Research Article

Effectiveness of Educational Intervention to Modify the Intentions Regarding the Risk Factors of Cardiovascular Diseases Among School Teachers in Arghakhanchi, Nepal

Yamuna Marasini[1], Niranjan Shrestha[1], Abhinav Vaidya[2], Pomawati Thapa[3], Rudra Prasad Marasini[4], Sita Aryal[1], Ashok Pandey[5], Tulsi Ram Bhandari[1]

1. Pokhara University, Nepal; 2. Department of Community Medicine, Kathmandu University, Nepal; 3. Non-Communicable and Mental Health Section, Epidemiology and Disease Control Division, Nepal; 4. National Trauma Centre, Nepal; 5. Policy Research Institute, A Government Think Tank, Nepal

Introduction: Cardiovascular disease (CVD) is a leading cause of mortality worldwide. This study aimed to evaluate the effectiveness of educational intervention on the intention to modify CVD risk factors among school teachers based on a Theory of Planned Behavior (TPB).

Study Design: A quasi-experimental study.

Method: The study was conducted from November 2023 to September 2024, and enrolled 120 teachers from 6 schools of Arghakhanchi, Nepal. It was a quasi-experimental design with pretest and posttest control groups. The intervention group received a 50-55-minute lecture session, enhanced by audio-visual materials, focused on CVD risk factors, while the non-intervention group did not receive any intervention. The effect was analyzed by comparing the changes in the theory of planned behaviour (TPB) constructs between and within non-intervention and intervention groups. The difference in scores within and between groups was tested using student t-test. Adjusted Difference-in-Difference was calculated through linear regression. Data were entered into Epi-Data version 3.1 and analyzed using R 4.4.1.

Results: The intervention group demonstrated significant improvements in the knowledge score (Cd: -1.522, p = < 0.001) and in the intention to modify CVD risk factors (Cd: -1.159, p = < 0.001). The adjusted increase in mean scores resulting from the interaction of time and intervention ranged from 1.936 to 7.856. The greatest gain was observed in the intention score (beta = 7.856, 95% CI:

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6.696-9.016), while the smallest improvement was seen in subjective norms (beta = 1.936, 95% CI: 0.566-3.307).

Conclusion: The theory-based educational intervention was found effective for modifying the intention of risk factors of CVDs. The findings indicate that the school-based intervention package could be useful in encouraging teachers to reduce unhealthy behaviors related to CVDs.

Corresponding author: Yamuna Marasini, marasiniyamuna@gmail.com

Introduction

Globally, Cardiovascular diseases (CVDs) are responsible for a significant number of fatalities each year with more than 17.9 million lives lost annually[1][2][3]. By 2030, CVDs are expected to result in approximately 23.6 million deaths, with about 80% of these fatalities taking place in low- and middle-income nations[4]. WHO has reported that more than three- quarters of CVDs deaths occur in low and middle-income countries[5][6]. In Nepal, premature deaths from non- communicable diseases (NCDs) have increased from 51% in 2010 to 71% in 2019[7]. The percentage of deaths due to NCDs continues to rise, with (CVDs) accounting for 30% of these fatalities[8]. Cardiovascular disease includes conditions that impact the blood vessels, heart and brain, such as stroke, heart attacks and arterial disorders. Risk factors for CVDs are generally classified into two main categories: modifiable and non-modifiable. Non- modifiable risk factors are inherent characteristics such as age, ethnicity, and family history. On the other hand modifiable risk factors, that can be changed through behavior adjustments[9][10][11][12][13]. The leading NCD risk factor in terms of attributable deaths is raised blood pressure (accounting for 13% of global deaths), followed by physical inactivity (6%), raised blood glucose (6%), tobacco use (9%), and overweight and obesity (5%)[5][14][15].

The Theory of Planned Behaviour (TPB), is a theoretical framework that outlines key constructs influencing health behaviors: attitude, subjective norms, perceived behavioral control, and intentions[16]. Lifestyle changes are essential for managing and preventing CVDs. Reducing overweight, promoting healthy habits and increasing exercise could prevent up to 80% of CVDs[17]. TPB-based interventions have been found effective in modifying the intention of risk factors of CVDs[18][19][20]. The sedentary nature of teaching profession increases the risk of NCDs diseases, including cardiovascular diseases[21][22][23]. A study conducted on Flemish secondary school teachers

in Belgium found that their perceived health levels are low, making them a key target group for health improvement interventions[21]. A cross-sectional survey in Nigeria found that only 47.8% of secondary school teachers had adequate knowledge of heart diseases. However, their attitudes and at-risk behaviors were also unsatisfactory, with weighted means of 2.34 and 2.23, below the criterion of 2.5[24].

TPB-based interventions have been found effective in modifying the intention of CVDs' risk factors. Despite their vulnerability of risk factors of CVDs among school teachers, there were limited studies. The school serves as a place for students to socialize, gain knowledge, and adopt healthy behaviors from teachers, while also protecting them from developing cardiovascular diseases which could potentially be transmitted to students[25]. The primary goal of this study was to assess how effective a school-based intervention program was in addressing risk factors for cardiovascular diseases, using the TPB model. The focus for change among public school teachers in Arghakhanchi district, Nepal will be on modifiable risk factors such as physical inactivity, smoking, alcohol consumption, unhealthy diet, obesity, and hypertension.

Materials and Methods

Study design and participants

A quasi-experimental (pretest-posttest control group) study was designed to test the educational intervention's effectiveness on intention to modify CVD risk factors among teachers at public schools in Arghakhanchi, Nepal, from November 2023 to September 2024. The intervention period was from May to June, lasting 8 weeks. The required sample size was 60, calculated using the intervention study formula $n=((z_{1-\alpha/2}+z_{\beta})^2\sigma^2\times2)/\epsilon^2$ through Open-Epi software, where $z_{1-\alpha/2}$=1.96 at a 95% confidence level, z_{β}=0.84 at 80% power of the study, mean desired change in physical activity intention (ϵ) = 0.64, and adding a 5% nonresponse rate to the calculated sample size[19][26][27][28].

Selection criteria: Teachers aged 25 years and above, not on cardiovascular medication, and willing to participate were included. Exclusions comprised teachers physically challenged, or with serious medical conditions like heart disease or asthma.

Study process (Flow diagram)

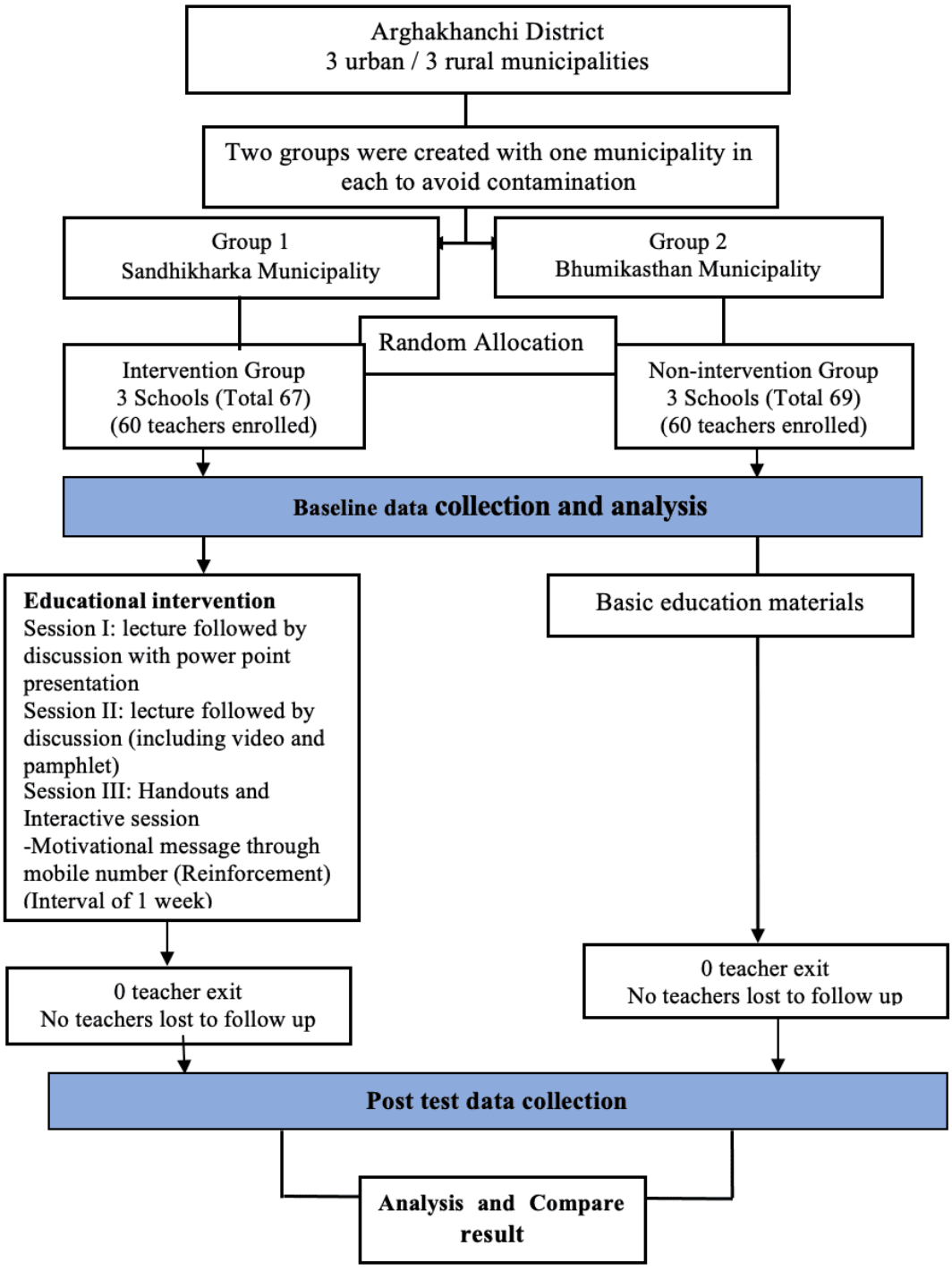

Figure 1. Flow chart of participant enrolment.

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Intervention description: The Theory of planned behaviour served as the theoretical framework for creating a CVDs intervention package specifically designed for teachers[29]. The TPB constructs, including attitude, subjective norms, perceived behavioral control, and behavioral intention toward modifying CVDs risk factors, were considered when designing the educational intervention package. The CVDs promotion package was developed in a five-step process. This approach, utilized globally for designing strategic health communication programs since 1991, was enhanced in 2003[30]. TPB-based interventions are effective as it has constructs that lead to intention and behaviour[19]. Five steps have included: analysis, intervention strategies design, intervention development and testing, and monitoring and evaluation. The content of the package primarily promotes physical activity and the consumption of a healthy diet in their daily routines. The intervention package was also created by drawing on information from previously published books, pamphlets, guidelines, and videos from the National Health Education, Information and Communication Center and World health organization (WHO)[31].

Sessions/Time	Content	Construct	Presentation
1st and 2nd (50-55 minutes)	Welcome, introduction and objectives of the session	Lecture PowerPoint slides	
	CVD and its risk factor's introduction to cardiovascular disease and its sign and symptoms, diagnosis and future complications	Knowledge - Attitude	Interactive lecture PowerPoint slides
3rd and 4th (50-55 minutes)	A 50-year-old teacher diagnosed with cardiovascular disease was invited to share his story and talk to the topics about the cardiovascular diseases Benefits of consuming fruits and vegetables and the risk of smoking and excessive alcohol consumption Importance of friends and family in the prevention of CVD risk factors	Attitude and Subjective norms	Interactive lecture Group discussion Power Point slides, Pamphlets, Text message
	Types of physical activities how people with disability are involved in Physical activities, pictures of physically active personalities, Stories of quitting smoking and alcohol.	Perceived behaviour control and Intention	Interactive lecture PowerPoint slides, Pamphlets, Video show, Text message
5th (60 minutes)	Types of physical activities promoted in the package The previous sessions were reviewed and the participants were provided with educational materials	Hamstring stretches, Abdominal crunches, Lunge with twist jumping jacks, Side arm and leg raise, Push-ups, Sit and reach, sit-ups, Knee to chest, Leg raise.	

Table 1. Components and types of CVDs promoted in educational intervention package

Measures

Behavioral and Biological Characteristics: Behavioral risk factors were evaluated, including physical activity, BMI, diet and blood pressure. Individuals who reported engaging in at least 150-300 minutes of moderate-intensity exercise and 75-150 minutes of vigorous-intensity exercise per week were classified as physically active. Those with systolic blood pressure (SBP) ≥140 mm Hg and/or diastolic blood pressure (DBP) ≥90 mm Hg were categorized as hypertensive. Overweight was defined as a BMI of 25.0 or greater, and obesity was defined as a BMI of 30.0 or greater. Additionally, a diet exclusively composed of fruits and vegetables was assessed. The questionnaire was adapted from the WHO STEPS survey[32].

Validity and Reliability of the Tools: The development of these tools involved input from a panel of experts, encompassing public health specialists, experts of cardiovascular health, professionals in health education and promotion and school teachers. The process adhered to the guidelines for developing TPB-based questionnaires[16][33][34][35][36].The study team confirmed the face and content validity of the tools in accordance with measurement guidelines aligned with the conceptual definition of the constructs. Content validity was assessed using the Lawshe method to ensure the contextual relevance of questions/items in the country's settings and to ascertain essential items in each construct of the TPB for the calculation of intention scores. Only items scoring 1 and 0.6 were included in the study, while items scoring 0.2 were excluded from the tool.

Data were collected by a single trained enumerator using the same tools. Before the study, the tools underwent pretesting in a non-study school. The internal consistency of the questions about the constructs of TPB with Likert scales was evaluated using Cronbach's alpha (α). The alpha value for each construct exceeded 0.8, indicating sufficient reliability.

Data analysis: Errors in data entry were minimized through careful data entry and by applying checks in Epi-Data version 3.1, while analysis was conducted using R 4.4.1. Descriptive statistics included reporting both quantitative and qualitative variables, using frequency (percentage) as well as mean and standard deviation. To compare baseline and post-test behavioral and biological characteristics related to cardiovascular health between the intervention and non-intervention groups, we employed the independent sample t-test for quantitative variables and the Chi-square test for categorical variables. Within each group, we used the paired t-test to compare baseline and post-test characteristics for quantitative variables. Effect size was determined by utilizing Cohen's D. In every

quantitative analysis, a p-value below 0. 05 was estimated as statistically significant, pointing towards notable variances either between groups or within groups across time. To calculate the adjusted interaction between time and intervention, regression modeling was used with the formula: $Y = \beta 0 + \beta 1*(\text{time intervention}) + \beta 2(\text{covariates}) + \varepsilon$, where Y represents the total mean score, and $\beta 1$ represents the Difference-in-Difference (DiD) effect. The covariate includes Age, marital status, education, attitudes, subjective norms, perceived behavioural control.

Ethical Consideration: Ethical approval was obtained from the Pokhara University – Institutional Review Committee (Ref No. 130/2080/81 and Date: BS. 2081/01/14 AD. 26/04/2024) and approval was also obtained from municipalities and school authorities. A written and signed informed consent was obtained from all participating teachers. To ensure confidentiality, a code number was given to each teacher in both the intervention and non-intervention groups, and they were asked to use the codes on their completed questionnaires.

Results

There were no statistically significant differences among the two groups in socio-demographic, teaching-related, and CVD-related characteristics (Table 2). Compared to the non-intervention group the intervention group had significant improvements in physical activity (effect size: -0.472, p =0.012) (Table 3). The intervention group demonstrated significant improvements in the knowledge score (effect size: -1.522, p = < 0.001) and in the intention to modify CVD risk factors (effect size: -1.159, p = < 0.001). The unadjusted (DiD) mean scores ranged from 1.04 to 6.67 points, with increases of 3.69% to 26.63%. The highest unadjusted DiD was observed in the intention score, which increased by 26.63%. The unadjusted DiD point score was seen in the knowledge score, which increased by 2.88 points, representing a 19.93% improvement from the baseline score in the intervention group (Table 4).

The adjusted increase in mean scores resulting from the interaction of time and intervention ranged from 1.936 to 7.856. The greatest gain was observed in the intention score (beta = 7.856, 95% CI: 6.696-9.016), while the smallest improvement was seen in subjective norms (beta = 1.936, 95% CI: 0.566-3.307) (Table 5).

Characteristics	Intervention group n (%) (n=60)	Non Intervention group n (%) (n=60)	χ^2 p-value
Age category (years)			
Adult (26-44)	45(75.0)	44(73.3)	1.000
Middle age (45-59)	15(25.0)	16(26.7)	
Mean age ± SD	39.70±8.73	39.30 ±9.16	
Gender			
Male	37(61.7)	33(55)	1.000
Female	23(38.3)	27(45)	
Marital status			
Unmarried	8(13.3)	7(11.7)	0.958
Married	52(86.7)	50(83.3)	
Others	-	3(5.0)	
Ethnic group			
Advantages	53(88.3)	48(80.0)	0.941
Relatively advantages	7(11.7)	7(11.7)	
Others	-	5(8.3)	
Educational level			
Proficiency or certificate level	14 (23.3)	9(15.0)	0.966
Bachelor level	19 (31.7)	19(31.7)	
Post graduate and above	27 (45.0)	32(53.3)	
Teaching-related characteristics			
Current position/level			
Primary level	17(28.3)	18(30.0)	0.806
Basic level	22(36.7)	21(35.0)	

Characteristics	Intervention group n (%) (n=60)	Non Intervention group n (%) (n=60)	χ^2 p-value
Secondary level	21(35.0)	21(35.0)	
Teaching subject			
Health subject	7(11.7)	2(3.3)	0.166
Others	53(88.3)	58(96.7)	
Type of teaching profession			
Permanent	26 (43.3)	29 (48.3)	1.000
Temporary	16 (26.7)	11 (18.3)	
Relief Teacher	15 (25.0)	15 (25.0)	
Others	3(5.0)	5 (8.3)	
Duration in teaching profession in completed years			
1-5	8(13.3)	16(26.7)	0.967
5-10	7(11.7)	14(23.3)	
>10	45(75.0)	30(50.0)	
CVD-related characteristics			
Physical Activity (self-reported)			
< 75 minutes of moderate and /or vigorous exercise/week	15(25.0)	15(25.0)	0.539
75-150 minutes of moderate and/or vigorous exercise/week	36(60.0)	32(53.3)	
>150 minutes of moderate and /or vigorous exercise/week	9(15.0)	13(21.7)	
Fruits and vegetable consumption (Serving/day)			
Consume1-2 serving of fruit/vegetables daily	5(8.3)	6(10.0)	0.081
Consume 3-4 serving of fruit/vegetables daily	24(40.0)	35(58.3)	

Characteristics	Intervention group n (%) (n=60)	Non Intervention group n (%) (n=60)	χ^2 p-value
Consume>4 serving of fruit/vegetables daily	31(51.7)	19(31.7)	
BMI category			
18.5-24.99 (Normal Weight)	18(30.0)	20(33.3)	0.806
25.0-29.99 (Overweight)	34(56.7)	29(48.3)	
>30 (Obesity)	8(13.3)	11(18.3)	
Raised blood pressure (mm of Hg)			
SBP>140 and/or DBP>90	19(31.7)	17(28.3)	0.941
SBP 130-139.99 and/or 85-89.99	8(13.3)	10(28.3)	
SBP120-129.99 mmHg and/or DPB 80-84.99	20(33.3)	19(31.7)	
SBP<120 and/or <80	13(21.7)	14(23.3)	
Tobacco user			
Yes	11(18.3)	7(11.7)	0.444
No	49(81.7)	53(88.3)	
Alcohol consumption			
Yes	20(33.3)	21(35.0)	1.000
No	40(66.7)	39(65.0)	

Table 2. Distribution of the study participant according to their background characteristics (n=120)

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Variables	Intervention Group Mean ±SD	Non-intervention Group Mean ±SD	p-value	Effect size
Fruits and vegetable consumption (servings/day)				
Before Intervention	4.17±1.42	3.93±1.14	0.02[a]	0.043 [c]
After the intervention	4.55±1.50	3.95±1.35	0.186[a]	-0.293 [c]
p value	0.109[b]	0.310[b]		
Effect size	-0.277 [c]	0.199 [c]		
Physical activity (min/week) self-reported				
Before Intervention	87.42±57.05	120.25±80.46	0.05[a]	0.472 [c]
After the intervention	113.35±52.59	94.20±65.49	0.007[a]	-0.322 [c]
p value	**0.012[b]**	0.103[b]		
Effect size	-0.472[c]	0.356 [c]		
Diastolic Blood Pressure (mm of Hg)				
Before intervention	79.18±8.15	80.00±8.83	0.600[a]	
After the intervention	78.55±8.43	80.55±8.59	0.201[a]	
p value	0.303[b]	0.710[b]		
Systolic Blood Pressure (mm of Hg)				
Before intervention	121.75±16.929	121.50±11.17	0.924[a]	
After the intervention	119.57±17.31	121.67±11.034	0.430[a]	
p value	0.197[b]	0.919		
BMI (kg/m^2)				
Before intervention	26.21±3.38	26.18±3.93	0.963[a]	
After the intervention	25.68±3.39	26.12±3.55	0.488[a]	

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Variables	Intervention Group Mean ±SD	Non-intervention Group Mean ±SD	p-value	Effect size
p value	0.382[b]	0.931[b]		

Table 3. Comparison of cardiovascular disease risk factors between the intervention and non-intervention groups at baseline and post -test (n=120)

[a] *Independent t-test*

[b] *paired t-test*

[c] *Cohen's d*

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Variables	Intervention Mean ± SD	Non-intervention Mean ±SD	p-value	Effect Size	The difference-in-difference (improved %)
Knowledge					
Before intervention	15.37±2.35	14.45 ±3.15	0.074[a]	-0.328 [c]	
After intervention	18.85±2.22	15.05±2.90	<0.001	-1.470 [c]	2.88 (19.93)
p-value	<0.001[b]	<0.001[b]			
Effect Size	-1.522 [c]	-0.180 [c]			
Attitude					
Before intervention	28.48±5.70	27.38±6.74	0.336[a]	-0.176 [c]	1.27 (4.64)
After intervention	32.42±4.72	30.05±6.64	0.026[a]	-0.411 [c]	
p-value	<0.001[b]	0.011[b]			
Effect size	-0.751 [c]	-0.398 [c]			
Subjective norms					
Before intervention	29.67±3.75	30.17±5.15	0.544[a]	0.110 [c]	1.68 (5.53)
After intervention	31.95±3.72	30.78±4.22	0.111[a]	-0.293 [c]	
p-value	0.001[b]	0.379[b]			
Effect size	-0.611 [c]	-0.130 [c]			
Perceived behavioural control					
Before intervention	30.18±3.96	28.20±5.16	0.020[a]	-0.417 [c]	1.04 (3.69)
After intervention	32.47±3.37	29.45±5.05	0.001[a]	-0.707 [c]	
p-value	0.002[b]	0.142[b]			
Effect size	-0.648 [c]	-0.244 [c]			
Intention					
Before intervention	27.40±3.65	25.05±5.35	0.060[a]	-0.510 [c]	6.67 (26.63)

Variables	Intervention Mean ± SD	Non-intervention Mean ±SD	p-value	Effect Size	The difference-in-difference (improved %)
After intervention	35.27±2.53	26.25±4.25	<0.001[a]	-1.348 [c]	
p-value	<0.001[b]	0.110[b]			
Effect size	-1.159 [c]	-0.246 [c]			

Table 4. TPB constructs at baseline and follow-up among intervention and non-intervention groups (n=120)

[a] *Independent t-test*

[b] *paired t-test*

[c] *Cohen's d*

	Knowledge Beta (95% CI)	**Attitude Beta (95% CI)**	**Subjective norms Beta (95% CI)**	**Perceived behavioural control Beta (95% CI)**	**Intention Beta (95% CI)**
Constant	16.287 (14.843,-17.731)	27.490 (24.156,-30.823)	29.010 (26.611,-31.409)	31.966 (29.715,-34.217)	27.020 (24.990-29.049)
Time (follow-up) and intervention	3.497 (2.672,-4.322)	3.764 (1.859,-5.669)	1.936 (0.566,-3.307)	2.302 (1.015,-3.588)	7.856 (6.696-9.016)
Age 40 years and above	-0.231 (-1.211,-0.749)	-2.588* (-4.850,-0.325)	1.170 (-0.458-2.798)	-0.504 (-2.032,-1.025)	-0.287 (-1.665-1.091)
Married	-1.039 (-2.007,-0.071)	1.268 (-0.967,-3.502)	1.268 (-0.340,-2.876)	1.318* (-0.191,-2.827)	0.028 (-1.332-1.389)
Education bachelor and above	0.433* (-0.721,-1.588)	0.434 (-2.230,-3.098)	-0.230 (-2.147,-1.687)	-0.362 (-2.161,-1.437)	0.393 (-1.229-2.014)
Teaching experience 10 yrs. and above	-0.484 (-1.778,-0.810)	1.150 (-1.837,-4.138)	-0.501 (-2.651,-1.649)	-2.638 (-4.655,-0.621)	0.305 (-1.513-2.124)
Ethnicity advantages group	0.710 (-0.678,-2.098)	-0.428 (-3.632,-2.776)	-0.925 (-3.230,-1.381)	0.070 (-2.093,-2.233)	-0.529 (-2.480-1.421)
R^2	0.403	0.170	0.104	0.188	0.617

Table 5. Effect of intervention (difference-in-difference) on different TPB construct on CVD

Discussion

The time-intervention interaction caused the adjusted mean score increase in TPB components to rise from 1.936 to 7.856. There was a slight improvement in subjective norms (beta = 1.936), but the intention score showed the largest gain (beta = 7.856). Following the intervention, the net increase in the intention to modify the risk factors for CVDs was 26.63% higher than that of the non-intervention group.

The intervention group showed a significant increase in knowledge scores compared to the non-intervention group. The results demonstrated the potential of educational interventions to modify cardiovascular disease risk factors among school teachers. The intervention group demonstrated substantial enhancements in their physical activity level, present the program's success in encouraging favorable behavioral transformations. The results align with previous research, demonstrated the effectiveness of health education programs in promoting physical activity and fostering healthier eating habits[3][19][37][38][39][40].

The study found no significant improvements in the evaluation of biological traits in spite of these positive behavioral modifications. This indicates that although the intervention had a positive effect on behavior, no significant physiological changes and dietary habits were observed over the study period. comparable findings from other research highlight how difficult it is to change biological indicators just by behavioral changes. According to a meta-analysis, it can take more than a year for lifestyle changes to significantly lower blood pressure, especially in Asian populations[41][42]. In contrast, another study conducted in Sokoto, Nigeria conveyed significant improvement in blood pressure at three months post-intervention[24]. The differences could stem from the additional incorporation of exercise and dietary control in their intervention compared to our merely education focused approach. Conducting periodical sessions for three months, while our study featured weekly sessions over the same period[24]. However, the decrease in measures like body mass index and blood pressure may need a more extensive educational program and behavioral modification intervention than the one implemented in this study.

Researchers have used various TPB-based interventions to modify cardiovascular disease risk factors, targeting specific groups with different purposes and durations. The purpose of our intervention was to raise the four TPB constructs among teachers who appeared to be in good health through an interactive lecture, incorporating participants' engagement in their lifestyle modification preparation

and adding action cues to enhance the intervention's effect. One 90-minute lecture session may not be adequate to increase TPB construct. We selected school teachers for follow-up assessments because they may be at risk of cardiovascular disease[19][43].

The results revealed that non-intervention and intervention groups had relatively low baseline knowledge scores regarding cardiovascular disease risk factors. The non-intervention group had a moderate mean score, indicating limited awareness and understanding of risk factors and prevention of cardiovascular diseases. Similarly, the intervention group had a slightly higher mean score at baseline, suggesting a better but still insufficient level of knowledge. Two weeks after the intervention, the knowledge scores increased significantly in the intervention and non-intervention groups, however, intervention group had a higher mean score compared to the non-intervention group. Similarly, given that teachers are involved as study participants, this may be attributed to their access to additional sources of information throughout the study period a factor beyond the researcher's influence. The increase in knowledge scores in the non-intervention group could be attributed to other factors, such as social media, individual interest in preventive behaviors, and friends and family characteristics. In a quasi-experimental study conducted in Nepal involving 126 school teachers to observe the outcome of an intervention based on the TPB related to physical activity and NCDs, the intervention group received two 90-minute sessions of educational intervention[19]. After four weeks from the intervention, the mean knowledge score showed a significant increase in the intervention group. Other results were in line with the outcomes of this research[44][45].

A systematic review conducted by Hassen et.al found that the majority of intervention packages utilized multi-faceted implementation approaches. However, interventions employing health education through workshops, group lectures and training were relatively more effective in enhancing cardiovascular disease knowledge compared to interventions via, telephone calls, media campaigns and take-home materials[46].

A prospective, interventional study conducted by Desai et.al found that an educational intervention study found in a significant increase in knowledge score related to modifying CVDs risk among individuals with type II Diabetes Mellitus[47].

There is a significant improvement in attitude scores among the intervention group. This positive change suggests that the educational intervention had a favorable impact on participants' attitudes towards modifying CVD risk factors. In line with these results, a quasi- experimental study was

conducted in Fasa City, Iran involving 200 women susceptible to CVDs. The experimental group received educational sessions aimed at improving their knowledge, consisting of 10 sessions lasting 50-55 minutes each. These sessions involved various teaching methods such as lectures, group discussions, question and answer sessions, video clips, images, and Power-Point presentations. The program was conducted by experts in health education and promotion, a cardiologist, and a nutritionist. After the educational intervention, the study demonstrated a significant increase in the mean score of attitudes towards healthy behaviors among women susceptible to CVDs in the intervention group, as compared to the non-intervention group[48][49]. Furthermore, the study conducted in Bhaktapur district Nepal demonstrated a significant improvement in attitude scores following an educational intervention. This suggests that the intervention effectively influenced participants' attitudes towards modifying CVD risk factors, leading to more positive and supportive views[19].

In terms of subjective norms, notable improvements were observed within the intervention group compared to the non-intervention group. However, after comparing the intervention and non-intervention groups post-intervention, no significant differences were evident. This lack of significance may be attributed to the short duration of the follow-up period and the intervention's sole focus on education, without targeting family members and other influential individuals who could aid in modifying CVD risk factors[43][50]. Furthermore, the study conducted in Nepal demonstrated a not significant improvement in subjective norm scores following an educational intervention. This suggests that study participants had higher expectations from individuals who were significant to them in terms of aiding them to engage in physical activity[19]. This aspect is linked to people other than the teachers who received the intervention, which could be another reason for the lack of improvement in the scores of this construct. However, there were no significant differences between the two groups.

On the contrary, the study by Jeihooni et al and Ghofranipour et.al demonstrated a significant results concerning subjective norms and the application of healthy diet behaviors related to cardiovascular disease[45][51]. A randomized control trial conducted by Kothe and Mullan found that the average rating of subjective norms regarding fruit and vegetable intake among Australian young adults notably rise following the TPB-based intervention. This implies the importance of families and other subjective norms in influencing participants' risk factor modification, underscoring the need for the intervention package to provide information about family and other social support[52].

There is a significant improvement in PBC scores among the intervention group. In Iran, a study revealed notable enhancements in PBC scores related to regular physical activity among female employees following an educational intervention, mirroring the findings of the current study[50]. However, multiple studies have shown that there was no statistically significant variance in the participants PBC before and after the TPB-based intervention regarding fruit and vegetable intake, contrasting the outcomes of the present study[19][43][52]. It can be suggested that since PBC depends on the perception of facilitators or barriers to a particular ability or behavior, numerous obstacles may exist for the program, including pre-existing barriers like habitual patterns, lack of skills and knowledge regarding physical activity and food selection, and time constraints (such as busy schedules or competing priorities). There are several reasons for this, one of them being the absence of direct intervention related to this concept. Additionally, the follow-up appointments might not have been adequate to observe any noticeable changes. These challenges may not necessarily be fully addressed through the educational program alone.

Despite the TPB-based intervention resulting in a notable boost in behavioral intention scores within the intervention group compared to the baseline, there were significant differences in scores between the two groups. A study conducted in Tehran University, Iran has observed notable enhancements in the intentions for regular physical activity among female employees following an educational intervention similar to the findings of the present study[50]. A study in Nepal reported significant improvements in the scores of Intention for regular physical activity among school teachers after an educational intervention that was similar to the results of the present study[19]. However, a study conducted by Hassani et.al and Kothe et.al observed that there was no significant difference in the intention to adopt a healthy diet between the intervention and non-intervention groups, post-intervention[43].

In a quasi-experimental study applying the Theory of Planned Behavior to foster a healthier lifestyle and prevent obesity, the experimental group displayed a notable increase in the mean scores of attitudes, subjective norms, perceived behavioral control, and actual behavior three months after the educational intervention[44].

The United Nations Sustainable Development Goal (SDG) 3, strives to ensure healthy lives and promote well-being for all. The health educational intervention contributes to the prevention of non-communicable diseases, including cardiovascular disease, thereby playing a role in enhancing public health overall.

This study used a quasi-experimental methodology rather than a randomized controlled study, which adds confounding variables and possible bias. This was due to limited resources caused by a lack of funding and time constraints. This study included six schools within a limited geographical area in Arghakhanchi, Lumbini Province, Nepal. The intervention and follow-up period were relatively short, only measuring intention to modify CVD risk factors rather than observing changes in behavioral and biological characteristics.

Some previous studies incorporated physical activity schedules and dietary control in addition to health education, our intervention solely focused on health education. The TPB-based intervention did not include specific strategies to address subjective norms such as engaging family members or offering interventions to them. These potential biases could have impacted the accuracy of the results. Finally, part of the information gathered, such as food patterns and level of physical activity, was based on self-reported data, which is prone to social desirability bias and recall bias.

Conclusion

The study found significant improvements in behavioural characteristics, particularly in physical activity level. There was no significant improvement in biological characteristics of the participants. Similarly, the knowledge score was low at baseline, but after the intervention, the mean knowledge scores increased in the intervention group compared to the non-intervention group. Following an eight-week educational intervention, our study also showed significant changes in the Theory of Planned Behavior components of attitudes, perceived behavioral control, and intention among the intervention group.

This study further exposed that participants' attitudes, perceived behavioral control, and intentions were positively impacted by an educational intervention created with an integrated approach that included interactive lectures, group discussions, experience sharing, and text messaging.

The findings of this study and the developed promotion package could be utilized to motivate school teachers to modify their intentions regarding the risk factors of CVD. Hence, the educational intervention program has to be expanded to school teachers utilizing school health nurses and community-based health organizations.

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