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Impact of text message-based intervention for weight control and health-promoting lifestyle behaviors of overweight and obese children

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Abstract:

BACKGROUND AND AIM: Little information is available on the use of text messages through mobile phones to address overweight/obesity in children. This study aims to evaluate the impact of a text message-based intervention for weight control and health-promoting lifestyle behaviors of overweight/obese children.

MATERIALS AND METHODS: This quasi-experimental study was conducted among overweight/obese school students. Data on sociodemographic, dietary intake, sleep, sedentary behavior, physical activity (PA), and anthropometry were collected before and after the intervention. Weight and height were examined according to the standard protocols. The intervention was consisted of tailored messages for weight control and healthy lifestyle, including diet, PA, sedentary behavior, and sleep. Child attitude and his practice were asked before and after the intervention. The paired *t*-test was performed to compare means of continuous variables before and after the intervention for normal distribution data. The Wilcoxon test was also used for nonnormal data.

RESULTS: A total of 71 boy students were included in the study (62% obese). The mean age was 10.07 years. The means of attitude score for PA, nutrition, and sleep after intervention were greater than before it, but it was significant only for PA. The mean of nighttime sleep duration of students after the intervention was significantly less. Furthermore, unhealthy score decreases after the intervention.

CONCLUSION: Three-month lifestyle intervention as text messages had positive effects on the nutritional intake of obese children and their attitudes toward PA, but no effect on child body mass index.

Keywords:

Child, healthy lifestyle, intervention, obesity, weight

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Introduction

Childhood obesity is a major public health problem worldwide. The obesity prevalence is at an alarming rate in children and adolescents.[1] In developed countries, approximately 19% of children are overweight and 7% are obese.[2] The prevalence of general and abdominal obesity is 11.89% and 19.12%, respectively, in Iranian children and adolescents.[3] Child and adolescent overweight/obesity is associated with several physical and psychological complications including type 2 diabetes, cancer, cardiovascular disease, and hypertension; therefore, interventions are necessary for child health, well-being, long-term weight control, and prevention of related comorbidities.[4] It has been suggested that weight loss up to 5%–10% significantly improves the risk of hypertension, diabetes mellitus, insulin resistance, and cancer. Therefore, lifestyle interventions which promote sustained weight loss have likely health benefits.[5]

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As technology has become an important part of the daily life, particularly among adolescents, technology-based interventions such as social media, smartphone applications, internet-based weight control tools, and video games have been developed to promote weight management in children and adolescents.[6,7]

Mobile phone short message service (SMS) or text messaging is known as a way to deliver health information in a simple and lower cost approach.[8] Previous studies have demonstrated the feasibility and acceptability of SMS as a tool for weight control interventions and health-promoting behaviors.[9-12] In addition, mobile messages are considered as an interesting way to involve children in health behavior changes.[12]

Data are available on technology and mobile applications in different clinical areas such as smoking cessation,[13] diabetes control,[14] cardiac rehabilitation,[15] and patient support,[16] but information is scarce regarding the use of mobile health approach in weight control and healthy behaviors of children and adolescents.

Mobile phones might provide an opportunity for improvement of health behaviors such as self-monitoring mainly using SMS or text messages. As an example, mobile phone SMS for college students and adults increased the effectiveness of an intervention for smoking cessation.[17] Online technology has also been used for chronic disease[18] and weight loss programs in adolescents.[19] Mobile-based interventions have been successfully used to provide reminders and health-care points for diabetic adolescents and resulted in glycemic control.[20,21] In a previous study, sending daily text messages has improved disease self-control, self-efficacy, and treatment adherence among youth with type 1 diabetes.[20] Another previous study conducted in South Korean adults demonstrated that text messages about health behavior modification, diet, and physical activity (PA) could promote the weight loss during 12 weeks.[22] Web-based interventions showed positive effects in promoting PA[23] and healthy eating[24] among adolescents.

To the best of our knowledge, there is little information on the use of daily text messages through mobile phones to address overweight/obesity and to promote healthy behaviors in children and adolescents. Therefore, the aim of this study was to evaluate the impact of a text message-based intervention for weight control and health-promoting lifestyle behaviors of overweight and obese children.

Materials and Methods

This quasi-experimental study was conducted among 71 overweight and obese school students with the mean age of 10.07 years. Data on sociodemographic, dietary intake, sleep, sedentary behavior, PA, and anthropometry were collected before and after the intervention. Anthropometric indices including weight and height were examined according to the standard protocols. Bodyweight was measured without shoes and wearing light clothes to the nearest 0.1 kg. Standing height was recorded without shoes with a nonelastic tape to the nearest 0.1 cm. Body mass index (BMI) was then calculated as weight divided by height (kg/m^2). Overweight (BMI between the 85th and 95th percentiles for age and sex) and obesity (BMI greater than the 95th percentile) were defined according to the World Health Organization (WHO) reference curves.[25] The intervention was consisted of tailored messages for weight control and healthy lifestyle, including diet, PA, sedentary behavior, and sleep. Written informed consent was obtained from parents. Messages were delivered through SMS for students and their parents. The child attitude and his practice were asked before and after the intervention.

Daily intake of food items was considered as high, weekly intake as moderate and never, or seldom intake was categorized as low. Eating 5–6 days/week of main meals was considered as high, 3–4 days/week as moderate and never, or 1–2 days/week was categorized as low. The unhealthy score was defined as sum of the food items including high-fat dairy, fried potatoes, sausages, cakes, biscuits, candy, puffs and chips, pretzels, soda and cola, sugar-sweetened beverages, fried foods, fried potatoes, and organ meat (liver, kidney, and face). Daily intakes of unhealthy food items were coded as 1, weekly, never or seldom intake was categorized as 0, and then, the sum of these items was considered.

Statistical analysis

The analyses data were performed using (USA) SPSS statistical software version 20 (IBM, Chicago, IL, USA). $P < 0.05$ was considered as statistically significant. The results are represented as mean (standard deviation [SD]) and *n* (%) for continuous and categorical variables, respectively. The normality of data was assess graphically and using statistical tests. The paired *t*-test was performed to compare means of continuous variables before and after the intervention for normal distribution data. The Wilcoxon test was also used for nonnormal data.

Results

A total of 71 boy students (62% obese) were included in the study. The age mean (SD) was 10.07 (1.47) years. Table 1 shows the characteristics of students and their parents. The means of attitude score for PA, nutrition, and sleep. Attitudes of students about lifestyle behaviors

Table 1: Participant characteristics in the study

Child characteristics	Mean (SD)/*n* (%)
Age (year), mean (SD)	10.07 (1.47)
Weight (kg), mean (SD)	49.06 (12.44)
Height (cm), mean (SD)	143.43 (12.05)
Single child, *n* (%)	29 (40.8)
Parent characteristics	
Father: Education level, *n* (%)	
Diploma or lower	30 (42.3)
Bachelor's degree	26 (36.6)
Higher than bachelor's degree	26 (36.6)
Work status, *n* (%)	
Employee	31 (43.7)
Others	40 (56.3)
Mother: Education level, *n* (%)	
Diploma or lower	24 (33.8)
Bachelor's degree	38 (53.5)
Higher than bachelor's degree	9 (12.7)
Work status, *n* (%)	
Housekeeper	45 (63.4)
Others	26 (36.6)

SD=Standard deviation

Table 2: Attitudes of students about lifestyle behaviors before and after the intervention

Attitudes of students	Before	After	*P*
Attitude score about PA	69.22 (20.40)	75.23 (21.21)	0.017
Attitude score about nutrition	70.17 (11.78)	72.65 (9.48)	0.094
Attitude score about sleep	49.51 (21)	51.35 (21.43)	0.6
Sedentary time in each days (h)	5.80 (1.13)	6.02 (1.47)	0.29
PA (min), median (IQR)	90 (60)	90 (60)	0.340*
Nighttime sleep duration (h)	8.52 (0.69)	8.32 (0.70)	0.005
BMI (kg/m^2)	23.25 (3.59)	23.41 (4.16)	0.71
Unhealthy score, median (IQR)	2 (1)	0 (1)	<0.001*

Results are expressed as mean (SD) for normal data. **P* values were obtained using paired *t*-test for normal data except that were obtained using the Wilcoxon test. SD=Standard deviation, IQR=Interquartile range, PA=Physical activity, BMI=Body mass index

before and after the intervention are presented in Table 2 after the intervention were greater than before it, but it was significant only for PA. The mean of nighttime sleep duration of students after the intervention was significantly less. Furthermore, unhealthy score decreases after the intervention. Dietary intake of students before and after the intervention are shown in Table 3, as frequency and percentages.

Discussion

We found that a 3-month lifestyle intervention for children who receive an SMS program had positive effects on nutritional intake and attitudes toward PA. However, 3 months of access to the same messages had no effect on child BMI.

Due to the high use of technology among children and adolescents,[26] the use of mobile technologies might offer a practical and reliable tool for obesity management and health-promoting behaviors. Previous studies have suggested that at least one SMS/day might be suitable for motivating participants to engage in weight management without considerable burden.[27] During the past decade, intervention programs using technology for obesity management and health-promoting behaviors have been examined in schools, after-school programs, and clinics.

Mobile phone programs for weight control have mainly consisted of SMS text messages and/or mobile applications. It has been indicated that programs using text messages had positive effects on management of bodyweight, waist circumference, and increasing PA levels among adults and lower intake of sugar-sweetened beverages, better monitoring for physical activities, and sedentary behaviors among children.[28,29] An intervention-based study using tailored messages resulted in weight loss over 4 months in overweight and obese adults.[28] Therefore, the use of technology has the potential to reduce obesity, particularly when the intervention mainly focuses on lifestyle modification and health promotion including healthy dietary habits and PA.[5]

The current findings are consistent with other previous interventions targeting overweight children and adolescents. A 12-week diet and PA intervention program among overweight adolescents indicated lower levels of fasting insulin, but no change was documented in BMI or adiposity.[30] Another 12-month school-based intervention on overweight adolescents at risk for diabetes found no effects on BMI or PA but results in higher self-efficacy for PA and better food choices.[31] Thus, it is possible that these students were more self-motivated than before intervention.

Consistent with these findings, another study found an average 2% decrease in the body fat of participants who received tailored PA SMS, but no significant difference in BMI.[22] A community-based intervention with counseling calls and E-mails had no effect on weight loss, improvement in diet or PA.[32] Given that, in the present study, BMI or adiposity and PA did not change, suggest the need for more and comprehensive intervention, for example, adding PA classes for overweight children and family-based behavioral interventions.

Several intervention programs provided short-term improvements in BMI, but none of them seem to have sustainable effects.[33] In some previous studies, participants did not have access to exercise opportunities; thus, they more likely returned to their previous lifestyle habits and obesity.[33] Due to the large variation in

Table 3: Dietary intake of students before and after the intervention

Dietary intake of students	Before			After		
	Low	Moderate	High	Low	Moderate	High
High fat dairy	13 (18.8)	48 (69.6)	8 (11.6)	13 (18.8)	48 (69.6)	8 (11.6)
Ordinary dairy	2 (2.9)	28 (40)	40 (57.1)	1 (1.4)	25 (36.2)	43 (62.3)
Meat and pulses	2 (2.9)	51 (72.9)	17 (23.9)	2 (2.9)	45 (65.2)	22 (31.9)
Junk foods*	14 (20.3)	51 (73.9)	4 (5.8)	13 (18.8)	54 (78.3)	2 (2.9)
Grains (bread, rice, and spaghetti)	0 (0)	26 (37.1)	44 (62.9)	0 (0)	33 (47.8)	36 (52.2)
Nuts and dried fruits	17 (23.9)	38 (53.5)	16 (22.5)	15 (21.1)	43 (60.6)	13 (18.3)
Fruits and natural fruit juices	4 (5.7)	28 (40)	38 (54.3)	2 (2.9)	27 (38.6)	41 (58.6)
Vegetables	11 (15.5)	21 (29.6)	39 (54.9)	11 (15.5)	30 (42.3)	30 (42.3)
Break fast	23 (32.9)	15 (21.4)	32 (45.7)	12 (17.4)	18 (26.1)	39 (56.5)
Lunch	3 (4.2)	6 (8.5)	62 (87.3)	5 (7.2)	6 (8.7)	58 (84.1)
Dinner	1 (1.4)	8 (11.3)	62 (87.3)	9 (12.9)	7 (10)	54 (77.1)

Data are presented as frequency (%). *Junk foods include fried potatoes, sausage, cakes, biscuits, candy, puffs and chips, pretzels, soda and cola, sugar-sweetened beverages, and fried foods

program duration (from 10 weeks to 2 years) and type of intervention (daily and weekly), it is not clear what length of intervention could be most effective to prevent child and adolescent obesity.

The impact of any potential change in weight- and health-related outcomes might depend on the prevalence of using technology among these age groups[33] and participant's age might define which type of technology including internet, video game, or text messages has more effects. As an example, younger children may prefer games and peer interacting, while older adolescents might prefer internet-based programs or mobile applications.[33] However, the efficacy of mobile-based programs might be higher through tailoring text messages to the individual and providing more forms of interventions.[28,34]

Limitations of the current study included a high loss to follow-up at 3 months, which is consistent with the previous research.[35] In addition, the large decrease in participants who follow the messages over the 3-month intervention might demonstrate lower interest in the intervention and subsequently lower adherence to the intervention or advices which could explain failure to improve main outcomes. Diet, sedentary behavior, and PA data were self-reported, and therefore, might be inaccurate. Furthermore, generalizability of the study findings is limited due to the small sample size and relatively narrow age range of participants. The study duration was short and insufficient to determine outcome improvements. Intervention design, frequency, and time of SMS delivery might also affect the findings.

More technology-based interventions for weight control and/or child and adolescent health promotion need to be developed in a continued way to be accessible and to see its sustainability. Future research should evaluate the cost-effectiveness of technology-based interventions and also include more long-term follow-up. Furthermore, the evaluation of other weight-related health outcomes, including quality of life and self-efficacy are recommended.

Conclusion

Three-month lifestyle intervention as text messages had positive effects on the nutritional intake of obese children and their attitudes toward PA but no effect on the child BMI.

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Conflicts of interest

There are no conflicts of interest.

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