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Research Article

RISK FACTORS FOR NON-COMMUNICABLE DISEASES AMONG RURAL ADOLESCENTS: A SCHOOL-BASED CROSS-SECTIONAL STUDY

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ABSTRACT

Objective: Non-communicable diseases (NCD) in recent times have attained a magnitude of epidemic proportion, with increasing number of adolescence being reported as obese. The risk factors for NCD such as obesity, sedentary lifestyle, smoking, dietary habits, etc. are inculcated during adolescence and continue to exist in adult life there by increasing the risk for hypertension, diabetes, and cardiovascular diseases. To assess the prevalence of risk factors for NCD among adolescents of a high school in rural Karnataka.

Methods: In a school-based cross-sectional study 297 adolescents belonging to classes 8, 9 and 10 were assessed for the presence of risk factors for NCD using pretested questionnaire modified from NCD Risk Factor Survey Questionnaire, WHO-STEPS Questionnaire and Integrated Disease Surveillance Project Questionnaire.

Results: The participants were aged between 12 and 17 years; mean age of the participants being 14.3 years. More than half (n=158, 53.2%) of the participants were boys, and a higher proportion (n=119, 40%) belonged to low socio-economic status class 5 according to B.G Prasad Scale. Based on International Physical Activity Questionnaire scoring protocol, 30.3% (n=90) participants were minimally active. The family history of hypertension and diabetes was seen among 55 (18.5%) and 28 (9.5%) of the participants respectively. Based on CDC 2000 standards 7 (2.4%) of the participants were overweight. The proportion of participants who were classified as having prehypertension, Stage I and Stage II hypertension was 20 (6.7%), 16 (5.4%) and 1 (0.3%) respectively. Inadequate intake of fruits and vegetables was seen in 235 (80.1%) and inappropriate dietary intake (fried foods, salted items more than 3 times/week) was seen in 166 (55.9%) of the participants.

Conclusion: Several risk factors, both modifiable and non-modifiable are prevalent among the adolescents. Early detection of the risk factors and timely interventions are essential to reduce the burden of NCDs in future. Simple measures such as health education, nutritional education, and lifestyle modifications could go a long way in reducing the morbidity and mortality associated with NCD.

Keywords: Adolescents, Non-communicable diseases, Risk factors, South India.

INTRODUCTION

Non-communicable diseases (NCD) in recent times have attained a magnitude of epidemic proportion, with increasing number of adolescence being reported as obese. In the year 2008, 36 million people died from NCDs [1]. Communicable and NCD pose a double burden on developing countries like India. NCDs such as cardiovascular diseases, Type 2 diabetes and cancers account for 53% of all deaths and 44% of the disability-adjusted life years in India [2]. The earlier knowledge of the occurrence of these diseases among the well to do urban groups is now changed with the increasing evidence of the occurrence of these diseases among the rural populace [3-5]. Most rural areas in India are witnessing a social and demographic transformation. The rapid industrialization, urbanization, and globalization is associated with high prevalence of risk factors such as unhealthy diet, physical inactivity, obesity, tobacco and alcohol abuse in low and middle income countries [6]. The risk factors for NCD such as obesity, sedentary lifestyle, smoking, dietary habits etc., are inculcated during the adolescence and these lifestyle changes continue to exist into adult life. It is already evident that nearly 75% of the obese adolescents remain obese as adults, increasing the risk of NCDs [7-9]. Hence, it is vital to assess the magnitude of these risk factors among adolescents in order to achieve the goal of primordial prevention among this age group. With this background the current research was conducted to assess the prevalence of NCD risk factors among the school going adolescents in a rural set up of Coastal South Indian.

METHODS

The current cross-sectional study was conducted among 297 adolescents in the age group between 12 and 17 years studying in class 8 to class 10 in Kugur village situated in southern part of Karnataka state of India. The sample size was calculated considering the prevalence of NCD risk factors in adolescents as 20% [10], confidence interval of 95%, and absolute precision of 5% and a non-response rate of 15%.

The sub sample to be selected from each class was calculated using probability proportion to size technique, and the participants were selected conveniently. The data pertaining to presence of risk factors for NCD among the study participants was collected using a pretested questionnaire modified from NCD survey questionnaire, Integrated Disease Surveillance Project Questionnaire [11] and WHO-STEPS questionnaire [12]. The questionnaire was suitably modified for adolescents and translated in the local language, Kannada. The questionnaire had two parts:

Section A: Pertained to risk factors for NCDs

Socio-demographic details

1. Dietary practices were assessed by questions on dietary preference, fruit and vegetable consumption, type of oil used for meal preparation at home, extra table salt added and frequency of intake of butter/ghee, fried items, non-vegetarian items, aerated drinks, fast foods, bakery products and food rich in salt like pickles and papads
2. Physical activity as in the STEPS questionnaire physical activity was divided into three grades: Vigorous, moderate and light activity continued for more than 10 minutes
3. Metabolic equivalents (MET) based on International Physical Activity Questionnaire (IPAQ) scoring protocol [13,14] were calculated to categorize physical activity as:
   - Inactive (<600 MET-minute/week)
   - Minimally active (600-3000 MET-minute/week) and
   - Active (>3000 MET-minute/week).
4. Smoking and alcohol consumption was assessed by asking for a single trial of tobacco (smoking/smokeless) and alcohol; and if yes, then frequency of use was noted. Age of onset of tobacco/alcohol consumption was noted. History of passive smoking was also ascertained by asking for exposure to tobacco smoke at home/other places
5. Family history of diabetes mellitus, hypertension, obesity, smoking and alcohol consumption among siblings, parents, aunts/uncles and grandparents was ascertained
6. Personal history of diabetes mellitus and hypertension was asked for and if yes, age of onset, duration of disease and treatment being taken was ascertained. Presence of any other co-morbid illness was also noted.

Section B: Physical measurements of participants

1. Weight in kg
2. Height in cm
3. Body mass index (BMI) was calculated from weight and height as follows:
   - BMI=Weight (kg)/Height^2 (m)
4. Waist circumference in cm
5. Blood pressure (BP) measurements-systolic BP (SBP) and diastolic BP (DBP) in mm Hg.

Operational definitions

1. Risk factor: 'A "risk factor" refers to any attribute, characteristic, or exposure of an individual, which increases the likelihood of developing a NCD [15]
2. Adolescent: Defined by WHO as a person between 10 and 19 years of age
3. Adequate dietary intake: Consumption of at least 5 servings of 80 g of fruit and vegetable/day
4. Inadequate dietary intake: Consumption of <5 serving of 80 g of fruit and vegetable/day
5. Physical inactivity: <10 minutes of activity at a stretch during leisure, work, transport
6. Nutritional status: Based on weight for age and gender, categorized as:
   - Obese: BMI ≥95th percentile
   - Overweight: BMI ≥85th and <95th percentile
   - Normal weight: BMI <85th percentile
   - Underweight: BMI <5th percentile.
7. Central obesity: Waist circumference ≥90th percentile (based on waist circumference for age and gender).
8. BP: Based on SBP and DBP, categorized as:
   - Normal BP: SBP and DBP<90th percentile
   - Prehypertension: SBP and DBP ≥90th percentile but <95th percentile or BP ≥120/80 mm Hg for adolescents
   - Hypertension: SBP and DBP ≥95th percentile
   - Stage I hypertension: SBP and DBP from 95th percentile to 99th percentile plus 5 mm Hg
   - Stage II hypertension: SBP and DBP >99th percentile plus 5 mm Hg.

The permission from the school authorities was obtained before the commencement of the study and the study participants were recruited after obtaining their ascent and informed consent from the parents. The questionnaires were administered in two steps: Section A of the questionnaire was administered to all the students simultaneously. Each question was explained one at a time, following which all the students answered their respective questionnaire. All the questionnaires were checked for completeness, and ambiguous responses were clarified with the student when carrying out their physical measurements. Section B pertaining to physical measurements and other risk factors was carried out on an individual student. After assuring the student of confidentiality questions pertaining to other risk factors such as trial of alcohol and tobacco (smoking/smokeless) were asked. Personal history of diabetes mellitus, hypertension or any other co-morbid illness was also asked. The data collected were entered in, and analyzed using Statistical Packages for Social Sciences version 11.5. Analysis of socio economic status (SES) was based on B.G. Prasad Scale adjusted for Consumer Price Index for Agricultural Laborers [16]. The results obtained were expressed in proportions.

RESULTS

A total of 297 students were assessed regarding the presence of risk factors for NCD. The participants were aged between 12 and 17 years; mean age of the participants being 14.3 years. The proportion of boys was higher (n=158, 53%) compared to girls (n=139, 47%). The majority (40%) of the participants belonged to the SES class 5 as per B.G. Prasad scale. The family history of hypertension was seen among 18.5% (n=55) of the participants. The majority (197, 66.5%) of the participants had a positive family history of using smokeless form of tobacco. The general participant information is depicted in Table 1.

With regards to alcohol consumption and smoking, only 1 boy admitted to having tried alcohol once in the past 6 months. None of the adolescents reported to have tried tobacco either in the smoking or smokeless forms. However, 62 (21%) boys and 28 (9%) girls were exposed to second hand smoke through the parent/relatives smoking in the family. Table 2 shows the prevalence of risk factors for NCD. The prevalence of underweight based was more among boys (n=99, 62.6%) compared to girls (n=56, 40.3%). The prevalence of overweight was minimal among both boys and girls. None of the participants in our study were obese.

According to IPAQ, 70.9% (n=112) boys and 68.3% (n=95) girls were physically active. A total of 162 (54.6%) participants were involved in activities like Yoga. On an average 4 hrs/day were spent in a sedentary lifestyle. Using cut-off as more than 95th percentile for age, gender and height the overall prevalence of hypertension was found to be 17 (5.7%). Gender specific prevalence was 10 (7.2%) among girls and 7 (4.4%) among boys. The majority (n=276, 93%) of the participants were predominantly non-vegetarian among whom 56% (n=166) consumed fried foods and 27% (n=80) consumed salted items like pickles and papads more than 3 times a week. 27% of the participants preferred adding extra salt to their food. Adequacy of fruit and vegetable consumption of the study participants is shown in Table 3.

Table 1: General information of the study participants (N=297)

Variables	N (%)
Socio-economic status	
Upper	5 (2.0)
Middle	75 (25.3)
Lower	217 (73.7)
Family history of risk factors for NCD	
Hypertension	55 (18.5)
Diabetes mellitus	28 (09.5)
Obesity	23 (07.7)
Positive family history of smoking	139 (47.3)
Positive family history of using smokeless tobacco	197 (66.5)
Positive family history of consuming alcohol	99 (33.3)

NCD: Non-communicable diseases

Table 2: Risk factors for NCD (N=297)

Risk factors	N (%)		
	Boys (N=158)	Girls (N=139)	Total (N=297)
Physical activity grading (IPAQ)			
Minimally active	46 (29.1)	44 (31.7)	90 (30.3)
Active	112 (70.9)	95 (68.3)	207 (69.7)
Nutritional status			
Underweight	99 (62.6)	56 (40.3)	155 (52.2)
Normal	57 (36.1)	78 (56.1)	135 (45.5)
Overweight	2 (1.3)	5 (3.6)	7 (2.3)
HTN			
Normotensives	146 (92.4)	114 (82.0)	260 (87.5)
Pre HTN	5 (3.2)	15 (10.8)	20 (6.7)
Stage I HTN	6 (3.8)	10 (7.2)	16 (5.4)
Stage II HTN	1 (0.6)	0 (0.0)	1 (0.3)

IPAQ: International Physical Activity Questionnaire, HTN: Hypertension, NCD: Non-communicable diseases

Table 3: Adequacy of fruit and vegetable consumption of the study population (N=297)

Number of serving	N (%)		
	Consumption; all days of week	Consumption<6 days/week	Total
1	0 (0.0)	6 (2.0)	6 (2.0)
2	4 (1.3)	32 (10.8)	36 (12.1)
3	15 (5.1)	49 (16.5)	64 (21.5)
4	12 (4.0)	35 (11.8)	47 (15.8)
≥5	59 (19.9)	85 (28.6)	144 (48.5)
Total	90 (30.3)	207 (69.7)	297 (100.0)

DISCUSSION

Among all settings, a high school forms a priority setting to assess the prevalence of risk factors for NCDs among adolescents, as it not only covers a vast population but also offers substantial opportunities for prevention [17]. The proportion of boys in the study was slightly higher than that of the girls. Similar observations were found in other studies done in both rural and urban schools in India [17,18]. Most of the participants were from the low SES, which is a common observation in schools situated in the rural areas and urban slums.

Though most of the participants (92.9%) were non-vegetarian, they did not consume non-vegetarian diet on a daily basis. 55.9% and 26.9% consumed fried foods and salted items (pickles, papads) more than 3 times a week, which poses high risk for acquiring NCDs in the later part of life. In addition, 26.6% participants admitted to adding extra salt to their food. Overall 235 students (80.1%) had inadequate dietary consumption (WHO recommends at least 5 servings of fruits and vegetables/day). Similar findings were observed in studies conducted elsewhere in India and abroad [10,19-21]. These findings are of concern as dietary habits are one of the most important modifiable risk factors for the development of NCD and unless corrected earlier in adolescence, the dietary patterns are likely to continue during adulthood.

On gradation of physical activity using IPAQ scoring protocol, 69.7% of the participants were found to be active. Most of the participants were involved in moderate intensity activity. Our data shows a considerably higher prevalence of hypertension in rural adolescents who were not overweight and were physically active, thus suggesting possible consequences of intrauterine nutritional insults [22]. Similar observations were seen in a study done in Pune where 53% of adolescents were involved in "light" activity, 34% in "moderate" and 13% in "heavy" activity [23]. None of the participants were obese, whereas 2.4% of the participants were overweight in our study. Prevalence of overweight/obesity among adolescents and young adults reported from other part of India was found to be relatively higher and ranged between 18% and 26% [24-26].

A study conducted in urban Delhi reported that 28.5% of the school children had tried alcohol and 2.5% had tried smoking tobacco [10], an observation in contrast to the findings of the present study in which none of the participants reportedly tried smoking and only one boy admitted to have tried alcohol. A lower prevalence of alcohol consumption and smoking could be due to social reasons as alcohol and tobacco consumption is often considered a taboo for these rural adolescents. A lower prevalence of alcohol and tobacco consumption can arguably be due to inaccurate responses. For the same reasons, other strategies to get more accurate responses such as the questionnaire being administered by the peers or the ex-students may have to be tried to overcome this limitation so that the students come out with the true responses. A similar technique was used in a study conducted in urban Delhi [10]. Unlike findings reported in adults, Soudarssanane *et al*. have reported no effect of smoking and alcohol consumption on BP of adolescents [18]. The possible explanation is that the amount and duration of exposure to smoking and alcohol consumption may not be sufficient enough to bring out a real change in BP levels at a young age. A follow-up of the cohort could bring out the possible relationship between the two.

The prevalence of prehypertension, Stage I hypertension and Stage II hypertension among adolescents was 6.7%, 5.4% and 0.3%, respectively. Elsewhere, studies done in Pune [20] and Debrecen [21] have recorded the prevalence of hypertension in adolescents to be 21.8% and 2.5%, respectively. In a similar study done in Ludhiana, prevalence of hypertension among urban children was 6.7% and 2.6% among rural children [17]. The higher prevalence of hypertension in previous studies includes "point" hypertension (transient hypertension). Thus, a serial determination of BP is recommended to estimate the prevalence of sustained hypertension [27-29]. While sustained severe hypertension in children can almost always be related to a definite cause, population-based epidemiological studies indicate primary hypertension to be predominant among apparently healthy children [30]. In a study done among adolescents in urban Delhi, the prevalence of systolic hypertension was 7.8% and diastolic hypertension was 2.15% [10].

The prevalence of hypertension was significantly higher among girls in comparison to boys in the present study. In a study carried out in urban and rural areas of Ludhiana, the number of hypertensive boys was more than girls; however, no statistical significance could be established in their study [17]. No association of hypertension and gender was established in a study done in urban Delhi [10]. The insidious and steady course of hypertension in adults may be indicative of its roots in childhood and adolescence, which perhaps goes undetected. 19.7% of the boys and 17.2% of the girls in the study reported family history of hypertension i.e. hypertensive parents or any of the grandparents when compared with 50.5% of boys and 48.5% of girls who had a positive family history of hypertension in urban Delhi [10]. This study showed a significant association between positive family history of parental hypertension and hypertension among the adolescents, similar to the findings reported among adolescents in Pondicherry [18]. Familial tendency for developing high BP is well known suggesting a genetic role in the development of hypertension.

CONCLUSIONS

The present research shows that the risk factors for NCD are widely prevalent among rural adolescents. The epidemiology of NCD has already made inroads into the rural populace affecting primarily the adults and elderly. To prevent its further penetration into the lives of younger people urgent measures should be taken within the existing framework of national programs such as National Program for Prevention and Control of Diabetes, Cardiovascular diseases and Stroke and also from the inter-sectorial coordination through various agencies. Simple measures such as health education, nutritional education, and lifestyle modifications could go a long way in reducing the morbidity and mortality associated with NCD.

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