Original Article

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Child Obesity Prevention Intervention in Kuwaiti Summer Camps Targeting Health Behaviors in Nutrition, Physical Activity, and Screen Time

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Abstract:

Objective: To assess the effectiveness of an eight-week nutrition and physical activity intervention, entitled: "My Healthy Habits", at summer camps to prevent obesity, reduce screen time, promote healthy eating habits and physical activity among children.

Material and Methods: Eight-week pretest-posttest: intervention versus a comparison group was conducted, in two comparable summer camps in Kuwait and randomized at the site level. Convenient sampling (n=79) included children aged 6-10, receiving 8 weeks of nutrition education: 2 days/week, 40 minutes/day and physical activity sessions: 4 days/week for 20 minutes/day. Outcomes included: the Modified Healthy Habits Survey (items about diet, physical activity and sedentary behavior) and anthropomorphic: Body mass index (BMI) for age and gender percentile and waist-to-height ratio (WHtR). Group changes were measured by independent t-test, and within group changes by the McNemar's test (categorical data) and paired t-test (interval data).

Results: Significant increases in nutrition knowledge scores (from 4.3±1.7 to 10.5±1.2) and in the total score of the major food groups (from 10.0±2.6 to 13.7±2.2) were observed from pretest to posttest. Healthy eating significantly increased (from 12.8±1.8 to 14.5±1.5) for the intervention group only; however, intake of French fries, chips (FF) and sugar-sweetened beverages (SSB) remained the same for both groups. Physical activity increased and screen time decreased,

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only in the intervention group. The participants' BMI and WHtR decreased significantly in the intervention group: p-value=0.001.

Conclusion: Healthy food and physical activity increased, while screen time decreased. Consumption of unhealthy food (FF and SSB) remains an issue.

Keywords: child obesity, Kuwaiti public health, modified CATCH program, nutrition and physical activity intervention, screen time

Introduction

The prevalence of overweight and obesity has tripled worldwide, since the 1970's. Up to 1.9 billion (39.0%) adults are overweight, and more than 650 million (13.0%) are obese. Additionally, over 340 million children and adolescents aged 5–19 years are either overweight or obese.[1] According to the Obesity Rates by Country report in 2017, the Middle East is the second highest region for obesity; after the Oceania Islands. Kuwait was ranked the eleventh highest country with obesity, wherein 39.7% of Kuwaiti adults were obese, 21.6% of children aged 6–18 years were overweight and 30.5% were obese.[2,3] The harsh climate of Kuwait coupled with the availability of food and technology have led to an overconsumption of food and a sedentary lifestyle; both of which have contributed to an increased prevalence of obesity in Kuwait.[4] In addition, Kuwaiti mothers tend to underestimate their children's weight, leading them to overfeed their children.[5]

The World Health Organization (WHO) considers childhood obesity to be a global epidemic, and has developed recommendations to combat childhood obesity.[6,7] Their recommendations include: promoting the intake of healthy food and reducing the intake of unhealthy food and sugar-sweetened beverages; promoting physical activity and reducing sedentary behaviors; provision of a healthy school environment, with nutrition and physical activity education; and provision of family-based weight management services for children with obesity.[7] After-school, summer-camps and child-care programs offer opportunities to act on these recommendations in a convenient setting.[8]

Schools can be valuable sites for intervention programs related to children's nutrition knowledge, eating habits or physical activities; since children spent most of their day at school.[9] However, student focus on coursework by the administration or teachers' and lack of interest may interfere with providing the opportunity and success of nutrition education. Therefore, targeting children during their free time, such as in aftercare or summer camps, may prove to be effective settings to provide nutritional education, physical activity and modify nutritional behavior. Positive results were reported by "Educació en Alimentació", an afterschool lifestyle behavioral intervention, which emphasized food choices, encouraged physical activity and discouraged sedentary behavior. They reported a reduction of boy's obesity prevalence by 2.4% (from 9.6% to 7.2%), while it increased in the control group by 2.0% (from 7.4% to 9.4%); with a difference of 4.4% between the 2 groups.[10]

Although, intervention programs aimed to reduce/prevent obesity have been developed in the United States (U.S.) and Europe no known programs exist in Kuwait, or other parts of the Middle East. However, results of a five-year randomized controlled trial to reduce obesity in the overall population in Kuwait are pending publication.[11]

Furthermore, there are no known programs delivered in after school or summer camp settings that focus on obesity prevention in Kuwait. Nutrition intervention

studies are needed in Kuwait, to inform the direction of implementation science, by refining the objectives, involving both stakeholders and the community, so as to influence the direction of future policies and implementation processes.[12] Accelerated summer weight gain was found for Black, Hispanic, and already overweight children in the U.S. in six out of seven studies.[13] In a large, multi-ethnic cohort of U.S. children, accelerated summer weight gain was highest for children aged 6-11 years.[14] The determinants of excess summer weight gain have been proposed, but not adequately studied. They include diet, physical activity, sedentary time and lack of structure.[15]

The literature provided strong evidence on the effectiveness of summer-camp interventions by creating a suitable environment to expose children to healthy eating habits and physical activity in other countries.[16-21] Because, afterschool programs are not available in Kuwait, summer-camps provide the best opportunity to deliver this type of intervention. The aim of this study was to assess the effectiveness of an eight-week nutrition and physical activity intervention, at a summer camp in Kuwait, to prevent children's obesity, reduce screening time and to improve nutrition and physical activity knowledge and behaviors. Children aged 6-10 were chosen, since they receive the same camp activities at both camps, the nutrition education materials were suited to this age group and physiologically they are pre-pubescent.

Material and Methods

Study design

Prior to designing this study, a qualitative pilot study was conducted to review the materials, consisting of 10 children and their mothers in single-paired interviews from within the Kuwait community. Their suggestions resulted in translation of materials to Arabic, revising the nutrition knowledge questionnaire food, replacing ham with beef (due to religious restrictions). The questions were then read to several other members of the community; children and mothers, for their clarity. No modifications were needed for physical activities. As the changes did not significantly change the content and delivery of the previously validated materials for the CHAMPS program, reliability and validity for this population was not assessed. This eight-week trial was conducted during the summer of 2017 (July–August) with two summer camps, using site-randomization by coin toss to assign the intervention and the control groups. The intervention had assessments, pre and post assessments (weeks 1, 10), and received treatment for weeks 2-9. The control group had assessments, pre and post (weeks 1, 10), and received no treatment for weeks 2-9. Intervention participants received 8 weeks of nutrition education during weeks 2-9: 2 days/week, 40 minutes/day and 8 weeks of physical activity sessions: 4 days/week for 20 minutes/day, directly after the camp ended. The total intervention time was 160 minutes per week, for 8 weeks and totaling 21.4 hours of contact time: 10.7 hours for nutrition and 10.7 hours for physical activity. All the required activities and assessments took place in the same summer camps the children were attending, during a 10-week period.

Participating summer-camps were selected from Mathallah Expo, the largest annual summer-camps exposition exhibit specializing in the development of child skills in Kuwait. Two comparable summer camps in Kuwait were chosen, based on the activities they offer: parents' socioeconomic status, serving children between 6-10 years of age of both genders. Once the sites were randomly assigned by coin toss, participants were recruited by convenience sampling, based on their enthusiasm to participate and those meeting the inclusion criteria. A pretest to posttest design was used to compare participants, within and across the intervention and control groups. An incentive offered was a discount on camp costs and two free weeks.

Recruitment, inclusion criteria, and informed consent

Recruitment involved telling both parents and children which study arm they would be in. Flyers for each arm of the study were tailored to either intervention or control. Children attending the participating summer camps received the flyer that matched their study arm. Parent consent and child assent were required for participation. The inclusion criteria was as follows: children aged 6–10 years old; attending the participating summer camps; availability and willingness to participate in the full 8-weeks of the intervention, with greater than 80.0% attendance (from July 2nd to August 31st, 2017); available and willing to participate in data collection for pre- and post- intervention; willing and able to participate in physical activities and having to provide parent's consent and child's assent. Children who did not meet the inclusion criteria, included those suffering from a chronic disease, physical or mental disability and were therefore excluded. Participants needed to complete at least 80.0% of the classes to be considered completers. Participants who attended less than 80.0% of the classes were not included in the analysis, since the inclusion criteria required a minimum of 80.0% attendance. This criterium is based on the increased likelihood of success in behavior change, and maintenance found for completers; as compared to non-completers in a summary of nutrition and healthy aging by the National Academy of Medicine (U.S.).[22]

The informed consent form explained the study and the investigator indicating which treatment they would receive (assessments and intervention or assessments and no intervention). Information included what the study was about, when it would be conducted, why, where and by whom. It also included contact information of the investigator. Written consent and assent forms were obtained from the parents and children to participate in the study. Approval was obtained from the Institutional Review Board of Florida International University (IRB number: IRB-17-0197).

Participants

A demographic questionnaire was obtained from the parents, and they were informed that all of the information would be kept confidential all the times. A total of 89 participants were screened, 79 were eligible for the study, based on the inclusion/exclusion criteria. From the intervention summer camp 41 children participated in the pre-assessment, followed by the intervention; including nutrition education two days a week, for eight weeks. The control group consisted of 38 children who participated in the pre-assessment and regular summer camp activities, without any kind of intervention, for eight weeks. After the eight weeks, two participants from the intervention group were excluded from the data analysis due to an attendance rate of less than 80.0%. Data from 77 children were included in the final analysis, and these received post-intervention assessment: 39 from the intervention group and 38 from the comparison group. The attrition was 2.5%, total 5.1% from the intervention group and 0.0% from the control group). The treatment consisted of nutrition and physical activity sessions.

Intervention procedures

Children started camp at 09:00, had a lunch that they brought in at 11:00 and were dismissed at 13:00. The transition to the sessions began when camp activities were completed, from Sunday through till Wednesday. All activities took place indoors, because the heat in Kuwait during the summer is oppressive. The children participating in the intervention followed the investigator into the arts and crafts room. Attendance was taken by a check off list, they then went to the gymnasium. Physical activity

for twenty minutes was performed for all groups, following the Coordinated Approach to Child Health (CATCH) activities[23] (details provided in Physical activity sessions). No modifications were made to this curriculum, except for those that were performed indoors. All students had a 10-minute break, where they could eat a snack that their parents had packed for them, use the bathroom or just relax. Water was available by fountain in the intervention rooms. Children then were separated into groups: 6-7 for nutrition on Sundays and Tuesdays, and the 8-10-year-old children waited to be picked up by their parents. On Mondays and on Wednesdays, the 8-10-year-old children remained for nutrition sessions; while the 6-7-year-old children waited to be picked up by their parents. Children waited in the gymnasium to be picked up and those taking nutrition sessions and followed the investigator into the arts and crafts room. This room had several round tables where the children sat in small groups of 4-6 children each. The nutrition content was the same for both groups, but the delivery method differed (see Nutrition education sessions).

Physical activity sessions

Physical activity sessions were conducted four days a week, for 20 minutes per day. The sessions were focused on motivating the children to engage in moderate to vigorous physical activities. The activities were developed based on CATCH physical education activity box[23], which provides more than 300 age appropriate fun games and activities. The activities included jump rope, hula-hoop, team races and other activities/games. These activities included: worm up, flexibility, muscle strength, endurance, aerobic games, fitness, and cool down. All the activities that were suitable to be used, in regards to the space and materials available, were placed in a draw box, and each time one participant could draw an activity.

Nutrition education sessions

The nutrition education sessions were conducted by the principle investigator 2 days a week, for 40 minutes per day. The first 20 minutes was for discussion and interaction about the topic of the week, and the second 20 minutes consisted of hands on activities related to the topic. The participants were divided into two groups, based on their age: 6 and 7-year-olds; and, 8 to 10-year-olds. Since the aim of this study was to improve the participants nutritional knowledge and behaviors, the nutrition education sessions provided information and activities emphasizing the importance of healthy eating; based on the social cognitive theory, which considers behavior changes as the result from dynamic interactions between individuals and their environments.[24] Lessons were modified for the Kuwaiti culture from the CATCH nutrition curriculum. "CATCH Kids Club."[25] The sessions in this intervention were divided into themes, and delivered in the form of group learning games, individual practices, stories, discussions, skill building activities and goal setting. Nutrition topics included modifying Kuwaiti food to fit the U.S.' recommendations for specific food groups and their portion sizes. The same content was delivered for both age groups, using nursey rhymes with music and games; such as food bingo and food jeopardy, with pictures for 6-7-year-old participants and riddles and the same games (food bingo and food jeopardy) with words. Taste-tests were combined with lesson for each of the basic food groups. Children were asked to place a particular food on the corresponding food group in the picture of MyPlate on a table mat. Fruit kebabs were provided on the fruit day, vegetable sticks on the vegetable day, dairy products for sessions on the dairy group and whole grain snacks for the grain group topic. For the lesson on sugary beverages versus water, the children were given water bottles with cartoon drawings on them.

Data collection: sociodemographics

After signing the consent forms, the parents were asked to fill out the sociodemographic questionnaire at baseline (week 1). The questionnaire included information related to sociodemographic variables such as: age, gender, income, number of siblings, the child's rank in the family and nutrition background related to the child and the mother.

Data collection: Modified Healthy Habits Survey (HHS)

The survey was used pre- (week 1) and post-intervention (week 10) to assess whether the intervention increased the child's knowledge, and improved attitudes about nutrition, physical activity, and screening time; as compared to the comparison group. Children self-reported their behavior on the HHS, with assistance from the interviewer for any difficulties in understanding the content.

The survey measures children's knowledge, behavior and attitude about nutrition, screening time and physical activities and was validated for a group of U.S. elementary school children[26]: this was modified for the current study to fit the Kuwaiti culture for types of food and language.[27] The survey was translated to Arabic, the native language of the country, and "ham" was replaced by "beef": since ham is not a food choice in Kuwait. HHS consisted of 40 questions and took around 20 minutes to be completed. For knowledge related questions, correct answers were scored with "1" and incorrect answers with "0. For behavior questions, the answers were scored 1 to 4 or 1 to 5 (if the question had 5 answers), a high score indicated a healthier behavior. The highest possible score was 17 for nutritional knowledge, 20 for healthy eating habits and 16 for unhealthy eating behavior. Healthy food score represents whole grain, dairy, lean proteins, fruit and vegetables. Unhealthy food score represents fries and chips, sweets, and sugary and soft drinks.

Data collection: children's anthropometrics

The children's height and weight were measured using the same stadiometer for pre-intervention and post-intervention. The stadiometer was placed behind a partition on a hard, even floor. Children's weight was measured in light clothing without shoes. The children stood on the scale with their feet slightly apart, without touching anything. The weight was measured to the nearest 0.1 kilogram. Height of the children was measured standing straight, head straight, and their back against the stadiometer without shoes and hair accessories that might have affected the child's height: height was recorded to the nearest 0.1 centimeter. Body mass index for age and gender (BMI) was calculated by using WHO BMI AnthroPlus software.[28] BMI percentile helped to assess, if the intervention was effective in decreasing the number of children with BMI percentile in the overweight and obese range (>85.0%).[29]

Weight-to-height ratio (WHtR) was used to assess central obesity in the children, since it is a cost-effective way for measuring central obesity.[29] The children's waist circumference was measured behind a partition, using a measuring tape at the uppermost lateral border of the hip crest. A cutoff point of 0.5 has been established to indicate central obesity, if the child had a WHtR value greater than 0.5.[30]

Statistical analysis

The study was modified for within-group measures, and between group measures of continuous variables (in this case BMI and WHtR), where 60 participants (30 per group) should yield sufficient power; based on the recommendations of Whitehead et al.[31], whereas a 25 per treatment arm yields 90.0% power, and a two-sided 5.0% significance for an expected small effect size (0.2). The independent variables were: nutrition education and physical

activity classes. Dependent variables were: participants' nutrition, physical activity, and screen time knowledge and behavior as well as participants WHtR and BMI percentile. The intervention group was the group of participants that received nutrition education intervention for 8 weeks. The control group had assessments only, and did not receive any kind of intervention. For descriptive statistics, Chi squared test for categorical variables and independent t-test for continues variables were used in the demographic characteristics. Chi-square test was also used for the distributions of subjects' BMI category and central obesity, pre- and post-intervention in comparison and intervention groups. To study the effect of participating in the intervention, paired t-test and was used to determine changes in nutritional knowledge scores and scores of healthy and unhealthy food intake, BMI percentile and WHtR; before and after the intervention, within the intervention group and within the control group. McNemar's test was used for categorical data to analyze changes in participants eating habits, related to healthy and unhealthy food intake, changes in physical activity and screen time knowledge, time spent on physical activities and screen time from baseline to post-intervention between the intervention and comparison group. The significance level for outcomes was set at p-value<0.050. The statistical analysis was performed using the Statistical Package for Social Sciences version 23.0.

Results

Attendance was 100.0%, for both the control group and intervention group for assessments. The average attendance rate was 91.0% for the intervention. The highest attendance was 100.0% of the intervention sessions and the lowest was 63.0%. Only participants with an attendance rate of 80.0%, or higher were included in the analysis: two participants were excluded. Baseline sociodemographic characteristics are summarized in Table 1 for the participants and their mothers. There was no significant difference between the intervention and control groups in regard to children's or mother's sociodemographic characteristics. More mothers in the comparison group were overweight, 52.6% compared to 25.6% in the intervention group, p-value=0.008. The nutrition knowledge score can be seen in Table 2. There was a significant increase in the intervention groups' nutrition knowledge score from baseline to post-intervention, but no significant change in the comparison group. The number of servings of healthy food increased in the intervention group from baseline to post intervention, but not in the comparison group. Table 2 revealed that there was no significant decrease in the number of servings of unhealthy food in the intervention group, nor in the comparison group, for the number of serving French fries, chips (FF) and sugar-sweetened beverages (SSB). Thirteen participants in the intervention group decreased their consumption of sweets and candies to one time or less per day p-value=0.001. Physical activity and screen time knowledge are presented in Table 3. There was a significant increase in the intervention group in both physical activity and screen time knowledge p-value=0.001; and a significant decrease in screen time behavior in the intervention group, from more than two hours per day to the recommended time of two hours or less p-value=0.001. Time spent on physical activities increased in the intervention group, from less than five days per week to five to seven days per week p-value= 0.001. Table 4 contrasts anthropometrics pre and post intervention. The participants' BMI increased by 0.14 in the control group, and decreased in the intervention group by 0.21 p-value=0.001. Table 5. shows the distributions of subjects' BMI category and central obesity pre- and post-intervention, between intervention and control groups.

Table 1 Baseline demographic characteristics by treatment group (n=77)

Characteristics	Control group (n=38)	Intervention group (n=39)	p-value
Child's age in years	7.1±1.4	7.4±1.5	0.357
Child's baseline BMI (age/gender)	17.4±2.7	18.0±2.8	0.342
Child's nationality			0.141
Kuwaiti	94.7 (36)	89.7 (35)	
Other	5.3 (2)	10.3 (4)	
Child's gender			0.721
Male	42.1 (16)	46.2 (18)	
Female	57.9 (22)	53.8 (21)	
Child's order in the family	2.0±1.0	2.0±1.0	0.924
Child's nutrition education			
No	100.0 (38)	100.0 (39)	
Yes	0.0 (0)	0.0 (0)	
Mother's age in years	35.6±4.9	34.44±4.19	0.448
Mother's nationality			0.052
Kuwaiti	97.4 (37)	84.6 (33)	
Other	2.6 (1)	15.4 (6)	
Mother's marital status			0.299
Married	86.6 (33)	94.9 (37)	
Divorced	7.9 (3)	5.1 (2)	
Number of kids	3.0±1.0	3.0±1.0	0.823
Mother's BMI			0.008*
Underweight	0.0 (0)	5.1 (2)	
Normal	26.3 (10)	59.0 (23)	
Overweight	52.6 (20)	25.6 (10)	
Obese	21.1 (8)	10.3 (4)	
Mother's education level			0.511
High school or below	10.5 (4)	5.1 (2)	
2 years diploma	26.3 (10)	23.1 (9)	
Bachelor's degree	55.3 (21)	53.8 (21)	
Graduate level	7.9 (3)	17.9 (7)	
Monthly household income (KD)			0.057
<2,000	15.8 (6)	2.6 (1)	
2,000–3,000	47.4 (18)	69.2 (27)	
>3,000	36.8 (14)	28.2 (11)	
Mother's working status			0.689
Homemaker	31.6 (12)	35.9 (14)	
Working	68.4 (38)	64.1 (25)	
Mother's nutrition education			0.094
No	78.9 (30)	92.3 (36)	
Yes	21.1 (8)	7.7 (3)	

S.D.=standard deviation, BMI=body mass index; KD=kuwaiti dinar (currency)

Continuous variable (age) is presented as mean±S.D. and categorical variables as percentage (n).

*Represents significant differences. Level of significance set at p-value<0.050.

Table 2 Participants nutritional knowledge and behavior at baseline and post-intervention

Nutrition behavior questions	Control group (n=38)			Intervention group (n=39)		
	Baseline	Post intervention	p-value	Baseline	Post intervention	p-value
Nutritional knowledge total score	5.6±2.2	5.9±1.9	0.250	4.3±1.7	10.5±1.2	<0.001*
Healthy food intake total score	10.3±1.7	10.1±1.7	0.506	10.0±2.6	13.7±2.2	<0.001*
Yesterday, how many times did you eat/drink dairy, such as milk, yogurt, or cheese?			0.607			0.013*
1 time or less	60.5 (23)	68.4 (26)		41.0 (16)	15.4 (6)	
2 or more times	39.5 (15)	31.6 (12)		59.0 (23)	84.6 (33)	
Yesterday, how many times did you eat fresh, frozen, dried or canned fruit? (Do not count fruit juice)			0.219			0.007*
1 time or less	65.8 (25)	76.3 (29)		76.9 (30)	48.7 (19)	
2 or more times	34.2 (13)	23.7 (9)		23.1 (9)	51.3 (20)	
Yesterday, how many times did you eat fresh, frozen, or canned vegetables? (Do not count French fries or potato chips)			0.727			<0.001*
1 time or less	78.9 (30)	84.2 (32)		76.9 (30)	41.0 (16)	
2 or more times	21.1 (8)	15.8 (6)		23.1 (9)	59.0 (23)	
Yesterday, how many times did you eat whole grains, such as whole grain bread, whole grain tortillas (not corn or white flour tortillas), whole grain pasta, or whole grain crackers?			1.000			0.002*
1 time or less	97.4 (37)	100.0 (38)		84.6 (33)	53.8 (21)	
2 or more times	2.6 (1)	0.0 (0)		15.4 (6)	46.2 (18)	
Yesterday, how many times did you eat lean protein, such as beef, chicken, fish, beans, peanut butter, eggs, nuts, or seeds? (Do not include fried meat)			0.118			0.012*
1 time or less	34.2 (13)	15.8 (6)		74.4 (29)	43.6 (17)	
2 or more times	65.8 (25)	84.2 (32)		25.6 (10)	56.4 (22)	
Unhealthy food intake total score	13.5±1.9	13.4±1.6	0.590	12.8±1.8	14.5±1.5	<0.001*
Yesterday, how many times did you eat French fries or chips? Chips are potato chips, tortilla chips, corn chips, or other snack chips			1.000			1.000
2 or more times	23.7 (9)	21.1 (8)		15.4 (6)	12.8 (5)	
1 time or less	76.3 (29)	78.9 (30)		84.6 (33)	87.2 (34)	
Yesterday, how many times did you drink any punch, sports drinks, or other fruit-flavored drinks? (Do not count 100.0% juice or diet drinks)			1.000			1.000
2 or more times	10.5 (4)	7.9 (3)		10.3 (4)	7.7 (3)	
1 time or less	89.5 (34)	92.2 (35)		89.7 (35)	92.3 (36)	

Table 2 (continued)

Nutrition behavior questions	Control group (n=38)			Intervention group (n=39)		
	Baseline	Post intervention	p-value	Baseline	Post intervention	p-value
Yesterday, how many times did you drink any regular (not diet) sodas or soft drinks?			1.000			0.500
2 or more times	2.6 (1)	5.3 (2)		7.7 (3)	2.6 (1)	
1 time or less	97.4 (37)	94.7 (36)		92.3 (36)	97.4 (38)	
Yesterday, how many times did you eat doughnuts, cookies, brownies, cakes, or candy?			0.754			0.001*
2 or more times	26.3 (10)	31.6 (12)		35.9 (14)	2.6 (1)	
1 time or less	73.7 (28)	68.4 (26)		64.1 (25)	97.4 (38)	

Paired t-test was used for questions related to total score. Data represented by mean (standard deviation)
highest possible score; 17 for nutritional knowledge, 20 for healthy food intake, and 16 for unhealthy food.
Health food score represents whole grain, dairy, lean proteins, fruit and vegetables.
Unhealthy food score represents fries and chips, sweets, and sugary and soft drinks
McNemar's test was used for questions related to behavior. Data represented by percentage (n)
*Represents significant differences. Level of significance set at p-value<0.050.

Table 3 Participants knowledge and behavior related to physical activity and screen time at baseline and post-intervention

Physical activity and screen time behavior questions	Comparison group (n=38)			Intervention group (n=39)		
	Baseline	Post intervention	p-value	Post intervention	Baseline	p-value
How often are you physically active for at least 60 minutes per day or more? (This includes activities such as exercise, sports, running, walking, dancing, etc.)			0.180			<0.001*
<5 days/week	78.9 (30)	92.1 (35)		82.0 (32)	18.4 (7)	
5-7 days/week	21.1 (8)	7.9 (3)		18.0 (7)	81.6 (32)	
How many minutes of physical activity do you think you should get each day to be healthy?			0.125			<0.001*
At least 15 min/day	86.8 (33)	76.3 (29)		76.9 (30)	18.4 (7)	
At least 30 min/day						
At least 90 min/day						
At least 60 min/day	13.2 (5)	23.7 (9)		23.1 (9)	81.6 (32)	
Why is physical activity good for kids?			0.375			<0.001*
Helps keep you from getting sick	78.9 (30)	86.8 (33)		87.2 (34)	18.4 (7)	
Builds healthy bones and muscles to keep you strong						
All of the above	21.1 (8)	13.2 (5)		12.8 (5)	81.6(32)	
Yesterday, I watched the screen (TV, IPad, etc.) for:			0.453			<0.001*
2 hours or less	21.1 (8)	13.2 (5)		20.5 (8)	74.4 (29)	
3 hours or more	78.9 (30)	86.8 (33)		79.5 (31)	25.6 (10)	

Table 3 (continued)

Physical activity and screen time behavior questions	Comparison group (n=38)			Intervention group (n=39)		
	Baseline	Post intervention	p-value	Post intervention	Baseline	p-value
How many hours of screen time do you think you shouldn't exceed each day to be healthy?			0.687			<0.001*
2 hours (correct)	15.8 (6)	10.5 (4)		18.4 (7)	92.3 (36)	
3 hours						
4 hours						
Screen time has nothing to do with health	84.2 (32)	89.5 (34)		81.6 (32)	7.7 (3)	

min=minutes, TV=television, IPad=intelligence pad
McNemar's test was used. Data presented by percentage (n)
*Level of significance is at p-value<0.050.

Table 4 Anthropometric measurements by group at baseline and post-intervention

Variables	Control group (n=38)				Intervention group (n=39)			
	Pre-intervention	Post-intervention	Mean difference	p-value	Pre-intervention	Post-intervention	Mean difference	p-value
Weight (kg)	27.5 (7.7)	28.0 (7.7)	0.44	<0.001	30.0 (9.0)	29.8 (8.7)	-0.19	0.036
Height (cm)	124.9 (8.3)	125.4 (8.3)	0.44	<0.001	127.7 (10.6)	128.1 (10.6)	0.37	<0.001
Waist circumference (cm)	60.5 (8.8)	61.0 (8.8)	0.39	<0.001	62.6 (9.1)	62.3(8.6)	-0.35	0.008
Waist-to-height ratio	0.48 (0.05)	0.49 (0.05)	0.01	<0.001	0.49 (0.04)	0.48 (0.04)	-0.01	0.001
BMI	17.4 (2.7)	17.5 (2.8)	0.14	0.006	18.0 (2.8)	17.7 (2.7)	-0.21	0.001

Kg=kilograms, cm=centimeters, BMI=body mass index

Table 5 Distributions of subjects' body mass index category and central obesity pre- and post-intervention between the comparison and intervention groups

Category	Baseline groups			Post intervention groups		
	Comparison (n=38) Percentage (n)	Intervention (n=39) Percentage (n)	p-value	Comparison (n=38) Percentage (n)	Intervention (n=39) Percentage (n)	p-value
BMI			0.566			0.588
Healthy weight	57.9 (22)	59.0 (23)		52.6 (20)	64.1 (25)	
Overweight	26.3 (10)	17.9 (7)		31.6 (12)	23.1 (9)	
Obese	15.8 (6)	23.1 (9)		15.8 (6)	12.8 (5)	
Central obesity			0.575			0.195
Yes	39.5 (15)	33.3 (13)		39.5 (15)	25.6 (10)	
No	60.5 (23)	66.7 (26)		60.5 (23)	74.4 (29)	

Chi square test was used. Data represented by percentage (n)

Discussion

This study indicated that children in Kuwait are lacking an understanding of nutrition, as seen in low nutrition knowledge scores at baseline. Moreover, no previous nutrition education classes were received by all of the participating children in both the intervention or comparison groups. Providing guidance to children on health benefits and nutritional values, versus the detriments of consuming unhealthy food, is the first step in helping children make informed decisions about their diet. This intervention was successful in increasing nutrition knowledge of children aged 6–10 years old, by providing nutrition education sessions following a modified version of the CATCH Kids Club curriculum, tailored to the Kuwaiti culture, twice per week for eight weeks. The increase in knowledge concerning health behaviors was also seen in "SWITCH" a community, school, and family-based eight-month intervention that aimed to reduce the risk of childhood obesity. Children's knowledge regarding nutrition, food choices and physical activity were improved.[32,33] This current intervention was successful in increasing the consumption of healthy food choices; including, fruits, vegetables, dairy, whole grains and lean proteins, for participants. There was a significant decrease in sweets and candies in the intervention group, but not in other kinds of unhealthy food such as fries, and sugary drinks. However, the participants already had low intake of these unhealthy food types. Nutrition education for similar aged children improved healthy eating in populations within the U.S.. Werner et al.[34] reported a significant increase of fruit and vegetable intake, by following the CATCH curriculum in summer camps in the U.S., for children in grades three and five.

For this Kuwaiti study, prior to the intervention less than 25.0% met the exercise recommendations for their age (78.9% from the control group and 82.0% from the intervention group did not meet the recommended 60 minutes of physical activity per day). More than three-quarters of both groups (78.9% of the control and 79.5% of the intervention groups) spent three or more hours of screen time (televisions, smart-phones or other devices). Both groups scored as to a lack of knowledge for the recommended times for physical activity and screen time. Physical inactivity is likely to increase further as children reach adolescence, as only 3.4% of adolescents spend the recommended 60 minutes per day doing such activities, as demonstrated in a recent study of Kuwaiti adolescents, and only 21.0% met the screen time guidelines (Hashem et al, 2018).[35] According to the Study of Health and Activity among adolescents in Kuwait (2012–2013), there was a significant association of higher body mass index for boys, with higher sedentary time and higher body mass index in both genders being significantly associated with hours of videogaming.[36] Post intervention, this modified CATCH program in 8 weeks of summer camp, was associated with a significant increase in time spent on physical activity, to the recommended five to seven days per week. Post-intervention: there was also a significant increase in the participants' knowledge regarding the recommended time spent on screen or physical activity, and the benefits of physical activities and screen time behavior was reduced to the recommendation of no more than 2 hours per day. Several studies in the literature supported the results of this study, in other environments. Reductions in BMI was reported for overweight children attending a school program[37], hospital outreach program[38], and an afterschool program[39] in the U.S. and Europe and only few interventions were conducted in summer camps where children had free time.[40] No child-nutrition interventions have been reported in Kuwait, to date. This study modified the CATCH curriculum dietary questionnaire and components to fit the Kuwaiti culture, from types of food and language for the treatment group in a Kuwaiti summer camp against a similar Kuwaiti summer camp for comparison.

Strengths and limitations

This study has several limitations. The sample size was small (n=79). Although, power was sufficient for within-group measures and between-group measures for continuous variables, there was not sufficient power to measure between-group differences for behavioral data. There was a significant difference in the mother's BMI between groups. The comparison group had significantly more overweight mothers than the intervention group. This study is also lacking long term follow-up, to observe if the results were sustainable through childhood. As with most interventions, sample bias has to be considered. Those who choose to participate may have different characteristics than those not choosing to participate.

Major strengths of this study were the use of a pilot to modify lessons for the community, site randomization and contribution toward an understudied area of vulnerable children. There were no significant differences in the parents' sociodemographic status between the two camps. This study had a high rate of completers, (77 out of 79 participants) who attended over 80.0% of the classes. This study can be seen in the larger context of implemental science. The results of this study promote the need for nutrition interventions for children. The objectives can, in turn, call for policy change, involving the community, implement the processes and can be reevaluate for sustainability.

Conclusion

The purpose of this study was to assess the effectiveness of a culturally adapted eight-weeks nutrition and physical activity intervention at: "My Healthy Habits" summer camp, to prevent obesity, reduce screen time and improve the participant's nutrition and physical activity knowledge and behavior among children in Kuwait. The results of this study showed that following a modified, culturally tailored version of CATCH Kids Club curriculum was effective in preventing obesity, decreasing the total consumption of unhealthy food, increasing physical activity, screen time knowledge, increasing physical activity and decreasing screen time behavior for children aged 6-10 years in Kuwait. However, consumption of FF and SSB still remains an issue. Future studies should add strategies to help children substitute healthy food and beverages for FF and SSB. Long-term follow-up is recommended to check the sustainability of these results.

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Conflict of interest

The authors report that there are no direct or indirect conflicts of interest with respect to this research.

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