

## INTRODUCTION

- The Non-Communicable Disease (NCD) Risk Factor Collaboration reported an anthropometric analysis of 31.5 million children aged 5 to 19 years worldwide and found a **tenfold increase in the number of obese children and adolescents**.<sup>1</sup>
- In Malaysia, National Health and Morbidity Survey (NHMS) on adolescent health conducted in 2017 reported that about **1 in 3 adolescents was overweight and obesity**.<sup>2</sup>
- Taking into consideration the prevalence, health effects, and cost of childhood obesity, there are considerable benefits in determining effective methods to prevent or manage weight gain in children and adolescents<sup>3</sup> and there is great potential for school-based interventions for prevention of risk factors associated with NCDs.
- This study aimed to evaluate the effectiveness of an integrated school-based intervention on anthropometric, behavioural and psychosocial outcomes by conducting a cluster randomised controlled trial.**

## MATERIALS & METHODS

- A **single blinded, two-arm parallel, cluster randomized control trial** was conducted to compare intervention group (IG, n = 200) and wait-list control group (CG, n = 200) among adolescents in Seremban, Negeri Sembilan, Malaysia.
- Combination of **simple, cluster, systematic random sampling** were used to select 8 out of 47 schools in Seremban.
- 4 schools were allocated to IG using **lottery method**, while another 4 schools were served as CG (usual co-curricular activities).
- A school-based intervention was developed by conceptualizing **Social Cognitive Theory (SCT) & behaviour change techniques**.<sup>4</sup>
- The module was delivered through **5 face-to-face sessions**, with a two-week gap between every session (Figure 1) and each session took about 60 to 90 minutes.
- Data were collected during **baseline (T0), immediate post-intervention (T1) and 3 months post-intervention (T2)**.
- Primary outcomes: **body mass index (BMI) and BMI-for-age z-scores (BAZ)**.
- Secondary outcomes: **breakfast consumption frequency, Physical Activity Questionnaire for Older Children, Healthy Eating and Weight Self-Efficacy scale, and Perceived Physical Activity Self-Efficacy Scale for Adolescents**.
- Generalised Linear Mixed Model (GLMM)** analysis was used to examine the effectiveness of the intervention (level of significance at p < 0.05).

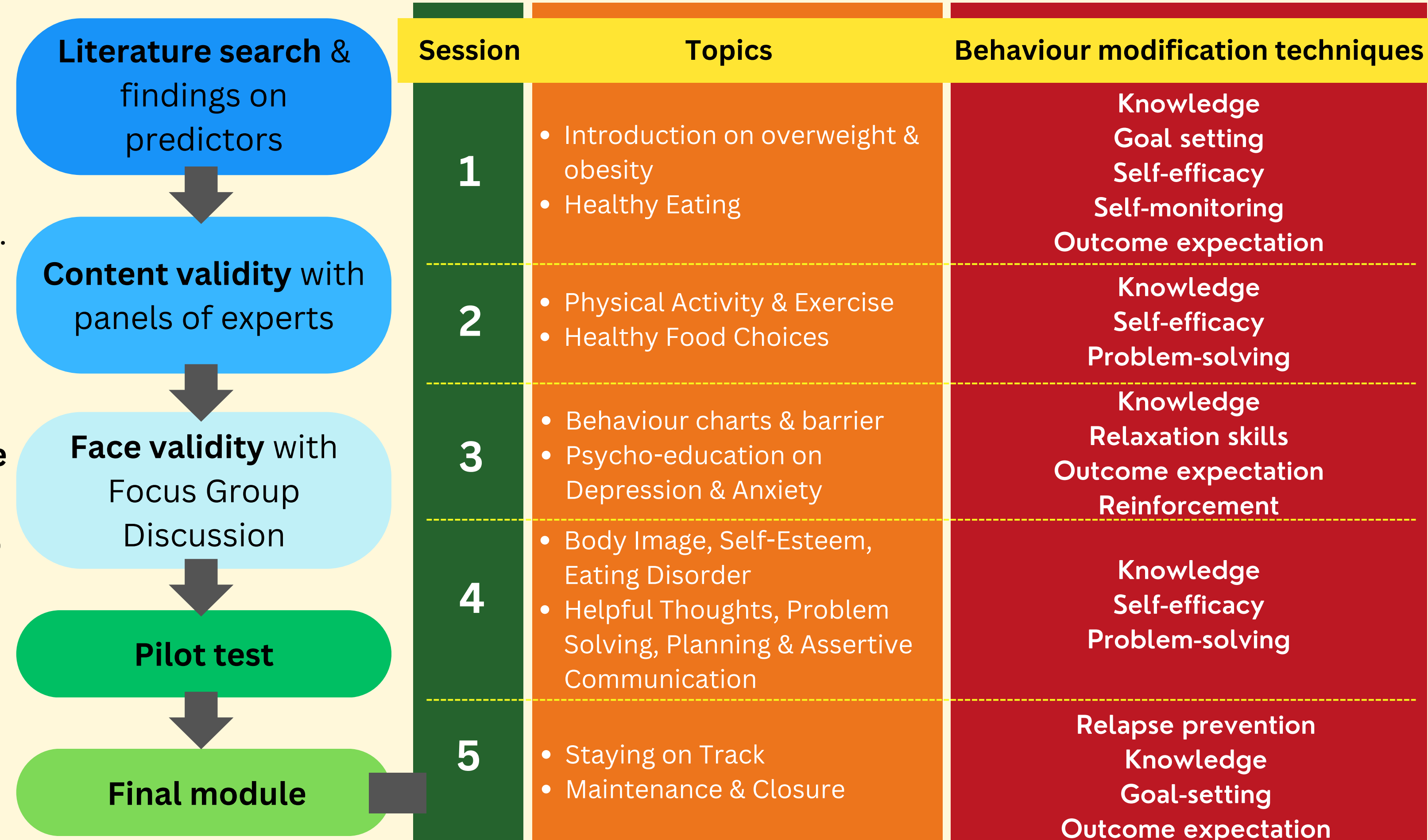


Figure 1. Development and session outlines of the intervention module

## RESULTS

- The adherence was 80.1% (Figure 2).
- There was no significant difference between IG and CG in all the outcome measures at baseline.
- A significant interaction between group and time was observed on all outcome variables (Table 1).
- The BMI and BAZ reduction among the participants in IG were significantly higher as compared to those in CG.
- In terms of behavioural outcomes, the frequency of breakfast consumption and physical activity scores among the participants in IG were increased significantly compared to CG.
- In terms of psychosocial outcomes, the healthy eating and weight self-efficacy scores and perceived physical activity self-efficacy scores among the participants in IG were increased significantly compared to CG.

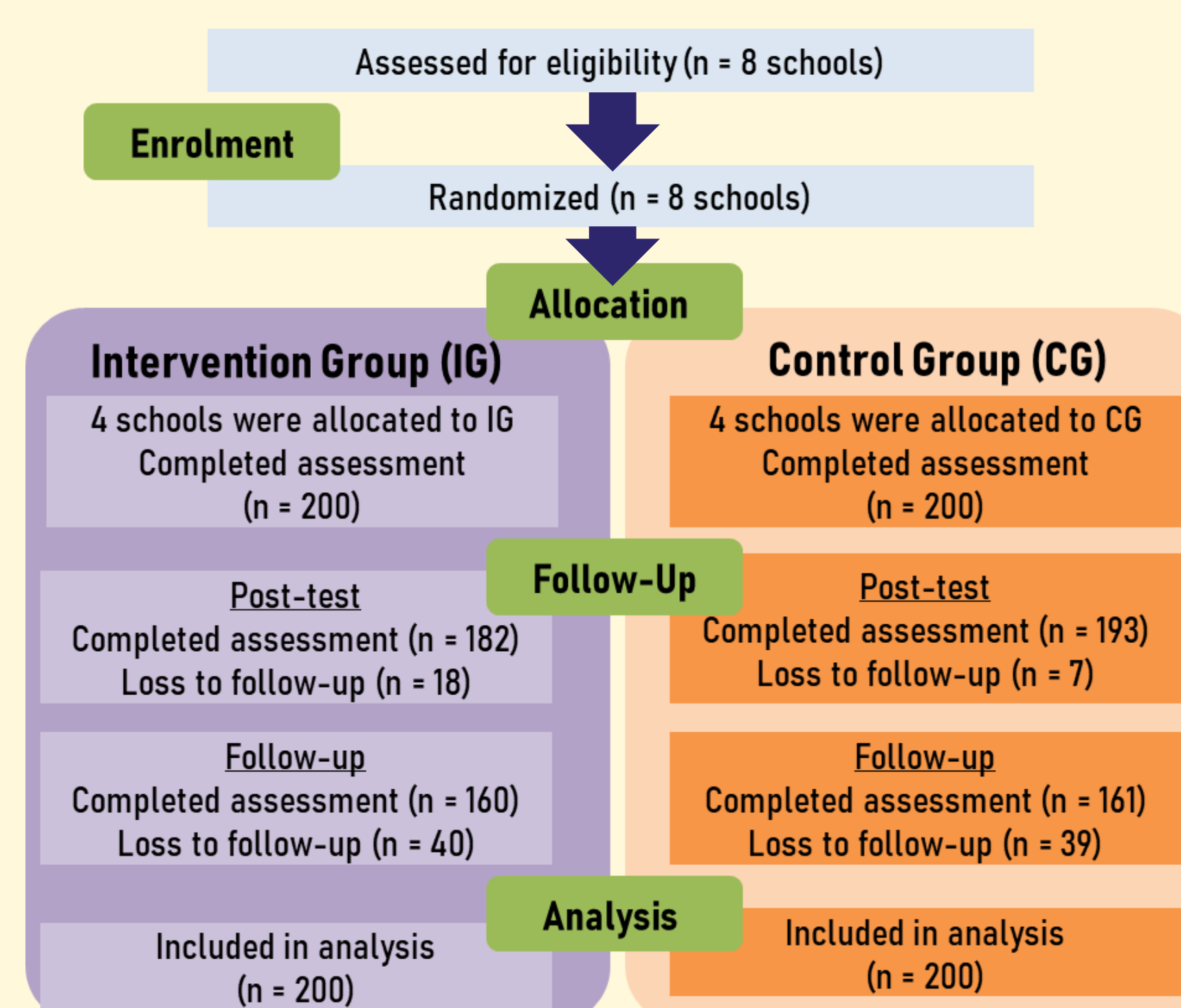


Figure 2. CONSORT diagram of the clusters and study participants

Table 1. Effect of intervention on outcome variables between groups over time

Outcome Variables; mean ± SD	T0	T1	T2	Outcome variables	Coefficient	t	95% CI	p-value <sup>a</sup>	Effect size (Cohen's d)	
BMI (kg/m <sup>2</sup> )	IG	28.10 ± 4.39	27.93 ± 4.44	27.80 ± 4.39	T1 x IG	-0.793	-8.355	[-0.979, -0.607]	<0.001	0.1686
	CG	27.89 ± 3.85	28.51 ± 4.18	28.53 ± 4.27	T2 x IG	-0.938	-9.882	[-1.124, -0.752]	<0.001	
BMI-for-age z-scores	IG	2.19 ± 0.70	2.12 ± 0.73	2.07 ± 0.74	T1 x IG	-0.133	-8.010	[-0.166, -0.101]	<0.001	0.2282
	CG	2.20 ± 0.60	2.26 ± 0.64	2.23 ± 0.66	T2 x IG	-0.157	-9.451	[-0.190, -0.124]	<0.001	
Breakfast consumption	IG	2.53 ± 2.12	3.12 ± 1.93	3.02 ± 2.14	T1 x IG	0.735	3.687	[0.344, 1.126]	<0.001	0.2910
	CG	2.52 ± 2.19	2.38 ± 1.86	2.42 ± 1.98	T2 x IG	0.590	2.959	[0.199, 0.981]	0.003	
Physical activity score	IG	2.26 ± 0.51	2.17 ± 0.43	2.38 ± 0.49	T1 x IG	0.174	3.668	[0.081, 0.268]	<0.001	0.2449
	CG	2.32 ± 0.58	2.06 ± 0.42	2.26 ± 0.49	T2 x IG	0.184	3.866	[0.091, 0.277]	<0.001	
Healthy eating and weight self-efficacy	IG	36.75 ± 6.48	38.70 ± 5.88	37.62 ± 5.98	T1 x IG	2.540	3.876	[1.254, 3.826]	<0.001	0.2677
	CG	37.11 ± 7.60	36.52 ± 6.94	35.89 ± 6.91	T2 x IG	2.090	3.189	[0.804, 3.376]	0.001	
Perceived physical activity self-efficacy	IG	26.51 ± 4.32	28.20 ± 4.50	27.76 ± 4.71	T1 x IG	2.345	3.958	[1.183, 3.507]	<0.001	0.2008
	CG	27.16 ± 5.32	26.51 ± 5.36	26.79 ± 4.95	T2 x IG	1.625	2.743	[0.463, 2.787]	0.006	

T0: Baseline; T1: Immediate post-intervention; T2: 3-month post-intervention; IG: Intervention Group; CG: Control Group;

Reference group: T0 x CG; T0 x IG; T1 x CG; T2 x CG

<sup>a</sup> a (kg) generalised linear mixed model adjusted for student's sex, age, ethnicity, and respective outcome measures at baseline

## DISCUSSIONS

- The findings of this study are:
  - comparable to those studies of similar intervention duration where there was a significant intervention effect on lowering the BMI or BAZ.
  - consistent with previous studies applying SCT in the intervention where there was a significant improvement on the frequency of eating breakfast daily and self-efficacy.
- Adolescent health promotion via school-based interventions in low and middle-income countries suggested that health education and health promotion are the typical interventions and are effective in improving knowledge, attitudes, behaviours, health policies and healthy environment.<sup>5</sup>
- Strength of the study: the intervention was theory-based where SCT was applied. Besides, GLMM was used to perform robust analysis where random effects, fixed effects, non-normal distributed data, and repeated measures were assessed.
- Limitation: relatively short study duration of the intervention in this study may not have seen sufficient to induce proper and sustained behavioural changes.

## CONCLUSION

- Findings from this cluster randomised controlled trial suggested that school-based, theory-driven intervention, delivered through face-to-face sessions may improve behavioural and psychosocial outcomes while reducing BMI and BAZ of the participants.**
- This study also demonstrated the feasibility of conducting an intervention programme in a school setting by healthcare and/or education providers.**

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