Prevalence of risk factors of Coronary Artery Disease (CAD) - Is it different in Kerala?

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Abstract

The development of coronary artery disease (CAD) in humans has its foundations in certain well-established risk factors globally. This has been established by well-conducted epidemiological studies in the west. However, similar studies in India have pointed towards a young-age escalation of CAD. Kerala, having its social indicators almost on par with the developing countries is expected to share this feature. The article attempts to review the reported prevalence of various cardiovascular risk factors in Kerala in comparison with India and the rest of the World and examine if the prevalence of CAD can be explained with these alone.

It is well known that Indians have higher prevalence of coronary artery disease (CAD) than many other ethnic groups. Indians also seem to develop the disease at an earlier age.\(^1\)\(^2\) This imposes a huge burden on the society and the health administration of the government. There are reasons to believe that Kerala, the southernmost state of India, shares this high prevalence of CAD equally or at a higher level. The only major published study from Kerala that looked at the prevalence of CAD and its risk factors found a CAD prevalence of 7.4% in a rural setting in Thiruvananthapuram district.\(^3\) This figure was much higher than the contemporary data available from rest of the country in a similar setting. It can be argued that this is an anomaly and the data from
Thiruvananthapuram may not be applicable to the whole state. However, a recent multi-centric study from Kerala (Cardiological Society of India Kerala Chapter Coronary Artery Disease and its Risk factors Prevalence Study, briefly CSI Kerala CRP Study) showed that the prevalence of CAD in Kerala continues to be high and the so-called urban - rural divide noted in studies from rest of the country may not be relevant to Kerala. It is also possible that the 7.4% quoted may be an over-estimation since criteria employed may not be comparable. However, using stricter criteria, CAD prevalence was found to be 5.4% (unpublished data) which is almost same if not higher than data from developed countries.

What could be the cause of the high prevalence of CAD in Kerala? Previously it was believed that the higher prevalence of CAD in India is due to some novel risk factors, like hyper homocysteinemia, elevated levels of C Reactive Proteins (CRP) or Lipoprotein (a). There are no large scale studies to support this contention. The INTERHEART study showed that more than 90% of the Population Attributable Risk (PAR) of myocardial infarction can be explained by conventional risk factors. It seems logical then to presume that increased prevalence of CAD in Kerala is due to higher prevalence of conventional risk factors.

**Prevalence of conventional risk factors in Kerala**

Recent studies indicate that prevalence of Diabetes is very high in the state. In the study by Thankappan *et al*, among adults 15 – 64 years of age in Thiruvananthapuram, prevalence was 14.3% in men and 17.8% in women with an overall figure of 16.2%. In both urban and rural settings prevalence was higher in women than men (17.1% and 22% respectively). This high prevalence is not confined to Thiruvananthapuram. In the CSI Kerala CRP Study on prevalence of CAD and its risk factors conducted in Kerala among adults 20 – 79 years age group (unpublished data) the over-all prevalence of diabetes was 14.9%. Prevalence was 21.5% for Thiruvananthapuram. Considering the higher age groups included in the latter study, this figure is consistent with the figure for Thiruvananthapuram in the earlier study thereby indicating that there could be regional differences in diabetes prevalence in the state.

Overweight/obesity is a significant problem in the state. 30.8% of adults in the state have a BMI ≥ 25. This is considerably more for women than for men. The problem is much higher in the urban areas with 44.8% of women living in urban areas being overweight/obese. Almost similar findings were obtained in the CSI Kerala CRP Study (unpublished data).
Hypertension is also very highly prevalent in Kerala. Prevalence of hypertension was 28.8% among adults in the age group 15 – 64 years.\(^5\) The multi-centric study referred to earlier (unpublished) also showed similar figures for hypertension for Kerala as a whole (38.9% in a more elderly population – unpublished). Hypertension was more common in men than women and in urban areas than rural areas.

Keralites have very high mean cholesterol levels. In the study by Thankappan et al, mean cholesterol level (in mg/dL) was 203.9 ± 40.2. For Kerala women it was still higher at 209.7 ± 38.6.\(^5\) Even though mean cholesterol levels were higher in urban areas compared to rural areas, surprisingly rural women had the highest value at 210.5 ± 39.5. Almost similar results were found in the CSI Kerala CRP Study. In this study in all regions of the state, women had higher mean cholesterol values than men. Proportion of Keralites with serum cholesterol values more than 200 mg/dl was 54.1%.\(^5\) Again a significantly higher proportion of women in Kerala had elevated cholesterol values. In the CSI Kerala CRP Study, 60.2 % of women and 54.7% of men had high serum cholesterol levels (unpublished data).

Low HDL levels are also a big problem in Kerala. In the study by Thankappan et al, 36.9% of the state population had low HDL Cholesterol (defined as <40mg/dL in men and <50mg/dL in women).\(^5\) In both rural and urban areas, higher proportion of men had low HDL than women. Overall, more than 50% of men had low HDL Cholesterol.

Despite banning smoking in public places, smoking is still a big problem in Kerala. In GATS study smoking in men was 27.9 %.\(^6\) In IDSP it was 27%.\(^7\) In the study by Thankappan et al (2005-06) smoking in men was 35%.\(^8\) In the Kerala CRP study (unpublished) smoking in men was 31.3%. In GATS and IDSP, smoking was more common in rural areas rather than urban areas while no difference was seen in Kerala CRP Study. Clearly almost one third of Kerala men continue to smoke.

Low physical activity, low intake of fruits and vegetables and positive family history are also found in significant proportion of people in Kerala. However figures from published studies vary widely probably due to the variations in the criteria employed.

**Prevalence of risk factors in Kerala in comparison to rest of India**

There has been large number of studies looking at prevalence of risk factors for CAD from various parts of India (9 – 12). However these studies vary markedly with regard to sample selection methods, age
groups and criteria adopted; it is very difficult to compare prevalence results from one part of the country to another. In 2006, ICMR conducted a multi-centric study on prevalence of cardiovascular risk factors in 6 regions of India namely Ballabgarh (Haryana), Chennai (Tamil Nadu), Dibrugarh (Assam), Delhi, Nagpur (Maharashtra) and Thiruvananthapuram (Kerala) utilizing similar inclusion criteria and sample selection procedures thereby providing an opportunity to compare results from one part of the country with another.\textsuperscript{5,9}

In Thiruvananthapuram centre, mean fasting blood glucose and mean fasting cholesterol were significantly higher than the figures from all the 6 centres from India put together. Mean BP however did not show significant difference (Table 1). Difference in mean serum cholesterol and mean fasting blood sugar values are striking in the case of rural women. Same differences were also seen in the proportion of diabetes and hypercholesterolemia, but not for hypertension. However the National Nutrition Board Survey conducted in 2004 – ‘05 in nine states including all four southern states found marked increase in prevalence of hypertension in rural Kerala compared to rural areas in other states.

\textbf{Table 1.} Mean BP, Mean Fasting Cholesterol and Mean Fasting Blood Glucose among men and women in ICMR Study (Pooled data) along with data from Thiruvananthapuram centre (in Italics, SE not shown).\textsuperscript{5,9}

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Urban Men</th>
<th>Urban Women</th>
<th>Rural Men</th>
<th>Rural Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean BP (mm Hg)</td>
<td>ICMR study</td>
<td>130.6/80.2</td>
<td>126.4/79.1</td>
<td>126.5/77.4</td>
</tr>
<tr>
<td></td>
<td>Trivandrum</td>
<td>130.2/79.2</td>
<td>126.4/78.8</td>
<td>129.5/78.7</td>
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<tr>
<td>Fasting Cholesterol (mg/dl)</td>
<td>ICMR study</td>
<td>176.9</td>
<td>180.0</td>
<td>161.0</td>
</tr>
<tr>
<td></td>
<td>Trivandrum</td>
<td>209.7</td>
<td>208.3</td>
<td>191.4</td>
</tr>
<tr>
<td>Fasting blood Glucose (mg/dl)</td>
<td>ICMR study</td>
<td>83.6</td>
<td>85.4</td>
<td>76.3</td>
</tr>
<tr>
<td></td>
<td>Trivandrum</td>
<td>84.9</td>
<td>98.1</td>
<td>98.5</td>
</tr>
</tbody>
</table>
Prevalence of smoking in men continues to be high in Kerala. In the CSI Kerala CRP Study, 31.3% of men in Kerala were current smokers. This figure was 35% in ICMR study by Thankappan et al. and 27.9% in Global Adult Tobacco Survey (GATS) for Kerala. Here again prevalence of smoking was higher in Kerala than rest of India (24.3% in GATS and 27% in Integrated Disease Surveillance Program).

From the above figures one can safely conclude that prevalence of coronary risk factors is significantly higher in Kerala than rest of India. The difference is pronounced for hypercholesterolemia and diabetes and remains significant for hypertension and smoking.

**Risk factors for CAD in Kerala versus other countries in the world**

A look at the prevalence of various risk factors in countries of the world shows that smoking in men in Kerala is less than China, Japan and USA and same as in the United Kingdom. Diabetes is significantly higher in Kerala when compared to USA, UK, Japan and China. Hypertension also appears to be slightly higher in Kerala than these countries.

In 2008, age standardized mean total cholesterol world-wide was 179.1mg/dL for men and 183.7mg/dL for women. In the high income region comprising Australasia, North America and Western Europe, mean total cholesterol (in mg/dL) was 202.3 in men and 201.9 in women respectively. The Kerala figure for mean total cholesterol as noted earlier was clearly higher.

**Implications and possible mechanisms**

To summarise, nearly 50% of adults in Kerala have high serum cholesterol, 15% have diabetes, 30 – 40% have high blood pressure and 30% men continue to smoke. These values are higher than most other states in India. Mean total cholesterol level in Kerala is higher than most of the developed countries of the world. In addition, consumption of fruits and vegetables are low and sizable proportion of the Kerala population is physically inactive. Why this is so has no clear answers. Possibilities to be considered are genetic predisposition and environmental factors. There is no reason to suspect that Keralites are genetically different from other south Indian states and more susceptible to risk factors like hypercholesterolemia and diabetes. Rapid urbanization that has happened in Kerala in the last two decades can be a contributing factor. According to census 2011, there has been 80% increase in the urban areas in Kerala during this period (Census 2011). Urbanization in its wake brings in physical inactivity, faulty eating habits and heightened stress. Dietary
pattern in Kerala could be a factor. In CSI Kerala CRP Study, more than 90 % of participants said they use coconut oil for cooking which is high in saturated fatty acids. Most Keralites in that study were non vegetarians. Twenty four percent of the study participants said they follow the practice of adding salt to rice when being cooked or served. The NNMB study conducted by national institute of nutrition in 2004-05 in rural areas of 9 states including 4 southern states looked at dietary pattern of the people. Total energy derived from fat was 17.2% for Kerala compared to 8.6% for all 9 states pooled together. Carbohydrate as percentage of total calorie intake was 72% for Kerala versus 80.9% for all states together. Protein intake per day for rural Kerala is below recommended daily allowance (RDA) like rest of the country. Fats and oil use was 6 g/CU/day compared to 14 g/CU/day for all states together. (Consumption Unit, CU is also known as adult unit which is based on the suggested allowances of calories). These figures argue against a significant role for dietary factors in the causation of the marked changes in cholesterol levels and blood sugar levels in the rural areas. Increased stress level due to necessity to work outside the state and societal pressures could be a factor. Reduced physical activity can also contribute to high prevalence of the risk factors. These need to be studied more exhaustively in Kerala to arrive at valid conclusions.

References


