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Research Article

Effect of Healthy Lifestyle Interventions in Schools of Jazan City, Kingdom of Saudi Arabia: A Quasi-experimental Study

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Abstract

Background: Unhealthy dietary habits and lifestyle among adolescents is considered as a risk factor for nutrition-related diseases in adulthood. The objective of this study was to investigate the effectiveness of a healthy lifestyle intervention—including physical activity (PA) and eating habits (EH)—among female students in Jizan City, southwest Kingdom of Saudi Arabia (KSA).

Methods: A representative sample of 565 school students aged 12–15 years was randomly selected from four schools in Jizan, KSA. The PA and EH were assessed using a validated self-administered questionnaire. A pre-post quasi-experimental study was implemented in three phases.

Results: Following the intervention, the school children in the intervention groups showed a significant improvement in their EH and PA. These improvements were documented in increased physical walking measured by the number of students walking daily, the number of days walked, and the time spent on vigorous activities (54.11 ± 54.89 to 63.24 ± 76.16). Fruits and vegetables had a similar consumption frequency in both the intervention and control groups. The snacks were frequently consumed among intervention group with a significant increase in the mean number from 1.64 ± 0.93 to 1.96 ± 1.13 (p = 0.000) and fast food were less frequently consumed among intervention group than the control group (p = 0.000). The prevalence of obesity in the intervention group was reduced from 16.3% to 12.9%, while it was significantly increased from 17.6% to 19.0% in the control group (p = 0.0148). Weight decreased by 0.37 kg in the intervention group, while it increased by 0.07 kg in the control group, but with no statistically significant increase.

Conclusion: In conclusion, healthy lifestyle interventions can improve short- and long-term outcomes in school children. When examining the health benefits of healthy lifestyle, the importance of dietary and PA behaviors should be considered.

Keywords: lifestyle, dietary habits, physical activity, chronic diseases, Jazan-KSA

1. Introduction

Unhealthy dietary habits and lifestyle among adolescents are considered as risk factors for nutrition-related diseases in adulthood [1]. A large body of evidence suggest that obesity has become a major public health problem in the Arab countries, creating a health and economic burden on the government of these countries' [2]. The profile of nutritional status among adolescents in the Arabian Gulf countries is characterized by the increase of obesity and overweight among them [3, 4]

Many studies have been conducted in Saudi Arabia to evaluate the prevalence of overweight and obesity among Saudi children. Al-Dossary *et al*. reported that there is a variation in the prevalence of obesity and overweight among children from different geographical regions of the Kingdom [5]. The eastern and central regions in KSA have a higher prevalence of obesity and overweight than the southern regions [5]. The overall prevalence of overweight and obesity among children in Eastern province was 19.0% and 23.3%, respectively [5]. Another study conducted in Riyadh found that the overall prevalence of overweight and obesity were higher among girls in the age group 10–14 years (14.4% and 18%, respectively) [6]. Besides, another study conducted in southwestern Saudi Arabia found that the prevalence of overweight and obesity among girls were 15.5% and 13.9%, respectively [7].

Reducing childhood obesity requires effective lifestyle and behavioral interventions that target healthy eating and physical activity among the general child population [8, 9]. Most public health interventions for overweight prevention in children and adolescents have been conducted through the schools [8–10]. Lifestyle programs are multi-factorial interventions that are designed for individuals or groups according to their risk factor status and the needs of the subjects. These include promoting healthy lifestyle habits, dietary counseling, physical exercise training, and behavioral change targets [11].

Studies addressing school-based interventions among children and adolescents in Jazan region are scarce, and most of them are cross-sectional studies measuring obesity and lifestyle patterns. The aim of this study was to assess the effectiveness of a healthy multicomponent lifestyle interventions among students at intermediate schools in Jazan city, Saudi Arabia. This school-based lifestyle intervention study was developed with a hope to reduce childhood obesity in Jizan, Saudi Arabia and to investigate whether this lifestyle intervention is able to reduce obesity risk and increase healthy behaviors and knowledge of the pupils.

2. Materials and Methods

2.1. Study design and subjects

A pre-post quasi-experimental study was implemented among the female students aged 12–15 years of intermediate schools (grades 7–9) in Jazan city, Kingdom of Saudi Arabia (KSA).

2.2. Sampling procedures

The population included all female students among all schools belonging to the education office of the Jazan General Administration of Education, Ministry of Education. Four schools were randomly chosen according to the desired sample size. First two schools were non-randomly allocated to the intervention group, and the other two were allocated to the control group. Participants were recruited from each school voluntarily after a full description of study, then they were filtered by the study's inclusion and exclusion criteria. Eligible participants were recruited by a simple randomization method proportional to the number of students per school. Finally, the eligible chosen participants were asked to sign informed consent forms before data collection. The sample size was calculated using a 95% confidence level and 80% power of the study, the assumed reduction of obesity from 8% to 4% following intervention, which is taken as P1 and P2. The minimum sample size required for the present study after accounting for 15% dropout rate was 713 participants for both the intervention and control groups. The sampling frame of schools was obtained from the Ministry of Education in Jazan.

2.3. Study phases and intervention strategies

The following three phases were implemented among the schools selected as the intervention group: (i) base-line survey; (ii) intervention; and (iii) evaluation (post-survey) phases.

(i) Base-line survey phase: This was conducted amongst the students of the selected schools, with an aim to assess their healthy lifestyle patterns using the same tools, namely, questionnaire and anthropometric measurements. Each student who agreed to participate was interviewed first to collect sociodemographic data using a pre-tested, structured, close-ended questionnaire (following the stepwise approach to surveillance STEPS procedure) [12].

Questionnaires were administered in the classroom with the assistance of a class teacher to collect information on students' sociodemographic characteristics such as age, sex, and socioeconomic status; behavioral risk factors such as dietary patterns

and physical activity; as well as family history of chronic diseases. Then, the student's anthropometric measurements were measured and recorded.

(ii) Intervention phase: This phase started in the two selected intervention schools for all students. The main goal of the intervention was based on promotion of healthy lifestyle patterns such as weight reduction, decreased consumption of fat, increased consumption of fruits and vegetable, and increased exercise. It focuses on the promotion of physical education classes per week; additional sport and play activities outside school hours; counseling sessions by the team and classroom education on healthy eating behavior; and active living and healthy lifestyle choices [11].

The intervention strategies were as follows:

1. One-day counseling session: The objectives of this session were:
    - to convey knowledge to all students as well as teachers
    - to influence attitudes and behaviors of students
    - to assess knowledge and practice toward their healthy lifestyle
    - the session included lectures, open discussions, role-playing, games, and questions
2. Health education classes: Following the strategies for healthy eating and physical *a*ctivity within existing curriculum using classroom teachers for all students.
3. Morning session before class (*Taboor*): practice exercise.
4. Messages and material for the parents: mainly for those at risk to confirm their participation and collaboration
5. Individual intervention plan for overweight and obese students

(iii) Evaluation phase**:** Post-study survey was conducted for all schools to evaluate the effectiveness of intervention program on changing or promoting healthy lifestyle patterns among the students. Data were analyzed and used to compare and study the differences between the outcomes in the intervention and control schools.

For control schools, both pre- and post-study surveys were conducted.

2.4. Study instruments

For the purpose of the study, the World Health Organization (WHO) STEPS was used [12]. It covers three different levels of steps of risk factor assessment. These steps include: questionnaire (basic demographic information and behavioral risk factors) (STEP-1);

physical measurements (STEP-2); and biochemical measurements (STEP-3). For the purpose of the study, we used STEPS 1 and 2.

(STEP – 1): Questionnaire included the following:

A. Basic demographic information: collection of information on demographic variables, such as age, sex, race/ethnicity, and socioeconomic status.

B. Behavioral risk factors: dietary patterns, physical activity.

(STEP – 2): Physical measurements: Obtaining anthropometric measurements such as weight, height after completion of the questionnaire, using standardized protocols and instruments.

Anthropometric measurements were taken using standardized techniques and calibrated equipment. Subjects were weighed to the nearest 0.1 kg in light indoor clothing and with bare feet or stockings. Height was measured without shoes and recorded to the nearest 0.5 cm using detecto weighing scale [13]. Scales were calibrated and checked daily.

Body Mass Index (BMI) was calculated as weight (kg) divided by the height squared (m^2) and then compared with the reference charts developed by the Center for Disease Control and Prevention [14]. BMI is a measurement standard used to determine childhood overweight and obesity. Overweight is defined as a BMI at or above the 85th percentile and below the 95th percentile for children and teens of same age and sex. Obesity is defined as a BMI at or above the 95th percentile for children and teens of same age and gender [14].

2.5. Statistical analysis

Epi Info version 3.2.2 software (Centers for Disease Control and Prevention (CDC), https://www.cdc.gov/epiinfo/index.html) was used to capture the data and SPSS version 17 (SPSS Inc., Chicago, IL, USA) was used for data analysis. Continuous variables were expressed as mean ± SD (standard deviation) and 95% confidence intervals (95% CI). Categorical variables were expressed as median or percentages. The difference between the control and intervention groups was calculated using the two-sample mean-comparison test or Pearson's Chi-square test, depending on the kinds of variables. Each child's BMI (kg/m^2) was calculated using the weight and height data. Prevalence rates were given in percentages. All *p*-values were two-tailed and considered significant when < 0.05.

2.6. Ethical approval

The study proposal, instruments, and tools were approved by the Medical Research Ethics Committee, Medical Research Center, Jazan University (project no. 3053). All participants, including the guardians on behalf of minors/children participants, who were involved in this study read, understood, and signed a written consent form. Permission was taken from school's administration. All records were kept confidential.

3. Results

Of the 713 initially eligible participants, 565 (79.2%) completed the survey. The main reasons for the non-response was that students were sick or absent on the survey day. The mean age of the intervention group was 15.27 ± 1.07 years compared to 14.68 ± 0.95 years for the control group. The mean age of all students in both groups was 15.4 ± 1.06 years. As observed in Table 1, the majority of sampled participants (63.4%) live in urban settings. The table further suggested that there are no significant differences in the distribution of most background characteristics for both the intervention and control groups except for the mode of living.

Table 2 shows that there was no significant difference in the mean of eating fruits and vegetables for both the intervention and control groups. It was also noticed that there was a significant increase in the mean number of snacks between meals from 1.64 ± 0.93 to 1.96 ± 1.13 (p = 0.000) in the intervention group. As shown in the table, the mean number of meals taken per day was increased from 2.49 ± 0.84 at baseline to 2.56 ± 0.96 in the intervention group; however, they were not statistically significant. Also, there was a remarkable increase in habitual water drinking (for all $p < 0.05$). Statistically significantly reduction was seen in the intervention group than in the control group in the mean number of days fast foods were eaten per week from 6.35 ± 1.77 to 5.74 ± 1.95 (p = 0.000). Moreover, there was a reduction in drinking soft drinks per week after the intervention contrary to no significant change in the control group.

As presented in Table 3, there was a significant increase in the percentage of students who were walking at least 10 min a day from 49% to 61.2% compared to the control group, where there was no significant difference observed. The mean number of days walking for 10 min increased from 1.69 ± 2.30 to 5.30 ± 2.23 after the intervention (p = 0.0000). Additionally, there was an increase in the mean of time doing moderate activity (walking or bicycling for travel) from 35.66 ± 35.04 to 47.19 ± 49.24 over time during the intervention with statistically significant increase (p = 0.02). This is in contrast to the control group where there was a reduction in the meantime from 52.07 ± 66.64 to

Table 1: Background characteristics of the study population

Characteristics	Intervention	Control	Total	P- value
Mode of living:				
Rural	114 (32.7)	93 (43.1)	207 (36.6)	0.013
Urban	235 (67.3)	123 (56.9)	358 (63.4)	
Parental status:				
Live together	319 (91.4)	198 (91.7)	517 (91.5)	
Divorced	5 (1.4)	5 (2.3)	10 (1.8)	0.750
Separated	6 (1.7)	2 (.9)	8 (1.4)	
Widowed	19 (5.5)	11 (5.1)	30 (5.3)	
Father's education status:				
Illiterate	11 (3.2)	5 (2.3)	16 (2.8)	
Read and write	7 (2.0)	2 (.9)	9 (1.6)	
Primary	28 (8.0)	13 (6.0)	41 (7.3)	
Intermediate	39 (11.2)	23 (10.6)	62 (11.0)	0.372
Secondary	69 (19.8)	47 (21.8)	116 (20.5)	
University & post graduate	126 (36.1)	70 (32.4)	196 (34.7)	
Don't know	69 (19.7)	56 (26.0)	125 (22.1)	
Mother's education				
Illiterate	46)13.2)	16 (7.4)	62 (11.0)	
Read and write	8 (2.3)	4 (1.9)	12 (2.1)	
Primary	59 (16.9)	43 (19.9)	102 (18.1)	
Intermediate	62 (17.8)	33 (15.3)	95 (16.8)	0.480
Secondary	59 (16.9)	37 (17.1)	96 (17.0)	
University & post graduate	83 (23.7)	56 (25.9)	139 (24.6)	
Don't know	32 (9.2)	27 (12.5)	59 (10.4)	
Descriptive measures Mean ± (SD)	349 (100)	216 (100)	565(100)	
Age (years)	15.27 ± 1.07	14.68 ± 0.95	15.4 ± 1.06	0.000
Hight (cm)	150.5 ± 6.6	150.3 ± 6.3	150.4 ± 6.5	0.800
Weight (kg)	48.9 ± 13.3	48.3 ± 13.7	48.7 ±13.4	0.586
BMI	21.5 ± 5.2	21.3 ± 5.7	21.47 ± 5.4	0.691
Total	**349 (100)**	**216 (100)**	**565(100)**	

35.07 ± 36.17. In the intervention group, the mean time spent doing vigorous-intensity activities was increased from 54.11 ± 54.89 to 63.24 ± 76.16 with no statistical significant difference.

Figure 1 as well as Table 3 show that the prevalence of obesity among students in the intervention group was reduced from 16.3% at baseline to 12.9% but with no change in the number of overweight students. On the other hand, Figure 2 and the Table 4

Table 2: Comparisons between intervention and control groups on the nutritional habits

Factor	Intervention group			Control group		
	Pre Mean ± SD	Post Mean ± SD	P-value	Pre Mean ± SD	Post Mean ± SD	P-value
Fruit intake per week (number of days)	2.25 ± 2.02	2.13 ± 1.80	0.336	2.33 ± 2.25	2.64 ± 2.11	0.182
Number of meals per day	2.49 ± 0.84	2.56 ± 0.96	0.296	2.46 ± 0.84	2.61 ±1.10	0.091
Number of snacks between meals	1.64 ± 0.93	1.96 ± 1.13	0.000	1.65 ± 0.924	1.88 ± 1.05	0.006
Fast food intake per week	6.35 ± 1.77	5.74 ± 1.95	0.000	6.13 ± 1.86	5.88 ± 1.98	0.143
Number of water cups per day	3.28 ± 1.98	4.21 ± 2.86	0.000	3.32 ± 2.18	4.10 ± 2.49	0.001
Bread intake per week	2.53 ± 2.30	2.07 ± 2.03	0.012	2.31 ± 2.10	2.33 ± 2.23	0.932
Soft drinks per week	4.03 ± 2.44	3.77 ± 2.30	0.094	4.12 ± 2.42	4.15 ± 2.47	0.876
Number of fish rations per day	0.84 ± 0.62	0.96 ± 0.78	0.027	0.90 ± 50	0.91 ± 0.79	0.827

Table 3: Comparisons between the intervention and control groups on the physical activity habits

Variable	Intervention group			Control group		
	Pre	Post	P-value	Pre	Post	P-value
Walk for at least 10 min:						
Yes	171(49.0)	215(61.2)	0.001	139(64.4)	144(66.7)	0.687
No	178(51.0)	134(38.4)		77(35.6)	72(33.3)	
Factor	**Intervention group**			**Control group**		
	Pre Mean ± SD	**Post Mean ± SD**	**P-value**	**Pre Mean ± SD**	**Post Mean ± SD**	**P-value**
Days walked for at least 10 min continuously	1.69 ± 2.30	5.30 ± 2.23	0.000	2.57 ± 2.54	5.45 ± 1.98	0.000
Time spent walking or biking for travel on a typical day	35.67 ± 35.03	47.19 ± 49.24	0.024	52.07 ± 66.64	35.07 ± 36.17	0.022
Time spent doing vigorous-intensity sports on a typical day	54.11 ± 54.89	63.24 ± 76.16	0.297	57.53 ± 48.76	79.11 ± 86.27	0.045
Weight (kg)	48.91 ± 13.28	48.83 ±14.29	0.939	48.27 ± 13.70	48.35 ± 14.66	0.953

illustrate a significant increase in the prevalence of obesity among students in control group from 17.6% to 19.0%. (p = 0.01484).

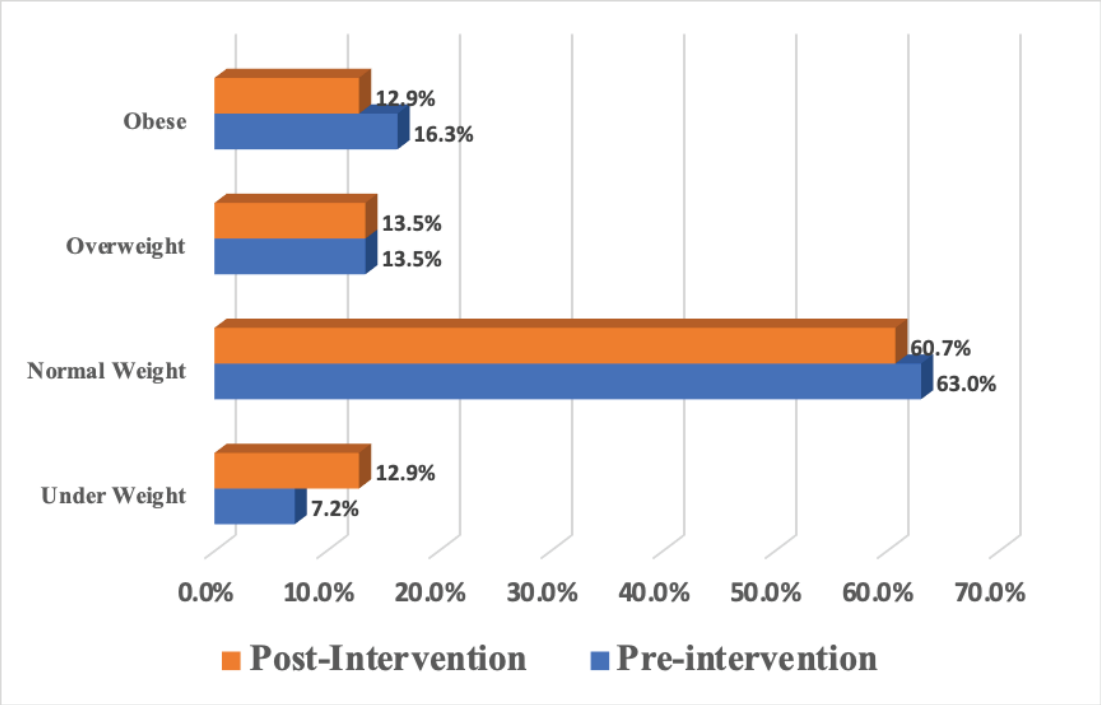

Figure 1: Impact of intervention program on BMI among the intervention group

TABLE 4: Comparisons between the intervention and control groups on BMI categories pre- and post-intervention program

BMI category	Intervention group		P- value	Control group		P- value
	Pre N%	Post N%		Pre N%	Post N%	
Under Weight (< 5%ile)	25(7.2)	45(12.9)	0.06365	16(7.4)	37(17.1)	0.01484
Normal Weight (5%–85%ile)	220(63.0)	212(60.7)		142(65.7)	119(55.1)	
Over Weight (85%–95%ile)	47(13.5)	47(13.5)		20(9.3)	19(8.8)	
Obese (> 95%ile)	57(16.3)	45(12.9)		38(17.6)	41(19.0)	

4. Discussion

The purpose of this study was to assess the effect of a school-based lifestyle intervention program on some nutritional and physical activity habits as well as weight change among the female students in the intermediate schools in Jazan. Accumulated evidences suggest that the effect of school-based lifestyle interventions on obesity did not reach a consistent conclusion [15, 16].

In this study, a longitudinal analysis showed that over the six months period, the prevalence of obesity among students in the intervention group reduced from 16.3% at baseline to 12.9%, but with no change in the percentage of overweight students. For the control group, there was no significant increase (from 17.6% to 19.0%) in the prevalence of obesity. These findings indicate that school-based interventions targeting obesity prevention can have positive and fruitful effects on student's anthropometric measures.

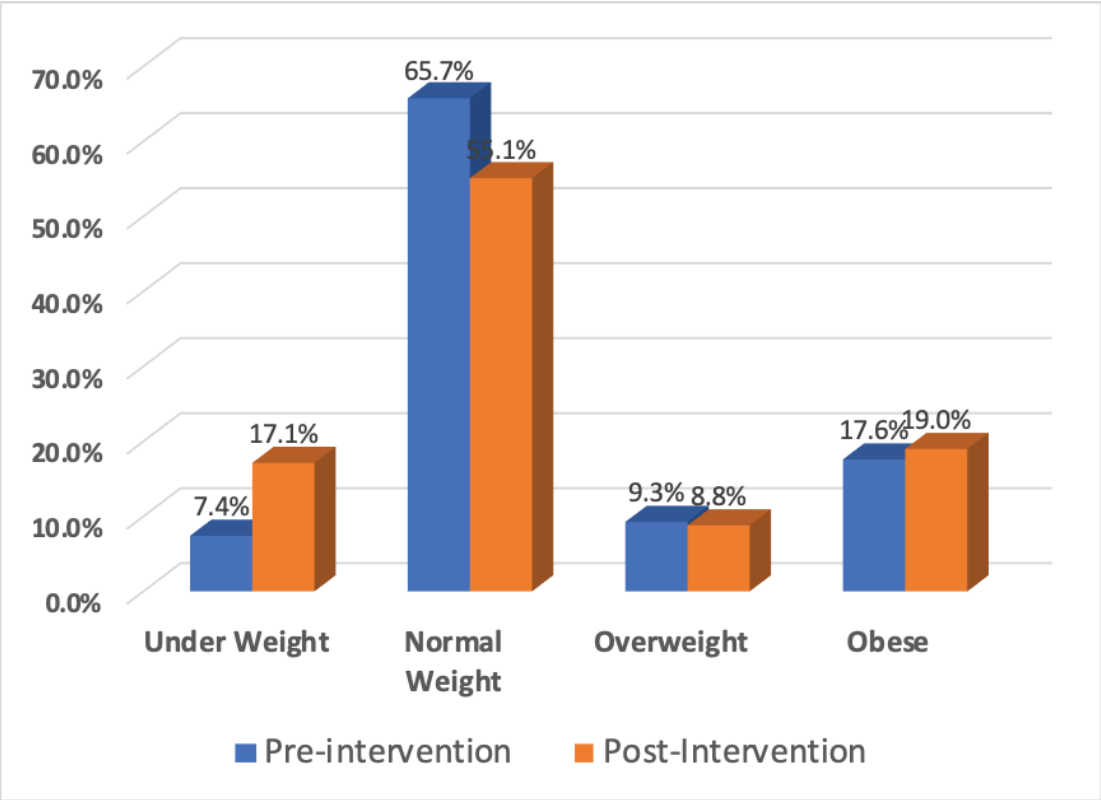

Figure 2: BMI among the control group pre- and post-intervention

Schools have been suggested as the ideal place to implement obesity prevention programs, in reducing the prevalence of overweight and obesity [17, 18].

Most published school-based interventions reported statistically significant beneficial effects compared with the control in at least some of the body-weight-related indices. In the present study, the students weight decreased by 0.37 kg in the intervention group, compared to an increase of 0.07 kg in the control group. This finding is in contrast with another study conducted for short time period of intervention where there was no significant change in the weight and BMI generally [18].

Changes in the behavior of students toward physical activity showed statistically significant increases in the percentage of students walking at least 10 mins a day from 49% to 61.2%, compared to no change in the control group. Additionally, the mean number of days walking 10 min increased from 1.69 ± 2.30 to 5.30 ± 2.23 after the intervention.

There was a statistically significant increase in the mean of time doing moderate activity (walking or bicycling for travel) from 35.66 ± 35.04 to 47.19 ± 49.24 over time during the intervention. This is in contrast to the control group where there was a reduction in the meantime from 52.07 ± 66.64 to 35.07 ± 36.17. This is in line with

the study conducted in the United Arab Emirates (UAE), where there was a remarkable decrease in the estimated physical inactivity among females [19].

In the intervention group, the mean time spent doing vigorous-intensity activities was increased from 54.11 ± 54.89 to 63.24 ± 76.16, but with no significant increase. Internationally, the Global School Based Student Health Survey, conducted in 2010, showed that among 34 countries, only 24% of male and 15% of female school children met the recommendations of 60 min of moderate-to-vigorous physical activity per day [20].

Significant reduction was seen in the intervention than in the control in the mean number of days eating fast foods per week. Moreover, 4.1% of the students in the intervention group had restricted their frequency of intake of fast foods per week. Additionally, there was reduction in drinking soft drinks per week after intervention contrary to no significant change in the control group. This change could be attributed to the role of school administration and support of parents regarding the side effects of drinking soft drinks and eating fast foods. Other studies have also resulted in a significant restriction (16.3%) of the frequency of fast food intake among students. Fruits and vegetables are important components of a healthy diet. Low fruit and vegetable consumption and high saturated fat intake are linked to poor health and increased risk of non-communicable diseases [21, 22]. An estimated 5.2 million deaths worldwide were attributable to inadequate fruit and vegetable consumption in 2013 [22].

The strength of this study is that it is relatively easy to replicate. Despite this strength, the study has some limitations. First, the lack of random assignment is a major weakness of this quasi-experimental study, the randomization was conducted at school level, not at student level. Second, the study participants were aware of the experiment and might have changed their behavior and this in turn may have affected the internal validity of the study. Finally, the limited time frame, as we were not able to do follow-up the students for more than six months.

5. Conclusion

In conclusion, the school children in the intervention group showed improvements in eating habits (EH), and physical activity (PA). These improvements were manifested in increased physical walking measured by the number of physical steps per week, daily snacks and less fast food consumption and the daily quantity of water ingested. While their nutrition/physical activity knowledge significantly increased, their BMI significantly decreased. When examining the health benefits of healthy lifestyle, the importance

of dietary and PA behaviors should be considered. We recommend healthy lifestyle program to be integrated in the Jizan school health programs.

Acknowledgments

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Conflict of Interest

None declared.

Author Contributions

FAEE is the chief investigator of the project. HEEK, AMG, MEM, and IAB contributed to the development and implementation of the project. All authors and MSM contributed to the drafting of this manuscript and approved the final version of the manuscript for publication.

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