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DOI: 10.46903/gjms/21.04.1511

ORIGINAL ARTICLE

PARENTAL PARTICIPATION IN REDUCING OBESITY AND OVERWEIGHT AMONG BASIC SCHOOL STUDENTS: A RANDOMIZED CONTROLLED TRIAL

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ABSTRACT

Background: The prevalence of obesity and overweight among children and adolescents has increased globally. Research in Iraq reported an increase in the rate of obesity and overweight among the Iraqi population. In a study of 620 students in basic school, the prevalence of overweight and obese students in Baghdad rose to 30.3%. This study aimed to evaluate the effectiveness of parental education interventions through specific education programs to reduce obesity and overweight in basic school students.

Materials & Methods: A randomized controlled trial was conducted in the Sulaimani governorate of the Kurdistan region/Iraq among 15 basic schools. A total of 300 students aged 6 through 15 years, 150 in the intervention group and 150 in the comparison group, who were obese or overweight, were enrolled in this study. Participants were selected by applying stratified multistage cluster sampling from a total of 647 schools, and students were selected according to a probability proportional to the size. The intervention process included two parental education sessions focused on improving eating habits and physical activity of students. Data collection included anthropometric measurements, dietary habits, daily time spent on digital devices, and physical activity at the beginning and end of the school year.

Results: A significant change in body mass index (BMI) was observed between the groups at the end of the intervention; 1.16 kg/m^2 was reduced in the intervention group and 0.58 kg/m^2 in the comparison group, P ≤0.001. There was a significant change in the mean waist circumference (WC) between the groups: (-3.49) centimeters (cm) in the intervention group and (-2.52) cm in the comparison group (P = 0.05). After the follow-up, the baseline intervention group's total mean physical activity score was 27.66 ±9.58 and significantly increased to 30.78 ±7.80 at the end of the year. While in the comparison groups, it increased from 27.58 ±8.51 to 28.00 ±7.32.

Conclusion: Parental participation in education programs positively affected body mass index, dietary habits, and physical activity of obese and overweight students in basic school and lead to reducing body weight of students.

KEY WORDS: Childhood Obesity; Dietary Habits; Exercise; Intervention; Overweight.

Cite as: Ibrahem AM, Ali BM, Ezzaddin SA. Parental participation in reducing obesity and overweight among basic school students: a randomized controlled trial. Gomal J Med Sci 2023 Oct-Dec;21(4):288-97. https://doi.org/1046903/gjms/21.04.1511

INTRODUCTION

The prevalence of obesity and overweight among children and adolescents has increased widely around the world,[1] and according to World Health Organization (WHO) data, obesity and overweight in children in the last three years increased to 47.1%.[2] Several studies in Iraq reported an increase in the rate of obesity and overweight among the Iraqi population. In a study conducted among 620 basic school children, the prevalence of obesity and overweight increased to 30.3% in Baghdad.[3]

Initial education programmes about childhood obesity are critical to addressing the obesity epidemic.[4] Epidemiological and clinical studies have confirmed the role of a low-calorie diet, increased physical activity, and cognitive strategies to change behaviours.[5] School-based interventions, practice- policy, and education are required to reach across all areas throughout all regions and countries, socioeconomic levels, cultures, and healthcare coverage systems

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Date Submitted: 24-05-2023
Date Revised: 12-11-2023
Date Accepted: 09-12-2023

to reach those people with the greatest needs because all participate in the health outcomes of the consequences of overweight and obesity of children and adolescents. Therefore, it should not include only children and adolescents concerning reducing childhood overweight and obesity. It should also include parents, schools, early care and education providers, caregivers, community and business leaders, healthcare professionals, state and local officials, and society in general.[6] Until now, no meta-analysis or systematic reviews have been conducted that determined plan that had the maximum effect on healthy eating behaviour of basic school children.[7]

This study hypothesised that teaching school-aged students healthy lifestyle habits will help them break their unhealthy eating. Children will be taught about healthy eating, form healthy eating habits, and maintain an active lifestyle in order to learn the possibility that they will develop chronic diseases like obesity, cardiovascular disease, non-insulin-dependent diabetes, specific types of cancer, etc. as they get older. This study aimed to evaluate the effectiveness of the parental participation by adopting an educational program on the reduction of obesity and overweight in basic school students in the Sulaimani governorate, and to assess how the intervention affected school-age students and would change their eating habits and physical activity.

MATERIALS AND METHODS

The research protocol number was (7/5/9558), and the study was reviewed and approved by the ethics committee of the College of Medicine/ University of Sulaimani. The present study is a randomized controlled trial. A total of 300 overweight or obese students aged 6-15, corresponding to grades one-nine. were enrolled in this study. It included boys and girls from 15 basic schools in the Sulaimani governorate. Participants were selected by applying stratified multistage cluster sampling from a total of 647 schools, and students were selected according to a probability proportional to the size. Participants were randomly assigned to two groups: 150 students were assigned to the intervention group, and 150 students were assigned to the comparison group.

The educational program was under the name I'M ACTIVE, focusing on promoting a healthy lifestyle for obese and overweight students by providing two different parent education sessions. The educational program was provided for 22 weeks. The anthropometric measurements were conducted at two different time points: the baseline measurement was started on 19th September 2021, and the follow-up measurement was conducted at the end of the school year on 15th April 2022.

Parents in the intervention groups participated in a one-hour seminar presentation provided by the principal researcher, and they received a paper-printed brochure contained the same information of the seminar presentation. While, parents in the comparison groups received only the paper-printed brochure without a seminar presentation. After 10 weeks, the principal researcher provided a second education session for both groups.

The questionnaire form was in Kurdish, and the pretest was performed on 15 students before starting data collection. After selecting participants', the questionnaire was distributed among the parents through eligible children. Then, the parents filled out the questionnaires collected the next day.

The weight was measured without shoes and in a light cloth school uniform using a MEDEL 2316 crystal international digital weighing scale/ Italy and measured to the nearest 0.1 kg.

Similarly, height was measured using an ANTHROFLEX wall-mounted stadiometer with a wall plate without shoes used with students standing on the wall and measured to the nearest 0.1 cm. Body weight status was defined based on BMI for age and sex Z-score cut-off points from the WHO Z-score child growth chart reference.[2] The WC and hip circumferences (HC) were measured to the nearest 0.1 cm with an anthropometric tape while the children wore light clothing.[8]

The analysis was performed using the SPSS for Windows statistical software package (version 22.0. IBM corporation. Inc., Chicago. USA). Categorical variables were presented in percentages and evaluated using the chisquare test, while continuous variables were reported as mean ±standard deviation (SD). The paired *t*-test was used for values with continuous variables to independently compare the results from baseline and follow-up measurements for each group. Repeated measures ANOVA test was used to evaluate the mean changes between the intervention and comparison group.[9] Furthermore, McNemar test was used to find possible changes in dietary consumption at baseline and follow-up for both groups The P-value of ≤ 0.05 was accepted as statistically significant.

RESULTS

In this study, 300 students were enrolled during the study period, representing the response rate of 95.1%. Baseline and follow-up measurements were available only for 295 (98.3%) of them, representing 148 (50.2%) of the intervention group and 147 (49.8%) of the comparison group; the dropouts did not attend the class for various reasons (see Figure 1). Of this, 189 (64.1%) were boys and 106 (35.9%) were girls. Additionally, 74.2% of the students were held in grades 1-6, while 25.8 % were in grades 7-9 (see Table 1). At the beginning there were no significant differences between the intervention and comparison group characteristics.

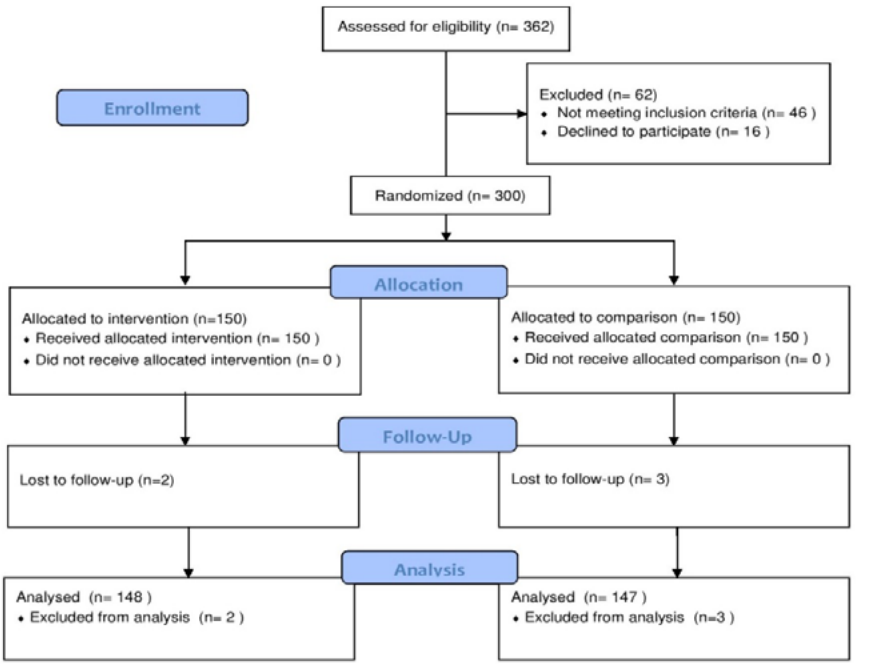

Figure 1. Flow chart of participants through the study

The results showed that the mean body weight of the intervention groups at the beginning of the study was 60.57±18.32 kg, and after follow-up it was 59.54±17.93 kg with a mean difference of (-1.02±2.11 kg). However, the mean body weight of the participants in the comparison group at the beginning and follow-up of was 61.70±19.20 kg and 61.90±19.15 kg, respectively, with a mean difference of 0.20±2.14 kg.

The study results also showed a significant decrease in mean BMI for study participants between baseline and follow-up for both groups, among the intervention group, it was reduced from 27.03±4.68 kg/m^2 to 25.86±4.55 kg/m^2 (P≤ 0.001), while among the comparison group, it was reduced from 26.92±4.26 kg/m^2 to 26.34±4.26 kg/m^2 (P≤0.001). Furthermore, based on repeated measure ANOVA analysis, the difference in mean BMI was significant between the groups (P ≤0.001) at the end of the study (see Table 2).

The results of this study showed that the percentages of students who had a regular breakfast among the intervention group increased after follow-up (62.2% at the beginning and 70.9% at the end of the year; P =0.015), fruit consuming three times or more per a day among the intervention group was increased from 9.5% to 26.4%, (P≤0.001). On the other hand, among the comparison group, the percentages of students who ate regular breakfast increased from 60.5% vs. 63.9%, and vegetables consumption one to two times a day increased from 55.1% vs. 57.8%. Still, the changes were insignificant (P=0.082) (see Table 3).

Figure 2 shows daily time spent on digital devices; the study results showed a notable variation in the mean daily time spent in hours from baseline to the end of the year for all variables in the intervention group.

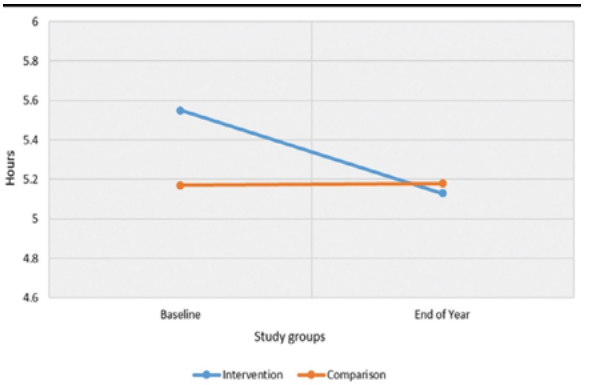

Figure 2. Daily time spent on digital devices during baseline and end of the year

The summary of various physical activities was analysed in the paired *t-test*. The results showed that the total mean score of the intervention group at baseline was 27.66 ± 9.58 and significantly increased to 30.30± 8.70 at follow-up. Although the total mean score of the comparison group was 27.58 ±8.51 at baseline, it did not change significantly to 28.00± 7.32 after follow-up. There was a significant difference of total activity scoring between intervention and control group at the end of the year (P≤0.001) (see Table 4).

Table 1. Sociodemographic characteristics of students

Characteristics No. (%)		Intervention	Comparison	Total	P-value*
		No. (%)	No. (%)		
Gender	Boys Girls	99 (66.9) 49 (33.1)	90 (61.2) 57 (38.8)	189 (64.1) 106 (35.9)	0.310
Grades	Grade 1-6 Grade 7-9	110 (74.3) 38 (25.7)	109 (74.1) 38 (25.9)	219 (74.2) 76 (25.8)	0.973
Age groups (Years)	6-10 11-15	58 (39.2) 90 (60.8)	48 (32.7) 99 (67.3)	106 (35.9) 189 (64.1)	0.242
Father age groups (Years)	25- 44 45-64 ≥ 65 Uncertain	92 (62.2) 50 (33.8) 2 (1.4) 4 (2.7)	86 (58.5) 56 (38.1) 1 (0.7) 4 (2.7)	178 (60.3) 106 (35.9) 3 (1.0) 8 (2.7)	0.832
Mother age groups (Years)	25- 44 45-64 Uncertain	123 (83.1) 24 (16.2) 1 (0.7)	113 (76.9) 33 (22.4) 1 (0.7)	236 (80.0) 57 (19.3) 2 (0.7)	0.398
Father Education	Illiterate Primary Secondary College Uncertain	24 (16.2) 60 (40.5) 44 (29.7) 16 (10.8) 4 (2.7)	26 (17.7) 52 (35.4) 53 (36.1) 12 (8.2) 4 (2.7)	50 (16.9) 112 (38.0) 97 (32.9) 28 (9.5) 8 (2.7)	0.726
Mother Education	Illiterate Primary Secondary College Uncertain	48 (32.4) 46 (31.1) 34 (23.0) 19 (12.8) 1 (0.7)	50 (34.0) 49 (33.3) 33 (22.4) 14 (9.5) 1 (0.7)	98 (33.2) 95 (32.2) 67 (22.7) 33 (11.2) 2 (0.7)	0.924
Father Occupation	Unemployed Manual Non-Manual High-level Dead, divorced	8 (5.4) 39 (26.4) 88 (59.5) 9 (6.1) 4 (2.7)	5 (3.4) 41 (27.9) 87 (59.2) 10 (6.8) 4 (2.7)	13 (4.4) 80 (27.1) 175 (59.3) 19 (6.4) 8 (2.7)	0.939
Mother Occupation	Housewife Manual Non-Manual High-level Dead, divorced	120 (81.1) 4 (2.7) 19 (12.8) 4 (2.7) 1 (0.7)	120 (81.7) 4 (2.7) 19 (12.9) 3 (2.0) 1 (0.7)	240 (81.4) 8 (2.7) 38 (12.8) 7 (2.4) 2 (0.7)	0.998
SES**	Low SES Medium SES High SES	38 (25.7) 92 (62.1) 18 (12.2)	30 (20.4) 102 (69.4) 15 (10.2)	68 (23.1) 194 (65.7) 33 (11.2)	0.422

*Comparisons between groups in the variables were conducted using the chi-square test

**SES; Socioeconomic status.

Table 2: Anthropometric measurements of students during baseline and follow-up

Variables	Mean ± SD		Mean difference	P-value* time effect	P-value** group effect
	Baseline	Follow-up	Mean ± SD		
Weight (kg)					
Intervention	60.57 ± 18.32	59.54 ± 17.83	-1.02 ± 2.11	≤ 0.001	≤ 0.001
Comparison	61.70 ± 19.20	61.90 ± 19.15	0.20 ± 2.14	0.268	
Height (cm)					
Intervention	147.97 ± 12.66	150.04 ± 12.94	2.06 ± 2.94	≤ 0.001	0.538
Comparison	149.45 ± 13.21	151.35 ± 13.15	1.90 ± 1.29	≤ 0.001	
BMI $(kg/m)^2$					
Intervention	27.03 ± 4.68	25.86 ± 4.55	-1.16 ± 1.31	≤ 0.001	≤ 0.001
Comparison	26.92 ± 4.26	26.34 ± 4.26	-0.58 ±1.04	≤ 0.001	
BMI Z- score					
Intervention	2.11 ± 0.60	1.85 ± 0.65	-0.26 ± 0.51	≤ 0.001	0.029
Comparison	2.03 ± 0.65	1.89 ± 0.67	-0.14 ± 0.37	≤ 0.001	
WC (cm)					
Intervention	84.25 ± 12.06	80.75 ± 11.57	-3.49 ± 4.27	≤ 0.001	0.05
Comparison	84.21 ± 12.11	81.69 ± 11.56	-2.52 ± 4.26	≤ 0.001	
HC (cm)					
Intervention	93.34 ± 11.50	91.48 ± 11.30	-1.86 ± 3.32	≤ 0.001	0.128
Comparison	93.99 ± 11.70	92.69 ± 11.83	-1.30 ± 3.03	≤ 0.001	
WHR (cm)					
Intervention	0.90 ± 0.06	0.88 ± 0.06	-0.02 ± 0.05	≤ 0.001	0.277
Comparison	0.89 ± 0.06	0.88 ± 0.06	-0.01 ± 0.04	≤ 0.001	

BMI body mass index, BMI Z- score body mass index Z-score, WC waist circumference, HC hip circumference, WHR waist circumference to hip circumference ratio, SD standard deviation *results based on a paired *t*-test of compare groups, **results based on repeated measure ANOVA for compare groups.

Table 3. Eating habits during baseline and follow-up between the intervention and comparison groups

Eating habit	Intervention		*P**	Comparison		*P**	*P***
	Baseline n (%)	**Follow-up** n (%)		**Baseline** n (%)	**Follow-up** n (%)		
Eating breakfast regularly							
Yes	92 (62.2)	105 (70.9)	0.015	89 (60.5)	94 (63.9)	0.302	0.006
No	56 (37.8)	43 (29.1)		58 (39.5)	53 (36.1)		
Eating fruit /day							
Never	4 (2.7)	1 (0.7)	≤0.001	4 (2.7)	3 (2.0)	0.050	≤0.001
1-2 times/day	130(87.8)	108 (73.0)		133(90.5)	129 (87.8)		
≥3 times/day	14 (9.5)	39 (26.4)		10 (6.8)	15 (10.2)		
Eating vegetables/ day							
Never	65 (43.9)	37 (25.0)	≤0.001	64 (43.5)	59 (40.1)	0.082	≤0.001
1-2 times/day	82 (55.4)	104 (70.3)		81 (55.1)	85 (57.8)		
≥ 3 times/day	1 (0.7)	7 (4.7)		2 (1.4)	3 (2.0)		
Eating snack per /day							
Never	44 (29.7)	69 (46.6)	≤0.001	52 (35.4)	70 (47.6)	≤0.001	≤0.001
1-2 times/day	88 (59.5)	69 (46.6)		78 (53.1)	61 (41.5)		
≥ 3 times/day	16 (10.8)	10 (6.8)		17 (11.6)	16 (10.9)		
Eating during homework							
Yes	29 (19.6)	24 (16.2)	0.063	27 (18.4)	23 (15.6)	0.289	0.022
No	119 (80.4)	124 (83.8)		120 (81.6)	124 (84.4)		
Eating fast food /week							
Never	35 (23.6)	48 (32.4)	≤0.001	37 (25.2)	44 (29.9)	0.005	≤0.001
1-2 times/week	68 (45.9)	65 (43.9)		57 (38.8)	59 (40.1)		
3-4 times/week	31 (20.9)	25 (16.9)		41 (27.9)	33 (22.4)		
> 4 times/week	14 (9.5)	10 (6.8)		12 (8.2)	11 (7.5)		
Soft drinking /week							
Never	15 (10.1)	30 (20.3)	≤0.001	6 (4.1)	16 (10.9)	0.01	≤0.001
1-2 times/week	65 (43.9)	63 (42.6)		70 (47.6)	66 (44.9)		
3-4 times/week	43 (29.1)	39 (26.4)		34 (23.1)	33 (22.4)		
> 4 times/week	25 (16.9)	16 (10.8)		37 (25.2)	32 (21.8)		
Dessert per /week							
Never	14 (9.5)	36 (24.3)	≤0.001	24 (16.3)	31 (21.1)	0.125	≤0.001
1-2 times/week	67 (45.3)	57 (38.5)		65 (44.2)	58 (39.5)		
3-4 times/week	49 (33.1)	43 (29.1)		38 (25.9)	38 (25.9)		
> 4 times/week	18 (12.2)	12 (8.1)		20 (13.6)	20 (13.6)		

*Results based on compare between baseline and follow-up of each group independently.

** Results based on compare between intervention and comparison group. P-value is significant at level ≤ 0.05

Table 4: Physical activity of students at baseline and follow-up

Variables	Mean ±SD		Mean difference	P-value* time effect	P-value** group effect
	Baseline	Follow-up	Mean ±SD		
Sport activity score					
Intervention	5.36 ± 4.69	6.29 ± 4.47	0.93 ±1.47	≤0.001	≤0.001
Control	5.20 ± 4.58	5.31 ± 4.28	0.12 ±1.14	0.222	
leisure time activity score					
Intervention	13.81 ± 5.14	15.34 ± 4.61	1.53 ± 2.29	≤0.001	≤0.001
Control	13.66 ± 5.01	13.71 ± 4.32	0.05 ± 2.36	0.780	
School time activity score					
Intervention	8.42 ± 3.74	9.15 ± 3.43	0.73 ± 1.60	≤0.001	0.002
Control	8.79 ± 3.34	8.97 ± 3.10	0.18 ± 1.31	0.091	
Total activity score					
Intervention	27.66 ± 9.58	30.78 ± 8.70	3.12 ± 3.31	≤0.001	≤0.001
Control	27.58 ± 8.51	28.00 ± 7.32	0.42 ± 2.67	0.057	

* A paired t-test used to assess effects between baseline and follow-up,

** A repeated measure ANOVA is used to compare groups at the end of the year; the score unit of various physical activities is determined by point.

DISCUSSION

The sample represents basic schools in the Sulaimani Governorate -Kurdistan region/Iraq. The reason for choosing school is essential to prevent childhood obesity and overweight through health education about physical activity and a healthy diet plan.[10] Many childhood obesity-related prevention programs were carried out in schools and focused on obese and overweight children[9, 11, 12] emphasizing the need for parental participation in such effective programs.[13] No similar study is available examining the effectiveness of parental participation in seminars presentation and a paper-printed brochure on childhood obesity and overweight. To some extent, the study hypothesis successfully improved anthropometric measurements. Regarding changes from baseline and follow-up, the results of this study showed a significant difference between the mean weight of the intervention group and the comparison group (-1.02±2.11, 0.20±2.12, respectively, P≤0.001); this result is consistent with a study by Nemet et al., which reported a significant increase in the mean weight of the comparison group compared to the intervention group.[14] The weight reduction plan should be recommended only in people with severe obesity while keeping body weight constant with linear growth and focusing on practical goals when applying the weight management plans.

The exciting finding of this study is a significant change (P≤0.001) in mean BMI for age from baseline and follow-up for the intervention group (-1.16 kg/m^2) compared to the comparison group (-0.58 kg/m^2). Our results indicate a good point of influence for the parent education program in reducing their child's body mass index, which is in agreement with the results of previous studies conducted by Jiang et al.[15], Seyed Saeed Mazloomy et al.[16] and Pasdar et al.[17] that demonstrated that body mass index decreased among schoolchildren and adolescents after education intervention. In contrast, others reported that BMI did not appear to be influenced by the intervention.[18, 19, 20, 21] The study by Waters et al.[21] reported that 0.15 units of BMI reduction in BMI in the intervention was considered to clinically significant. Keep your BMI, and in some individuals, even a limited increase in BMI can be considered an achievement because the BMI often increases with age[14, 16] (e.g., the 97th percentile for boys is 22.2kg/m^2 at the age of 10 years and 26.4 kg/m^2 at the age of 15 years).

Our results are consistent with a previous intervention study on diet and physical activity that reported a significant decrease in WC among children[22] and a study conducted by Stuart J Fairclough et al. that

reported significant differences between the WC groups after intervention.

This study showed that regular breakfast consumption increased significantly between the intervention group and the comparison group, indicating a protective factor against childhood obesity. This result is similar to other studies that reported a positive change in breakfast intake after intervention,[23, 24, 25, 26] contrary to other studies that reported no change in breakfast intake during the intervention period[27, 2827, 28.37,38] Children and adolescents with regular breakfast consumption have been associated with healthy body weight and positive health outcomes.[8, 29] Furthermore, according to a systematic review and meta-analysis study conducted in 2019, breakfast skipping is correlated with overweight and obesity.[30]

Interestingly, the surprizing point of our results was the significant improvement in vegetable intake by students in the intervention group after follow-up. For those who never ate vegetables, the percentage decreased from 43.9% to 25%, and for those who ate one to two times a day, it increased from 55.4% to 70.3%. These results are consistent with the study being conducted to reduce the prevalence of obesity among children who reported a significant increase in daily fruit and vegetable intake.[31]

The result of this study is consistent with other studies that last for various durations or revealed a significant increase in physical activity in the intervention groups compared to the comparison groups.[32, 33] Some studies recommended implementing these interventions on the entire population of basic schools[34, 35]. In contrast, some other studies reported no significant differences in physical activity between the intervention group and the comparison group[36, 3736, 37.49,50] according to Brown and Summer Bell, who reported in their study[38] that a combination of strategies based on physical activity and diet might be more effective in combating overweight and obesity.

The limitations of our study should be considered. First, the intervention involved only two round of measurement and two education session. Second, the evaluation of changes in knowledge, attitude, and behaviour linked to childhood obesity was not conducted in this study, since it has already been addressed in previous reports. Despite these limitations, the study has several strengths that can also be mentioned. First, the current intervention approach is the first study design conducted in the Kurdistan Region, so the importance of this study allowed for recognizing the association between parent behaviours and student lifestyle. Second, a multistage cluster randomized design was used and 15 basic schools from different geographical areas in Sulaimani governorate were used to make the representative results a strength point. Furthermore, positive cooperation was obtained from parents and the authority of selected schools, resulting in a high response rate of participation in this study.

CONCLUSIONS

In the current study, I'm Active programme effectively decreased BMI, WC in children and adolescents with obesity and overweight. This work significantly improved some of the eating and dietary habits and reduced the daily time spent on digital devices among students. This study also assessed that the education approaches significantly increased physical activity among the intervention groups, especially sports and leisure time activities.

Trial registration: The study was registered at International Standard Randomized Controlled Trial Number: ISRCTN17752811 (https://www.isrctn.com)

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
GRANT SUPPORT AND FINANCIAL DISCLOSURE
None declared.

AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

Conception or Design:	AMI, BMA
Acquisition, Analysis or Interpretation of Data:	AMI, BMA, SAE
Manuscript Writing & Approval:	AMI, BMA, SAE

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.