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Original Article

Relationship between Participation in Physical Activity and Subjective Well-Being: Evidence from Korea during the Pandemic

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Abstract

Background: The lack of physical activity because of restrictions from the pandemic has increased interest in the deterioration of mental and physical health. This is the first study in Korea to investigate how participation in physical activity is correlated with subjective well-being among Koreans in the early stages of the COVID-19 pandemic.

Methods: The survey was conducted among those aged >13 years, from August 24 to September 7, 2020. The process included self-reported surveys, telephone surveys, and face-to-face household interviews; 11,604 people (men=7,758 and women=3,846) participated. Frequency, correlation, and one-way analysis of variance were performed to identify differences between age and sex groups according to the physical activity level, while post-hoc Scheffe tests to examine between-group differences when significant results were observed.

Results: Statistically significant correlations were observed between life satisfaction, living environment satisfaction, and levels of happiness and anxiety based on sex and age (P<0.05). There were significant differences between frequency and time spent on physical activity and subjective well-being according to sex and age (P<0.05).

Conclusion: The study results are highly generalizable considering the analysis of a large-scale sample within a big area in Korea. The findings emphasize that subjective well-being is influenced by sex, age, frequency, and time spent engaged in physical activity. Such basic data can be helpful for establishing policies related to physical activity.

Keywords: Life satisfaction; Mental health; Pandemic; Physical activity; Well-being

Introduction

Physical activity is defined as a wide range of movements involving skeletal muscle energy consumption. It encompasses activities, such as exercise and sports that improve body strength and heart functions, and mental health (1). The health benefits of physical activity are based on certain levels of participation, frequency, and intensity. Despite performing at minimum levels, positive effects can still be expected (1). Physical activity is defined as a wide range of movements involving skeletal muscle energy consumption, which can help prevent and alleviate chronic diseases (2). Moderate regular physical activity can reduce the risk of infectious diseases by 31% and mortality

by 37% in COVID-19 cases and non-communicable diseases (3).

Pandemic-related physical activity has increased interest because of deterioration of both mental and physical health (4). The effects of such activity affect physical, emotional, and mental states (5). A meta-analysis on physical activity during COVID-19 reported that individuals who were able to be more physically active had fewer depressive symptoms and less anxiety and stress, regardless of age, and an increased sense of well-being and a better quality of life (6). During the COVID-19 pandemic, physical inactivity has been observed among children and adults. In Italy, participants (78.1%) had to abandon their usual physical activity habits during the COVID-19 outbreak (7). This highlights the importance of addressing the health of children and adults during the current situation, as well as for potential infectious disease epidemics in the future (7).

Physical activity in children substantially improves health indicators (e.g., cholesterol, insulin and blood glucose levels), muscular strength and endurance (8). Moreover, physical activity also improves children's psychological, emotional, social, and cognitive states (9). In particular, moderate- and high-intensity physical activity has been associated with lower anxiety levels (10), and high levels of physical activity have been linked to lower mood disorder levels (11). In addition, activity that is more physical reduces depression and anxiety among adolescents (12).

Most studies related to the effects of physical activity on psychological, emotional, and mental factors have been conducted in Europe and the United States, with a few conducted in China and Japan. Therefore, I investigated how physical activity, such as exercise and sports, affected the subjective well-being of Koreans during the early stages of the COVID-19 pandemic and specifically examined the relationship between the frequency and time spent on physical activity and life satisfaction, living environment satisfaction, and happiness and anxiety levels according to sex and age. This study will be of reference in understanding the physical activity level participation in Korea during the pandemic and identify psycho-emotional trends. Furthermore, the findings should provide information on physical education's role and direction in the recovery of psychological health.

Materials and Methods

Participants

This survey included residents aged >13 years in Chungcheongbuk-do from August 24 to September 7, 2020, and used the 2020 Social Survey of Chungbuk data conducted by the Office of the North Chungcheong Province to investigate the quality of life and leisure activities (13). The raw data, such as various government surveys, were obtained from the organization Microdata Integrated Service (https://mdis.kostat.go.kr/). The survey process comprised self-reported surveys, telephone surveys, and household face-to-face interviews, with 11,604 citizens (men=7,758 and women=3,846) participating. Sampling was stratified by region and colony using multi-stage cluster sampling, followed by phylogenetic sampling. Table 1 details the participants' characteristics.

Ethics approval

The collected survey data were anonymous, without any identifiable information; thus, the need for ethical approval was waived. Informed consent was obtained from all participants.

Participation in physical activity

Frequency of physical activity

This was assessed using the following question: "*How much exercise or physical activity do you perform for your health, such as jogging, mountain climbing, swimming, and badminton?*" The possible responses were (a) none, (b) once per month, (c) twice per month, (d) once per week, (e) 2-3 times per week, and (f) over 4 times per week.

Table 1: Participant characteristics (n=11,604)

Variables		*Frequency (n)*	*Ratio (%)*
Sex	Men	7,758	66.9
	Women	3,846	33.1
Age (yr)	13–19	15	0.1
	20–29	438	3.8
	30–39	926	8.0
	40–49	1,611	13.9
	50–59	2,464	21.2
	60–64	1,414	12.2
	>65	4,736	40.8
Frequency of physical activity participation	None	5,558	47.9
	Once per month	566	4.9
	Twice per month	313	2.7
	Once per week	1,513	13.0
	2-3 times per week	2,076	17.9
	Over 4 times per week	1,578	13.6
Time of physical activity participation	>1 hour per week	2,144	35.5
	1 to <3 hour(s) per week	2,312	38.2
	3 to <5 hours per week	751	12.4
	5 to <7 hours per week	468	7.7
	>7 hours per week	371	6.1

Time spent on physical activity

This was assessed using the following question: "*If you are exercising or engaged in physical activity, how many hours per week do you exercise or do physical activity?*" the possible responses were (a) under one hour per week, (b) 1 to <3 hour(s) per week, (c) 3 to <5 hours per week, (d) 5 to <7 hours per week, and (e) over 7 hours per week.

Subjective well-being

Life satisfaction

This was assessed using the following question: "*Generally, how satisfied are you with your life these days?*" The responses were measured on a Likert-like scale from 0 to 10, with 0 being not satisfied at all, 5 being average, and 10 being very satisfied. On a sub-scale of 5 points, responses close to 0 represented dissatisfaction, while those close to 10 represented satisfaction.

Living environment satisfaction

This was assessed using the following question: "*How satisfied are you with the overall life of the area you currently live in?*" The responses were measured on a Likert-like scale from 0 to 10, with 0 being not satisfied at all, 5 being average, and 10 being very satisfied. On a sub-scale of 5 points, responses close to 0 represented dissatisfaction, while those close to 10 represented satisfaction.

Happiness level

This was assessed using the following question: "*How happy were you?*" The responses were measured on a Likert-like scale from 0 to 10, with 0 being not happy at all, 5 being average, and 10 being very happy. On a sub-scale of 5 points, responses close to 0 represented low happiness, while those close to 10 represented high happiness.

Anxiety level

This was assessed based on the following question: "*How worried were you yesterday?*" The responses were measured on a Likert-like scale from 0 to 10, with 0 being not concerned at all, 5 being moderate, and 10 being very concerned. On a 5-point sub-scale, responses close to 0 and 10 indicated low and high anxiety, respectively.

Statistical analysis

All results are presented as the mean ± standard deviation or number (%). Frequency analysis, Pearson correlation analysis, and one-way analysis of variance were performed to identify differences between groups according to the level of physical activity. When there was a significant difference, a post-hoc Scheffe test was conducted to assess differences between each group. Statistical analyses were performed using SPSS version 24.0 (IBM Corp., Armonk, NY, USA), and statistical significance was set at $P<0.05$.

Results

Correlation analysis

Table 2 shows the correlations between each set of variables. Sex exhibited a statistically significant correlation with life satisfaction, living environment satisfaction, and happiness level; however, the association with anxiety level was not statistically significant. Age exhibited a statistically significant correlation with life satisfaction, living environment satisfaction, happiness level, and anxiety level. The frequency of physical activity exhibited a statistically significant correlation with life satisfaction, living environment satisfaction, happiness level, and anxiety level. The time spent on physical activity exhibited a statistically significant correlation with life satisfaction, living environment satisfaction, happiness level, and anxiety level.

Table 2: Correlations between variables

Variable		*Life satisfaction*	*Living environment satisfaction*	*Happiness level*	*Anxiety level*
Sex	*r*	-0.067	-0.047	-0.057	0.017
	P	<0.001***	<0.001***	<0.001***	0.070
Age(yr)	*r*	-.0124	-0.024	-0.146	-0.022
	P	<0.001***	0.010*	<0.001***	0.019*
Frequency of physical activity participation	*r*	0.132	0.116	0.156	-0.052
	P	<0.001***	<0.001***	<0.001***	<0.001***
Time spent on physical activity participation	*r*	0.141	0.113	0.169	-0.041
	P	<0.001***	<0.001***	<0.001***	<0.001***

*$P<0.05$, ***$P<0.001$ (tested by Pearson correlation)

Frequency of physical activity and subjective well-being

Table 3 shows differences in the frequency of physical activity and subjective well-being according to sex. Statistical significance was confirmed for both men and women for life satisfaction, living environment satisfaction, happiness level, and anxiety level.

Table 4 shows the differences in the physical activity frequency and subjective well-being according to age. For younger and older adults, statistical significance was confirmed for life satisfaction, living environment satisfaction, happiness level, and anxiety level.

Table 3: Differences in the frequency of physical activity and subjective well-being according to sex

Variable	*None (a)*	*Once per month (b)*	*Twice per month (c)*	*Once per week (d)*	*2-3 times per week (e)*	*Over 4 times per week (f)*	*F*	*P*	*Post-hoc*
Men	n=3,492	n=410	n=233	n=1,071	n=1,447	n=1,105			
Life satisfaction	5.48 ± 1.95	5.75 ± 2.04	5.73 ± 2.01	5.87 ± 1.94	6.13 ± 2.02	6.01 ± 2.01	28.555	<0.001***	d,e,f>a
Living environment satisfaction	5.55 ± 1.86	5.58 ± 1.94	5.64 ± 1.88	5.83 ± 1.89	6.10 ± 1.94	6.06 ± 1.99	24.416	<0.001***	d,e,f>a
Happiness level	5.49 ± 1.97	5.97 ± 1.99	5.96 ± 2.00	5.95 ± 2.00	6.25 ± 2.01	6.14 ± 2.08	39.638	<0.001***	b,c,d,e,f>a
Anxiety level	4.98 ± 2.21	5.04 ± 2.28	5.22 ± 2.24	5.00 ± 2.20	4.69 ± 2.37	4.59 ± 2.39	9.015	<0.001***	a,c,d>e,f
Women	n=2,066	n=156	n=80	n=442	n=629	n=473			
Life satisfaction	5.24 ± 2.02	5.61 ± 2.06	5.56 ± 2.18	5.64 ± 1.98	5.85 ± 2.06	5.77 ± 2.16	12.610	<0.001***	d,e,f>a
Living environment satisfaction	5.41 ± 1.92	5.47 ± 1.99	5.69 ± 1.82	5.67 ± 1.89	5.84 ± 1.97	5.93 ± 2.07	8.730	<0.001***	e,f>a
Happiness level	5.29 ± 2.05	5.92 ± 2.20	6.00 ± 2.01	5.86 ± 2.09	6.02 ± 2.19	5.86 ± 2.16	18.010	<0.001***	b,d,e,f>a
Anxiety level	5.04 ± 2.26	5.32 ± 2.39	4.99 ± 2.21	5.11 ± 2.28	4.85 ± 2.35	4.70 ± 2.44	2.996	0.011*	

*P<0.05, ***P<0.001(tested by one-way analysis of variance and Scheffe post-hoc test)

Table 4: Differences in the frequency of physical activity and subjective well-being according to age

Variable	*None (a)*	*Once per month (b)*	*Twice per month (c)*	*Once per week (d)*	*2-3 times per week (e)*	*Over 4 times per week (f)*	*F*	*P*	*Post-hoc*
Adult	n=2,890	n=451	n=254	n=1,066	n=1,407	n=785			
Life satisfaction	5.56 ± 2.04	5.76 ± 2.11	5.89 ± 1.96	5.91 ± 2.00	6.17 ± 2.05	6.092.08	20.785	<0.001***	d,e,f>a
Living environment satisfaction	5.56 ± 1.94	5.49 ± 2.00	5.76 ± 1.79	5.79 ± 1.93	6.02 ± 1.94	6.04 ± 2.04	16.345	<0.001***	d,e,f>a
Happiness level	5.62 ± 2.08	6.02 ± 2.10	6.5 ± 1.94	6.07 ± 2.03	6.31 ± 2.08	6.24 ± 2.13	27.022	<0.001***	b,c,d,e,f>a
Anxiety level	5.01 ± 2.30	5.23 ± 2.34	5.17 ± 2.18	5.02 ± 2.21	4.78 ± 2.39	4.76 ± 2.41	4.910	<0.001***	b>e,f
Older adults	n=2,658	n=114	n=59	n=445	n=667	n=793			
Life satisfaction	5.20 ± 1.89	5.51 ± 1.76	4.81 ± 2.21	5.55 ± 1.81	5.79 ± 1.99	5.79 ± 2.03	19.284	<0.001***	d,e,f>a
Living environment satisfaction	5.44 ± 1.82	5.77 ± 1.72	5.17 ± 2.08	5.75 ± 1.82	6.03 ± 197	6.00 ± 1.99	19.101	<0.001***	d,e,f>a
Happiness level	5.19 ± 1.89	5.69 ± 1.79	5.22 ± 2.09	5.55 ± 1.98	5.90 ± 2.02	5.88 ± 2.08	25.242	<0.001***	d,e,f>a
Anxiety level	4.99 ± 2.15	4.62 ± 2.15	5.14 ± 2.47	5.08 ± 2.27	4.63 ± 2.30	4.50 ± 2.39	8.745	<0.001***	a>e.f

***P<0.001(tested by one-way analysis of variance and Scheffe post-hoc test

Time spent on physical activity and subjective well-being

Table 5 shows the differences in the time spent on physical activity and subjective well-being according to sex. For men, statistical significance was confirmed for life satisfaction, living environment satisfaction, happiness level, and anxiety level. For women, statistical significance was confirmed for happiness level.

Table 5: Differences in the time spent on physical activity and subjective well-being according to sex

Variable	*<1 hour weekly (a)*	*1 to <3 hour(s) weekly (b)*	*3 to <5 hours weekly (c)*	*5 to <7 hours weekly (d)*	*>7 hours weekly (e)*	*F*	*P*	*Post-hoc*
Men	n=1,395	n=1,691	n=540	n=360	n=280			
Life satisfaction	5.86 ± 1.90	5.92 ± 2.04	6.29 ± 1.92	6.07 ± 2.11	6.20 ± 2.17	5.871	<0.001***	c>a,b
Living environment satisfaction	5.85 ± 1.88	5.88 ± 1.95	6.18 ± 1.90	6.09 ± 2.13	6.16 ± 2.05	4.582	0.001**	c>a,b
Happiness level	5.97 ± 1.98	6.08 ± 2.02	6.28 ± 1.93	6.29 ± 2.18	6.27 ± 2.26	3.763	0.005**	c>a
Anxiety level	4.88 ± 2.28	4.89 ± 2.32	4.64 ± 2.27	4.68 ± 2.51	4.39 ± 2.41	4.169	0.002**	a,b>e
Women	n=749	n=621	n=211	n=108	n=91			
Life satisfaction	5.57 ± 1.94	5.85 ± 2.14	5.92 ± 2.06	5.84 ± 2.30	5.89 ± 2.33	2.293	0.057	
Living environment satisfaction	5.65 ± 1.89	5.87 ± 2.01	5.77 ± 1.90	5.94 ± 2.39	6.13 ± 2.01	2.080	0.081	
Happiness level	5.67 ± 2.07	6.13 ± 2.20	6.02 ± 2.06	6.12 ± 2.24	6.24 ± 2.38	5.027	<0.001***	b>a
Anxiety level	4.98 ± 2.22	4.98 ± 2.45	4.74 ± 2.40	4.80 ± 2.65	4.63 ± 2.52	0.947	0.435	

**P<0.01, ***P<0.001 (tested by one-way analysis of variance and Scheffe post-hoc test)

Table 6 shows the differences in the time spent on physical activity and subjective well-being according to age. For both younger and older adults, statistical significance was confirmed for life satisfaction, living environment satisfaction, happiness level, and anxiety level.

Table 6: Differences in the time spent on physical activity and subjective well-being according to age

Variable	*<1 hour per week (a)*	*1 to <3 hour(s) per week (b)*	*3 to <5 hours per week(c)*	*5 to <7 hours per week(d)*	*>7 hours per week(e)*	*F*	*P*	*Post-hoc*
Adults	n=1,320	n=1,697	n=495	n=274	n=225			
Life satisfaction	5.94 ± 1.98	5.99 ± 2.09	6.26 ± 1.97	5.99 ± 2.18	6.38 ± 2.21	4.046	0.003**	c>a

Living environment satisfaction	5.79 ± 1.88	5.87 ± 1.97	6.06 ± 1.93	5.89 ± 2.19	6.20 ± 2.08	3.321	0.010*	
Happiness level	6.10 ± 2.04	6.19 ± 2.07	6.35 ± 2.00	6.23 ± 2.25	6.47 ± 2.30	2.424	0.046*	
Anxiety level	4.95 ± 2.26	4.97 ± 2.33	4.79 ± 2.33	5.00 ± 2.49	4.36 ± 2.52	3.840	0.004**	a,b,d>e
Older adults	n=871	n=612	n=255	n=194	n=146			
Life satisfaction	5.53 ± 1.85	5.67 ± 2.00	6.03 ± 1.96	6.05 ± 2.13	5.73 ± 2.17	5.060	<0.001***	c,d>a
Living environment satisfaction	5.77 ± 1.88	5.92 ± 1.95	6.07 ± 1.86	6.29 ± 2.18	6.08 ± 1.97	3.792	0.004**	d>a
Happiness level	5.57 ± 1.96	5.85 ± 2.07	5.93 ± 1.89	6.27 ± 2.11	5.95 ± 2.24	5.990	<0.001***	d>a
Anxiety level	4.81 ± 2.26	4.79 ± 2.41	4.43 ± 2.21	4.28 ± 2.55	4.58 ± 2.31	3.228	0.012*	

*P<0.05, **P<0.01, ***P<0.001 (tested by one-way analysis of variance and Scheffe post-hoc test)

Discussion

This study aimed to analyze differences in subjective well-being according to the frequency of and time spent on physical activity, focusing on sex and age. Overall, the results show that there are differences in subjective well-being based on the frequency of physical activity and the amount of time spent across age groups and sexes.

A lack of physical activity has negative effects on mental health states, leading to anxiety, depression, and stress, and decreasing psychological well-being (14-16). I observed that individuals who exercised daily had lower stress levels than those who did not exercise daily (17). In addition, the non-physical group reflected a lower sense of well-being and higher levels of depression and anxiety than did the moderately active group (18). Moreover, those who participated in moderate or greater physical activity were found to have a better mental health states and well-being than those who recorded low participation (4).

In terms of the relationship between time spent on physical activity and subjective well-being, most men participated, on average, from 3 to <5 hours weekly; there was also a significant difference between this group and those participating <3 hours weekly. Among older adults, the group participating between 5 and <7 hours weekly reflected the best results in satisfaction, happiness, and mental health. However, an increase in absolute physical activity above this level did not reflect higher subjective well-being. This result suggests that there is a threshold of physical activity for mental health benefits (19).

In contrast, there were no significant differences in happiness based on time spent on physical activity or subjective well-being in women. This may be because I did not consider the exercise intensity. Some studies have shown that the intensity of the exercise is an important factor influencing mental health (20,21). That is, high-intensity physical activity is more closely linked to depressive symptoms than moderate-intensity physical activity (22). From this perspective, women may be participating in low- to moderate-intensity physical activity (23). As such, the correlation between women with subjective well-being may have been weaker if they were more frequently participating in low- and moderate-intensity physical activity.

This study had limitations. First, I only investigated the correlations between physical activity levels and subjective well-being, which may have affected evaluating the causal relationship be-

tween the variables. Second, I did not investigate the intensity level of physical activity. Therefore, future studies should include activity type, duration, intensity, and the role of school physical education as variables to offer data, providing better psychological and emotional health management.

The results indicated that a greater frequency of physical activity in men resulted in higher ratings of subjective well-being than with non-participation. Moreover, their ratings were also higher than those for men who participated for <1 hour weekly. Furthermore, a greater frequency of activity in women was associated with higher subjective well-being than with non-participation, while the time spent on exercise was less relevant. For younger and older adults, a greater frequency of activity was associated with higher subjective well-being than with non-participation, with the highest scores observed for those participating between 3 and <7 hours weekly.

Conclusion

This survey observed significant correlations between sex, age, time spent on physical activity, and subjective well-being, comprising satisfaction with life and one's living environment and levels of happiness and anxiety. As COVID-19 continues to exacerbate psychological and psychological problems, our results show that physical activity is one way to alleviate these issues. The findings also suggest that school physical education should consider setting psychological well-being as an important goal.

Nevertheless, I believe this study allows for strong generalization, considering the use of a large-scale sample in Korea. In addition, subjective well-being differs according to sex, age, and the frequency and time spent on physical activity. This information can act as reference in establishing policies related to physical activity. Moreover, in the development of physical education programs, our findings can be used to establish physical activity recommendations and goals according to individual backgrounds and development levels for people of all ages.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The author declares that there is no conflict of interests.

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