A study on clustering of Cardiovascular Risk Factors among a rural adult population in Tamil Nadu

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ABSTRACT

Background: In India, Cardiovascular diseases (CVDs) are the leading cause of death among both males and females and in urban as well as rural areas. Studies indicate that the risk of adverse health outcome increases with more number of unhealthy behaviors and moreover the behavioral risk factors often manifest themselves in specific pattern of combinations. **Objectives:** To study the pattern of clustering or combination of CVD risk factors in the study population and their associated factors. **Results:** In this study, 544 adults over the age of 20 years were included. Among them, 211(38.8%, 95%CI 32.3-45.3)) had none of the risk factors for CVD, 215(39.5%, 95%CI 33.0%-46.0%) had single risk factors and 118(21.7%, 95%CI 14.3-29.1) had clustering of CVD risk factors. The overall clustering of CVD risk factors was higher for adults over the age of 40 years (78.0%) compared to adults less than 40 years (22%) and this difference was found statistically significant (p=0.01). The overall prevalence of clustering was higher among men [29.5%, 95%CI 22.2%-36.8%] than women [18.7%, 95%CI 14.8%-22.6%]. Age, male gender, alcoholism, physical inactivity, family income, educational status and occupation were positively associated with clustering of CVD risk factors. **Conclusion:** A sound community based comprehensive behavioral and life style intervention approach should be established to reduce the modifiable risk factors of CVD. In addition we should design a strategy to incorporate primordial prevention in the school education such as advocating healthy lifestyle (dietary habits, importance of exercise, avoiding smoking and alcohol etc).

Key words: Clustering, Cardiovascular diseases, Prevalence, Risk factors, Rural population.

INTRODUCTION

Every year approximately 17 million people die from cardiovascular disease (CVD). Of the deaths attributable to CVD, which comprise roughly 29% of all deaths, about 80% occur in low- and middle-income countries, often in people less than 60 years of age.[1] The risk factors like hypertension, diabetes mellitus, dyslipidaemia, overweight/obesity, smoking and physical inactivity are the major risk factors for the development of CVD. With rapid economic development and increasing westernization of lifestyle in the past few decades, the proportion of these diseases has increased among Indians in the recent years. In India, CVDs are the leading cause of death among both males and females and in urban as well as rural areas.[2]

CVD affects relatively younger population and its twice in India than in US population in the age group of 30-59.[3] Nearly 52% of CVD deaths in India occur below the age of 70 years compared to 23% in established market economies.[4] In India, the number of new cases of CVDs is projected to increase to 64 million in 2015 (from 29 million in 2000).[5] In India, 25% of families with a member with CVD experience catastrophic expenditure and 10% are driven to poverty.[6] Cardiovascular diseases (CVDs) and their risk factors were originally more common in upper socioeconomic groups in the developed world but have gradually become more common in lower socioeconomic groups.[7]

Previous studies indicate that the risk of adverse health outcome increases with more number of unhealthy behaviors[8,9] and moreover the behavioral risk factors often manifest themselves in specific pattern of combinations.[10,11]

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DOI: 10.5530/jcdr.2015.2.7

Thus the present study was under taken to study the pattern of clustering or combination of CVD risk factors and their associated factors among the study population.

MATERIALS AND METHODS

After obtaining the approval from the Institutional Ethics Committee, a cross sectional study was carried out using the fixed mobile clinic of SRM Medical college, Community medicine department among 30 villages of Kattankulathur block in Kancheepuram district in Tamil Nadu from March 2012 to February 2013. Individuals over the age of 20 years who attended our fixed mobile clinic were interviewed in person with a structured interview schedule to elicit information on selected socio-demographic variables, tobacco and alcohol use, dietary intake, physical activity and treatment history for diabetes and hypertension. All the participants were subjected to physical examination such as measurements of height, weight, blood pressure; and collection of blood samples for plasma glucose. Written informed consent was obtained from the study participants.

Standard methods were used to measure weight & height.[12] Body mass index (BMI) was calculated and standard cut-offs for Asian adults were used to classify overweight and obesity[13] according to which, overweight is defined as BMI of more than 23. Overweight is further classified as at-risk of obesity (BMI=23–24.9), obesity grade 1 (BMI= 25–29.9) and obesity grade 2 (BMI≥30).

Blood pressure was recorded in the sitting position in the left arm to the nearest 1 mm Hg using an electronic OMRON blood pressure measuring device (Omron Corporation, Tokyo, Japan). Two readings were taken: first one before starting the interview, second one at the end of the interview and the mean of the two readings was used for analysis. Hypertension was diagnosed using the JNC-7 criteria.[14]

All current smokers and those who had quit smoking within 1 year before the assessment were considered smokers. Similarly, all current alcoholics and those who had quit alcohol within 1 year before the assessment were considered alcoholics.

Based on the physical activity the participants were classified into sedentary workers, moderate workers and heavy workers. In case of women, home makers with electrical and electronic appliances at home like grinder, mixer and oven were classified as light workers and home makers without these were classified as moderate workers. Those who were involved in manual labour work were classified as heavy workers.

Postprandial blood sugar was measured (approximately 2 hours after a morning breakfast) using glucometer (Accutrend Plus). A person was considered to have diabetes if postprandial plasma glucose concentration was more than 11.0 mmol/l (200 mg/l) or if he or she was taking insulin or oral hypoglycemic drugs.

Data were analyzed using the standard statistical software packages. Descriptive data were presented as percentages and unadjusted odds ratios (OR) to measure the strength of association and 95% confidence intervals (CI) were calculated. Chi-square test was used to lend statistical support to prove associations between categorical variables.

RESULTS

Socio-demographic profile

Among the 544 study participants, nearly two third (72.6%) were women. More than half (68.8%) of the participants were above the age of 40 years. 9.2% had monthly income of more than 24,000 rupees. Nearly one third of the participants were illiterate (35.8%) and only 10% of them had completed college education. About 9.6% were professionals and 44.5% were home makers. (Table 1)

In our study 211(38.8%, 95% CI 32.3-45.3) had none of the risk factors for CVD, 215(39.5%, 95% CI 33.0- 46.0) had single risk factors and 118(21.7%, 95% CI 14.3- 29.1) had clustering of CVD risk factors. Among the adults less than 40 years of age the prevalence of clustering of CVD risk factors was 15.3% compared to prevalence of 24.6% among adults of over the age of 40 years. This difference was found statistically significant (p=0.01). The overall prevalence of clustering was higher among men (29.5%, 95% CI 22.2% - 36.8%) than among women (18.7%, 95% CI 14.8%- 22.6%). The differences between men and women were statistically significant (p=0.008).

Among alcoholics, adults with single risk factor (47.2%) and clustering of risk factors (44.4%) were higher compared to adults with no risk factors (8.3%). In contrast, among non-alcoholics subjects with single risk factor (39.0%) and clustering of risk factors (20.1%) were low compared to subjects with no risk factors (40.9%). The differences between alcoholics and non alcoholics was statistically significant (p=0.000). Among sedentary workers, the proportion of participants with no risk (28.7%) was less compared to clustering of risk factors (31.9%). Among heavy workers the proportion of participants with no

Table 1: Characteristics of the participants according to prevalence of CVD risk factors

Statement	None	Single	Cluster	Total	P value
Prevalence	211(38.8)	215 (39.5)	118(21.7)	544(100)	
<40	79 (46.5)	65(38.2)	26(15.3)	170(31.2)	χ^2 = 8.53
>40	132(35.3)	150 (40.1)	92(24.6)	374(68.8)	df = 2 p = 0.014
Male	45(30.2)	60(40.3)	44(29.5)	149 (27.4)	χ^2= 9.74
Female	166(42.0)	155(39.2)	74(18.7)	395(72.6)	df = 2 p = 0.008
Alcoholics	3(8.3)	17(47.2)	16(44.4)	36(6.6)	χ^2= 19.0
Non alcoholics	208(40.9)	198(39)	102(20.1)	508(93.4)	df = 2 p = 0.000
Sedentary	27 (28.7))	37(39.4)	30(31.9)	94(17.3)	χ^2= 13.1
Moderate	120(38.5)	123(39.4)	69(22.1)	312(57.3)	df= 4
Heavy	64(46.4)	55(40.6)	19(13.8)	138(25.4)	p= 0.011
< 3 days / week (fruit)	136(38.1)	141(39.4)	80(22.4)	397(65.6)	χ^2= 0.37
>3 Days / week(fruit)	75(40.1)	74(39.6)	38(20.3)	187(34.4)	df= 2 p = 0.829
Income < Rs 12000	183(41.7)	170(38.7)	86(19.6)	439(80.7)	χ^2= 10.7
Rs 12000-24000	16(29.1)	24(43.6)	15(27.3)	55(10.1)	df = 4
>Rs 24000	12(24.0)	21(42.0)	17(34.0)	50 (9.2)	p = 0.031
Illiterate	90(46.2)	72(36.9)	33(16.9)	195(35.8)	
School education	103(35.4)	123(42.3)	65(22.3)	291(53.5)	χ^2= 12.2 df = 4 p = 0.016
College	18(31.0)	20(34.5)	20(34.5)	58(10.7)	
Professionals	14(26.9)	20(38.5)	18(34.6)	52(9.6)	
Semi skilled	23(32.9)	24(34.3)	23(32.9)	70(12.9)	χ^2= 20.3
Unskilled	64(46.4)	55(39.9)	19(13.8)	138(25.4)	df = 8
Home makers	97(40.1)	99(40.9)	46(19.0)	242(44.5)	p = 0.009
Retired	13(30.9)	17(40.5)	12(28.6)	42(7.7)	

Table 2: Clustering pattern of CVD risk factors among men and women

No. of risk factors	S	O	H	D	Men	Women	Total (%)
					N0 (%)	N0 (%)	N0 (%)
0	-	-	-	-	42(28.2)	169(42.3)	211(38.8)
1	+	-	-	-	14(9.4)	0(0)	14(2.6)
1	-	+	-	-	20(17.2)	96(24.3)	116(21.3)
1	-	-	+	-	24(16.1)	50(12.7)	74(13.6)
1	-	-	-	+	6(4.0)	5(1.3)	11(2.0)
2	+	+	-	-	5(3.4)	0(0)	5(0.9)
2	+	-	+	-	4(2.7)	0(0)	4(0.7)
2	+	-	-	+	2(1.3)	0(0)	2(0.4)
2	-	+	+	-	13(8.7)	50(12.7)	63(11.6)
2	-	+	-	+	7(4.7)	8(2.0)	15(2.8)
2	-	-	+	+	6(4.0)	9(2.3)	15(2.8)
3	+	+	+	-	3(2.0)	0(0)	3(0.6)
3	+	-	+	+	0(0)	0(0)	0(00
3	-	+	+	+	1(0.7)	8(2.0)	9(1.7)
4	+	+	+	+	2(1.3)	0(0)	2(0.4)
Total	30	213	170	54	149(27.4)	395(72.6)	544(100)

S- Smoking; O- obesity; H- hypertension; D- diabetes. Values in the parenthesis indicates percentage

risk factors (46.4%) were more compared to clustering of risk factors (13.8%). The differences among sedentary, moderate and heavy workers was statistically significant (p=0.01). Clustering of CVD risk factors was higher for those who consume fruits for less than 3 days per week [67.8%, 95% CI 59.3%-76.2%] compared to those

Table 3: Association of clustering of CVD risk factors and characteristics of participants

Characteristics of participants	Single (OR,95% CI)	χ^2	P Value	Cluster (OR,95% CI ,)	χ^2	P Value
Above 40 Years	1.38 (0.92-2.06)	2.47	0.11	2.11(1.26- 3.55)	8.24	0.004
Male	1.42 (0.97-1.44)	2.48	0.11	2.19 (1.20-2.12)	9.77	0.001
Alcoholics	5.9 (1.7-20.6)	8.61	0.003	10.87(3.09-38.17)	18.32	<0.001
Moderate worker	1.19(0.76-1.85)	0.62	0.43	1.93(1.07-3.49)	4.89	0.02
Sedentary	1.59(0.86-2.94)	2.24	0.13	3.74 (1.80-7.76)	13.1	0.0002
Fruit <3 days	1.05 (0.71-1.56)	0.06	0.80	1.16(0.72-1.87)	0.37	0.54
12000-24000	1.61 (0.94-1.64)	2.02	0.15	1.99 (0.94- 4.22)	3.35	0.06
>24000	1.88 (0.89-3.9)	2.89	0.08	3.01 (1.37-6.59)	8.22	0.004
School education	1.49 (0.99-2.2)	3.76	0.05	1.7 (1.03-2.85)	4.47	0.03
College education	1.38 (0.68-2.81)	0.83	0.36	3.03 (1.42-6.42)	8.75	0.003
Professional	1.66 (0.76-3.59)	1.68	1.94	4.33 (1.82-10.29)	11.78	0.0005
Semi skilled	1.21 (0.61-2.38)	0.32	0.57	3.36 (1.55-7.29)	9.91	0.001
Home makers	1.18 (0.75-1.87)	0.55	0.45	1.59 (0.85-2.97)	2.21	0.137
Retired	1.52 (0.67-3.41)	1.05	0.30	3.10 (1.21-7.35)	5.92	0.014

consume fruits for more than 3 days per week [32.2% 95% CI 23.8%- 40.6%]. This difference was not statistically significant (p=0.82).

Assessment of clustering of risk factors based on family monthly income revealed 19.6%, 27.3% and 34% of the participants had monthly income of less than 12,000 rupees, 12,000 to 23,999 rupees and more than 24,000 rupees respectively. Clustering of CVD risk factors were higher for high income group compared to low income group and it was found statistically significant (p=0.03).

Among illiterate 16.9% had clustering of CVD risk factors and it was 22.3% among school educates & 34.5% among college educates. The clustering of CVD was higher for adults with college education and it was found statistically significant. Clustering of risk factors was 34.6% among the professionals, 32.9% among semiskilled, and 28.6% among retired persons. The clustering of risk factors was higher for professional (34.6%), semiskilled (32.9%) and retired persons (28.6%) compared to house makers (19.0%) and unskilled workers (13.8%) (Table 1).

Table 2 depicts the clustering pattern of the CVD risk factors. With regard to prevalence of each of the four risk factors among 544 participants, the most common risk factor was obesity. Thirty nine percent of the participants were obese, 31.2% had either systolic or diastolic hypertension, 9.9% had diabetes and 5.5% were smokers. About 28.2% of men and 42.3% of women showed no risk factors. Nearly 46.7% of the men and 36.3% of the women had single risk factors, 25.1% of men and 21.4% of women had 2 or more risk factors. Among the individuals who had single risk factor, obesity (21.3%) was the common risk factor. Among those who had two risk factors, the most common grouping was obesity and hypertension (11.6%). Among those who had three risk factors, the most common grouping of the factors was obesity, hypertension and diabetes (1.7%). The mean risk factor score was estimated. Overall the mean number of risk factor score out of four was 0.86. Men had a mean risk factor score of 1.07 compared to women with a mean score of 0.78. Participants above the age of 40 years had mean score of 0.92 compared to participants below the age of 40 years with mean score of 0.75.

Table 3 depicts the association between participants and their characteristics. Clustering was associated with the age of above 40 years (OR=2.11), male (OR=2.19) compare to females, alcoholics (OR=10.87) compared to non-alcoholics, moderate workers (OR=1.93) and sedentary workers (OR=3.74) compared to heavy workers, monthly income of more than 24,000 rupees (OR=3.01), college educated (OR=3.03) compared to illiterate and professionals (OR=4.33) compared to unskilled.

DISCUSSION

In this rural population in Tamil Nadu the study revealed that over one fifth of the participants presented with clustering of risk factors for CVD. Similar finding was reported[15] where 27% of adults had 2 or more risk factors[16] where almost 20% of subjects had 3 or 4 risk factors.[17] Reported 25.9% had three or more risk factors. In contrast to our findings, the study done among Chinese adults revealed over half of those with CVD risk factors presented with a cluster of risk factors. Studies done[11,18,19] reported that more than half of the adult population in US had two or more of the four primary behavioral risk factors. Study done[11] revealed only 10% of the US adult population had

none of the risk factors, 33% had one risk factor, 41% had two and 17% had three or more risk factors.

Our study demonstrated that risk factors such as age, male gender, alcoholism, physical inactivity, family income, educational status and the occupation were positively associated with clustering of CVD risk factors. Similar findings were reported by Lim TO *et al*[15] where the elderly and the inactive, and individuals with lesser education, more income or residing in urban area had greater number of risk factors.

In our study men and individuals above the age of 40 years showed higher risk factor clustering compared to women and individuals below the age of 40 years. Similar findings were reported[20] where males and individuals older than 40 years showed more pronounced risk factor clustering. Nearly 40 per cent of participants older than 40 years had three or more risk factors across the Blood Pressure groups.

Study done[16] reported the presence of 3 or 4 risk factors almost as twice as often in men as in women and the frequency of factor clustering in men also increased with a decreasing educational Level but this gradient was not observed in women with educational level. In our study greater accumulation of risk factors was observed in men in upper social class but in contrast,[16] reported greater accumulation of risk factors in men in lower social class. The same pattern was not seen for women. Scientist[17] had reported 48.8% of men and 24.8% of women had two or more risk factors in a multi-ethnic, cross-sectional study in china.

In the present study, the overall mean risk factor score was 0.86. Men had a higher mean risk factor score compared to women. Participants above the age of 40 years had higher mean score compared to participants below the age of 40 years. Similar findings[11] where the mean number of risk factors for entire sample was 1.68. Men had more risk factor score than women, and individuals aged 40 to 64 years had higher risk factor score than the other age groups. The mean number of Behavioral risk factors (BRF) among Chinese population aged between 15-69 years to be 1.80 and mean score was higher for men compared to women. In contrast to our study mean number of BRFs was decreasing as the educational level and annual income were increasing.

CONCLUSION

In conclusion nearly one fifth of the population above the age of 20 years had clustering of CVD risk factors. Age, male gender, alcoholism, physical inactivity, family income, educational status and the occupation were positively associated with clustering of CVD risk factors. As India is facing the epidemiological transition of non-communicable diseases, planning a prevention and control strategy for the cardiovascular diseases is the need of the hour. A sound community based comprehensive behavioral and life style intervention approach should be established to reduce the modifiable risk factors of CVD. In addition we should design a strategy to incorporate primordial prevention in the school education such as advocating healthy lifestyle (dietary habits, taking more vegetable and fruits and avoiding junk foods, importance of exercise, avoiding smoking and alcohol etc).

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