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Research Article

Parent Involvement Intervention in Developing Weight Management Skills for both Parents and Overweight/Obese Children

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SUMMARY

Purpose: The purpose of the study was to evaluate a parent involvement intervention for childhood obesity intended to increase parents' skills in managing children's weight-related behavior and to improve child-parent relationships. Many studies reported on parental influence on childhood obesity, emphasizing parent involvement in prevention and management of childhood obesity.
Methods: A randomized controlled trial was conducted. Forty-two parents of overweight/obese children were recruited from four cities and randomized to the experimental group or control group. The parental intervention was provided only to parents in the experimental group and consisted of weekly newsletters and text messages for a period of 5 weeks. Exercise classes and nutrition education were provided to all children. Lifestyle Behaviour Checklist and the Child-Parent Relationship Scale (CPRS) were used for measurement of parent outcome. For the child outcome, dietary self-efficacy, exercise frequency, and body mass index were measured. A mixed-design analysis of variance was performed with city location entered as a random effect.
Results: After the intervention, CPRS of parents and dietary self-efficacy of children showed an increase in the experimental group ($p < .05$). Intervention effects differed significantly according to the city location regarding the control efficacy of parents and dietary self-efficacy of children ($p < .05$).
Conclusions: The results support the effectiveness of the parent involvement intervention in promoting child-parent relationship and dietary self-efficacy of children. However, a 5-week parent involvement intervention was not sufficient to produce significant changes in children's body mass index. Further research is needed to investigate effects of parent involvement intervention with long-term evaluation.

Introduction

Childhood obesity is a worldwide epidemic [1]. Obesity rates have increased two-fold among children and adolescents in Korea in recent decades [2]. As such, obesity in children comprises a significant public health concern in Korea. Obese children are more likely to have higher risk of obesity in adulthood, as well as increased risk of hypertension, diabetes mellitus, and premature death [3]. Childhood obesity is also associated with psychological health problems, including depression, low self-esteem, and social stigma [4], while others reported that body mass index and body image dissatisfaction were significantly associated with poor mental health among girls [5]. Thus, effective interventions are required in order to alleviate physical and psychological health problems associated with childhood obesity [6].

Studies have reported on the influence of parents on childhood obesity, emphasizing parent involvement in prevention and management of childhood obesity [7,8]. A previous study argued for the role of parent-child relationship in prevention of developing cognitions associated with eating disorder [9], while others found that parent-only interventions resulted in a significant reduction in weight among obese children [10]. West et al [11], who provided a

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12-week parent involvement intervention to parents of overweight and obese children, found that the body mass index (BMI) of children and parents' perception on problem behaviors of their children decreased, while control efficacy of parents on these problem behaviors improved at 1-year follow-up. Pinquart [12] reported association of a positive parent-child relationship with lower weight, healthier eating, and more physical activity of the child. Parents can serve as a role model and provide support in weight management, and an enhanced parent-child relationship functions as a mediator in development of healthier behaviors and further weight control [13]. Other researchers have argued that improved parent-youth relationship can help youth in coping more effectively with stresses associated with obesity, and also positively influence adoption and maintenance of healthy lifestyles conducive to weight control [13,14].

Parent involvement programs for childhood obesity have focused on lifestyle change (diet and physical activity) or cognitive approaches for behavior modification, while programs to promote parent-child relationship, general parenting skills, and/or family functioning have been scarce [15]. Women's participation in economic activities has increased in Korea, with both partners employed in 43.6% of couples [16], which poses difficulties with gathering parents in one place in order to provide interventions for their obese children. Accordingly, offering related information using text messages and/or newsletters would be an easier option for these busy parents.

The current study sought to develop a parent involvement program for childhood obesity using text messages and newsletters to promote lifestyle behaviors of children, general parenting skills of parents, and parents' management of problem behaviors of obese children. The purpose of this study was to evaluate the effects of a parent involvement intervention program for both parents and children. Targeting parents, (a) parents' perceptions of obesity-related problem behaviors of children, (b) control efficacy of parents, and (c) parents' perceptions of parent-child relationship were evaluated, while for the children, (d) dietary self-efficacy, (e) exercise frequency, and (f) BMI were evaluated after the intervention.

Methods

Design

This study used a randomized controlled trial (RCT) with pretest-posttest design and with an equivalent control group.

Setting and sample

The study participants included 55 overweight/obese children aged 7–12 years old and their parents. Study participants were recruited targeting 177 children who enrolled in the Y Health Coaching Program supported by the Korean Ministry of Health and Welfare, which was provided in four cities in Korea. Stratified randomization was performed using the RANDOM.ORG program [17], and participants were stratified according to the city location. Within each city, all participants were randomly given odd or even numbers by the RANDOM.ORG program. Participants who were given odd numbers were assigned to the experimental group, while those with even numbers were assigned to the control group. Accordingly, parents of 31 children were assigned to the experimental group, and parents of 24 children were assigned to the control group. Attrition of 13 parents resulted in inclusion of parents of 42 children (experimental group, $n = 23$, control group, $n = 19$) in the posttest (76.4%). Thirteen parents were excluded in the posttest because they were lost to follow up ($n = 11$) or discontinued participation in the program ($n = 2$). Inclusion criteria were (a) children and parents who agreed to participate in this study, (b) able to communicate using the Korean language, and (c) children with greater than 85% BMI-for-age, or BMI over 25 kg/m^2, based on gender-specific and age-specific growth chart of Korea [18].

Power analysis was performed using G*power 3.1.9. With an effect size of .45, which was determined based on a previous study involving parents for childhood obesity [19], 42 participants were required to produced 80.0% power ($\alpha = .05$) with eight groups (multiplying the level of both factors, 2 groups by 4 cities), wherein the numerator $df = 1$ (main effect for group) in the test of mixed-design analysis of variance (ANOVA) with fixed and random effects [20]. Considering 30.0% attrition, 55 participants were recruited.

Ethical consideration

This study was approved by the Institutional Review Board of Yonsei University in Korea (No. 2012-0012). The participants' confidentiality and anonymity were assured, and participants were informed that they could withdraw from the study any time at their request without any disadvantages. Written consent was obtained from parents who agreed to participate, and verbal assent was obtained from children before pretest data collection.

Measurements

Lifestyle Behaviour Checklist (LBC) and Child-Parent Relationship Scale (CPRS) were included as parental outcomes, while dietary self-efficacy, exercise frequency, and BMI were included as child outcomes.

Parents' outcome

LBC

Parents' perceptions of obesity-related problem behaviors of children (LBC–Problem) and control efficacy of parents on children's obesity-related problem behaviors (LBC–Control) were measured using LBC [11]. LBC–Problem, including eating habits, physical activity, and complaining of being overweight (i.e., being teased), was assessed with 24 items using a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*). Higher scores indicate more problematic behaviors. LBC–Control was assessed with 24 items identical to the LBC–Problem scale and measured using a 10-point Likert scale with higher scores indicating greater control. Cronbach α ranged from .85 to .95 in the literature [11], and .90 for LBC–Problem and .97 for LBC–Control in the current study.

CPRS

Parents' perception of the child-parent relationship was measured using CPRS [21]. This instrument consisted of two subcategories, including eight items of conflict dimension and seven items of closeness dimension. It was measured using a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*). Questions showing reverse meanings were inverted prior to analysis, and higher scores indicate better child-parent relationship, less conflict, and more closeness. Cronbach α ranged from .72 to .80 in the previous study [21], while .75 for conflicts scale, .77 for closeness scale, and .83 for CPRS in total in the current study.

The LBC and CPRS were translated into Korean by a bilingual research team member. Other research team members (one professor and two doctoral students) reviewed appropriateness of translation, accuracy of expressions and wordings in use with Korean parents, and modified the translated instruments for use in the current study. Although back translation was not performed,

research team members reviewed and modified a translated version of the instruments several times for conceptual and cultural equivalence and to reduce discrepancies in expressions.

Children's outcome

Dietary self-efficacy

Dietary Self-efficacy Scale [22] was used to assess self-efficacy in dietary behavior of children. The instrument was translated into Korean by previous researchers [23] and modified for use in the current study. The instrument consisted of 15 items measured using a 3-point Likert type scale (0 = *very insecure*, 2 = *very confident*). Cronbach α was .84 and .82 in previous studies [22,23], and .84 in the current study.

Exercise frequency

Exercise frequencies were measured by asking the number of days that children had performed physical activities for more than 60 minutes per day, that they felt shortness of breath, excluding minutes spent in physical activity classes in schools.

BMI

Two trained nurses visited each city while the Y Health Coaching Program was being conducted, and measured weights and heights of children before exercise classes using a body component analyzer (N20; Gyeonggi Province, Korea). BMI was calculated using height and weight (kg/m^2) measured with children wearing light clothes and bare foot. Height and weight were measured to the nearest 0.1cm and 0.1kg.

The panel of experts consisted of three researchers in child health nursing who reviewed content validity of the study instruments. Based on the panel recommendations, the instruments were modified for use in the current study.

Interventions

Children in both groups were offered exercise classes twice weekly and nutrition education once monthly by professional instructors. Intervention for children was a part of the Y Health Coaching Program supported by the Korean Ministry of Health and Welfare. Thus, professional instructors for exercise classes and nutrition education were recruited and provided training by the managers of the Y Health Coaching Program. Parents in the experimental group were provided weekly newsletters and weekly text messages for a period of 5 weeks, while no intervention was offered to parents in the control group. The program for parents consisted of five sessions with five topics, developed by the research team members through literature reviews and modified based on experts' recommendations. Messages and newsletters developed in the current study were sent to parents of participating children by research team members using mail services and text messages, each week. Detailed content of the programs follow.

Importance of parental involvement

The first week emphasized roles of parents and strategies for encouraging lifestyle changes for their children. Parents were encouraged to help children in goal setting, which would motivate both children and parents. Text messages elicited parent support for obesity control of their children.

Strategies to improve eating habits

The second newsletter included information on recommended dietary allowance, portion of serving size for each food, food ladder, and promoting eating habits that included healthy snacks. Text messages included information on enhancing healthier eating habits, providing three meals a day, and providing more vegetables, fruits, proteins, and dairy products.

Strategies to improve physical activity

In the third week, the newsletter included information on the benefits of exercise, recommended amount of daily physical activity, strategies to change lifestyle behavior that promoted physical activity, and amount of exercises needed to lose 100 kcal considering intensity and duration of exercise. Information on amount of exercise needed to lose weight when children ate each type of snack was also provided. Text messages included recommendations for encouraging children to perform daily exercise more than 1 hour per day.

Strategies to improve child-parent relationship

During the fourth week, content for improving child-parent relationships was provided in the newsletter, including effective communication skills, emotional control of their children, and stress management methods for both parents and children. Text messages included encouraging conversations with children, respectful listening, positive reinforcement, and understanding and management of children's stress together.

Let's do family activities!

In the final week, the newsletter stressed the importance of family activities, recommended indoor and outdoor activities for families, and things to consider when planning family activities. The newsletter also included maze games developed by the research team that encouraged selection of healthier foods and physical activities. Text messages emphasized and encouraged various family activities.

Procedures

Telephone calls were made to parents of eligible children to explain the purpose of the study. Pretest data collection was conducted before initiating interventions for parents and children, while posttest data collection was performed after completion of 5 weeks of intervention for both parents and children. Data collection was performed by trained research assistants between June and October 2012. Pretest and posttest data collections were conducted in the gym before exercise classes began. Children delivered questionnaires to their parents and completed questionnaires with signed written consents were returned to research assistants by children. Research assistants made phone calls to participating parents and explained the purpose of the study and provided guidance for completion of the survey questionnaire before questionnaires were delivered. Research assistants performing data collection were blinded to the group assignment. Completion of survey questionnaires took approximately 5 minutes for children and 10 minutes for parents. All children received a gift (jump-rope). Intervention materials (newsletters) were provided to parents in the control group after posttest data collection was completed.

Data analysis

SPSS version 20.0 for Windows was used for data analysis (SPSS, Inc., an IBM Company, Chicago, IL, USA). Homogeneity testing was performed using independent *t* tests and Chi-square tests. A mixed-design ANOVA was performed to assess the effects of intervention, and group (experimental and control) was entered as a fixed effect, while the city location was entered as a random effect. Although city distribution did not differ significantly between groups ($p = .350$), significant differences in major outcome variables were

observed according to the cities ($p < .05$). Thus, city location was entered as a random effect. Although random effects are not of interest in the study design, inclusion can increase generalizability and reduce Type I error [24,25]. Null hypotheses of no difference were rejected if p values were less than .05.

Results

Homogeneity test for general characteristics

The mean age of children was 9.70 years ($SD = 1.49$) for the experimental group and 9.79 years ($SD = 1.62$) for the control group (range: 7–12). Although 70.0% of the experimental group and 42.1% of the control group were boys, difference in gender composition was not significant between the two groups ($p > .05$). The mean BMI of children was 24.26 kg/m^2 ($SD = 2.74$) and 23.97 kg/m^2 ($SD = 2.34$) for the experimental group and the control group, respectively.

The mean age was 40.78 years ($SD = 4.64$, range: 30–51) for mothers and 43.00 years ($SD = 5.81$, range: 27–63) for fathers. The mean BMI of mothers was 22.33 kg/m^2 ($SD = 3.15$) for the experimental group and 23.48 kg/m^2 ($SD = 2.00$) for the control group, and mean BMI of fathers was 25.60 kg/m^2 ($SD = 2.26$) for the experimental group and 25.65 kg/m^2 ($SD = 3.49$) for the control group. Forty-four percent of mothers in the experimental group and 55.6% of mothers in the control group had occupations. There were no significant differences in general characteristics of children, parents, and family between the two groups ($p > .05$) (Table 1).

Homogeneity test for outcome variables

For the parental outcome, the mean LBC–Problem scores were 63.17 ($SD = 21.71$) for the experimental group and 59.53 ($SD = 21.91$) for the control group (range: 24–168), while total CPRS score was 59.83 ($SD = 9.18$) for the experimental group and 60.00 ($SD = 6.32$) for the control group (range: 15–75).

For the child outcome, the mean dietary self-efficacy scores were 23.78 ($SD = 5.48$) for the experimental group and 23.37 ($SD = 3.86$) for the control group (range: 0–30). Results of the pretest showed no significant difference in outcome variables for parents and children between the two groups ($p > .05$) (Table 2).

Table 2 *Homogeneity Test for Outcome Variables.*

Variables	Experimental ($n = 23$)	Control ($n = 19$)	F (p)
	$M \pm SD$	$M \pm SD$	
Parents			
LBC–Problem	63.17 ± 21.71	59.53 ± 21.91	0.54 (.592)
LBC–Control	191.35 ± 42.67	194.12 ± 45.42	−1.20 (.844)
CPRS (Total)	59.83 ± 9.18	60.00 ± 6.32	−0.07 (.945)
Conflicts	17.78 ± 6.47	17.42 ± 3.78	0.23 (.823)
Closeness	29.61 ± 3.78	29.42 ± 3.73	0.16 (.873)
Children			
Dietary self-efficacy	23.78 ± 5.48	23.37 ± 3.86	0.28 (.783)
Exercise (days/week)	3.57 ± 1.90	2.94 ± 1.55	1.12 (.269)

Note. BMI = body mass index; CPRS = Child-Parent Relationship Scale; LBC = Lifestyle Behaviour Checklist.

Effects of parental involvement intervention

For the parental outcome, the main effect of group was significant for CPRS (total) only ($p = .019$). A higher mean CPRS (total) score was observed for the experimental group (60.57 ± 7.91) compared to the control group (55.83 ± 6.67). The random effect of city location was significant for LBC–Control. Mean LBC–Control scores were significantly different according to the city location ($p = .003$). The results also indicated that there was a significant group × location interaction for closeness subscale, which indicated that intervention effects differed significantly according to the city location ($p = .049$).

For child outcome, the main effect of group was significant for dietary self-efficacy only ($p = .043$). After the intervention, a higher mean dietary self-efficacy score was observed for the experimental group (23.81 ± 5.03) compared with the control group (23.32 ± 3.86). The random effect of city location was significant for dietary self-efficacy, and mean dietary self-efficacy scores were significantly different according to the city location as well ($p = .034$). The main effects of group were not significant

Table 1 *Homogeneity Test for General Characteristics.*

Variables	Categories	Experimental ($n = 23$)		Control ($n = 19$)		t/χ^2	p
		n (%)	$M \pm SD$	n (%)	$M \pm SD$		
Children							
Age (yr)			9.70 ± 1.49		9.79 ± 1.62	0.20	.846
Gender	Male	16 (69.6)		8 (42.1)		3.20	.073
	Female	7 (30.4)		11 (57.9)			
Birth weight (kg)			3.47 ± 0.34		3.47 ± 0.36	0.17	.752
BMI (kg/m^2)			24.26 ± 2.74		23.97 ± 2.34	0.35	.728
Mother							
Age (yr)			40.57 ± 4.56		41.06 ± 4.86	0.33	.742
BMI (kg/m^2)			22.33 ± 3.15		23.48 ± 2.00	1.36	.188
Education	≤ High school	14 (60.9)		8 (44.4)		1.10	.295
	≥ College	9 (39.1)		10 (55.6)			
Occupation	Yes	10 (43.5)		10 (55.6)		0.59	.443
	No	13 (56.5)		8 (44.4)			
Father							
Age (yr)			42.74 ± 4.84		43.33 ± 7.00	0.32	.750
BMI (kg/m^2)			25.60 ± 2.26		25.65 ± 3.49	0.06	.953
Education	≤ High school	11 (47.8)		5 (27.8)		1.71	.192
	≥ College	12 (52.2)		13 (72.2)			
Occupation	Yes	23 (100.0)		18 (100.0)		–	–
Family monthly income (won)[a]	< 4 million	12 (52.2)		13 (68.4)		1.14	.286
	≥ 4 million	11 (47.8)		6 (31.6)			

Notes. BMI = body mass index.
[a] 1,000 won = 1.00 USD.

Table 3 *Effects of Parental Involvement Intervention on Outcome Variables.*

Variables	Experimental ($n = 23$)	Control ($n = 19$)	Factor	F (p)
	$M \pm SD$	$M \pm SD$		
Parents				
LBC–Problem	59.81 ± 21.16	62.50 ± 23.33	Group	0.29 (.623)
			Location	2.95 (.199)
			Gr × Loc	0.83 (.490)
LBC–Control	206.43 ± 26.15	202.00 ± 31.45	Group	2.38 (.137)
			Location	62.60 (.003)
			Gr × Loc	0.07 (.974)
CPRS (Total)	60.57 ± 7.91	55.83 ± 6.67	Group	9.66 (.019)
			Location	0.22 (.877)
			Gr × Loc	0.37 (.776)
Conflicts	17.43 ± 6.36	19.56 ± 4.89	Group	1.62 (.232)
			Location	3.86 (.148)
			Gr × Loc	0.20 (.898)
Closeness	30.00 ± 3.02	27.39 ± 5.81	Group	3.37 (.154)
			Location	0.41 (.761)
			Gr × Loc	2.91 (.049)
Children				
Dietary self-efficacy	23.81 ± 5.03	23.32 ± 3.86	Group	5.37 (.043)
			Location	12.42 (.034)
			Gr × Loc	0.11 (.954)
Exercise (days/week)	3.70 ± 1.81	3.53 ± 2.07	Group	0.25 (.643)
			Location	1.66 (.344)
			Gr × Loc	2.80 (.056)
BMI (kg/m^2)	24.02 ± 2.66	23.97 ± 2.67	Group	0.01 (.949)
			Location	1.42 (.390)
			Gr × Loc	0.58 (.631)

Notes. BMI = body mass index; CPRS = Child-Parent Relationship Scale; LBC = Lifestyle Behaviour Checklist.

for exercise frequency or BMI among the participating children ($p > .05$) (Table 3).

Discussion

This study sought to evaluate a parent involvement intervention for childhood obesity and found that parents' perception on CPRS was improved, while dietary self-efficacy of children was promoted after the intervention among those in the experimental group. The results of the current study indicated that a parent involvement program combined with exercise and nutrition intervention for children was more effective for both parents and children than intervention offered to children only. The current study is unique, because an RCT study design was employed with the parent involvement intervention. In addition, the current study evaluated outcomes for both parents and children, including child-parent relationship and self-efficacy of children. Previous studies mainly assessed physiological health or lifestyle behavior of children and did not measure parental outcomes in evaluation of parent involvement interventions, while the previous studies did not employ an RCT design [19,26].

The focus of parent involvement interventions to reduce childhood obesity includes behavior change of family members since family lifestyle could influence the development of childhood obesity [27], and those programs were proven effective in decreasing childhood obesity [11,28]. Previous studies found that parent involvement intervention for childhood obesity was effective in decreasing dietary intake of children, promoting parenting skills [28], and improving LBC–Control of parents [11]. It is assumed that parent involvement interventions have positive effects on both parents and children. Contrary to previous studies, the current study did not yield significant results regarding LBC–Problem and LBC–Control of parents, which may have contributed to the insignificant change in BMI among the children in the experimental group. It is assumed that that weekly newsletters and text messages were not sufficient to promote necessary skills of parents needed for modifying problem behaviors of children.

A short-term intervention period or involving only indirect parent involvement strategies might have been associated with insignificant results in these outcome variables (LBC–Problem and LBC–Control of parents, and BMI of children). Intervention strategies for direct involvement of parents for childhood obesity, such as family counseling and group sessions, can produce significant changes in BMI, physical activity, and dietary intake of children as well as LBC–Problem and LBC–Control of parents [11,28]. However, newsletters and text messages are simple and inexpensive [29], while avoiding difficulties in scheduling attendance at education sessions for their children. In addition, interventions using newsletters, postcards, and mail services have been found to be effective in promoting fruit and vegetable consumption and modifying healthy eating patterns of children [30,31].

In a parent involvement program for adolescent obesity, O'Neil and Nicklas [30] employed indirect strategies (mailed brochures and newsletters), and their study showed significantly increased awareness, knowledge, self-efficacy, and daily serving of fruits and vegetables among adolescents in the intervention group. To encourage parents' active participation in the program, they were provided an opportunity to submit questions using mail services, and the answers appeared in subsequent newsletters. Therefore, in future studies with indirect parent involvement intervention, use of strategies incorporating two-way communication methods may produce better outcomes for both parents and children.

Results of long-term follow-up of parent involvement intervention, intended to improve parental attention to adolescent antisocial behavior and enhance parental monitoring and communication, indicated that the intervention was effective in maintaining better parent-youth relationship, and improved health behaviors of children, including diet, sleep, and exercise at age of 17 years [13]. Similarly, this study also yielded significant improvements in parent-child relationship. Parents could use enhanced parent-child relationship as a mediator in reducing problem behaviors of children and in promoting balanced diet and physical activity. Other researchers evaluated parent involvement interventions involving exercise, nutrition, and behavior modification on childhood obesity, emphasizing role modeling by parents in health behavior change [32]. They found decreases in BMI and body fat of children in the intervention group at 6 months and 12 months. However, in the current study, insignificant BMI change after the intervention was observed among children in both groups. In the current study, the small change in BMI may be due to a relatively short-term follow-up period (5 weeks). Researchers have argued that weight loss occurs as a result of multiple behavior changes, and contended that treatment effects of intervention on weight were not observed until 24 months [33]. Others have argued that lifestyle interventions as brief as 4 months can be expected to produce significant change in BMI, while longer treatments are more beneficial and may produce better outcomes in younger children [34]. Thus, in designing future interventions to decrease BMI, it is recommended that researchers include an intervention period of at least 4 months.

Davison et al [28], who evaluated family-centered childhood obesity intervention, reported a significant decrease in BMI and improvements in dietary intake of obese children. Although change in dietary intake of children was not measured in the current study, a significant increase in dietary self-efficacy was observed among the children in the experimental group. Increased dietary self-efficacy positively influenced control of childhood obesity by promoting healthy eating patterns; increasing fruit and vegetable

consumption and decreasing high-fat diet [35]. Accordingly, it is expected that increased dietary self-efficacy will bring about change in eating habits, thereby further contributing to the reduction of BMI among the children in the experimental group of the current study.

Although differences in intervention outcomes according to the city location were not the primary purpose of the current study, former researchers found disparities in health and health behavior according to physical and social environments of residential locations; accordingly, they suggested that intervention efforts should address the relationship between environment and health [36]. The current study also found that effects of parent involvement intervention differed significantly according to the city location in some of the outcome variables (LBC–Control of parents and dietary self-efficacy of children).

Studies investigating intervention effects according to the city location have not been conducted for childhood obesity, although former researchers reported that psychiatric rehabilitation outcome differed significantly by urban and rural areas [37]. Tirupati et al [37] contended that socioeconomic, cultural, and ecologic differences between rural and urban communities produced different outcomes. Beard et al [38] noted that dietary habits of individuals are affected by the physical and cultural environments they encounter, while neighborhood characteristics, such as socioeconomic status, social capital, and community resources influence personal health behaviors. In the current study, children and parents were recruited from four cities with different neighborhood characteristics. Two of the cities are large cities adjacent to a metropolitan area, while the other two cities are relatively smaller cities located in rural areas in Korea [39]. Therefore, differences in neighborhood characteristics among four cities may have influenced the study outcomes; accordingly, city location was considered in the analysis of study results and entered as a random effect. By inclusion of city location as a random effect in a mixed-design ANOVA, generalizability would be increased, while Type I error would be reduced [24,25].

Previous studies reported that there were urban-rural differences in breast cancer management behavior among women, and in prostate cancer treatment choices among men [40,41]. However, studies to elucidate urban-rural differences in intervention effects for lifestyle behavior interventions have not been conducted. Therefore, future studies are needed in order to evaluate intervention effects considering neighborhood characteristics and to verify urban-rural differences considering social and physical environmental characteristics.

The current study found that a 5-week parent involvement intervention was effective in promoting CPRS of parents and dietary self-efficacy of children. With enhanced child-parent relationship among parents in the experimental group, parents would support obese children in their weight control efforts as a mediator and role model. Therefore, rather than providing obesity control intervention targeting only children, parent involvement intervention could increase parents' awareness on obesity related issues, and provide guidance to help children in their weight management efforts. In development of future parent involvement interventions, evaluation of the long-term effectiveness of the interventions is recommended, and efforts to elicit active participation of parents should be incorporated when using indirect parent involvement strategies such as measures to receiving questions and/or obtaining feedback from parents.

The limitations of the study include limited generalizability of the results to overweight/obese children in South Korea. Another limitation may be contamination bias, since the samples in both groups were recruited from the same clusters [42]. The current study performed a short-term evaluation (5-week period follow up) of the effects of the parent involvement intervention, which may have yielded inconsistent results regarding parental and child outcomes in comparison with a long-term evaluation.

Conclusions

The current study sought to evaluate a parent involvement intervention on childhood obesity using indirect strategies, and a 5-week intervention including newsletters and text messages sent to parents combined with exercise classes and nutrition education for children was compared with intervention for children only (exercise classes and nutrition education). The results of the current study showed that parent involvement intervention was more effective in improving parents' perception on CPRS and dietary self-efficacy of children. The study results also showed that LBC–Control and dietary self-efficacy of children differed significantly according to the city location. Neighborhood characteristics of family may have influenced intervention outcomes [38]. In the development of future parent involvement interventions, incorporating both direct and indirect involvement of parents would be recommended, and strategies to elicit active participation of parents such as measures to receiving questions and/or obtaining feedback from parents would improve indirect intervention outcomes. Obesity has shown continual growth among children and adolescents in Korea [43]. Interventions to curve childhood obesity should target both children and parents. Through the interventions, parents could serve as a role model and provide support in weight management for children.

Conflicts of Interest

The authors declare no conflict of interest.

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