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Original Article

Analysis of the Structural Relationship of Sports Participation and Ego-Resilience in the Health-Promoting Behavior of Korean Adolescents during the COVID-19 Pandemic

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Abstract

Background: We aimed to verify the structural relationship between sports participation, ego-resilience, and health-promoting behavior of Korean adolescents in a pandemic situation.

Methods: In Nov 2020, an online survey was conducted with 751 adolescents in Korea. The data obtained through the survey were analyzed in several ways, including frequency, reliability, confirmatory factor, descriptive statistical, and path analyses.

Results: Sports participation had a positive effect on ego-resilience and health-promoting behavior, while ego-resilience has a positive effect on health-promoting behavior. Overall, sports participation directly affects health-promoting behavior and that an indirect effect occurs through ego-resilience.

Conclusion: Educational institutions such as schools and the Korea Offices of Education should devise various measures so that adolescents growing up in a global pandemic situation can strengthen their health-promoting behavior by securing ego-resilience through participation in various sports.

Keywords: Adolescent; Sports participation; Ego-resilience; Health-promoting behavior; Pandemic

Introduction

In Mar 2020, the WHO declared a pandemic due to the spread of COVID-19, a disease caused by a novel coronavirus. Consequently, people have been faced with threats to the immune system both from viruses and from decreased physical activity due to "physical distancing." While physical distancing can prevent and reduce the transmission of the virus, we also need to pay attention to the consequences of the decreased physical activity caused by such distancing.

Along these lines, while physical distancing measures are in place, efforts to avoid human-to-human transmission of the virus can lead to unintended negative consequences as physical activity can be reduced (1). Recently, most adolescents do not perform moderate exercise for 60 min a day—the rate recommended by the WHO; failing to meet this guideline can jeopardize adolescents' physical, social, and mental health (2). Carefully examining the effects of physical distancing and isolation across the country and how it affects the mental and physical health of adolescents, as well as seeking ways to offset harmful effects, is necessary (3). Many researchers have focused on the health-promoting behavior of adolescents in this situation. Health-promoting behavior can be defined as having a lifestyle that improves and

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maintains health and is closely related to health promotion and disease prevention (4).

According to Dashtidehkordi et al (5), health-promoting behavior is closely related to sports activities. In general, adequate physical activity is associated with immune system benefits and has the potential to prevent respiratory infections (6-7). Accordingly, regular and moderate-intensity sports activities that can be performed indoors or in a home environment seem to be the best option for all people affected by the pandemic (8).

Ego-resilience has a significant connection with health-promoting behavior (9-10). Ego-resilience is a state that helps a person achieve good results and maintain or improve psychological balance through adaptation during difficult or negative circumstances (11). People with high ego-resilience can reduce psychological pain by positively evaluating surrounding stimuli or environmental factors in stressful situations. Therefore, it is necessary to examine the relationship between ego-resilience and health-promoting behavior when physical distancing and isolation cause mental health problems in adolescents (3). Previous related studies confirmed a positive relationship between ego-resilience and health-promoting behavior using various variables (9-10). People who spend extensive time sitting have low ego-resilience, but those who spend substantial time doing high-intensity exercise have high ego-resilience and mental health (12). Physical activity participation affects positive self-elasticity (12).

A summary of preceding studies showed a positive correlation between sports participation activities, ego-resilience, and health-promoting behavior. However, as previous studies separately reported the relationship between these variables, information on the comprehensive relationship among health-promoting behavior, sports participation activities, and ego-resilience cannot be provided. For example, while the study by Vella et al (13) examined the relationship between sports participation and health-related behavior, another study (14) examined the relationship between sports activity and ego elasticity. In addition, most studies have examined the relationship between the two outsiders, such as the relationship between ego elasticity and health-promoting behavior (15). However, no studies have yet comprehensively analyzed the outsiders set up in this study.

In addition, it was difficult to compare and analyze research results because subjects' groups are different depending on the previous studies. For example, the studies related to this paper were conducted with various subjects such as patients (15), workers (16), and poor adults (10). Therefore, we aimed to provide practical and useful information that can maximize health-promoting behavior in a pandemic situation by empirically examining the structural relationship among adolescents' health-promoting behavior, sports participation, and ego-resilience.

Methods

Participants

A total of 751 Korean adolescents were recruited to participate in this study using convenience sampling, which is a nonprobability sampling method. A survey was conducted using Google Forms in Nov 2020.

This study was conducted after obtaining ethical approval from the Institutional Review Board of Jeonbuk National University (JBNU 2020-10-011-003). The general characteristics of the participants are shown in Table 1.

Instruments

Question items about the general characteristics of the participants consisted of sex, frequency of sports participation, time spent sports participation, and duration of sports participation, which were determined to be factors that were relevant to the variables set up in this study. Previous studies (17, 18) show that adolescent health awareness, sports participation, and health-promoting behavior differ according to sex. In addition, health awareness and health-promoting behaviors vary according to the degree (i.e., frequency, duration, and intensity) of sports participation (19, 20).

Table 1: The general characteristics of the participants

Variable	*Classification*	*Number of cases*	*Percentage (%)*
Sex	Male	408	54.3
	Female	343	45.7
Frequency of sports participation	No participation	183	24.4
	Once per week	194	25.8
	2–3 times per week	215	28.6
	Over 4 times per week	159	21.2
Time spent sports participation	No participation	183	24.4
	Less than 30 minutes	194	25.8
	31–60 minutes	208	27.7
	More than 61 minutes	166	22.1
Duration of sports participation	No participation	183	24.4
	Less than 3 months	278	37.0
	3–6 months	70	9.3
	More than 6 months	220	29.3
Total		751	100.0

The scales used in this study were developed in previous studies (21-24) and used variables that verified reliability and validity. The content and sub-variates of the specific scale are as follows. The questionnaire items were based on the classification model of sports participation (21) and the measure of reliability and validity used in another study (22). A questionnaire measuring sports participation, which consisted of three sub-variables (cognitive participation, behavioral participation, and affective participation), was used. The ego-resilience questionnaires (23) used the Korean version of the self-elasticity questionnaire. A questionnaire measuring ego-resilience, which consisted of five sub-variables (positive thinking, problem-solving, intimate behavior, emotional control, and autonomous behavior), was used. Health-promoting behavior was based on Health-Promoting Lifestyle Profile-II (24), which was verified for its reliability and validity (22). Health-promoting behavior consisted of five sub-variables (personal hygiene and life habits, rest management, exercise management, eating habit management, and interpersonal relationships). Sports participation, ego-resilience, and health-promoting behavior were independently scored on a five-point Likert scale ranging from "strongly agree" (5 points) to "not at all" (1 point).

The questionnaire was demonstrated in a previous study to use tools that proved reliability and validity (17-24), and the obtained data were analyzed using the SPSS and AMOS 18.0 programs (IBM Corp., Armonk, NY, USA). In general, it was assumed that a skewness value of <3.00 and a kurtosis value of <±10.00 are the bases of the violations of univariate normality assumptions (25-26).

Reliability and validity of the instruments

Cronbach's α was used to assess the internal consistency of the items to verify the reliability of the scales used in this study and a confirmatory factor analysis (CFA) was performed to verify the validity. The reliability analysis of each variable was conducted, with the results shown in Table 2.

The Cronbach's α for all the observed variables was in the range of 0.609–0.931, all above the threshold level of 0.600, and can be assessed as having high internal consistency. However, "Alpha if Item Deleted" appeared to be higher than "Cronbach's α," indicating that the item is more reliable when eliminated.

Table 2: Reliability analysis

Variable		*Cronbach's α*
Sports participation	Cognitive participation	0.796
	Behavioral participation	0.733
	Affective participation	0.813
Ego-resilience	Positive thinking	0.931
	Problem-solving	0.841
	Intimate behavior	0.886
	Emotional control	0.825
	Autonomous behavior	0.824
Health-promoting behavior	Personal hygiene and life habits	0.726
	Rest management	0.609
	Exercise management	0.739
	Eating habit management	0.681
	Interpersonal relationships	0.764

Therefore, this study was conducted after eliminating 11 items (cognitive participation #1 in sports participation, emotional control #3 in ego-resilience, personal hygiene and life habits #1, #2, and #5; rest management #1 and #4; exercise management #1; eating habit management #1 and #2; and interpersonal relationships #1 in health-promoting behavior).

Next, CFA was performed to verify the validity of the scales used in this study. The suitability of the CFA of the proposed model was shown to be below the threshold, with root mean square residual (RMR)=0.058 and goodness-of-fit indices (GFI)=0.803. Therefore, several items (positive thinking, problem-solving, and rest management) were removed based on the squared multiple correlation values, and the fitted values of the modified model were RMR=0.039 and GFI=0.913, indicating that they were good models.

Next, the validity of the model was tested through CFA. The results are presented in Table 3. First, to verify convergent validity, three methods were validated: standardized coefficient, construct reliability, and average variance extracted (AVE). The standardized coefficients of all the variables ranged from -0.857 to 0.786, and significance (critical ratio) was 1.965 or higher. In addition, construct reliability was found to be 0.888–0.983 and the AVE was between 0.825 and 0.979, indicating that all three conditions were appropriate to ensure convergent validity. Next, the correlations between the constructs and AVE were compared to verify the validity of discriminant validity, as shown in Table 4.

Table 3: Results of the confirmatory factor analysis

Variable			*Non-standardized coefficient*	*Standard error*	*Critical ratio*	*P*	*Standardized coefficient*	*Construct reliability*	*Average variance extracted*
A	→	D	1.000				0.564	0.983	0.951
	→	E	1.391	0.102	13.679	<0.001***	0.786		
	→	F	1.868	0.144	13.010	<0.001***	0.689		
B	→	G	1.000				0.749	0.949	0.979
	→	H	-1.066	0.055	-19.396	<0.001***	-0.748		
	→	I	-1.267	0.059	-21.378	<0.001***	-0.857		
C	→	J	1.000				0.468	0.888	0.825
	→	K	0.776	0.076	10.178	<0.001***	0.476		
	→	L	-0.430	0.068	-6.305	<0.001***	-0.253		
	→	M	0.677	0.085	7.921	<0.001***	0.334		

A=sports participation, B=ego-resilience, C=health-promoting behavior, D=affective participation, E=behavioral participation, F=cognitive participation, G=autonomous behavior, H=emotional control, I=intimate behavior, J=interpersonal relationships, K=eating habit management, L=exercise management, M=personal hygiene and life habits, ***P<0.001, tested by confirmatory factor analysis

Table 4: Discriminant validity verification

Variable	*Correlations between the constructs*			*Average variance extracted*
	A	**B**	**C**	
Sports participation	1.000			0.951
Ego-resilience	-0.370***	1.000		0.979
Health-promoting behavior	0.401***	-0.293***	1.000	0.825

***P<0.001, tested by correlation analysis

Discriminant validity was verified against the AVE values by selecting the two variables with the highest correlation. The squared value of the correlation coefficient of sports participation ↔ health-promoting behavior was 0.161, which was lower than the AVE of sports participation (0.951) and health-promoting behavior (0.825), indicating that the discriminant validity between the variables was secured.

Results

Descriptive Statistical Analysis

All the variables and sub-variables were analyzed to investigate the descriptive statistics of sports participation, ego-resilience, and health-promoting behavior; the descriptive statistics are shown in Table 5. The mean is distributed from 2.21 to 3.93 points and the standard deviation is from 0.65 to 1.04. The absolute value of skewness was distributed between 0.06 and 0.99 and that of kurtosis was distributed between 0.01 and 0.39. These results could be evaluated as satisfying the conditions required for the normality of the structural equation model.

Path Analysis of the Study Model

The structural equation model developed in this study consisted of three potential variables (sports participation, ego-resilience, and health-promoting behavior) and 10 measured variables (cognitive participation, behavioral participation, affective participation, intimate behavior, emotional control, autonomous behavior, personal hygiene and life habits, exercise management, eating habit management, and interpersonal relationships). A path analysis of the study model was performed, and the goodness-of-fit of the entire study model was assessed to verify the direct and indirect effects. The results show that RMR=0.039 and GFI=0.913. This means that the GFI of the proposed model was acceptable overall. The results of testing the hypotheses via path analysis are shown in Table 6.

First, the path coefficient for verifying the effect of sports participation on ego-resilience was 0.687 (t=11.340), which was statistically significant and supported the hypothesis (P<0.001).

Table 5: Descriptive statistics (five-point Likert scale)

Variable		*Mean*	*Standard deviation*	*Skewness*	*Kurtosis*
Sports participation	Cognitive participation	2.97	1.04	0.13	-0.46
	Behavioral participation	3.14	0.68	0.17	0.72
	Affective participation	3.93	0.68	-0.29	0.33
	Intimate behavior	2.21	0.72	0.21	-0.06
	Emotional control	2.56	0.70	-0.07	0.54
	Autonomous behavior	3.66	0.65	0.01	-0.07
Health-promoting behavior	Personal hygiene and life habits	3.29	0.91	-0.03	0.08
	Exercise management	2.64	0.76	0.39	0.99
	Eating habit management	3.63	0.73	-0.10	-0.28
	Interpersonal relationships	3.49	0.96	-0.34	-0.28

Table 6: Path analysis results

Hypothesis	*Path*			*Standardized regression coefficient*	*Regression coefficient*	*Standard error*	*Critical ratio*	*P*	*Testing*
H1	A	→	B	0.687	0.878	0.077	11.340	<0.001***	Supported
H2	A	→	C	0.622	0.483	0.077	6.237	<0.001***	Supported
H3	B	→	C	0.526	0.730	0.111	6.558	<0.001***	Supported

A=sports participation, B=ego-resilience, C=health-promoting behavior, ****P*<0.001, tested by path analysis

As such, sports participation can be seen as having a positive effect on ego-resilience. Second, the path coefficient for verifying the effect of sports participation on health-promoting behavior was 0.622 (t=6.237), which was statistically significant and supported the hypothesis (P<0.001). As such, sports participation can be seen as having a positive effect on ego-resilience. Third, the path coefficient for verifying the effect of ego-resilience on health-promoting behavior was 0.526 (t=6.558), which was statistically significant and supported the hypothesis (P<0.001). As such, ego-resilience can be seen as having a positive effect on health-promoting behavior.

Discussion

We aimed to establish the structural relationship of the sports participation, ego-resilience, and health-promoting behavior of adolescents and provide a theoretical foundation for practical and useful information that can maximize the health-promoting behavior of adolescents during the COVID-19 pandemic. Based on the results derived from the research hypotheses established in this study, the implications of the analysis compared with the results reported in previous studies are as follows.

First, adolescents' sports participation was shown to have a positive effect on health-promoting behavior at a statistically significant level. Lee et al (22) results concurred with those of this study by reporting that sports participation has a positive effect on health-promoting behavior. In addition, the study of male and female high school students (27) reported that sports participation is related to promoting numerous positive health behaviors and curbing negative health behaviors. For example, adolescents who participated in organized sports were more likely to participate in clusters of healthy behavior such as high physical activity participation, adequate consumption of fruit and vegetables, and sufficient rest. In particular, Taliaferro et al (28) reported that most of adolescents who continue to sports participation, regardless of age, race, or ethnicity, had health-related behaviors (adequate physical activity, sufficient consumption of fruit and vegetables, and control of food or diet) that remained unchanged over time. The findings of these previous studies supported the results of this study.

It is not clear whether the change in physical activity is due to the impact of the COVID-19 pandemic. However, according to the WHO (2) and Organization for Economic Co-operation and Development (29), adolescents' participation in physical activities in 2020 was considerably low compared to that in the last decade, and the health of adolescents is threatened by the growing number of adolescents who have agonized over or attempted suicide. In the last decade, given that public health research has paid more attention to the determinants of physical activity for the outbreak and prevention of epidemics (30), it is now clear that adolescents can suffer serious consequences as a result of pandemics such as the COVID-19 pandemic. Therefore, physical activities should be encouraged to strengthen the health-promoting behavior of adolescents (31). In particular, policies to encourage participation in outdoor sports after school and make home training a part of daily life should be implemented at the school, local, and national (government) levels. For example, schools should provide guidelines for regular walking programs that utilize recess time and encourage at-home

exercises such as squats, push-ups, sit-ups, and stretching. This is especially necessary in a situation where physical distancing is being conducted and sports activities in schools are restricted.

Second, adolescents' sports participation was shown to have a positive effect on ego-resilience at a statistically significant level. According to Kunicki (32), physical activity and ego-resilience are strongly related, and through physical activity, ego-resilience is strengthened; moreover, physical activity can be maintained through ego-resilience. Adolescents who were more physically active were more likely to be ego-resilient than those who were not (14). In particular, participating in team sports for one to two years naturally strengthens ego-resilience by overcoming the sense of failure, conflicts with colleagues, and psychological contraction caused by unconscious comparisons (33). Consequently, the stress caused by pandemics can be overcome through physical activity (34); therefore, adolescents should be interested in strengthening their ego-resilience and devise measures to increase participation in various forms of sports activities.

Third, the ego-resilience of adolescents was shown to have a positive effect on health-promoting behavior at statistically significant levels. Dumitrescu et al (35) found a correlation between ego-resilience and health-promoting behavior. Ego-resilience interacts with other variables related to health-promoting behaviors to have a sense of health responsibility (36). In particular, all the sub-factors of ego-resilience and health-promoting behavior are positively correlated for children with chronic diseases (15). Further, prosocial behavior and ego-resilience play an important role in the individual's ability to engage in health-enhancing behaviors such as physical activity and exercise training (10). These results suggested that strengthening ego-resilience can lead to health-promoting activities during the COVID-19 pandemic by giving one a sense of responsibility for one's own health and increasing the ability to cope with stress.

Experts predict that the COVID-19 pandemic will not end soon. In this age, where the death toll from COVID-19 has reached one million and there are still hundreds of thousands of confirmed COVID-19 cases, health-promoting activities will have to be strengthened for adolescents to keep themselves healthy and safe from infectious diseases (37). Based on the results derived from this study, organizations at the local and national levels, along with educational institutions such as schools, will have to present various policies and provide education for the formation of healthy life habits for adolescents.

Several limitations were found in the process of producing these results. Suggestions for future studies center on these limitations. First, as this study limited study subjects to Korean adolescents, it would be difficult to generalize the results to other countries. In future studies, it will be necessary to conduct research in various countries with different characteristics. Moreover, although participants were surveyed using Google Forms in Korea, they do not represent all Korean adolescent students. Second, meaningful results could be achieved by setting sports participation and ego-resilience as variables that could affect the health-promoting behavior of adolescents in the pandemic situation. However, in addition to the variables set in this study, various variables may affect health-promoting behavior. Therefore, a multidimensional analysis of variables that may affect health-promoting behavior will need to be conducted in future studies. Third, although the survey method can produce meaningful results on adolescents' sports participation activities and health, it is unable to give meaning to adolescents' awareness of health and sports participation activities through the various contexts of the pandemic situation. Therefore, future studies will need to derive deeper meaning through qualitative, quantitative, or mixed research methods.

Conclusion

Sports participation had a positive effect on ego-resilience and health-promoting behavior, while ego-resilience was shown to have a positive effect on health-promoting behavior.

Ethical 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 authors declare that there is no conflict of interest.

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