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RESEARCH ARTICLE

Knowledge, attitude, and behaviours on diet, physical activity, and tobacco use among school students: A cross-sectional study in two Indian states [version 1; peer review: 1 approved, 1 approved with reservations]

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Abstract

Background: Non-communicable diseases (NCDs) are escalating in India and can be attributed to behavioural risk factors such as unhealthy diet, physical inactivity and tobacco use that began in early years. Understanding adolescents' knowledge, attitudes and behaviours (KAB) related to NCD risk factors would inform the development of school-based health programmes to prevent NCDs.

Methods: Sixth-grade students (n=1026) in 20 schools (10 private, 10 public) from two Indian cities (n=667 from Pune; n=359 from Bengaluru) participated in a KAB survey in 2019. Differences in KAB by gender, school type within cities were investigated.

Results: Knowledge about the harms of tobacco use was higher than knowledge about a healthy diet and the importance of physical activity. Only a small proportion of students did not eat breakfast (8.7%) or fruits (11.3%) daily. Only 33.4% of students read nutrition labels before choosing their food. Moderate-to-vigorous physical activity of less than an hour per day was reported by 42.5% of students. Approximately one-third of students had ever tried smoking tobacco (30.1%), smokeless tobacco (30.5%), and e-cigarettes (32.4%).

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Differences in these behaviours by gender and school type showed that both boys, girls and students of private and public schools are vulnerable.

Conclusions: The findings highlight that knowledge is low for thematic areas like diet and physical activity. Low knowledge can be attributed to unfavourable behaviours like lack of reading nutrition labels and indulgence in sedentary activities. To protect India's young population (adolescents), there is a need to amplify health education activities and context-specific health intervention materials for them by engaging parents and communities. Thus, these programmes should be incorporated into the curriculum as part of the regular teaching, as they may induce positive changes in their knowledge and behaviours. In India, school health programmes should dedicate significant time to health promotion and NCD risk prevention.

Keywords

Non-communicable diseases, risk factors, school, children, lifestyle related behaviours, health promotion

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Introduction

The rising epidemic of non-communicable diseases (NCDs), such as cardiovascular diseases, cancers, diabetes and chronic respiratory diseases, is recognised as a leading cause of mortality and morbidity across all age groups in India and globally.¹ NCDs are responsible for more deaths in India each year than all other causes of death combined.² In the year 2019, 9.3 million deaths in India were attributed to all cause mortality, of which 6.1 million (64.9%) were due to NCDs.³

Most NCDs are attributable to potentially modifiable behavioural risk factors, including unhealthy diets, physical inactivity, tobacco and alcohol use.⁴ Synergistic effects of demographic transition, globalisation, and economic growth have resulted in an environment where more children and adolescents are exposed to and/or engage in these behaviours than ever before.⁵ It is a well-known fact that lifestyle-related behaviours are often formed early and persist throughout life.^{6,7} Evidence has shown that 70% of premature deaths in adults due to NCDs are associated with risky behaviours that began in childhood.⁸ Primordial prevention, including community-based intervention to promote healthier lifestyles, is extremely important for national development and to achieve the Sustainable Development Goals by 2030. Investment at an early age can yield a triple dividend of benefits, i.e., improving health later during adolescence, enhancing health throughout the course of life, and eventually contributing to the health of the next generation of children.⁹ By 2030, India is expected to be the first country in the world to become home to more than 1.5 billion people, and its population is on target to reach 1.7 billion by 2050.¹⁰ Thus, protecting and supporting child and adolescent health in this country is paramount not only to India's overall well-being, but also to global health and economy.

Schools have been widely recognised as an important location for promoting healthy behaviours among children and adolescents.^{11,12} Incorporating health-based programmes into the school curriculum can substantially influence both health promoting behaviours and educational achievements. The above outcomes can be achieved by providing children and adolescents with adequate knowledge and skills, allowing them to establish healthy attitudes and social norms through such a curriculum.¹³ Understanding their current knowledge, attitudes and lifestyle-related behaviours would immensely help both the health and education sectors in developing and implementing effective and efficient school-based health lifestyle programmes.

We have developed Project PaTHWay, a three-year, school-based programme (2018-2021), to promote healthier lifestyle practices among children.^{14,15} The overall objective of the programme is to prevent and control the risk factors of NCDs by delivering a school-based health lifestyle programmes to students from two cities in India. Specifically, the programme aims to address key behavioural NCD risk factors, such as unhealthy diet, physical inactivity, and tobacco use among school children. The students followed for three years in the project PaTHWay. The first year of the programme included, baseline knowledge, attitude, and behaviour (KAB) assessment and development of the health education programme based on the KAB assessment. Subsequently, school-based health lifestyle programme is being implemented for two years, followed by endline evaluation. In this paper, we present the baseline KAB of students relevant to these NCD behavioural risk factors, which have helped us develop Project PaTHWay school intervention.

Methods

Study design

A cross-sectional study was conducted during January- March 2019 in schools of Pune and Bengaluru to understand the KAB of school students related to diet, physical activity and tobacco use.

Setting

The programme is being carried out in two cities of India, namely Pune (Maharashtra) and Bengaluru (Karnataka). Pune is situated in Western India, while Bengaluru is situated in Southern India. The number of NCD related deaths in both Maharashtra (70.6%) and Karnataka (72.4%) is higher than the national average of all Indian states (64.9%), across all age groups and both sexes.¹⁶ Both Pune and Bengaluru are densely populated and highly urbanised cities. The total population of Pune is 9,429,408, of which there are 4,924,105 males and 4,505,303 females. The average literacy rate is 86.2%.¹⁷ Similarly, Bengaluru is home to 9,621,551 individuals, of which there are 5,022,661 males and 4,598,890 females, and the average literacy rate is 87.6%.¹⁸

Twenty schools (n = 10 public and n = 10 private) in Pune and Bengaluru were selected to implement Project PaTHWay. These schools were purposely selected to represent different socioeconomic strata (private schools: middle to higher socioeconomic status; public schools: lower socioeconomic status) within the two cities. The selected schools had common characteristics, such as each school having a division of the sixth grade into not more than one to two sub-sections, availability of playgrounds and equipment for physical activity, and provision of a school meal programme (public schools only).

Participants

Students from these 20 schools, enrolled in the sixth grade (n = 1238; Pune: n = 806; Bengaluru: n = 432) were eligible and invited to participate in the baseline KAB questionnaire administered in 2019. Total sample of 1238 students (Pune: n = 806; Bengaluru: n = 432) were included in the present study.

Instrument and measures

A self-administered, baseline questionnaire was implemented, to assess the students' KAB related to NCD behavioural risk factors (unhealthy diet, physical inactivity, and tobacco use). The questionnaire included a section on socio-demographic profile of the student on aspects such as age, gender as well as education and occupation of their parents and other section on KAB. The diet related knowledge was measured with six questions, each related to elements of a balanced diet (e.g., *How many times per week should one eat breakfast?*). Knowledge about physical activity was measured with five questions (e.g., *How many minutes of physical activity should people of your age have daily?*); and tobacco use knowledge was assessed with 16 questions (e.g., *Does using chewing tobacco cause oral cancer?*).

Attitudes towards diet (e.g., *It is important for me to eat breakfast daily*), physical activity (e.g., *Taking part in physical activities can help me get better marks at school*) and tobacco use (e.g., *Using tobacco makes a person appear to be braver and more grown-up*) were measured using a 5-point Likert scale - strongly agree, agree, not sure, disagree and strongly disagree. Cronbach alpha was calculated for this construct as the mean score was calculated and presented for attitude towards diet, physical activity, and tobacco use. A higher diet and physical activity score denotes a positive attitude towards a healthy diet and physical activity, indicating lower risk of indulging in risky behaviours. A higher score for tobacco indicates that the adolescents have a less favourable attitude towards tobacco use, indicating a lower risk of tobacco consumption.

The questionnaire also included the behaviours specific to diet (e.g., *In a week, on how many days do you eat breakfast?*), physical activity (e.g., *How many hours do you spend doing moderate to vigorous physical activities?*), and tobacco use (e.g., *Have you ever tried a cigarette/beedi/hookah - even once or twice?*). Susceptibility to tobacco use, for both smoking tobacco and smokeless tobacco was also assessed using eight items (e.g., *Do you think you will smoke any type of tobacco when you enter college?*).

This questionnaire was developed based on the socio-ecological model¹⁹ and adapting measures from reliable instruments that have been validated with adolescents in India. Surveys that we referred were, Global Youth Tobacco Survey (GYTS-2010),²⁰ Global Adult Tobacco Survey (GATS-2016-17),²¹ Project EAT,²² SPAN survey²³ and surveys used by the author of this study in previous studies conducted in India.^{24–26} An English version of the questionnaire was administered in private schools, and Kannada and Marathi versions were administered in public schools in Bengaluru and Pune, respectively. The questionnaire was pre-tested to assess its validity (face and content) and reliability (internal reliability of attitude construct).

For content validity, feedback was obtained from experts (n = 5) from multi-disciplinary field. These national and international experts have more than two decades of experience in psychology, epidemiology, public health and nutrition. Based on their feedback, the sequence of the questions was modified, more relevant questions were incorporated and language edits were made to simplify the questionnaire for students for better comprehension. To assess face validity, focus group discussions were conducted with students (n = 80) of grade six from both cities. These 80 students were selected from two schools in each city (one public and one private). To assess reliability, the questionnaire was administered with another 177 students from both cities. These schools or the students who were involved in face validity and internal reliability were not part of the main study. Based on students' feedback and internal reliability findings, language of the questionnaire was simplified, repeated and offending questions were deleted, options for questions were changed and added, detailed marking instructions were added to the questionnaire. Revised questionnaire was administered by a trained research team of the project. The questionnaire was administered during school hours, using a standardised protocol. Students were given unique identification codes to ensure confidentiality. Copies of the questionnaire in all three languages (English, Marathi, and Kannada) are available in *Extended data*.⁶⁵

Ethics statement

Permissions for implementation of the study were obtained from the Maharashtra State Board of Secondary and Higher Education and Karnataka Secondary Education Examination Board. We also received permission from authorities at schools, written active informed parental consent, and student assent, indicated by a signature on the consent form. Information sheets were sent from the schools to the parents of all eligible students, wherein details of the study and questionnaire were outlined. The consent stated the permission for data collection, scientific publications, dissemination in conferences by maintaining the confidentiality of the study participants and anonymity of the collected data. Ethical

approval for this study was obtained from the Institutional Ethics Committee of both PHFI (TRC-IEC-373/18) and NIMHANS [NIMHANS/EC (BEH.SC.DIV.)].

Statistical analysis

Statistical analyses were performed using STATA Version.13.1 software.²⁷ The descriptive data were expressed as mean with standard deviation (SD) or proportions (%). A chi-square test was performed to examine differences in the categorical variables by socio-demographic factors (gender, school type). The summary scores for all attitude scales by gender and school type within each city were compared using the *t*-test. All statistics were analysed through a two-sided test; *p*-value less than or equal to 0.05 was considered statistically significant. Participants with missing information, parent refusal, student refusal or absenteeism on the day of questionnaire administration were excluded.

Results

82.8% of the recruited sample participated in the baseline questionnaire (*n* = 1026 out of 1238). The reasons for non-participation included absenteeism (*n* = 112; boys: 67, girls: 45) and parent refusal (*n* = 100, boys: 54, girls: 46). The final sample size was 1026 (Private: 518 and Public: 508) consisting of 61.1% boys and 55.1% of the sample was from private schools. The mean age of the students recruited for the study was 12.5 ± 0.75 years. The full, de-identified dataset of student responses is available in *Underlying data*.⁶⁴

Knowledge

Diet

Overall, students' knowledge about healthy dietary practices was low (Table 1). Many students (67.5%) knew that breakfast was the most important meal of the day. Only a few students (6.8%) knew they should eat at least five servings of fruits and/or vegetables a day. Knowledge about healthy dietary practices was generally highest among girls and private school students. In Pune, more girls (68%) knew breakfast was the most important meal of the day compared to boys (59.4%) (*p* = 0.02). Similarly, more girls (15.1%) were able to identify iron rich foods than boys (7.7%) (*p* = 0.03). In Bengaluru, more girls (42.2%) knew about the importance of a balanced diet than boys (22.2%) (*p* = 0.000). Knowledge on the importance of a balanced diet was more prevalent among private school students than public school students in both cities (*p* < 0.01). In Bengaluru, more private school students (49.2%) knew salty foods could lead to hypertension, compared to public school students (32.9%) (*p* = 0.002) (Table 1).

Physical activity

Compared to knowledge about healthy dietary practices, students' understanding of the benefits of physical activity was higher (Table 1). Around 66%-69% of students were aware of the positive impact physical activity can have on reducing the risk of NCDs such as diabetes, heart disease, and obesity. Difference in the knowledge level of boys and girls was seen in both Pune and Bengaluru but a significant difference was seen only in Bengaluru for variables linking physical activity with low risk of diabetes (boys: 84.8% vs girls: 73.9%, *p* = 0.01) and obesity (boys: 79.3% vs girls: 86.9%, *p* = 0.05). However, less than one-fifth of the students (18.9%, overall) knew that the level of recommended daily physical activity is 60 minutes or more. More students (59.2%, overall) knew screen time should be limited to two hours or less per day.

Tobacco use

Few differences in tobacco use knowledge by gender were seen in Pune and Bengaluru. Where present, there was higher comprehension among boys in Pune for items like tobacco use is harmful to health (boys: 83.2% vs girls: 76%, *p* = 0.025) and the legal age for buying or selling tobacco (boys: 61% vs girls: 52.1%, *p* = 0.025). In Bengaluru, girls had higher knowledge for smoking and its association with heart attack (boys: 84.3% vs girls: 95%, *p* = 0.001) and cancer (boys: 88.8% , girls: 95%, *p* = 0.03). In Bengaluru, significantly more public school students were knowledgeable about tobacco use related harms and policies in India than private school students (*p* < 0.01) (Table 2).

Attitudes

Diet

The maximum score a participant could achieve for attitude towards diet was 40. The mean score of students was 28.4 ± 6.5 , which is 70% of the maximum score. Within the two cities, students' attitude about healthy dietary practices was similar for boys and girls (*p* > 0.05) and was similar in both school types (*p* > 0.05) (Table 3).

Table 1. Knowledge related to diet and physical activity by gender and school type.

Variable		Overall (N = 1026) N (%)	Pune (N = 667)			Bengaluru (N = 359)			Pune (N = 667)			Bengaluru (N = 359)		
			Boys N (%)	Girls N (%)	p-value	Boys N (%)	Girls N (%)	p-value	Public School N (%)	Private School N (%)	p-value	Public School N (%)	Private School N (%)	p-value
Diet														
Knowledge about balanced diet	262 (25.5)	93 (21.6)	57 (23.9)	0.5	44 (22.2)	68 (42.2)	0.000**	33 (11.9)	117 (30)	0.000**	60 (25.9)	52 (40.6)	0.004**	
Should have five servings of fruits and vegetables daily	70 (6.8)	27 (6.3)	12 (5)	0.5	17 (8.6)	14 (8.7)	0.97	11 (4)	28 (7.1)	0.08	19 (8.2)	12 (9.4)	0.710	
Eating breakfast daily is important	693 (67.5)	255 (59.4)	162 (68.0)	0.02*	143 (72.2)	133 (82.6)	0.02*	178 (64.3)	239 (61.3)	0.434	172 (74.4)	104 (81.2)	0.144	
Fat is a calorie dense nutrient	186 (18.1)	81 (18.8)	45 (18.9)	0.99	33 (16.6)	27 (16.7)	0.979	20 (7.2)	106 (27.1)	0.000**	49 (21.2)	11 (8.5)	0.002**	
Excessive intake of salty foods can lead to hypertension	335 (32.6)	123 (28.7)	73 (30.7)	0.58	78 (39.4)	61 (37.8)	0.771	77 (27.8)	119 (30.5)	0.448	76 (32.9)	63 (49.2)	0.002**	
Sources of iron rich food	101 (9.8)	33 (7.7)	36 (15.1)	0.003*	21 (10.6)	11 (6.8)	0.212	17 (6.1)	52 (13.3)	0.003**	15 (6.5)	17 (13.3)	0.03*	
Physical activity														
Physical activity decreases the risk of diabetes	681 (66.3)	255 (59.4)	139 (58.4)	0.794	168 (84.8)	119 (73.9)	0.01*	151 (54.5)	243 (62.3)	0.04*	196 (84.8)	91 (71.0)	0.002*	
Physical activity decreases the risk of heart diseases	680 (66.2)	264 (61.5)	158 (66.4)	0.213	138 (69.7)	120 (74.5)	0.311	170 (61.3)	252 (64.6)	0.39	173 (74.9)	85 (66.4)	0.08	
Physical activity decreases the risk of obesity	714 (69.5)	257 (55.9)	160 (67.2)	0.06	157 (79.3)	140 (86.9)	0.05*	167 (60.3)	250 (64.1)	0.31	197 (85.3)	100 (78.1)	0.08	
60 minutes of physical activity is recommended	194 (18.9)	70 (16.3)	43 (18.0)	0.564	46 (23.2)	35 (21.7)	0.73	47 (16.9)	66 (16.9)	0.988	47 (20.3)	34 (26.5)	0.177	
Screen time should be less than 2 hours a day	608 (59.2)	250 (58.2)	154 (64.7)	0.104	102 (51.5)	102 (63.3)	0.02*	158 (57.0)	246 (63.0)	0.116	124 (53.6)	80 (62.5)	0.106	

*p < 0.05.

**p < 0.01.

Table 2. Tobacco related knowledge by gender and school type.

Tobacco	Overall (N = 1026) N (%)	Pune (N = 667)			Bengaluru (N = 359)			Pune (N = 667)			Bengaluru (N = 359)		
		Boys N (%)	Girls N (%)	p-value	Boys N (%)	Girls N (%)	p-value	Public School N (%)	Private School N (%)	p-value	Public School N (%)	Private School N (%)	p-value
All kinds of tobacco use are harmful to health	871 (84.9)	357 (83.2)	181 (76.0)	0.025*	186 (93.9)	147 (91.3)	0.338	229 (82.6)	309 (79.2)	0.268	220 (95.2)	113 (88.2)	0.01*
Tobacco use by a young person harms his/her health immediately	679 (66.2)	254 (59.2)	133 (55.8)	0.405	155 (78.3)	137 (85.1)	0.100	149 (53.7)	238 (61.0)	0.062	202 (87.4)	90 (70.3)	0.000**
Safe to use tobacco products for one or two years	724 (70.5)	272 (63.4)	145 (60.9)	0.526	164 (82.8)	143 (88.8)	0.109	173 (62.4)	244 (62.5)	0.977	212 (91.7)	95 (74.2)	0.000**
Smoking tobacco (e.g., cigarettes, bidis) causes heart attack	811 (79.0)	321 (74.8)	170 (71.4)	0.340	167 (84.3)	153 (95.0)	0.001**	207 (74.7)	284 (72.8)	0.582	211 (91.3)	109 (85.1)	0.07
Chewing tobacco (guthka, khaini etc.) causes heart attack	790 (77)	301 (70.1)	181 (76.0)	0.104	170 (85.8)	138 (85.7)	0.969	207 (74.7)	275 (70.5)	0.231	209 (90.4)	99 (77.3)	0.001**
Smoking tobacco (e.g., cigarettes, bidis) causes stroke	776 (75.6)	308 (71.7)	160 (67.2)	0.217	169 (85.3)	139 (86.3)	0.791	195 (70.4)	273 (70.0)	0.912	212 (91.7)	96 (75.0)	0.000**
Chewing tobacco (guthka, khaini etc.) causes stroke	765 (74.5)	305 (71.1)	163 (68.4)	0.481	164 (82.8)	133 (82.6)	0.956	189 (68.2)	279 (71.5)	0.358	200 (86.5)	97 (75.7)	0.01*
Smoking tobacco (e.g., cigarettes, bidis) causes lung cancer	820 (79.9)	314 (73.1)	177 (74.3)	0.741	176 (88.8)	153 (95.0)	0.036*	203 (73.2)	288 (73.8)	0.871	216 (93.5)	113 (88.2)	0.087
Chewing tobacco (guthka, khaini etc.) causes oral cancer	792 (77.1)	302 (70.4)	163 (68.4)	0.607	176 (88.8)	151 (93.7)	0.105	191 (68.9)	274 (70.2)	0.718	218 (94.3)	109 (85.1)	0.003**
It's harmful to your health if you are near a person who is smoking	788 (76.8)	291 (67.8)	165 (69.3)	0.691	181 (91.4)	151 (93.7)	0.396	189 (68.2)	267 (68.4)	0.950	225 (97.4)	107 (83.5)	0.000**
Quitting tobacco improves a person's health	707 (68.9)	254 (59.2)	137 (57.5)	0.680	177 (89.3)	139 (86.3)	0.375	175 (63.1)	216 (55.3)	0.04*	218 (94.3)	98 (76.5)	0.000**
Is there a law which bans sale of tobacco products to and by minors (under 18 years of age)	680 (66.2)	262 (61.0)	124 (52.1)	0.025*	159 (80.3)	135 (83.8)	0.385	162 (58.4)	224 (57.4)	0.787	203 (87.8)	91 (71.0)	0.000**

Table 2. *Continued*

Tobacco	Overall (N = 1026) N (%)	Pune (N = 667)			Bengaluru (N = 359)			Pune (N = 667)			Bengaluru (N = 359)		
		Boys N (%)	Girls N (%)	p-value	Boys N (%)	Girls N (%)	p-value	Public School N (%)	Private School N (%)	p-value	Public School N (%)	Private School N (%)	p-value
Is there a law which mandates display of a "Tobacco Free School" or "Tobacco Free Institution" sign at a prominent place on the boundary wall outside the main entrance of your school	594 (57.9)	207 (48.2)	117 (49.1)	0.822	140 (70.7)	130 (80.7)	0.028*	135 (48.7)	189 (48.4)	0.944	209 (90.4)	61 (47.6)	0.000**
Is there a law which mandates display of a "No smoking area - smoking here is an offence" sign inside your school?"	654 (63.7)	248 (57.8)	128 (53.7)	0.315	160 (80.8)	118 (73.3)	0.090	158 (57.0)	218 (55.9)	0.769	195 (84.4)	83 (64.8)	0.000**
Is there a law which bans tobacco advertising on television channels and print media?	674 (65.6)	237 (55.2)	120 (50.4)	0.231	176 (88.9)	141 (87.5)	0.701	128 (46.2)	229 (58.7)	0.001**	216 (93.5)	101 (78.9)	0.000**
Is there a law which stops people from smoking in public places (like within the premises of your school)?	726 (70.7)	260 (60.6)	150 (63.0)	0.539	172 (86.8)	144 (89.4)	0.455	158 (57.0)	252 (64.6)	0.048*	216 (93.5)	100 (78.1)	0.000**

*p < 0.05.

**p < 0.01.

Table 3. Attitude related to diet, physical activity and tobacco by gender and school type.

Variable	Cronbach Alpha	Overall (N = 1026)			Pune (N = 667)			Bengaluru (N = 359)			Pune (N = 667)			Bengaluru (N = 359)		
		Mean $\pm$ SD (95% CI)	Boys Mean $\pm$ SD (95% CI)	Girls Mean $\pm$ SD (95% CI)	p-value	Boys Mean $\pm$ SD (95% CI)	Girls Mean $\pm$ SD (95% CI)	Boys Mean $\pm$ SD (95% CI)	Girls Mean $\pm$ SD (95% CI)	p-value	Public School Mean $\pm$ SD (95% CI)	Private School Mean $\pm$ SD (95% CI)	p-value	Public School Mean $\pm$ SD (95% CI)	Private School Mean $\pm$ SD (95% CI)	p-value
Diet	0.68	28.4 $\pm$ 6.5 (28.0-28.8)	27.0 $\pm$ 7.3 (26.3-27.7)	27.8 $\pm$ 7.3 (26.9-28.8)	0.153	30.2 $\pm$ 3.8 (29.7-30.7)	30.7 $\pm$ 3.8 (30.1-31.3)	26.7 $\pm$ 7 (25.9-27.5)	27.7 $\pm$ 7.5 (27-28.5)	0.256	26.7 $\pm$ 7 (25.9-27.5)	27.7 $\pm$ 7.5 (27-28.5)	0.073	30.2 $\pm$ 3.9 (29.7-30.7)	30.8 $\pm$ 3.5 (30.2-31.4)	0.135
Physical activity	0.71	29.5 $\pm$ 7.5 (29.1-30.0)	27.4 $\pm$ 8.5 (26.6-28.2)	28.3 $\pm$ 7.5 (27.4-29.3)	0.152	32.6 $\pm$ 4.5 (31.9-33.2)	33.2 $\pm$ 4.3 (32.5-33.9)	26.7 $\pm$ 8.3 (25.7-27.7)	28.5 $\pm$ 7.9 (27.7-29.3)	0.186	26.7 $\pm$ 8.3 (25.7-27.7)	28.5 $\pm$ 7.9 (27.7-29.3)	0.005*	33.6 $\pm$ 4.5 (33-34.2)	31.5 $\pm$ 4.0 (30.8-32.2)	0.001**
Tobacco use	0.89	31.3 $\pm$ 12.7 (30.6-32.1)	26.8 $\pm$ 14.1 (25.5-28.2)	29.7 $\pm$ 13.3 (28.0-31.4)	0.011*	37.5 $\pm$ 6.5 (36.6-38.4)	38.1 $\pm$ 5.7 (37.2-39.0)	28.3 $\pm$ 12.5 (26.8-29.8)	27.6 $\pm$ 14.8 (26.1-29.0)	0.356	28.3 $\pm$ 12.5 (26.8-29.8)	27.6 $\pm$ 14.8 (26.1-29.0)	0.493	38.5 $\pm$ 5.8 (37.8-39.3)	36.4 $\pm$ 6.6 (35.2-37.6)	0.002*

*P < 0.05.

**p < 0.01SD: Standard deviation, Higher the score better is the attitude towards diet and physical activity and less favourable to tobacco use.

Physical activity

The highest score a student could achieve for attitude towards physical activity was 45. The students' mean score was 29.5 ± 7.5 , which is 65% of the maximum score. No significant differences were observed between boys and girls in both cities, highlighting that both have a positive attitude towards physical activity ($p > 0.05$). In Bengaluru, public school students had a more positive attitude towards physical activity in comparison to private school students ($p = 0.001$), whereas the opposite was observed in Pune (Table 3).

Tobacco use

The maximum score a student could achieve in this construct was 45. The students' mean score was 31.3 ± 12.7 , which is 68% of the maximum score. In Pune, mean scores were significantly higher among girls than boys (29.7 ± 13.3 in girls vs 26.8 ± 14.1 in boys; $p = 0.01$) and among public school (28.3 ± 12.5) students than private schools' students (27.6 ± 4.8) ($p = 0.01$), suggesting girls and public school students had less favourable attitudes towards initiating a tobacco habit. In Bengaluru, no significant differences between gender were observed but a significant difference in scores by school type was observed (public school: 38.5 ± 5.8 vs private school: 36.4 ± 6.6 , $p = 0.002$) (Table 3).

Behaviours

Diet

Overall, the vast majority of students (94.7%) were eating "outside food" (i.e. takeaway/street food) daily. Few students (8.7%) skipped breakfast daily. In Pune, fewer girls (8.8%) than boys (18.9%) reported that they had never eaten fruits ($p = 0.001$) or pulses ($p = 0.004$). In Bengaluru, fewer girls than boys reported that they had never eaten pulses (4.3% girls and 14.1% boys; $p = 0.002$) or salads (1.2% girls and 11.1% boys; $p = 0.000$) and more boys (51.8%) than girls (39.4%) reported that they had never read nutrition labels ($p = 0.020$). In Bengaluru, more girls (46.3%) than boys (35.2%) reported watching television while eating meals ($p < 0.01$), while the reverse was observed in Pune (boys: 20.2% vs girls 17.2%) ($p < 0.01$).

With respect to school type, in Pune skipping breakfast and never reading nutrition labels were more common among students in public schools (15.2%) compared to private school (9.7%) ($p < 0.05$). Nearly one-third of public school students (30%) and 22.7% of private school students never read a food label before buying food items ($p < 0.005$). Never reading nutrition labels was also very common among public school students in Bengaluru (64.8%) (Table 4).

Physical activity

Overall, very few students (3.3%) watched screens (television, computer, video games etc.) for more than two hours a day. No significant differences were seen between girls and boys for screen time either in Pune or Bengaluru ($p > 0.05$). However, significantly more public-school students compared to private school students reported at least two hours of screen time a day in both Pune (4.3% in public school and 1.0% in private schools; $p = 0.006$) and Bengaluru (6.9% in public schools and 1.6% in private schools; $p = 0.026$).

No significant differences in moderate-to-vigorous physical activity were seen by gender or school type in both cities ($p > 0.05$). However, fewer students in Bengaluru (21.9%-29.9%) reported that they had less than adequate moderate-to-vigorous physical activity per day compared to students in Pune (50.3%-52.1%) (Table 4).

Tobacco

Overall more students in Pune (50.7%) than Bengaluru (2.8%) reported having ever used tobacco. In both cities, no significant differences by gender were observed. However, the prevalence of ever smoking (65.4% vs. 33.0%, $p = 0.001$), ever use of smokeless tobacco (64.8% vs. 33.5%, $p = 0.001$), and ever e-cigarette use (69.2% vs. 36.7%, $p = 0.001$) was significantly higher among public school students in Pune than private school students (Table 4).

The boys from the participating schools of Pune were found to be more susceptible to tobacco use (23.3% smoking and 25.9% smokeless tobacco) in comparison to the girls (15.5% both smoking and smokeless tobacco use) ($p < 0.05$) (Table 5).

Table 4. Dietary, physical activity and tobacco use behaviour of students by gender and school type

Behaviours		Overall (N = 1026)	Pune (N = 667)			Bengaluru (N = 359)			Pune (N = 667)			Bengaluru (N = 359)		
		N (%)	Boys N (%)	Girls N (%)	p-value	Boys N (%)	Girls N (%)	p-value	Public School N (%)	Private School N (%)	p-value	Public School N (%)	Private School N (%)	p-value
Diet														
	Skipping breakfast (daily)	90 (8.7)	56 (13.1)	24 (10.1)	0.258	8 (4.0)	2 (1.2)	0.109	42 (15.2)	38 (9.7)	0.034*	5 (2.2)	5 (3.9)	0.337
	Eat whole fruits in a week (never)	116 (11.3)	81 (18.9)	21 (8.8)	0.001**	10 (5.1)	4 (2.5)	0.212	39 (14.1)	63 (16.2)	0.463	8 (3.5)	6 (4.7)	0.566
	Eat pulses and lentils in a week (never)	167 (16.2)	99 (23.1)	33 (13.9)	0.004**	28 (14.1)	7 (4.3)	0.002**	60 (21.7)	72 (18.5)	0.307	23 (10.0)	12 (9.4)	0.859
	Eat salads in a week (never)	187 (18.2)	114 (25.6)	49 (20.6)	0.085	22 (11.1)	2 (1.2)	0.000**	76 (27.4)	87 (22.3)	0.129	16 (6.9)	8 (6.3)	0.806
	Eat food/snack while watching TV (always)	261 (26.7)	79 (20.2)	39 (17.2)	0.364	69 (35.2)	74 (46.3)	0.034*	45 (17.6)	73 (20.1)	0.430	119 (52.2)	24 (18.8)	0.000**
	Read the food labels to choose if the food is healthy or not (never)	311 (33.4)	99 (27.7)	49 (22.4)	0.159	100 (51.8)	63 (39.4)	0.020*	71 (30.7)	77 (22.3)	0.022*	147 (64.8)	16 (12.7)	0.000**
	Eat food from outside (daily)	895 (94.7)	334 (92)	218 (95.6)	0.08	189 (97.4)	154 (96.2)	0.527	227 (96.6)	325 (91.3)	0.01*	220 (96.9)	123 (96.8)	0.973
Physical activity														
	Screen time (> 2 hours per day)	34 (3.3)	11 (2.6)	5 (2.1)	0.708	13 (6.6)	5 (3.1)	0.135	12 (4.3)	4 (1.0)	0.006**	16 (6.9)	2 (1.6)	0.026*
	Moderate to vigorous activity less than 60 minutes per day	437 (42.5)	216 (50.3)	124 (52.1)	0.665	52 (26.3)	45 (28.0)	0.720	140 (50.5)	200 (51.3)	0.850	69 (29.9)	28 (21.9)	0.102
Tobacco														
	Ever tried smoked tobacco (cigarette/beedi/hookah etc.)	289 (30.1)	174 (45.7)	111 (50.2)	0.160	3 (1.5)	1 (0.6)	0.391	174 (65.4)	111 (33.0)	0.001**	2 (0.9)	2 (1.6)	0.446
	Ever tried smokeless tobacco (gutkha, khaini, etc.)	293 (30.5)	179 (46.6)	107 (48.6)	0.347	6 (3.0)	1 (0.6)	0.100	173 (64.8)	113 (33.5)	0.001**	6 (2.6)	1 (0.8)	0.223
	Ever tried electronic vapor product	310 (32.4)	187 (49.3)	118 (53.8)	0.285	3 (1.5)	2 (1.2)	0.827	182 (69.2)	123 (36.7)	0.001**	2 (0.86)	3 (2.4)	0.243

*P < 0.05.

**p < 0.01.

Table 5. Tobacco use susceptibility of students by gender and school type.

Tobacco	Overall (N = 1026) N (%)	Pune (N = 667)			Bengaluru (N = 359)			Pune (N = 667)			Bengaluru (N = 359)		
		Boys N (%)	Girls N (%)	p-value	Boys N (%)	Girls N (%)	p-value	Public School N (%)	Private School N (%)	p-value	Public School N (%)	Private School N (%)	p-value
Susceptibility to smokeless tobacco	168 (16.4)	111 (25.9)	37 (15.5)	0.002**	13 (6.6)	7 (4.3)	0.368	58 (20.9)	90 (23.1)	0.513	11 (4.8)	9 (7.0)	0.369
Susceptibility to smoke tobacco	157 (15.3)	100 (23.3)	37 (15.5)	0.017**	11 (5.6)	9 (5.6)	0.989	58 (20.9)	79 (20.3)	0.830	15 (6.5)	5 (3.9)	0.306

*p < 0.05.

**p < 0.01.

Discussion

This is one of the few studies on NCD risk factors that has comprehensively assessed KAB of school going children from two major metropolitan areas of India and the KAB findings helped to develop the school-based health lifestyle programme. During recruitment, it was ensured that the schools included in the study had similar characteristics, as differences in school characteristics might have influenced the results. Given the wide geographic variability in NCDs in this country,^{16,28,29} it is important to assess students' KAB in a myriad of contexts.

The findings of our study revealed low dietary knowledge among students irrespective of gender and school type. Knowledge was better among girls and private school students. Similar differences were reported in school going students of Haryana (North India).³⁰ The students' knowledge of physical activity was better than their knowledge of diet and 66%–69% of students were aware of association between NCDs and physical inactivity. In contrast to our study findings, a better knowledge about physical activity (88%) was reported in students of Gujarat,³¹ and Delhi-India.³² Similarly, adolescents from the eighth and ninth grade in other low-and-middle-income countries (LMICs) such as Nepal, knew that physical activity is imperative for disease prevention and for staying healthy.³³

In our study, students' knowledge about the harms of tobacco use was much higher in comparison to their knowledge about diet and physical activity. This increase in knowledge could be attributed to the Government of India's efforts to combat rising burden of tobacco use and its associate health impact, including comprehensive national tobacco control law i.e., COTPA-2003,³⁴ National Tobacco Control Programme³⁵ as well as tobacco-free educational institutional guidelines.³⁶ Evidence from other LMICs, including Bangladesh, also reported high awareness of the harms of tobacco use among rural adolescents (13–18 years).³⁷

With regard to behaviours, only 8.7% of students were missing their breakfast daily. This is similar to the findings of a study conducted among school students of Gujarat, India.³⁸ Findings from a study conducted in Kenya also showed similar results, wherein 92.1% of the children and adolescents (8–11 years) consumed breakfast daily.³⁹ In our study, more students from public schools reported missing their daily breakfast than students in private schools. This could be attributed to a low level of knowledge and the presence of students from lower middle-income families in these schools. Students from lower income families are more likely to experience scarcity of good quality food, meaning they may lack a wholesome breakfast as well as other meals of the day.⁴⁰ An additional factor could be the availability of a mid-day meal scheme (i.e., school meal) in public schools,⁴¹ which may preclude the importance of their first meal at home (i.e., breakfast).

Other protective dietary factors include fruit consumption, and only 11.3% of students did not eat fruits daily. The Comprehensive National Nutrition Survey (2019) showed that among adolescents (10–14 years), 59% in Maharashtra and 74% in Karnataka ate whole fruits only once a week.²⁸ Though fruits are “price elastic” (a term that describes the connection between income and the demand of a product),^{42,43} no difference in consumption was seen by school type. Results from other LMICs were poorer, with only 9% of adolescents (8–11 years) consuming fruits four to seven times a week.³⁹ On other hand, in a cross-country comparison among 49 LMICs, India had highest percentage (29.5%) of adolescents (13–17 years old) who met WHO's recommendation for fruit and vegetable consumption.⁴⁴ All of the included 49 countries were selected due to the availability of the Global School Based Student Health Survey (GSHS) data from 2004–2013 for this ecological study and provided a data on a total of 164,771 adolescents.

Another worrisome behaviour observed among students was the habit of eating “outside food” (i.e., takeout) every day (95%). Contributing factors to its popularity could be ease of access, taste, parent's occupation, and fast-food companies marketing strategies.⁴⁵ Fast food consumption data from 153,496 young adolescents (12–15 years) from 54 LMICs showed that 55.2% (51.3–59.1%) of the adolescents consumed fast food at least once per week, and 10.3% (8.3–12.4%) consumed fast food between four to seven days per week. The prevalence of fast-food consumption for four to seven days per week was lowest in the Americas (8.3%; 95% CI: 6.7–9.9) and highest in Southeast Asia (17.7%; 95% CI: 2.3–33.2%).⁴⁶ Our study found that students are not reading nutritional labels while making food choices, as only 33% of students read labels. Students in public schools were practicing this behaviour more often than students in private schools. In contrast to this trend, 88% of students in Kolkata reported reading nutritional labels, and this was most common among girls.⁴⁷

Lack of physical activity among adolescents is a major NCD risk factor. More than half of the students (57.5%) in this study reported engaging in moderate-to-vigorous physical activity for at least 60 minutes, daily, with no significant differences by gender or school type. One recent publication showed that 73.9% of adolescents in India are insufficiently physically active.⁴⁸ However, a global study of 49 LMICs with 164,771 adolescents found that India had the highest percentage (29.5%) of adolescents who met WHO's recommendations for physical activity.⁴⁴ On an encouraging note, in

the same study, few adolescents (3%) reported screen time of more than two hours a day. This is in contrast to 52.5% of school going adolescents in Tamil Nadu (Southmost part of India) who had an average daily screen time of more than two hours a day.⁴⁹

One third of adolescents had ever tried tobacco (smoke, smokeless and e-cigarette). Evidence from 68 LMICs showed that mean prevalence of tobacco use among adolescents (12-15 years) was 13.6%, ranging from 2.8% in Tajikistan to 44.7% in Samoa and in most countries prevalence among boys was higher compared to girls.⁵⁰ However, no difference among boys and girls was observed in this study, indicating a narrowing of gender gap for tobacco use which is much wider among adults in India.⁵¹ In Pune, public school students used more tobacco (all forms) in comparison to private schools. Whereas in Bengaluru, smokeless tobacco was more commonly used among public school students in comparison to smoke forms. Tobacco use (all forms) was found to be more prevalent in public school boys (13.4%) in comparison to private school boys (11.7%).⁵² This could be due to the students' lack of compliance with provisions of Indian tobacco control law as well as the availability and ease of access to tobacco products outside of their schools.⁵³ Surprisingly, 32.4% of the students also reported that they have tried e-cigarettes in the past. To the best of our knowledge, no other study in India has yet reported the prevalence of e-cigarette use among school going children. The prevalence found in our study was much higher than that found in a study from Mexico.⁵⁴

Results suggest that tobacco use prevention will be especially important for schools in Pune, while promoting physical activity may be a key strategy to pursue in Bengaluru. Students in both cities would benefit from additional school-based intervention to support healthy dietary practices, including eating pulses and vegetables frequently; eating healthier, eating home-cooked meals; and reading nutrition labels.

As the 2030 deadline for Sustainable Development Goals are only a decade away, the low levels of knowledge, particularly about unhealthy diet and physical inactivity, are a matter of concern.⁵⁵ Aiming to reduce the NCD burden, the budding role of education in primary prevention was emphasised at the 2011 United Nations' Meeting on the Prevention and Control of NCDs.⁵⁶ Lack of healthy behaviours among adolescents has been linked with lack of sufficient knowledge, and research has also indicated a positive relationship between information level and overt behaviour.⁵⁷ Sufficiently designed health promotion programmes⁵⁸ may provide the much needed knowledge that will help to reduce risk behaviours such as unhealthy diet, physical inactivity, and tobacco use, hence providing a pathway for behaviour change. Health promotion strategies in schools provide an avenue to reach school children at a time coinciding with their cognitive development. Such an approach can impart information effectively, especially with respect to lifestyle choices.⁵⁹ Studies have shown that if implemented efficiently, health promoting schools can enhance decision-making skills among students, too.⁶⁰

In India, various education programmes have been designed for school going adolescents but there are only few comprehensive education programs addressing diet, physical activity and tobacco.⁶¹ In 2018, the Government of India launched the National School Health Programme under Ayushman Bharat or Healthy India. The programme comprehensively addresses the above risk factors, and is delivered by health ambassadors (two teachers per school) only in government and government aided schools across country.⁶²

The results of the present study are being used to inform the development of a two-year intervention programme in these cities which will target students in the sixth to eighth grades, their parents, and community members. This intervention programme is being implemented from 2019-2021 by trained teachers and is facilitated by trained peer leaders in both public and private schools. This model of delivery has proven successful in India and elsewhere globally for tobacco⁶³ and nutrition¹² education.

One of the limitations of this study was that the sample of schools was not randomly selected from the population but was representative of the mix of types of schools in these two cities. This limits generalisability of the findings. The self-reported method utilised (i.e., survey) also may have led to skewed estimates of dietary intake, physical activity and tobacco use patterns among the students due to the fact that adolescents would have wanted to report positive health behaviours (social desirability - reporting bias). Behaviour for every type of tobacco use was evaluated without further investigating the number of times the tobacco was used by the students. Given budgetary constraints, no anthropometric or biochemical (e.g., salivary cotinine) measurements were completed, which may be a drawback of this study.

Conclusion

There is a need to amplify health education activities in schools in India, and school health interventions need to be adequately designed to ensure that they do not further widen existing socio-economic inequalities. This study highlights the need to augment school health programmes in India with a differential approach based on the issues which are specific

to each school type (public and private) and city (Pune and Bengaluru). School health programmes should be structured with a dedicated focus on health promotion and NCD prevention. Developed intervention materials should be incorporated in the curriculum to become part of the regular teaching.

Data availability

Underlying data

Figshare: Knowledge, Attitude and Behaviours (KAB) on diet, physical activity, and tobacco use among school students: Survey Dataset. <https://doi.org/10.6084/m9.figshare.14760147.v4>.⁶⁴

This project contains the following underlying data:

- KAB Survey Dataset.xlsx (student knowledge, attitude and behaviour responses regarding their diet, physical activity and tobacco consumption).

Extended data

Figshare: Knowledge, Attitude and Behaviours (KAB) on diet, physical activity, and tobacco use among school students: Survey Tool. <https://doi.org/10.6084/m9.figshare.14760480.v2>.⁶⁵

This project contains the following extended data:

- KAB Questionnaire_English.pdf
- KAB Questionnaire_Marathi.pdf
- KAB Questionnaire_Kannada.pdf

Data are available under the terms of the [Creative Commons Attribution 4.0 International license](#) (CC-BY 4.0).

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References

1. World Health Organization: **Non-communicable diseases: progress monitor 2020**. Geneva: World Health; 2020.
2. World Health Organisation: **Global Status Report on Non-Communicable Diseases**. 2011.
[Reference Source](#)
3. Institute for Health Metrics and Evaluation: **Global Health Data. GBD Results Tool|GHDx**.
[Reference Source](#)
4. WHO: **Global action plan for the prevention and control of noncommunicable diseases 2013-2020**. *World Heal Organisation*. 2013; 102.
[Reference Source](#)
5. Watkins D, Hale J, Hutchinson B, *et al.*: **Investing in non-communicable disease risk factor control among adolescents worldwide: A modelling study**. *BMJ Glob Heal*. 2019 Apr 1; 4(2).
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
6. Paavola M, Vartiainen E, Haukka A: **Smoking, alcohol use, and physical activity: A 13-year longitudinal study ranging from adolescence into adulthood**. *J Adolesc Heal*. 2004 Sep; 35(3): 238–244.
[PubMed Abstract](#) | [Publisher Full Text](#)
7. Craigie AM, Lake AA, Kelly SA, *et al.*: **Tracking of obesity-related behaviours from childhood to adulthood: A systematic review**. *Maturitas*. Maturitas; 2011; 70: p. 266–84.
[PubMed Abstract](#) | [Publisher Full Text](#)
8. Sawyer SM, Afifi RA, Bearinger LH, *et al.*: **Adolescence: A foundation for future health**. *Lancet*. Lancet Publishing Group; 2012; 379: p. 1630–40.
[PubMed Abstract](#) | [Publisher Full Text](#)
9. World Health Organization Regional Office for South-East Asia: **Strategic Guidance on Accelerating Actions for Adolescent Health**. 2018.
10. Cilluffo A, Ruiz NG: **World's population is projected to nearly stop growing by the end of the century**. Pew Research Center; 2019.
[Reference Source](#)
11. Singh A, Bassi S, Nazar GP, *et al.*: **Impact of school policies on non-communicable disease risk factors - a systematic review**. *BMC Public Health*. 2017 Apr 4; 17(1): 292.
[Reference Source](#)
12. Bassi S, Gupta VK, Chopra I, *et al.*: **Novel school-based health intervention program—a step toward early diabetes prevention**. *Int J Diabetes Dev Ctries*. 2015 Nov 1; 35(4): 460–468.
[Reference Source](#)
13. Langford R, Bonell CP, Jones HE, *et al.*: **The WHO Health Promoting School framework for improving the health and well-being of**

- students and their academic achievement. *Cochrane Database of Systematic Reviews*. John Wiley and Sons Ltd; 2014; 2014.
14. Public Health Foundation of India: **Project PaTHWay: PromoTing Health and Wellbeing**. 2019. [Reference Source](#)
 15. Express Healthcare: **Directorate of Health Services, Maharashtra and PHFI collaborate for Project PaTHWay**. 2019; [Reference Source](#)
 16. Indian Council of Medical Research, Public Health Foundation of India, Institute for Health Metrics and Evaluation: **GBD India Compare**. 2016. [Reference Source](#)
 17. Directorate of Census Operations: **District Census Handbook, Pune Maharashtra: Census of India**. Pune; 2011. [Reference Source](#)
 18. Kumar TKAK: **Directorate of Census Operations Karnataka. CENSUS OF INDIA 2011: Primary Census Abstract Data Highlights Karnataka**. 2011.
 19. Bandura A: **Health promotion by social cognitive means**. *Health Educ Behav*. 2004; **31**: p. 143–64. [PubMed Abstract](#) | [Publisher Full Text](#)
 20. Global Youth Tobacco Survey Collaborative Group: **Global Youth Tobacco Survey (GYTS): Core Questionnaire with Optional Questions**. GA, Atlanta; 2014.
 21. Global Adult Tobacco Survey Collaborative Group: **Global Adult Tobacco Survey (GATS): Core Questionnaire with Optional Questions**. *Centers Dis Control Prev*. 2010; [Reference Source](#)
 22. Neumark-Sztainer D, Story M, Hannan PJ, *et al.*: **Overweight status and eating patterns among adolescents: Where do youths stand in comparison with the Healthy People 2010 objectives?** *Am J Public Health*. 2002; **92**(5): 844–51. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 23. Hoelscher DM, Day RS, Kelder SH, *et al.*: **Reproducibility and validity of the secondary level School-Based Nutrition Monitoring student questionnaire**. *J Am Diet Assoc*. 2003; **103**(2): 186–194. [PubMed Abstract](#) | [Publisher Full Text](#)
 24. Reddy KS, Arora M, Kohli A, *et al.*: **Tobacco and Alcohol Use Outcomes of a School-based Intervention in New Delhi**. *Am J Health Behav*. 2002 May 1; **26**(3): 173–181. [PubMed Abstract](#) | [Publisher Full Text](#) | [Reference Source](#)
 25. Perry CL, Stigler MH, Arora M, *et al.*: **Preventing tobacco use among young people in India: Project MYTRI**. *Am J Public Health*. 2009; **99**(5): 899–906. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 26. Bassi S, Gupta VK, Park M, *et al.*: **School policies, built environment and practices for non-communicable disease (NCD) prevention and control in schools of Delhi, India**. Tadakamadla SK, editor. *PLoS One*. 2019 Apr 18; **14**(4): e0215365. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 27. StataCorp: **Stata Statistical Software. Release 12**. College Station, TX: StataCorp LP.; 2013.
 28. Ministry of Health and Family Welfare Government of India: **Comprehensive National Nutrition Survey**. 2016–2018. 2018. [Reference Source](#)
 29. Gulati A, Hochdorn A, Paramesh H, *et al.*: **Physical Activity Patterns Among School Children in India**. *Indian J Pediatr*. Springer; 2014; **81**: p. 47–54. [PubMed Abstract](#) | [Publisher Full Text](#) | [Reference Source](#)
 30. Rani J: **Impact of Nutritional Knowledge Status of Adolescents on their Health [Internet]**. *Int J Innovations Engineering Technology (IJJET)*. 2013; **3**. [Reference Source](#)
 31. Puwar T, Saxena D, Yasobant S, *et al.*: **Noncommunicable diseases among school-going adolescents: A case study on prevalence of risk factors from Sabarkantha District of Gujarat, India**. *Indian J Community Med*. 2018; **43**(5): 33. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#) | [Reference Source](#)
 32. Yadav S, Khokhar A: **Effect of information, education, and communication activity on health literacy of obesity and physical activity among school-going adolescents in Delhi**. *Indian J Community Fam Med*. 2020; **6**(1): 22. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#) | [Reference Source](#)
 33. Pahlm J, Svensson J, Joshi SK, *et al.*: **Physical activity and diet among adolescents of Kathmandu, Nepal: Knowledge and attitudes**. *J Kathmandu Med Coll*. 2014 Jun 18; **2**(2): 51–58. [Publisher Full Text](#)
 34. National Health Mission, Government of India: **COTPA 2003 and Rules made thereunder**. [Reference Source](#)
 35. Ministry of Health and Family Welfare Government of India: **National Tobacco Control Programme: Operational Guidelines**. New Delhi; 2015. [Reference Source](#)
 36. Ministry of Health and Family Welfare Government of India: **Guidelines for Tobacco Free Educational Institution (Revised)**. New Delhi; 2018.
 37. Ullah MZ, Lim JNW, Ha MA, *et al.*: **Smokeless tobacco use: Pattern of use, knowledge and perceptions among rural Bangladeshi adolescents**. *PeerJ*. 2018 Aug 21; **2018**(8): e5463. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#) | [Reference Source](#)
 38. Kotecha PV, Patel SV, Baxi RK, *et al.*: **Dietary pattern of schoolgoing adolescents in Urban Baroda, India**. *J Heal Popul Nutr*. 2013 Dec; **31**(4): 490–496. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 39. Kigaru DMD, Loechl C, Moleah T, *et al.*: **Nutrition knowledge, attitude and practices among urban primary school children in Nairobi City, Kenya: a KAP study**. *BMC Nutr*. 2015 Dec 29; **1**(1): 1–8. [Publisher Full Text](#)
 40. Arora M, Nazari GP, Gupta VK, *et al.*: **Association of breakfast intake with obesity, dietary and physical activity behavior among urban school-aged adolescents in Delhi, India: Results of a cross-sectional study**. *BMC Public Health*. 2012; **12**(1). [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 41. Ministry of Human Resource Development, Government of India: **Mid Day Meal Scheme**. [Reference Source](#)
 42. Andreyeva T, Long MW, Brownell KD: **The impact of food prices on consumption: A systematic review of research on the price elasticity of demand for food**. *Am J Public Health*. American Public Health Association; 2010; **100**: p. 216–22. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 43. Kavitha V, Umanath M, Paramasivam R, *et al.*: **Determinants of Consumption Probability and Demand for Fruits in India**. *Agric Econ Res Rev*. 2016; **29**(conf): 161. [Publisher Full Text](#)
 44. Darfour-Oduro SA, Buchner DM, Andrade JE, *et al.*: **A comparative study of fruit and vegetable consumption and physical activity among adolescents in 49 Low-and-Middle-Income Countries**. *Sci Rep*. 2018 Dec 1; **8**(1): 1–12. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#) | [Reference Source](#)
 45. Das JC: **Fast Food Consumption in Children: A Review**; [Reference Source](#)
 46. Li L, Sun N, Zhang L, *et al.*: **Fast food consumption among young adolescents aged 12–15 years in 54 low- and middle-income countries**. *Glob Health Action*. 2020 Dec 31; **13**(1): 1795438–1795438. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 47. Saha S, Vemula SR, Mendu VVR, *et al.*: **Knowledge and practices of using food label information among adolescents attending schools in Kolkata, India**. *J Nutr Educ Behav*. 2013 Nov 1; **45**(6): 773–779. [PubMed Abstract](#) | [Publisher Full Text](#)
 48. Guthold R, Stevens GA, Riley LM, *et al.*: **Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1.6 million participants**. *Lancet Child Adolesc Heal*. 2020 Jan 1; **4**(1): 23–35. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 49. Kumar SS, Shirley SA: **Association of screen time with physical activity and BMI in middle school children at Tamil Nadu, India**. *Int J Contemp Pediatr*. 2019 Dec 24; **7**(1): 78. [Publisher Full Text](#) | [Reference Source](#)
 50. Xi B, Liang Y, Liu Y, *et al.*: **Tobacco use and second-hand smoke exposure in young adolescents aged 12–15 years: data from 68 low-income and middle-income countries**. *Lancet Glob Heal*. 2016; **4**(11): e795–e805. [PubMed Abstract](#) | [Publisher Full Text](#) | [Reference Source](#)
 51. Ng M, Freeman MK, Fleming TD, *et al.*: **Smoking prevalence and cigarette consumption in 187 countries, 1980–2012**. *JAMA - J Am Med Assoc*. 2014 Jan 8; **311**(2): 183–192. [PubMed Abstract](#) | [Publisher Full Text](#) | [Reference Source](#)
 52. Narain R, Sardana S, Gupta S, *et al.*: **Age at initiation & prevalence of tobacco use among school children in Noida, India: A cross-sectional questionnaire based survey**. *Indian J Med Res*. 2011 Mar; **133**(3): 300–307. [PubMed Abstract](#) | [Free Full Text](#)
 53. John Hopkins Bloomberg School of Public Health, Milken Institute of Public Health: **Compliance with the Cigarette and Other Tobacco**

Products Act (COTPA) Results from 2012 and 2013: Maharashtra.
[Reference Source](#)

54. Lozano P, Barrientos-Gutierrez I, Arillo-Santillan E, *et al.*: **A longitudinal study of electronic cigarette use and onset of conventional cigarette smoking and marijuana use among Mexican adolescents.** *Drug Alcohol Depend.* 2017 Nov 1; **180**: 427–430.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
55. United Nations: **Sustainable Development Goals.** 2015.
[Reference Source](#)
56. Bay JL, Hipkins R, Siddiqi K, *et al.*: **School-based primary NCD risk reduction: education and public health perspectives.** *Health Promot Int.* 2017; **32**: 369–379.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Reference Source](#)
57. Fleary SA, Joseph P, Pappagianopoulos JE: **Adolescent health literacy and health behaviors: A systematic review.** *J Adolesc.* Academic Press; 2018; **62**: p. 116–127.
[PubMed Abstract](#) | [Publisher Full Text](#)
58. Magarey AM, Pettman TL, Wilson A, *et al.*: **Changes in Primary School Children's Behaviour, Knowledge, Attitudes, and Environments Related to Nutrition and Physical Activity.** *ISRN Obes.* 2013; **2013**: 1–10.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
59. Day RE, Sahota P, Christian MS: **Effective implementation of primary school-based healthy lifestyle programmes: A qualitative study of views of school staff.** *BMC Public Health.* 2019 Sep 9; **19**(1): 1239.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#) | [Reference Source](#)
60. Karkada S, Pai MS: **Concept of Health Promoting School.** *Manipal J Nurs Heal Sci.* 2016; **2**(2): 65–8.
[Reference Source](#)
61. Saraf DS, Gupta SK, Pandav CS, *et al.*: **Effectiveness of a School Based Intervention for Prevention of Non-communicable Diseases in Middle School Children of Rural North India: A Randomized Controlled Trial.** *Indian J Pediatr.* 2015; **82**(4): 354–362
[PubMed Abstract](#) | [Publisher Full Text](#)
62. Ministry of Health and Family Welfare and Ministry of Human Resource Development: **School Health Programme under Ayushman Bharat, Operational Guidelines.** New Delhi; 2018.
[Reference Source](#)
63. Arora M, Stigler MH, Reddy KS: **Effectiveness of health promotion in preventing tobacco use among adolescents in India research evidence informs the national tobacco control programme in India.** *Glob Health Promot.* 2011; **18**(1): 09–12.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
64. Bassi S: **Knowledge, Attitude and Behaviours (KAB) on diet, physical activity, and tobacco use among school students: Survey Dataset.** *figshare. Dataset.* 2021.
[Publisher Full Text](#)
65. Bassi S: **Knowledge, Attitude and Behaviours (KAB) on diet, physical activity, and tobacco use among school students: Survey Tool.** *figshare. Dataset.* 2021.
[Publisher Full Text](#)

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Nishibha Thapliyal

Department of Sports Science, Punjabi University Patiala, Patiala, Punjab, India

The paper "Knowledge, attitude and behaviours on diet, physical activity and tobacco use among school students: A cross-sectional study in two Indian states by Shalini Bassi *et.al.* looks at measuring the knowledge, attitudes and behaviours (KAB) of school children (grade 6) in relation to NCD behavioural risk factors, primarily unhealthy dietary intake, physical inactivity and tobacco use. This information gathered is the baseline evaluation of Project PaTHway (a 3-year school-based healthy lifestyle programme).

Overall, an interesting and impressive read. The strength of the paper lies in its massive contribution (KAB findings) towards limited literature of school-going children about NCDs awareness and also in providing emphasis to support the development of school-based health education programmes (policy) in India. However, since the subject population from rural areas (villages) could not be captured, it is suggested to be added as a limitation.

Abstract: It is an extremely well structured abstract with reasonable focus on the key areas.

Introduction: The introduction is sound and clearly demarcates the problem that will be addressed in the paper. The area of focus and the aims are easily identified. However, a little more on the prospective role of KAB as a tool to develop any kind of intervention programme can be added. A little on the current behavioural habits of school children can also be mentioned, including the reason for the selection of school children (specifically 6th grade) as the study population.

Methods: It is a well planned and thoroughly designed methodology, keeping in mind all permissions, clearance and consents requirement of a good study design. The credibility and validity of the tools have also been established. However, certain factors that could not be controlled (home environment) should be mentioned as a limitation. Also, the use of an additional supportive tool (like a food frequency or anthropometric) to decrease the reporting bias of a 'self-reporting survey' (also highlighted by the author) should be mentioned as a suggestive approach for future researches.

Results & Discussion: The results are extensive and logically sequenced with a simple and easy to understand presentation. All areas of interest (KAP of dietary intake, tobacco use and physical inactivity) have been clearly depicted. However, there are certain findings (results of fruit intake, screen time and consumption of outside food) that challenge the traditional findings/beliefs of people's behaviours that vary due to socioeconomic inequality. This could be due to the bias (subjects giving out socially approved answers) in self-reporting surveys (also listed as a limitation by the author) and can be added as a limitation in the study.

Conclusion: The findings of this project correctly identify the need for school-based lifestyle intervention programmes in terms of national policy planning for the prevention of NCD's. The conclusion is precise and clear.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Public health nutrition, physical activity, NCD, obesity

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 23 Sep 2021

Shalini Bassi, Public Health Foundation of India, Gurgaon, India

Overall, an interesting and impressive read. The strength of the paper lies in its massive contribution (KAB findings) towards limited literature of school-going children about NCDs awareness and also in providing emphasis to support the development of school-based health education programmes (policy) in India. However, since the subject population from rural areas (villages) could not be captured, it is suggested to be added as a limitation.

- **Response:** Suggestion accepted. Added a line in the limitation section.

Abstract: It is an extremely well structured abstract with reasonable focus on the key areas.

Introduction: The introduction is sound and clearly demarcates the problem that will be addressed in the paper. The area of focus and the aims are easily identified. However, a little more on the prospective role of KAB as a tool to develop any kind of intervention programme can be added. A little on the current behavioural habits of school children can also be mentioned, including the reason for the selection of school children (specifically 6th grade) as the study population.

- **Response:** Suggestion accepted, we have incorporated a justification for assessing a KAB at baseline. *"The baseline analysis of the KAB of the target population would provide better insight on the 'on-ground' situation and can guide the development of the intervention programme"*.
- We have included a justification of recruiting class 6th students under the Introduction section: *"Recruitment of sixth graders was done as the World Health Organization defines that adolescent age begins at 10 years. When a child enters adolescence, there is a change in explorative and emotive behaviors due to the shift from parental dependence to independence. Adolescents are vulnerable as they gain more control of what, when, how, and where they eat; moreover, their preferences and personal choices may gain priority over eating habits that are nurtured within the family setting"*.

Methods: It is a well-planned and thoroughly designed methodology, keeping in mind all permissions, clearance and consents requirement of a good study design. The credibility and validity of the tools have also been established. However, certain factors that could not be controlled (home environment) should be mentioned as a limitation. Also, the use of an additional supportive tool (like a food frequency or anthropometric) to decrease the reporting bias of a 'self-reporting survey' (also highlighted by the author) should be mentioned as a suggestive approach for future researches.

- **Response:** With context to the role of home environment in shaping the individual behavior has been added in the limitation section. We have also added the use of a food frequency questionnaire in the limitation section.

Results & Discussion: The results are extensive and logically sequenced with a simple and easy to understand presentation. All areas of interest (KAP of dietary intake, tobacco use and physical inactivity) have been clearly depicted. However, there are certain findings (results of fruit intake, screen time and consumption of outside food) that challenge the traditional findings/beliefs of people's behaviours that vary due to socioeconomic inequality. This could be due to the bias (subjects giving out socially approved answers) in self-reporting surveys (also listed as a limitation by the author) and can be added as a limitation in the study.

- **Response:** This information already exists in the limitation section: *"The self-reported method utilised (i.e., survey) also may have led to skewed estimates of dietary intake, physical activity and tobacco use patterns among the students due to the fact that adolescents would have wanted to report positive health behaviours (social desirability - reporting bias)."*

Conclusion: The findings of this project correctly identify the need for school-based lifestyle intervention programmes in terms of national policy planning for the prevention of NCD's. The conclusion is precise and clear.

- **Response:** Thanks.

Competing Interests: No competing interests

Reviewer Report 17 August 2021

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Subhash Pokhrel

Health Economics Research Group, Division of Global Public Health, Department of Health Sciences, Brunel University London, Uxbridge, UK

This is a well-written paper that provides data on the knowledge, attitude and behaviours of school students in two Indian states. Such data will provide a baseline against which the impact of any behaviour change intervention can be measured in the future. As such, this is a timely and valuable paper.

A few areas where the authors may want to improve on:

Abstract

1. Conclusions: The last few sentences are policy speculations, not study conclusions, so they may be better placed in the Discussion section instead (of course with some backup references there).

Methods

1. Setting: Purposive sampling technique - explain a bit further to explain how exactly the 20 schools were selected. What was the sampling frame (total number of schools) and how exactly did you balance various characteristics mentioned here.
2. Participants: The number given for the final sample size (n=1238) does not match the number given in the Results section. Need to rephrase this sentence.
3. Statistical analysis: A commentary needs to be added in the limitation section later saying that statistical tests are indicative only, as the sampling design was purposive (not random). Also, need justification for a t-test in the light of Likert-scale data.

Results

1. The presentation looks fine as this is largely descriptive data. However, I wonder whether additional analysis examining if the reported KAB differed by parental education and occupation may provide more helpful insights. In other words, would observed gender differences in KAB disappear (or the other way around) once you have controlled for parental education and/or parental occupation? Note that in the Discussion section (p.13, para 6), you hypothesise the habit of eating outside food may have been influenced by

parental occupation, among other things. Why not test these when you have collected your own data?

Discussion

1. Most space in the Discussion section has been devoted to compare and contrast study findings with wider literature, which is important but doing so has limited the ability for the study to provide valuable insights for policymakers in relation to answering “what next”. So, you may choose to summarise the comparison of your findings with the study results in addition to providing a succinct discussion as to how Indian (and wider South Asian) policymakers can go from here. For example, for the sake of the argument, if we followed COM-B model of behaviour change to design and implement interventions for this age group, how can the study results help us identify where capabilities, opportunities and motivations lie and how can adolescents be supported in their lacking space to change their behaviour. I think the rich discussion in this area makes this paper more useful.
2. A confusion/error, p.13, para 5: Seems to be a confusion between “price elasticity” and “income elasticity”. Please revise the sentence.
3. Limitations: Acknowledge that statistical tests are indicative only as the whole sample was purposive.

Conclusion

1. Strongly recommend revising the conclusion section. The sentences here must be backed up by the study findings and leave any speculative policies to the Discussion section above. An example conclusion may be: “In the two states of India, a higher proportion of school students know the harm of tobacco use than the benefits of a healthy diet and physical activity. Both gender of the student and which type of the school that the student went to influenced specific KABs but both the magnitude and direction of such influence were variable. The data suggests that there is an urgent need for designing and implementing interventions that can improve school students’ capability and motivation as well as create opportunities to change their unhealthy behaviours.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Public health, behaviour change, health economics

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 23 Sep 2021

Shalini Bassi, Public Health Foundation of India, Gurgaon, India

Abstract

1. Conclusions: The last few sentences are policy speculations, not study conclusions, so they may be better placed in the Discussion section instead (of course with some backup references there).

- **Response:** This has been revised as suggested. The conclusion highlighted the key study findings.

Methods

1. Setting: Purposive sampling technique - explain a bit further to explain how exactly the 20 schools were selected. What was the sampling frame (total number of schools) and how exactly did you balance various characteristics mentioned here.

- **Response:** Schools and colleges were selected based on the existing network of collaboration to represent different socio-economic statuses. This information has been incorporated under the setting section to make information comprehensible.

2. Participants: The number given for the final sample size (n=1238) does not match the number given in the Results section. Need to rephrase this sentence.

- **Response:** The line "Total sample of 1238 students (Pune: n = 806; Bengaluru: n = 432) were included in the present study" has been deleted. The existing lines under this section emphasized that 1238 students were eligible and invited to participate in the study. Out of 1238 eligible students, 1026 students participated, which is already highlighted in the result section.

3. Statistical analysis: A commentary needs to be added in the limitation section later saying that statistical tests are indicative only, as the sampling design was purposive (not random). Also, need justification for a t-test in the light of Likert-scale data.

- **Response:** Suggested accepted, added a line in the limitation section regarding purposive sampling. Each attitude statement was given a score and a mean score was calculated for this construct. This has been explained under the instrument and measure section. Thus, a t-test was used for this construct to do gender and school type comparisons within each city.

Results

1. The presentation looks fine as this is largely descriptive data. However, I wonder whether additional analysis examining if the reported KAB differed by parental education and occupation may provide more helpful insights. In other words, would observed gender differences in KAB disappear (or the other way around) once you have controlled for parental education and/or parental occupation? Note that in the Discussion section (p.13, para 6), you hypothesise the habit of eating outside food may have been influenced by parental occupation, among other things. Why not test these when you have collected your own data?

- **Response:** We anticipated doing this analysis, however, many of the students did not attempt the questions (missing response) related to their parental education and occupation.

Discussion

1. Most space in the Discussion section has been devoted to compare and contrast study findings with wider literature, which is important but doing so has limited the ability for the study to provide valuable insights for policymakers in relation to answering “what next”. So, you may choose to summarise the comparison of your findings with the study results in addition to providing a succinct discussion as to how Indian (and wider South Asian) policymakers can go from here. For example, for the sake of the argument, if we followed COM-B model of behaviour change to design and implement interventions for this age group, how can the study results help us identify where capabilities, opportunities and motivations lie and how can adolescents be supported in their lacking space to change their behaviour. I think the rich discussion in this area makes this paper more useful.

- **Response:** Some information on the applicability of the research findings exist in the discussion and is linked to the implications for Sustainable Development Goals and School Health Programmes by the Government of India. Further information has been added on the underlying theory of change models and linked with recommendations for the Government. Few comparative literatures has also been deleted.

2. A confusion/error, p.13, para 5: Seems to be a confusion between “price elasticity” and “income elasticity”. Please revise the sentence.

- **Response:** As suggested, revised.

3. Limitations: Acknowledge that statistical tests are indicative only as the whole sample was purposive.

- **Response:** Suggestion accepted and this has been incorporated in the limitation section.

Conclusion

1. Strongly recommend revising the conclusion section. The sentences here must be backed up by the study findings and leave any speculative policies to the Discussion section above. An example conclusion may be: “In the two states of India, a higher proportion of school students know the harm of tobacco use than the benefits of a

healthy diet and physical activity. Both gender of the student and which type of the school that the student went to influenced specific KABs but both the magnitude and direction of such influence were variable. The data suggests that there is an urgent need for designing and implementing interventions that can improve school students' capability and motivation as well as create opportunities to change their unhealthy behaviours.

- **Response:** Suggestion accepted and the conclusion has been revised.

Competing Interests: No

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