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Original article

Effects of rewards and pedometer-feedback on children's physical activity: a school-based intervention study

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Summary. *Background:* Current prevalence estimates for child obesity in Arabian Gulf countries are some of the world's highest. The study aims to evaluate the effect of rewarding and pedometer- feedback on increasing the children's physical activity and decrease obesity rates. *Methods:* A sum of 225 participants (110 boys - 115 girls) ranging from 9 to 11 years old from six public elementary schools in Kuwait City, Kuwait took part in the study. Three different groups were created; feedback (FB), feedback with rewards (FD+R), and control group (C). Children were assigned to one of the three groups randomly. In the FB group, participants received information about the function of pedometer only wherein the FB+R group received information about the function of the pedometer and were asked for a 3000 counts milestone to get ten stickers. The control group participants haven't received any information about the function of the pedometer. Pedometer counts were taken from all participants through five physical education classes. *Results:* The average step counts for the groups were; 2091±483 for the control group, 2655±577 for the FB group, and 3429±458 for the FB+R group. A significant difference was found in the counts among the three groups ($p < 0.05$). Post-hoc Tuky analysis indicated a specific significant difference between the FB+R group and the two other groups ($P < 0.00$). *Conclusion:* The results of the study showed that encouraging children with rewards will sustainably increase their physical activity.

Key words: children, physical activity, rewards, pedometer

Background

Facing the growing rates of child obesity is an important research area as it has been increasing vastly in many countries all over the world (1-3). Literature shows that the Food Dude program which is simply a peer-modeling and rewarding has increased children's fruits and vegetables' consumption (4, 5). The Food Dude program is based on a group of fictional characters presented to children in a video series. Food dude stickers and pencils were awarded daily to children as they achieve a certain number of fruit and vegetable virtues. Previous studies indicate that the poor eater's consumption noticeably increased over the others. Also, the combination of both the video modeling and the daily rewards gave better results than using each separately (6-8).

This study investigates the influence of the previously discussed model in increasing the children's physical activity. While a large percentage of children in Kuwait do not take the recommended daily physical activity hours (9), studies show that Food Dude program may also be effective when it comes to changing the children's behavior for a better level of physical activity. Children and adolescents are evident to be influenced by significant other in their social environment. For instance, an observational study that was conducted in a school playground indicated that children were motivated to be more active from their peers (10). Also, it has been indicated through research

that higher levels of physical activity were tied to peer encouragement, supports, and participation (11).

When it comes to increasing children's physical activities, It is evident that rewards become more effective when they are tangible items like baseball tickets and stickers and when awarded after clear and explicit goals (12). So, in this study, children need to have the ability to monitor their own progress through the task that leads to the reward. To achieve that, activity monitors, like the pedometer, need to be used. The pedometer is an activity monitor that provides a count of movements and steps which will help in setting activity goals and help children follow their own performance to achieve the goal according to the given instructions. Goldfiel et al. (2006) instructed obese children to set a goal of either 750 steps or 1500 steps in a 20 lab session to get 10 minutes of television viewing in return. Results indicated that the 1500 steps group was more active than the 750 steps group, which was more active than the control group. Over a six week period, this approach has shown to be effective at increasing physical activity of sedentary children (13). A follow-up study showed that obese children achieved more physical activity than children who had physical activity monitors but no rewards in returns. Findings accumulatively indicate that a combination of activity monitoring and tied rewards has a broader effect than just activity monitoring (14).

No experimental studies have been conducted in Kuwait to investigate the effectiveness of rewards on increasing children's physical activity up till today. This study evaluated the effect of the effectiveness of a combined pedometer-feedback and rewards versus feedback alone on increasing physical activity.

Methods

Participants

A total of 225 children participated in the study (110 boys, 115 girls). The age ranged from 9 to 11 years old. Children attended six different public schools in Kuwait City, Kuwait. Participants were selected from this age because pre-adolescent has been identified as a high-risk age for developing obesity (15). Studies also showed that physical activity noticeably declined with age during elementary school (16). Also, the age is appropriate as children would have the cognitive abilities to absorb the process of setting up the pedometer and self-monitoring. The consent form for the study was approved by the department of food science and nutrition at Kuwait University. A written consent form was signed by the parent of each child.

Experimental design and procedures

Three different groups were created; feedback (FB), feedback with rewards (FD+R), and control group (C). Children were assigned to one of the three groups randomly. In the FB group, participants received information about the function of pedometer only wherein the FB+R group received information about the function of the pedometer and were asked for a 3000 counts milestone to get ten stickers. The control group participants haven't received any information about the function of the pedometer. Cross-contamination was minimized through assigning children to groups based on the school they attended. A well-validated pedometer (Yamax Digiwalker SW-200, Tokyo, Japan) that displays a digital count of physical activity was used. Physical activity was measured through 5 physical activity sessions.

Measures

Pedometers were given to participants at the beginning of every session. All pedometers were set to zero and participants were instructed to keep wearing them during the whole session (50 minutes). The pedometer given to the control group was sealed with a tape. Step counts were not revealed to the control group and the researcher would simply say thank you to the child at the end of a session. Children's Body mass (to the nearest 0.1 kg) and height (to the nearest 0.1 cm) were measured without shoes using a Hanson electronic scale and a tape measure attached to a vertical wall, respectively. Each child's body mass index (BMI) was then computed.

Statistical analysis

Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA) version 24 was used for data analysis. Differences in average values and p-values were tested by analysis of variance (ANOVA) with a 95% confidence interval.

Results

Characteristics of the participants are shown in (table 1), the average weight was 38.7±12.4 kg, the average height was 137.4±7.1 cm and the average BMI was 27.9±7.9 kg/m2. It is also important to notice that the number of girls was a little bit more than boys, 115 to 110. The average weight of boys was 37.5±11.6 kg, while the average weight for girls was 39.9 ± 13.1. Girls had a higher average height than boys, 137.9±7.8 cm to 136.9±6.4 cm). The average BMI for boys was 27.2±7.6 kg/m2 while the average BMI for girls was 28.6±8.1 kg/m2. According to ANOVA, there was no significant difference between boys and girls in the average age ($p = 0.43$), step counts ($p = 0.16$), height ($p = 0.13$), mass ($p = 0.15$), or BMI ($p = 0.15$).

The average step counts for the groups, shown in (table 2), were; 2091±483 for the control group, 2655±577 for the FB group, and 3429±458 for the FB+R group. A significant difference was found in the step counts among the three groups. ($p < 0.05$). Post- hoc Tuky analysis indicated a specific significant difference between the FB+R group and the two other groups ($p < 0.00$).

Discussion

Results claimed the efficacy of pedometer-feedback and rewards combination in increasing the physical activity of 9 to 11 years old children. During the study, the FB children showed a sustainable increase (2655 steps) while the FB+R group showed an increase of 3429 steps which is a great progress over the control group that had an average of 2091 steps.

No significant difference was noticed between the two sexes in the step counts ($p = 0.16$). Although Vandongen et al., Sallis et al., 1997 found the girls are more responsive to physical activities than boys (17), further research is required to explore the validity of gender differences. Generally, an active lifestyle needs to be mentioned over long period of time so children can experience its health benefits.

Table 1. Descriptive data for the total sample and within sex groups

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	Sig.
						Lower Bound	Upper Bound			
steps	Boys	110	2639	666	63	2513	2765	1108	4494	0.16
	Girls	115	2775	786	73	2629	2920	273	4679	
	Total	225	2708	731	49	2612	2804	273	4679	
weight	Boys	110	37.5	11.6	1.1	35.3	39.7	21.0	71.0	0.15
	Girls	115	39.9	13.1	1.2	37.4	42.3	22.0	96.0	
	Total	225	38.7	12.4	0.8	37.1	40.3	21.0	96.0	
height	Boys	110	136.9	6.4	0.6	135.7	138.1	123.0	153.0	0.31
	Girls	115	137.9	7.8	0.7	136.4	139.3	119.0	159.0	
	Total	225	137.4	7.1	0.5	136.4	138.3	119.0	159.0	
BMI	Boys	110	27.2	7.6	0.7	25.8	28.6	16.0	47.3	0.17
	Girls	115	28.6	8.1	0.8	27.1	30.1	16.4	60.4	
	Total	225	27.9	7.9	0.5	26.9	29.0	16.0	60.4	

Table 2. Mean step counts for the control, feedback and feedback plus reward groups

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	Sig.
					Lower Bound	Upper Bound			
Control	72	2091	483	57	1977	2204	273	3251	0.00
FB	85	2655	557	60	2535	2775	1349	4494	0.00
FB+R	68	3429	458	56	3318	3540	2212	4679	0.00
Total	225	2708	731	49	2612	2804	273	4679	

The use of intervention and pedometer step target to promote physical activity behavior change is what is unique about this intervention. The literature showed many studies using self-reporting to assess physical activity while there is a widespread concern about the validity of such measures (18).

The current study is the first test in this pilot intervention. Strong effects were accomplished, although the study was short in duration (only 5 sessions). Basic learning principle suggests that longer exposure to such circumstances may result in better consistency of effect. For future research, longer periods are recommended. It also appears that it might be more useful to include parents in the process due to the importance of parental support and encouragement (19). In this study, parents were involved only by via home pack and information letters, but in future research, the role of parents should be promoted to maybe giving parents their own pedometers with a set of step count goals in order to promote modeling. Also, the pedometer data were collected at school which means that the study missed measuring the physical activity on the weekends. Many studies have shown a significant difference between physical activity on weekends and weekdays (20), so it is recommended that weekends should be included in future studies of this intervention.

Future research should also investigate the effects of this intervention on children of different weight status as it was indicated that pre-adolescence is a high-risk age for developing obesity which calls for programs that aim to prevent it from a very young age.

Conclusion

The current study indicates, for the first time, the effectiveness of rewards and pedometer feedback in increasing habitual activity among 9 to 11 years old children in Kuwait city, Kuwait. Even though, some modifications in the process might be necessary to ensure long-term maintenance of behavioral change in children. The findings of this study are considered an initial step towards a physical activity intervention program in Kuwait which can lead up to the reduction of child obesity if implemented widely.

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