Original Article

Prevalence of risk factors of noncommunicable diseases in a rural population of district Gautam-Budh Nagar, Uttar Pradesh using the World Health Organization STEPS approach

Shalini Srivastav[1], Harsh Mahajan[1], Sonia Goel[1], Sidhyartha Mukherjee[1]

[1]Department of Community Medicine, School of Medical Sciences and Research, Sharda University, Greater Noida, Uttar Pradesh, India

Abstract

Context: Globally, it is estimated that by 2020, noncommunicable diseases (NCDs) will account for 73% of deaths and 60% of disease burden. India is in the midst of an epidemiological transition leading to increasing the prevalence of NCDs. Targeting the risk factors for NCDs is recognized as an essential preventive strategy. **Aims:** The rationale of this study was to decipher the baseline data on the prevalence of NCD risk factors among the rural population. **Settings and Design:** A community-based cross-sectional study was conducted among 207 adults in the rural catchment area of the Department of Community Medicine. **Subjects and Methods:** The World Health Organization STEPS approach was employed which includes three sequential phases: Collection of information on sociodemographic variables and behavioral risk factors (STEP 1), obtaining physical measurements (STEP 2), and acquiring biochemical measurements (STEP 3). **Statistical Analysis:** Data were analyzed using the SPSS version 16. $P < 0.05$ was considered to be statistically significant. **Results:** Among the study subjects, the prevalence of smoking, smokeless tobacco use, alcohol use, and sedentary lifestyle was 26.0%, 35.1%, 16.9%, and 9.6%, respectively, in males and 4.6%, 15.4%, 0.0%, and 19.0%, respectively, in females. The prevalence of hypertension and diabetes was 15.6% and 13.0% respectively among males and 20.0% and 7.7% respectively among females. Hypercholesterolemia and Hypertriglyceridemia were observed in 5.2% men and 13.8% women and 22.1% men and 16.9% women, respectively. **Conclusions:** The study reveals high burden of NCD risk factors in rural areas as well and reiterates the need to take preventive measures.

Keywords: Noncommunicable diseases, risk factors, rural population

Introduction

According to the World Health Organization (WHO), of the 56 million global deaths in 2012, 38 million, or 68%, were due to noncommunicable diseases (NCDs).[1] The major risk factors associated with NCDs are tobacco use, alcohol use, physical inactivity, obesity, and raised blood pressure.[2] It is evidence based that by controlling the risk factors of NCDs, a large number of cases suffering from chronic diseases can be prevented.

The WHO has recommended surveillance of common NCD risk factors using the "STEPS" approach for monitoring trends within and across countries.[3] Very few studies have comprehensively assessed the NCD risk factors using the STEPS approach among the Indian population, particularly in rural areas. Moreover, the studies done in the past relied mostly on behavioral risk factors and physical measurements excluding the

Address for correspondence: Dr. Harsh Mahajan, 3013/9, First Floor, Street No. 18, Ranjit Nagar, New Delhi - 110 008, India.
E-mail: harsh2709@gmail.com

Access this article online

Quick Response Code:

Website: www.jfmpc.com

DOI: 10.4103/2249-4863.222027

How to cite this article: Srivastav S, Mahajan H, Goel S, Mukherjee S. Prevalence of risk factors of noncommunicable diseases in a rural population of district Gautam-Budh Nagar, Uttar Pradesh using the World Health Organization STEPS approach. J Family Med Prim Care 2017;6:491-7.

biochemical measurements. The rationale of the present study was to decipher the baseline data on the prevalence of NCD risk factors among the rural population of district Gautam-Budh Nagar, Uttar Pradesh. This data can supplement the available information in the formulation of population-based strategies using cost-effective interventions for prevention of NCDs in the population susceptible to developing the disease.

Subjects and Methods

- Study design: Cross-sectional analytical study
- Study area: Rural field practice area of the Department of Community Medicine, of a Medical College in district Gautam-Budh Nagar, Uttar-Pradesh
- Duration of study: January 2013–October 2013
- Sample size and sampling: The study area has about 420 households and a total population of 2084 with 1310 individuals 18 years and above of age
- A sample size of 207 was calculated using current prevalence rates of NCDs in Delhi (NCR) (10–30%), with the precision of 5% and 95% confidence intervals.[4] Every alternate house in the area was selected and all adults 18 years and above in the selected households were approached and informed about the study. From among the willing members, one member was selected randomly from each household using a simple lottery method. After obtaining informed consent, the selected participants were interviewed, physically examined, and tested for fasting blood sugar (FBS) and lipid profile.
- Study tools: The WHO STEPS approach was employed to study the profile of the risk factors for the NCDs in the population. STEPS approach includes three sequential phases: Collection of information on sociodemographic variables, and behavioral risk factors, i.e. tobacco use, alcohol use, physical inactivity, and dietary factors using a questionnaire (STEP 1); obtaining physical measurements such as weight, height, waist circumference, and blood pressure using standardized protocols and instruments (STEP 2); acquiring biochemical measurements such as blood glucose, serum total cholesterol, serum low-density lipoprotein (LDL) and high-density lipoprotein (HDL) cholesterol, and triglycerides (TG) using fasting blood samples (STEP 3).

The standard WHO STEPS questionnaire was translated into local Hindi language and had been pretested before the study. Self-reported history of use of tobacco as bidi or cigarette or any other form of tobacco, alcohol consumption, physical activity, and dietary habits including consumption of fruits and vegetables as well as history of hypertension and diabetes mellitus was obtained from the respondents.

The cutoffs and the definitions used in the study are:

Current smokers were defined as individuals who had smoked cigarettes, bidis, etc., during the previous month and current smokeless tobacco users were defined as those who had used any kind of smokeless tobacco such as snuff, chewing tobacco, and betel, during the previous month.[5] Current alcohol users were those who consumed an alcoholic drink within the past 1 year.[6] The frequency of consumption of fruits and vegetables was obtained from the participants in terms of a number of servings per day. Low consumption of fruits and vegetables was considered to be less than five servings per day.[7] Physical inactivity was measured in terms of a number of sedentary hours per day. A number of sedentary hours ≥7 h per day was considered as a sedentary lifestyle.

Physical measurements

Physical body measurements including height, weight, waist circumference, and blood pressure were taken. Height was measured with the participant standing barefoot, upright against a wall with head in the Frankfurt position, heels, and knees together and looking straight ahead. Weight was recorded in kilograms using a standard weighing scale.[8] Body mass index (BMI) was calculated as:

BMI = Weight (in kg)/Height (in meters).[2]

BMI was categorized according to the WHO classification[9] into following categories: underweight - <18.5, normal - 18.5–24.9, overweight - 25–29.9, and obesity - ≥30. Waist circumference was measured in centimeters using a measuring tape.[8] Waist circumference >90 cm for males and >80 cm for females was considered an indicator of abdominal obesity.[10] Blood pressure was recorded using standard protocol three times in sitting position, on the right arm, using a standard digital sphygmomanometer. The mean of the second and third readings was calculated and taken as the final reading.[8] Hypertensive subjects were defined as those with systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg or those being treated for hypertension.[11]

Biochemical measurements

The participants were asked to fast overnight, and a venous blood sample was obtained next morning. Estimations for fasting blood glucose, total cholesterol, serum LDL and HDL cholesterol, and serum TG were performed using commercial kits. Raised fasting blood glucose was taken as the fasting plasma glucose level of ≥126 mg/dL according to the WHO diagnostic criteria.[12] Diabetes mellitus was defined as those having raised fasting blood glucose levels of ≥126 mg/dL or those being treated for diabetes. The modified criteria of National Cholesterol Education Program, Adult Treatment Panel III was used to define raised total cholesterol ≥200 mg/dL, raised serum TG ≥150 mg/dl, raised serum LDL ≥130 mg/dl, and abnormal serum HDL <40 mg/dl.[13]

Statistical analysis

Data were analyzed using the SPSS version16.0, Chicago , U.S.A, SPSS Inc. Chi-square test was used to analyze the difference between proportions. $P < 0.05$ was considered to be statistically significant.

Ethical considerations

The study participants were explained the purpose of the study and informed consent was taken. The study was approved by the Institutional Ethics Committee.

Results

This study had 207 subjects of which majority were women (n = 130; 62.8%). The mean age of the study subjects was almost 37 years with most individuals being in the 26–35-year category (40.1%). Majority had some schooling (65.2%) were Hindus (97.1%) and were married (91.8%). Most men were employed in clerical jobs (40.3%) or were self-employed (37.7%) whereas most women were homemakers (85.4%). There was significant difference in the sociodemographic profile among males and females in terms of education ($P < 0.0001$), religion ($P = 0.028$), marital status ($P = 0.004$), and occupation ($P < 0.0001$) [Table 1].

Table 2 shows the distribution of behavioral risk factors according to age and gender of the study participants. Among the study subjects, 26.0% of men and 4.6% of women were smokers ($P = 0.001$). The intake of smokeless tobacco was observed in 35.1% men and 15.4% women ($P = 0.002$). Regarding the alcohol intake, 16.9% males were current alcohol users whereas none of the females were taking alcohol ($P < 0.0001$). Low consumption of fruits and vegetables was reported in 89.6% of males and 90.0% of females ($P = 0.883$). The prevalence of sedentary lifestyle was found in 9.6% of men and 19.0% of women ($P = 0.014$). Table 3 shows the distribution of physical measurements. The majority of men (64.9%) and women (53.1%) had normal BMI. More women (30.8%) than men (19.5%) were overweight, and more women (9.2%) than men (2.6%) were obese as well. Regarding the waist circumference, it was found that majority (67.7%) of the women had raised waist circumference whereas 33.8% males were found to have raised waist circumference. The highest prevalence of abdominal obesity was found in the age group of 56–65 years in both males and females. More women (14.6%) than men (10.4%) were known hypertensives. The total prevalence of hypertension was 20.0% among women and 15.6% among men ($P = 0.428$).

Table 4 depicts the distribution of biochemical measurements. Elevated FBS levels were found in 6.5% of males and 3.8% of females ($P = 0.50$). Among the study subjects, 7.8% men and 6.2% women were known diabetics ($P = 0.775$). Thus, the overall prevalence of diabetes was found to be 13.0% among men and 7.7% among women ($P = 0.26$). Hypercholesterolemia was observed in 5.2% of men and 13.8% of women ($P = 0.039$). Hypertriglyceridemia was observed in 22.1% of men and 16.9% of women ($P = 0.364$). A total of 14.3% men and 18.5% women had raised serum LDL ($P = 0.565$) with most men being in the

Table 1: Sociodemographic characteristics of the study participants

Characteristics	*n* (%)			*P**
	Men (*n*=77; 37.2%)	Women (*n*=130; 62.8%)	Total (*n*=207; 100%)	
Age group (years) (36.87±11.22)				
18-25	12 (15.6)	13 (10)	25 (12.1)	0.68
26-35	30 (39)	53 (40.8)	83 (40.1)	
36-45	18 (23.4)	39 (30)	57 (27.5)	
46-55	11 (14.3)	16 (12.3)	27 (13)	
56-65	6 (7.8)	9 (4.3)	15 (7.2)	
Education				
Illiterate	1 (1.3)	34 (26.2)	35 (16.9)	<0.0001
Some schooling	57 (74)	78 (60)	135 (65.2)	
Graduate and above	19 (24.7)	18 (13.8)	37 (17.9)	
Religion				
Hindu	72 (93.5)	129 (99.2)	201 (97.1)	0.028
Muslim	5 (6.5)	1 (0.8)	6 (2.9)	
Marital status				
Married	65 (84.4)	125 (96.2)	190 (91.8)	0.004
Unmarried	9 (11.7)	2 (1.5)	11 (5.3)	
Others	3 (3.9)	3 (2.3)	6 (2.9)	
Occupation				
Professional	4 (5.2)	0	4 (1.9)	<0.0001
Clerical	31 (40.3)	2 (1.5)	33 (15.9)	
Self-employed/skilled	29 (37.7)	8 (6.2)	37 (17.9)	
Unskilled labor	9 (11.7)	9 (6.9)	18 (8.7)	
Student	2 (2.6)	0	2 (1)	
Homemaker	0	111 (85.4)	111 (53.6)	
Retired	1 (1.3)	0	1 (0.5)	
Unemployed	1 (1.3)	0	1 (0.5)	

*P values derived from Fisher-exact tests comparing men and women

Table 2: Distribution of behavioral risk factors (World Health Organization STEP 1) for noncommunicable diseases according to age and gender of the study participants

	Men's age groups (years), *n* (%)						Women's age groups (years), *n* (%)						All ages, *n* (%)		
	18-25 (*n*=12)	26-35 (*n*=30)	36-45 (*n*=18)	46-55 (*n*=11)	56-65 (*n*=6)	*P*	18-25 (*n*=13)	26-35 (*n*=53)	36-45 (*n*=39)	46-55 (*n*=16)	56-65 (*n*=9)	*P*	Men (*n*=77)	Women (*n*=130)	*P*
Smoking															
Yes	5 (41.7)	2 (6.7)	7 (38.9)	5 (45.5)	1 (16.7)	0.01	1 (7.7)	1 (1.9)	1 (2.6)	2 (12.5)	1 (11.1)	0.143	20 (26.0)	06 (4.6)	0.001
No	7 (58.3)	28 (93.3)	11 (61.1)	6 (54.5)	5 (83.3)		12 (92.3)	52 (98.1)	38 (97.4)	14 (87.5)	8 (88.9)		57 (74.0)	124 (95.4)	
Tobacco use (smokeless)															
Yes	6 (50)	9 (30)	10 (55.6)	2 (18.2)	0	0.05	3 (23.1)	6 (11.3)	6 (15.4)	3 (18.8)	2 (22.2)	0.668	27 (35.1)	20 (15.4)	0.002
No	6 (50)	21 (70)	8 (44.4)	9 (81.8)	6 (100)		10 (76.9)	47 (88.7)	33 (84.6)	13 (81.2)	7 (77.8)		50 (64.9)	110 (84.6)	
Alcohol use															
Yes	5 (41.7)	2 (6.6)	5 (27.7)	1 (9.0)	0	0.03	0	0	0	0	0		13 (16.9)	0	<0.0001
No	7 (58.3)	28 (93.4)	13 (72.3)	10 (91.0)	6 (100)		13 (100)	53 (100)	39 (100)	1116 (100)	9 (100)		64 (83.1)	130 (100)	
Fruits and vegetables consumption (servings/day)															
0-2 servings	9 (75)	21 (70)	17 (94.4)	8 (72.7)	2 (33.3)	0.02	12 (92.3)	42 (79.2)	26 (66.7)	13 (81.2)	7 (77.8)	0.317	57 (74)	100 (76.9)	0.883
3-4 servings	0	6 (20)	1 (5.6)	3 (27.3)	2 (33.3)		1 (7.7)	5 (9.4)	8 (20.5)	3 (18.8)	0		12 (15.6)	17 (13.1)	
≥5 servings	3 (25)	3 (10)	0	0	2 (33.3)		0	6 (11.3)	5 (12.8)	0	2 (22.2)		8 (10.4)	13 (10)	
Physical activity (sedentary h)															
≤2 h	6 (50)	14 (51.9)	9 (50)	4 (40)	2 (33.3)	0.5	4 (33.3)	18 (36)	6 (16.7)	4 (28.6)	2 (22.2)	0.629	35 (47.9)	34 (28.1)	0.014
3-6 h	5 (41.7)	11 (40.7)	9 (50)	3 (30)	3 (50)		6 (50)	25 (50)	21 (58.3)	8 (57.1)	4 (44.4)		31 (42.5)	64 (52.9)	
≥7 h	1 (8.3)	2 (7.4)	0	3 (30)	1 (16.7)		2 (16.7)	7 (14)	9 (25)	2 (14.3)	3 (33.3)		7 (9.6)	23 (19)	

36–45 year age group (38.9%) (P = 0.014) and most women being in the 56–65 years' age group (55.6%) (P = 0.016). A total of 57.1% of men and 40.8% of women had low serum HDL (P = 0.03).

Discussion

India in the recent times has gone through a rapid health transition, with higher as well as increasing burden of chronic NCDs. In rural India, according to a recent study, the leading cause of death was NCDs.[14] Epidemiological field studies are important as they contribute not only in the estimation of the prevalence of a disease but help to gain an insight into the spectrum of the disease which is incompletely brought out by hospital-based data.

In this study, among the behavioral risk factors, the prevalence of current smoking was found to be 26% among males and 4.6% among females. Thus, the prevalence of smoking among males was found to be comparatively less than the national average for males which was 33.4% according to NFHS-3. However, the prevalence of current smoking among females (4.6%) was higher than the national average of 1.4%.[15]

The study carried out by Bhardwaj in Nagpur, Maharashtra found the prevalence of current smoking as 20.5% among men. These findings are almost similar among men in the present study. However, among women, none was smoking tobacco which is not in concordance with the present study.[16]

In this study, 35.1% males and 15.4% females were found to be consuming smokeless tobacco. The use of smokeless tobacco was comparatively less in the present study than the study conducted by Bhagyalaxmi in the rural Gujarat where 43.4% of males and 19.2% of females were consuming smokeless tobacco.[17] In the present study, 16.9% of males were found to be current alcohol users whereas none of the females were consuming alcohol. This figure was found to be appreciably lower than that found in the WHO-ICMR surveillance conducted in six regions of India which reported that 40.5% of the males were current alcohol users.[18] Another study conducted by Bhardwaj in a rural population of Nagpur, Maharashtra found that 37.7% of males were current alcohol users whereas none of the females were reported to be consuming alcohol.[16] In this study, the consumption of fruits and vegetables was found to be low among 89.6% of males and 90.0% of females. This could be attributed to the low socioeconomic status of the study subjects and unawareness regarding the benefits of fruits and vegetables consumption. Similarly, low consumption of fruits and vegetables was reported in a study conducted by Bhagyalaxmi in the rural population of Gujarat which was found to be 95.8% among males and 97.1% among females.[17] Regarding physical activity, in the present study, 9.6% of males and 19.0% of females were found to be physically inactive. Similar are the findings of the study conducted in the rural area of Gujarat where 14.8% males and 13.6% females were found to be physically inactive.[17] These figures are appreciably lower than the findings of WHO-ICMR surveillance study conducted in six regions of India in which

Table 3: Distribution of physical measurements (World Health Organization STEP 2) for noncommunicable diseases according to age and gender of the study participants

	Men's age groups (years), *n* (%)						Women's age groups (years), *n* (%)						All ages		
	18-25 (*n*=12)	26-35 (*n*=30)	36-45 (*n*=18)	46-55 (*n*=11)	56-65 (*n*=6)	*P*	18-25 (*n*=13)	26-35 (*n*=53)	36-45 (*n*=39)	46-55 (*n*=16)	56-65 (*n*=9)	*P*	Men (*n*=77)	Women (*n*=130)	*P*
BMI*															
Underweight	4 (33.3)	2 (6.7)	1 (5.6)	3 (27.3)	0	0.084	2 (15.4)	4 (7.5)	2 (5.1)	0	1 (11.1)	0.068	10 (13)	9 (6.9)	0.034
Normal	7 (58.3)	19 (63.3)	12 (66.7)	8 (72.7)	4 (66.7)		7 (53.8)	36 (67.9)	16 (41)	8 (50)	2 (22.2)		50 (64.9)	69 (53.1)	
Overweight	1 (8.3)	9 (30)	4 (22.2)	0	1 (16.7)		4 (30.8)	11 (20.8)	15 (38.5)	6 (37.5)	4 (44.4)		15 (19.5)	40 (30.8)	
Obesity	0	0	1 (5.6)	0	1 (16.7)		0	2 (3.8)	6 (15.4)	2 (12.5)	2 (22.2)		2 (2.6)	12 (9.2)	
Waist circumference															
Normal	11 (91.7)	18 (60.0)	10 (55.6)	10 (90.9)	2 (33.4)	0.028	9 (69.3)	19 (35.8)	8 (20.5)	5 (31.2)	1 (11.2)	0.012	51 (66.2)	42 (32.3)	<0.0001
Raised	1 (8.3)	12 (40.0)	8 (44.4)	1 (9.1)	4 (66.6)		4 (30.7)	34 (64.2)	31 (79.5)	11 (68.8)	8 (88.8)		26 (33.8)	88 (67.7)	
Known hypertensive**															
Yes	0	4 (13.3)	2 (11.1)	1 (9.1)	1 (16.7)	0.751	1 (7.7)	5 (9.4)	5 (12.8)	3 (18.8)	5 (55.6)	0.02	8 (10.4)	19 (14.6)	0.522
No	12 (100)	26 (86.7)	16 (88.9)	10 (90.9)	5 (83.3)		12 (92.3)	48 (90.6)	34 (87.2)	13 (81.2)	4 (44.4)		69 (89.6)	111 (85.4)	
Hypertension***															
Yes	0	5 (16.7)	2 (11.1)	3 (27.3)	2 (33.3)	0.278	1 (7.7)	6 (11.3)	8 (20.5)	5 (31.2)	6 (66.7)	0.002	12 (15.6)	26 (20.0)	0.428
No	12 (100)	25 (83.3)	16 (88.9)	8 (72.7)	4 (66.7)		12 (92.3)	47 (88.7)	31 (79.5)	11 (68.8)	3 (33.3)		65 (84.4)	104 (80.0)	

*WHO classification, underweight <18.5, normal 18.5-24.9, overweight 25.0-29.9, obesity ≥30, **Known hypertensives were those who gave the history of hypertension or were on anti-hypertensives, ***Known hypertensives and systolic blood pressure ≥140 (mmHg) or diastolic blood pressure ≥90 (mmHg). BMI: Body mass index; WHO: World Health Organization

35% of the rural residents were found to be following a sedentary lifestyle.[18] Physical activity is difficult to measure at the community level with existing instruments, and therefore these results need to be interpreted with caution. However, it does appear that contradictory to general impression; physical inactivity is an emerging cause of concern in rural India.

In the present study, 19.5% of males and 30.8% of females were found to be overweight whereas, obesity was present in 2.6% of males and 9.2% of females. This prevalence was found to be much higher than that reported in the studies by Krishnan *et al*.[19] and Bhardwaj *et al*.,[16] respectively. In the current study, 66.2% of the males and 32.3% of the females were reported to be having raised waist circumference. This prevalence is much higher as compared to the study conducted by Bhardwaj in a rural population of Nagpur, Maharashtra where 3.2% of men and 7.2% of women had increased waist circumference.[16] This difference can be attributed to the different cutoff levels of waist circumference taken in both the studies. In the current study, hypertension was found to be present in 15.6% of men and 20.0% of women. This prevalence is quite high as compared to the findings of a study by Krishnan in Haryana where hypertension was found in 10.7% of men and 7.9% of women.[19] In another study from Nagpur, Maharashtra, the prevalence of hypertension was found to be 14.8% in males and 15.9% in females.[16] These findings are in support of the findings of a current study which is also reflecting the rising trend of increasing the prevalence of hypertension among women.

In the study, the prevalence of diabetes mellitus was found to be 13% in males and 7.7% in females. The prevalence of diabetes was comparatively more in males. These findings are contradictory to that reported by Thankappan *et al*. in the study carried out in a rural area of Kerala where the prevalence of diabetes was found to be more in females (22%) as compared to males (19%).[20]

In the present study, 5.2% males and 13.8% females had total cholesterol levels more than the normal. These figures are much lower than that reported by Thankappan *et al*.[20] in rural areas of Kerala where 45.9% males and 64.8% females had hypercholesterolemia. In the current study, hypertriglyceridemia was found in 22.1% males and 16.9% females, which is almost similar to that found in the study by Thankappan *et al*.[20]

Regarding HDL levels, 57.1% males had lower than normal levels of healthy cholesterol as compared to 40.8% females having low HDL levels in the present study. However, the prevalence of decreased HDL levels was comparatively low in the study conducted by Thankappan *et al*.[20] in rural Kerala (42.9% males and 22.3% females).

Conclusion

The study reveals high burden of NCD risk factors in the rural areas as well and reiterates the need to address these issues

Table 4: Distribution of biochemical risk factors (World Health Organization STEP 3) for noncommunicable diseases according to age and gender of the study participants

	Men's age groups (years), *n* (%)						Women's age groups (years), *n* (%)						All ages		
	18-25 (*n*=12)	26-35 (*n*=30)	36-45 (*n*=18)	46-55 (*n*=11)	56-65 (n=6)	*P*	18-25 (*n*=13)	26-35 (*n*=53)	36-45 (*n*=39)	46-55 (*n*=16)	56-65 (*n*=9)	*P*	Men (*n*=77)	Women (*n*=130)	*P*
Raised fasting glucose (mg/dl)															
FBS* <126	12 (100)	29 (96.7)	16 (88.9)	10 (90.9)	5 (83.3)	0.54	13 (100)	53 (100)	37 (94.9)	14 (87.5)	8 (88.9)	0.12	72 (93.5)	125 (96.2)	0.50
FBS ≥126	0	1 (3.3)	2 (11.1)	1 (9.1)	1 (16.7)		0	0	2 (5.1)	2 (12.5)	1 (11.1)		5 (6.5)	5 (3.8)	
Raised total cholesterol (mg/dl)															
<200	12 (100)	28 (93.3)	16 (88.9)	11 (100)	6 (100)	0.76	12 (92.3)	48 (90.6)	33 (84.6)	14 (87.5)	5 (55.6)	0.112	73 (94.8)	112 (86.2)	0.039
≥200	0	2 (6.7)	2 (11.1)	0	0		1 (7.7)	5 (9.4)	6 (15.4)	2 (12.5)	4 (44.4)		4 (5.2)	18 (13.8)	
Raised serum triglycerides (mg/dl)															
<150	12 (100)	24 (80)	12 (66.7)	9 (81.8)	3 (50)	0.08	12 (92.3)	48 (90.6)	31 (79.5)	11 (68.8)	6 (66.7)	0.097	60 (77.9)	108 (83.1)	0.364
≥150	0	6 (20)	6 (33.3)	2 (18.2)	3 (50)		1 (7.7)	5 (9.4)	8 (20.5)	5 (31.2)	3 (33.3)		17 (22.1)	22 (16.9)	
Raised serum LDL** (mg/dl)															
<130	11 (91.7)	29 (96.7)	11 (61.1)	10 (90.9)	5 (83.3)	0.014	13 (100)	46 (86.8)	31 (79.5)	12 (75)	4 (44.4)	0.016	66 (85.7)	106 (81.5)	0.565
≥130	1 (8.3)	1 (3.3)	7 (38.9)	1 (9.1)	1 (16.7)		0	7 (13.2)	8 (20.5)	4 (25)	5 (55.6)		11 (14.3)	24 (18.5)	
Abnormal serum HDL** (mg/dl)															
<40	6 (50)	19 (63.3)	11 (61.1)	5 (45.5)	3 (50)	0.817	5 (38.5)	23 (43.4)	17 (43.6)	3 (18.8)	5 (55.6)	0.355	44 (57.1)	53 (40.8)	0.03
≥40	6 (50)	11 (36.7)	7 (38.9)	6 (54.5)	3 (50)		8 (61.5)	30 (56.6)	22 (56.4)	13 (81.2)	4 (44.4)		33 (42.9)	77 (59.2)	
Known diabetic															
Yes	0	3 (10)	2 (11.1)	1 (9.1)	0	0.73	0	2 (3.8)	4 (10.3)	0	2 (22.2)	0.108	6 (7.8)	8 (6.2)	0.775
No	12 (100)	27 (90)	16 (88.9)	10 (90.9)	6 (100)		13 (100)	51 (96.2)	35 (89.7)	16 (100)	7 (77.8)		71 (92.2)	122 (93.8)	
Diabetes															
Yes	0	3 (10)	4 (22.2)	2 (18.2)	1 (16.7)	0.445	0	2 (3.8)	4 (10.3)	2 (12.5)	2 (22.2)	0.218	10 (13)	10 (7.7)	0.26
No	12 (100)	27 (90)	14 (77.8)	9 (81.8)	5 (83.3)		13 (100)	51 (96.2)	35 (89.7)	14 (87.5)	7 (77.8)		67 (87)	120 (92.3)	

*Fasting blood sugar, ** NCEP: National cholesterol education program; ATP III: Adult treatment panel III; FBS: Fasting blood sugar; LDL: Low-density lipoprotein; HDL: High-density lipoprotein

comprehensively as a part of NCD prevention and control strategy. Further surveys are recommended in different parts of India based on this approach to explore the prevalence as well as the association between various risk factors as well and to study further trends of various NCD risk factors.

Acknowledgment

The authors would like to acknowledge the funding from the ICMR for this study. The authors are thankful to the medical social workers as well as the study participants for their cooperation.

Financial support and sponsorship

ICMR - STS funding.

Conflicts of interest

There are no conflicts of interest.

References

1. World Health Organization. Deaths from NCDs. Available from: http://www.who.int/gho/ncd/mortality_morbidity/ncdtotal/en/index.html. [Last accessed on 2016 Jun 10].
2. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, *et al.* A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: A systematic analysis for the global burden of disease study 2010. Lancet 2012;380:2224-60.
3. STEPS Country Reports. World Health Organization (WHO). Available from: http://www.who.int/chp/steps/reports/en/index.html. [Last accessed on 2016 Jun 10].
4. Laskar A, Sharma N, Bhagat N. Lifestyle disease risk factors in a North Indian community in Delhi. Indian J Community Med 2010;35:426-8.
5. World Health Organization. Guidelines for Controlling and Monitoring the Tobacco Epidemic. Geneva: World Health Organization; 1998.
6. World Health Organization. International Guide for Monitoring Alcohol Consumption and Related Harm. Geneva: World Health Organization; 2000.
7. US Department of Health and Human Services. US Department of Agriculture. Dietary Guidelines for Americans 2005. Washington, DC: US Government Printing Office; 2005.
8. World Health Organization. Guide to Physical Measurements (Step 2). WHO STEPS Surveillance. Geneva: World Health Organization; 2008.
9. World Health Organization. Obesity: Preventing and Managing the Global Epidemic. Report of a WHO Consultation. WHO Technical Report Series 894. Geneva: World Health Organization; 2000.
10. World Health Organization. Waist Circumference and Waist-Hip Ratio: Report of a WHO Expert Consultation. Geneva: World Health Organization; 2011.
11. Misra PJ, Mini GK, Thankappan KR. Risk factor profile for non-communicable diseases among mishing tribes in Assam, India: Results from a WHO STEPs survey. Indian J Med Res 2014;140:370-8.
12. American Diabetes Association. Standards of Medical Care in Diabetes; 2013. Available from: http://www.care.diabetesjournals.org/content/36/Supplement_1/S11.full. [Last accessed on 2016 Jun 10].
13. Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. Executive summary of the third report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). JAMA 2001;285:2486-97.
14. Kinra S, Bowen LJ, Lyngdoh T, Prabhakaran D, Reddy KS, Ramakrishnan L, *et al.* Sociodemographic patterning of non-communicable disease risk factors in rural India: A cross sectional study. BMJ 2010;341:c4974.
15. Goel S, Tripathy JP, Singh RJ, Lal P. Smoking trends among women in India: Analysis of nationally representative surveys (1993-2009). South Asian J Cancer 2014;3:200-2.
16. Bhardwaj SD, Shewte MK, Bhatkule PR, Khadse JR. Prevalence of risk factors for non-communicable disease in a rural area of Nagpur district, Maharashtra – A WHO STEP wise approach. Int J Biol Med Res 2012;3:1413-8.
17. Bhagyalaxmi A, Atul T, Shikha J. Prevalence of risk factors of non-communicable diseases in a district of Gujarat, India. J Health Popul Nutr 2013;31:78-85.
18. Deepa M, Pradeepa R, Anjana R, Mohan V. Noncommunicable diseases risk factor surveillance: Experience and challenge from India. Indian J Community Med 2011;36 Suppl 1:S50-6.
19. Krishnan A, Shah B, Lal V, Shukla DK, Paul E, Kapoor SK. Prevalence of risk factors for non-communicable disease in a rural area of Faridabad district of Haryana. Indian J Public Health 2008;52:117-24.
20. Thankappan KR, Shah B, Mathur P, Sarma PS, Srinivas G, Mini GK, *et al.* Risk factor profile for chronic non-communicable diseases: Results of a community-based study in Kerala, India. Indian J Med Res 2010;131:53-63.