Study of Risk factors of Coronary Heart Disease in Urban Slums of Patna

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Original Article

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Abstract

Background

Coronary Heart Diseases (CHDs) are imminent cause of disability and death with economic adverse effects in the disadvantaged population in India.

Materials and Methods

This population based study was conducted from 1st December 2010 till 31st May 2011 among the adults in the slums of Patna to assess the magnitude and risk factors of CHDs concerning age, sex, tobacco use, alcohol consumption, physical activity, weight, height, waist circumference, blood pressure and random capillary blood glucose (RCBG).

Results

Among 3118 participants 16.36 percent (males 18.79 %, females 14.48 %) were hypertensive; 26.3 percent (males 25.94 %, females 26.58 %) had elevated RCBG; 4.46 percent were Diabetic. High body mass index (BMI), waist circumference (WC) and waist to height ratio (WHtR) was noted in 31.94 percent (males 31.83%, females 32.03%), 50.45 percent (males 39.1%, females 59.17%), 86.53 percent (male 83.12%, female 89.15%) respectively; tobacco users were 12.54 percent, while 9.14 percent reported alcohol consumption; 33.64 percent were sedentary (males 30.55%, females 37.65%). BMI, WC, WHtR, tobacco use, alcohol consumption and physical inactivity were significantly associated with hypertension ($p < 0.05$). Elevated RCBG was significantly associated with increased BMI, WC, WHtR. Multivariate logistic regression revealed that BMI, WHtR and alcohol were associated with hypertension, not with elevated RCBG.

Conclusion

Our study indicated that CHDs and their risk factors are not only limited to affluent societies but also affect the underprivileged mass. Preventive care and multipronged intervention including extensive behavior change communication needs to be organized to reduce the risk of CHDs in urban poor.

Key words

Coronary Heart Diseases, urban slums, risk factors

Background

World Health Report 2002 of the World Health Organization (WHO) predicts that by 2020 AD, cardiovascular diseases (CVDs) will be the leading cause of death and disability in

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India. 2.6 million Indians are likely to die of coronary heart disease (CHD) comprising 54.1 percent of all cardio vascular disease (CVD) deaths. Half of these will be in the age range of 30-69 years. Indians experience CHD deaths a decade earlier than in the developed countries, 52 percent of deaths occur below the age of 70 years in India as compared to 23 percent of similar age groups in the latter[1]. In global comparison, other researchers have also predicted that CHDs are emerging major health problems and will be the leading cause of disability by 2020[2,3].

Overall economic growth and globalization have helped surfacing of CHDs even in the developing countries where they were conventionally labelled as the diseases of affluence[4]. The section of urban poor is escalating in the developing world due to migration of rural population who have to bear the stress of urban lifestyles with the underprivileged economy and poor health care delivery services. Health hazards of urban slum dwellers are directly affected by poverty, pollution and stressful environment. With the increase in urban population of India to 31.80 percent, 22.76 percent now dwell in urban slums; urbanization is expected to rise to 50 percent by 2021 and the proportion of urban poor will double in 5 years[5,6].

In planning of health services, priority is generally given to the vast rural population with a focus on the communicable diseases and maternal and child health problems. National urban health mission is yet to roll out; the growing urban poor are yet to receive attention. A few studies have been done on health of slum dwellers in Southern India, Chennai, Delhi and Faridabad, but none in Bihar. This study was undertaken to get baseline data of health of urban poor living in the slums of Patna especially in reference to risk factors of CHDs.

Material and Methods

Study design and participants

This population based cross sectional observational study, for obtaining baseline data on the health status of the urban poor residing in slums of Patna, focused on screening for diabetes, hypertension and risk factors of CHD as the part of a health check up. It was undertaken at the behest of State Health Society, Bihar (SHSB). A list of 90 approved slums of Patna was obtained from Municipal Corporation, Patna. Two teams were formed consisting of 3 doctors and 3 paramedics each, who were trained at Patna Medical College to conduct anthropometric, blood pressure and random capillary blood glucose (RCBG) measurements. As per plan and directives of SHSB, the 2 teams visited all the 90 slums consecutively on prefixed days to conduct health checkups in camp setting.

Inclusion criteria: Adults above 30 years of age visiting the health camps were included.

Exclusion criteria: Persons below the age of 30 years, those who were unable to participate due to incapacitating illness and non-consenting persons.

Sample size calculation:

The study, conducted under directions of State Health Society, Bihar (SHSB) to get baseline data on CHD risk factors of the slum population of urban Patna, employed the camp approach to enroll participants rather than any sampling methodology. Total number of participants thus enrolled was 3118.

Data collection procedure:

The health team visited the slums on the prefixed dates between 1st December 2010 and 31st May 2011. Each camp was preceded by the field visits and health education activities by the assigned teams to motivate the slum dwellers to avail the facilities of the health camps and participate in study. Explanatory variables collected included age, gender, consumption of tobacco in any form and or alcohol intake and their duration, physical activity, weight, height, waist circumference. Outcome variables measured were blood pressure and RCBG. Those who screened positive with undiagnosed hypertension, hyperglycemia and or diabetes were referred to Patna Medical College for further evaluations. Case definitions used were those of WHO STEPS Manual for exercise, alcohol users and smokers[7]. Heights were recorded to the nearest centimeter (cms) using portable height measuring stand; weights were recorded using standard bathroom scales; waist circumference was measured using flexible non-stretchable measuring tape in standing position. Blood pressures were taken by mercury sphygmomanometer as per JNC 7 criteria and was considered positive if the systolic blood Pressures (SBP) of $\geq$ 140 mmHg and or diastolic blood pressures (DBP) of $\geq$90 mmHg or if they reported previous diagnosis of hypertension[8]. Random capillary glucometer blood tests were performed by finger prick method irrespective of the time of food intake and blood glucose was measured by On Call Plus glucometer of ACON Laboratories, India. The random capillary blood glucose (RCBG) was taken positive $\geq$ 140 mg/ dl (7.8 mmol/l), based on WHO diabetes diagnostic criteria to distinguish a group with significantly increased premature mortality and increased risk of microvascular and cardiovascular complications[9]. This value of RCBG has the same sensitivity and specificity as venous blood to discriminate pre diabetics with impaired glucose tolerance test[10]. Those with RCBG $\geq$ 200 mg/ dl (11.1 mmol/l) and reporting with any one of the classic symptoms or weight loss were also diagnosed as

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positive cases of diabetes mellitus[11]. BMI was calculated by the standard formula of weight in kg / height in m^2 and ≥ 25 was taken as cut off. Waist circumference (WC) of more than 90cms in males and 80cms in females respectively were taken as cut off[12]. Waist to height ratio (WHtR) was calculated by waist circumference (WC) in cm/ height in cm; cut offs for high WHtR were ≥ 0.48 in males and ≥ 0.45 in females[13].

Ethical committee approval

Preceding the study, approval was obtained from the Institutional Research and Ethics Committee of Patna Medical College and conducted after informed consent were obtained from the participants

Data management and statistical analysis:

Data were entered into Excel 2003 and analyzed using SPSS Version 17. Descriptive statistics including odds ratio were used to analyze the risk factors. Chi square test used to examine statistical difference between risk factors and hypertension and elevated RCBG. Risk factors for CHD were separately tested in univariate and multivariate regression analysis. Independent variables tested were BMI, Waist Circumference, waist height ratio, tobacco, alcohol & physical activity and presence of hypertension or elevated RCBG levels were dependent variable. In univariate analysis, chi square test was employed for comparison. Odds ratio (OR) with 95% confidence interval (95% CI) for categorical variables calculated. Backward LR method was used to perform multiple logistic regression.

Results

Of the 3118 subjects, 1357 (43.52%) were males and 1761 (56.48%) females. The age wise breakup revealed that the largest number of males were in 50 – 59 age group (25.06%) whereas the largest number of females were in the 40 - 49 year age group (28.28%). Hypertensives were 16.36 % (95% CI 15.62 – 17.1); males were 18.79 % and females 14.48 %. Considered age and sex wise, highest number of hypertensives were males in the age group of 50 – 59 years (5.82%); for females it was in 40-49 age group (4.32%). Elevated RCBG levels (≥ 140 mg/ dl 7.8 mmol/l) was noted in 26.3 % (95% CI 25.42 – 27.18) subjects, of which 25.94 % were males and 26.58 % females; largest proportion of males were in age group of > 60 years and females in the 40 – 49 year age group. Using the criteria of elevated RCBG levels ≥ 200 mg/ dl (11.1 mmol/l) and presence of any of the classic symptoms, 4.46 % of the study participants were labeled as diabetic (Table 1).

Table 1: Age & sex distribution of subjects with hypertension and elevated RCBG

Age Group	No of subjects (percent)	HTN No of subjects (percent)	Elevated Blood Sugar (mg/dl) (>140)		
			140 – 200 No of subjects (percent)	> 200No of subject (percent)	Total No of subject (percent)
Males(1357)					
30-39	293 (21.59)	41 (3.02)	37 (2.73)	7 (0.52)	44 (3.24)
40-49	411 (30.29)	71 (5.23)	64 (4.72)	34 (2.51)	98 (7.22)
50-59	340 (25.06)	79 (5.82)	52 (3.83)	47 (3.46)	99 (7.30)
>= 60	313 (23.07	64 (4.72)	67 (4.94)	44 (3.24)	111 (8.18)
Total	1357 (100)	255 (18.79)	220 (16.21)	132 (9.73) **63*** **(4.64)**	352 (25.94)
Females(1761)					
30-39	575 (32.65)	55 (3.12)	80 (4.54)	15 (0.85)	95 (5.39)
40-49	498 (28.28)	76 (4.32)	114 (6.47)	36 (2.04)	150 (8.52)
50-59	348 (19.76)	60 (3.41)	65 (3.69)	41 (2.33)	106 (6.02)
>= 60	340 (19.31)	64 (3.63)	72 (4.09)	45 (2.56)	117 (6.64)
Total	1761 (100)	255 (14.48)	331 (18.80)	`137 (7.78) **73*** **(4.15)**	468 (26.58)

***** Also had classical symptoms of diabetes

HTN = Hypertension

RCBG = Random Capillary Blood Glucose

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Table 2: Distribution of subjects with high levels of Risk Factors for Cardiovascular diseases

Parameters	Male =1357 n (percent)	Female = 1761 n (percent)	Total =3118 n (percent)
Hypertension	255 (18.79)	255 (14.48)	510 (16.36)
Elevated Random Capillary Blood Glucose	352 (25.94)	468 (26.58)	820 (26.30)
Body Mass Index	432 (31.83)	564 (32.03)	996 (31.94)
Waist Circumference	531 (39.13)	1042 (59.17)	1573 (50.45)
Waist Height Ratio	1128 (83.12)	1570 (89.15)	2698 (86.53)
Tobacco	287 (21.15)	104 (5.91)	391 (12.54)
Alcohol	226 (16.65)	59 (3.35)	285 (9.14)
Physical Inactivity	511 (37.65)	538 (30.55)	1049 (33.64)

HTN = Hypertension
RCBG = Random Capillary Blood Glucose

BMI was high in 996 (31.94 %); 432 (31.83%) males and 564 (32.03%) females. WC was higher in 1573 (50.45%), out of which 531 (39.1%) were males and 1042 (59.17%) females. WHtR were higher in 2698 (86.53%); 1128 (83.12%) in male and 1570 (89.15%) in female. Consumption of tobacco in any form was 391 (12.54 %); higher in males (21.15 %) than females (5.91 %). Alcohol users were 285 (9.14 %); 226 (16.65 %) were males and only 59 (3.35 %) were females. In lifestyles, 1049 (33.64 %) were sedentary and physically inactive; 538 (30.55%) males and 511 (37.65%) females (Table 2). A significantly higher BMI, WHtR, tobacco use, alcohol consumption and physical inactivity was noted in hypertensives as compared to normotensives ($p < 0.000$). Unadjusted Odds ratio (95% CI) for hypertension with increased BMI, WHtR and alcohol use was found to be 1.522 (1.250-1.854), 1.651(1.360-2.003) and 2.09 (1.583-2.770) respectively. RCBG on the other hand had an OR of 1.2 with increased BMI. Three factors, namely WHtR, BMI and alcohol use were significant after simple regression. So they were put to the final model. After multiple logistic regression, they were significant. Adjusted OR were 1.54 (95% CI: 1.252 – 1.893) for WHR, 1.35 (95% CI: 1.095 - 1.663) for BMI and 2.2 (1.656 – 2.924) for alcohol use (Table 3).

Table 3: Association of Risk Factors with Hypertension & Elevated RCBG

Risk Factors	Association with HTN				Association with Elevated RCBG		
	n (%)	P-value	Odds Ratio (OR)		n (%)	P value	Odds Ratio
			Unadjusted (95% CI)	adjusted (95% CI)			
BMI	203 (39.80)	0.001*	1.522 (1.250-1.854)	1.35 (1.095-1.663)	290 (35.37)	0.014*	1.2#
WC	310 (60.78)	0.001*	---		432 (52.68)	0.136x	---
WHR	471 (92.35)	0.001*	1.651 (1.360-2.003)	1.54 (1.252-1.893)	721 (87.93)	0.172x	1.1
Tobacco	97 (19.02)	0.001*	---		102 (12.44)	0.919x	---
Alcohol	78 (15.29)	0.001*	2.094 (1.583-2.770)	2.2 (1.656-2.924)	72 (8.78)	0.677x	---
Physical Inactivity	193 (37.84)	0.028*	---		283 (34.51)	0.540x	---

*P<0.05 – statistically significant

Other variables were not significant, hence elevated RCBG not put into multiple regression

x statistically not significant

Discussion

Prevalence of CHD Risk Factors

This CHD risk factor study was carried out in a hitherto poorly studied urban setting of the lowest socioeconomic strata spread across 90 wards of Patna Municipal Area. The study subjects, mostly rural migrants who had come to Patna for economic reasons and residing in the slums showed a marked prevalence of hypertension, hyperglycemia and obesity indices. The study conducted on a population of slum dwellers showed a 16.36 % prevalence of hypertension. Studies conducted in slums of Faridabad, Delhi and urban Chennai in lower socioeconomic groups reported a prevalence of 17.2, 12 and 8.4 % respectively[14, 15, 16]. There is also a prevalence of 26.30% of elevated RCBS.

According to the recommendation adopted by WHO in 1999 impaired glucose tolerance is a not clinical entity but rather a risk factor for future diabetes and adverse outcome[17]. Studies of elevated RCBS were not found but in a study on railway employees of Solapur Division of Central Railways, hyperglycemia was found to be 7.57 %. And in a study of urban slum population of Faridabad, prevalence of diabetes mellitus was found to be 10.3percent [13,14]. In the studies reported from Chennai, RCBG cut points were also used to report and identify diabetes[10].

Age and Sex

Of the 3118 subjects, 1357 (43.52%) were males and 1761 (56.48%) females. Age wise breakup revealed that the largest number of males were in the 50 – 59 age group (25.06%) whereas largest number of females were in the 40 - 49 years (28.28%). Overall, hypertensives were 16.36 percent (95% CI 15.62 – 17.1); males were 18.79 percent and females 14.48%. Considered age and sex wise, highest number of hypertensives were males in the age group of 50 – 59 years (5.82%); for females it was in 40-49 age group. Our findings are similar to World Heart Federation study of CVD risk factor[17] and to the study of "Age, Sex Cardiovascular Risk Factors, and Coronary Heart Diseases" by Joshilahti, Vartiainen et al. [18].

BMI and WHtR

A limited number of studies have been done to assess the prevalence of CHD risk factors in this segment of the population. The prevalence of overweight and obese was 31.94% in this study. In urban Chennai, Mohan et al reported a 33 % prevalence of overweight and obesity in low income group and the prevalence increased with increase in income[16]. Misra et al and ICMR Task force study reported a prevalence of 25 percent and 20 percent respectively in Delhi slums[15,19]. BMI levels of $\geq$25 was significantly associated with both hypertension (HTN) and elevated blood glucose levels in this study; similar results were observed in Indians living in Mauritius who had increased rates of type 2 diabetes and HTN at these BMI levels[20]. Chirinos et al. of Pennsylvania school of Medicine reports among patients with hypertension increasing BMI was a significant predictor of hypertension (OR1.04,95%CI,1.02-1.06) [21].

Prevalence of diabetes and impaired glucose tolerance was lower in low income group (LIG) than high Income group (HIG); high BMI was significantly associated with diabetes; hypertension was more in LIG than HIG (53% *vs* 40%). Hyperglycemia, dyslipidmia, hypertension, smoking and alcohol consumption was more in LIG group[22].

In our study it was seen that the prevalence of central obesity indicators was higher in females as compared to males. Waist circumference more than 90 cm in males and 80 cm in females was taken to be a risk factor in for development of metabolic syndrome and measure of CHD risk[12]. Recently there has been exponential increase in the evidence from other investigations showing the superiority of waist height ratio (WHtR) as a predictor of metabolic and cardiovascular risk based on studies in both adults and children[23].

Using International Diabetic Federation (IDF) criteria, waist circumference was high in 50.45 % of the study population. Misra et al reports 12 percent and the ICMR Task Force 31% in Delhi slums using higher cut offs[15,19]. New research shows that WHtR and not BMI is a better assessment tool for diabetes & CHD risk and WHtR represents the best predictor of the risk and mortality, with a relative risk of 2.75 of cardiovascular mortality[23, 24]. WHtR was abnormal in 86.5% in this study, it was 82 % in a study on anthropometric indices and coronary risk factors in a study on railway employees [13]. Sayeed et al also concluded that WHtR was a valuable obeisity index for predicting hypertension and diabetes and CHD risk[25].

Tobacco and Physical Inactivity

Tobacco consumption in either smoky or chewable form was found to 12.54% in the study population which is less than the prevalence rate of 22.75 percent in those above 15 years and both sexes and all social classes in Bihar[26].

Several studies from developing countries have shown the presence of hypertension and other risk factors for CHDs in urban compared with rural populations[27]. Zimmet et al. reported that by 2020 CVDs are predicted to account for 73% of deaths and 60% of disease burden globally[28]. WHO has developed guidelines for the identification of the magnitude and patterns of major risk factors by countries which is fundamental for their prevention in urban poor[29].

The study at 8 purposively selected communities of Chandigarh and Haryana during 2004-05, on 400 adults > or =30 years of age, selected by cluster sampling, the prevalence of hypertension was found in urban (39%; 95% CI 29.5%-49.2%), slum (35%; 95% CI 27.2%-42.9%) and rural (33%; 95% CI 25.4%-40.8%) communities was found to be statistically similar after controlling for age, gender and education. The prevalence of physical inactivity (17% v. 12%), central obesity (90% v. 88%), overweight (20% v. 19%) and hypertension (34% v. 36%), were found to be statistically similar among literate and illiterate population after controlling for the effect of age, sex and place of residence. However, the risk of tobacco use was

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significantly lower among literates (OR 0.3, 95% CI 0.1-0.8). The researchers concluded that in selected communities of northern India, most of the cardiovascular disease risk factors did not have a social gradient except tobacco use, which was more common in the lower social group[30].

In a cross-sectional survey conducted on male employees working in an urban industrial population in Chennai the prevalence of the metabolic syndrome was 41.3% and 51.4% using IDF and American Heart Association (AHA) criteria respectively. Risk factors were age above 35 years, family history of diabetes and body mass index (BMI) above 23.9 kg/m^2 [31].

A cross-sectional study was conducted on urban poor in New Delhi on 531 using the WHO STEPS-1 questionnaire. About 73 (13.7%) were known hypertensives; 40.3%) did not partake in any kind of specific physical activity[32].

Relevance of the study

Valuable baseline data on the health status of slum dwellers was obtained for the first time from the capital city of Bihar state of India; it underlines the vulnerability of the slum dwellers to CHD risk and the necessity of interventions. It also endorses the fact that the traditional categorization of coronary heart disease as a disease of affluence needs to be changed. This study, undertaken under the constraints of a "health camp approach", enrolled 3118 participants which probably would not have been possible by any other methodology. This study uses RCBG testing for screening of elevated blood glucose level. It has the advantage that it can be done at any time of the day which does not require venepuncture and can be carried out even by lay people with training. A limitation was that since it was conducted under camp conditions, other risk factors of dietary intake and dyslipidemia could not be studied. Though further evaluation and follow up of those with elevated blood pressure and glucose was done, follow up study can also be done.

Future scope of study

Data on conventional CHD risk factors or even the magnitude of hypertension and diabetes in this population is scanty. CHDs have a noteworthy association with hypertension, high lipids and blood sugar, obesity, lifestyle issue with alcohol and tobacco related addictions. Though the association of these risk factors with disease is well established, there were no such studies in Bihar; more studies including diet and dyslipidemia and further multivariate analysis can be undertaken in future.

Conclusion

The magnitude of CHD risk factors in slum population of Patna is a matter of concern; there is necessity of including them in the ambit of preventive care and intervention. Since the poor also have the burden of communicable diseases, it could very well be that all major diseases are diseases of the poor. The finding of this study will assist in developing targeted programs and monitoring intervention on CHDs.

Conflict of Interest

The authors do not have any conflict of interest arising from the study.

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Authors' contributions

RS: Conception & design of the study; analysis and interpretation of data; drafting the article revising it critically for important intellectual content; and final approval of the version. MM: Acquisition, analysis and interpretation of data; drafting the article revising it critically for important intellectual content; and final approval of the version. RK: Collection, analysis and interpretation of data; drafting the article revising and final approval of the version. RS: Acquisition, compilation, analysis of data; drafting the article, revising it critically for final approval. RP: Analysis and interpretation of data; drafting the article revising it critically for important intellectual content; and final approval of the version.

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