

# The Feasibility and Preliminary Efficacy of a School-based Intervention on the Health Cognition of Adolescents

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## Abstract

**Background:** The major modifiable risk factors for noncommunicable diseases are physical inactivity, food habits, alcohol, and smoking. The risk factors typically emerge during adolescence and extend to the later years of life. Even though several structural and proximal elements decide these health-related behaviors (HRBs), the thoughts and feelings attributed to the behavior mediate the interaction between the external environment and behaviors and are amenable to change. **Objectives:** The current study aimed to assess whether the school-based intervention improved health cognition such as knowledge, self-efficacy, intention, and locus of control of HRBs of adolescents. **Materials and Methods:** We used a quasi-experimental research design. One hundred and ninety-six students from four schools in an urban district were recruited into the intervention group ( $n = 112$ ) and waitlist group ( $n = 84$ ). The researchers developed questionnaires to assess knowledge, self-efficacy, and intention and used the Multidimensional Health Locus of Control Scale to evaluate the participants' locus of control. Outcomes were assessed at baseline, 1 month, and 3 months after the intervention. **Results:** Out of 196, 181 students completed the study. The intervention group had 106 students and waitlisted group had 76 students. Even though both groups showed improvement, Kendall's W analysis showed that the intervention group had a higher quantum of changes in the health cognitions than the waitlisted group over time. **Conclusion:** School-based intervention effectively changed the adolescents' health cognition.

**Key words:** Adolescent, health cognition, health-related behaviors, school intervention

## INTRODUCTION

Noncommunicable diseases (NCDs), including mental illnesses, contribute to significant morbidity and mortality worldwide.<sup>[1]</sup> The age of onset of NCD is typically a decade earlier in India, whereas it is in the age group of 55 and above, worldwide.<sup>[2,3]</sup> According to the World Health Organization, tobacco use, harmful use of alcohol, physical inactivity, and unhealthy diet are the major causes and modifiable risk factors of NCD.<sup>[4]</sup> The prevalence of tobacco and alcohol use in India was 32.8% and 15.9%, respectively, in an earlier study. Earlier research evaluating the risk factors for NCD in an Indian sample showed that 41.3% were physically inactive and a majority (98.4%) had less than five servings of fruits and/or vegetables per day.<sup>[5,6]</sup>

The risk factors, such as physical inactivity, unhealthy diet, and alcohol and tobacco consumption, typically start during adolescence.<sup>[7,8]</sup> Therefore, intervention during this

period can prevent the development of these health-related behaviors (HRBs) and the negative health consequences, thereafter. The proportion of the adolescent population is growing globally, with a current population of 1.3 billion making up to 16% of the world's population.<sup>[9]</sup> This emphasizes the need for adolescent-focused interventions. Neurobiology, hormonal changes, and other social determinants such as family, peer, community, society, and culture shape the HRBs of adolescents.<sup>[8,10]</sup> These factors are difficult to modify and usually require large-scale and policy-level intervention. However, the

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**Submitted:** 22-Sep-2023

**Revised:** 10-Mar-2024

**Accepted:** 09-Apr-2024

**Published:** 30-Jun-2025

**How to cite this article:** John S, Pandian D, Elangovan AR, Bhaskar A. The feasibility and preliminary efficacy of a school-based intervention on the health cognition of adolescents. *Indian J Public Health* 2025;69:172-7.

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**DOI:**  
10.4103/ijph.ijph\_1198\_23

thoughts and feelings attributed to the behavior mediate the interaction between the external environment and behaviors and are amenable to change.<sup>[11]</sup> Meta-analysis has shown that other than knowledge about the advantages and disadvantages of a behavior, intention, self-efficacy, and perceived behavior control explain more than 50% of the change in HRBs.<sup>[11]</sup>

Extant research shows that school interventions targeting lifestyle modification in adolescents found positive results. However, the interventions mostly addressed at-risk students with obesity<sup>[12]</sup> or measured only behavior changes and association with anthropometry and metabolic risk profiles.<sup>[13,14]</sup> All these interventions were multicomponent and required a longer time to complete. Therefore, the current study aimed to assess whether the school-based intervention alters health cognition such as knowledge, self-efficacy, intention, and locus of control of HRBs of adolescents. We hypothesized that the intervention would significantly increase the knowledge, self-efficacy, locus of control, and intention of adolescents in the intervention groups immediately and during follow-up assessments.

## MATERIALS AND METHODS

### Study design and setting

We adopted a quasi-experimental control group design for the study in 2018 and the study setting was the Urban district of Bengaluru. This design was chosen because of the following reasons. The first reason is the vast adolescent population spread across numerous schools in the Bengaluru Urban district. This renders a proper random sample selection with multistage sampling time-consuming, challenging, and practically difficult. The second reason was the challenge of getting permission from the school authorities to conduct the study in the school setting during various examinations.

### Study sample

Based on the “knowledge” score from the pilot study, at a 5% significance level and 80% power, the minimum sample size required was 180 for two-way repeated measures ANOVA. One hundred and ninety-six students from four schools were recruited for the study. One division from the 8<sup>th</sup>/9<sup>th</sup> standards was selected for the study, and one school gave two divisions. Two schools were allotted to the intervention group, and the other two to the waitlist group. Out of 196, 181 students completed the study. The medium of language, age, standard at which adolescents study, and syllabus of the teaching of the intervention group were matched to the adolescents in the waitlisted group. The outcomes were assessed at baseline, and follow-up assessments were conducted at the 1<sup>st</sup> and 3<sup>rd</sup> months after the intervention.

### Intervention

We developed the intervention following the Medical Research Council London framework for developing and evaluating complex interventions that involve development, feasibility, pilot testing, evaluations, and implementation.<sup>[15]</sup> We carried out a literature search to find out the evidence-based

intervention strategies that effectively brought changes in the HRBs of adolescents. In addition, the intervention incorporated findings from two focused group discussions (FGDs) with adolescent students and one FGD with the school counselors. Later, we shared the draft intervention with experts in the field and got it validated. Later, we pilot-tested the program with 47 adolescents and estimated recruitment and retention, sample size estimation feasibility, and practicality. The researchers also developed a fidelity checklist to ensure the presence of the components of intervention during the implementation, and the sessions were frequently monitored by the second and third authors using the checklist.

The intervention had 15 sessions, each session lasting for 40 minutes. The sessions were spaced across a month according to the time availability of the schools. The intervention started with icebreaking, discussing the importance of health, enhancing and taking charge of our health, and improving the internal locus of control of health. Following this, the intervention discussed physical activity, its types, benefits, and barriers to engagement. We also incorporated video demonstrations of physical activities for everyday practice and live demonstrations of physical activities in the program. Subsequently, the intervention discussed alcohol use, tobacco use, consequences, risk situations, dealing with risk situations, positive addiction, and healthy habits. The next part of the intervention covered types of foods, principles of healthy eating, and planning for healthy eating during everyday life. The intervention concluded with a planning session emphasizing significant lessons learned from the program, decisions made, and plans of action to implement the decisions.

The control group was not given any intervention during the research and the researchers visited them for assessments. However, once the research was over, we conducted a half-day session for the adolescents in the control group covered the content of the intervention and shared the content of the intervention in a booklet form with them.

### Outcome measures

#### *Multidimensional Health Locus of Control Scale*

This scale was used to assess the locus of control of the health of the adolescents. The instrument has 18 questions, with a six-point Likert response scale ranging from “strongly agree” to “strongly disagree.” It contains three subscales: internal, chance, and powerful others.<sup>[16]</sup> The scale was validated in the Indian setting and had high internal consistency (internal  $\alpha=0.613$ , chance  $\alpha=0.690$ , and powerful others  $\alpha=0.588$ ).<sup>[17]</sup>

The researchers developed self-administered questionnaires to assess knowledge, self-efficacy, and intention about physical activity, tobacco and alcohol use, and eating habits. First, the researchers reviewed the available literature to conceptualize the constructs and generate items for the tools. Once the items were generated, the researcher gave the tools to seven experts for face validity and content validity. They evaluated each item on relevance and appropriateness on a 5-point Likert scale. The items in the tools were finalized based on the feedback of the

experts. Later, we administer the tools to 52 adolescents in a school for internal consistency reliability. The same tools were administered to the adolescent group again after two weeks to check the test–retest reliability [Table 1].

**Statistical analysis**

Data were analyzed using the IBM Statistical Package for the Social Sciences (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.). The Spearman correlation was carried out to determine the test–retest reliability score of the questionnaires. The normality of the study variables was tested using the Shapiro–Wilk test and the data were not normally distributed. An Independent sample *t*-test was conducted to see the age difference between groups. Chi-square test/Fisher’s test was done to ascertain the association between demographic variables and HRBs between groups at baseline. Friedman test was utilized for the hypotheses testing and the changes over time of the outcome variable in the intervention and the waitlisted groups. Pair-wise comparisons were performed after the Friedman test to see the changes between specific time points. Kendall’s W was done to know the intervention’s effect size on the outcome variables.

**Ethical consideration**

The research protocol obtained approval from the Institute Ethics Committee of the National Institute of Mental Health and Neuro Sciences (NIMHANS), Bengaluru. All the children, teachers, and parents were oriented to the study’s aim and objectives, including the children’s right to withdraw from the study at any point. Informed assent was obtained in writing from each study participant, and informed consent was obtained from the parents/guardians. Confidentiality was ensured and maintained by not revealing the identity and the information of the participants.

**RESULTS**

The study could not collect parents and family-related sociodemographic data because some schools and parents were uncomfortable sharing their background information [Table 2]. The Chi-square test result showed a statistically significant difference in the distribution of gender and religion across groups ( $P < 0.05$ ).

The Chi-square test showed no significant difference ( $P > 0.05$ ) between groups in the involvement of sports and games in the school [Table 3]. For the intervention group, 15.10% of adolescents ever tried alcohol products, and 22.70% of adolescents in the waitlisted group also ever tried alcohol products. 7.50% of adolescents in the intervention group tried tobacco products, whereas 4.00% of adolescents from the

waitlisted group tried tobacco products, and the differences were not statistically significant ( $P > 0.05$ ). Similarly, there were significant differences between the groups in being physically active and consumption of vegetables, fish, and meat.

**Knowledge**

*Group effect*

There was a statistically significant difference between the mean scores of the intervention group and the waitlisted group at postassessment and follow-up assessment ( $P < 0.025$ ). The intervention group had higher (better) mean scores at postassessment and follow-up assessments [Table 4].

*Time effect*

In the intervention group, changes were reported from pretest to posttest, pretest to follow-up, and posttest to follow-up, while the waitlisted group had changed from pretest to posttest. The effect size measures indicated that the intervention group had a higher quantum of changes (0.801) than the waitlisted group (0.052).

**Self-efficacy**

*Group effect:* In the postassessment, the mean score of the intervention group ( $146.63 \pm 12.11$ ) was higher than the mean score of the waitlisted group ( $124.47 \pm 18.87$ ). Similarly, the mean score of the intervention group ( $138.34 \pm 10.41$ ) was higher than the mean score of the waitlisted group ( $129.56 \pm 5.1$ ) in the follow-up assessment, and these differences were statistically significant [Table 4].

*Time effect:* In the intervention group, the change was observed from pretest to posttest, pretest to follow-up test, and posttest to follow-up test. The size of the changes in the group was large (0.772).

**Intention**

*Group effect:* We observed a statistically significant difference ( $P < 0.05$ ) between the groups on the mean score at postassessment. The mean score of the intervention group ( $46.77 \pm 5.74$ ) at postassessment was higher than that of the waitlisted group ( $40.88 \pm 7.12$ ).

*Time effect:* Significant improvements were observed in the intervention group from pretest to posttest, pretest to follow-up, and posttest to follow-up [Table 4]. Kendall’s W result showed that the intervention group had a larger change (0.735) than the waitlisted group (0.007).

**Internal locus of control**

*Group effect*

The difference between the groups’ mean scores at postassessment was statistically significant, where the

**Table 1: Summary of the process of tool construction**

Areas	Items	Cronbach ( $\alpha$ )	Test–retest	Response	Interpretation
Knowledge	45	0.744	0.694	Yes, no, I don’t know	The higher the score better the knowledge
Self-efficacy	40	0.762	0.560	Never, sometimes, most of the time, always	The higher the score better the self-efficacy
Intention	10	0.653	0.636	I don’t plan to do, I want to, I need to, I will, I already do	The higher the score higher the intention

**Table 2: Between-group comparison of demographic details and outcome variables at baseline**

Variable	Category	Group		Test statistic	P
		Intervention n (%)	Waitlisted n (%)		
Gender	Boys	48 (49.50)	49 (50.50)	7.001	0.008
	Girls	58 (69.00)	26 (31.00)		
Religion	Hindu	89 (58.20)	64 (41.80)	10.977	0.009
	Christian	5 (41.70)	7 (58.30)		
	Muslim	10 (100.00)	0		
	Others	2 (33.30)	4 (66.70)		
Age (years)		13.44 (0.81)	13.53 (0.58)	3622.00	0.266

**Table 3: Health-related behaviors of adolescents**

Variables	Responses	Group		Test statistic	P
		Intervention number (%) / Median (range)	Waitlisted number (%) / Median (range)		
Involvement in sports/games	Yes	73 (54.50)	61 (45.50)	3.55 <sup>a</sup>	0.060
	No	33 (70.20)	14 (29.80)		
Ever tried alcohol	Yes	16 (15.10)	17 (22.70)	1.69 <sup>a</sup>	0.194
	No	90 (84.90)	58 (77.30)		
Ever tried tobacco	Yes	8 (7.50)	3 (4.00)		0.367
	No	98 (92.50)	72 (96.00)		
Physical activity		3 (1–7)	5 (1–7)	3124.50 <sup>b</sup>	0.013
Fruit consumption		2 (0–6)	2 (0–6)	3709.50 <sup>b</sup>	0.427
Vegetable consumption		3 (0–6)	4 (0–6)	2611.00 <sup>b</sup>	<0.001
Meat and fish		2 (0–6)	0 (0–6)	3204.50 <sup>b</sup>	0.021
Consumption of soft drink		2 (0–6)	0 (0–6)	2272.50 <sup>b</sup>	<0.001
Consumption of fast food		2 (0–7)	2 (0–7)	3215.00 <sup>b</sup>	0.024

<sup>a</sup>Chi-square test/Fisher's test, <sup>b</sup>Mann-Whitney-test, Intervention group N=106, Significance level at P=0.05, Waitlisted group N=75

intervention group had higher scores ( $P < 0.05$ ). There was no significant difference between groups at follow-up assessment where the waitlisted group's mean score increased, and the intervention group's mean score decreased from the postassessment score.

#### Time effect

In the domain of "Internal," both groups had statistically significant increases over a period of time ( $P < 0.05$ ). However, the intervention group had higher changes (0.467) than the waitlisted group (0.046).

#### Chance locus of control

##### Group effect

In this domain, a lesser score means better control. The test result showed that the difference between the mean scores of groups at postassessment was significant ( $P < 0.05$ ), where the mean score of the intervention group ( $16.51 \pm 4.65$ ) was lesser than the waitlisted group ( $19.21 \pm 5.05$ ). However, the mean score of the intervention increased from post to follow-up, the mean score of the waitlisted group came down from postfollow-up assessment, and the difference between groups at follow-up was insignificant ( $P > 0.05$ ) [Table 4].

##### Time effect

Test results in the "chance locus of control" reported that the intervention group had a significant reduction over a period of

time ( $P < 0.025$ ), and the waitlisted group did not have a significant change ( $P > 0.025$ ). The Kendall's W result reported that the intervention group had a higher quantum of changes (0.332) than the waitlisted group (0.002). Hence, it can be concluded that the intervention was effective in bringing a significant reduction in "chance locus of control" over a period of time.

#### Powerful others

##### Group effect

The study reports no group effect.

##### Time effect

Both groups had significant reductions over a period of time. However, the amount of reduction in the intervention group was higher than the waitlisted group [Table 4].

## DISCUSSION

In this study, we found significant improvement in the health cognition of the adolescents. The primary focus of the study was to see whether the intervention improved the knowledge about adolescents' HRBs. After adjusting the baseline differences, the intervention group had a higher percentage of increase in knowledge than the waitlisted group. While looking at similar studies, it was shown that most preventive and promotive interventions addressed knowledge, and knowledge was one of the major determining factors of adolescents' health behaviors.<sup>[18,19]</sup>

**Table 4: Comparison between groups on changes in outcome variables over a period of time**

Variables	Group	Pretest (T1) Mean (SD)	Posttest (T2) Mean (SD)	Follow-up (T3) Mean (SD)	Within-group comparison		Effect size**	Significant pair-wise comparison
					Test statistic	P*		
Knowledge	Experiment	23.67 (5.91)	41.25 (3.91)	37.58 (3.86)	169.91	<0.001	0.801	T1 versus T2, T1 versus T3, T2 versus T3
	Waitlisted	31.27 (5.03)	31.76 (5.76)	31.76 (5.37)	7.804	0.020	0.052	T1 versus T3
	Between-group comparison	<0.001	<0.001	<0.001				
Self-efficacy	Experiment	112.39 (12.81)	146.63 (12.11)	138.34 (10.41)	164.00	<0.001	0.772	T1 versus T2, T1 versus T3, T2 versus T3
	Waitlisted	125.42 (13.30)	124.47 (18.87)	129.56 (5.1)	2.86	0.240	0.019	
	Between-group comparison	<0.001	<0.001	<0.001				
Intention	Experiment	30.57 (6.84)	46.77 (5.74)	44.54 (4.93)	155.92	<0.001	0.735	T1 versus T2, T1 versus T3, T2 versus T3
	Waitlisted	40.65 (6.86)	40.88 (7.12)	41.72 (8.10)	1.05	0.592	0.007	
	Between-group comparison	<0.001	<0.001	0.075				
Internal LC	Experiment	23.19 (5.47)	31.17 (4.23)	29.79 (5.58)	99.00	<0.001	0.467	T1 versus T2, T1 versus T3, T2 versus T3
	Waitlisted	28.97 (4.00)	28.73 (4.47)	30.37 (4.41)	6.95	0.031	0.046	T2 versus T3
	Between-group comparison	<0.001	<0.001	0.851				
Chance LC	Experiment	21.66 (5.20)	16.51 (4.65)	19.03 (4.80)	70.29	<0.001	0.332	T1 versus T2, T1 versus T3, T2 versus T3
	Waitlisted	19.30 (4.18)	19.21 (5.05)	18.84 (5.14)	0.343	0.843	0.002	
	Between-group comparison	<0.001	<0.001	0.851				
Powerful others LC	Experiment	26.28 (6.34)	22.30 (5.64)	22.91 (6.22)	40.86	<0.001	0.193	T1 versus T2, T1 versus T3, T2 versus T3
	Waitlisted	24.93 (5.51)	22.92 (4.56)	22.52 (5.60)	9.48	0.009	0.063	T1 versus T2, T1 versus T3
	Between-group comparison	0.102	0.421	0.496				

\*Significance level at 0.025, Bonferroni corrected. \*\*Kendall's W to see the effect size. Intervention group N=106, waitlisted group N=75. SD: Standard deviation, LC: Locus of control

During the baseline assessment, adolescents were unaware of the nature and content of alcohol and tobacco, the significant health consequences of substance use, different types of food items, different types of physical activities, and the dosage of physical activities. The content of the intervention was derived from documents, and FGDs with experts were validated by experts. Systematically planned and scientifically developed interventions improved the knowledge and changed the target population.<sup>[15,20]</sup> We incorporated participatory learning techniques that involved and motivated learners by focusing on their experiences and skills, using examples and situations from their daily lives, and using new, enjoyable, and visual teaching methods. Participatory learning is found to be more effective than formal teaching.<sup>[21]</sup>

School-based studies focusing on HRBs, and lifestyles of adolescents addressed self-efficacy as a significant outcome variable. They could bring changes in self-efficacy,<sup>[22-24]</sup> and the current study findings corroborated the earlier findings. Self-efficacy is learned from task accomplishment, vicarious experiences (modeling), and verbal persuasion.<sup>[25]</sup> As part of the intervention, the researchers listed the significant risk situations and hurdles to follow a healthy lifestyle and trained the students on the skills needed to deal with these situations.

Games, skill training, demonstration and practical sessions of physical activities, hands-on experience with types of food, and brainstorming were carried out to identify and develop appropriate skills required for the adolescents. Imparting information about advantages and disadvantages and the expected outcome of behavior also improves an individual's self-efficacy.<sup>[26]</sup>

An individual's intention is determined by the perceived benefits of performing a behavior, perceived social pressure to achieve the behavior, and a high level of self-efficacy.<sup>[26]</sup> The intervention imparted knowledge regarding HRBs to adolescents, and learning has shown significant improvement. Similarly, self-efficacy regarding each HRB was also improved after the intervention. The intervention process could have worked as a social pressure and influenced the adolescents' intentions. Specific intervention strategies like "activity planner" also would have contributed to the increase in the adolescent's intention.

Both groups showed an increase in the "internal locus of control" of health, and in the case of the "chance locus of control," only the intervention group reported a significant reduction over time. In "locus of control by powerful others," both groups reported a decrease over time. However, the intervention group had a higher quantum of change in all the domains of locus of

control. Previous studies have shown a mixed result in the locus of control. Research on social cognition, especially on locus of control, reported that adolescents with a stronger internal locus of control paid more attention to healthy behaviors. Adolescents with a stronger belief in health professionals and family members also showed a stronger association with healthy behaviors. Adolescents with more confidence in chance factors had unhealthy behaviors.<sup>[27,28]</sup> A study on adolescents' dietary behavior reported that locus of control of health was associated with changes in HRBs.<sup>[29]</sup> The study findings give us a positive direction in bringing changes in the HRBs of adolescents and preventing chronic and disabling NCD, including mental health conditions.

The research has observed baseline differences in gender, education, and outcome variables between the groups. Instead of a convenient sampling, a multistage stratified cluster sampling would have resulted in a representative sample of the adolescent population. The study had a small 3-month follow-up period, which was a very short duration. A research design with a longer follow-up time could have given a better result of changes in the behaviors of adolescents. The intervention development process followed a series of steps, from the systematic review of evidence to pilot testing of the intervention. Intervention strategies were carefully planned in the FGD with experts. The research was carried out following the pretest and posttest with a control group design. The research design helped the researcher to state the effectiveness of the intervention.

## CONCLUSION

The results indicated that the intervention group had significant improvement in health cognitions than the waitlisted group after the intervention. The study's findings are significant as they provide insights into designing school-based programs that can promote better HRBs among adolescents to prevent NCD.

## Financial support and sponsorship

The research work was carried out as part of the UGC-JRF for Ph.D.

## Conflicts of interest

There are no conflicts of interest.

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