JHAD
Health and Development Journal
https://jhad.kmu.ac.ir
10.34172/jhad.92330
Vol. 11, No. 2, 2022, 84-91

Original Article

Investigating the Effectiveness of Virtual Physical Activity Education on Students' Quality of Life of Karaj in 2020

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Abstract

Background: Sedentary lifestyle is regarded as one of the main risk factors for obesity and chronic diseases. As schools provide students with important opportunities for physical activity, their closure, prompted by the COVID-19 pandemic, had a detrimental impact on vulnerable populations, particularly youth and school students. Therefore, this study aimed to investigate the effect of virtual physical education on students' quality of life during the COVID-19 pandemic.

Methods: This community trial was conducted with an experimental and a control group. For this purpose, 300 students aged 13 to 15 years, selected among students of the 1st year of high school, were selected from the four education districts of the urban areas of Karaj city in the year 2020 using a cluster sampling method. The selected students were randomly assigned to the two groups of intervention and control, each with 150 people. There was no difference between the two groups in terms of inclusion criteria and demographic characteristics. Following group assignment, the intervention group received virtual physical education for eight 30-minute sessions, one session each week. All subjects completed the Physical Activity and Quality of Life Questionnaires before and after the training. The data were analyzed with SPSS software version 20, using the chi-square test, paired *t*-test, and independent *t*-test.

Results: The mean and standard deviation of the scores in almost all areas of quality of life (both physical activity and mental health) in the intervention group had a significant improvement after the training courses ($P<0.05$). After training, the mean scores of quality of life in the virtual education group were significantly greater than control group ($P<0.05$).

Conclusion: The virtual school-based physical activity intervention had positive effects on children's psychological and psychological wellbeing. The online educational method could provide customizable physical education learning activities as a suitable step in promoting physical activity engagement for different groups of students.

Keywords: Physical activity, Virtual learning, Quality of life, Students

Citation: Heidarpoor P, Hadyan S. Investigating the effectiveness of virtual physical activity education on students' quality of life of Karaj in 2020. Health Dev J. 2022;11(2):84–91. doi:10.34172/jhad.92330

Received: July 15, 2023, **Accepted**: September 27, 2023, **ePublished**: October 4, 2023

Introduction

Worldwide, almost 85% of children and young people fail to meet the World Health Organization (WHO) recommendations for physical activity and are regarded as an inactive population (1). During the COVID-19 pandemic and the resulting quarantine restrictions, the limitations on leisure activities, including physical exercise, intensified the rate of inactivity, particularly among children and students (2,3). Consequently, these vulnerable members of society had their mobility and leisure activities significantly reduced by school closures prompted by the pandemic, which led to a sedentary lifestyle, unhealthy habits, and the diseases associated with them (4).

Improving the level of physical activity and, thereby, quality of life has a significant impact on health promotion programs among children and youth. In the statement of mission, goals, and objectives associated with mobility and increase in physical and mental health of students, healthy leisure activities have been emphasized (5). Since the closure of schools due to quarantine restrictions, the concern of implementing curricula to continue physical education at home has become a considerable challenge for education systems (6). One of the most practical solutions introduced and implemented by most countries was e-learning or virtual education. In fact, online educational interventions through the use of social media, gamification, and smart phones have been proposed to have the potential to enable effective engagement in physical activity among students by providing them with opportunities for integrating physical activity and distance learning (7-9). Distance learning physical education courses should not be merely knowledge-based and theoretical, but they should also provide realistic conditions for learners to simultaneously pursue virtual training exercises and improve their functional abilities (10). Owing to unequal access to technology, unsuitable internet, sports equipment, and required

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space to participate in online physical education, there is some degrees of inequality intrinsic to online learning (11). However, in well-designed online courses that take into consideration the different physical activity needs of students, there is significant potential to reduce the mentioned disadvantages (12).

In a study conducted by Lynch and Soukup, it was suggested that physical activity education programs in school settings should be based on course components focusing on promotion of lifelong wellbeing (13). It has also been said that the second decade of people's lives plays the most crucial role in the formation of behavioral health. Therefore, conducting intervention programs at this age has been proposed as a key strategy in schools (14). Indeed, considering the capacity of virtual learning to be accessed by larger populations and its potential to decrease health inequalities, the efficacy of virtual school intervention programs has been confirmed in several studies (15,16). Considering different modes of course design, virtual learning has the potential to provide great advantages in comparison with conventional learning in classrooms in terms of convenience and ease of access to teaching materials (17). In a study by Webster et al, it was concluded that after the COVID-19 outbreak, online physical education played a vital role in maintaining students' physical activity and improving their physical and mental health (18). Similarly, the research by Gao et al confirmed the benefits of virtual learning for reducing obesity, increasing mobility, and improving physical, cognitive, and psychological outcomes during the epidemic (19). In addition, the literature has shown that online physical education plays a key role in children and youth's healthy lifestyles through delivering live lessons on the distance learning network (20,21). In a similar study, Abou Elmagd concluded that virtual sports activities at home strengthened the immune system of children and improved their bone health, leading to lower risks of cardiovascular disease, diabetes, and other life-style threatening problems (22). However, limited research has been conducted to evaluate the impact of the virtual learning approach to physical and mental health of school students in Iran. To this end, this study was conducted to investigate the status of physical activity, psychological distress, and students' quality of life during the online physical education period.

Methods

This was a community trial conducted with the aim of investigating the effect of virtual physical education on students' quality of life during the COVID-19 pandemic. The study population included first-year high school students who were selected from the four education districts of the urban areas of Karaj city by cluster sampling. First, we selected three schools from each district, and then, out of the total 12 schools, six were randomly chosen and randomly assigned to the intervention (three schools) and control (three schools) groups. According to Cohen's guidelines which propose three levels of effect size, including small ($d=0.2$), medium ($d=0.5$), and large ($d=0.8$) effect size, we selected a small effect size representing the 25th percentiles; then, considering the power of 80% and the error of 0.05, the sample size was estimated to be 273 individuals. Assuming 10% attrition, the final sample size of 300 was calculated. we expected that 150 students would participate in each group.

Study design and participants

There are 382 619 students in Karaj city, including 91 223 first-year high school students who are studying in the four educational districts of Karaj. In this study, sampling was initially done as a cluster of the four education districts, and three schools based in the urban areas were selected from each district, and six schools were randomly selected from the resulting 12 schools. To control the contact and Exchange of information between the students of intervention and control group, randomization was done based on schools, and three schools were selected as the intervention group and three schools as the control group.

Taking into account the effect size equal to 0.17, the power of 80%, and the error of 0.05, the sample size was estimated to be 273 people. After considering the possible loss of participants, a final sample size of 300 was calculated.

With considering inclusion and exclusion criteria, 150 people participated in each group took part in the study. First-year high school students aged 13 to 15 years old without any special diseases such as anemia, hypertension, diabetes, cardiovascular disease, etc. who had access to the Internet and social networking, lived in Karaj city, and agreed to participate in the research were included in the study. Those who were absent from the educational sessions more than once were excluded from the study.

Educational intervention

First, both groups had a pre-test examination using the two study questionnaires. Considering quarantine restrictions and the enforced social distancing and lockdown regulations during the COVID-19 pandemic, the research questionnaires were designed electronically and the link was sent to the study subjects via the phone number of their parents. Then, the experimental group received a planned virtual educational program for physical activity based on the physical mobility protocol (virtual physical education for eight 30-minute sessions, one session each week. by a healthcare provider or a school sports coach with the coordination of the school principal). The physical activity program was set in such a way that it included warm up activities, including

soft exercises, jogging, running, or jumping rope. The program continued with more strenuous exercises aimed at increasing the heart rate and maximizing oxygen uptake, such as fast walking, running, jumping rope, and climbing or walking down stairs. Finally, it ended with cooling the muscles with soft movements. In all these stages, a trainer taught the physical exercises to students under the supervision of parents, and the researcher guided and supported them on the phone in order to ensure that all activities were performed correctly. For the control group, routine interventions were performed according to the previous procedure. After the completion of the study intervention, the questionnaires were sent to both the experimental and control groups for the second time. Furthermore, after the intervention phase was completed and data collection ended, we provided the same educational material through the virtual learning approach to the control group in compliance with ethical obligations. An application prepared by the Ministry of Education entitled "Shad" was used for providing online learning.

Measurement

Study data were collected using the International Physical Activity Questionnaire (IPAQ-SF) and the short form of quality-of-life questionnaire. This tool is a seven-day recall questionnaire that measures the overall level of moderate to vigorous physical activity of students during the academic year using nine questions about their physical activity in the past week, each measured on a five-point scale. The answer to each of the questions is given between 1 and 5. To determine the final score, after setting a value of 1 to 5 for each of the nine questions, all points are added together and averaged. The final score indicates an individual's physical activity score. Therefore, the range of physical activity score is between 1 and 5, with 1 indicating a low physical activity level and 5 representing a high physical activity level. Scores between 1 and 2.33 are regarded as low physical activity, between 2.34 and 3.66 as moderate, and ≥ 3.67 as vigorous physical activity level. This data collection tool is a standardized measurement instrument of physical activity used among different communities and verified for its test-retest reliability (intra-class coefficient > 0.7) and validity (Spearman $P = 0.30$) (23, 24).

The short form of quality-of-life questionnaire (SF-12) containing a number of demographic questions and 12 items to measure global quality of life was also administered. The global quality of life subscale contained two items of physical and psychological wellbeing, each rated on a seven-point scale (25). The internal consistency of the questionnaire was assessed by Cronbach's alpha coefficient to test the reliability. In a study by Nunnally and Bernstien, Cronbach's alpha coefficient was estimated at 0.7 which was considered satisfactory (26). Furthermore, the questionnaire was previously validated among Iranian children and adolescents to assess the quality of life among students (27). The internal consistency reliability and Cronbach's alpha of this questionnaire were 0.91 and 0.73, respectively. The achievable scores from SF-12 ranged between 12 and 84, with higher scores showing better physical and mental health conditions (26, 27).

Ethical considerations

Ethical approval was obtained from the Ethics Committee of Shahid Beheshti University of Medical Sciences (IR.SBMU.SME.REC.1399.069), and written informed consent was obtained from each of the participants and their parents.

Statistical analysis

Data were analyzed using SPSS software version 20 to calculate descriptive statistics (mean, standard deviation, and 95% confidence interval). In order to compare the questionnaire scores within the groups, paired *t*-test was used. In order to compare the questionnaire scores between the groups, independent *t*-test was used. The level of significance was set at 5% for statistical tests.

Results

The study included 300 students equally divided between an experimental and a control group. The study characteristics of the participants are shown in Table 1. All the students continued their participation in the study and the intervention group completed the virtual learning which was designed for them as an intervention strategy. As depicted in the table, 58.7% of individuals in the experimental group, and 69.3% in control group were male. The mean age of participants was 14.0 ± 0.8 in experimental and control groups. Regarding the educational status, 48% of participants had fathers with academic education in the intervention and control groups, respectively. As Table 1 depicts, there was no statistically significant difference between the experimental and control groups in terms of study variables before the educational intervention ($P > 0.05$).

Table 2 shows that before virtual educational intervention, there was no statistically significant difference between the experimental and control groups in terms of physical performance and quality of life aspects ($P > 0.05$); however, after intervention, a significant difference was seen between these groups in terms of physical activity score and all dimensions of quality of life ($P < 0.05$).

As results show, the most significant change was in the quality-of-life score with an effect size of 0.67, depicting an increase of 44.3% from 25.5 to 44 after intervention, followed by physical wellbeing with an effect size of 0.57 and mental health with an effect size of 0.55 (Table 3). The same analysis was conducted for the control group

Table 1. Comparison of study participants' characteristics between experimental and control groups

Characteristics		Experimental Group No. (%)	Control Group No. (%)	*P* value
Gender	Female	62 (41.3)	46 (30.7)	0.07
	Male	88 (58.7)	104 (69.3)	
Family size	3	44 (29.4)	55 (36.7)	0.4
	4	53 (35.3)	48 (32)	
	5	53 (35.3)	47 (31.3)	
Parental education	Illiterate	-	2 (1.3)	0.48
	Pre-academic	78 (52)	76 (50.7)	
	Academic	72 (48)	72 (48)	
Parental occupation	Manual worker	19 (12.7)	25 (16.7)	0.57
	Government employee	21 (14)	24 (16)	
	Self-employed	23 (15.3)	14 (9.2)	
	Military	15 (10)	22 (14.7)	
	Teacher	25 (16.7)	22 (14.7)	
	Health professional	24 (16)	22 (14.7)	
	Other	23 (15.3)	21 (14)	
Type of accommodation	Rented	54 (36)	60 (40)	0.48
	Owned	96 (64)	90 (60)	
Owning a personal car	No	75 (50)	70 (47)	0.64
	Yes	75 (50)	80 (53)	
Age	Mean ± SD	14 (0.8)	14 (0.8)	0.5

P is based on the chi-square test.

(Table 4) which revealed that there was not significant change in this group after intervention.

Discussion

This study was conducted to provide evidence-based information on the effectiveness of virtual educational intervention as a promotion strategy for quality of life among students and youth. To do so, we conducted community trial research to investigate the condition of physical activity, psychological distress, and students' life quality during an online physical activity learning period. Our findings revealed that both physical well-being and mental health in the intervention group had significant improvement after the physical activity training courses. In recent years, some of the literature has examined the health-related quality of life (HRQOL) of overweight and obese children in combination with their physical activity status (28-32). Most of them mentioned physical activity as an important factor associated with HRQOL, regardless of weight condition (33). Similar to these findings, our study showed that an increase in the average score of physical activity following 8 weeks of regular exercise in the intervention group led to a significant surge in the students' quality of life.

In fact, our findings demonstrated that school-based virtual physical-activity intervention had positive effects on children's quality of life both from the psychological wellbeing and physical health condition aspects. The finding was in line with similar previous studies conducted among school-aged children (34-36). They emphasized that increasing physical activity is often suggested as an important strategy to avoid childhood obesity and enhance individuals' mental health. In fact, an appropriate level of physical activity in children and youth is one of the key indicators of health-related outcomes and is defined as a measure of flexibility, muscular fitness, and body composition (37,38). A systematic review conducted by Fogelholm found that individuals with good aerobic fitness had lower risk for cardiovascular mortality, compared with those with poor physical fitness, indicating the important role of physical activity on overall health condition (39). In a similar study conducted by Onur et al, a significant relationship between sports activities and quality of life has been proven (40). In another research by Hamidizade et al, the key role of implementing sports training intervention in increasing the average quality of life among elderly people was confirmed (41). Brach et al also found that doing physical activity with moderate intensity (20 to 30 minutes a day) helps to increase the quality of life and feeling of well-being among the elderly (42).

Considering the high prevalence of overweight and obesity among primary school students, the development of educational intervention programs is hypothesized to be associated with increase in physical activity and improvement in the students' quality of life. School age is one of the most important time periods in life, which determines the health condition of individuals in future. As appropriate physical activity during the growth years goes a long way toward stabilizing health, therefore an enormous potential exists for increased health in this age group (43). In order to improve the quality of life among school children, it is necessary for policy makers to plan for promoting physical activities in school programs. The significance of such an issue, particularly during the COVID-19 era, has doubled due to the existing quarantine conditions. In order to reduce the physical and psychological effects of children's quarantine, schools and teachers could play a key role, not only by providing appropriate educational packages, but also through creating online communication between trainees and trainers in an effective manner. Indeed, providing students with good physical fitness is one of the most important tasks of physical education at schools, which is among the main aims of education planning (43). The physical education lesson should be viewed as an ethics lesson which constitutes effective interaction between students and their teachers so that the trainers play the role of a coach and guide. To teach the principles of exercise and physical fitness as well

Table 2. Comparison of the physical activity score and different domains of quality-of-life pre- and post-educational intervention in the experimental and control groups

Variables	Pre-intervention				*P* value	Post-intervention				*P* value
	Experimental		Control			Experimental		Control		
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Physical activity scale	3.15	0.44	2.62	0.36	0.1	3.78	0.57	2.88	0.69	0.01
Perception of health	2.5	0.5	2.5	0.5	0.06	4.5	0.5	2.5	0.5	0.01
Physical performance	2.5	0.5	2.5	0.5	0.05	4.5	0.5	2.5	0.5	0.02
Physical well-being	2.5	0.5	2.5	0.5	0.2	4	0	3	0.01	0.01
Physical pain	4.5	0.5	2.5	0.5	0.1	2.5	0.5	2	0.5	0.01
Emotional problems	2.5	0.5	2.5	0.5	0.06	4	0	2.5	0.5	0.01
Social performance	2.5	0.5	2.5	0.5	0.6	5.5	0.5	2.5	0.5	0.02
Exhilaration	2.5	0.5	2.5	0.5	0.1	5.5	0.5	2.5	0.5	0.01
Mental health	7.5	0.5	7.5	0.5	0.05	11.5	0.5	7.5	0.5	0.01
Overall score	25.5	3.9	25	4.01	0.05	44	3.01	24	3.5	0.02

Table 3. Comparison of the physical activity and different domains of quality-of-life pre- and post-educational intervention in the experimental group

Variables	Pre-intervention		Post-intervention		% Change	Effect size	*P* value
	Mean	SD	Mean	SD			
Physical activity scale	3.15	0.44	3.78	0.57	12.6	0.38	0.05
Perception of health	2.5	0.5	4.5	0.5	44.4	0.68	0.05
Physical performance	2.5	0.5	4.5	0.5	44.4	0.68	0.05
Physical well-being	2.5	0.56	4	0	36.25	0.57	0.01
Physical pain	2.5	0.5	4.5	0.5	44.4	0.68	0.05
Emotional problems	2.5	0.5	4	0	36.25	0.57	0.06
Social performance	2.5	0.5	5.5	0.5	54.5	0.72	0.06
Exhilaration	2.5	0.5	5.5	0.5	54.5	0.72	0.06
Mental health	7.5	0.5	11.5	0.5	34.7	0.55	0.01
Overall score	25.5	3.9	44	3.01	44.3	0.67	0.01

Table 4. Comparison of the physical activity and different domains of quality-of-life pre- and post-educational intervention in the control group

Variables	Pre-intervention		Post-intervention		% Change	Effect size	*P* value
	Mean	SD	Mean	SD			
Physical activity	2.62	0.36	2.88	0.69	5.2	0.36	0.06
Perception of health	2.5	0.5	2.5	0.5	0	0.18	0.06
Physical performance	2.5	0.5	2.5	0.5	0	0.26	0.06
Physical well-being	2.5	0.5	3	0.01	10	0.32	0.052
Physical pain	2.5	0.5	2	0.5	10	0.16	0.057
Emotional problems	2.5	0.5	2.5	0.5	0	0.57	0.1
Social performance	2.5	0.5	2.5	0.5	0	0.72	0.4
Exhilaration	2.5	0.5	2.5	0.5	0	0.72	0.1
Mental health	7.5	0.5	7.5	0.5	0	0.55	0.06
Overall score	25	4.01	24	3.5	20	0.72	0.06

as creating morality, vitality, and cheerfulness among students is necessary to identify those with physical abnormalities, know the history of their illness, and finally nurture them in all aspects of their existence with the help of physical education lessons. In this regard, a study by Mansori et al, revealed that doing regular online sports activities during the COVID-19 pandemic has a positive effect on increasing quality of life and reducing the level of aggression among students (43). Findings have also showed that virtual educational intervention related to physical activity and sports exercises could significantly lead to an improvement in trainees' quality

of life. Similar studies regarding the value of online sports interventions have indicated that using virtual methods has a fundamental potential to improve students' quality of life and provide a new insight to physical activities during the pandemic (44-46). In addition, the use of online education by physical education teachers can be regarded as a strategy to maintain satisfactory levels of exercise and foster the personal development of students through the improvement of the fitness status of individuals. Therefore, using digital platforms can be recommended as they are associated with improved quality of life, particularly when combined with the approach that aims to engage trainees in learning. Thus, evaluating the effectiveness of online learning can be regarded as a suitable technique for academics to compare the initial level of skill and knowledge with the actual level acquired (47). Furthermore, as the virtual learning method is swiftly attracting attention as a standard approach to training, measures should be taken to ensure that required knowledge and skill delivered during the conventional teaching process are flawlessly transmitted to students through the virtual learning settings (48,49). Online learning should also ensure the provision of adequate opportunities for learners to have control over both the content and the time spent on learning so that the teaching process would suit their needs and promote the course learning outcomes (50).

However, there was a concern about equal access to online learning methods and availability of teacher resources as substantial challenges related to online physical education during the COVID-19 pandemic (51). Mercier et al found that twenty percent of physical education teachers regarded their online teaching less effective during the pandemic. They stated that trainers' responses might not reflect the actual learning needs of students given that almost half of the trainees did not use the video instructions and do their assignments properly (52). Furthermore, a review by Killian et al found an important need for further research to develop customizable online learning tools that meet the needs of physical education teachers and promote the knowledge and skills of students regarding physical activity and sports exercises (53).

Study Strengths and Limitations

Attrition is one of the major methodological problems in longitudinal studies. However, as none of the participants left the research process during the study, our findings were not affected in terms of generalizability. However, as physical exercises that were done by the intervention group were recorded based on the parents' self-report, our study might have suffered from self-reporting bias as a type of measurement error that can happen where random or systematic misreporting is possible.

Conclusion

The study results showed the significant effect of the virtual physical activity educational intervention on the quality of life of students and highlighted the importance of doing physical activity and sports exercises through different educational methods as a crucial means of improving the health status of trainees. The online educational method could provide customizable physical education learning activities as a suitable step in promoting physical activity engagement for different groups of students. This method can also help teachers increase trainee physical activity equity and improve their mental health during the COVID-19 pandemic and similar conditions.

Acknowledgments

This article was conducted as part of a master's thesis at Shahid Beheshti University of Medical Sciences. The authors thank all participants, including parents and students.

Authors' Contribution

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Competing Interests

The authors declare no conflict of interest.

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