ORIGINAL ARTICLE

Prevalence of Non-communicable diseases risk factors among school-going adolescents – A Government and Private school variation

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ABSTRACT

Background: Non-communicable diseases (NCDs) are a leading cause of mortality globally, with risk factors often originating during adolescence. Understanding the prevalence and distribution of these risk factors among school-going adolescents is crucial for early intervention. **Objectives**: To determine the prevalence of lifestyle-associated NCD risk factors among apparently healthy adolescents in urban Meerut and to compare these between government and private school students. **Methods**: A cross-sectional study was conducted among 400 adolescents aged 10–19 years, selected through multistage random sampling from one government and one private secondary school. Data were collected using a pre-tested semi-structured questionnaire, followed by anthropometric measurements. Analysis was performed using CDC Epi Info™ version 7.2.3.1, with Chi-square tests applied; $p<0.05$ was considered significant. **Results**: Only 2.25% of participants had no identifiable NCD risk factor, while 46.25% had two and 34% had three or more. Daily vegetable intake was significantly higher in government school students, whereas daily fruit and fast food consumption were higher in private school students. Adequate physical activity (>60 min/day) was more prevalent in government schools, while alcohol consumption was significantly higher among government school adolescents. No significant differences were found in screen time, smoking, or smokeless tobacco use. Overall, 20.25% of adolescents were overweight/obese, with higher prevalence in private schools. **Conclusion**: Multiple lifestyle-related NCD risk factors are highly prevalent among adolescents, with notable variations between government and private schools. School- and community-based interventions focusing on diet, physical activity, and substance use prevention are essential to curb the future burden of NCDs.

KEYWORDS

NCDs (Non-Communicable Diseases); Noncommunicable Diseases; Adolescent; School Going

INTRODUCTION

Non-communicable diseases are a set of chronic health conditions that, unlike infectious diseases, cannot be transmitted from person to person. These illnesses—including cardiovascular diseases (such as heart attack and stroke), diabetes, chronic respiratory diseases, and cancers —develop over long periods, often manifesting after years of exposure to various risk factors. Globally, NCDs are responsible for nearly three-fourths of all deaths, claiming over 41 million lives each year.[1]. Of these, around 17 million people die before the age of 70. Low-middle-income countries. In India alone, NCDs cause about 63% of annual deaths, with heart disease being the leading contributor. The economic consequences are equally concerning, with billions lost in productivity due to illness and early death.[2]. Once considered problems of old age, Non-communicable diseases (NCDs) are no longer limited to older adults. They are now emerging at much younger ages. Many of the behaviours that drive these diseases, such as

unhealthy eating, physical inactivity, and substance use, often take root during adolescence. This makes the adolescence a decisive stage for shaping lifelong health. If these risk factors go unchecked, they can lead to an increased burden of NCDs and their complications in the future. Understanding their prevalence among adolescents is therefore essential, as it provides an opportunity to intervene early, promote healthier choices, and reduce the long-term impact on individuals and the healthcare system.

Aims & Objectives

- To find out the prevalence of lifestyle-associated risk factors for non-communicable diseases among apparently healthy adolescents in schools of urban Meerut.
- To compare lifestyle-associated risk factors of non-communicable diseases between public and private school students

Material & Methods

This study was conducted among school-going adolescents (10 to 19 years) attending secondary schools in urban Meerut. The Sample size for the study was calculated using the formula n = $Z_{\alpha/2}{}^2$ x p x q /d^2. Where, n is sample size,$Z_{\alpha/2}$ denotes standard normal variant (1.96 at 0.05 level of significance), p is anticipated value of proportion in the population,q = (1- p) and d as absolute precision. By taking the prevalence of obesity[3] a prominent NCD risk factor among adolescents 6.9 at 95% confidence level and 2.5 % absolute precision, the sample size was calculated as

n = $(1.96)^2$ x .069 x 0.931/ $(2.5)^2$= 394.68. After rounding, the final sample size was taken as 400 adolescents, equally divided between government and private secondary schools with 200 students from each.

Multistage random sampling was employed to select a representative sample. A list of all government and private secondary schools was obtained one government and one private school were randomly selected using the lottery method.

Using proportionate stratified random sampling, students were selected from each stratum based on their relative population size within the school to reach 200 students per school. Adolescents who were present on the day of data collection, whose parent's provided consent, and who themselves were willing to participate were included in the study. Those with major systemic illnesses, those who did not provide consent, were absent, or were unwilling to participate, were excluded.

A pre-designed and pre-tested semi-structured questionnaire was administered to selected participants, which included sections on demographic data, family history of NCDs, lifestyle factors, and health-related questions. Following questionnaire completion, physical examinations were conducted. Frequency distributions and correlation tables were prepared. Data analysis was performed using **CDC Epi Info™ version 7.2.3.1** software. The Chi-square test was applied to assess associations between categorical variables. A p-value < 0.05 was considered statistically significant. Ethical clearance was obtained for this study by the ethical committee of LLRM Medical College (SC-1/2025/2962).

Results

Figure 1 Distribution of Non-Communicable Disease Risk Factors Among Study Participants

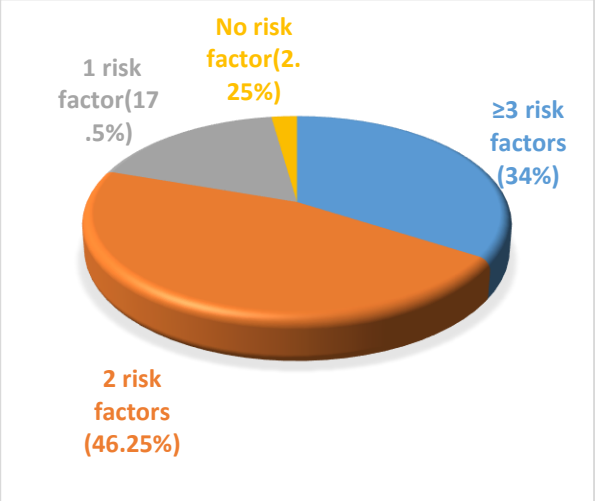


Figure 1 depicts that nearly half of the participants (46.25%) were found to have two risk factors, highlighting a significant prevalence of multiple risk behaviors or exposures within this group. A further 34% of adolescents had three or more risk factors, while 17.5% exhibited only one risk factor. Encouragingly, a very small proportion—just 2.25%—of the adolescents reported having no identifiable risk factors.

Table 1: Comparison of dietary risk factors of NCDS among Adolescents in Government and Private Schools.

	Government School N (%)	Private School N (%)	Total N (%)	Test of significance
Frequency of intake of vegetables				
>3 times daily	32 (52.46)	29 (47.54)	61 (15.25)	χ^2 = 20.91
Daily	134 (53.39)	117 (46.61)	251 (62.75)	p <0.05

2–3times/week	12 (22.22)	42 (77.78)	54 (13.50)	
Occasionally	22 (64.71)	12 (35.29)	34 (8.50)	
Frequency of intake of Fruits				
>2 times daily	17 (36.96)	29 (63.04)	46 (11.50)	$\chi^2 = 17.12$
Daily	35 (38.46)	56 (61.54)	91 (22.75)	$p < 0.05$
2–3times/week	126 (53.85)	108 (46.15)	234 (58.50)	
Occasionally	22 (75.86)	7 (24.14)	29 (7.25)	
Frequency of intake of carbonated drinks				
Daily	8 (36.36)	14 (63.64)	22 (5.50)	$\chi^2 = 5.11$
2–3times/week	62 (46.62)	71 (53.38)	133 (33.25)	$p > 0.05$
Occasionally	117 (51.77)	109 (48.23)	226 (56.50)	
None	13 (68.42)	6 (31.58)	19 (4.75)	
Frequency of intake of Fast food				
Daily	15 (42.86)	20 (57.14)	35 (8.80)	$\chi^2 = 8.15$
2–3times/week	71 (44.65)	88 (55.35)	159 (39.80)	$p < 0.05$
Occasionally	100 (58.14)	72 (41.86)	172 (43.00)	
None	14 (41.18)	20 (58.82)	34 (8.50)	

Table 1 represents the comparison of dietary risk factors among school-going adolescents study shows that daily vegetable intake was higher in government school's students (65.27%) than in private school's students (46.61%), while daily fruit intake was higher in private schools (61.54%) than in government schools (36.96%). Daily carbonated drink use was low and not significantly different between groups. Fast food consumption was significantly higher in private school students (57.14%) compared to government school students (42.86%).

Table 2: Frequency of Physical Activity among Adolescents in Government and Private Schools

	Government School N (%)	**Private School N (%)**	**Total N (%)**	**Test of significance**
Frequency of Physical Activity				
Physical activity > 60min/ day	141 (63.80)	80 (36.20)	221 (55.25)	$\chi^2 = 37.62$ $p<0.05$
physical activity < 60min/ day	59 (32.96)	120 (67.04)	179 (44.75)	
Frequency of Muscle strengthening exercises				
Muscle strengthening exercises ≥3 days /week	43 (51.81)	40 (48.19)	83 (20.80)	$\chi^2 = 0.1368$ $p > 0.05$
Muscle strengthening exercise < 3 days/week	157 (49.53)	160 (50.47)	317 (79.20)	

Table 2 represents the frequency of physical activity and muscle strengthening exercises among adolescents in government and private schools. Physical activity of more than 60 minutes per day was significantly higher among government school students compared to private school students. In contrast, the frequency of engaging in muscle strengthening exercises for three or more days per week did not differ significantly between the two groups .

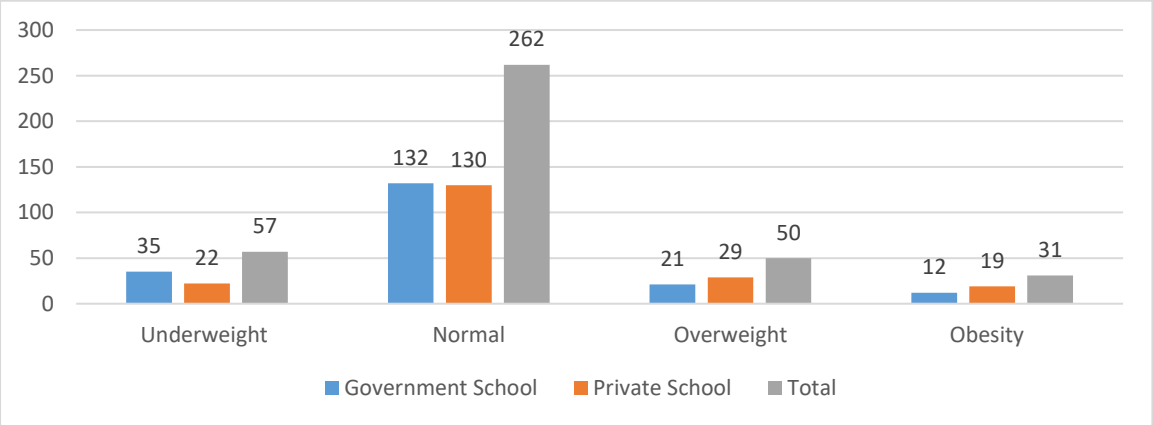
Table 3 : Comparison of Screen Time and Addiction-related Behaviors among Adolescents in Government and Private Schools

	Government School N (%)	**Private School N (%)**	**Total N (%)**	**Test of significance**
Screen time(per day)				
Less than 2hr	68 (53.54)	59 (46.46)	127 (31.80)	$\chi^2 = 1.7178$
More than 2 hrs	99 (50.00)	99 (50.00)	198 (49.50)	$p > 0.05$
More than 4 hrs	33 (44.00)	42 (56.00)	75 (18.80)	
Smoking Status				

Current Smoker	10 (71.43)	4 (28.57)	14 (3.47)	$\chi^2 = 3.4065$ $p > 0.05$
Past Smoker	4 (66.67)	2 (33.33)	6 (1.53)	
Non-smoker	186 (48.95)	194 (51.05)	380 (95.00)	
Use of Smokeless tobacco				
Yes	9 (69.23)	4 (30.77)	13 (3.25)	$\chi^2 = 1.9877$ $p > 0.05$
No	191 (49.35)	196 (50.65)	387 (96.75)	
Status of Alcohol Consumption				
Current Drinker	15 (78.95)	4 (21.05)	19 (4.74)	$\chi^2 = 7.8953$
Past Drinker	6 (66.67)	3 (33.33)	9 (2.26)	$p < 0.05$
Yet not tasted	179 (48.12)	193 (51.88)	372 (93.00)	

Screen time patterns showed insignificant difference between the government and private schools, with similar proportions reporting more than two hours of daily use. Smoking prevalence was low, with current and past smoking status showing no significant difference. Use of smokeless tobacco was also infrequent and comparable between the groups. Alcohol consumption showed a significant difference, with current drinking being more common among government school's students (78.95%) in comparison to private school's students (21.05%), while the majority in both groups had never tasted alcohol.

Figure 2: Body Mass Index of Study Participants



BMI distribution revealed 14.25% underweight, 65.5% normal, 12.5% overweight, and 7.75% obese students, with no significant school-wise variation. Significant differences ($p < 0.05$) were observed in vegetable and fruit intake, fast food consumption, physical activity, and alcohol use.

DISCUSSION

The present study revealed that 34% of the study participants had three or more than three risk factors for NCDs, while 46.25% had two risk factors, and only 17.25% had at least one risk factor. Similar results have been reported in other Indian studies. Virmani et al. (2024) found that 48.8% of adolescents in urban areas had two risk factors, and 12.1% had three or more, indicating a growing burden of behavioral and metabolic risks among school-aged children.(4) A similar study conducted by Biswas et al. (2022) in Bangladesh observed that most adolescents had at least one risk factor, with a high burden of overlapping NCD risk factors, with 14% of participants exhibiting one risk factor, 22% two risk factors, 29% three, and 34% presenting with four or more risk factors. (5).

In the present study, only 15.25% of adolescents reported consuming vegetables more than three times a day, while 62.75% had at least one daily serving. Notably, government school students (67.0%) showed a higher daily intake compared to private school students (58.5%). These findings align with Sharma et al. (2024), where 65.49% of adolescents consumed vegetables daily.(6) Kanjilal et al. (2019) also reported 52% daily intake among Delhi school students, slightly lower than government school students in the current study but higher than that of their private counterparts.(7) In the present study, fruit consumption among adolescents was generally inadequate, with only 11.5% consuming fruits more than twice daily and 22.75% having them daily. These results align with Jain B et al. (2023), who found that 20.6% consumed fruits daily, 40.1% 2–3 times weekly, and 37.2% occasionally.(3)

In the present study, 55.25% of adolescents engaged in adequate physical activity (>60

minutes/day). This is slightly higher compared to the study by Virmani et al. (2024), where 53% of adolescents were reported to be physically inactive. In the present study, only 20.8% met the recommended frequency of three or more days per week, indicating a low prevalence of regular engagement.(4) This finding aligns with Borle et al. (2022), who reported inadequate muscle-strengthening activity (<3 days/week) in 94.3% of adolescents.(8). Both government and private school students in the current study showed similarly low participation levels, with nearly 80% falling short of recommendations.

The present study found that nearly half of adolescents (49.5%) had screen time exceeding 2 hours daily, with 18.8% surpassing 4 hours, similar to Moitra et al., who reported 85% of adolescents aged 10–15 years exceeding 2 hours(9), and in line with Katkuri et al. (2015) and Guthi et al. (2023), who observed higher screen exposure in private schools(10). Smoking prevalence was low at 5%, comparable to Mahmood SE et al. (2017) in urban Bareilly (past 5.2%, current 4.8%)(11), but much lower than Sogarwal et al. (2014), who reported 31.5% tobacco use among higher secondary students(12). Smokeless tobacco use was 3.25%, slightly higher than Puwar et al. (2018) in Gujarat (2.2%) but lower than Mahmood SE et al. (2017) (current 4.8%, past 2.4%). (13) Alcohol consumption was minimal, with 93% never consuming and 7% current or past users, slightly lower than Virmani et al. (2024) (9.3%) and much lower than Srivastava et al. (2021), who reported 16% substance use among adolescents in Uttar Pradesh and Bihar(4,12). Overweight and obesity affected 20.25% of adolescents, slightly lower than Jain B et al. (2023) in urban Meerut (24.3%), with higher prevalence in private schools (58% overweight, 61.29% obese)(3), consistent with Gujjarlapudi et al. (2017), who reported 26.2% in private schools versus 5.8% in government schools with strong statistical significance(14). Overall, these findings indicate low substance use but persistent high screen time and notable overweight/obesity, especially in private school adolescents.

In the present study, 12.5% of adolescents were classified as overweight and 7.75% as obese, totaling a combined prevalence of 20.25%. These findings are slightly lower than those reported by Jain B et al. (2023) in urban Meerut, where 24.3% of students were either overweight (17.4%) or obese (6.9%)(3). The present study also noted a higher concentration of overweight and obese students in private schools (58.00% and 61.29%, respectively)(4), a trend partially supported by Gujjarlapudi et al. (2017), who reported a significantly higher prevalence (26.2%) among private school children compared to 5.8% in government schools, with a strong statistical association (14).

CONCLUSION & RECOMMENDATION

The study brings attention to a worrying reality: almost every adolescent surveyed had at least one lifestyle-related risk factor for non-communicable diseases, and only 2.25% were found without any. This shows how common unhealthy habits have become, even among school-going children who appear to be healthy. Whether it's poor dietary practices, physical inactivity, excessive screen exposure, or early use of substances, these behaviors are becoming part of everyday life and are often influenced by family background and school setting. Since these risk factors are largely preventable, early and structured interventions are essential. By focusing on adolescent health now, we are laying the foundation for a stronger and healthier future generation.

Based on the findings of this study, it is recommended that comprehensive school-based health programs be strengthened to promote healthier lifestyle habits among adolescents. Regular awareness sessions on balanced nutrition, the importance of daily physical activity, and the risks associated with tobacco, alcohol, and excessive screen time should be integrated into the school curriculum. Schools should also ensure the availability of healthy food options and create more opportunities for physical activity during school hours. Parents must be actively involved through regular communication and workshops that encourage healthy practices at home. At the community level, local health authorities can support adolescent wellness through accessible counseling services, youth clubs, and safe recreational spaces. Policymakers should consider developing adolescent-focused policies that prioritize early screening, prevention, and health promotion efforts. By taking a multi-sectoral and preventive approach, we can effectively reduce the burden of NCDs and nurture a generation of healthier, more informed youth.

LIMITATION OF THE STUDY

The present study has certain limitations. Being a cross-sectional study, causal relationships between risk factors and outcomes could not be established. The study was conducted in only one government and one private school in urban Meerut, which may limit the generalizability of findings to other regions or rural populations. Information regarding dietary habits and substance use was self-reported and

therefore subject to recall and social desirability bias. Additionally, biochemical assessments of NCD risk factors were not performed, which might have provided more objective evaluation.

Relevance of the Study

This study adds to the existing evidence by highlighting the clustering of multiple lifestyle-related non-communicable disease risk factors among school-going adolescents in an urban North Indian setting. It provides a comparative perspective between government and private school students, demonstrating how socio-educational environments influence dietary patterns, physical activity, and substance-use behaviors. The findings emphasize that NCD risk factors begin early in life and underline the need for school-based preventive interventions targeting adolescents before adulthood.

Authors Contribution

All authors have contributed equally

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NIL

Conflict of Interest

None declared.

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Declaration of Generative AI and AI Assisted Technologies in the Writing Process

During the preparation of this work, the authors did not use any generative AI or AI-assisted tools in writing, editing, or formatting the manuscript. All content, analysis, and interpretations were generated solely by the authors, who take full responsibility for the accuracy and integrity of the publication.

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