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ORIGINAL ARTICLE

Physical Activity and Nutrition Education Programs Changes Body Mass Index and Eating Habits of 12th Grade Students: An Intervention during the COVID-19 Pandemic

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ABSTRACT

Background. The importance of physical activity (PA) for maintaining and improving health status increases with each passing day. **Objectives**. The present study aimed to examine the effects of PA and nutritional education programs applied to 12th-grade students on body mass index (BMI), PA level, and eating habits during the COVID-19 pandemic. **Methods**. One hundred fifty-nine 12th grade students were randomly assigned to the experimental group (EG) (n=87, 42 male and 45 female) and control group (CG) (n=72, 39 male and 33 female). At first, physical characteristics, PA level, and eating habit questionnaires were completed by students. Then, EG received a single session face-to-face PA and healthy nutrition-themed programs. After an 8-week follow-up, questionnaires were completed by students again. Also, the number of daily steps of EG was recorded during the 8-week follow-up. Differences between pre and post-BMI, PA level, and eating habits of the groups were analyzed using the mixed model ANOVA test. **Results**. Results showed that educational programs had a positive effect on BMI, PA level, and eating habits of EG ($p<.05$). There was no improvement in CG ($p>0.05$). Qualitative findings of EG revealed that the educational program is a beneficial process not only for a short period but also for a lifelong learning structure. **Conclusion**. In conclusion, PA and healthy nutrition-themed educations are effective methods to improve youths' awareness to be more active and healthier in their daily life, including during the pandemic processes.

KEYWORDS: ***Exercise, High School, Nutrition, Quarantine, Pandemic, Physical Inactivity, SARS-COV-2.***

INTRODUCTION

The importance of physical activity (PA) for maintaining and improving health status increases with each passing day (1). Factors such as the rapid spread of an inactive/sedentary lifestyle to the masses and the lack of participation in PA at the desired level (2) cause inactivity-based diseases to become widespread worldwide (3). Although physical inactivity is a modifiable concept, it affects global mortality (4) and is considered within individual factors affecting activities such as insomnia, lifestyle, psychological disorders, disability, and time spent looking at the screen during the day (5-7). Climatic conditions, culture, and income status

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are evaluated within environmental factors (8, 9), and finally, the global pandemic (COVID-19) has been added to environmental factors (10). During the global pandemic time, many restrictions and lockdowns were applied around the World, which limited many people from going out and participating in physical activities. Staying at home has also led to the development of unbalanced eating habits.

PA is defined as all body movements produced by skeletal muscles by increasing energy expenditure compared to the condition at rest (11). To maintain the ideal body weight required for energy expenditure, at least 150 minutes of moderate-intensity PA per week is recommended (12). However, there has been a significant increase in inactivity due to the pandemic (13). Therefore, the COVID-19 pandemic exacerbates a different pandemic, likely to be much longer-lasting and permanent, in other words, physical inactivity (14). It is thought that physical inactivity brings about problems such as thickening around the waist, increased body fat ratio, fat deposition in the internal organs and many physical negativities, psychological restlessness during the day, fear of being disliked, and decreased quality of life (15). It should be accepted as an inevitable condition that PA should be considered as the primary goal for making the person feel psychologically sound and preventing the mentioned problems.

The youth period, which is of vital importance in the physiological and psychological development processes of individuals, is accepted as a transitional period (16). Significant changes in the body during this period directly affect nutrition and eating attitudes/habits. The change in eating attitudes and nutritional habits during youth lays the groundwork for possible health problems that may occur in adulthood (17). Within this framework, obtaining information about essential nutrients and eating habits since childhood comes to the fore as an inevitable condition for public and community awareness specific to individuals (18, 19). Studies conducted before the pandemic displayed that youths, to some extent, already have physical inactivity and unhealthful diets (20). Even though PA and diet may not be heavily related, it has been stated that those behaviors are interrelated within individuals themselves (21). Therefore, the relationship between physical activity and eating habits is significant in terms of correctly establishing these habits, especially in youth. In their study, Iannotti and Wang (20) surveyed a large sample of youths' PA, sedentary behavior (SB), and eating habits. They defined three classes regarding the mentioned behaviors. The first class consisted of the youths (26.5%) who had high PA, good eating habits, and low SB. The second class consisted of the youths (26.4%) who had high SB and unbalanced eating habits. Finally, the third class consisted of the youths (47.2%) with low PA and unbalanced eating habits. These undesirable statistics show how important physical activity and proper eating habits are during youth. As we stated above, this phenomenon becomes more critical during the pandemic.

The age range with the highest obesity rate is 12-19 years (22), reveals the need for high school-aged youth to obtain information about PA and nutrition. Recent studies have emphasized that it is essential to develop programs for PA and healthy nutrition during the COVID-19 pandemic (23-25). Based on this, the present study aimed to examine the effects of PA and nutrition education programs applied to 12th-grade students during the COVID-19 pandemic.

MATERIALS AND METHODS

Participants. There were 174 high school students (12th grade) from a state high school accepting the highest grade students in the city voluntarily accepted to attend this study. Participants were randomly divided experimental (n= 87) and control (n= 87) groups. During the study, 15 students from the control group did not want to continue and were extracted from the study. The final sample of this study comprised the experimental group (n=87, 42 male and 45 female) and control group (n=72, 39 male and 33 female), a total of 159 high school students. Inclusion criteria were 12. grade students, 16-17 years old, and volunteer participation in studying. Exclusion criteria were being younger than 16 years old, any acute infection or medications before inclusion, or the presence of an injury (before inclusion) that might have affected participation in to study.

The ethical commission of a state university approved this study (Document No: 2021/101). Permission for scientific research was obtained from the provincial directorate of national education. Moreover, individual consent forms from the school manager, students, and their parents were collected before the study began.

Study design. A mixed research design (see Figure 1) which includes qualitative and quantitative methods, was used for this study. It allows researchers to present, analyze and assemble within a framework (26). In the quantitative part of the study, a semi-experimental design with a pre-post test control group was utilized. The semi-structured interview method was used for the qualitative part.

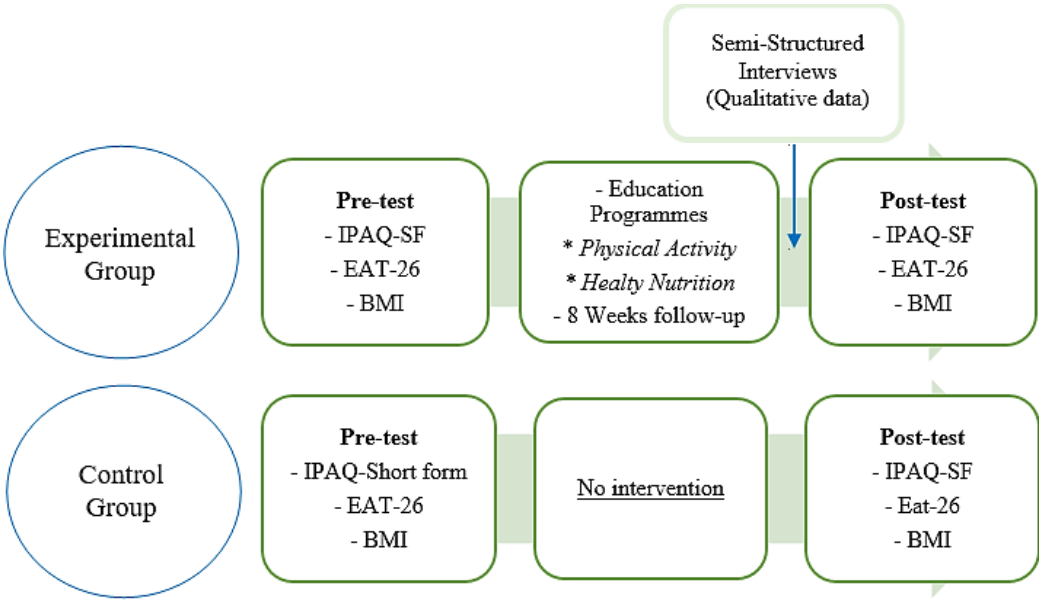

Figure 1. Flow chart of study design.
IPAQ-SF: International physical activity questionnaire short form; **EAT-26:** The Eating Attitudes Test; **BMI:** Body Mass Index.

Physical Activity and Nutrition Education Programmes. An educational program based on a quasi-experimental design is shown in Figure 1. Participants were allocated either experimental, or control groups and were purposefully selected before the education programs began. The study was conducted in a public school with students with the city's highest grade scores. In the experimental group, education programs were provided face to face following obeying COVİD-19 pandemic rules. PA education program was a total of 140 minutes (120 minutes presentation and 20 minutes questions-answers). The presentation content of the program included PA and its effects on the body and subjects about exercise-cognitive process relations. The duration of the healthy nutrition education program was 90 minutes, and 20 minutes Question-answers (a total of 110 minutes) were allowed for students to ask questions about the session. Content of the healthy nutrition education program was adequate-balanced nutrition, essential nutrients and their duties, and daily energy needs. To ensure consistency, nutrition educators were provided a curricula guide with specific curricula and materials appropriate for the target audience. Materials were from the sources of the Turkish Ministry of Education (27).

A team of health professionals designed both education programs. Education sessions were provided once in the school's conference hall on separate days. After each education session, experimental group participants also received 15-20 minutes of individual PA and healthy nutrition guidance/counseling. School counselors and one of the authors regularly followed students' attendance and communicated the importance of keeping advice about healthy nutrition and daily PA. Experimental group participants were asked to complete the follow-up questionnaire at the end of the education programs. The control group participants did not receive any group or individual education programs.

Data Collection Process and Tools. The data collection process of this study consisted of three steps. In the first step, pre-test data with IPAQ-SF, EAT-26, and anthropometric measurements from both groups were collected. Two lecturers presented physical activity and healthy nutrition education programs in the second step. Participants also sent the number of their daily steps during eight weeks to one of the researchers via the online platform "Google Forms." In the final step, post-test data were collected with IPAQ-SF, EAT-26, and anthropometric

measurements. Moreover, individual interview data were collected from students who voluntarily accepted.

Anthropometric Measurements. Participants' weight (kg) and height (m) measurements were recorded by a bioelectrical impedance device (SECA 220, SECA, Hamburg, Germany). Measurements were conducted with naked feet and sports clothes. Collected data were used for calculating participants' body mess index (BMI). The formula used for calculating the body mass index (BMI) is taking weight in kilograms (kg) divided by height in meters (m) squared.

International Physical Activity Questionnaire- Short Form (IPAQ-SF). PA level of the participants was assessed with IPAQ-SF created by Craig et al. (28). The Turkish version of the EAT-26 was adapted by Öztürk et al. (29). The short form IPAQ is a 7-item scale, assessing the number of minutes spent in vigorous and moderate intensity activity and walking during the last seven days. Durations are multiplied by a known metabolic equivalent of task (MET) per activity, and the results for all items are summed for the overall PA score. Scores for walking and moderate and vigorous activities are sums of corresponding item scores. A sitting question is not included in the physical activity score. Vigorous physical activity, defined by the questionnaire, refers to intense exercise that results in very rapid breathing and an elevated heart rate (e.g., intense weight lifting, aerobics, running, and cycling). Moderate physical activity was defined as less intense exercise that slightly heightened breathing and heart rate (e.g., less exertive cycling, fast walking, and light weight lifting). Participants were asked only to report physical activity that exceeded ten minutes in duration

For all categories, the amount of METs minutes is calculated by multiplying the number of minutes by 8 (vigorous), 4 (moderate), 3.3 (walking), or 1.3 (sitting). Besides these four subscores, a total score is calculated by counting the METs-minutes of the first three categories together.

Respondents were then classified (high, moderate, and low physical activity) based on the following criteria:

1. High physical activity – three or more days of vigorous physical exercise, including at least 1,500 MET-minutes/week, or seven or more days of any combination of vigorous exercise, moderate exercise, and walking that exceeded 3,000 MET-minutes/week.

2. Moderate physical activity – three or more days of vigorous physical exercise (at least 20 minutes per day), five or more days of moderate exercise or walking (at least 30 minutes per day), or five or more days of a combination of vigorous exercise, moderate exercise, and walking that exceeded 600 MET-minutes/ week.

3. Low physical activity – Little physical activity resulted in a failure to comply with moderate or high physical activity classifications (less than 600 MET-minutes/week) (30, 31).

Questions on height and weight are also asked as part of the IPAQ-SF, which were used to determine body mass index (BMI) (kg/m2). BMI can be used to classify people into four referenced weight categories: underweight (14.50–18.49), healthy weight (18.50–24.99), overweight (25.00– 29.99), and obese (> 30.00) (32).

The Eating Attitudes Test (EAT-26). The EAT-26 is widely used to measure eating attitudes and possible symptoms of disordered eating, and it is a Likert scale using a 6-points ranking from 'always' to 'never'. The scale is an abbreviated 26-item version of the EAT-40, created by Garner et al. (33). The Turkish version of the EAT-26 was adapted by Bas et al. in (34). The scale consists of 26 questions and has been used in both clinical and non-clinical settings, among males and females as well as adults and adolescents. It consists of three subscales characteristic of eating disorders, including (a) dieting, (b) bulimic behavior, and (c) oral control. The dieting scale evaluates food restriction and obsession with losing weight. The bulimic behavior scale evaluates the use of binge-eating/induced vomiting conducts and thoughts about food. Finally, the oral control scale evaluates food intake, self-control, and the pressure of the environment to lose weight.

Items 1, 6, 7, 10, 11, 12, 14, 16, 17, 22, 23, 24, and 25 pertain to the diet scale, while the values obtained in items 3, 4, 9, 18, 21, and 26 account for the bulimia scale. The remaining items correspond to the oral control scale (2, 5, 8, 13, 15, 19, and 20). The answers and values for each item (except for items 1 and 25) include: never (0 points), rarely (0 points), sometimes (0 points), often (1 point), usually (2 points), and always (3 points). The answers and scores for items 1 and 25 were inverted. A score of 20 or more (out of a total of 78) indicates a risk of developing or presenting an eating disorders. It has a high level

of convergent validity, concurrent validity, and internal reliability (35).

Number of Steps. After the physical activity and healthy nutrition education programs, participants' number of daily steps was recorded using Hattrick PD 30 pedometer. Studies in the literature indicated that the number of daily steps should be expected to be over 6000, and we stated this expectation to participants (36).

Data Analysis. The statistical analyses were performed using SPSS 23.0 for Windows (SPSS, Inc., Chicago, IL, USA). Descriptive statistics are reported as mean ($\bar{X}$) and standard deviation (SD) values. The data were usually distributed based on the Kolmogorov- Smirnov test and skewness/kurtosis values. Boxplot analysis assessed potential outliers, and Levene's test was used to test the homogeneity of variances. Differences between pre and post-PA, BMI, and EAT-26 subscale values of the groups were analyzed using the mixed ANOVA test (between and within group variance differences) (37). Significance for all comparisons was set a priori at an alpha level of 0.05. Effect sizes (ES) are reported based on Cohen's recommendations: where 0.2–0.49 is a small effect, 0.5–0.79 is a moderate effect, and ≥0.8 is a large effect (38).

The content analysis method was used for the analysis of qualitative data. The data from the face-to-face interviews are first converted into codes. Then the codes come together to form the themes (39).

RESULTS

Results showed that the experimental group participants positively affected physical activity and healthy nutrition education programs applied to high school students. According to statistical analysis, there was a significant difference in MET, BMI, and subscales of EAT-26 "dieting and bulimic behavior" variables in favor of the experimental group ($p<0.05$). There was no improvement in control group participants. It was determined that experimental group participants reached the expected number of daily steps during the 8-week follow-up. As a result of semi-structured interviews with experimental group participants, it was concluded that PA and healthy nutrition education programmes had positive reflections on them regarding the post-education process and lifelong learning.

Results of PA and healthy nutrition education programs are presented in Table 1. When Table 1 was examined, it was seen that there was a statistical difference between pre to post-test BMI and BMI values in both experimental and control group participants. ($p=0.05$; $p=0.02$ respectively). The difference in the MET and BMI parameters was found as a "large effect" according to the "effect size (Cohen's d)" classification.

Table 2 indicated a significant difference between experimental and control groups regarding MET and BMI post-test results ($p=0.01$; $p=0.03$, respectively). The increase in post-test MET values and the decrease in post-test BMI values of the experimental group indicated that both education programs had a positive effect. The difference in the MET($d=0.88$) and BMI ($d=1.51$) parameters was found as a large effect.

Table 3 showed no significant pre- to post-test differences on EAT-26 sub-domains: dieting, bulimic behavior, oral control and total EAT-26 ($p>.05$) non-significant difference; post-test data of the experimental group showed a decreasing trend. The higher the mean values obtained from the sub- subscales of the EAT-26 scale, the higher the risk of eating disorders. Hence, it was seen that the risk of eating disorders in the experimental group participants decreased after the healthy eating program. The findings also indicated that the risk of eating disorders increased in the control group of students who did not receive healthy nutrition education.

Table 4 demonstrated significant post-test differences between experimental and control groups on EAT-26 subscales: dieting, bulimic behavior, and total EAT-26 ($p=.02$; $p=.00$; $p=.00$, respectively). The difference in the bulimic behavior score was found to have a large effect ($d= 1.03$). Overall findings revealed that the applied healthy nutrition program positively affected the experimental group participants.

The Number of Experimental Group Participants' Daily Steps. According to the findings obtained during the eight-week follow-up period, it was determined that the experimental group participants' the daily average number of steps was 6.178±1.211. Therefore, it was concluded that participants reached the requested target number of daily steps (at least 6000 steps).

Table 1. PA and BMI results of the groups (mixed ANOVA- within groups)

Variables		Group				
		Control (N=72)	Experimental (N=87)			
		X̄±SD	X̄±SD	F	p	*Cohen's d (†)*
PA (MET)	Pre-test	316.58±334.65	487.74±307.77	3.80	.05	.80
	Post-test	416.41±402.25	885.86±634.20			
BMI (kg/m^2)	Pre-test	23.23±1.71	24.11±1.27	6.00	.02	1.46
	Post-test	24.09±1.08	21.76±1.89			

*: p<0.05. †Cohen's d effect size. where ≤ 0.2 = small. ≤ 0.5 = medium. and ≤ 0.8 = large

Table 2. PA and BMI results of the groups (mixed ANOVA- between groups)

Variables	Group				
	Control (N=72)	Experimental (N=87)			
	X̄±SD	X̄±SD	*F*	*p*	*Cohen's d (†)*
PA (MET)	416.41±402.25	885.86±634.20*	8.15	.01	.88
BMI (kg/m^2)	24.09±1.08	21.76±1.89*	5.16	.03	1.51

*: p<0.05. †Cohen's d effect size. where ≤ 0.2 = small. ≤ 0.5 = medium. and ≤ 0.8 = large

Table 3. EAT-26 subscale scores of the groups (mixed ANOVA-within groups)

EAT-26 scores		Group				
		Control (N=72)	Experimental (N=87)			
		X̄±SD	X̄±SD	*F*	*p*	*Cohen's d (†)*
Dieting	Pre-test	6.12±5.19	5.08±4.22	.45	.50	.21
	Post-test	6.98±6.98	5.02±3.74			
Bulimic behavior	Pre-test	2.93±2.87	2.51±3.20	.69	.41	.14
	Post-test	4.56±3.56	1.54±2.10			
Oral Control	Pre-test	4.20±3.56	4.23±3.82	.08	.78	.01
	Post-test	4.93±4.08	3.78±3.40			
Total EAT-26	Pre-test	11.82±6.64	13.24±9.16	1.19	.28	.18
	Post-test	10.44±5.68	17.02±13.65			

*: p<0.05. †Cohen's d effect size. where ≤ 0.2 = small. ≤ 0.5 = medium. and ≤ 0.8 = large

Table 4. EAT-26 subscale scores of the groups (mixed ANOVA-between groups)

EAT-26 scores	Group				
	Control (N=72)	Experimental (N=87)			
	X̄±SD	X̄±SD	*F*	*p*	*Cohen's d (†)*
Dieting	5.11±3.74	6.98±6.98*	5.48	.02	.33
Bulimic behavior	1.54±2.10	4.56±3.56**	21.89	.00	1.03
Oral Control	3.78±3.40	4.93±4.08	1.32	.25	.31
Total EAT-26	10.44±5.68	17.02±13.65**	12.67	.00	.63

*: p<0.05. **Statistically significant differences (p<0.01). †Cohen's d effect size. where ≤ 0.2 = small. ≤ 0.5 = medium. and ≤ 0.8 = large

Qualitative Data Results

Content analysis was used for the semi-structured interview findings collected from the experimental group participants. After the coding process, two themes emerged, which were "the effect of PA and healthy nutrition education programs" and "life-long PA and healthy nutrition."

Theme 1: The Effect of PA and Healthy Nutrition Education Programmes. It was

determined that the students had an inadequate and unbalanced diet before the PA and healthy nutrition education programs.

"Frankly, I am not on a healthy diet. I'm focused on the exam and eating to fill my stomach."
Student 1

"I was consuming too much junk food. I love dessert. I was consuming more sweet products than usual while studying."
Student 4

It was determined that the high school students participating in this study had an inactive lifestyle created by the university exam and the Covid-19 pandemic.

"I was so affected by the pandemic, and I could not move much sometimes I played football. Unfortunately, it happened once or twice in the whole pandemic process."
Student 3

"I was walking for at least an hour a day before the university exam and the pandemic. The exam and the pandemic affected me negatively. Before the PA education program, I hardly moved"
Student 7

It was determined that the education carried out for healthy nutrition contributed positively to the nutritional habits of the students.

"In my general daily nutrition, I would try not to consume junk-style foods. After the education program, I realized I should not eat them."
Student 2

"I constantly heard the concept of healthy eating but understood what it meant after the education program. I am trying to eat healthier now, more consciously."
Student 9

It was determined that the applied PA education program helped students understand why they should do PA and its benefits.

"Education programs impressed me a lot. I have been trying to walk every day since I learned that walking is important."
Student 3

Theme 2: Life-long PA and Healthy Nutrition

It was seen that applied PA education was influential on the 12th-grade students' awareness that they should be physically active throughout their life

"I understood and implemented how walking is important. When I start university, I plan to attend other sports branches besides walking."
Student 8

"After the lecturer explained the necessity of walking for the PA education programme, I tried walking at least 6,000 steps per day. I no longer feel good if I do not walk every evening. Walking has become a part of my life."
Student 3

The participants stated that applying a healthy nutrition education program helped them how they should be fed. It can be said that participants will continue this situation throughout their lives after the exam was an indication that the education programs helped them to gain lifelong healthy eating habits and that the programs have achieved their purpose.

"Especially the points emphasized by the lecturer impressed me. I want to integrate this diet into my life."
Student 1

"I realized that eating junk food is unhealthy. I'm going to cut it out of my life completely. I will try to eat a more balanced and healthy diet."
Student 1

DISCUSSION

The COVID-19 pandemic has resulted in a sedentary life for people under lockdowns and excessive food consumption due to spending much time at home (40, 41). This process creates more significant problems, especially for individuals of the developmental age (42). The current study aimed to examine the effects of the education programs applied to high school students during the COVID-19 pandemic on their PA and nutrition attitudes. The results obtained at the end of the study reveal that the applied education programs have positive reflections.

The study results were discussed under two separate headings, PA and nutrition education.

Physical Activity Education. Some recent studies have emphasized that the pandemic has adversely affected the PA levels of individuals (24, 43). Pellegrini et al. (43) reported a statistical

difference in the weight gain of obese individuals at the end of the first month of quarantine. Nicodemo et al. (24) emphasized that it was difficult to lead a healthy life due to inactivity, especially for sick individuals during lockdowns during the pandemic. Considering the physical and mental effects of regular PA, it is likely to affect individuals, especially during the pandemic positively. In their study, Maugeri et al. (44) reported that PA positively improved psychological state, increased self-confidence, and reduced stress/depression levels during pandemic processes. Hammami et al. (45) stated that home-based (i.e., bodyweight training, dance, and active video gaming) PA was helpful for mental and physical health, especially in children and adolescents. Lesser and Nienhuis (46) indicated that the improvement of PA level in individuals leading a physically inactive life would positively affect their "well-being." Thus, improving PA levels in individuals (especially individuals of developmental age) who spend much time at home during the pandemic should be considered a necessity for health.

When the pre-test MET values of the students in the experimental and control groups who led a sedentary lifestyle during the pandemic were examined in our study, it was observed that their PA levels were insufficient. When the post-test results were examined, it was determined that the MET values of the control group students were insufficient; however, the experimental group students had a "moderate MET" value. Furthermore, it was revealed that the MET values of the experimental group students were significantly higher than the control group. Upon examining the BMI values of the experimental and control groups in our study, it was observed that the pre-test mean values were close to the overweight classification (>25 BMI) (32). However, there was a statistical decrease in the post-test BMI values of the experimental group after the education program and the eight-week follow-up period. Quinn et al. (47) stated that the PA education program applied to obese women ensured an improvement in their exercise attitude. They also indicated that long-term education practices could affect the lifestyle change necessary for weight loss. Atella and Kopinska (48) explained that the PA-based education program was effective on BMI. In a different study, Abu-Moghli et al. (49) stated that due to the healthy lifestyle-themed education program applied to university students, sportive activities were a condition for a healthy lifestyle. The current literature and the results of our study support that PA education can cause individuals to lead a more active life and become physically healthier on this axis.

Massey et al. (50) revealed that PA programs applied to students with low income at the primary school level positively affected students' classroom behaviors. In their review study, Trudeau and Shephard (51) emphasized that PA-based courses should be included more in school curricula. Moreover, it was stated that there was a relationship between PA and cognitive skills. Therefore, it reveals that participation in PA education programs and regular sportive activities will improve individuals physically and psychologically/socially. These findings also coincide with the results obtained in the face-to-face interviews (qualitative data) conducted with students in the experimental group (Student 3, 8). In a qualitative study in which Boyle et al. (52) examined the reflections of OA education in adolescents, they reported that students could not take enough physical education lessons and that the situation adversely affected students. Martins et al. (53) stated that PA intervention programs were helpful for young individuals to lead a more active life in a qualitative review study examining the barriers to adolescents' participation in PA. Our study's quantitative and qualitative results, which align with the literature, revealed that PA education could be a supportive method for healthy living and well-being.

Nutrition Education. When the eating attitudes of 12th-grade students before and after healthy nutrition education were examined in our study, a statistical difference was determined between the experimental and control groups. The results revealed that the EAT-26 post-test values of the experimental group students decreased in comparison with the pre-test values. When studies on the subject are reviewed, it is observed that nutrition education programs varying in content and structure are applied to students studying at different levels. In their study in the "position paper" format, Hayes et al. (54) emphasized that it was necessary to provide students in schools with an understanding of healthy nutrition, and nutrition education and promotion activities in schools were among the key strategies that could be used in this respect. Nicodemo et al. (24) recommended implementing education programs on

food/nutrition before the lockdowns during the pandemic. Raby Powers et al. (55) revealed that the six-week nutrition education program applied to 2nd-3rd-grade primary school students had a positive effect on students' eating attitudes and nutrition knowledge. Cousineau et al. (56) indicated that web-based nutrition education programs were helpful for university students. In a study conducted with female students at the primary school level, Vardanjani et al. (57) reported that the applied nutrition education program positively affected topics such as nutrition knowledge/attitude and unhealthy food consumption. Ueda et al. (58) stated that the nutrition education program applied to high school students could be a motivation-enhancing strategy for changing their eating attitudes. It is observed that the positive development detected in the experimental group after the healthy nutrition education program applied in our study parallels the literature. It indicates that the basic knowledge that students, especially of the developmental age, will acquire in a concept that will guide life, such as nutrition, will change quickly.

A different study in the review format examined the effect of nutrition education programs applied to university students on their eating behaviors (Lua & Elena, 59). The study results revealed significant changes in the eating behaviors of the students who participated in the education program and indicated that these changes could impact the quality of life in the future. The qualitative results obtained in our study showed that the education programs' effect was not for the short term but on lifelong learning (Student 1, 3, 8). In their study, which revealed the qualitative results of the nutrition education program applied to children living in homeless shelters, Rodriguez et al. (60) determined that children needed nutrition and PA for health and academic achievement. Specific to the results of our study, it was revealed that the education programs applied during the COVID-19 pandemic had permanent effects on students. Therefore, determining nutrition knowledge levels of individuals of the developmental age during the pandemic and implementing education programs are regarded as appropriate methods to prevent possible health problems.

CONCLUSION

Our study, which was conducted to examine the effect of PA and healthy nutrition on high school students during the COVID-19 pandemic, determined that students in the experimental group developed their understanding of PA and nutrition. However, there was no change in the control group. Furthermore, a negative trend was observed in the eating habits of the control group. In the face-to-face interviews conducted to determine students' perceptions after the education applied in the study, it was observed that the students understood the importance of PA and healthy nutrition. The fact that the education applied to the experimental group was regarded as adequate by the students indicates that the education was carried out following its purpose. Moreover, the students emphasized in the face-to-face interviews that the provided education was a beneficial process not only for a short period but also for a lifelong learning structure that could be applied in the future. Within this framework, it was observed that the education programs carried out within the scope of the study were an effective method in terms of content and expression.

In summary, to prevent spreading the pandemic's adverse effects on individuals' exercise and nutrition, it is recommended to inform individuals about the issue and create awareness of healthy living. Considering that such a study, in which the participants took an active role, was performed under pandemic conditions, the importance of the study results increases. However, it was determined that the fact that the study was carried out in eight weeks and the motivational factors caused by the pandemic created difficulties, especially in the follow-up of individuals in the control group. In this context, it is recommended that future studies be planned by evaluating the problems experienced at the data collection stage.

APPLICABLE REMARKS

- The program should be developed to increase high school students' physical activity levels.
- This study ensured that well-designed PA and nutrition education programs increased high school students' motivation.

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