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Exploring Potential Risk Factors for Cardiovascular Disease Among the Populations in Rural Areas of Central-Southern Region of Kerala, India: A Prospective Observational Study

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Abstract

Background: Cardiovascular disease is a leading cause of death among the population in rural areas and therefore the risk factors associated with various groups of population are key factors to help in the treatment and prevention of this diseases.

Objective: The objective of this study was to determine the various risk factors among the population in rural areas of Pathanamthitta, Kerala, India.

Materials and methods: A prospective observational study was carried out among the rural areas of Pathanamthitta district. The sample size of the study was 500 individuals. The study period ranged 6 months. The data was collected using a semi structured questionnaire and various instruments to evaluate risk factors including diabetes mellitus, blood pressure and BMI.

Results: Of the total population of 500 individuals, positive family history of cardiovascular disease (32%), lifestyle diseases such as hypertension (53.5%), diabetes mellitus (39.4%), undesirable body mass index (39%) were seen. Other risk factors include consumption of saturated fat (39%), high salt intake (64.6%), high stress levels (42%), insufficient sleep (47%) and sedentary lifestyle (35.4%). Harmful lifestyle behaviours like alcohol consumption (37.8%) and smoking (17%) were also prevalent.

Conclusion: As the number of risk factors increases in a rural population, the probability of developing cardiovascular disease increases.

Keywords: Cardiovascular Disease, Risk Factors, Rural, Kerala.

Introduction

According to the World Health Organization, cardiovascular disease (CVD) was the leading cause of up to 32% of fatalities in 2019. Heart attacks and strokes accounted for 85% of the lives that were claimed. Furthermore three quarters of CVD related fatalities was seen in low and middle income countries.[1] In

India, CVD attributed to 27% of all deaths in 2016, 45% of those fall between the age group of 40 to 69 years.[2]

CVD rates are typically higher in urban areas [3]. However states like Kerala, Goa and Andaman and Nicobar show a surprising turn of events owing to higher CVD prevalence in rural areas as compared to the national average.[4][5][6] Kerala possess a major healthcare challenge, with a prevalence of 54% of CVD cases in rural areas and a slight increase of 55% of CVD cases in urban areas.[6]

There are various reasons contributing to the increased occurrence of CVD in rural areas, some of them comprise of extended life expectancy, increased urbanization, prevalent risk factors and higher literacy rate. [4][7][8]

The major contributors to the development of CVD encompass unhealthy dietary habits, sedentary lifestyle, excessive tobacco as well as alcohol intake, elevated blood pressure, high blood sugar levels, increased blood lipid levels and issues related to overweight or obesity due to unfavourable BMI.[1] Besides these traditional risk factors that are prominent in claiming the lives of millions of individuals, other emerging factors such as sleep disorders and psychosocial stress play a crucial part. Although these emerging factors can be due to a wide array of reasons, healthy lifestyle choices along with regular health check-ups, and stress management becomes imperative.[9] This study therefore sheds light on the various risk factors that are prominently seen among the population in rural areas, which in turn can aid by reducing the prevalence of such risk factors by proper prevention and counselling.

Materials and Methods

A prospective observational study was done. The study was conducted among the rural areas of Pathanamthitta district which is located at the central-southern part of Kerala. The study period was 6 months.

The sample size was calculated based on Slovin's formula which is

$n=N \div 1+ Ne^2$. (1)

Here N is population size and e is margin of error. A total of 1,000,000 residents live among the rural areas of Pathanamthitta district, therefore N=1,000,000. A margin of error (e) of 5% (0.05) is taken. By substituting these values into the formula, the sample size (n) becomes 399.84. A total of 400 individuals can be taken, however for a higher level of precision and lower margin of error, the choice of 500 individuals is made.

Individuals aged 30 to 80 years are taken in this study. Inclusion criteria include those participants that are willing to participate in the study and those who are not previously diagnosed with any type of cardiovascular diseases. Exclusion criteria include pregnant or lactating mothers as well as those individuals that are unwilling to participate in the study.

First, participants who were willing to participate in the study were asked to fill the consent form followed by a semi structured questionnaire to determine the knowledge and various risk factors affecting the individual.

To assess the various risk factors of CVD, parameters such as, glucose levels, blood pressure levels, BMI and lipid levels were evaluated. Glucose levels were evaluated by identifying the random blood sugar (RBS) levels with the help of a Glucometer. A small drop of blood by pricking the finger, is placed on the test strip to obtain the RBS level on the digital readout device. Blood pressure levels were evaluated using a sphygmomanometer. The cuff is inflated, temporarily stopping blood flow and the systolic and diastolic pressures are recorded by listening to the characteristic Korotkoff sounds. Body mass index is calculated

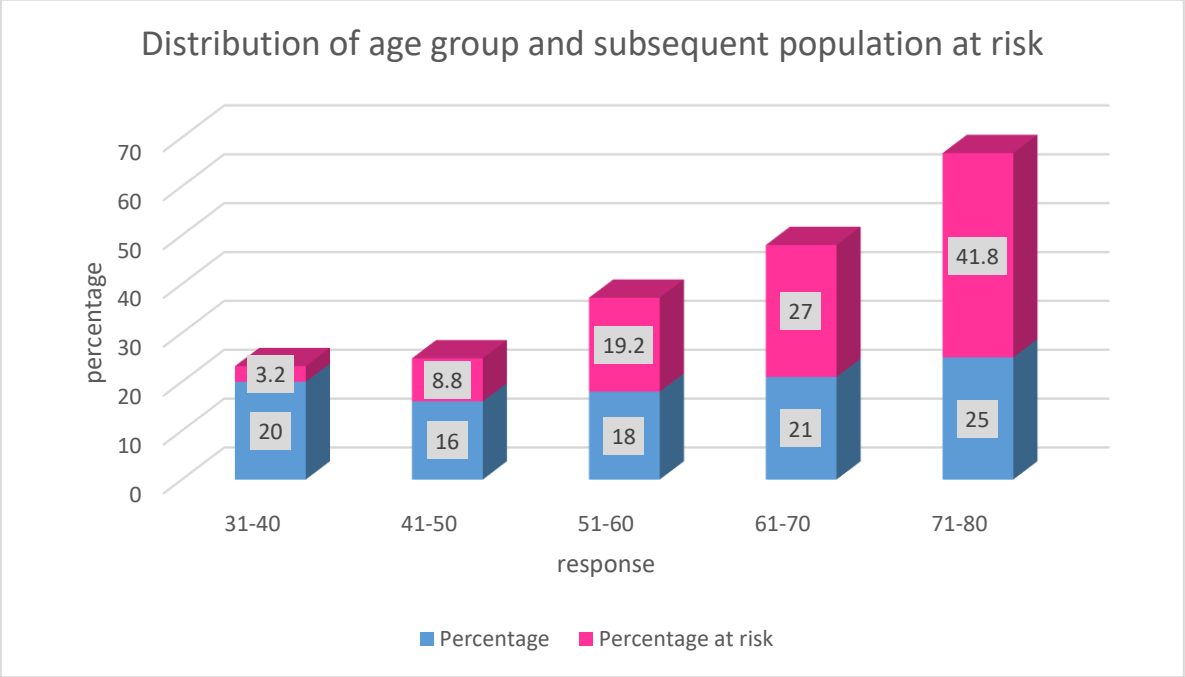
by the following formula; BMI=weight in kilograms/ (height in meters) ^{2}. The weight is obtained in 'kilograms' by a weighing machine calibrated to zero before use and the height is obtained in 'meters' by a measuring tape. Subsequently the BMI of the individual is calculated and interpreted as underweight, normal weight, overweight, or obese. Lipid levels are recorded from the individual based on the latest available data in their recent lab assessments.

All the data is carefully entered into Microsoft excel and analysed with the help of various excel functions. Findings are generated with the help of tables, charts or graphs and results interpreted accurately.

Results

Out of the 500 individuals, The distribution of age group among study population (Fig 1) shows that 102(20%) individuals were in the age group of 31-40 and the risk for developing CVD was found in 3.2%. 78(16%) individuals were in the age group of 41-50 and risk was found in 8.8%. 88 (18%) individuals were in the age group of 51-60, and risk was found in 19.2%. 107(21%) individuals were in the age group of 61-70, and risk was found in 27% .125 (25%) individuals were in the age group of 71-80 and risk was found in 41.8%.

Figure 1: graph showing distribution of age group and subsequent population at risk

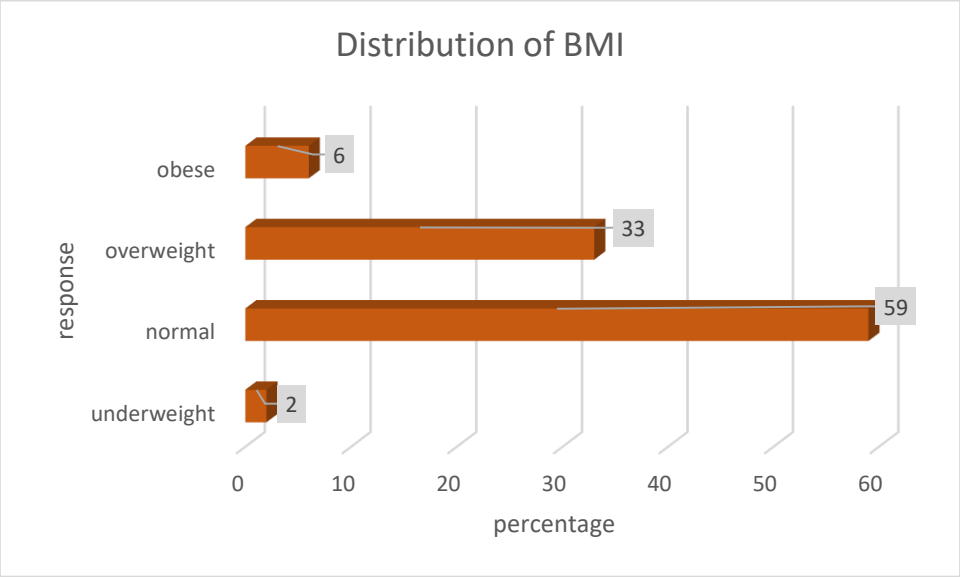


Of the total population, 242 (48%) individuals were male while 258 (52%) individuals were female. The education status shows that about 255 (51%) individuals were undergraduate, 240 (48%) individuals were graduate and 5 (1%) individuals were post graduate. From these 250 (50%) individuals were employed while 250 (50%) individuals were unemployed. Marital status is as follows: 449 (90%) individuals were married while 51 (10%) individuals were not married.

Risk factors of cardiovascular disease

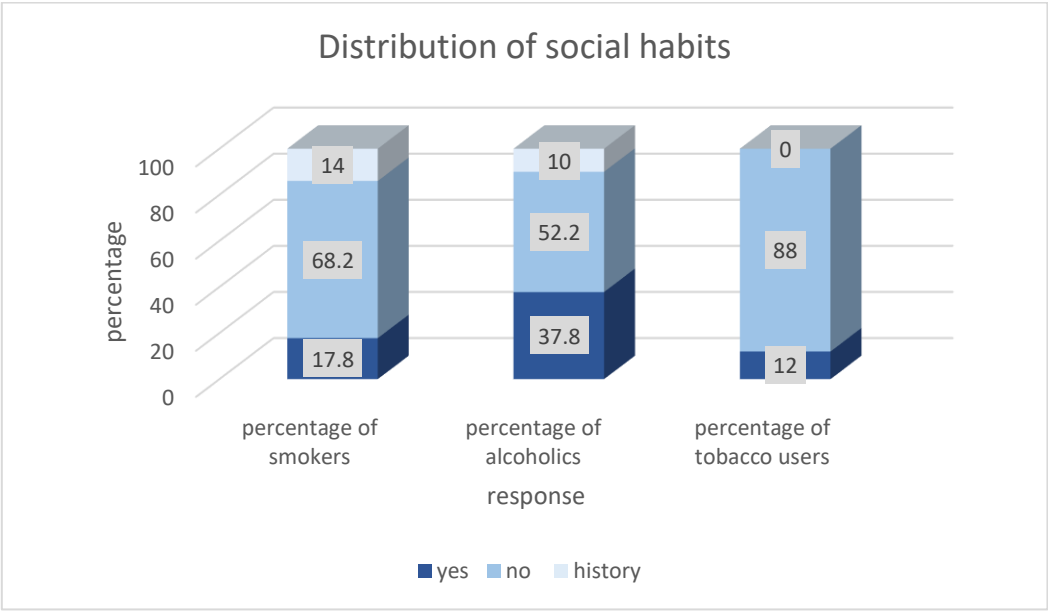
From the distribution of BMI (fig 2), out of 500 individuals, 9 (2%) were found to be underweight, 295 (59%) were found to be normal BMI, 165 (33%) were found to be overweight, and finally 31(6%) were found to be obese.

Figure 2: graph showing distribution of BMI



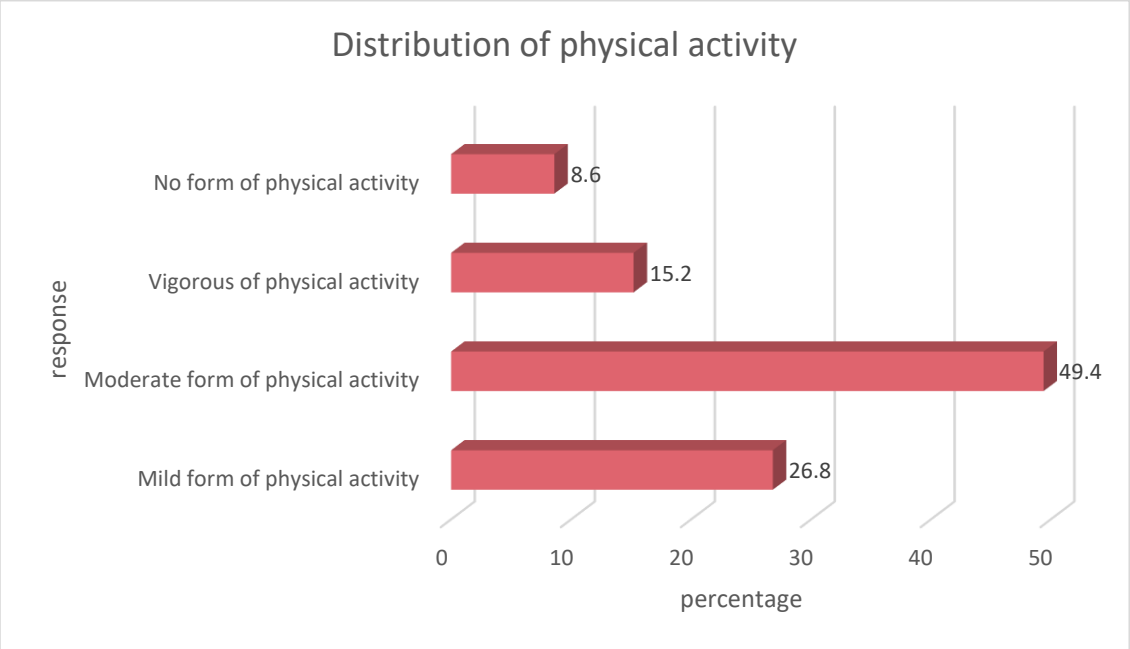
The various social habits were evaluated among the study population (fig 3) and about 89 (17.8%) individuals were smokers, 341(68.2%) individuals were non-smokers and 70 (14%) individuals had a history of smoking. Similarly, 189 (37.8%) individuals were alcoholics, 261 (52.2%) individuals were non alcoholics and 50 (10%) individuals had a history of alcoholism. Likewise, 62 (12%) individuals had consumption of various forms of tobacco and 438 (88%) individuals did not consume any form of tobacco.

Figure 3: graph showing distribution of social habits



The distribution of physical activity among the study population (fig 4) shows that, 134 (26.8%) individuals did mild form of physical activity, 247 (49.4%) individuals did moderate form of physical activity,76 (15.2%) individuals did vigorous form of physical activity and 43 (8.6%) individuals did no form of physical activity.

Figure 4: Graph showing distribution of physical activity



Dietary habits of saturated fats among the study population(fig 5) shows that, 196 (39%) individuals had consumption of foods rich in saturated fats while 304 (61%) individuals did not consume any foods rich in saturated fat likewise assessment of salt consumption among the study population(fig 6) shows that, 146 (29.2%) individuals consumed foods high in salt 'all the time', 177 (35.4%) individuals 'often' consumed foods high in salt, 103 (20.6%) individuals 'sometimes' consumed foods high in salt and 74 (14.8%) individuals 'rarely' consumed foods high in salt.

Figure 5: Graph of saturated fat consumption

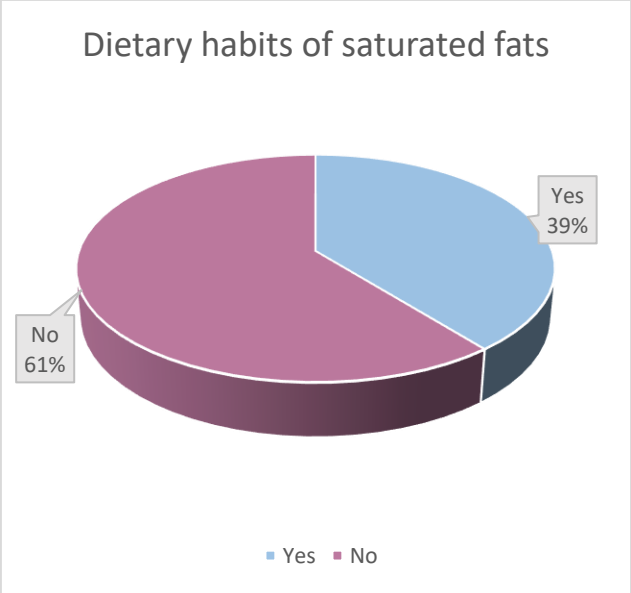
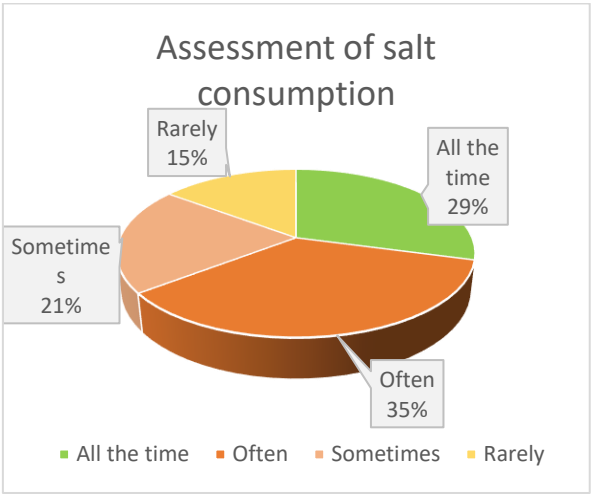


Figure 6: Graph of assessment of salt consumption



Assessment of stress among the study population (fig 7) shows that out of 500 individuals, 86 (17%) individuals had low levels of stress, 204 (41%) individuals had moderate level of stress and 210 (42%) individuals had high levels of stress. The duration of sleep assessment among the study population (fig 8) shows that, 234 (47%) individuals had less than 5 hours of sleep, 175 (35%) individuals had 5 to 6 hours of sleep and 91(18%) individuals had more than 6 hours of sleep.

Figure 7: Graph on evaluation of stress

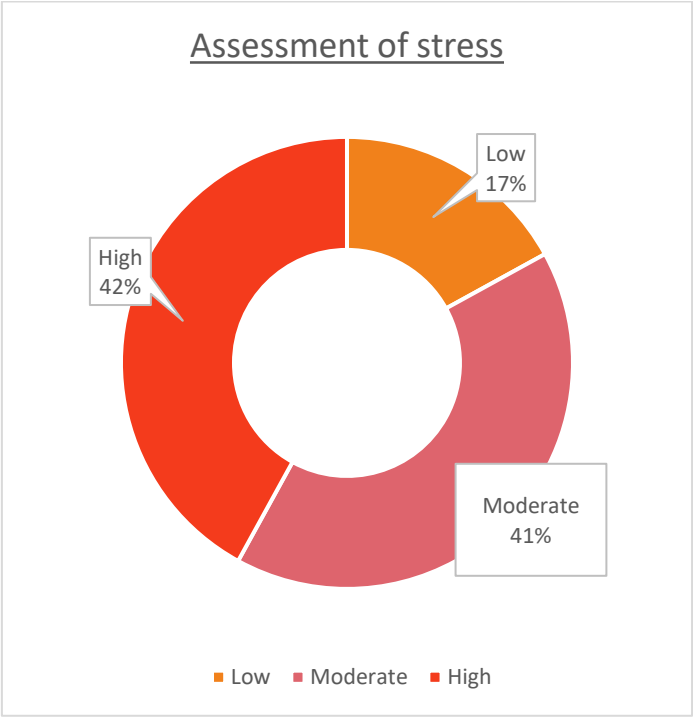
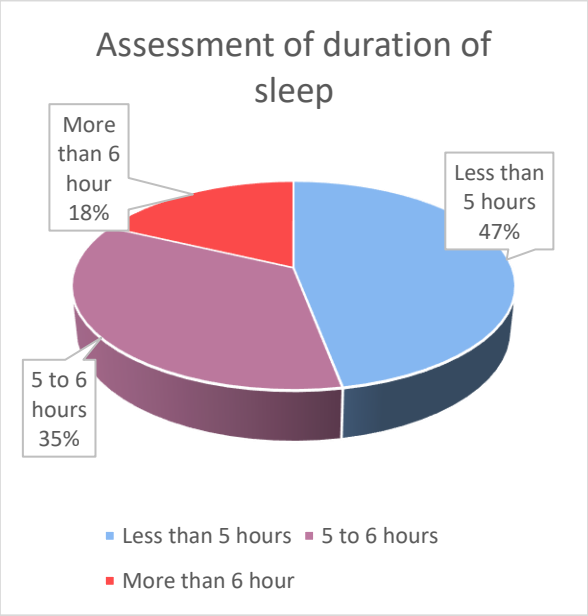


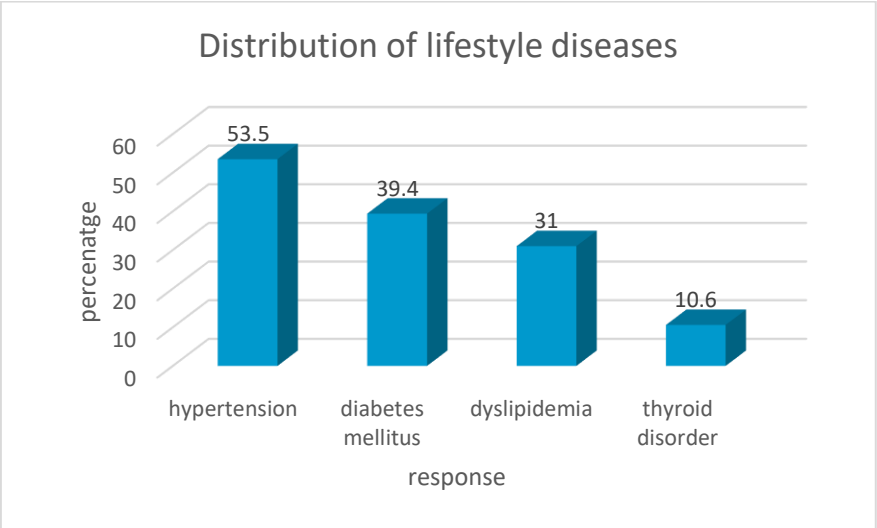
Figure 8: Graph on duration of sleep



The prevalence of chest pain among the study population shows that, about 174 (35%) individuals experience some form of chest pain, while 326 (65%) individuals do not experience any form of chest pain.

Distribution of lifestyle diseases among the study population (fig 9) shows that out of 500 individuals, 267 (53.5%) were found to be hypertensive, 197 (39.4%) were found to have diabetes mellitus, 155 (31%) were found to have dyslipidaemia and 31 (10.6%) were found to have thyroid disorder. About 60% of the population consumes medications on a daily basis however to our dismay 54% of those individuals have low medication adherence.

Figure 9: Graph showing distribution of lifestyle diseases.



Finally among the overall population of 500 individuals, 317 (63.4%) were found to have low risk while 183 (36.6%) were found to have high risk.

Discussions

Taking into account that the age distribution as well as gender distribution is conducted in alignment of

the total population in the district, the age at risk can be evaluated (fig 1). The population at most risk was found to be between the age group of 71-80 (41.8%). This is similar to the study conducted by **Geldsetzer *et al***. on Geographic and sociodemographic variation of cardiovascular disease risk in India: A cross-sectional study of 797,540 adults[10] where the risk of CVD increases with age.

BMI, which is one of the risk factors of CVD, has various classes such as: Under 18.5 as underweight, 18.5-24.9 as normal weight, 25-29.9 as overweight, and 30+ is obese.[11] Based on fig 2, undesirable BMI was found in overweight (33%) and obese(6%) individuals. This is similar to the study conducted by **Islam *et al*.** on Prevalence and associated risk factors of general and abdominal obesity in rural and urban women in Bangladesh.[12] Here the prevalence of general and abdominal obesity was 24% and 33% respectively. It is also seen that with time, there was a larger increase in overweight and obesity in rural areas as compared to urban areas.[13]Based on family history of CVD as seen in Fig 3, 32% of the total subjects had a positive history of CVD which makes it more likely to develop CVD. This is not similar to the study conducted by **Krishnan *et al***. on Prevalence of coronary artery disease and its risk factors in Kerala, South India: a community-based cross-sectional study[14]. There is 18% positive family history among the population in Kerala based on this study. Since there is limited data on the family history of CVD, this risk factor becomes challenging. There is also substantial difference in the number of individuals who have a positive family history of CVD over the years.

Social habits such as smoking, alcohol and tobacco consumption is a major contributor to the development of CVD (fig 3). In this study, 17.8% were found to be smokers, 37.8% were found to be alcoholics and subjects known to chew tobacco were found to be 12%. Smoking is seen as similar to the study of **Devassy *et al*.** on Social and behavioural risk factors in the prevention and management of cardiovascular disease in Kerala, India: a catchment area population [15] with 16.4%. Alcohol consumption has therefore seen a significant rise with time among the population in rural areas of Kerala.

Sedentary lifestyle is another key factor for the development of CVD. In this study, subjects with no form of physical activity and mild form of physical activity were found to be 8.6% and 26.8% respectively (fig 4). Therefore about 35.4% of the population live a sedentary lifestyle which is similar to a study conducted by **Devassy *et al*.** on Social and behavioural risk factors in the prevention and management of cardiovascular disease in Kerala, India: a catchment area population survey. The study also found that physical inactivity had a significant effect on high blood pressure and high BMI, which are indicators of CVD risk. [15]

Diet is one of the most important triggering factors of CVD. Saturated fat (fig 5) can raise the level of cholesterol in the blood and in turn increase the risk of CVD by plaque build-up in the arteries which can further reduce the blood flow to the heart and other organs.[16] Salt intake (fig 6) can cause fluid retention that can subsequently strain the heart and blood vessels and cause increase in blood pressure.[17] Both these risk factors can therefore worsen and ultimately cause life threatening impacts. In this study, 39% of the population was found to consume foods rich in saturated fat most of the time while 64.6% were found to consume excessive salt on a daily basis. This is similar to the study by **Devassy *et al*.** on Social and behavioural risk factors in the prevention and management of cardiovascular disease in Kerala, India: a catchment area population [15]

Stress (fig 7) and sleep (fig 8) are correlating fators as well as contributing factors for the emergence of CVD. In ths study population, the population with high stress was found to be 42% moderate stress was found to be 41% and finally low stress were found to be 17%. This is contradictory to the study conducted by **Santosa *et al***. on psychosocial risk factors and cardiovascular disease and death in a population-based

cohort from 21 low-, middle-, and high-income countries as it is conducted in a multi ethnic population. [18] The prevalence of stress has increased considerably especially in rural areas due to financial stability, work, health, and environmental hazards. Likewise in terms of duration of sleep, 47% had less than 5 hours of sleep followed by 35% that had 5-6 hours of sleep and finally 18% that had more than 6 hours of sleep. This is contradictory to the study conducted by **Wang *et al.*** on Association of estimated sleep duration and naps with mortality and cardiovascular events: a study of 116 632 people from 21 countries.[19] In our study the subjects were known to have high stress which may in turn affect the sleep pattern of an individual.

Regarding the prevalence of signs and symptoms of cardiovascular disease, fatigue was found to be 33.2%, dyspnea was found to be 36%, peripheral edema was found to be 23%, unintentional weight gain was found to be 16%, nocturia was found to be 29% and finally chest pain was found to be 35%. Those subjects that possess these symptoms have a higher chance of developing cardiovascular disease. There is limited data on the prevalence of signs and symptoms related to CVD among the population in rural areas.

Regarding the distribution of adherence of medication for lifestyle disease, 54% were found to have low adherence. Low adherence can influence the efficacy of medications taken to control various lifestyle diseases which can further cause significant risk for CVD. This is in accordance with the study conducted by **Shaik *et al***. on a prospective study on impact of patient counselling on the management of risk factors in cardiovascular diseases.[20]

Considering the distribution of lifestyle diseases (fig 9), 53.5% were hypertensive, 39.4% were found to have diabetes mellitus and 31% were found to have dyslipidemia. This is similar to the study conducted by **Jana *et al***. on Prevalence and potential determinants of chronic disease among elderly in India: Rural-urban perspectives. [21]

Finally, 36.8% were in the category of high risk and 63.6% were in the category of low risk. As discussed above, adiposity, family history of CVD, social habits, sedentary lifestyle, diet patterns, psychological factors, signs and symptoms and lifestyle diseases together illustrate an increased risk of CVD among the population in rural areas of Kerala. This is similar to the study conducted by **Vasan *et al***. on Prevalence, incidence and predictors of cardiovascular risk factors: longitudinal data from rural and urban South India and comparison with global data**.[22]**

Conclusions

From this study, it is evident that the risk factors of CVD is significantly higher in rural areas as seen above. Therefore increasing awareness, healthy lifestyle and preventive screening are some of the many ways that needs to be undertaken.

Acknowledgment

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Conflict of Interest

There are no conflicts of interest.

Abbreviations

BMI: Body mass index
CVD: Cardiovascular disease
RBS: Random blood sugar

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