Original Article

A social cognitive theory-based programme for eating patterns and sedentary activity among overweight adolescents in Makassar, South Sulawesi: a cluster randomised controlled trial

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Background and Objectives: Social cognitive theory provides the opportunity for program development to enhance healthy personal behvioural characteristics. We devised study to employ social cognitive theory to reduce snacking habits and sedentary activity among overweight adolescents . **Methods and Study Design:** Eight junior high schools in Makassar city were randomly assigned as intervention and control schools. A total of 238 overweight students aged 11-15 years (BMI z-score ≥1 SD, according to a 2007 report from the WHO) were recruited. Adolescents from the intervention schools attended 12 weekly 75-min nutrition education group sessions, which focused on behavioural modification assisted by trained facilitators; furthermore, their parents received weekly nutrition education leaflets. Adolescents from the control schools, but not their parents, received leaflets on evidenced-based nutrition information. The BMI z-scores, waist circumference, snacking habits, sedentary activity, and the adolescents' self-efficacy data were assessed prior to and after 3 months of intervention. The outcomes were analysed on an intent-to-treat basis. **Results:** Compared with the control group, the intervention group showed a higher reduction in BMI z-scores (−0.08; $p<0.05$) and waist circumference (−1.5; $p<0.05$) at 3 months. Significant between-group differences were also observed for decreased snacking habits, but not for sedentary activity. Additionally, the programme improved self-efficacy for reducing these behaviours. Mean compliance and satisfaction with the programme were 95% and 92%, respectively. **Conclusions:** These high reduction rates suggest that the programme is promising and may address the problem of overweightness in adolescents. Additional studies are required to develop the programme in community settings.

Key Words: adolescents, overweight, social cognitive theory, self-efficacy, snacking

INTRODUCTION

Indonesia, a southeast Asian country, has demonstrated remarkable changes in childhood overweightness and obesity. The Indonesian Ministry of Health has reported that the national prevalence of overweight and obese school-aged (6–14 years) children increased from 6.5% in 2001 to 15.9% in 2007, with a higher prevalence among those living in urban areas.[1,2] However, some cities in Indonesia have shown a higher prevalence of childhood obesity than the national prevalence.[2] One such place is Makassar, the capital city of the South Sulawesi Province. According to data from the Indonesian Basic Health Research conducted in 2007, 20.2% of school-aged boys and 10.1% of school-aged girls in Makassar are overweight. This prevalence was the highest among that of other regencies in the South Sulawesi province.[3]

The complications of childhood overweightness and obesity can be physical and psychosocial, with both short- and long-term consequences,[4,5] including an increased frequency of cardiovascular risk factors and their persis-

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tence into adulthood.[4,6] Psychosocial problems, such as stigmatisation, the perception of being the least desired friend, and bullying by peers, are common consequences of childhood obesity.[7,8] The rising prevalence of childhood obesity cannot be attributed to a single aetiology because of the numerous genetic, biological, environmental, and behavioural influences. However, behavioural modifiable factors, such as unhealthy eating habits, physical inactivity, and a sedentary lifestyle, play crucial roles in the rising prevalence of childhood obesity worldwide.[9]

To tackle the rising prevalence of obesity, early behavioural modification is needed to sustain behavioural changes. Adolescence is a time of major physical and cognitive changes, when independence is established and overweightness- and obesity-related behaviours, such as dietary and activity patterns, may be adopted. Thus, establishing healthy behaviours among this age group is critical for overweight children and adolescents to ensure that the benefits of these behaviours persist into adulthood.[10,11]

To understand overweightness- and obesity-related behaviours, using behavioural change theories to design intervention strategies is essential and can lead to more effective and meaningful intervention.[12] To date, theory-based obesity interventions targeting behavioural changes among children and adolescents have been conducted in clinical[13] and community[14,15] settings. The most popular theory used is social cognitive theory (SCT), which emphasises personal and environmental factors for behavioural change. The interventions designed and applied according to the constructs of this theory have been used as behavioural change strategies, and have been applied through several sessions involving nutrition education curricula. Various delivery durations and levels of parental involvement have been features of the interventions, which have significantly improved healthy behaviour[15,16] and reduced overweightness as measured through anthropometric assessments.[13,15]

However, none of these theory-based interventions have measured and documented changes in the behavioural constructs of the theory applied in the intervention. This is critical information to identify the components or constructs of a theory are effective in changing behaviours related to overweightness among adolescents. To the best of our knowledge, no studies focusing on overweight adolescents have been conducted in developing countries, particularly Indonesia. Therefore, the intervention efficacy conducted in developed countries cannot be generalised in developing countries because of differences in characteristics of the community particularly on behaviour related to overweightness. Kolopaking et al[17] indicated that SCT-based interventions involving nutrition education through a self-regulatory approach improved children's self-regulatory behaviours in terms of food choice and maternal self-efficacy in the home food environment. However, these interventions only focused on healthy school-aged children from middle- and low-income families.

Therefore, to provide evidence regarding behavioural treatment for theory-based interventions and to mitigate the increasing prevalence of overweightness and obesity in Indonesian adolescents, this study investigated the effect of a healthy lifestyle programme that was implemented in Makassar and which involved overweight adolescents and their parents.

MATERIALS AND METHODS

Study design

This study used a cluster randomised controlled trial (CRCT) design and followed the Consolidated Standards of Reporting Trials (CONSORT) guidelines to discuss the trial methods and outcomes.[18] Randomisation of the participants was conducted according to schools, and several steps were involved in selecting school samples. Specifically, the schools were chosen according to the following criteria: type of school (state- or privately run, as designated by the Department of Education of Makassar city), number of students (≥300), lack of school dormitories for students to live together, and schools' willingness for participation (indicated by the principal's approval). Of the 228 junior high schools (SMP) in Makassar,[19] 48 were eligible for this study. Thereafter, all grade 7 and 8 students from these schools were examined to determine the overweight prevalence (BMI z-score +1 to +2 SD, according to WHO growth reference values).[20]

Following the initial selection, the schools were further screened on the basis of the prevalence of overweight students; only schools with a student population > 3% overweight were selected. Accordingly, eight schools were eligible for sampling, and they were randomly categorised as intervention or control schools by a researcher who used the lottery method for allocation. Schools did not receive information regarding their allocation, but were informed regarding the type of intervention to be provided to students. Overweight adolescents from selected schools were eligible for participation if they were 11–15 years of age, in grade 7 or 8, physically healthy, not using prescription weight loss drugs, not enrolled in another weight loss programme, and willing and available to attend the scheduled sessions of the programme. Approval from both the school principal and the adolescents' parents were required for their participation in this study.

The adolescents from intervention and control schools were automatically designated as part of the intervention and control groups, respectively. All of the adolescents and their parents received information regarding the study objectives and were asked to provide informed consent. This study was approved by the Research Ethics Committee of the Faculty of Medicine at the University of Indonesia (clearance number: 26/H2.F1/ETIK/2014).

Description of the intervention

The intervention model used in this study was entitled the healthy lifestyle programme (HLP), a SCT-based intervention targeted towards overweight adolescents that consists of a nutrition education curriculum. Increasing physical activity and healthy eating, and modifying self-efficacy, motivation, perseverance, and self-regulation among the adolescents were the primary focuses of this programme. In accordance with the constructs of the SCT, the specific strategies for managing behavioural changes that were used in this study were goal setting, dealing with stress, and building self-esteem.[21] Moreover, because the shift from motivation to change to action re-

quires <6 months,[22] and because short-term interventions incur lower expenses and higher compliance than do long-term interventions, the programme was conducted for 3 months (12 weekly sessions, 75 min each). The programme was also divided into a module for the student adolescents and a module for the facilitators, which provided guidelines in the nutrition education process. Adopted from a previous study,[15] the 75-min sessions comprised the following content: reconnection with the group and a review of the progress in goals (15 min), facilitator-led discussion on a set topic (35 min), review of the key points and recording of individual goals for the upcoming week (15 min), and a fun activity or game and light refreshments (10 min).

The initial session focused on the benefits of healthy living and encouraged goal setting; here, the adolescents were taught to set 'SMART' goals that were ***s***pecific, ***m***easurable, and ***a***chievable and could be attained in a fixed ***t***ime frame. Sessions two to five focused on enhancing the consumption of healthy and balanced food, including increasing fruit and vegetable consumption and reducing snacking habits. The next four sessions focused on increasing physical activity and reducing sedentary habits. The subsequent two sessions focused on stress management, and the final session focused on strategies for maintaining positive changes.

The sessions were delivered in groups, with each group consisting of 9 or 10 adolescents and a trained facilitator. Through the sessions, the adolescents learnt from each other how to manage their lifestyle and attain their goals related to behavioural change. This programme has been evaluated by experts in the fields of nutrition, behaviour, and educational psychology, and has been pilot tested for its applicability and feasibility.

All of the intervention activities were conducted in the schools after class hours. The adolescents in the intervention group were asked to attend every education session at a time mutually agreed upon by the facilitator and the adolescents, and the parents in this group received nutrition education leaflets weekly for 12 weeks. Notably, the leaflets were designed and arranged in accordance with the weekly topic of the adolescents' sessions; this enabled the parents to act as facilitators at home and encourage their adolescent to exhibit more positive behaviours. The leaflets were delivered to the parents through the adolescents after each completed group session. To ensure that the parents had received the leaflets, the facilitators telephoned and informed them of the leaflets.

By contrast, the adolescents in the control group received 12 leaflets on evidenced-based nutrition information. The leaflets were designed according to the general guidelines for balanced nutrition in Indonesia, and were delivered weekly to the adolescents after school hours. No explanations were provided during distribution, and the mothers in this group did not receive any information regarding nutrition.

Outcomes

The primary outcome of the programme was the change in BMI z-scores. Changes in waist circumference, snacking habits, sedentary activity, and adolescents' self-efficacy in decreasing their snacking and sedentary activity were the secondary outcomes of the programme.

Procedure for data collection

All data collection took place at the schools; however, for those participants who could not visit the schools at the specified time, data were collected by an enumerator through a home visit. First, the anthropometric measurements of the adolescents were obtained. Subsequently, they completed self-report-structured questionnaires about food frequency (prior to and after 3 months of intervention) to provide information on their snacking habits and self-efficacy. Self-reported demographic information and self-efficacy questionnaires were also collected from the parents.

Anthropometry indicators

Weight was measured to the nearest 0.1 kg using a portable scale (Seca, Model 770; Germany), with shoes and heavy clothing removed. Height was measured to the nearest 0.1 cm using a portable stadiometer (Seca, Model 206; Germany). Waist circumference was measured at the narrowest point between the lower costal (rib) border and the iliac crest using a rib scale (Seca, Model 201; Germany). All of these measurements were conducted in a private room. Weight and height were then converted into a BMI z-score, depending upon the age-and sex-specific reference values,[20] using the WHO AnthroPlus software. To minimise inter- and intra-observer errors, all enumerators were trained by the researcher. Similar to the self-report surveys, these data were collected prior to and after 3 months of intervention.

Overweightness-related behaviours

Data regarding snacking habits were collected through a food frequency questionnaire, which listed a series of common snack food items and offered six response options for each item, namely 'more than once per day', 'once per day', '3–6 times per week', '1 or 2 times per week', '1–3 times per week or less', and 'never'. The list of food items was derived from the Indonesian Food Composition Database, and included the local snack foods available in Makassar.[23] To analyse snacking frequency, the response option chosen by the adolescent was transformed into a daily score by dividing it across 7 days as follows: 'more than once per day = >1', 'once per day = 1', '3–6 times per week = 0.43–0.86', '1 or 2 times per week = 0.14–0.29', '1–3 times per week or less = < 0.03–0.1', and 'never = 0'. Thereafter, these consumption scores were arranged into four groups: 'daily = ≥ 1–3', 'weekly = 0.14–0.86', 'monthly = < 0.03–0.1', and 'never = 0'. All these variables were collected through the self-reported questionnaires.

Sedentary behaviours were defined by the frequency of screen-based activities, such as TV viewing, computer use, and other gadget use for playing games. The parameter for change in sedentary behaviour involved adherence to global recommendation guidelines,[24] which recommend daily participation in at least 60 min of moderate-to-vigorous physical activity and no more than 2 h of screen activity per day. The sedentary behaviour scores were calculated on a scale from 1 to 4, where 1 = < 30

min/day, 2 =30 min to 1 h/day, 3 = 1 or 2 h/day, and 4 = > 2 h/day. A sedentary behaviour questionnaire was adapted from the Adolescent Sedentary Activity Questionnaire[25] to collect the data.

Adolescents' self-efficacy

Adolescents' self-efficacy was defined as adolescents' beliefs in their capability to engage in healthy behaviours that would positive influence overweightness, such as reducing snacking habits and sedentary activities, despite the presence of barriers. Self-efficacy was expressed as a score ranging from 0 to 100, with lower scores indicating lower self-efficacy and higher scores indicating higher self-efficacy. A validated and reliable measurement questionnaire that was developed in a previous study[26] was adapted herein; a reliability test demonstrated that the Cronbach's alpha value was 0.82. The value indicated that the questionnaire was reliable.

Baseline variables

Demographic characteristics

The adolescents also completed a questionnaire to provide information on their date of birth, gender and self-esteem. Self-esteem was measured using the Rosenberg Self-Esteem Profile, which comprised ten questions about the general feelings of adolescents[27] and was assessed using a 4-point Likert scale (higher scores indicated stronger agreement with the item). Meanwhile, the parents completed a questionnaire that retrieved the following information: number of family members in the household, parental age, highest education level, and parental occupation.

Evaluation of the programme

The structure of the healthy lifestyle programme was evaluated through an assessment of the compliance with and satisfaction rate of the programme. Compliance rate was defined as the extent to which the adolescents obeyed the requirements of the programme, and was determined by the adolescents' adherence to filling out their weekly journals to assess behaviour changes. To assess compliance, the adolescents were asked to set a goal for the upcoming week and note it in their weekly journal at the end of every session; this journal was then discussed and evaluated at the beginning of the next session. Satisfaction rate was defined as the extent to which the adolescents felt satisfied with the delivered programme. This information was collected from the adolescents and their parents after the completion of all 12 sessions.

Quality Control

Field staff

The field staff in this study comprised enumerators and group facilitators. The main task of the enumerators was to collect quantitative baseline data and perform the endline assessment, whereas the task of the group facilitator was to assist adolescents during the group sessions. To ensure that qualified field staff were recruited, the staff were required to have a bachelor's degree in community nutrition or psychology, experience in data collection and facilitating nutrition education, and a commitment to following the study's procedures. They received 3 days of standardised training to minimise intra- and inter-individual variations in the measurements and to standardise activities in facilitating group sessions on nutrition education. A facilitator's manual containing detailed information specific to each group session, including a script for the educational material, the time to be allotted for each component, a type of ice-breaking activity to be performed, suggestions for various activities and games, and a list of required resources, was provided. Group facilitators also had to attend a weekly meeting with the principal investigator to ensure protocol adherence.

The group facilitators completed a standardised evaluation form after finishing each group session to record the degree of the adolescents' compliance and note the processes followed during that session. The principal investigator supervised group session activities to ensure protocol adherence. All information regarding process evaluation was discussed at the weekly meeting.

Measurements of the self-reported questionnaires

Before completing the self-reported questionnaires, the participants received thorough explanations regarding the process. The process was also supervised by trained field staff.

Anthropometric assessment

Trained staff members conducted anthropometric measurements of the participants using calibrated instruments and according to standardised procedures. The measurement tools were reviewed and calibrated regularly, and all anthropometric measurements were performed twice using a standard procedure to minimise intra- and inter-observer errors.

Statistical analysis

Sample size

The sample size was calculated using the formula for group comparison on the basis of the study hypothesis, in which the estimated standard deviation was assumed to be equal for each group.[28] First, a total of 164 overweight students (i.e., 82 participants in each group) was estimated as the sample size. This provided 80% power to detect a 0.24[16] unit difference in the mean change of BMI z-scores from prior to, to 3 months after, intervention, and accommodated a 20% drop out rate. In a CRCT, the sample size must be adjusted by a coefficient calculated on the basis of a fixed number of clusters.[29] In the current study, the number of clusters per arm (k) was four schools and the fixed number of individuals per cluster (m) was 28 adolescents. In addition, the intra-cluster correlation used was 0.017.[30] Accordingly, the sample size required was 238 overweight adolescent (i.e., 119 per intervention arm) after adjustment.

Data analysis

Anthropometric data were calculated using the WHO AnthroPlus software, and z-score values for BMI were estimated using WHO data on adolescent boys and girls.[20] Subsequently, SPSS software was used to analyse all quantitative data, and the Kolmogorov–Smirnov test of normality was employed to evaluate all continuous data for normal distribution; variables that were not normally

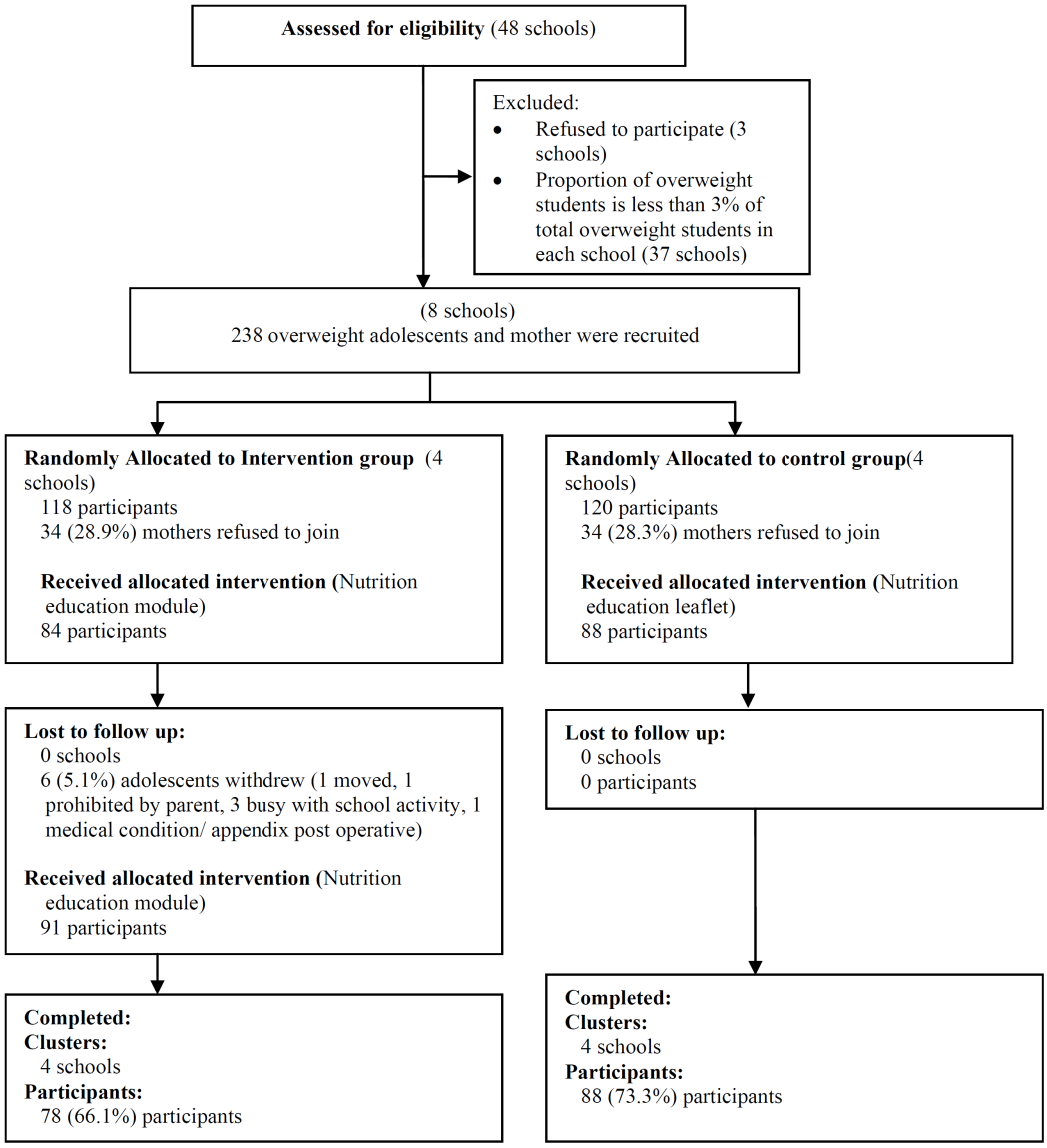

Figure 1. Flow of clusters and participants through the trial of the healthy lifestyle programme among overweight adolescents in Makassar city.

distributed were transformed for normality, or nonparametric techniques were used. Changes in the outcome measures were then assessed using independent sample t-tests (continuous variables) and the chi-square test (categorical variables) in normally distributed data (two-group t-test, 0.05 of one-tailed significance). An estimation of the intervention effect on the outcomes was obtained at the end of observation (i.e., after 3 months of intervention) on an intention-to-treat basis. Finally, analysis of covariance was used to test for differences in the baseline characteristics, and adjustments to the analyses were made as required.

RESULTS

Cluster and sample size

In this study, 48 eligible schools were assessed (Figure 1). Of these, 40 schools were excluded because of refusal to participate (3) and failure to meet inclusion criteria for the trial (37). The remaining eight schools were randomly designated intervention or control schools (n=4 each), and a total of 238 overweight adolescents and their parents were recruited from these schools. One hundred sixty-six (70%) of the participants completed the intervention.

Prior to commencing the study, 68 participants (28.6%) were excluded because their parents refused to join the study, and another six participants (5.1%) withdrew during the course of the study. Specifically, one adolescent changed schools, one was refused parental permission to participate for academic reasons, three were busy with extracurricular activities, and one withdrew for medical reasons. Nevertheless, 172 participants (n=84 in the intervention group and n=88 in the control group) who received allocated intervention were included in the intention-to-treat analysis.

The schools were in eight different sub districts in Makassar, and are geographically representative of the study area because they are spread across the western (two schools), northern (two schools), eastern (two schools), and southern (two schools) areas of the city. All of the schools were state-run and provided extracurricular activities (e.g., basketball, volleyball, badminton, futsal, scouting, Junior Red Cross, karate, dancing, and swimming)

Table 1. Baseline characteristics of schools, adolescents and family of the Healthy Lifestyle Program among overweight adolescents in Makassar City

Variable	Intervention group (n=84)	Control group (n=88)	Total (n=172)	*p* value[§,¶,††]
School				
Number	4	4	8	-
School status (state school)	4	4	8	-
Having school canteen	4	4	8	-
Adolescents				
Aged (median, IQR[†])	13.0 (12.0, 14.0)	13.0 (12.0, 14.0)	13.0 (12.0, 14.0)	NS[¶]
Gender (n, %)				
Boys	31 (36.9)	30 (34.1)	61 (35.5)	NS[††]
Girls	53 (63.1)	58 (65.9)	111 (64.5)	
Makassar Ethnicity (n, %)	43 (51.2)	41 (46.6)	84 (48.8)	NS[††]
Adolescents' self-esteem[‡] (median, IQR)	2.7 (2.5, 3.0)	2.8 (2.5, 3.0)	2.7 (2.5, 3.0)	NS[¶]
Live with parents (n, %)	78 (92.9)	82 (93.2)	160 (93.1)	NS[††]
Family				
No. of family member (median, IQR)	5 (4,6)	5 (4,6)	5 (4,6)	NS[¶]
Fathers'occupation as Entrepreneurs/trader (n, %)	31 (36.9)	34 (39.5)	65 (37.8)	NS[††]
Mother as housewife (n, %)	55 (65.5)	57 (66.3)	112 (65.1)	NS[††]
University degree (n, %)				
Father	40 (47.6)	45 (52.3)	85 (49.4)	NS[††]
Mother	34 (40.5)	43 (50.0)	77 (44.8)	NS[††]
Mothers' age (mean±SD)	41.9 ±5.6	41.4±5.2	41.7±5.4	NS[§]

[†] IQR: inter quartile range, (percentiles 25th and 75th).
[‡] Scale: 1-4, scores closer to zero indicate lower level of self esteem.
[§,¶,††] Difference between group used Independent t-test, U-Mann Whitney test (for continuous data), or Pearson chi-square test (for categorical data).

that were scheduled after class hours. To facilitate these activities, the schools recruited coaches from outside the school. Moreover, for the activities lacking school-ground facilities (e.g. futsal and swimming), the students were directed to the city's general training centre. Notably, the extracurricular activities did not require compulsory participation and the students were free to join (or not join) any activity; however, the teachers encouraged the students to participate in at least one activity in school. All of the schools had canteens, which provided several packaged and nonpackaged foods, as well as beverages and snacks. The students were not allowed to leave the premises for snacking during school hours. None of the schools involved in the study had a lunch programme; thus, the students bought food from the canteen or brought a lunch box from home.

No significant differences in the adolescents' characteristics were observed between the intervention and control groups. The mean age of the adolescents was 13 years, and a majority of them were girls. Most of the adolescents (93.1%) lived with their parents, and the remaining lived with either their father or mother alone, or with other family members. Additionally, there were no significant differences in the self-esteem scores noted between the intervention and control groups; on average, the adolescents had moderate self-esteem scores.

Furthermore, no significant differences were observed between the groups regarding the number of members in participants' families, or the occupations or highest educational qualifications of the parents. The average participant had five family members, consisting of two parents and three children. Most of the adolescents' fathers and mothers were entrepreneurs and housewives, respectively. The highest educational qualification of most of the parents was a college degree (Table 1).

Baseline characteristics of the study outcome

No significant differences in the baseline BMI z-scores, snacking habits, sedentary behaviours, or adolescents' self-efficacy scores for reducing snacking habits and sedentary behaviours were observed between the groups.

Results for the research hypothesis

The results for the research hypothesis are presented in Tables 2 and 3. Overall, the healthy lifestyle programme had a positive effect on the anthropometric indices of overweight adolescents within 3 months. The mean decrease in the BMI z-scores and waist circumference in the intervention group was significantly higher than that in the control group. After the 3-month intervention, the mean difference (Δ) was a 0.08 decrease in the intervention group, compared with a 0.02 decrease in the control group; likewise, the mean difference (Δ) in waist circumference was a decrease of 1.5 points in the in the intervention group, compared with an increase of 0.1 points in the control group.

The programme was also effective in term of behaviour modification. First, a significant difference in the reduction of snacking habits was observed between the groups. Although the frequency of snacking was still categorised as weekly, the frequency score for snacking was significantly decreased in both groups. After the 3-month intervention, the mean difference (Δ) in the intervention group scores was 0.15, compared with the 0.03 in the control group scores (p<0.05). However, for sedentary behaviours, no significant differences were observed between the groups; the average time spent on screen-based activities by the adolescents was 1 h/day in both the intervention and control groups.

The increasing score of adolescents' self-efficacy in reducing snacking habits and sedentary behaviour was

Table 2. The effect of healthy lifestyle programme on anthropometry after three months intervention among overweight adolescent in Makassar city

Variables[†]	Intervention (n=84)	Control (n=88)	Unadjusted *p*-value[§]	Adjusted *p*-value[¶]
BMI z-score[‡]				
Baseline (week 0)	1.45±0.26	1.48±0.26	NS	
End line (week 12)	1.37±0.38	1.46±0.33	<0.05*	
Change (Δ)	-0.08±0.23	-0.02±0.17	<0.05*	<0.05*
Waist Circumference (cm)				
Baseline (week 0)	78.4±5.0	76.2±6.5	<0.05*	
End line (week 12)	76.9±5.3	76.4±6.3	NS	
Change (Δ)	-1.5±3.7	0.1±3.5	<0.05*	<0.05*

[†]Expressed as mean±SD.
[‡]Calculated based on age- and sex-specific reference value from WHO 2007 growth reference, overweight; BMI Z-score = 1.00 – 2.00.
[§]Difference between groups use Independent t-test.
[*]Significant at *p*-value <0.05 (one-tiled). Symbol (-) showed the decreasing mean between baseline and end line.
[¶]Further analysis to see the effect of HLP on intervention group and control group (as reference), adjustment for variables of gender, age, and baseline data of anthropometric data. Analysis used ANCOVA.

Table 3. The effect of Healthy Lifestyle Program on adolescents' behaviours and self efficacy after three months intervention among overweight adolescents in Makassar City

Variables	Intervention (n=84)	Control (n=88)	Unadjusted *p*-value[§¶]	Adjusted *p*-value[††]
Behaviours[†]				
Reducing snacking habit				
Baseline (week 0)	0.50 (0.27; 0.99)	0.50 (0.27; 0.99)	NS	
End line (week 12)	0.37 (0.23; 0.79)	0.44 (0.24; 0.77)	NS	
Change (Δ)	-0.15 (-0.02; 0.44)	-0.03 (-0.11; 0.28)	<0.05*	
Reducing Sedentary Behaviour				
Baseline (week 0)	2.34 (1.96; 2.89)	2.55 (2.04; 2.96)	NS	
End line (week 12)	2.30 (1.87; 2.78)	2.43 (2.02; 2.91)	NS	
Change (Δ)	-0.02 (-0.32; 0.46)	-0.02 (-0.36; 0.43)	NS	
Self-efficacy[‡]				
Reducing snacking habit				
Baseline (week 0)	58.7±18.6	60.5 ±19.4	NS	
End line (week 12)	68.8±17.3	65.0±19.9	NS	
Change (Δ)	10.1±20.4	4.6±22.8	<0.05*	<0.05*
Reducing Sedentary Behaviour				
Baseline (week 0)	50.9±22.2	52.1±23.1	NS	
End line (week 12)	64.5±19.8	58.9±23.8	<0.05*	
Change (Δ)[3]	13.7±25.3	6.8±24.4	<0.05*	<0.05*

[†]Expressed as (median, IQR); IQR: inter quartile range, (percentiles 25th and 75th).
[‡]Expresses as mean±SD.
[§]Difference between groups use U Man-Whitney test (for not normal distribution of continuous data). As the baseline and three months data were not normally distributed, this variable was log transformed but this did not have a substantial impact on the presented results.
[¶]Difference between groups use Independent T-test.
*Significant at *p*-value <0.05 for (one-tiled). Symbol (-) showed the decreasing mean between baseline and end line.
[††]Further analysis to see the effect of HLP on intervention group and control group (as reference), adjustment for variables of gender, age, and baseline data of anthropometric data. Analysis used ANCOVA.

significantly higher in the intervention group than in the control group. After the 3-month intervention, the mean difference (Δ) was 10.0 and 11.9 in the intervention group, compared with the 4.6 and 4.6 in the control group for reducing snacking habits and sedentary behaviour, respectively.

Overall, most of the adolescents (92%) reported that they were satisfied with the programme. Those with problems such as unhealthy eating patterns and low physical activity levels were particularly interested in the sessions related to their specific behavioural problem. A majority of the parents (94%) also reported that they were highly satisfied with the programme; they especially found the nutrition education programme useful for inducing healthy behaviour in their adolescents.

The high compliance and satisfaction rates suggest that overweight adolescents and their parents found this intervention acceptable.

DISCUSSION

As a theory-based intervention, the healthy lifestyle programme applied all of the constructs of SCT as strategies for behavioural change.[21] The programme focused on four major categories, namely personal factors, environmental factors, behaviour, and nutritional status. We considered adolescents' self-efficacy in reducing snacking habits to be a personal factor, reducing snacking habits and sedentary behaviour to be behaviours, anthropometric indices

of BMI z-scores and waist circumference to be the nutritional status, and involvement of the adolescents' parents to be an environmental factor.

A significant reduction in the BMI z-scores was observed between the intervention and control groups. The reduction in BMI z-scores was accompanied by a reduction in waist circumference and snacking habits, and an increase in adolescents' self-efficacy in reducing their snacking habits after 3 months of nutrition education. Moreover, the reduction among overweight adolescents was higher in the intervention group than in the control group. By contrast, reduction in sedentary behaviour was not supported by our results.

Several similar studies on lifestyle interventions in overweight adolescents have been conducted.[15,16] These studies were also conducted for short-term periods (≤6 months), involved parents, and applied the behavioural strategies of SCT, such as goal setting, coping skills, and maintaining positive changes. In the present study, the reduction in BMI z-scores of the adolescents in the intervention group was marginal and less than that described in the previous studies;[15,16] however, these scores were still significantly higher than those of the control group, who only received nutrition information through leaflets.

In terms of overweightness-related behaviours, our hypothesis of a reduction in snacking habits was supported by the results. In particular, a significant reduction in the frequency of snacking was observed among overweight adolescents after 3 months of nutrition education; this reduction was higher in the intervention group than in the control group. Snacking is an eating pattern associated with overweightness; as previous studies have indicated, the consumption of food and beverages such as soft drinks and energy-dense fast foods, outside of the three main meals is associated with overweightness and obesity in adolescents.[31,32]

Our results regarding the reduction in the frequency of snacking provides evidence that nutrition education can improve adolescents' behaviour and facilitate adolescents' ability to take action.[12] In SCT, increasing behavioural capabilities and goal setting are appropriate strategies for enhancing the ability to take action.[21] To improve behavioural capability, adolescents in the current study learnt how to identify and choose less calorie-dense foods by improving their skills in reading food labels. Our results suggest that this strategy may stimulate adolescents' motivation to reduce their snacking habits.

The healthy lifestyle programme led to significant improvement in the self-efficacy scores of behavioural change between the two groups. After 3 months of nutrition education for overweight adolescents, self-efficacy in reducing snacking habits and sedentary behaviours was higher in the intervention group than in the control group.

According to SCT, self-efficacy is enhanced when individuals are motivated to achieve, exposed to positive models, and taught strategies to overcome challenges.[21] In other words, adolescents will not undertake tasks they feel are beyond their capabilities unless they believe they can produce the desired results. The more convinced they are that they can deal with a situation effectively, the more opportunities they receive, and the better they express their talents, thus increasing the probability of their success.[26]

Different sources to appraise self-efficacy beliefs of adolescents exist, including personal accomplishment or mastery experiences, vicarious experience, verbal persuasion by others, and emotional arousal;[21,26] in this programme, the first three strategies were applied. Personal mastery was achieved through the adolescents capably selecting healthy food; this was developed in the session on healthy eating, where the adolescents were taught to read food labels and were assisted in choosing a packaged snack on the basis of the nutrient content provided on the label. Previous studies have supported the use of personal mastery for increasing self-efficacy.[33, 34] One intervention study conducted among elementary school students aged 9–11 years revealed that treatment procedures such as the provision of problem-solving principles, practice in applying the principles, corrective feedback, and self-directed mastery were effective in developing skills and enhancing a sense of efficacy in children who had experienced profound failure in mathematics.[33] Another study conducted on 50 high school girls demonstrated that self-monitoring during self-regulated practice for the acquisition of a novel motor skill enhanced self-efficacy beliefs and skills in dart throwing.[34]

Vicarious experience was obtained through the other adolescents who had succeeded in achieving their own behavioural change goals. At each group session, the adolescents who had succeeded in achieving their goal of increasing their physical activity or increasing healthy eating shared their experience in dealing with their behavioural problems. They also shared the endorsements and impediments in their efforts to change unhealthy habits, which became a lesson for the others who were not yet successful in their effort. Thus, a successful adolescent became a 'role model' to motivate others, particularly those who failed to achieve their weekly behavioural change goals. Modelling is one of the most important ways to promote learning and self-efficacy,[33] the impact of which is strongest when observers believe that they too can be successful if they follow the model's behaviours and if they believe they are similar to the model in term of age, ability, and sex.[35,36]

Verbal persuasion was frequently delivered in group sessions to improve adolescent motivation for achieving a healthy lifestyle. Facilitators frequently persuaded the adolescents by delivering encouraging or reassuring statements in each session, particularly when the adolescent showed a lack of progress in their behavioural changes. Examples of encouraging comments and reassuring statements from facilitators were 'We believe in your ability to do it' and 'It's okay if you don't succeed this week, you will do better next week', respectively.

Although previous studies on strategies for increasing self-efficacy were not conducted for overweightness and obesity prevention, their findings could provide supporting evidence for the effect of personal mastery and vicarious experience on self-efficacy, which was also proven in the present study.

Strengths and limitations

This study is among the very few conducted in a developing country, particularly in Indonesia, that have applied a

theory-based intervention to address overweightness among adolescents. The SCT conceptual framework guided the development of the healthy lifestyle programme used in this study, which was tailored to the needs of adolescents in terms of the content, presentation of the module, and method of delivery. The main focus of the programme was to increase healthy behaviour for addressing the weight problem, increasing the awareness of adolescents' regard for their own behaviours, and enhancing their ability to make healthy behavioural choices. Notably, this was achieved while also engaging environmental forces to influence their choices.

Another strength of this study was the programme used. In addition to being developed according to the needs of adolescents herein, it has been evaluated by experts in nutrition, behaviour, and educational psychology for substantial and technical standardisation. Furthermore, prior to its implementation, the programme was assessed in a pilot study to demonstrate the feasibility of the programme among overweight adolescents with similar characteristics to those evaluated in the present study.

Nonetheless, this study also has several limitations. First, the programme focused on two behaviours (physical activity and healthy eating) for weight control, and the grouping adopted for the programme was not based on the adolescents' specific concerns regarding weight-related behaviours. Second, because the adolescents had their own focus, their attention was lower during unrelated sessions and discussions; this was reflected in the likelihood of behavioural change (namely, behaviours that were focused on were significantly changed, whereas other behaviours were not). Thus, the absence of change in some of the behaviours may not indicate that the programme was ineffective. Finally, the implementation of the intervention was inherently biased because the cluster randomisation study design prevented a blind study. To mitigate this bias, the schools and participants were not informed whether they had been classified into the intervention or control group.

Conclusion and recommendations

In short, the healthy lifestyle programme significantly contributed to decreasing the BMI z-scores and waist circumference, decreasing the frequency of snacking habits, and increasing self-efficacy to reduce snacking habits and sedentary behaviour among overweight adolescents. Notably, however, the increase in self-efficacy to reduce sedentary behaviours did not coincide with a reduction in the practice of such behaviours.

We offer some recommendations for future research on the basis of our results. First, additional studies that classify participants according to the type of behaviour change should aim to more accurately evaluate the effectiveness of the programme. In the current study, group sessions for nutrition education involved adolescents with different weight-related behaviours and different concerns regarding the behaviours to be changed, which likely influenced the apparent effectiveness of the programme. Second, the healthy lifestyle programme was effectively conducted in the school environment, as indicated by the high response rate of the participants. Therefore, we argue that integrating nutrition education into the school curriculum to familiarise students with healthy behaviours should be a key health strategy. Finally, high compliance and satisfaction rates for the healthy lifestyle programme suggest that the programme is promising and may address the issue of overweightness in adolescents; however, further study is needed to develop the programme in the community.

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AUTHOR DISCLOSURES

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