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# Risk Factors of Cardiovascular Disease among Rural Population in Southern India

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## ABSTRACT

**Background and Objectives:** The study was conducted to study the magnitude of risk factors of cardiovascular disease (CVD) among rural population in Southern India.

**Methodology:** A community based cross sectional study was conducted in Shirur, Bagalkot. The study was conducted among a sample of 1226 respondents aged 20 years and above by systematic random sampling method. Information on socio-demographic and risk factors of cardiovascular disease collected by interview method using a pre-designed, semi structured proforma.

**Results:** Of the total 1226 respondents, 539 were males & 687 females with the mean age 45.06 (±16.08) years and 44.27(±16.48) years respectively. There was significant difference ($p<0.05$) noticed in family history of hypertension, nature of work, dietary pattern. Men had significantly higher mean systolic blood pressure (124.8±16.1mmHg), serum fasting plasma glucose (101.9±30.9 mg/dl), serum post prandial plasma glucose (101.9±30.9 mg/dl), WHR (0.87± 0.08).

**Conclusion:** The present study revealed that the higher rates of risk factors like family history of hypertension, sedentary nature of work, mixed diet pattern, obesity, smoking and alcohol consumption. The higher levels of diastolic blood pressure and significantly different levels of distribution fasting blood sugar and total cholesterol levels among males and females is the matter of concern.

**Key words:** Cardiovascular disease; smoking; BMI; Hypertension.

## INTRODUCTION

In the modern India the population is undergoing epidemiological transition and thus causes of death and disability are shifting from nutritional and infectious diseases to chronic diseases such as cardiovascular diseases (CVDs), diabetes and cancer[1] The burden of CVD in developed nations is on the rise in over several decades due to a long period of epidemiological transition. But in India epidemiological changes have occurred in a much shorter time because of the rapid pace of economic development. Thus CVD has emerged as the leading cause of death all over India, with CHD affecting Indians at least 5-6 years earlier than their western counterparts[2]

The large population and the high prevalence of CVD risk factors are contributing to the huge burden of CVD in India. The projected increase in deaths and disability due to CVD is expected to follow a rapid increase in the prevalence of risk factors.[3] Now our main approach should be to identify risk factors at the individual level to minimise the social and economic burden due to CVD and other non-communicable diseases. This work began with the Framingham study in 1948 and has continued unabated.[4] Many cross-sectional surveys from various parts of India have reported the rising trends and a higher burden in the levels of conventional risk factors such as diabetes, hypertension and metabolic syndrome which we expect due to urbanization and they also reported the

urban-rural difference in the risk factors all over India.[5] The present mortality rates which we are observing today are the consequence of past exposure to behavioural risk factors such as inappropriate nutrition, insufficient physical activity and increased tobacco consumption which is called the "lag-time" effect of risk factors for CVD. Overweight, central obesity, high blood pressure, dyslipidaemia, diabetes and low cardiorespiratory fitness are among the biological factors contributing principally to increased risk.[6]

CVD risk factors among the urban poor and middle class are rapidly increasing due to the epidemiological transition against a background of economic globalization, in India. Following this impact of globalization, there is an "aspiration effect" which has behavioral consequences among the upper middle class and rich people in India. This strong desire to imitate the western society leads to improved awareness of the preventive measures to the raised CVD risk but also puts forth the society to higher levels of tobacco use, obesity or overweight and hypertension and they are now associated with lower levels of education and income in India.[7] Risk factor prevalence rates may not be uniform throughout the country as the dietary habits and cultural practices vary in a vast country like India.[8] Hence a to find out the magnitude of risk factors of cardiovascular disease among an rural population in southern India, among the people aged 20 years and above, is taken up in Shirur, a rural field practice area of S. N. Medical College Bagalkot.

## MATERIALS AND METHODS

A cross-sectional study was conducted in the rural field practice area of S. Nijalingappa Medical College, Bagalkot is Shirur, Karnataka between 1st January 2012 to 30th June 2013. For a population of 12498 with a sampling frame of 7,015 and prevalence of 4%,[5] using Open Epi- version 2.3.1, a sample size was calculated to be 1219.[9, 10] Using Systematic Random Sampling technique, every 5th person was included, interviewed from the permanent residents of Shirur and who gave written informed consent for the study. Thus the effective sample size was found to be 1226 respondents.

**Data collection:** A house to house survey was conducted for enumeration of population with the help of anganawadi workers to delineate the areas covered by anganawadi. All the houses in each of the anganwadi were numbered continuously for study purpose. A prestructured and pretested, questionnaire was used to collect information on the socio demographic profile, which included contact details, age, gender, religion, marital status, education, occupation, and income and also the risk profile, anthropometry, medical history, physical activity, and dietary habits. The investigator who administered the questionnaire carried out anthropometric, BP measurements. Motivation and instructions were given to participants on the previous day to stay in fasting state the following day. Weight, Height, Waist and hip measurements were taken from all participants.

**Definitions:** Age of the person was recorded in completed year. Marital Status was recorded as currently married at the time of study, unmarried (participants who were not married) and others which included widowed, separated and divorced.[11] The maximum level of educational qualification attained was taken as literacy status which was defined as Illiterate and literate. Illiterate is a person who could not read or write. This category also includes those who could only sign or reproduce some writing mechanically without any meaning. Literate is the one who had taken formal education. This category also included those who could read or write with meaning but had not taken any formal education in school.[12]

Occupation: Socio economic classification: Monthly earning of each individual from all the sources was recorded and the agricultural income in the form of crops is converted into present price rates and was taken for calculation of income. B G Prasad classification was used with correction to March 2011 for Socio Economic Classification.[13]

Diet: Vegetarian: A person consuming fruits, vegetable, wheat, rice, pulses, milk and milk products. Mixed diet: A person consuming egg and/or meat in addition to what a vegetarian eats.[14]

Smoker: A person who has been smoking at least a bidi, a cigarette, or any other form of tobacco used for smoking for at least last six months.

Alcohol user: A person from study population who has been consuming at least 30 ml alcohol per day for at least last six months.

Physical activity: Any bodily movement produced by skeletal muscle that result in a substantial increase over the resting energy expenditure. Physical activity was assessed using close-ended questions probing self-perceived, self-reported type (occupational, domestic, leisure time and transport related) during the past 5 years. The intensity of physical activity was classified as sedentary (light) moderate and heavy work according to recommendations of Ad hoc 'Expert Committee on Energy and Protein Requirements' – Report of a joint FAO and WHO (1973).[15]

**Measurements:**

Height: Height was measured with a Stadiometer

mounted on weighing scale to the nearest 0.5cm. Subjects were requested to stand upright without shoes with their back and head against the height rod, heels together and eyes directed forward.[16]

Weight: Weight was measured with traditional spring balance that was kept on a firm horizontal surface. The scale was checked every day and calibration was done with "known" weights. Subjects were asked to wear light clothing and weight was recorded to the nearest 0.5 kg.[16]

BMI: Body mass index (BMI) was calculated using the formula weight in kilograms for height and classified based on WHO recommendations.[17]

Blood Pressure: Blood pressure was recorded in the sitting position in the right arm to the nearest 2mm Hg using the same mercury sphygmomanometer machine. Three readings were taken 5 minutes apart and the mean of the three was taken as the blood pressure. Disappearance of Korotkoff sound was considered as diastolic B.P11 Hypertension was classified according to Joint National Committee (JNC) 7 criteria.[18]

Mental stress score: To assess the exposure to uncope stress, 'Mental stress score' was used. This score has been given on the basis of the Presumptive Stressful Life Events Scale [PSLES].[19, 20]

Blood sugar Estimation: Two venous blood samples were taken for glucose estimation. One sample after 8 hours of overnight fast was taken and considered for fasting blood sugar and for total cholesterol. The other venous blood sample was drawn after two hours after having food for postprandial blood glucose levels in each participant in the study.

Diabetes: The diagnosis of diabetes was based on the American Diabetes Association (ADA) definition, i.e. fasting plasma glucose ≥126 mg/dl (≥7.0 mmol/L) or subjects who reported that they had diabetes and were on treatment by a physician.[16]

Hypercholesterolemia was diagnosed if the serum cholesterol levels were ≥200 mg/dl (≥5.2 mmol/L) or if the subjects were receiving drugs for the treatment of hypercholesterolemia.

Study protocol was approved by the Institution's Ethical Committee. Data was analyzed with SPSS version 20. Proportions, Chi square test, odd's ratio were used wherever relevant.

## RESULTS

Out of total 1226 study participants, 539 were males with the mean age 45.06 (±16.08) years & 687 were females with the mean age 44.27(±16.48) years. The age group among males and females were comparable (p = 0.3772). Majority of the respondents were Hindus (96.3%) and gender distribution was equal among them. 3.7% were Muslims and nobody belonged to other religions. Married male (83.7) and female (83.0) respondents were more compared to others. Only 51.3% of the respondents were literate and also very highly significant difference (p < 0.001of literacy status between males and females noticed. Majority of the respondents were agricultural laborers followed by others (37%) which included housewives among them. Majority of the respondents belonged to lower socio economic class (57.3%). [table 1]

**Table 1: Socio demographic profile of respondents**

| Profile | Male (n =539) | Female (n =687) | Total (n=1226) |
|---|---|---|---|
| **Age** | | | |
| 20 - 29 | 105 (19.5) | 159 (23.1) | 264 (21.5) |
| 30 - 39 | 115 (21.3) | 136 (19.8) | 251 (20.5) |
| 40 - 49 | 100 (18.6) | 134 (19.5) | 234 (19.1) |
| 50 - 59 | 86 (16.0) | 85 (12.4) | 171 (13.9) |
| 60 - 69 | 81 (15.0) | 109 (15.9) | 190 (15.5) |
| ≥70 | 52 (9.6) | 64 (9.3) | 116 (9.5) |
| **Religion** | | | |
| Hindu | 515 (95.5) | 666 (96.9) | 1181 (96.3) |
| Muslims | 24 (4.5) | 21 (3.1) | 45 (3.7) |
| **Marital status** | | | |
| Married | 451 (83.7) | 570 (83.0) | 1021 (83.3) |
| Unmarried | 81 (15.0) | 31 (4.5) | 112 (9.1) |
| Others | 7 (1.3) | 86 (12.5) | 93 (7.6) |
| **Literacy status** | | | |
| Literate | 357 (56.8) | 272 (43.2) | 629 (51.3) |
| Illiterate | 182 (30.5) | 415 (69.5) | 597 (48.7) |
| **Occupation** | | | |
| Agricultural labourer | 347 (64.4) | 216 (31.4) | 563 (45.9) |
| Non-Agricultural labourer | 50 (9.3) | 16 (2.3) | 66 (5.4) |
| Own business | 28 (5.2) | 4 (0.6) | 32 (2.6) |
| Employed | 81 (15.0) | 31 (4.50) | 112 (9.1) |
| Others | 33 (6.1) | 420 (61.1) | 453 (37) |
| **Socio economic status** | | | |
| Upper | 19 (3.5) | 32 (4.7) | 51 (4.2) |
| Middle | 217 (37.2) | 255 (37.1) | 472(38.5%) |
| Lower | 303 (56.2) | 400 (58.3) | 703(57.3%) |

In the present study the past history of hypertension was more among men which was no statistically different from women. There was significantly significant difference (p < 0.05) noticed in family history of hypertension, nature of work, dietary pattern and mental stress scores. There was definite difference noticed in the levels of BMI which was statistically not significant. [table 2]

In the present study smokers (16.1%) were all males and only one woman (0.1%) used consume alcohol occasionally indicating very highly significant difference between males and females (p <0.05**).** [table 3]

**Table 2: Risk factor profile of respondents**

| Risk factor | Male (n = 539) | Female (n = 687) | Total (n = 1226) | P | OR | 95% CI |
|---|---|---|---|---|---|---|
| **History (past) of hypertension** | 20 (3.7) | 17 (2.5) | 37 (3.0) | 0.212 | 1.519 | 0.788 – 2.929 |
| **Family of Hypertension** | 20 (3.7) | 9 (1.3) | 29 (2.4) | 0.009* | 2.903 | 1.311 – 6.428 |
| **Nature of work** | | | | | | |
| Sedentary | 221 (41.0) | 330 (48.0) | 551 (44.9) | < 0.003* | 0.724 | Ref |
| Moderate | 260 (48.2) | 315 (45.9) | 575 (46.9) | | 1.673 | 1.089 – 2.571 |
| Heavy | 58 (10.8) | 42 (6.1) | 100 (8.2) | | 2.062 | 1.339 – 3.177 |
| **Dietary pattern** | | | | | | |
| Vegetarian | 264 (49.0) | 451 (65.6) | 715 (58.3) | 0.000* | 0.858 | Ref |
| Mixed | 275 (51.0) | 236 (34.4) | 511 (41.7) | | 1.991 | 1.580 – 2.508 |
| **BMI Levels (kg/m²)** | | | | | | |
| Underweight (< 18.50) | 138 (25.6) | 197 (28.7) | 335 (27.3) | 0.2154 | 1 | Ref |
| Normal (18.50 - 24.99) | 321 (59.6) | 381 (55.5) | 702 (57.3) | | 1.04 | 0.290 – 1.114 |
| Overweight & obesity (>25.00-29.99) | 84 (14.9) | 105 (15.9) | 189 (15.5) | | 1.05 | 0.225- 1.055 |
| **Mental stress score** | | | | | | |
| No Stress | 486 (90.2) | 624 (90.8) | 1110 (90.5) | 0.098 | 1 | Ref |
| Moderate to severe Stress | 53 (9.8) | 63 (9.2) | 116 (9.4) | | 1.08 | 0.52 – 7.101 |

* P <0.05 - significant

**Table 3: Smoking and alcohol consumption status of respondents**

| | Male (n = 539) | Female (n = 687) | Total (n = 1226) |
|---|---|---|---|
| Smoking status * | 43 (8.0) | 0 (0.0) | 43 (3.5) |
| Alcohol consumption * | 87 (16.1) | 1 (0.1) | 88 (7.2) |

* P <0.05 - significant

Compared with women, men had significantly higher mean systolic blood pressure (men 124.8 ± 16.1mmHg, women 122.8 ± 17.8 mmHg), serum fasting plasma glucose (men 101.9 ± 30.9 mg/dl, women 98.3 ± 27.3), serum post prandial plasma glucose (men 101.9 ± 30.9 mg/dl), WHR (men 0.87 ± 0.08, women 0.81 ± 0.1). There was significantly higher in the mean levels of total cholesterol among women (152.7 ± 24.9, men 149.9 ± 23.5). There was no difference observed in mean diastolic blood pressure (men 81.3 ± 11.0mmHg, women 81.2 ± 31.9 mmHg and BMI (men 21.2 ± 3.9kg/m2, women 21.2 ± 4.5 kg/m2) among both the gender. [table 4]

The present study revealed that 25% of the males and 25% of the females were normotensives, 43.6% of males and 46.3% were females were prehypertensives and 31.2% of males and 28.5% of females were hypertensives. The differences of blood pressure levels among both the gender and agewise difference were found to be statistically insignificant (p>0.05). [table 5]

**Table 4: mean and standard deviation of some of the risk factors**

| Risk factor | Male (n = 539) | Female (n = 687) | Total (n = 1226) | P value |
|---|---|---|---|---|
| SBP (mg/dl) | 124.8 ± 16.1 | 122.8 ± 17.8 | 123.7 ± 17.1 | 0.049* |
| DBP (mg/dl) | 81.3 ± 11.0 | 81.2 ± 31.9 | 81.3 ± 24.9 | 0.937 |
| BMI (kg/m²) | 21.2 ± 3.9 | 21.2 ± 4.5 | 21.2 ± 4.2 | 0.920 |
| FBS (mg/dl) | 101.9 ± 30.9 | 98.3 ± 27.3 | 99.9 ± 28.9 | 0.032* |
| Total cholesterol (mg/dl) | 149.9 ± 23.5 | 154.8 ± 25.9 | 152.7 ± 24.9 | 0.000* |
| WHR | 0.87± 0.08 | 0.81± 0.1 | 0.84 ± 0.1 | 0.000* |

* P <0.05 - significant (t test)

**Table 5: Age wise distribution of current blood pressure levels among the respondents**

| Age | Normotension | | Prehypertension | | Hypertension | |
|---|---|---|---|---|---|---|
| | Male (%) (n = 539) | Female (%) (n = 687) | Male (%) (n = 539) | Female (%) (n = 687) | Male (%) (n = 539) | Female (%) (n = 687) |
| **< 30** | 26 (4.8) | 41 (6.0) | 52 (9.6) | 77 (11.2) | 27 (5.0) | 41 (6.0) |
| **30 - 39** | 33 (6.1) | 32 (4.7) | 45 (8.3) | 57 (8.3) | 37 (6.9) | 47 (6.8) |
| **40 - 49** | 22 (4.1) | 26 (3.8) | 44 (8.2) | 68 (9.9) | 34 (6.3) | 40 (5.8) |
| **50 - 59** | 20 (3.7) | 20 (2.9) | 40 (7.4) | 40 (5.8) | 26 (4.8) | 25 (3.6) |
| **60 - 69** | 19 (3.5) | 28 (4.1) | 34 (6.3) | 55 (8.0) | 28 (5.2) | 26 (3.8) |
| **70 - 79** | 16 (3.0) | 26 (3.8) | 20 (3.7) | 21 (3.1) | 16 (3.0) | 17 (2.5) |
| **Total** | 136 (25.2) | 173 (25.2) | 235 (43.6) | 318 (46.3) | 168 (31.2) | 196 (28.5) |

P value > 0.05

## DISCUSSION

The present study is an attempt to know the magnitude of risk factors for CVD among rural population of south India. The present study revealed that the study population is of homogenous age groups among both the gender, majority were Hindus, married individuals. There was low literacy level especially among females. Major occupation was agriculture among males and females being housewives as it is a rural based area. More than half of the respondents, hence belonged to lower socio economic class.

History of hypertension among males and females was comparable but family history of hypertension was significantly high among males ($p<0.05$) suggesting familial tendency of hypertension tends to be more among males. Sedentary lifestyle or physical inactivity was much high in the present study (45%) and it was more so among females probably due to more number of female participants who used to be there at survey time and men used to go for work. Chow et al.[21] conducted cross-sectional survey by selecting a random sample stratified by age and gender from rural Andhra Pradesh reported 11.3% physical inactivity and Hazarika et al [22] did study on hypertension in the native rural population of Assam reported physical inactivity was found among 25.5% participants which are lower values compared to present one. This observation suggests that behavioral change taking place with the epidemiologic transition in the form of physical inactivity. Dietary pattern was significantly different among males compared to females. Vegetarian food consumption was more of among females and more than half of the males being mixed food consumers. Overweight in this study was (males-14.9%, females-15.9%) comparable with the results of Anand et al.[23] (males - 16%, females - 21.9). This suggests that overweight was more among females in this study may be because of more number of sedentary female respondents and lifestyle changes to epidemiologic transition. The distribution of mental stress was not significantly different among both the gender.

The prevalence of smoking was 3.5 % which was lower than the result presented by Chow et al.[21] (19.9%) and Hazarika et al[22] (12.5%). In the present study 16% of the study population was consuming alcohol which is a little high as reported by Thankappan et al.[24] (13.4%). Oommen AM et al[10], did a study on rising trend of cardiovascular risk factors in urban and rural Vellore and reported similar to our study that all the smokers and alcohol consuming population was of male population.

Mean systolic blood pressure were comparable and higher diastolic blood pressure than the reports of Shah B et al.[25] (SBP: males-126.5±18.6 females-123.9±20.3) (DBP: males-76.6± 11.4, females-77.4±11.6) Higher levels of mean fasting blood glucose levels (males-101.9 ± 30.9, females-98.3 ± 27.3) were noticed compared to the report on ICMR – WHO six sites study published by Shah B et al.[25] Conversely mean fasting total cholesterol levels of current study (males-149.9 ± 23.5, females-154.8 ± 25.9) were lower than the reports of Shah B et al. [25] (males-161±11.5, females-169.2±11.5) probably due to more number of vegetarians in the study.

Hypertension status in the present study (males-31.2%, females-28.5%) revealed higher levels of blood pressure among males but Thankappan et al[21] in his study on prevalence, correlates, awareness, treatment, and control of hypertension in kumarakom, kerala, a rural based community study revealed more blood pressure levels among females (males- 36.0% and females-37.2%) which are much higher compared to our study.

## CONCLUSION

The present study revealed that the higher rates of risk factors for cardiovascular diseases like family history of hypertension, sedentary nature of work, mixed diet pattern, obesity, smoking and alcohol consumption. The higher levels of diastolic blood pressure levels and significantly different levels of distribution fasting blood sugar and total cholesterol levels among males and females is the matter to be given importance. The risk factors for CVD in the relatively young population of rural area from southern India are increasing. This is the matter of concern and we should look forward for further research and preventive measures of CVD risk factors. It also suggests the need of the awareness towards risk factors not only of CVD but also whole of the non-communicable diseases.

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