Correlation between Physical Fitness Factors and Career Path Factors in High School Students

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Purpose This study is to confirm the correlation between physical factors and career pathways for domestic high school students. ***Method*** The data in this study used the SPSS 19.0 statistical program, and Pearson's correlation analysis was used to find out the correlation between physical factors and career pathways in domestic high school students. ***Results*** In the variables of physical factors and career pathways, unknown constants showed positive correlations in long-distance shuttle run, hand grip strength, and standing broad jump, and a negative correlation in body fat percentage and cardiorespiratory endurance step test. The number of graduates showed a positive correlation with sit-up, and a negative correlation with body fat percentage. The number of students entering the same field showed a negative correlation between long distance shuttle run and hand grip strength. The number of students enrolled the non same field showed positive correlation in the 50m run, and a strong negative correlation in the long distance shuttle run and the standing broad jump. The number of enlisted students showed a positive correlation in 50m run, and negative correlation between body fat percentage and the standing broad jump. The number of employment studies showed a negative correlation between BMI and long-distance shuttle run. Meister and specialized high schools and the number of dropout students had a positive correlation with body fat percentage, and negative correlation with long-distance shuttle run, hand grip strength, and standing broad jump. The number of employed had a positive correlation with overall flexibility, and a negative correlation with body fat percentage and sit and stoop. ***Conclusions*** As for the career pathways of domestic high school students, positive correlations were found in long distance shuttle run, hand grip strength, standing broad jump, sit and stoop, 50m run, and overall flexibility and negative correlations were shown in long distance shuttle run, hand grip strength, body fat percentage, BMI, cardiorespiratory endurance step test, standing broad jump, and sit and stoop. Future research suggests the development of school-based health promotion programs that can improve adolescents' health and quality of life and influence their career pathways.

Key Words High school students, Physical factors, Career pathways, Schnellkraft, Cardiorespiratory endurance

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Ⅰ. Introduction

According to the World Health Organization, one in four adults and more than 80% of the youth population worldwide do not have enough physical activity.[1)] The World Health Organization has set a target for schools as places to promote physical activity among adolescents.[2)] And schools play an important role in promoting participation in physical activity and educating people on the importance of physical activity.[3)]

Skeletal muscles consume energy to make body movements,[4)] and regular physical activity improves cardiorespiratory health in adolescents so that they can maintain health.[5)] Physical activity also provides numerous physiological and psychosocial benefits for muscle, bone, and adipose tissue growth.[3)]

Through physical activity, adolescents improve physical self-awareness, build self-esteem, reduce obesity, improve cardiovascular health and mental health, aerobic metabolism, strengthen muscles and bones, improve physical strength, reduce cardiovascular risk, improve cardiovascular metabolism, and improve

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weight loss through energy balance, increase in motor skills and body coordination, and improve cognition.[6] Physical activity is known to contribute to the health and physical development of adolescents along with cognitive and academic achievement, and provides an opportunity to acquire basic motor skills.[7] Physical activity promotes cognitive development, brain structure and function, and improves quality of life in adolescents.[8]

Recognizing the lifetime health risks associated with physical inactivity, the World Health Organization has formulated effective strategies to reduce the global burden of death and disease through improved diet and promotion of physical activity.[2] There is a firm association between high levels of physical activity and greater weight loss.[9] The association between physical activity, sedentary lifestyle, and physical and mental health in adolescents is well established.[10] And a school curriculum that focuses mainly on academic achievement, lack of support, lack of funds and resources, and low-quality school education are barriers to physical activity for adolescents.[7] Physical activity, balanced nutrient intake, and quality sleep have an impact on the physical health of adolescents. However, the worldwide prevalence of obesity increases the risk of chronic non-communicable diseases, and the increased risk of cardiovascular disease is affecting the decrease in survival rate and the increase in social burden.[11] Less than 30% of children and adolescents worldwide meet the global physical activity recommendation of at least 60 minutes of moderately vigorous physical activity per day.[12] The current environment reduces opportunities for physical activity and causes overweight and obesity and health problems.[7] Obesity causes adipose tissue dysfunction, adipose tissue damage extension, adipocyte hypertrophy, altered lipid metabolism, and local inflammation.[11]

However, adolescents still spend a lot of time eating out, consuming more energy-dense, high-calorie foods from eating out, and using television or computers.[13] And the gradual decrease in physical activity in school contributes to poor physical and mental health problems, including metabolic and cardiovascular problems in adolescents.[7]

Obesity can be managed through daily behavioral changes related to energy intake and expenditure, and regular exercise contributes to weight and fat loss and metabolic fitness.[9] Physical activity has the potential to improve physical fitness and cognition, its association with academic achievement, reduce weight and alleviate obesity, but is often underestimated[7,9]

Currently, education authorities should systematically provide policy directions for increasing physical activity and lead changes in public policy, but do not attempt to increase classes related to physical activity.[7] Until recently, there has been almost no research on physical factors and career pathways for high school students. This study analyzes the relationship between physical factors and career factors for domestic high school students to identify the effect of high school students' physical fitness on career factors.

II. Materials and Methods

1. Subjects

This study targeted 73,151 high school students nationwide who were satisfied with physical fitness and career factors from 2011 to 2021 of the School Information Disclosure with the data provided by the Edu data service.[14]

2. Collecting data

This study utilized data from the Edu Data Service (EDSS) operated by the Ministry of Education and the Korea Education and Research Information Service (KERIS).[14] It was based on the data recorded in the student health and fitness evaluation supervised by the Ministry of Education for all high school students nationwide from 2011 to 2021. The contents of the data are as follows. physical factors; long run walk, Long distance shuttle run, cardiorespiratory endurance step test, sit-up, push-up, hand grip strength, body fat percentage, BMI, standing broad jump, 50M run, overall flexibility, sit stoop and career pathways; unknown constant, number of graduates, number of students entered the same field, number of students entered the non-same field, number of enlisted students, num-

ber of employment studies, number of students unable to work, number of Meister school and specialized high school students and dropout students and number of employed people.

3. Data analysis

All data were analyzed with the SPSS 19.0 statistical program, and Pearson's correlation analysis was used to find out the correlation between physical fitness factors and career status factors of domestic high school students.

III. Results

The results of the test on the correlation between physical factors and career pathways of domestic high school students are as follows (Table 1, 2).

In the variables of physical factors and career pathways, the unknown constant showed strong positive correlations in long distance shuttle run, hand grip strength, standing broad jump(p<0.025), and negative correlations in body fat percentage and cardiorespiratory endurance step test (p<0.025) (Table 1, 2).

Table 1. Correlation between physical factors and career pathways in domestic high school students Ⅰ

		Cardiorespiratory endurance			Muscular endurance		
		Long run walk	Long distance shuttle run	Step test	Sit-up	Push-up	Hand grip strength
Unknown constant n=93762	Pearson correlation coefficient	.006	.055**	-.018**	.011	.007	.037**
	p	.361	.000	.008	.108	.268	.000
Number of graduates n=925682	Pearson correlation coefficient	.007	.003	-.004	.016*	.012	-.005
	p	.286	.697	.578	.020	.067	.492
Number of students entered the same field n=248145	Pearson correlation coefficient	.005	-.025**	.001	.005	.005	-.021**
	p	.441	.000	.828	.447	.501	.002
Number of students entered the non-same field n=112092	Pearson correlation coefficient	-.006	-.018**	.009	.002	.006	-.012
	p	.347	.006	.165	.711	.403	.082
Number of enlisted students n=6784	Pearson correlation coefficient	.003	.012	-.008	.005	.000	.003
	p	.668	.072	.262	.463	.993	.657
Number of employment studies n=11887	Pearson correlation coefficient	.009	-.026**	.002	-.007	-.004	-.011
	p	.197	.000	.819	.274	.589	.091
Number of students unable to work n=8177	Pearson correlation coefficient	.010	-.004	-.006	.005	-.005	.006
	p	.130	.535	.374	.457	.480	.368
Number of meister and specialized high school students and dropout students n=63311	Pearson correlation coefficient	-.011	-.024**	.008	.001	.002	-.027**
	p	.097	.000	.222	.916	.768	.000
number of employed people n=32807	Pearson correlation coefficient	.001	-.005	.009	.006	-.002	.001
	p	.885	.457	.177	.340	.751	.899

** p<0.025, * p<0.05

Table 2. Correlation between physical factors and career pathways in domestic high school students Ⅱ

		Body fat percentage	BMI	Schnellkraft		Overall flexibility	Sit stoop
				Standing broad jump	50m run		
unknown constant n=93762	Pearson correlation coefficient	-.040**	-.002	.021**	.004	-.011	.011
	p	.000	.712	.002	.506	.114	.102
number of graduates n=925682	Pearson correlation coefficient	-.022**	-.002	.005	-.001	-.001	-.002
	p	.001	.809	.477	.850	.922	.730
number of students entered the same field n=248145	Pearson correlation coefficient	.003	-.010	-.007	-.001	.000	-.001
	p	.642	.143	.328	.875	.960	.882
number of students entered the non-same field n=112092	Pearson correlation coefficient	.008	.002	-.025**	.018**	-.004	.001
	p	.234	.737	.000	.008	.571	.864
number of enlisted students n=6784	Pearson correlation coefficient	-.018**	.005	-.023**	.020**	-.003	-.002
	p	.006	.459	.001	.003	.684	.718
number of employment studies n=11887	Pearson correlation coefficient	.000	-.022**	-.006	.000	.002	-.006
	p	.943	.001	.409	.947	.723	.363
number of students unable to work n=8177	Pearson correlation coefficient	-.011	.012	.006	-.005	-.008	.001
	p	.101	.065	.337	.442	.252	.926
number of meister and specialized high school students and dropout students n=63311	Pearson correlation coefficient	.025**	.005	-.018**	-.002	-.005	-.005
	p	.000	.462	.007	.790	.450	.485
number of employed people n=32807	Pearson correlation coefficient	-.013*	.008	.010	-.011	.015*	-.015*
	p	.046	.245	.155	.110	.027	.028

** $p<0.025$, * $p<0.05$

In the variables of physical factors and career pathways, the number of graduates showed a positive correlation in sit-up(p<0.05), and a negative correlation with body fat percentage (p<0.05) (Table 1, 2). In the variables of physical factors and career pathways, the number of students entered the same field showed a strong negative correlation between long distance shuttle run and hand grip strength (p<0.025) (Table 1, 2). In the variables of physical factors and career pathways, the number of students entered the non-same fields showed a positive correlation in the 50m run (p<0.025), and a negative correlation in the long distance shuttle run and the standing broad jump (p<0.025) (Table 1, 2). In the variables of physical factors and career pathways, the number of enlisted students showed a strong positive correlation in 50M run(p<0.025), and a strong negative correlation between body fat percentage and long broad jump (p<0.025) (Table 1, 2). In the variables of physical factors and career pathways, the number of employment studies showed a strong negative correlation between Body mass index (BMI) and long distance shuttle run (p<0.025) (Table 1, 2). In the variables of physical factors and career pathways, the number of

Meister school and specialized high school and the number of dropout students showed positive correlations in body fat percentage ($p<0.025$), and negative correlations in long distance shuttle run, hand grip strength, and standing broad jump ($p<0.025$) (Table 1, 2). In the variables of physical factors and career pathways, the number of employed showed a positive correlation with overall flexibility ($p<0.05$), and a negative correlation with body fat percentage and sit and stoop ($p<0.05$) (Table 1, 2).

Ⅳ. Discussion

Lang et al. (2017) supports the use of long distance running as a health indicator in the youth population because it is positively associated with obesity, cardiac metabolism, cognitive and psychosocial health indicators.[15] Endurance exercise induces adaptations in the pulmonary, cardiovascular, and neuromuscular systems that improve oxygen delivery from the atmosphere to mitochondria and enhance control of metabolism in muscle cells.[16] Cao et al. (2019) studied the effects of high-intensity interval exercise and moderate-intensity continuous exercise on cardiopulmonary health in adolescents and found that high-intensity interval exercise significantly improved cardiopulmonary health compared to endurance training.[17] In the variables of physical factors and career pathways in this study, unknown constants showed strong positive correlations in long distance shuttle run, hand grip strength, standing broad jump, and strong negative correlations in body fat percentage and cardiorespiratory endurance step test. It is believed that the unknown students represent various types of physical factors, including obesity.

Endurance training appears to be most effective in this respect, but resistance training and high-intensity interval training play a distinct role in exercise intervention effects.[9] Running causes numerous physiological changes in the body, not only increasing the number of new neurons but also affecting input and synaptic plasticity including the complex and dynamic network of neurotransmitter systems that impinge new neurons on glutamatergic and cholinergic signaling in the brain.[16,17,18]

Obesity is known to cause deterioration of behavioral fitness such as speed, agility, flexibility, endurance, muscular strength, and circulatory system ability, as well as deterioration of metabolic ability. It is said to impair exercise capacity.[19] In the variables of physical fitness and career factors in this study, the number of graduates showed a positive correlation in sit-up ($p<0.05$), and a negative correlation with body fat percentage. This is thought to be that the number of graduates have excellent muscular endurance and are far from obesity, so they do steady self-management.

Jone and Carter et al. (2000) stated that endurance exercise induces important adaptations of the cardiorespiratory and neuromuscular systems that increase oxygen delivery from the atmosphere to mitochondria and enable higher control of muscle metabolism.[16] In the variables of physical fitness factor and career path factor in this study, the number of students entered the same field showed a strong negative correlation between long distance shuttle run and hand grip strength. This is thought to have had a negative effect on long distance run and hand grip strength because adolescents in their growing period mostly stayed on chairs in an educational environment focused on entrance exams rather than active outdoor physical activities.

Cava et al. (2021) studied the obesity epidemic during the COVID-19 outbreak and reported that they supported the implementation of strategies aimed at preventing obesity and minimizing metabolic abnormalities that could lead to reduced immune responses and chronic low-grade systemic inflammation.[1]

Kyröläinen et al. (2017) studied training adaptation and optimization of physical ability in a military environment and said that training that combines endurance and muscular strength considering the development of maximum muscular strength, power, and aerobic capacity is an excellent method to improve the overall physical ability of soldiers.[20]

In the variables of physical fitness factor and career path factor in this study, the number of enlisted students showed a strong positive correlation in 50m

run, and a strong negative correlation between body fat percentage and standing broad jump. It is thought that the steady physical activity and self-management of the enlisted students made their instant power excellent and kept them away from obesity.

Ingel et al. (2012) studied the relationship between risk prediction and body mass during a treadmill cardiorespiratory exercise test in patients with chronic heart failure and reported that the risk predictive value slightly increased in obese patients with chronic heart failure.[21)]

In the variables of physical fitness factor and career path factor in this study, the number of employment studies showed a strong negative correlation between BMI and long-distance shuttle run. I think this shows the possibility of obesity and reduced cardiorespiratory endurance of the number of employment studies.

Endurance exercise improves athletic performance, for reasons including: improved maximal oxygen consumption, improved neuromuscular function, increased metabolism, increased cardiovascular function, numerous physical adaptations to the respiratory and endocrine systems, increased maximal oxygen consumption, improved exercise economy, and improved parameters of lactate/ventilation threshold and oxygen uptake.[16)]

Wu et al. (2017) studied the effects of physical activity and sedentary behavior on health-related quality of life in adolescents and reported that the higher the frequency of physical activity and the less time spent sitting, the better the quality of life in adolescents.[10)] And it was reported that a school health program that promotes an active lifestyle of adolescents can contribute to the improvement of health-related quality of life.

Kovacs (2007) studied competitive athlete training in tennis physiology and reported that male tennis players maintain body fat below 12% and maximal oxygen intake above 50 mL/kg/min and at a maximum of 70 mL/kg/min.[22)]

In the variables of physical fitness factor and career path factor in this study, the Meister school and specialized high school and the number of dropout students showed a positive correlation in body fat percentage, and a negative correlation in long distance shuttle run, hand grip strength, and the standing broad jump. It is thought that the lack of self-management of students led to obesity, which in turn caused a decrease in endurance or muscular endurance, leading to the suspension of studies.

Swift et al. (2018) studied the effects of exercise and physical activity on weight loss and maintenance. 150 minutes of moderate-intensity physical activity per week and 75 minutes of vigorous physical activity per week are beneficial to cardiovascular health, and regular physical activity and change in diet has been shown to help with weight loss.[23)]

Dobbins et al. (2013) studied a school-based physical activity program to promote physical activity and physical fitness in adolescents aged 6-18 years. School-based physical activity programs reported positive effects on increased duration of physical activity, decreased television viewing, increased oxygen saturation, and decreased blood cholesterol.[2)]

In the variables of physical fitness factor and career path factor in this study, the number of employed showed a positive correlation in overall flexibility, and a negative correlation in body fat percentage and sit and stoop. This is because the general flexibility due to the adolescent growth period is maintained, but the possibility of obesity is high.

As a conclusion of this study, the career pathways of domestic high school students showed positive correlations in long distance shuttle run, hand grip strength, standing broad jump, sit-up, 50M run, and overall flexibility. And it showed negative correlations in long distance run, hand grip strength, body fat percentage, BMI, cardiorespiratory endurance step test, standing broad jump, and sit and stoop.

Adolescents are most effective in curricula and programs that target increased daily physical activity.[6)] Future research suggests the development of school-based health promotion programs that can improve adolescents' health and quality of life and influence their career pathways.

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