CHAPTER-6

SUMMARY AND CONCLUSIONS

The major objective of the current study is an effort to study the obesity, lipid profile, apolipoprotein A-I & B and other life style related risk factors of coronary artery disease (CAD) among adult Khatri males and females between 40-55 years of age. The age range was preferred because the disease manifests itself during these years. The study was based on a cross-sectional sample of 150 CAD patients 150 normal controls belonging to Khatri/Arora caste were selected purposively from different hospitals of Delhi, Haryana and Punjab. The studied group of patients was admitted to the hospitals and control group consisted of individuals who were healthy and were not the blood relatives of the patient; had no evidence of any cardiac disease on examination or history. In the beginning, purpose of the study was explained to the subjects in local language and the investigator interviewed the eligible candidates who agreed to participate in the study after getting consent.

The study was planned with the following major aims:

1. To estimate the serum concentration of various lipids: Triglycerides, total cholesterol, HDL and LDL cholesterol among CAD Patients and normal, healthy controls.

2. To study the serum concentration of Apo B and Apo A-I among CAD patients normal, healthy controls

3. To find out the prevalence of overweight/obesity on the basis of Body Mass Index (BMI), Waist Hip Ratio (WHR), Waist Circumference (WC) and Hip Circumference (HC) among CAD patients and controls.

4. To find the association of BMI with serum biochemical variables.

5. To investigate the associations between indices of adiposity body fat and CAD to evaluate their relative role.

6. To evaluate the relative role of various serum risk factors to predict CAD.

Data collection involved personal interview, relevant anthropometric measurements, biochemical analysis of blood for lipid profile, apolipoprotein A-I, apolipoprotein B...
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and physiological parameters like blood pressure and pulse rate were taken. All measurements were taken on the subjects, following standard techniques. The anthropometric measurements include height, weight, hip circumference, waist circumference, upper arm circumference and skinfolds including triceps, biceps, subscapular, suprailliac and medial calf. Questions related to socio-economic and lifestyle characteristics of respondents consisting type of family, education, dietary habits, socio-demographic variables, physical activity and symptoms related with the disease and history of other diseases were asked from the subjects. Waist Hip Ratio, Waist height Ratio, Conicity Index, subscapular triceps skinfold ratio, Centripetal fat ratio, abdomen triceps skinfold ratio, fat free mass, fat free mass index, fat mass index, fat free mass index have been derived from anthropometric measurements.

The data collection on various variables was subjected to statistical analysis by using appropriate techniques. In all cases, standardized and kurtosis were within the range expected for the data from a normal distribution. The results of descriptive statistics and hypotheses testing were presented in tables. The difference between mean values for different parameters between CAD and Controls were tested using independent sample t-test. The difference between proportions for CAD and Controls was tested using Chi-square test. The p-value less than 0.05 were considered statistically significant. Spearman’s correlation was done to find correlation between two quantitative variables. Bivariate and multivariate logistic regression analysis was done to see the association of independent risk factors with the outcome (CAD vs. Control). The unadjusted and adjusted odds ratio and 95% confidence interval was presented in the results.

**Signs and symptoms and co-morbidities related with CAD**

The results of present study revealed that there was no significant correlation of CAD with education or its association with type of family (Joint or nuclear family). About 87% of the CAD patients showed the occurrence of chest pain. Prevalence of shortness of breath, sweating, giddiness and hypertension was significantly higher in CAD as compared to Controls.

Of the clinical symptoms chest pain, shortness of breath, sweating and giddiness were significant independent determinants of CAD. Various physiological characteristics are known to influence CAD. Hypertension was a significant CAD associated co-
morbidity while diabetes was a significant CAD non-associated co-morbidity. Smoking was a significant determinant of CAD.

Chi-square test test showed statistically significant differences between the Cad and control groups for diastolic blood pressure (shows mean of 91.7 for CAD patients while 78.6 for the controls), systolic blood pressure (mean value of 145.2 for CAD patients while mean of 117.9 for control) and pulse rate (the mean of 90.95 in CAD and 75.88 in Controls) in CAD and controls respectively.

Biochemical Factors

Mean+ standard deviation of triglycerides in the CAD and the controls were 161.48±59.74 mg/dl and 127.0229.90 mg/dl, respectively. The level of triglycerides was significantly higher in the CAD in contrast to the controls. Total serum cholesterol was which was significantly higher in the CAD (197.18±42.60 mg/dl) as compared to the control group (158.46±21.76 mg/dl). LDL-Cholesterol in the CAD and the controls was (128.41±41.16 mg/dl) and (87.04±19.66mg/dl), respectively. The difference was statistically significant i.e. higher in CAD when compared to controls. HDL cholesterol among the CAD and Control group was (37.18±13.41 mg/dl) and (47.14±6.89mg/dl), respectively. The mean level of Apolipoprotein A-1 in the study group was found to be (99.98±12.36mg/dl), whereas in control group it was (123.00±18.14mg/dl). The difference was statistically significant. The mean value of Apolipoprotein B in the study group was (140.46±24.04 mg/dl) and in control group it was (83.39±16.26 mg/dl). The difference in two groups was statistically significant. Higher levels of Apo B were found in CAD patients.

Anthropometric Traits

Though BMI is useful in evaluating the body mass of individuals of different stature, FMI and FFMI are potentially useful in helping investigators interpret the body composition data from individuals who differ in stature. Mean values for BMI among CAD and Control are (30.70±1.89) and (27.06±2.29) respectively. Mean values of BMI for males and females CAD (30.26±1.51) and (31.14±2.12) respectively and for males and females Control group are (27.70±1.62) and (26.43±2.66) respectively. The differences between them were statistically significant.
Mean values for Waist Circumference among CAD and Control are (99.61±7.78) and (94.22±6.08) respectively. Comparisons of males versus female CAD patients reveal that the average waist circumference of females (94.65) was more than that of the males (104.57), and differences between them were statistically significant.

Mean values for Hip Circumference among CAD and Control are (107.06±5.51) and (99.17±4.83) respectively. Comparisons of males versus female CAD patients reveal that the average hip circumference of females (104.44) was less than that of the males (109.68), and differences between them were statistically significant.

Mean values for Upper Arm Circumference among CAD and Control are (32.09±1.98) and (27.98±2.54) respectively. Comparisons of males versus female CAD patients reveal that the average upper arm circumference of females (31.80) was less than that of the males (32.38), and differences between them were statistically significant.

Mean values for Waist Hip ratio among CAD and Control are (0.95±0.08) and (0.92±0.08) respectively. Comparisons of males versus female CAD patients reveal that the average Waist Hip ratio of females (0.90) was less than that of the males (0.95), and differences between them were statistically significant.

Mean values for Waist height ratio among CAD and Control are (0.61 ±0.04) and (0.57±0.03) respectively. Comparisons of males versus female CAD patients reveal that the average Waist height ratio of females (0.61) was same as that of the males (0.61), and differences between them were not statistically significant.

Mean values for triceps skinfold among CAD and Control are (26.40±3.44) and (23.45±3.84) respectively. Comparisons of males versus female CAD patients reveal that the average triceps skinfold of females (29.24) was more than that of the males (23.57), and differences between them were statistically significant.

Mean values for biceps skinfold among CAD and Control are (16.12±1.95) and (12.89±1.91) respectively. Comparisons of males versus female CAD patients reveal that the average biceps skinfold of females (17.22) was more than that of the males (15.02), and differences between them were statistically significant.

Mean values for subscapular skinfold thickness among CAD and Control are (26.73±2.89) and (21.34±3.02) respectively. Comparisons of males versus female
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CAD patients reveal that the average subscapular skinfold thickness of females (27.37) was more than that of the males (26.10), and differences between them were statistically significant.

Mean values for supra-iliac skinfold among CAD and Control are (26.05±3.35) and (21.69±2.42) respectively. Comparisons of males versus female CAD patients reveal that the average supra-iliac skinfold thickness of females (28.09) was more than that of the males (24.02), and differences between them were statistically significant.

Mean values for medial calf skinfold among CAD and Control are (25.23±2.74) and (21.92±2.55) respectively. Comparisons of males versus female CAD patients reveal that the average medial calf skinfold thickness of females (25.83) was more than that of the males (24.61), and differences between them were statistically significant.

Mean values for sum of four skinfold among CAD and Control are (95.31±8.12) and (79.39±8.48) respectively. Comparisons of males versus female CAD patients reveal that the average sum of four skinfold of females (101.92) was more than that of the males (88.71), and differences between them were statistically significant.

Mean values for Body Density among CAD and Control are (1.02±0.01) and (1.02±0.008) respectively. Comparisons of males versus female CAD patients reveal that the average Body Density of females (1.01) was less than that of the males (1.04), and differences between them were statistically significant.

Mean values for Percentage Body Fat among CAD and Control are (33.45±5.86) and (33.39±3.89) respectively. Comparisons of males versus female CAD patients reveal that the Average Percentage Body Fat of females (39.22) was more than that of the males (27.68), and differences between them were statistically significant.

Mean values for Fat Mass among CAD and Control are (26.99±3.08) and (22.20±2.58) respectively. Comparisons of males versus female CAD patients reveal that the Average Fat Mass of females (29.26) was more than that of the males (24.74), and differences between them were statistically significant.

Mean values for Fat Free Mass or Lean Body Mass among CAD and Control are (54.99±10.53) and (44.65±6.24) respectively. Comparisons of males versus female CAD patients reveal that the Average Fat Free Mass or Lean Body Mass of females
(45.35) was less than that of the males (64.63), and differences between them were statistically significant.

Mean values for Fat Mass Index among CAD and Control are (16.64±2.54) and (16.58±2.36) respectively. Comparisons of males versus female CAD patients reveal that the Average Fat Mass Index of females (18.90) was more than that of the males (14.38), and differences between them were statistically significant.

Mean values for Fat Free Mass Index among CAD and Control are (33.44±4.63) and (34.17±9.34) respectively. Comparisons of males versus female CAD patients reveal that the Average Fat Free Mass Index of females (29.2) was less than that of the males (37.58), and differences between them were statistically significant.

Mean values for Conicity Index among CAD and Control are (1.29±0.93) and (1.29±0.07) respectively. Comparisons of males versus female CAD patients reveal that the Average Conicity Index of females (1.25) was less than that of the males (1.33), and differences between them were statistically significant.

Mean values for Subscapular Triceps Skinfold Ratio among CAD and Control are (1.02±0.15) and (0.92±0.13) respectively. Comparisons of males versus female CAD patients reveal that the Average Subscapular Triceps Skinfold Ratio of females (0.94) was less than that of the males (1.11), and differences between them were statistically significant.

Mean values for Centripetal Fat Ratio among CAD and Control are (50.37±3.79) and (47.74±3.63) respectively. Comparisons of males versus female CAD patients reveal that the Average Centripetal Fat Ratio of females (48.32) was less than that of the males (52.42), and differences between them were statistically significant.

Mean values for Abdominal Tricep Skinfold Ratio among CAD and Control are (3.85±0.98) and (4.15±0.88) respectively. Comparisons of males versus female CAD patients reveal that the Average Abdominal Tricep Skinfold Ratio of females (3.26) was less than that of the males (4.45), and differences between them were statistically significant.
Bivariate Analysis of Risk Factors

Bivariate logistic regression analysis between CAD and the following variables viz. waist circumference, Waist Hip Ratio, Waist Height ratio, Body percentage Fat, Total Cholesterol, Serum Triglycerides, LDL-C, HDL-C, Triceps Skinfold, Bicep Skinfold, Subscapular Skinfold, Suprailiac Skinfold, Sum of four skinfold, Hypertension, chest pain, Shortness of breath, sweating, Giddiness, Diabetes, Hypertension, Smoking, Alcohol, Exercise, Intake of Vegetarian and non-vegetarian food, family history, antihypertensive treatment, antithyroid drug therapy was carried out to select the candidate variables for developing the classification model in multivariate logistic regression analysis.

It is evident that out of factors considered to assess their association with CAD, Bivariate logistic regression analysis revealed that waist circumference (WHO), Waist Hip Ratio, Waist Height ratio, Body percentage Fat, Total Cholesterol, Serum Triglycerides, LDL-C, HDL-C, Triceps Skinfold, Bicep Skinfold, Subscapular Skinfold, Suprailiac Skinfold, Sum of four skinfold, Hypertension, chest pain, Shortness of breath, sweating, Giddiness, Diabetes, Hypertension, Smoking, intake of vegetarian and non-vegetarian food, family history, antihypertensive treatment were significantly associated with CAD. However, Alcohol, Exercise, intake of antithyroid drug therapy was not significant statistically.

Multivariate Analysis

Multiple regression analysis was performed to evaluate the strength of the relationship between overweight/obesity and the anthropometric measurements/indices and it was interpreted in terms of squared correlation coefficient (R²). According to Multivariate logistic regression analysis, candidate variables were selected using the criteria with p-value < 0.15 in the bivariate analysis of association and variable with known biological importance regardless of their statistical significant level in the bivariate analysis. In this study, stepwise multivariate analysis was carried out using backward elimination with a test of forward selection with probability levels for entry and removal as 0.15 and 0.20, respectively. The multivariate logistic regression analysis considering Chest Pain, shortness of breath, sweating, giddiness, Diabetes, Hypertension, smoking, alcohol, exercise, intake of vegetarian/non-vegetarian food, family history, Intake of hypertensive, antithyroid drugs, waist circumference, waist
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hip ratio, waist height ratio, total cholesterol, total glycerides, Low density lipids, high density lipids, triceps Skinfold, bicep Skinfold, Subscapular Skinfold, suprailiac Skinfold, medial calf, sum of four skin folds was carried out to assess the effect of various independent variables on CAD group. Since both Waist Circumference and Waist Hip Ratio were correlated variables, and both the variables were given the opportunity to be selected along with other independent risk factors. Since only one of the two variables i.e. Waist Circumference and Waist Hip Ratio were finally selected, multicollinearity was not an issue.

The results clearly indicated that among that Chest Pain, shortness of breath, sweating, giddiness, Diabetes, Hypertension, smoking, intake of vegetarian/non-vegetarian food, family history, waist height ratio, total cholesterol, total glycerides, Low density lipids, high density lipids, triceps Skinfold, bicep Skinfold, suprailiac Skinfold, medial calf were found to be significant independent determinants of CAD.

The stepwise multi variable logistic regression analysis revealed that waist height ratio and skinfolds were significantly independent determinants of CAD of the lipid fat. LDL-C, HDL, total cholesterol and triglycerides were found to be significant independent CAD determinants.

Canonical Linear Discriminant Analysis

Canonical linear discriminant analysis reveals that the value of canonical correlation (0.9518) indicated that 90.59% of variation was observed between the two groups (CAD and Control). A higher eigen value (9.63286) supports that a large amount of variation was shared by the linear combination of variables i.e. a majority of variance in the relationship. The value of proportion was 1 indicating that the function had 100% discriminating power of the discriminating variables. Cumulative proportion gives the total proportion of discriminating power. The value of cumulative proportion (0.0940) showed that there was no equality between covariance matrices within the group. The value of df1 (28) indicated there were 28 independent variables in the group. The p value showed that the results were significant.

Group means on canonical variables shows that the discriminant function scores by group for each function had a mean of zero which can be calculated as (150*-3.072561) + (148*3.114082)=0. The difference observed between CAD and Control is 6.186643 which is the better predictive power of canonical discriminant function in
the observation and therefore the above listed variables are discriminant functions for CAD.

Since, there was significant Co-relation between various variables canonical linear discriminant function analysis was performed. This analysis revealed that there were 28 independent variables, which resulted in the 100% discrimination between controls and CAD.

To identify the nature of relationship between different anthropometric variables, Biochemical Variables and Body Composition, correlation coefficient \( r \) was calculated.

To recognize the nature of association between biochemical variables, skinfolds, indices and body composition, correlation coefficient was calculated. The correlation result analysis revealed significant correlation among bicep and Subscapular Skinfold, Supra iliac skinfold, medial calf, Sum of Four skinfolds, percentage body mass, fat mass, fat mass index and negatively among body density fat free mass, fat free mass index, subscapular skinfold ratio, Centripetal fat ratio and abdomen triceps skinfold ratio.

It is thereby concluded from the present study that Serum Total Cholesterol, LDL-Cholesterol and triglycerides are higher in patients with CAD as compared to controls, whereas HDL-Cholesterol was lower on the other hand. Apo B was more in patients with CAD as compared to those with Control.

Rising outbreak of obesity in developing countries due to ecological trends and socio-behavioral influences and cheap promotional offers of multinational companies in food items and lavish life style are the cause. Regional distribution of fat storage is an important indicator of medical risk associated with obesity and is a complex disorder and a threat for many successive diseases. It is also related with considerable physical and psychological impairment contributing to an overall reduced quality of life. It can be concluded from the present study that family history of obesity and raised lipid profile, harmful pattern of lunch intake eating fast foods, consumption of canned food, fewer meals at home, skipping of breakfast, more outside meals, consumption of non-vegetarian foods, low levels of exercise, consumption of alcohol, smoking are positive contributors of overweight and obesity. Eating balanced healthy food which includes green vegetables, fresh fruits, intake of beverages like juices and skimmed
milk, having home cooked meals and enhanced exercises. Yoga, walking or gym play
an important role in reducing overweight, obesity therefore resulting in lower level of
lipids.