The present study is on “Baseline risk factors for coronary heart diseases in Kochi”. The vulnerability of urban Indian to CHD is possibly related to different nutritional, environmental and lifestyle factors. Here an attempt has been made to assess the effect of socio-economic factors, life style pattern, selected biochemical parameters, anthropometry and dietary habits of subjects on the risk of coronary heart disease.

Industrialisation and urbanisation and the resultant changes in the lifestyle of the people are the prominent factors predisposing to CHD. The area selected for the present study was Kochi, a cosmopolitan city often referred to as the industrial capital of Kerala.

In the present study out of six hospitals with Cardiology units in and around Kochi, a cluster of three hospitals - Lissie Hospital, Lourdes Hospital and Indira Gandhi Co-operative Hospital - were selected.

Two sets of sample ‘cases’ (CHD subjects, n=350) and ‘control’ (Non-CHD subjects, n=100) were selected for the study. The sample identification was done based on the following inclusion and exclusion criteria.
Inclusion criteria: The sample selected for the study included 350 patients who had experienced a first event of acute myocardial infarction and unstable angina and admitted in the identified hospitals during the year 2004-2005. They were in the age group of 25 to 79 years.

Exclusion criteria: Patients were excluded if they had a history of myocardial infarction or unstable angina in the past, with or without any clinical symptoms or suspected coronary artery disease in their medical history.

Inclusion criteria: A random sample of 100 Non-CHD subjects (50 male and 50 female) in the age group 25 to 79 years were selected for the purpose of studying the relative risk of CHD subjects. The controls were selected from patients admitted at the same time in the hospital and the ones who came for health checkup.

Direct interview was the technique adopted for collecting data on the socioeconomic background and lifestyle, clinical status and diet survey of the sample.

Anthropometric measurements and biochemical assessment were done on all sample (350 case and 100 control sample).

The data collected were analysed using appropriate statistical treatment. (SPSS package, version 15).
The major findings of the study are detailed below:

In the present study, it was observed that percentage occurrence of CHD was significantly ($p<0.01$) high among males (69.70%) than females (29.30%).

The incidence of CHD was significantly ($p<0.01$) high in all the three religions such as Hindus, Muslims and Christians.

Educational status of the sample found to have an inverse relation with CHD. The highest percentage (48.60%) of the victims of CHD in the present study had only primary education.

Irrespective of the gender the incidence of CHD was significantly ($p<0.01$) high among the low-income group. Majority of the cases studied (70.50% of males and 77.40% females) came under this category.

The incidence rate of CHD was also significantly ($p <0.01$) high among labourers, retired persons, and businessmen. Equally high risk was reported among women engaged in domestic work.

Smoking habit was common among the subjects. Majority of the male cases (49.20%) were current smokers. There were ex-smokers (24.20%), and non-smokers (26.60) too. The female smokers who formed only1.90 percent of the total number of cases; failed to show any significant relation with CHD.

The habit of drinking alcohol among the sample was also studied. It was found that 53.70 percent of the male CHD cases were non-drinkers and
46.30 percent were habitual drinkers. In the control group also majority of the males (68.00%) were reported to be non-drinkers.

Stress, yet another risk factor of CHD was more predominant among the CHD groups of both males (75.80%) and females (82.10%).

The work status of the sample showed that majority of them both males (61.10% cases and 76.00% control); and females (95.20% cases and 98.00% control) were sedentary workers. The occurrence of CHD was also found to be significantly (p<0.01) very high among both males and females engaged in sedentary work. At the same time moderate and heavy workers also had CHD to a significant (p<0.01) level only among males but not among females.

Lack of exercise was commonly seen among both cases and controls, chi-square analysis indicated that there was a significantly (p<0.01) high relation between the lack of exercise and occurrence of CHD in both gender.

Mean body weight of the male population in general was found to be greater than the standard weight given by ICMR (1999) except in the elderly (>60 years) of the control group. But there observed a highly significant (p<0.01) difference in the body weight of the CHD and non CHD groups. Females also had a greater body weight than the recommended standard. But the case-control comparison failed to show any statistical significance.

BMI status revealed that majority of the CHD males (34.40%) had normal BMI and 26.60 percent and 22.50 percent respectively were obese and overweight. Where as among women majority of the CHD subjects
(34.9%) had obesity. Sample with under weight (BMI<18.5) and low body weight (BMI 18.5-20) were comparatively less in number in CHD and non CHD groups. Incidence of CHD was significantly high among obese women.

Irrespective of gender and CHD risk, majority had of the sample a waist/hip ratio higher than the normal. But in female CHD subjects it was very obvious .It was seen that 94.30 percent of the sample with a waist / hip ratio of above 0.80 were afflicted with the disease.

A significantly (p<0.01) higher prevalence of CHD among men (28.3%) and women (34.9%) was also noticed with a high serum cholesterol level (>240mg/dl). The risk in this respect was found to be highest among women. Where as in control group, majority of the males (58%) and females (74%) had normal serum cholesterol level (<200mg/dl) with female subjects in a more advantageous position.

More than 50 percent of the CHD subjects, both males (56.10%) and females (54.70%) had HDLc above normal level (>40 mg/dl), which is advantageous. But controls, predominantly (men-88% and women-90%) had normal HDLc. Case-control comparison also indicated a significantly (p<0.01) high risk of CHD with reduced HDLc.

Normal LDL cholesterol level (<130 mg/dl) was reported by majority of men (62.00%) and female (76.00 %) in control group. Where as among CHD subjects 38.50 percent of men and 43.30 percent female had high LDLc (>160mg/dl).
The risk of CHD was found to be significantly very high (p<0.01) among the subjects (both men and women) having a triglyceride level more than 150 mg/dl.

Although the mean homocysteine value in the study group was (47.32±44.92µmol per litre) significantly higher (p<0.01) than the normal value (15µmol per litre) and 66.70 percent of CHD sample had hyper homocysteinemia (≥15µmol per litre), the chi-square analysis failed to show any significant association between homocystiene levels and coronary risk factors in male or female group.

Myocardial infarction (63.10%) and unstable angina (36.90%) were the common manifestation of CHD among the cases. No comorbidities was observed in 36.60 percent of the CHD subjects. Hypertension was present in 40.30 percent CHD subjects and the prevalence was slightly more in men (41.00%) than women (38.70%). Diabetes was seen in 36.60 percent of CHD subjects (33.20% male and 44.30% female).

The family history of CHD was found to be more prominent among the cases than the controls (37.40 % CHD and 23.00% non CHD). Where as the other morbidities like diabetes and hypertension were reported more among the non CHD than CHD subjects. Around 50 percent of the cases (50.90%) and controls (57.00%) did not have any family history of comorbidities.

An attempt to study the dietary habits of the subjects revealed that non-vegetarianism was more popular among both CHD (96.10%) as well as Non CHD (92.00%) subjects.
Comparison of mean food intake of the sample with RDA was done for the male and female subjects (below 60 years and above 60 years) of CHD and non-CHD groups.

The mean intake of cereals, pulses, milk and its products, roots and tubers, leafy vegetables and other vegetables by both CHD and non CHD males below 60 years was significantly lower (p<0.01) than the RDA recommended by ICMR (1999). Whereas mean intake of non-vegetarian food items by cases and controls were significantly higher (p<0.01) than RDA. Sugar intake was comparable with RDA in both the groups and fats and oils intake was significantly higher (p<0.01) than the RDA in cases and not in controls. Mean intake of fruits by CHD subjects was significantly lower (p<0.01) than RDA.

Among females below 60 years the mean intake of cereals, milk and its products, roots and tubers, leafy vegetables, other vegetables and fruits by both female CHD and non CHD group was significantly (p<0.01) lower than the RDA. The intake of non-vegetarian food items was significantly higher (p<0.01) in both cases and controls. Fats and oils intake was adequate in both the groups and sugar intake was significantly lower (p<0.01) in controls. Pulses intake was comparable with RDA in controls, and significantly lower (p<0.01) in cases.

Above 60 years the mean intake of fish, milk and its products, fats and oils, roots and tubers, leafy vegetables, other vegetables and fruits by both
CHD and non CHD male subjects was significantly lower (p<0.01) than the RDA recommended by Pasricha and Thimmayamma (2005).

Among females above 60 years the mean intake of fish, milk and its products, other vegetables and fruits was significantly lower (p<0.01) than RDA in both CHD and non CHD subjects. Except for mean intake of cereals and fats and oils (in cases) and roots and tubers, leafy vegetables and sugar (in controls) the elderly females (above 60 years) were subsisting on inadequate diet when compared to RDA.

Mean intake of nutrients by males below 60 years showed that irrespective of disease status, the energy, iron, folic acid and fibre were significantly lower (p<0.01) than RDA. Where as the intake of protein was adequate and that of fat was significantly high (p<0.01) for both the groups. A significantly low intake of vitamin C (p<0.05) and β-carotene (p<0.01) was also reported among the cases. While among the control group (non CHD) adequate intake of β-carotene and a significantly high (p<0.01) intake of vitamin C were reported.

Among females below 60 years, the mean intake of energy, iron, β-carotene, folic acid and fibre was significantly lower (p<0.01) than the RDA in both CHD and non CHD subjects. Whereas, the intake of protein and vitamin C was adequate in both the groups.

In males over 60 years of age belonging to both CHD and non CHD groups, the mean intake of iron, β-carotene, folic acid and fibre was
significantly lower (p<0.01) for than RDA. The mean intake of protein and fat were comparable with RDA in both the groups. Whereas the mean intake of energy and vitamin C was adequate in controls, and significantly lower (p<0.01) in CHD subjects.

In females over 60 years of age, the mean intake of iron, folic acid and fibre was significantly lower when compared to RDA in both cases and controls. Protein intake was comparable with RDA in both the groups. Where as the intake of energy and β-carotene was adequate in controls, significantly (p<0.01) inadequate among CHD subjects. The vitamin C intake was significantly high (p<0.01) among the controls, while it was significantly lower (p<0.01) among the cases. The mean intake of fat was significantly higher than the RDA in both the CHD (p<0.01) and non CHD subjects (p<0.05).

The relative risk of CHD based on the frequency of consumption of foods has been computed using binary logistic regression. The results indicated an increase in the relative risk of CHD among males, with increased frequency of intake of cereals, meat, fish, egg, and fats and oils. Where as food groups like pulses, roots and tubers, other vegetables, leafy vegetables, milk and its products, fruits, sugar and coconut had a significant role in the control of CHD with the increased frequency of consumption.

In the females, food groups like cereals, pulses, other vegetables, leafy vegetables, milk and its products, roots and tubers, nuts, sugar and fruits had a significant cardiac protective effect, as their frequency of consumption
increased. Where as food groups like meat, fish and oil showed an increased risk of CHD with increased frequency of consumption.

As far as nutrients are concerned, Canonical Discriminant Function Analysis revealed that protein, carbohydrate, cholesterol and potassium were pivotal in distinguishing between cases and control in female subjects with corresponding coefficients such as -0.744, 0.557, 0.751 and 0.684 respectively. Whereas only β-carotene and vitamin C were pivotal in distinguishing between CHD and Non-CHD male subjects with corresponding coefficients such as -0.790 and +0.365 respectively.

Limitations

The sample of CHD may not be representative in the sense that those who were undiagnosed, misdiagnosed, reported late to the hospital or died as soon as after arrival (or who did not report to the hospital at all) were less likely to be included.

Extrapolation of the findings of the present study to different populations, ethnic groups and urban populations in India may be inappropriate.

Conclusions

➢ The incidence of CHD was significantly (p<0.01) high among males than females and significantly (p<0.01) high in all the three religions. As for educational status the highest percentage (48.60%) of the victims of CHD had only primary education. Irrespective of the gender the
incidence of CHD was significantly high (p<0.01) among the low income group. Work status revealed that the incidence rate of CHD was significantly high (p <0.01) among labourers, retired persons, women engaged in domestic work and also among businessmen.

- With respect to personal habits, current smokers reported to have extremely high risk of CHD followed by ex-smokers. Irrespective of drinking habits, all the subjects had a significantly (p<0.01) high risk of CHD. The CHD risk was highly significant (p< 0.01) among the sample, who were under stress. The occurrence of CHD was also found to be significantly (p<0.01) very high among the cases of both males and females engaged in sedentary work. There was a highly significant (p<0.01) relation between the lack of exercise and occurrence of CHD in both the genders.

- As indicated by the anthropometric data majority of the CHD males (34.40%) had normal BMI (20-23) followed by obesity (26.60%) and overweight (22.50%). Majority of females (34.9%) had obesity. Above normal waist circumference was conspicuous among women (75.50%) than men (49.20 %). In the waist / hip ratio also, majority (94.30%) of women with a waist /hip ratio of above 0.80 were afflicted with CHD.

- The biochemical parameters showed a significantly (p<0.01) higher prevalence of CHD among men (28.30%) and women (34.90%) having a high serum cholesterol level (>240mg/dl). But more than 50 percent of the CHD subjects, both males (56.10%) and females (54.70%) also
had HDLc above normal level (>40 mg/dl). Women showed a higher risk (43.30%) of CHD with a high LDLc level (>160 mg/dl) than men (38.50%). The risk level of triglycerides (>150 mg/dl) was observed in 35.70 percent of males and 26.40 percent of females with CHD.

- Among the CHD sample, 63.10 percent and 36.90 percent had myocardial infarction and unstable angina respectively. Hypertension was present in 40.30 percent CHD subjects and diabetes in 36.60 percent. Family history of CHD was observed more in the CHD subjects than non CHD.

- When the relative risk of CHD with food consumption pattern was studied, there observed an increased risk of CHD with increased consumption of meat, fish, egg, fats and oils among males. Where as consumption of meat, fish and oils among females. Regarding nutrient intake protein, carbohydrate, cholesterol and potassium were pivotal in distinguishing between the cases and control in female subjects. Whereas βcarotene and vitamin C were pivotal in distinguishing between cases and control in males.

**Further studies recommended**

1. A study with wider coverage including urban and rural parts of Kerala may be carried out.

2. Effect of lifestyle factors and stress due to urbanization and industrialization, on cardiac morbidity could be studied.
3. An Educational intervention with the objective of prevention and control of CHD among younger generation.

4. A large epidemiological study is mandatory as is research on awareness, behavior, compliance and delivery of health care in relation to heart disease.

**Steps to be taken to improve the overall profile**

1. Management strategies both established and evolving should include careful assessment and determination of possible CHD risk, and application of appropriate therapeutic intervention.

2. Medical checkup and screening of coronary risk factors should begin early, preferably by 40 years of age in all, and by 30 years of age in those with family history of premature coronary disease and should be repeated at periodic intervals.

3. A healthy diet should be reduced in cholesterol and saturated fats and saturated fatty acids should be placed in part with monounsaturated and polyunsaturated fatty acids, as well as with complex carbohydrate. However dietary counseling given by physicians to high risk patients has to be adapted to individual risk factors, promoting when necessary, weight reduction, lowering blood pressure and blood cholesterol and control of blood glucose.
4. Meanwhile, a prudent approach for prevention of coronary disease to recommend a reduced intake of saturated fat, cholesterol, and trans unsaturated fatty acids accompanied by an increased consumption of foods rich in fibre, including cereals, vegetables, and fruit.

5. Regular exercise decreases plasma tryglyceride levels and reduce cardiovascular morbidity and mortality. Daily physical activity of 30 minute is enough to help reduce and maintain body weight and should be encouraged.

6. People need to be educated about the excess risk of coronary heart disease and its symptoms.

7. The key to combating the increasing incidence is an aggressive treatment of known risk factors through both an individual based as well as population based approach aimed at comprehensive risk factor reduction.

8. Early institution of healthy life style beginning with adolescents seems justified. Regular physical activity smoking cessation and reduced consumption of saturated fat should become the main focus of the therapeutic life style changes.

9. On the national level in India, where demographic transitions and changing diet and life styles have instigated the CHD epidemic, prompt socio-political and public health initiatives are required. With the initial focus on adolescents and the persons at lower socio-economic level,
swift regulatory and educational interventions must be instituted to root out smoking, make foods healthier and safer through food labeling and close monitoring, and promote regular exercise for the entire population.

10. Much can be achieved in terms of reduction of early mortality and morbidity associated with CHD in Indians with a lucid appreciation of its epidemiology and etiopathogenesis, and concerted action towards already known risk factors.