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RESEARCH ARTICLE

EFFECTIVENESS OF PHYSICAL ACTIVITY COUNSELING IN UNIVERSITY STUDENTS EDUCATED BY DISTANCE LEARNING DURING COVID-19 PANDEMIC: A RANDOMIZED- CONTROLLED TRIAL

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ABSTRACT

Introduction: Students educated by distance learning experienced more physical inactivity and poorer quality of life (QOL) due to COVID-19 pandemic. Current study aimed to reveal the impacts of 4-week physical activity counseling (PAC) on step counts, physical activity (PA), anxiety, depression, and QOL in university students.
Material and Methods: Students (19.97±1.14 years) were randomly grouped as PAC (n=15, progressive increases in step counts) or control (n=16, maintaining routine activities). Step count (pedometer applications), PA (International Physical Activity Questionnaire-short form), anxiety (Beck Anxiety Inventory), depression (Beck Depression Inventory), and QOL (Short Form-36) were evaluated remotely. The students were followed up between December 2020 and March 2021.
Results: Out of all students (4147.32±2916.54 steps/day), 29% were inactive; 67.7% had anxiety; 61.3% were depressed before PAC. After PAC, step count (mean difference (MD): 3999.69 steps/day, Cohen's *d*=1.8), total walking (MD: 734.15 MET-min/week, Cohen's *d*=0.4) and total PA (MD: 924.22 MET-min/week, Cohen's *d*=0.4) scores, and role limitations due to emotional problems, vitality, and emotional well-being subscales scores of QOL significantly increased in PAC group compared with controls; anxiety scores decreased vice versa ($p<0.05$). Changes in depression, total vigorous and moderate PA scores, and other QOL subscales scores were similar between groups ($p>0.05$).
Conclusion While PAC, a feasible, effective, and safe method during COVID-19 pandemic, improved anxiety, step count, PA level and QOL in students, PAC did not affect depression and some domains of QOL. Therefore, PAC should be offered to students and explored in other segments of society to prevent long-term effects of COVID-19.

Key Words: Anxiety, COVID-19, depression, exercise, quality of life, telehealth.

INTRODUCTION

Due to novel fast-transmitted coronavirus disease 2019 (COVID-19) pandemic, people have had to confined to their homes (1). Gyms, walking parks and other activity areas where people can be physically active and social have been closed (2). In line with these regulations, active lifestyle of people is often changing rapidly in a negative way. As physical activities are restricted in infected or non-infected individuals (3), sedentary behaviors, stress,

nutritional and/or mental disorders such as anxiety, and depression are dramatically increasing among people (4,5), all of which resulted in deterioration of quality of life (QOL) (5).

Prolonged school closure and transition to active distance learning at home are important restrictions coming with COVID-19 pandemic which causes severe psychological stress, changing in sleeping habits and mood disturbances in students (6-8). As a result, university students are more physically inactive and spending longer time in front of the screen. They have experienced mood disorders such as anxiety, depression, over fear and stress, sleep disturbances and poorer QOL compared to pre-pandemic period. They are at risk of decreased cardiovascular fitness and increased chronic diseases in the long-term, as well (4,5). Because inflammatory process accelerates due to the transition from active lifestyle to reduced activity and inactive lifestyle in these students which causes an increase in risk factors of non-communicable disease (9). Moreover, a 2-week sharp reduction in daily step counts causes significant alterations in human body such as decreases in glucose infusion rate, maximal oxygen consumption and lean mass of legs (10). Last of all, COVID-19 infection with a high risk of transmission affects young population through indirect and/or direct ways (11).

At the process of COVID-19 pandemic, daily step counts dramatically decreased approximately 67.7% in young adults (12) and physical inactivity became another pandemic accompanying COVID-19 pandemic. Therefore, there have been some efforts to help individuals be physically active during COVID-19 (2). Numerous fitness centers and trainers have been giving free online physical fitness programs via social media, videoconference, and other channels (2). On the other hand, a study resulted in positive improvements in depression and stress scores following online mindfulness yoga practice in university students during COVID-19 pandemic (13). As known, doing regular exercise at moderate intensity and being physically active provide both potential behavior changes and many benefits to human health in healthy individuals (14) and patients with chronic diseases (15). Furthermore, doing exercise and physical activity can modify white cells distribution, phenotype, and cytokine production. It therefore plays an important role to affect susceptibility to infection and prevent cardiovascular diseases and viral respiratory diseases like COVID-19 (15). Although it is recommended that students are provided with emotional and activity support under COVID-19 pandemic conditions (7), there is no prospective randomized controlled study investigating effectiveness of physical activity counseling (PAC) in university students, to our knowledge. Therefore, in current study, it was planned to investigate the effects of PAC based on remotely increasing daily step counts on daily average step counts, physical activity level, anxiety, depression and/or QOL in university students during COVID-19 pandemic.

MATERIAL AND METHODS

Study Population

Izmir Democracy University students were included in current study. Inclusion criteria were volunteering to participate in the study, being a university student actively educated by distance learning, being ≥18 years and having a smartphone or pedometer providing knowledge about daily step counts. Exclusion criteria were having any physical disability, infection, cooperation problem, severe asthma, an orthopedic or a neurological disease which would prevent doing regular physical activity and being in a quarantine situation.

Study Design

The study was planned as prospective, single-blinded, parallel, and randomized controlled. The study was announced via an e-mail to students of Faculty of Health Sciences of the Izmir Democracy University and the students were invited to participate in the study. All eligible students were blinded and randomly grouped as either PAC group or control group using a website-based randomization. All assessments including step counts, physical activity level, anxiety, depression, and QOL were performed both before and after 4-week PAC program. The PAC was applied remotely via telephone, internet and/or video/live conference. The Izmir Democracy University Non-Interventional Clinical Research of the Ethics Committee approved the study (Decision No: 2020/24-4, Date: 16/12/2020) which followed up the principles of Declaration of Helsinki. Informed consents were obtained from all students.

PAC Program

A 4-week PAC based on increasing daily step counts was performed in university students. The PAC consisted of regular outdoor walking, stepping inside the home, doing leisure activities and/or doing housework. Before PAC, one-hour separate

Table 1. Progressive physical activity counselling program based on increasing daily step counts

Weeks	Walking	Step counts	Minimum step counts in a day
1st week	30 min/day, at least 3 days/week	500-1000 steps increase in daily step counts taken in previous week	5000 steps/day
2nd week	30-45 min/day, 3-5 days/week	500-1000 steps increase in daily step counts taken in previous week	7500 steps/day
3rd week	30-60 min/day, 5 days/week	2000 steps increase in the daily step counts taken in previous week	10000 steps/day
4th week	30-60 min/day, 5 days/week	Keeping 10000 steps/day	10000 steps/day

Min Minute.

meetings about the study, measurements and program requirements were held with each group via online platform. The students were informed about the study and the measurements including anxiety, depression, physical activity, QOL and the use of smartphone pedometer application.

While students in PAC group were also informed about types of physical activities including vigorous/moderate physical activities (basketball, volleyball, fitness, pilates, yoga, gardening, doing sports, etc.), outdoor walking, stepping inside the home, doing leisure activities and/or doing housework, students in control group were asked to continue their normal daily living activities. However, students in PAC group were not forced to do these activities due to the confinements.

During 4-week, students in each group were remotely followed up via mailing for the diaries and daily step counts, telephone texting for the weekly connection about physical activities and direct telephone call when a student could not be reached by mail and/or telephone texting. At the end of 4-week, students in control group were similarly informed about types of physical activities and directed to increase daily step counts like PAC group.

After all baseline measurements had been completed within a week, students in PAC group were gradually gotten accustomed to regular walking with the aim of increasing daily step counts through weekly group telephone texting and direct telephone call if necessary (Table 1). However, both online course hours during the day and curfew for under 20 ages related with COVID-19 pandemic restrictions were considered. Therefore, students were not forced to walk outside. While eligible students took a walk outside, ineligible students took short walks to reach 10000 steps/d at home for at least 10 min at a time and 3-8 times/day (14). In the first week, the students were asked to walk for totally 30 min in a day, minimum 3 days per non-consecutive weekdays and increase their baseline daily step count by approximately 500-1000 steps/d. In the second week, students were asked to add 500-1000 steps on daily step counts taken in previous week and reach 7500 steps/d. In the third week, students were asked to add 2000 steps on daily step counts taken in previous week and reach 10000 steps/d. In last week, students were asked to walk over 10000 steps for everyday (Table 1). The students were instructed about general recommendations for safe physical activity such as not walking when hungry, taking a walk 1-2 hours after meals, drinking water after walking and walking using a mask. The students recorded their daily step counts in their diaries every day.

Measurements

Demographic characteristics of university students were recorded. All measurements including questionnaires were answered in two days.

Daily Step Counts

Daily average step counts were recorded via pedometer applications installed on smartphones (16). All students were asked to carry their smartphones with them during the day. At the end of each day, each student captured the screenshots of total daily step counts and recorded it in their diaries. Every Sunday, the students sent these screenshots and diaries to the researcher by e-mail.

Physical Activity Level

Turkish version of International Physical Activity Questionnaire-short form was used to determine physical activity levels of the students in the last seven days (17,18). This valid, reliable, self-administered, short-form questionnaire consists of 7 items that provide knowledge about time spent for

sitting, walking, moderate and vigorous physical activities. Physical activity level is calculated as an estimation of energy expenditure in metabolic equivalent (MET) minutes (min) per week (MET-min/week) for both walking (3.3 MET), moderate intensity (4 MET), vigorous intensity (8 MET) activities and total physical activity. According to these calculations, physical activity levels of students are classified as inactive (less than 600 MET-min/week), minimal active (at least 600 MET-min/week) or very active (at least 3000 MET-min/week) (19).

Anxiety Level

Turkish version of Beck Anxiety Inventory was used to measure severity of anxiety (20,21). This reliable, valid, and self-report inventory consists of 21 multiple-choice self-report items. These items measure emotional, cognitive, and physiological symptoms of anxiety. Each item is scored between 0 (not at all) and 3 (severely). Total score is minimum 0 and maximum 63 points. Higher total scores show that severity of anxiety is increasing. Total scores of 0-7, 8-15, 16-25 and 26-63 demonstrate minimal, mild, moderate, and severe anxiety, respectively (20).

Depression Level

Turkish version of Beck Depression Inventory was used to determine presence and levels of depression symptoms (22,23). This reliable, valid, and self-report inventory consists of 21 items that measure physical, emotional and cognitive symptoms seen in depression (22). Each item is scored between 0 and3. While the lowest total score is 0, the highest total score is 63. Higher total scores show that severity of depression is increasing (22). According to Beck, total scores of 0-13, 14-24 and ≥25 demonstrate minimally

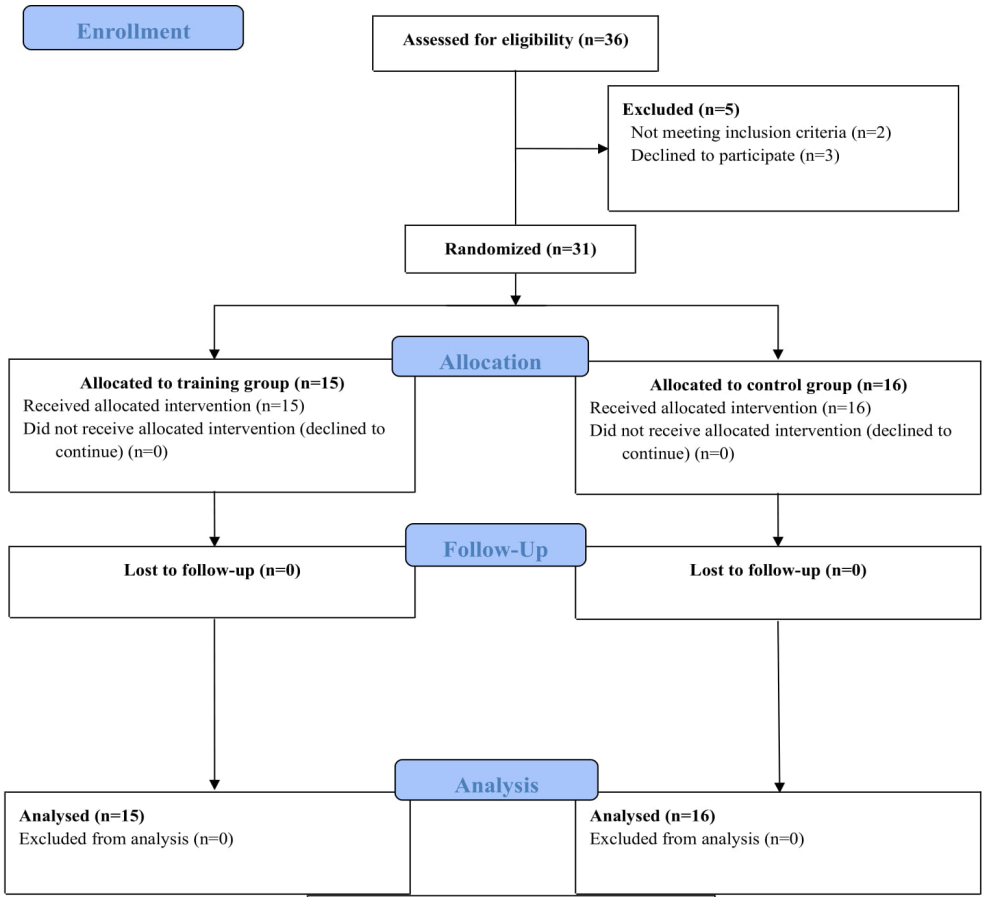

Figure 1. Consort flow diagram of the study

Table 2. Baseline demographic characteristics of university students educated by distance learning due to COVID-19 pandemic

	PAC group (n=15)	Control group (n=16)	
Characteristics	**X±SD**	**X±SD**	**p value**
Age (year)	20±1.07	19.94±1.24	0.882
Male/female (n;%)	2;13.3% / 13;86.7%	1;6.3% / 15;93.8%	0.600
Weight (kg)	60±9.83	58.4±10.61	0.667
Height (m)	1.67±0.06	1.68±0.06	0.822
Body mass index (kg/m^2)	21.43±2.86	20.87±4.33	0.675
Smoking (pack×years)	0.29±0.22	1.45±0.61	**0.028***
Smoking (current/ex-smoker/non) (n;%)	3;20% / 1;6.7% / 11;73.3%	4;25% / 0;0% / 12;75%	0.561
Total education duration at the university (month)	19.2±9.59	19.75±10.48	0.880
The status of going outside (n;%)	14;93.3%	12;75%	0.333
The time spent outdoors during the day before training (minute)	76.33±59.12	98.13±144.88	0.592
The time spent outdoors during the day after training (minute)	95.33±72.89	103.44±155.81	0.856
Total lecture listening time during the day (hour)	3.4±1.12	3.22±1.08	0.650
Total studying time during the day (hour)	2.2±1.15	2.81±1.12	0.144
Average sleeping time during the day (hour)	8.07±0.7	7.97±0.94	0.746
The status of doing sport before training (n;%)	5;33.3%	5;31.3%	1.000
Total sports time before training (minute)	53±23.35	62±42.07	0.687
The status of doing sport after training (n;%)	6;40%	7;43.8%	1.000
Total sports time after training (minute)	68.33±31.89	45.71±38.13	0.275
Having had COVID-19 before training (n;%)	4;26.7%	2;12.5%	0.394

% Percent, kg Kilogram, m Meter, COVID-19 New coronavirus disease 2019, PAC Physical activity counseling. Descriptive analyses were presented using X±SD (mean±standard deviation), n (frequency), % (percentage), Student's t-test *p<0.05, Chi square test #p<0.05.

or non-depressed, mild to moderate depressed and severely depressed individual, respectively (22).

Quality of Life

Turkish version of Short Form-36 was used to evaluate QOL in the students. This generic and self-reported scale developed by Rand Corporation assesses QOL along with negative and positive aspects of health based on physical and mental components (24,25). Short Form-36, multi-item scale, comprises evaluation of eight subscales which are physical function, role limitations due to physical problems, role limitations due to emotional problems, vitality, emotional well-being, social functioning, bodily pain, and general health. All subscales are scored between 0 to 100%. Higher scores indicate better QOL (24,25).

Statistical Analyses

Sample size analysis prior to study (G*Power 3.0.10 system, Franz Faul, Universität Kiel, Germany) was performed to detect difference between two independent means/groups for an α value of 0.05, effect size of 0.78, 80% power, and at least 8 participants were calculated for each group (13). All analyses were conducted by using windows-based SPSS 15.0 statistical analysis program (SPSS Inc., USA). Descriptive data were stated as mean±standard deviation (X±SD), mean difference between groups (MD), 95% confidence interval (95%CI), frequency (n) and percentage (%). Both visual and analytical methods were used to determine normal distribution. Tests of Student t and Chi-square were employed to compare normally distributed and nominal data between PAC and control groups, respectively. To investigate the impact of 4-week PAC, ANCOVA which met the assumptions was performed on outcomes whose baseline values were used as covariates. Intention-to-treat analyses was not performed since there were no dropouts. Post-hoc statistical power (1- β) values for outcomes were also presented. Bonferroni test was used for manually adjusted post-hoc comparisons. Moreover, Cohen's

d, an effect size, was calculated to represent the practical significance. The effect sizes of 0.20, 0.50 and ≥0.80 were considered as small, moderate, and large, respectively (26). A p-value below 0.05 was considered as statistically significant.

RESULTS

As shown in Fig. 1, out of 36 university students, 31 were randomized. Five students were excluded from the study due to refusing to participate in the study (n = 3), being a national athlete who is physically very active (n = 1) and having asthma and migraine that prevent to be physically active (n = 1). Fifteen students in PAC group and 16 in control group completed the study. Demographic characteristics except for smoking exposure were similar in both groups (Table 2, p>0.05).

Before PAC, out of 31 students, 9 (29%), 15 (48.4%) and 7 (22.6%) were inactive, minimal active and very active; 10 (32.3%), 6 (19.3%), 10 (32.3%) and 5 (16.1%) had minimal, mild, moderate, and severe anxiety; 12 (38.7%), 13 (41.9%) and 6 (19.4%) were minimally or non-depressed, mild to moderate depressed and severely depressed, respectively. Moreover, levels and scores of physical activity, anxiety, and depression along with QOL subscales scores were similar within and between groups (Table 3, p>0.05). Baseline average step counts of all students were 4147.32±2916.54 steps per a day and 22832.42±15153.5 steps per a week during COVID-19 pandemic despite curfew.

After 4-week PAC, daily (MD: 3999.69 steps/d, Cohen's *d* = 1.8, 1-β = 87.2%) and weekly (MD: 35415.33 steps/week, Cohen's *d* = 2.3, 1-β = 100%) step counts, total walking (MD: 734.15 MET-min/week, Cohen's *d* = 0.4, 1-β = 96.2%) and total physical activity scores (MD: 924.22 MET-min/week, Cohen's *d* = 0.4, 1-β = 77.4%), along with role limitations due to emotional problems (Cohen's *d* = 1.2, 1-β = 76.9%), vitality (Cohen's *d* = 0.8, 1-β = 72.2%), and emotional well-being (Cohen's *d* = 0.5, 1-β = 66.3%) subscales scores of QOL significantly increased in PAC group compared with control group (Table 3, p<0.05). Moreover, anxiety scores (Cohen's *d* = 0.3, 1-β = 51.9%) significantly decreased in PAC group compared with control group (Table 3, p<0.05).

DISCUSSION

Progressive PAC considerably improved step counts, walking and total physical activity scores, anxiety, and role limitations due to emotional problems, vitality, and emotional well-being subscales scores of QOL in university students during COVID-19 pandemic which was supported with high power and moderate-large effect sizes in current study. However, PAC did not have remarkable effects on depression, total vigorous and moderate physical activity scores, sitting durations, and other subscales scores of QOL in the students which may aroused from cold weather conditions, exam week, and/or insufficient duration and content of the program.

The students have been experiencing physical inactivity (44%) (4,27), decreased physical activity levels in public spaces (5), high perceived stress, anxiety (52%), depression (63%) (8), deterioration in overall QOL (71.7%) (28), increased sedentary behavior including sitting (approximately 10 hours) and sleeping time during COVID-19 quarantine according to pre-COVID-19 period (7). In accordance with these previous results, current study demonstrated physical inactivity, presence of anxiety and depressive symptoms in the students during COVID-19 pandemic. Steps counts (4147.32 steps/d, 22832.42 steps/week) of all students in the current study, which were evaluated at baseline during curfew due to COVID-19 pandemic, were higher than result of Sañudo et al study (2754 steps/d evaluated using accelerometer) (12). It may derive from that the accelerometer used in Sañudo et al study (12) underestimates step counts at slower walking speeds (29). Nevertheless, walking an average of 4147.32 steps/d is already a low physical activity since <5000 steps/d may be accepted as a sedentary lifestyle index or inactive (30). Although there are significant attempts for increasing physical activities and well-being in the students based on mostly previous professional guidelines, practices, and experiences (14,31), there are no studies investigating the effectiveness of PAC during COVID-19 pandemic in the literature yet. The current study has strong and novel evidence showing improvements in physical activity, mental health and QOL after progressive PAC program in university students. Therefore, university students should be urgently directed to doing regular physical activities with the most convenient way all over the world.

To obtain beneficial contributions and preventive effect of exercise and physical activities across COVID-19 (14,15), it is recommended that people should exercise at a moderate intensity for at least 150 min/week and/or walking 10000 steps/d at a rate of 64-170 steps/min for at least 10 min duration (14).

Table 3. Effects of physical activity counseling on step count, anxiety, depression, physical activity levels and quality of life in the university students educated by distance learning due to COVID-19 pandemic

	PAC group (n=15)			Control group (n=16)			Exercise training affect (Intergroup difference)	
	Before training	After training	Intragroup difference	Before training	After training	Intragroup difference		
	X±SD	X±SD	p value	X±SD	X±SD	p value	Groups' MD [95%CI]	p value
Step count (steps/day)	3460.87±2762.4	5049.53±4668.79	0.298	4790.88±2996.21	1120.31±998.48	**0.001***	3999.69 [(1443.53) - (6555.84)]	**0.003***
Step count (steps/week)	21641.13±12467.69	51268.33±15187.6	**<0.001***	23949.25±17647.3	17081.63±18553.98	0.106	35415.33 [(24205.75) - (46624.92)]	**<0.001***
Beck Anxiety Inventory score (0-63)	16.4±13.89	11.47±15.23	**0.002***	14.19±11.78	13.5±11.21	0.593	-4.13 [(-8.19) - (-0.06)]	**0.047***
Beck Depression Inventory score (0-63)	18.13±9.33	13.6±12.24	**0.018***	16.5±9.64	15.19±8.34	0.405	-2.96 [(-7.98) - (2.06)]	0.237
IPAQ Short Form scores								
Total vigorous PA (MET-min/week)	645.33±980.01	688±1185.74	0.792	457.5±855.16	480±1019.18	0.910	26.89 [(-469.04) - (522.81)]	0.912
Total moderate PA (MET-min/week)	209.33±227.64	340±391.48	0.100	192.5±321.32	206.25±265.8	0.901	125.33 [(-100.69) - (351.36)]	0.266
Total walking (MET-min/week)	675.4±614.83	1229.8±660.64	**0.002***	1235.44±2856.37	904.41±2153.39	0.060	734.15 [(345.66) - (1122.65)]	**0.001***
Total PA (MET-min/week)	1530.07±1095.25	2257.4±1332.69	**0.008***	1885.44±3014.99	1590.66±2292.51	0.288	924.22 [(250.39) - (1598.04)]	**0.009***
Sitting duration (hours/day)	14.13±1.17	14.37±0.81	0.257	13.78±2.93	14.41±2.19	**0.040***	-0.25 [(-1.01) - (0.51)]	0.512
SF-36 subscales scores (0-100%)								
Physical functioning	88.33±6.99	91.33±10.26	0.230	87.81±12.78	86.25±14.78	0.510	4.65 [(-2.43) - (11.73)]	0.189
Role limitations due to physical health	66.67±37.4	61.67±44.19	0.765	60.94±41.8	67.19±40.54	0.658	-7.67 [(-37.44) - (22.09)]	0.602
Role limitations due to emotional problems	24.45±34.43	62.22±45.19	**0.002***	41.67±41.28	33.33±45.54	0.589	39.99 [(10.66) - (69.33)]	**0.009***

Table 3. Continued

Vitality	43±20.25	60.33±22.08	**0.001***	46.25±22.32	45.94±23.18	0.969	16.64 [(3.73) - (29.56)]	**0.013***
Emotional well-being	56.27±16.59	68.53±15.33	**<0.001***	55±20.79	57±13.58	0.602	11.01 [(1.86) - (20.17)]	**0.020***
Social functioning	59.17±24.76	80±24.91	**<0.001***	62.5±25.41	70.31±15.73	**0.047***	11.39 [(-0.81) - (23.59)]	0.066
Bodily pain	71.33±21.34	81.83±24.83	**0.027***	75.31±17.32	78.91±20.68	0.354	6.17 [(-6.2) - (18.54)]	0.316
General health	61.33±16.19	67.33±13.99	0.123	66.88±16.11	63.75±17.37	0.478	7.18 [(-1.84) - (16.2)]	0.114

PAC Physical activity counseling, IPAQ International Physical Activity Questionnaire, PA Physical activity, MET Metabolic equivalent, min Minute, SF-36 Short Form-36.
Descriptive analyses were presented using X±SD (mean±standard deviation), mean difference (MD) between groups and 95%CI (95% Confidence interval). ANCOVA test, *p<0.05

The results of current study conducted in the light of these knowledge are consistent with the beneficial effects of exercise (14,15). Current study brought out that PAC program based on increasing daily step counts to 10000 steps/d has positive effects on step counts, physical activities, anxiety, and many domains of QOL in university students against controls. The improvements in the PAC group may have resulted from the effect of group training and group progression in addition to the effects of PAC program, too. Moreover, while these outcomes improved following PAC despite side effects of COVID-19 pandemic, curfew, cold weather conditions and exam week within PAC group, sitting time and step counts deteriorated following routine daily activities during COVID-19 pandemic within control group. However, there was no considerable effect of PAC on sitting duration in the PAC group compared to controls while sitting durations increased within control group. The PAC seems to have prevented, but not decreased, the increase in sitting durations of the students within PAC group. Moreover, social functioning subscale of QOL questionnaire improved in both groups. However, while the students in PAC group socialized by walking, another group seemed to socialize by sitting during pandemic curfew. A study with a control group demonstrated that a home-based multicomponent online physical activity intervention (30 min/session, 3 sessions/week during 6-week) under supervision via Youtube exercise channels improved cardiorespiratory fitness, muscular endurance, intrinsic motivation, and body appreciation but not physical activity in 42 adolescent girls during COVID-19 quarantine (32). In contrast to result of current study, it is interesting not to improve physical activity levels of the girls (32). This difference may arise from use of self-report questionnaire, on which may be recorded perceived physical activity levels rather than actual activity levels in the individuals. Attention was paid to the answers of the university students during current study to avoid this overestimation situation of daily activities while answering questionnaires. Another study without a control group also revealed positive impacts of a 4-week online mindfulness yoga practice on depression and stress scores in university students (13). In parallel with the results of Hosseinzadeh et al (13), depression scores decreased within PAC group in current study. However, group difference related with depression scores could not be shown in current study. The reason for this situation may be that many of the students were not able to use their time efficiently during the COVID-19 quarantine period, which is still an unusual condition for students (7). Therefore, mood disturbances have occurred during the quarantine period in the students who need emotional support (7). Since 4-weeks PAC may have been insufficient to improve depression scores for the students, emotional and psychological support in addition to PAC should be investigated and provided to the students. On the other hand, as previously demonstrated (33-35), PAC showed considerable decrease in anxiety scores in the students of the current study which supports that regular 4-week PAC improves behavior and/or mental health in students under special conditions like COVID-19 pandemic. Therefore, PAC program, a safe and effective way to increase daily activities, may be offered to students around the world during the

pandemic to protect or improve mental health and QOL of the students. Given the positive results of all studies, that physical activity and various types of exercise have significant undeniable influence on people during COVID-19 pandemic can be said. Nevertheless, more future studies are also needed in both patient groups and healthy individuals.

Limitations

Since the students were at their homes in different cities of the country, changes in regional weather conditions could not be taken into consideration. Therefore, some of the students could not walk comfortably under cold and snowy weather conditions. Another limitation of the study was that the female students reduced their physical activities on their special days due to pain. Luckily, rate of gender distribution was similar between groups.

CONCLUSION

Current study is valuable, well designed, prospective, and randomized controlled study which harmoniously showed effectiveness of PAC program on psychological and physical health as well as QOL in the university students during COVID-19 pandemic and at the period of strict curfew measures. Nowadays, as predicted, it is important for everyone to both protect health across COVID-19 infection and related restrictions and prevent long-term disorders related with COVID-19. To reach 10000 steps per a day during COVID-19 pandemic, it is appropriate and safe to walk outside or take short walks at home for at least 10 min at a time and 3-8 times/d for the students. Given the safety and feasibility of PAC program in the students, regular online/distance physical activity and exercise trainings at moderate intensity should be investigated in other individuals and/or patients with chronic conditions during COVID-19.

Conflict of interests: None.
Ethical approval: The Izmir Democracy University Non-Interventional Clinical Research of the Ethics Committee approved the study (Decision No: 2020/24-4, Date: 16/12/2020) which followed up the principles of Declaration of Helsinki.
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