text{Standard Conc.} = 200 \text{ mg/dl}$$

Reference values:¹⁷

Suspected Above : 150 mg/dl

Increased Above : 200 mg/dl

LABORATORY PROCEDURE:

Samples of blood from 125 cases were included in the study after overnight fasting. The blood samples were centrifused and serum were seperated for estimation of cholesterol, HDL, LDL & TG. For cholesterol estimation, three test tube were filled with 2 ml. of working reagent. Working reagent was prepared by mixing 1 ml of reagent I and 1 ml of reagent II

(Composition given) of the three test tubes one was for blank, one for standard and one for sample. In the blank test tube nothing was added. On the other hand 20 μ l of the standard and 20 μ l of the sample was added in the other two test tubes. After mixing incubated for 5 mins. at 37°C. Reading of the sample was taken against blank and standard in analyser and calculated [measure the extinction (E)] of standard and sample against Blank Reagent at 505 nm by colorimeter. In the similar way HDL, LDL & TG were estimated & calculated accordingly. The whole laboratory procedure was accomplished in the Armed forces Institute of Pathology (AFIP) Dhaka Cantt.

Dietary history:

A dietary history (24 hours recall) of all study population were taken. Dietary advice was given to all subjects.

Weight:

For adults, undressing poses problems of modesty and has to be carried out separately both sexes, light weight underpants, drawers, or shorts minimum clothing known weight will usually retained. If clothing of significant weight is necessary the weight of standard garment should be discovered and subtracted from the individuals weight and shoes should be moved. The subject stand on the centre of the platform without touching else. Weighing should be an accuracy of upto 0.1 kg.

Height:

A vertical measuring rod or a scale fixed to a wall can be employed. After removing shoes, the subject should stand on a flat floor by the scale with feet parallel and with heels, buttocks, shoulders, and back of the head

touching the upright. The head should be held comfortably erect with the lower border of the orbit in the same horizontal plane as the external auditory meatus. The arm should be hanging at the sides in a natural manner. The measuring scale should be 2 meter high and capable of measuring to an accuracy of 0.5 cm.

Blood pressure:

Blood pressure of all the patients were taken after overnight fasting and after a long sleep. Patient was asked to lie down on the bed in supine position. The blood pressure was measured on the right arm. Placing the blood pressure cuff 2 finger over and above the right elbow joint Patient was allowed to take rest for 5 mins. Then BP measured with Alrk₂ SPHYGMO MANOMETER (Japan) using littman 3M USA stethoscope.

Normal level: Reference Range¹⁸

- a) upto 140/90 mm of Hg. (at the age of 20)
- b) upto 160/95 mm of Hg (at the age of 50)
- c) upto 170/105 mm og Hg (at the age of 75).

For the above studies a questionnaire was prepared to collect the data on the history / information of each patient. All the data were coded, checked after entry into the main frame computer, processed and analysed by SPSS. Statistical analysis was done by Chi- square test and proportion test when and where necessary. A model of the questionnaires is attached herewith.

RESULTS

In this study, pattern of cholesterol among the vegetarian, beef eating, fish eating and mixed meal eating population were analyzed. The relationship between cholesterol and dietary pattern along with some important variables were also studied. According to age dietary habit of patients and 25 Myocardial Infarction (MI) subjects were catagorised in groups. Mean age for fish eating population were 42.3 ± 11.1 , vegetable eating 48.3 ± 9.21 , beef eating 45.04 ± 9.97 and mixed meal eating 44.23 ± 11.2 years respectively. While for M.I subjects mean age was 52.4 ± 8.3 years. Their age limit was 40-72 years.

TABLE 1: AGE DISTRIBUTION OF THE SUBJECTS

Study Groups	n	Mean	Std. Dev
Fish eating	25	42.30	11.10
Beef eating	25	45.04	9.97
Vegetable eating	25	48.32	9.21
Mixed eating	25	44.23	11.20
Myocardial Infarction	25	52.40	8.30

The male subjects (68%) consumed 56,80,68 and 68 percent of fish, beef, vegetable and mixed meal where as the same eating pattern were 44, 20, 32 and 32 percent in females (32%)

TABLE 2: THE SEX DISTRIBUTION OF THE SUBJECT BY STUDY GROUPS

Study Groups	Male		Female	
	No.	%	No.	%
Fish eating (n=25)	14	56.0	11	44.0
Beef eating (n=25)	20	80.0	5	20.0
Vegetable eating (n=25)	17	68.0	8	32.0
Mixed eating (n=25)	17	68.0	8	32.0
Total and %	68		32	

Education level were categorised as signature position only i.e. who can sign his/her name and upto class V. The other groups were upto S.S.C level, upto H.S.C level, graduation and above level. Only 4% of beef eating, mixed meal and fish eating population were on signature position only. In comparison to different dietary pattern 56% of the M.I. patient had education level graduation and above.

TABLE 3: EDUCATION LEVEL OF STUDY GROUPS IN %

Study Groups	Signature	Up to class V	S.S.C	H.S.C	Graduation and Above
Fish eating	4.0	20.0	4.0	16.0	56.0
Beef eating	4.0	48.0	20.0	4.0	24.0
Vegetable eating	8.0	36.0	20.0	20.0	16.0
Mixed eating	4.0	12.0	8.0	32.0	44.0
Myocardial Infarction	0	12.0	8.0	24.0	56.0

Among the service holders the practice of fish eating was 40% but among the business people intake of beef is as high as 56%. Similarly patients by profession business suffers maximum from M.I. The second group suffer from M.I. in others which includes Doctor, Engineer, Teacher and Lawyers. Only 8% were housewives and 16% service personnel suffers from M.I.

TABLE 4: OCCUPATION OF THE SUBJECTS IN %

Study Groups	Service	Business	Housewife	Others
Fish eating	40.0	24.0	28.0	8.0
Beef eating	20.0	56.0	24.0	0
Vegetable eating	12.0	4.0	28.0	56.0
Mixed eating	8.0	48.0	24.0	20.0
Myocardial Infarction	16.0	48.0	8.0	28.0
Total	20.0	33.0	26.0	21.0

In this study we found that 59% of the subjects were from urban areas while 41% from rural areas. But 100% of the M.I. subjects were from urban areas. This study shows urban dominance over rural among different dietary habits.

TABLE 5: RURAL URBAN DISTRIBUTION OF THE SUBJECTS

Study Groups	Rural n	%	Urban n	%
Fish eating	14	34.14	11	18.64
Beef eating	2	4.88	23	38.98
Vegetable eating	16	39.02	9	15.26
Mixed eating	9	21.96	16	27.12
Total %	41		59	

Majority of rural people were vegetarian(39.02%) fish is in their second choice where as mixed eating comes the third. Majority of urban people eats beef (38.98%) and mixed meal (27.12%) and then comes fish (18.64%) and vegetables (15.26%).

Table: 6 showed none of the M.I. patients had the monthly income less than Tk. 1000.00 per month. The prevalence of M.I. was significantly higher among the patients with a monthly income above Tk. 15,000.00 per month. 72% of the M.I. subjects had the monthly income >Tk15000.00 per month, but 56% among the beef eating population. A total of 36% had average income of >Tk.20,000.00 per month. About 72% of the vegetarian had monthly income <Tk.5,000.00 per month and fish eating group was in Tk.5000-10000 income group. In mixed meal eating group it was highest (32%) >Tk..15000.00 per month.

TABLE 6: MONTHLY INCOME OF THE SUBJECTS IN %

Study Groups	1000-5000	5001-10000	10001-15000	>15000	Dependant
Fish eating	16.0	28.0	8.0	20.0	28.0
Beef eating	0	12.0	8.0	56.0	24.0
Vegetable eating	72.0	0	0	0	28.0
Mixed meal eating	16.0	4.0	20.0	32.0	28.0
Myocardial Infarction	12.0	4.0	4.0	72.0	8.0
Total	23.2	9.6	8.0	36.0	23.2

Table: 7 showed the average weight for fish eating population were 60.96 ± 7.63 kg. While it was highest in beef eating subject (70.28 ± 9.2 kg). The vegetarian had the lowest average body weight which was (52.52 ± 6.14 kg). The mean height was 164.49 ± 6.01 cms among the beef eating population but lowest in MI subjects which was 162.26 ± 4.88 cms.

TABLE 7 : AGE, HEIGHT, WEIGHT AND BODY MASS INDEX (BMI) OF THE SUBJECTS

Group	No. of Patients	Age (years)	Height (cm)	Weight (Kg)	BMI
Fish eating	25	43.30 ± 11.10	163.16 ± 7.97	60.96 ± 7.63	23.06 ± 2.33
Beef eating	25	45.04 ± 9.97	164.49 ± 6.01	70.28 ± 9.20	26.12 ± 3.36
Veg.eating	25	48.32 ± 9.21	162.76 ± 8.74	52.52 ± 6.14	19.85 ± 1.67
Mixed diet	25	44.23 ± 11.20	164.19 ± 7.36	62.24 ± 7.68	23.15 ± 2.49
MI	25	52.40 ± 8.30	162.26 ± 4.88	66.64 ± 6.84	25.26 ± 2.21

TABLE 8: BODY MASS INDEX (BMI) OF SUBJECTS

Groups	BMI <18.4	BMI 18.5-24.9 (Normal)	BMI >25 (Obese)
Fish eating	0	20 (80%)	5 (25%)
Beef eating	0	11 (44%)	14 (56%)
Veg. eating	6 (24%)	19 (76%)	0
Mix. meal eating	0	19 (76%)	6 (24%)
MI patients	0	18 (72%)	7 (28%)
Total %	6(4.8)	78(62.4)	41(32.8)

The average BMI for fish eating population was 23.06 ± 2.33 . Similar pattern observed in mixed meal eating population. But in beef eating and vegetable eating population the average BMI was calculated as 26.12 ± 3.36 and 19.85 ± 1.67 respectively. This results indicate that beef eating population in respect to other groups had heightest BMI and Fifty six percent of them were over weight (Table 8).

This Figure showed the highest BMI among the beef eating population which was $26.12 \pm 3.36 \text{ kg/m}^2$. Subsequently lowest BMI in vegetable eating subjects which was $19.85 \pm 1.67 \text{ kg/m}^2$.

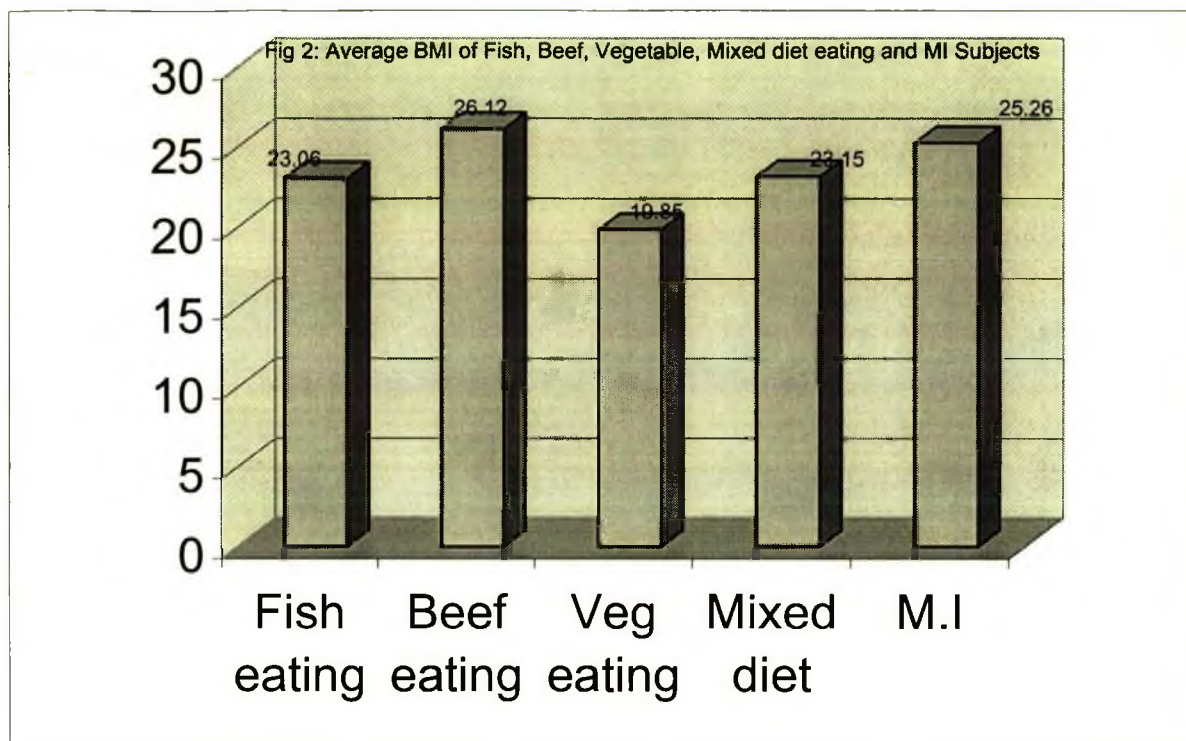


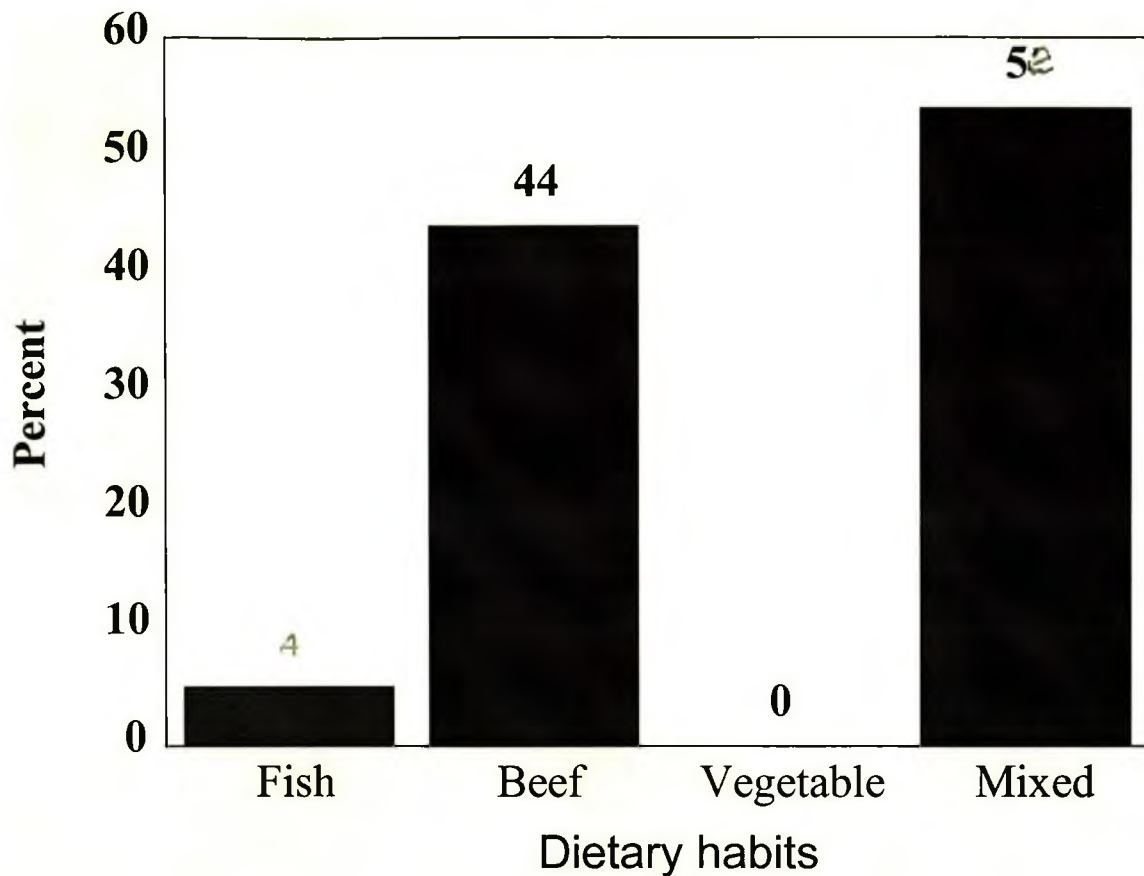
Table:9 showed all patients of M.I. from urban areas of which 80% drinks boiled water but it was lowest in vegetable eating population (16%). Eighty four percent MI subject had own house while 40% of the vegetarian staying in sublet houses.

All subjects of fish, mixed meal and MI subject had kitchen room. While 92 and 72% among the beef and vegetable eating subject.

**TABLE 9: ENVIRONMENTAL CONDITION OF THE
SUBJECTS**

Study Groups	Fish Eating (%)	Beef Eating (%)	Vegetable Eating (%)	Mixed Eating (%)	Myocardial Infarction (%)
Residence					
Own	60.0	60.0	40.0	72.0	84.0
Rent	40.0	36.0	20.0	28.0	16.0
Sub-let and others	-	4.0	40.0	-	-
Building	64.0	96.0	48.0	72.0	100.0
Pucca Tin	28.0	-	12.0	20.0	-
Tin and others	8.0	4.0	40.0	8.0	-
No. of Room					
One	-	12.0	12.0	-	-
Two	12.0	4.0	20.0	-	-
Three	40.0	24.0	24.0	48.0	8.0
Above three	48.0	60.0	44.0	52.0	92.0
Kitchen room					
Present	100.0	92.0	72.0	100.0	100.0
Absent	-	8.0	28.0	-	-
Hand wash before meals					
Yes	28.0	64.0	36.0	64.0	64.0
No	72.0	36.0	64.0	36.0	36.0
Place of Defaecation					
Pacca	100.0	100.0	68.0	92.0	100.0
Kacha	-	-	32.0	8.0	-
Use of water					
Supply	20.0	52.0	28.0	-	20.0
Tube well	32.0	16.0	56.0	40.0	-
River/pond	-	-	-	-	-
Boild Mineral	48.0	32.0	16.0	60.0	80.0

Fig. 1: Incidence of Myocardial Infarction in Fish, Beef, Vegetable and Mixed meal eating subjects



This figure showed dietary pattern of MI subjects. Fifty two percent of the MI subject had the history of taking mixed meal while 44% were beef eating. We found none among the vegetarian with the history of MI but 4% of the fish eating population suffers from MI.

Table:10 showed the base line cholesterol level among fish eating population was 174.39 ± 28.4 mg/dl. which is statistically non significant. Similarly after dietary advice total cholesterol level at three and six month interval showed non significant change.

TABLE 10: COMPARISON OF CHOLESTEROL LEVEL OF FISH EATING SUBJECTS AT THREE MONTHS INTERVAL

Cholesterol Level(mg/dl)	Mean $\pm$ SD	% difference	P. Value
Base line	174.39 ± 28.4	-	>0.05
After three months interval	173.75 ± 24.4	-.37	>0.05
After six months interval	176.1 ± 20.1	.98	>0.05

Analysis of variance : $F = 0.07$ $P > 0.05$ NS

Multiple range test : No two groups are significantly different at the 5 % level

Fig. 2 : Linear trend of Cholesterol level of Fish eating subjects by consecutive 3 months interval

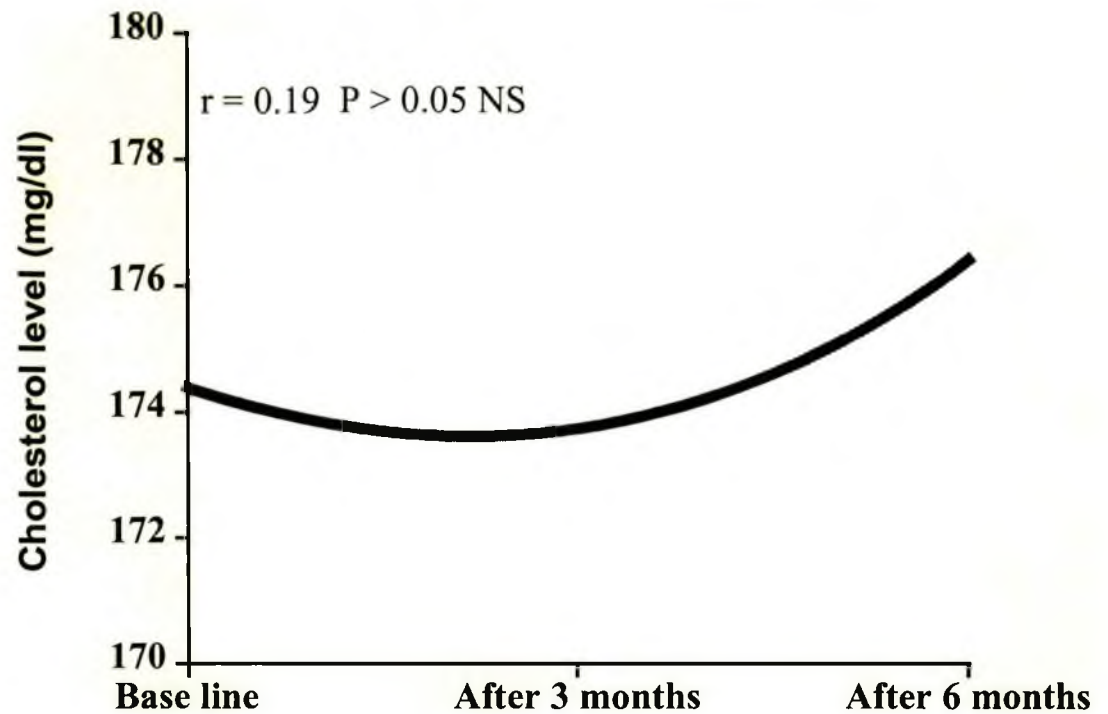


Figure:3 showed rise of cholesterol level. The % difference at six month interval was not significant ($P > 0.05$)

Table: 11 showed the base line mean cholesterol level for beef eating population $236.2 \pm 33.62 \text{ mg/dl}$ which was statistically significant ($P < 0.05$). After dietary advice total cholesterol level at six month interval was $207.2 \pm 22.05 \text{ mg/dl}$ which is statistically significant as the % difference – 12.28. This is also significant that beef eating population are mostly hypercholesterolemic.

TABLE 11: COMPARISON OF CHOLESTEROL LEVEL OF BEEF EATING SUBJECTS AT THREE MONTHS INTERVAL

Cholesterol Level	Mean $\pm$ SD	% difference	P. Value
Base line	236.2 ± 33.62	-	<0.05
After three months interval	218.96 ± 24.4	-7.3	>0.05
Next after six months interval	207.2 ± 22.05	-12.28	<0.05

Analysis of variance : $F = 6.84$ $P < 0.05$ S

Multiple range test: *Denotes pairs of groups are significantly different at the 5 % level

Figure:4 showed the linear trend of cholesterol level among the beef eating population the base line cholesterol level was significant. But after three month dietary advice showed non significant change (218.96 ± 24.4) and the % difference was -7.3 . But after six month of dietary advice showed the gradual fall in cholesterol level which was statistically significant ($P < 0.05$)

Fig.3 : Linear trend of Cholesterol level of Beef eating subjects by consecutive 3 months interval

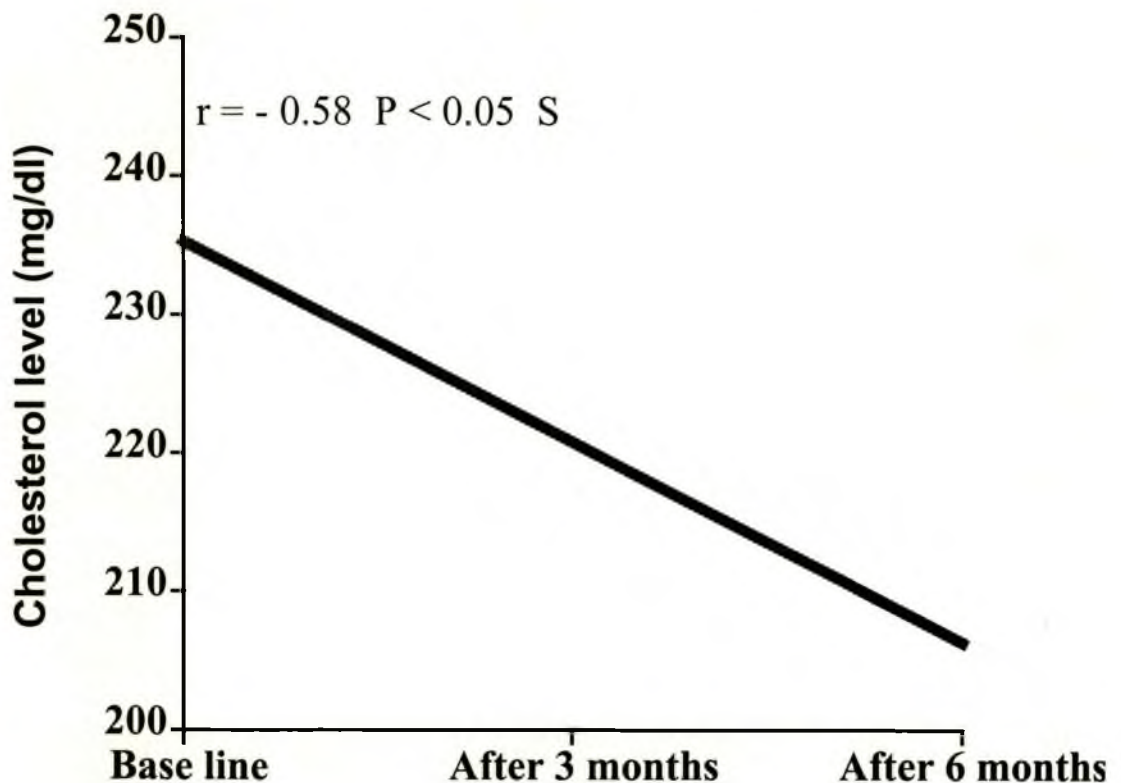


Table:12 showed the mean cholesterol level for vegetable eating population 167.64 ± 25.1 mg/dl at baseline. Cholesterol level measured at 3 months interval with dietary advice. Mostly all patient refused to take red meat. But intake of milk and egg shown non significant change in total cholesterol pattern. After six month the total cholesterol level was 169.7 ± 18.7 mg/dl. The % difference was 1.23. This change was not significant ($P > 0.05$).

TABLE 12: COMPARISON OF CHOLESTEROL LEVEL OF VEGETABLE EATING SUBJECTS AT THREE MONTHS INTERVAL

Cholesterol Level	Mean $\pm$ SD	% difference	P. Value
Base line	167.64 ± 25.1	-	>0.05
After three months interval	168.10 ± 18.8	.27	>0.05
Next after six months interval	169.7 ± 18.7	1.23	>0.05

Analysis of variance : $F = 0.5$ $P > 0.05$ NS

Multiple range test : No two groups are significantly different at the 5 % level

Figure:5 showed the rise of total cholesterol level after dietary advice at three and six month interval. But this trend of rise in cholesterol level was not statistically significant ($P>0.05$).

Fig.4 : Linear trend of Cholesterol level of Vegetable eating subjects by consecutive 3 months interval

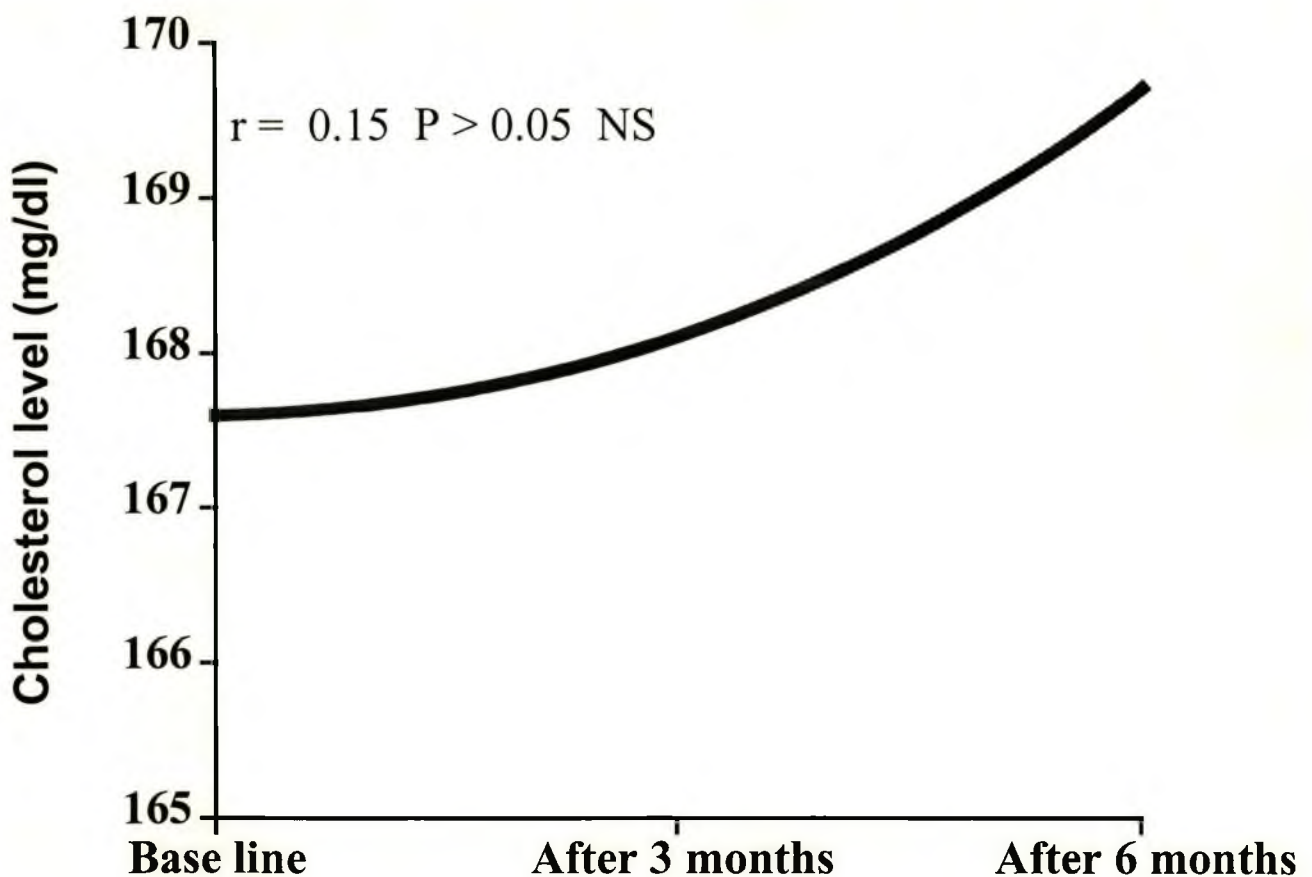


Table:13 showed the base line mean cholesterol level mixed eating population 178.8 ± 31.8 mg/dl which was statistically non significant. After dietary advice the fall in cholesterol level was non significant (178.0 ± 21.4). The % difference was -.45.

TABLE 13: COMPARISON OF CHOLESTEROL LEVEL OF MIXED MEAL EATING SUBJECTS AT THREE MONTHS INTERVAL

Cholesterol Level	Mean $\pm$ SD	% difference	P. Value
Base line	178.8 ± 31.8	-	>0.05
After three months interval	178.4 ± 27.10	-.22	>0.05
Next after six months interval	178.0 ± 21.4	-.45	>0.05

Analysis of variance : $F = 0.15$ $P > 0.05$ NS

Multiple range test : No two groups are significantly different at the 5 % level

Figure:6 showed the linear trend of cholesterol level among the mixed meal eating population at three and six months interval the fall of cholesterol level was not significant ($P>0.05$).

Fig.5: Linear trend of Cholesterol level of Mixed eating subjects by consecutive 3 months interval

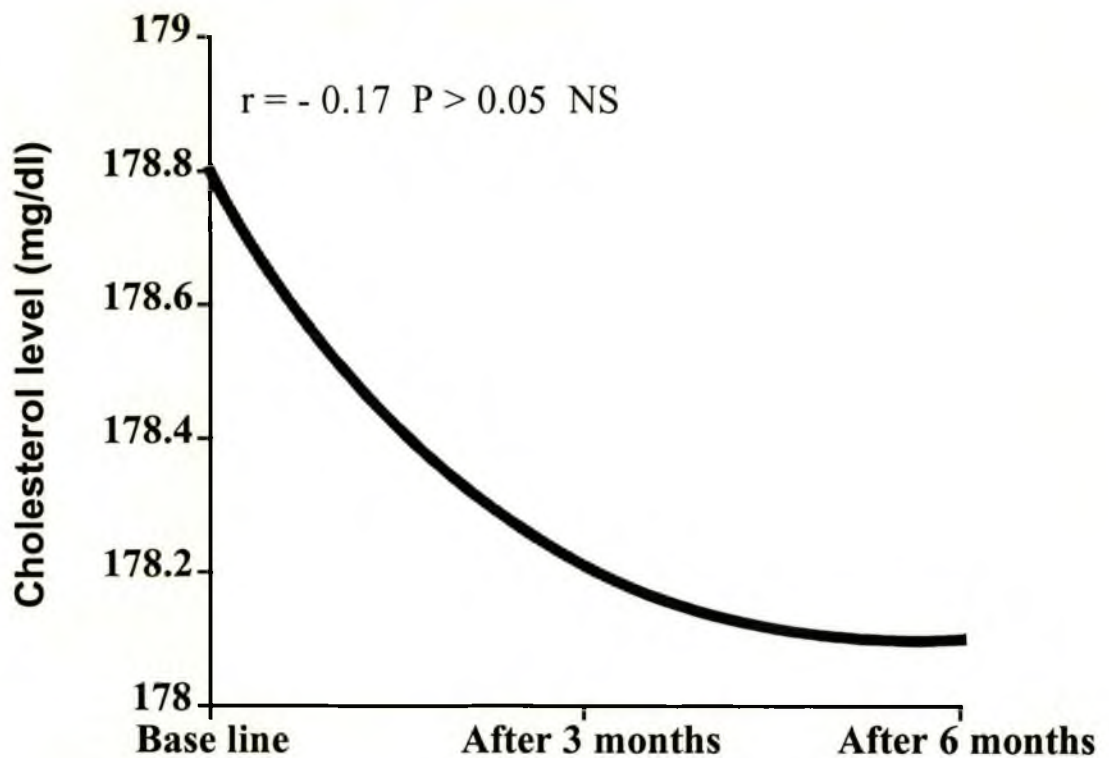


Table:14 showed among the MI patients the mean cholesterol was 229.44 mg/dl which is statistically significant ($P < 0.05$). But after dietary advice the cholesterol level at 3 and 6 months interval were estimated. There is a gradual fall of total cholesterol but not statistically significant (209.84 ± 33.2) after six month. The % difference was -8.54 .

TABLE 14: COMPARISON OF CHOLESTEROL LEVEL OF MI SUBJECTS AT THREE MONTHS INTERVAL

Cholesterol Level	Mean $\pm$ SD	% difference	P. Value
Base line	229.44 ± 50.4	-	<0.05
After three months interval	220.92 ± 40.7	-3.71	>0.05
Next after six months interval	209.84 ± 33.2	-8.54	>0.05

Analysis of variance : $F = 1.36$ $P > 0.05$ NS

Multiple range test : No two groups are significantly different at the 5 % level

Figure:7 showed gradual fall in cholesterol level at three and six month interval. But the change in cholesterol pattern among the mixed meal eating population was not significant ($P>0.05$).

Fig.6: Linear trend of Cholesterol level of MI subjects by consecutive 3 months interval

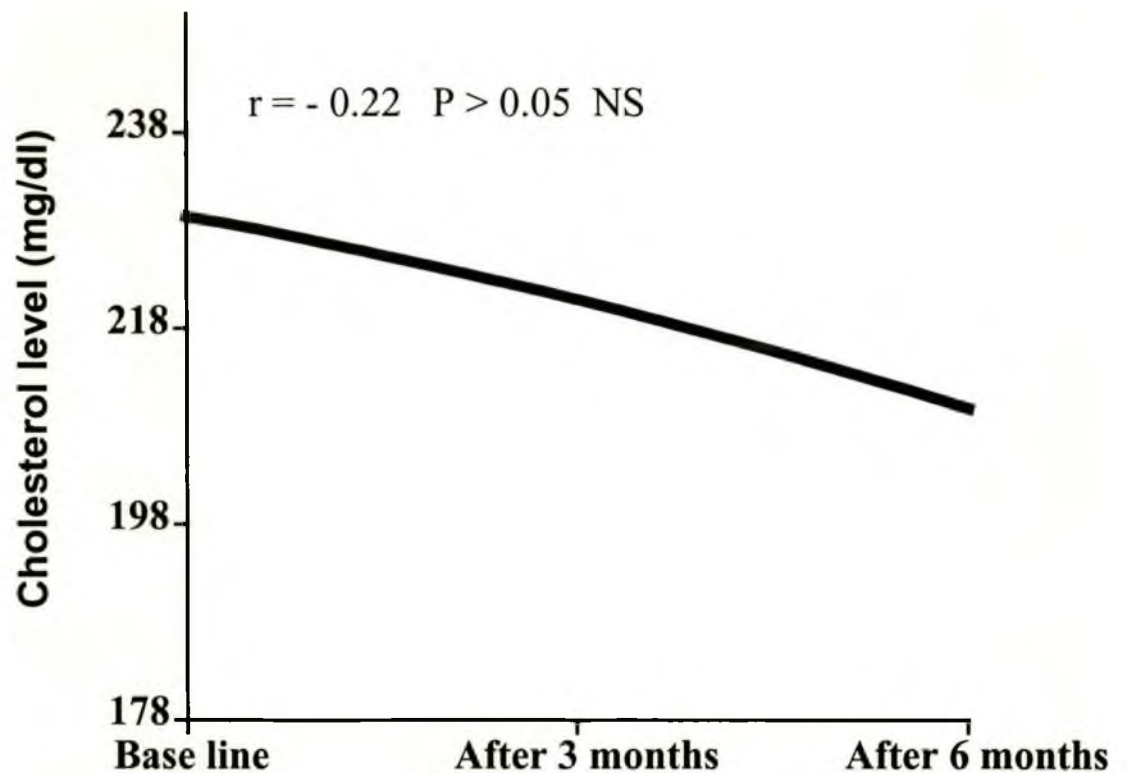


Table:15 showed the baseline cholesterol level of different dietary groups. The MI patients had the significant relation with fish, vegetable and mixed meal eating population ($P>0.05$). While fish eating population had non significant relation with vegetable and mixed meal eating population ($P>0.05$). Similarly the table shows non significant relation between MI and beef eating population.

TABLE 15: COMPARISON OF BASE LINE CHOLESTEROL LEVEL OF THE SUBJECTS BY GROUPS

Study Groups	Cholesterol level	Fish eating	Beef eating	Vegetable eating	Mixed eating	Myocardial infarction
Fish eating	174.4±28.4		*P<0.05	NS	NS	*P<0.05
Beef eating	236.2±33.6	*P<0.05		*P<0.05	*P<0.05	NS
Vegetable eating	167.8±25.3	NS	*P<0.05		NS	*P<0.05
Mixed eating	178.8±31.8	NS	*P<0.05	NS		*P<0.05
Myocardial Infarction	229.4±50.4	*P<0.05	NS	*P<0.05	*P<0.05	

Analysis of variance : $F = 18.56$ $P < 0.001$ S

Multiple range test: *Denotes pairs of groups are significantly different at the 5% level.

Table:16 showed mean cholesterol level for fish, vegetable and mixed meal population were 173.75 ± 24.4 , 168.1 ± 18.8 and 178.4 ± 27.1 respectively which was non significant ($P > 0.05$). Subsequently beef eating and MI subjects had significant relation with fish, vegetable and mixed meal eating population ($P < 0.05$). The total cholesterol level for beef eating and MI subject after three month of dietary advice were significant.

TABLE: 16 COMPARISON OF CHOLESTEROL LEVEL AFTER 3 MONTHS OF DIETARY ADVICE OF THE SUBJECTS BY GROUPS.

Study group	Cholesterol level mg/dl	Fish eating	Beef eating	Veg. eating	Mixed meal eating	M.I.
Fish eating	173.75 ± 24.4	-	* $P < 0.05$	NS	NS	* $P < 0.05$
Beef eating	218.96 ± 24.4	* $P < 0.05$	-	* $P < 0.05$	* $P < 0.05$	NS
Veg. eating	168.1 ± 18.8	NS	* $P < 0.05$	-	NS	* $P < 0.05$
Mixed meal eating	178.4 ± 27.10	NS	* $P < 0.05$	NS	-	* $P < 0.05$
M.I.	220.92 ± 40.7	* $P < 0.05$	NS	* $P < 0.05$	* $P < 0.05$	-

Analysis of variance : $F = 17.42$ $P < 0.001$ S

Multiple range test. *Denotes pairs of groups are significantly different at the 5% level.

Table:17 showed the cholesterol pattern after 6 months of dietary advice. The cholesterol pattern was significant among beef eating and MI subjects ($P<0.05$). But they had significant relation with fish, vegetable and mixed meal population ($P<0.05$).

TABLE:17 COMPARISON OF CHOLESTEROL LEVEL AFTER 6 MONTHS OF DIETARY ADVICE OF THE SUBJECTS BY GROUPS

Study group	Cholesterol level mg/dl	Fish eating	Beef eating	Veg. eating	Mixed meal eating	M.I.
Fish eating	176.1±20.1	-	*P<0.05	NS	NS	*P<0.05
Beef eating	207.2±22.05	*P<0.05	-	*P<0.05	*P<0.05	NS
Veg. eating	169.7±18.7	NS	*P<0.05	-	NS	*P<0.05
Mixed meal eating	178.0±21.4	NS	*P<0.05	NS	-	*P<0.05
M.I.	209.84±33.2	*P<0.05	NS	*P<0.05	*P<0.05	-

Analysis of variance : $F = 17.02$ $P < 0.001$ S

Multiple range test. *Denotes pairs of groups are significantly different at the 5% level.

Table:18 showed the fish eating population had the significant relation with MI subjects ($P < 0.001$). Only 12% of fish eating population had the cholesterol level > 200 mg/dl. While among the MI subjects it was 68%.

TABLE 18: ASSOCIATION OF CHOLESTEROL LEVEL BETWEEN FISH EATING AND MI SUBJECTS

Groups	Cholesterol ≤ 200 mg/dl	> 200 mg/dl	Total
Fish eating	22(88%)	3(12%)	25
MI	8(32%)	17(68%)	25
Total	30	20	50

Corrected $\gamma^2 = 16.24$ $P < 0.001$ S

Odds ratio = 24.44 ($3.14 < OR < 197.13^*$)

Relative risk = 2.88 ($1.60 < RR < 5.15$)

Sensitivity = 74 Specificity = 89

Table:19 showed among the beef eating population 76% had the cholesterol level $>200\text{mg/dl}$ which had non significant relation with MI subjects ($P>0.05$).

TABLE 19: ASSOCIATION OF CHOLESTEROL LEVEL BETWEEN BEEF EATING AND MI SUBJECTS

Groups	Cholesterol $\leq 200\text{ mg/dl}$	$> 200\text{ mg/dl}$	Total
Beef eating	6(24%)	19(76%)	25
MI	8(32%)	17(68%)	25
Total	14	36	50

Corrected $\gamma^2 = 0.99$ $P > 0.05$ NS

Odds ratio = 0.40 ($0.08 < \text{OR} < 1.86^*$)

* cornfield not accurate exact limit preferred

Relative risk = 0.50 ($0.17 < \text{RR} < 0.45$)

Sensitivity = 33 Specificity = 44

Table:20 showed that the vegetable eating population had significant relationship with MI subjects ($P < 0.001$). Only 4% of them had the cholesterol level $> 200 \text{ mg/dl}$ which was non significant.

TABLE 20: ASSOCIATION OF CHOLESTEROL LEVEL BETWEEN VEGETABLE AND MI SUBJECTS

Groups	Cholesterol $\leq 200 \text{ mg/dl}$	$> 200 \text{ mg/dl}$	Total
Veg. eating	24(96%)	1(4%)	25
MI	8(32%)	17(68%)	25
Total	32	18	50

Corrected $\chi^2 = 19.53$ $P < 0.001$ S

Odds ratio = 51.0 ($0.54 < \text{OR} < 1203^*$)

* cornfield not accurate exact limit preferred

Relative risk = 3.0 ($1.68 < \text{RR} < 5.34$)

Sensitivity = 75 Specificity = 94

Table:21 showed the association of cholesterol level between mixed meal eating population and MI subjects. Among the mixed meal eating population only 22% had the cholesterol level >200mg/dl which had significant relation with MI subjects ($P<0.05$).

TABLE 21: ASSOCIATION OF CHOLESTEROL LEVEL BETWEEN MIXED MEAL AND MI SUBJECTS

Groups	Cholesterol ≤ 200 mg/dl	> 200 mg/dl	Total
Mixed meal eating	20(80%)	5(20%)	25
MI	8(32%)	17(68%)	25
Total	28	22	50

Corrected $\chi^2 = 0.58$ $P < 10.05$ S

Odds ratio = 1.70 $(0.55 < OR < 5.34)$

Relative risk = 1.39 $(0.72 < RR < 2.60)$

Sensitivity = 71 Specificity = 77

Table:22 showed among the MI subjects considering the HDL level which was lower than the normal range. HDL level $<55\text{mg/dl}$ considered as risk factor. In our study population the mean HDL level among the MI subjects were $47.08 \pm 12.44\text{mg/dl}$ which was statistically significant ($P < 0.05$). But after dietary advice the change in HDL level was not significant after 3 months ($P > 0.05$). While at six month the rise of HDL level was $48.99 \pm 10.84\text{mg/dl}$. The % difference was 3.97 which was statistically non significant.

TABLE 22: COMPARISON OF HDL LEVEL OF MI SUBJECTS AT THREE MONTHS INTERVAL

HDL Level(mg/dl)	Mean $\pm$ SD	% difference	P. Value
Base line	47.08 ± 12.44	-	<0.05
After three months interval	46.72 ± 11.78	-0.77	>0.05
After six months interval	48.99 ± 10.86	3.90	>0.05

Analysis of variance : $F = 0.64$ $P > 0.05$ NS

Multiple range test : No two groups are significantly different at the 5 % level.

Table:23 showed non significant LDL level among the MI subjects which was $134.25 \pm 24.66 \text{ mg/dl}$ ($P > 0.05$). After 3 and 6 months dietary advice the LDL pattern showed non significant change (134.18 ± 16.69). The % difference was -0.08 .

TABLE 23: COMPARISON OF LDL LEVEL OF MI SUBJECTS AT THREE MONTHS INTERVAL

LDL Level(mg/dl)	Mean $\pm$ SD	% difference	P. Value
Base line	134.25 ± 24.66	-	>0.05
After three months interval	136.91 ± 18.61	1.94	>0.05
After six months interval	134.18 ± 16.69	-0.08	>0.05

Analysis of variance : $F = 0.12$ $P > 0.05$ NS

Multiple range test : No two groups are significantly different at the 5 % level.

Table:24 showed the base line TG level among the MI subjects were 235.46mg/dl which was statistically significant($P<0.05$). After 3 months of dietary advice TG level showed no significant change. But after 6 months dietary advice there was gradual fall of TG level (199.74 ± 74.33 mg/dl). This fall of TG level was significant ($P<0.05$). The % difference after six month was -17.18 which was statistically significant.

TABLE 24: COMPARISON OF TG LEVEL OF MI SUBJECTS AT THREE MONTHS INTERVAL

TG Level(mg/dl)	Mean $\pm$ SD	% difference	P. Value
Base line	235.46 ± 120.31	-	<0.05
After three months interval	213.8 ± 93.3	-10.13	>0.05
After six months interval	199.74 ± 74.33	-17.88	<0.05

Analysis of variance : $F = 8.74$ $P < 0.05$ S

Multiple range test : No two groups are significantly different at the 5 % level.

DISCUSSION

The prevalence of M.I. was maximum between 41 - 60 yrs. of age. This study collaborates with the result of another study carried out in Czechoslovakia¹⁹. Another study showed maximum prevalence of MI between 50-70 yrs of age²⁰. Different studies also demonstrate CHD risk factors in older men and women over 60 yrs^{21,22}. From this study it seems that male dominance over female in context to M.I. So, we can say prevalence of M.I. is the highest among male. This study shows the ratio Male: Female were 9 : 1. Similarly intake of beef is 4 times higher in male than in female. This study shows urban dominance over rural among different dietary habits.

We found that, the incidences of myocardial infarction mostly among the literate persons. On the other hand M.I is a rare occurrence among the low educated people. As the literate people almost engaged in business, secretarial job, Bank job, and other professions, like doctor, Engineer, Teacher are accustomed with mental work rather than physical work thus they are the most vulnerable group to develop M.I. So this study suggests that highly educated people of the society should be aware of M.I. as they mostly suffer from myocardial infarction. But another study in Czechoslovakia which shows significant lower risk of coronary heart disease (CHD) and myocardial infarction¹⁹.

In our study we found that business people mostly are the victims of M.I. as anxiety, tension are the common part of life among the business people thus they are vulnerable group to develop M.I. The study showed business people more money and highly educated persons suffer mostly from M.I.

in our country. This result gives a negative reflect with a study carried out in Czechoslovakia¹⁹ Our study suggests that high earning persons of the society are common victim of CHD as well as M.I. In our total study population 67.2% urban subject. The Prevalence of MI was highest among the urban population. This study showed the urban dominance over the rural.

In our study population mostly between 61-70 kg. body weight. So Average body weight in context to height significantly indicates overweight of the study population. So life style measures (weight reduction, low intake of fat, increased intake of vegetables, controlling hypertension, lowering total cholesterol) are the secondary prevention of CHD²³. Average height of the study population ranging between 154-175cm.

In our study the beef and vegetable eating population had average BMI calculated as 26.12 and 19.85 respectively. This study is significant. This results indicate that beef eating population in respect to other groups with highest BMI. Different studies suggest that BMI was significantly and linearly associated with systolic Blood pressure, glucose level, total cholesterol, LDL-cholesterol & inversely associated with HDL - cholesterol²⁴ Height BMI is related to many disorders like hypertension, adverse lipid profile and increased risk of CHD²⁵

This study showed the incidence of MI was highest among the mixed meal eating population. Similarly beef eating population had the 44% history of MI. In our study we found the total cholesterol level among the fish eating

population less than 200mg/dl which is statistically not significant. This result has the reflect on another study Carried out in Chicago²⁶. This study is very much significant and reflects another study carried out among the Eskimos²⁷. This study suggest consumption of fish at least 1 serving/day reduces the risk of coronary heart disease²⁷. So for prevention of CHD and M.I. moderate level of fish consumption should be encouraged. Another study suggests that A low-to-moderate average daily fish consumption has been reported to convey protection against coronary heart disease incidence and mortality²⁸. Fish with total fat calories <30% of total calories reduced cholesterol, LDL-cholesterol and triglycerides and mortality. Fish with 30% fat diet reduce cholesterol, HDL- cholesterol. So, daily fish meal substantially lower triglycerides and reverses the fall in HDL-Cholesterol that is usual with a low fat diet²⁹.

A review on diet and coronary heart disease recommended regular fatty fish consumption and a high intake of vegetables and fruits to reduce the risk of CHD and stroke³⁰.

A study in Bangladesh found the hypocholesteremic effect of fish on hypercholesteremic subjects³¹. Even the fatty fish although it contains cholesterol, but it may reduce cholesterol level in hypercholesterolemic subjects. In our study we found the total cholesterol level were significantly lower among fish eating population which also reflects the other study. Nevertheless fish and fish oil also have the hypotriglyceridemic effect³². For the prevention and treatment of CHD vigorous dietary intervention so far carried out to lower the serum cholesterol level by at least 6%. So, from our study we can say that consumption of fish every day has the direct

effect maintaining normal cholesterol level and thus decreases the incidence of myocardial infarction as well as the risk of CHD. For prevention of CHD fish consumption may be encouraged³³.

In our study we found dramatic results of cholesterol pattern among the beef eating population which was 236.2 ± 33.62 mg /dl which is statistically significant. As beef, mutton and dairy products all are saturated fatty acids contribute to the formation of cholesterol. This study reflect the results on another study³⁴. This is statistically significant that beef eating population are mostly hypercholesterolemic. Diets rich in meat are claimed to contribute to the high tissue arachidonic acid content in people of westernized countries. Moreover meat contain a variety of long chain polyunsaturated fatty acid that are susceptible to oxidation, thus enhances the production of cholesterol³⁵.

In our study we found no significant change in cholesterol level which reflects another study³⁶. In our study population hypercholesterolaemic patients were advised to take lean beef instead of beef tallow as well as chicken. It was advised because reducing the fat content of the diet resulted in decreased concentration of LDL- cholesterol and HDL cholesterol as well as in total serum cholesterol³⁷. In our study we found the significant result of lowering total cholesterol level. Beef has two portions. One is beef protein and the other is beef fat. Beef fat contains more than 19% stearic acid which increases the cholesterol level⁴. We also advised to avoid milk and milk products, egg yolk, prawn which are known to be high cholesterol diet. In our study showed a reduction of total cholesterol level after 6

months dietary advice. The mean also suggest not to avoid beef as a part of cholesterol lowering programme³⁶. As lean beef and chicken had the similar effect on plasma levels of total cholesterol, LDL- Cholesterol, HDL-cholesterol and triglyecrides. So from this study we can say lean beef and chicken are interchangeable in the diet lowering the total cholesterol level.

The mean cholesterol level among the vegetarian was 167.64 ± 25.1 (SD) as baseline. Two consecutive cholesterol level measured at 3 months interval with dietary advice. Mostly all patient refused to take red meat. But intake of milk and egg did not shown any significant change in total cholesterol pattern. As the vegetables contain maximum food fiber thus it decreases risk of myocardial infarction³⁸. American heart society advised for increased intake food fibre from vegetable to reduce the incidences of coronary heart disease . In this study we found only one vegetarian with the history of M.I. This is very much significant in our study which reflect the other studies carried out in different countries. A study in Finland suggest that increased intake of vegetables reduces three quartens the risk of coronary heart disease as veg, decreases total Cholesterol (TC) being the most important one³⁹ . It also reduces the low density lipoprotein. This study suggest dietary fibre from vegetable sources has the potential to produce significant beneficial changes in lipoprotein lipid profile ⁴⁰. We can say vegetarians has the less risk to be hypercholestermic thus has the less incidence to develop myocardial infarction or coronary heart disease.

Among the mixed meal eating population mean cholesterol level was not significant. After six months of dietary advice shown non significant

change which has the reflect on another study⁴¹. Another study suggests that mixed diet rich in monounsaturated fat was as effective as a diet rich in poly unsaturated fat in lowering LDL- cholesterol⁴². A dietary weight reduction program with mixed diet reduces total cholesterol as well as triglyceride⁴³. This study also strongly suggest a mixed diet in lowering body weight. Another study also suggest mixed diet for lowering the LDL-cholesterol ⁴⁴. From our study population we can say, mixed meal eating population has the less risk to be hypercholesterilemie. As the high cholesterol level in an independent risk for CHD, thus a mixed meal eating subject has the less risk of CHD.

The baseline total cholesterol level of MI subject were 229.44 ± 50.4 which is statistically significant. This result showed a relation between myocardial infarction and high total cholesterol (>200 mg/dl) level which has an impact with another study⁴⁵. So, from this study we can say M.I. patients are directly related to high cholesterol level. Though it differs from another study⁴⁶. Another study suggest high cholesterol level is not the only risk factor for M.I. but one of the cause to develop M.I⁴⁷ Another study showed TC not significantly associated with mortality from Ischaemic heart disease (IHD)⁴⁸. At three months interval showed fall of total cholesterol though it is statistically non significant. This study reflects the result of another study⁴⁹. This Italian study made conclusion that high serum cholesterol was an independent risk factor for Acute Myocardial Infarction (AMI). Same reflect with another study carried out by National Cholesterol Education programme in USA⁵⁰. A two year study on M.I. patients also showed that strong linear relationship between total serum cholesterol and risk of

myocardial infarction⁵¹. It is noted that all our M.I. patients were from urban areas with 68% had TC above 200 mg/dl which is significant with another study which showed no relationship between M.I. and high levels of TC in rural areas⁵². Another study suggest for prevention of M.I. cholesterol level should be controlled compared to the Singapore population and majority of Indians had high cholesterol after M.I.⁵³. In context to Bangladesh our study also support this result and also reflect another study carried out in England⁵⁴.

Among the 25 M.I. patients none with the dietary habit of vegetable eating. In our study we found only 1 patient among the 25 vegetarians with high cholesterol level. Which is statistically not significant. So, from this study we can encourage the practice of taking vegetables but not the hydrogenated vegetable oil. As different studies suggest that partially hydrogenated vegetable oil may contribute to occurrence of coronary heart disease as well as increased risk factor for myocardial infarction^{55,56}. In a study in India vegetable enriched prudent diet allowed to obese persons and the effects were observed. The result showed greater changes in diet had the greater improvements in central obesity thus reducing the prevalence of CHD⁵⁷. Another study also suggests that consumption of vegetable rich in antioxidant may reduce the plasma levels of lipid. Vegetables and fruits are rich in anti-oxidant which may reduce myocardial necrosis⁵⁸. For prevention of coronary heart diseases different studies also suggests to take increase dietary fibre.

In our study we found 1 patient of M.I. with the history of taking fish everyday and statistically not significant. As omega-3 fatty acid found in fish oil have various biologic properties that may modify myocardial injury caused by severe ischaemia⁵⁹. Dietary fish oil also shown to exert protective effects against arrhythmias and myocardial infarction⁶⁰. These studies had direct relation with our study of fish consumption population. However our study differs from another study carried out in USA among the physicians. These data do not support the hypothesis that moderate fish consumption lower the risk of cardiovascular disease⁶¹. Another study showed an inverse association between fish consumption and death from coronary heart disease especially non sudden death from myocardial infarction⁶².

In our study among the M.I. patients 52% were with the habit of taking mixed meals. It is statistically significant that mixed meal eating population has the increased risk of coronary heart disease and as a consequence to develop M.I. A Dutch study concluded that a normal mixed diet provides only minor amounts of cholesterol oxidation products. So, a mixed diet rich in saturated fatty acid has significant association with CHD and independent predictor of future risk of M.I.⁶³.

It is also seen in our study that beef eating M.I. subjects had a high level of cholesterol which had the reflect of another study⁶⁴. Our study showed a decrease in cholesterol pattern with dietary advice. Avoidance of beef fat, milk and milk products, Prawn, egg and increased consumption of food fibre, fruits and diet rich in anti oxidants lowered significantly the total cholesterol level. So our study support the hypothesis that increased consumption of beef fat, mutton, and diet rich in saturated fatty acids are

increased risk factor to develop coronary heart disease and especially myocardial infarction.

Among the M.I. patients 32% had the cholesterol level within normal range (upto 200mg/dl). Patients were advised to avoid red meat, milk and milk product and fatty meals and to add vegetables, fish and fruits. As a result 16% of the M.I. patients respond with the dietary advice and within 6 to 9 months total cholesterol down to normal. This percentage is non significant but the improvement is noticeable. This results coinsides with other study⁶⁵. The concept is management of hypercholesterolemia requires baseline T.C level after an acute myocardial infarction by restriction of diet. Another study also found relationship between nutrition and CHD and the role of diet rich in cereals, Vegetables, fruits and less saturated fat ⁶⁶. A 6- month study also showed modest improvement with dietary advice among the heart attack patients ⁶⁷. A-25 years follow-up study were carried out in 8 countries. The result showed the high cholesterol level for in creased risk of CHD and reduction of cholesterol by dietary restriction causes a decrease in recurrent heart attack ⁶⁸.

Among the 32% M.I. patient with the normal TC level were advised to take lean beef instead chicken but the result did not show any significant change in the total cholesterol level which has the reflect with another study⁶⁹. Commercial fats, palm-kernel, coconut oil, butter, are considered as hypercholesterolemic food ⁷⁰. So reduction or complete avoidance of these foods also helps in control the cholesterol level . Another study in Israel suggest combined community strategy to reduce cholesterol and other risk factors ⁷¹. This study supports our study regarding restriction of egg, red

meat, milk products and increased consumption of fish, chicken, vegetable to reduce the risk of myocardial infarction. Low fat diets, fresh water fish, citrus fruits and vegetables results in lowering the blood pressure as well as the total cholesterol⁷². So, from our study we can say that restriction of diet i.e. egg, milk and milk products, prawn and oils can help to reduce the total cholesterol among the hypercholesterolaemic patients. This study also showed significant decrease in the total cholesterol level among increased risk subject.

In our study we found some dramatic results in lipid profile status. In dietary advice we suggested to take citrus fruits and diet rich in antioxidant. As a result we found significant relation between anti-oxidant and lipid profile which showed the reflect on another study⁷³. Dietary advice of vegetable along with anti-oxidants and low energy diet causes significant decrease of TG and LDL found in our study which had the similar result with another study⁷⁴. Different other studies also suggest that anti-cholesterol propaganda emphasis should be given to the prevention of antioxidant deficiencies by the increase of fruit and vegetables consumption^{75,76}. Another study also suggest to take diet rich in monounsaturated fat⁷⁷. It is believed that as a cholesterol lowering diet skinless chicken is advised. In our study we advised to take lean beef instead of chicken. Our study showed no significant change in total cholesterol level as well as in the lipid profile which shows reflect on other studies^{78,79}. Dietary advice increased the HDL level though not significant which reflect the other study⁸⁰. As high TC and low HDL considered as

increased risk factor for M.I. but a negative relationship also found in another study⁸¹.

Another study in Mexico also shows increased level of LDL and TG showed moderate risk of M.I. among the Mexican population⁸².

TG- level more than 190mg/dl considered as increased risk factor for M.I. In our study we found 235.46 mean TG in MI subject. It has the reflect with another study⁸³. Avoidance of milk and milk product, egg, beef fat and increased intake of vegetable, low energy diet and anti oxidant rich diet reduces the TG level which was statistically significant. It was also interesting that we found no death during our survey time. This may be due to the decrease in TC and TG which considered as independent risk, factor for M.I.⁸⁴. So, from our study we can say in lipid profile status among the M.I. patients high triglycerides level causes risk factor for M.I. So, the concept is to change in dietary pattern to take increased amount of vegetable and diet rich in anti-oxidant and avoidance of fatty meal can lower the TC and TG level . Hence fore recurrent attack of M.I. can be prevented.

Limitations

The follow up to ensure adherence to dietary advice was weak. As the service based on outdoor facilities, but repeated visits and advice kept it to a minimum.

SUMMARY AND CONCLUSION

Myocardial Infarction is the second major cause of deaths in our country. Most of the M.I. patients has the high serum cholesterol level. The objective of this study was to estimate the cholesterol level and LDL, HDL, TG level of M.I. patients and to compare pattern of cholesterol in beef, fish, vegetable and mixed meal eating subjects without the history of M.I.

A cross section study was conducted on 125 subjects who attended the clinic.

The study was carried out between January to December 1998. One hundred and twenty five subjects were selected on the basis of defined inclusion criteria from 3600 patients. Both male and female subjects age range between 24 - 72 yrs. with or with history of M.I. were selected. Anthropometric indices (weight, height), clinical examination and biochemical analysis of the blood sample were done. Diet counseling was given in all groups like fish, vegetable, beef, mixed meal eating and M.I. subjects. Cholesterol and lipid profile done every 3 and 6 months to all M.I. subjects and cholesterol level from fish, beef, vegetable and mixed meal eating population.

The mean age of fish, beef, vegetable and mixed meal eating subjects were 42.3, 45.04, 48.32 and 44.23 years respectively. While the mean age for M.I. patients were 52.4 ± 8.3 years. Among the control subjects 68% were male but in M.I. patients only 92% were male.

Except vegetable eating subjects all had higher educational background. (16%) Fish eating & M.I. patients were 56% with education level more than graduation. Majority of the subjects were business people (33%). In the control group 59% were from urban areas while 100% of the M.I. patients were urban people. About 36% of subject had the monthly income more than Tk. 15000/- per month but highest (72%) among the M.I. patients. Most of the vegetable eating population (72%) had the monthly income less than Tk. 5000/- per month.

Mean height was highest in beef eating population (164.49 ± 6.01) but lowest in M.I. patients (162.26 ± 4.88). Mean weight was highest 70.28 ± 9.2 kg in beef eating subjects but lowest in vegetable eating population (52.52 ± 6.14 kg). Similarly BMI was highest in beef eating population 26.12 ± 3.36 while it was 19.85 ± 1.67 among vegetarian. Mean BMI for M.I. patients were 25.26 ± 2.21 . of M.I. patients were obese ($BMI > 25$) while it was highest among beef eating subjects (56%). None of the vegetarian were obese. Average BMI for M.I. patients were 25.26 but in beef eating group 26.12.

Among the M.I. patients 52% had dietary history of mixed meal, 44% beef eating and only 4% were fish eating subjects.

The mean cholesterol level of fish eating subjects were 174.39 ± 28.4 μ g/dl at initial contact but of the dietary advice it was 173.75 ± 24.4 & 176.1 ± 20.1 μ g/dl at 3 and 6 months interval. But the baseline cholesterol level was 236.2 ± 33.62 μ g/dl in beef eating population. At the end of 6 months dietary advice it was 207.2 ± 22.05 μ g/dl. With the exception of 4% all vegetable eating subject had cholesterol level 167.64 ± 25.1 μ g/dl 76% of

the mixed meal eating subjects had cholesterol level less than 200 $\mu\text{g/dl}$ (mean $178.8 \pm 31.8 \mu\text{g/dl}$). But among the M.I. patient 68% had the cholesterol level more than 200 $\mu\text{g/dl}$. The base line mean cholesterol level was $229.44 \pm 50.4 \mu\text{g/dl}$. But after dietary advice it was $209.84 \pm 33.2 \mu\text{g/dl}$ after 6 month only 12% of fish eating population had cholesterol $> 200\mu\text{g/dl}$ but it was 68% among M.I. patients. 76% of beef eating subjects had cholesterol level $>200 \mu\text{g/dl}$ but 4% in vegetable 20% in mixed male eating subjects.

Base line mean HDL level was $47.08 \pm 12.44 \mu\text{g/dl}$ among the M.I. patient while LDL level was $134.25 \pm 24.66 \mu\text{g/dl}$ & T.G. level $235.46 \pm 120.31 \mu\text{g/dl}$. After diet counseling no significant change in HDL & LDL but after 6 months the T.G. level was $199.74 \pm 74.33 \mu\text{g/dl}$

CONCLUSION

The nutritional status of vegetable eating patients showed twenty four % malnutrition ($BMI < 18.4 \text{ kg/m}^2$). Besides this group other study population had average nutritional status ($BMI < 18.5-24.9 \text{ kg/m}^2$), with the exception of beef eating population and M.I. subjects. In the beef eating group we found 56% were over weight. After diet counseling, these patients showed gradual fall in cholesterol level. Similar picture i.e. 64% of M.I. subjects were over weight. After dietary advice showed reduction in cholesterol level. Though these changes are not that much significant.

A high incidence of M.I. (52%) among the mixed meal eating population with average BMI 25.43 kg/m^2 . After diet counseling and change in life style measures shows no mortality from M.I. during this study period. Proper medication and anti oxidants (Vitamin-E, Vitamin-C) intake ameliorates their clinical symptoms.⁸⁵ The importance of reading nutrition level in maintaining a low-fat diet, vegetables and fish⁸⁶. So this study suggest limiting fat intake, high intake of vegetables, fish and nutrition education are helpful for maintenance of heart health. Dietetic professionals can use the results of this study for the benefit of their patients.

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ANNEXURE

QUESTIONNAIRE FOR CLINICAL AND PARTIAL NUTRITIONAL STATUS OF STUDY GROUPS

Date:.....

Sl. No.....

1.NAME :

2. AGE :

3. SEX :

4. ADDRESS :

5. MARITAL STATUS : Married ☐ Unmarried ☐ Widow ☐ Others ☐

6. RELIGION: Muslim ☐ Hindu ☐ Others ☐

7. EDUCATION : Illeterate ☐ Signature position only ☐ Upto class V ☐

Up to SSC ☐ Up to HSC ☐ Above ☐

8. OCCUPATION: Student ☐ Service ☐ Business ☐ Labour ☐

unemployed ☐ Housewife ☐ Others ☐

9. MONTHLY INCOME: Below 1000/- ☐ 1000-5000/- ☐ 5000-10,000/- ☐

above 10000/- ☐ above 15000/- ☐ above 20000/- ☐

Dependent ☐ Others ☐

10 FAMILY NUMBER: 1- 4 ☐ 5 - 8 ☐ Above 8 ☐ Single ☐

11. HYGIENE: a) Residence and surrounding

i) Residence: Own ☐ Rent ☐ Sub-let ☐

Slum house ☐ Hostel ☐ Others ☐

ii) Condition of Residence Building ☐ Pucca tin ☐ Tin ☐

Straw ☐ Others ☐

iii) No. of room 1 ☐ 2 ☐ 3 ☐ 4 ☐ above ☐

iv) Kitchen room Present ☐ Absent ☐

v) Source of light Electricity ☐ Lamp ☐ Candel ☐ Others ☐

b. Do you wash your hand before meals ? Yes ☐ No ☐

Washing materials Only water ☐ Soap ☐ Ash/Clay ☐ Others ☐

c. Place of defaecation: Pucca ☐ Kacha ☐ Open space ☐

Do you clean hand after using toilet ? Yes ☐ No ☐

Washing materials Only water ☐ Soap ☐ Clay ☐ Ash ☐ Others ☐

d. Use of water : Supply ☐ Tubewell ☐ River/pond ☐

Boiled/mineral ☐ Others ☐

12. DIETARY HABITS Meat.....per week.
Fish.....per week
Vegetables.....per week
Milk.....per week

Menu of the last 24 hours diet:

a) Breakfast Rice ☐ Bread ☐ Vegetables ☐ Egg ☐ Milk ☐ Fish ☐

Meat ☐ Fruits ☐ Sugar ☐ Tea/Coffee ☐ Pulse ☐

Chicken ☐ Chapati ☐ Parata ☐ Others ☐

b) Lunch Rice ☐ Bread ☐ Vegetables ☐ Egg ☐ Milk ☐ Fish ☐

Meat ☐ Fruits ☐ Sugar ☐ Tea/Coffee ☐ Pulse ☐

Chicken ☐ Chapati ☐ Parata ☐ Others ☐

c) Supper Rice ☐ Bread ☐ Vegetables ☐ Egg ☐ Milk ☐ Fish ☐

Meat ☐ Fruits ☐ Sugar ☐ Tea/Coffee ☐ Pulse ☐

Chicken ☐ Chapati ☐ Parata ☐ Others ☐ Deserts ☐

d) Light refreshment (Morning) Tea ☐ Milk ☐ Biscuit ☐

Fruits ☐ Others ☐

d) Light refreshment (Morning)

i. Morning Tea ☐ Milk ☐ Biscuit ☐

Fruits ☐ Others ☐

ii) Evening Tea ☐ Milk ☐ Biscuit ☐

Fruits ☐ Others ☐

13. Dietary category:

Fish eating ☐ Beef eating ☐ Vegetable eating ☐ Mixed meal eating ☐

14. Immunization practice in the family:

a) Pregnant Yes ☐ No ☐

b) Children Yes ☐ No ☐

15. Blood pressure in mm of Hg.:

1st	2nd	3rd

16. Weight.....kg

17. Height.....ft.....inch

18. Medication if any

- a).....
- b).....
- c).....
- d).....

19. Lipid profile:

	1st	2nd	3rd
TOTAL CHOLESTEROL mg/dl			
HDL(High density lipoprotein)			
LDL(Low density lipoprotein)			
TG(Triglyceride)			

20. Dietary advice if any:.....

21. Comments: