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THE RELATIONSHIP BETWEEN SOCIOECONOMIC FACTORS AND PHYSICAL FITNESS VARIABLES AMONG KOREAN ADULTS

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ABSTRACT

Background:
The relationship between socioeconomic status and physical fitness level is unclear. Therefore, this study examined the relationship between socioeconomic factors and physical fitness among Korean adults.

Participants:
A retrospective analysis of the physical fitness and demographic data extracted from the 2013 National Fitness Award project conducted in Korea. The data from 1,690 men and 1,982 women, 19–64 years-old, were included. Sampling strategy, using 14 clusters and stratification levels, ensured a national representation of the Republic of Korea. The following physical fitness variables were included in the analysis: time on the 50 metre dash run, repetitions of shuttle run, distance of standing long jump, distance of sit-and-reach, number of sit-ups in 1 minute, and grip strength. Multivariate logistic regression analyses were performed to examine whether physical fitness levels were related to occupation (physically active, non-active and other), household income (divided into quartiles) and location of residence (rural or urban), adjusting for age and sex.

Results:
Participants with physically active occupations had higher fitness levels than those with non-active and other occupations. As the household income increased, the fitness levels also tended to increase. Participants living in a small city had higher fitness levels than those living in a large city, except on the 50 metre dash run.

Conclusions:
Physical fitness variables could be affected by socioeconomic status.

Keywords: *household income, occupation, region, physical fitness, socioeconomic factors*

Physical activity is defined as any movement of the body that results in energy expenditure. When physical activity is performed in a planned, structured and repetitive manner, it is known as physical exercise.1 Physical fitness refers to a set of innate or acquired components that are related to health, athletic performance and a person's functional capacity to perform physical activity.[1] In this way, physical activity, physical fitness and health are implicitly associated. Both direct and indirect relationships have been described between physical activity and fitness and the risk for diseases, including cardiorespiratory and cardiovascular disease, diabetes and obesity.[2,3]

Previous studies have reported a lower risk of disease among men, women and children living in rural areas, compared to city dwellers, due to higher levels and intensity of physical activity performed.[4–6] In contrast, another study reported that children in urban areas had better physical fitness levels and blood lipid profiles than those in rural regions.[7] Therefore, there are conflicting results regarding the relationships between residence area and fitness and physical activity levels.

In terms of socioeconomic status (SES), it was reported that children of middle and high SES families tend to show better physical fitness than those with a lower SES.[8–10] About 80% of noncommunicable diseases, such as diabetes, cancer and cardiovascular disease, occur in countries with low and middle-income residents.[11] Therefore, income status can affect the health of people, as well as their fitness, including physical activity levels.

Various studies have also explored the association between occupational physical activity and physical fitness. Although some studies have reported that physically active jobs exert a protective effect against cardiovascular events[12,13] and death,[14,15] other studies have shown that physically active employment increases the risk of mortality due to cardiovascular causes.[16] To our knowledge, the association between fitness components and socioeconomic variables has not been sufficiently examined. As such, the aim of our study was to examine the relationship between socioeconomic factors and physical fitness components among Korean adults.

METHODS

Participants

Our retrospective analysis used data from the National Fitness Award project, conducted by the Korean Ministry of Culture, Sports and Tourism and the Korea Institute of Sport Science (KISS) in 2013. A total of 3674 adults (1,690 men and 1,984 women) participated in this project. Upon review of the data, 2 women who had made errors on the self-report questionnaire were excluded, with the 3,672 participants (1,690 men and 1,982 women) entered in the analysis. The sampling method allocated participants to one of 14 clustering and stratification groups, ensuring that sufficient data were obtained from all regions of the Republic of Korea to provide a nationally representative sample of participants. The details of the data collection procedure have been previously described.[17] All study procedures were approved by the Korean Ministry of Culture, Sports and Tourism and the KISS, on January 12, 2015. The demographic characteristics of the study participants are summarized in Table 1.

Dependent Variables

The following dependent variables were used in the analysis: physical activity status of occupation, household income and place of residence. Physical status of occupation was evaluated by a self-report questionnaire, using a 3-point Likert-type scale: 1, physically active [sales and service workers]; 2, non-active [experts, officers, private business workers]; and 3, others [students, housewives, and unemployed participants]. Household income was categorized on a 4-point Likert-type scale as follows: 1, ≤ 700,000 won, annually; 2, 700,001 to 2,030,000 won, annually; and 3, 2,030,001 to 3,500,000 won, annually; and 4, ≥ 3,500,001 won, annually (1 USD=approximately 1,200 won). Location of residence was categorized on a 3-point Likert-type scale, as follows: 1, large metropolis; 2, small city; and 3, rural.

Independent Variables

Fitness level was classified as either high (first, second and third rank on the standard of national fitness survey, according to age) or low (below the third rank). Grip strength was used as a measure of general

TABLE 1 Demographic and Physical Fitness Variables of Our Study Group

Variables		Men (n = 1,690)	Women (n = 1,982)
Age (years)		42.72 ± 13.16	43.01 ± 13.24
Height (cm)		172.56 ± 6.22	159.25 ± 5.62
Weight (kg)		72.19 ± 9.51	57.08 ± 7.50
Body mass index (kg/m^2)		24.21 ± 2.70	22.52 ± 2.91
50 m dash run (seconds)		9.62 ± 4.85	12.13 ± 3.63
Shuttle run (repetitions)		36.72 ± 20.10	21.44 ± 12.05
Standing long jump distance (cm)		199.23 ± 35.83	137.12 ± 31.34
Sit-and-reach (cm)		10.02 ± 9.39	15.55 ± 8.45
Sit-ups (repetitions)		35.18 ± 14.23	21.73 ± 14.57
Grip strength (kg)		41.73 ± 7.50	24.85 ± 8.05
Occupation	Physically active	519 (30.71)	415 (20.94)
	Non-active	800 (47.34)	649 (32.74)
	Others	371 (21.95)	918 (46.32)
House income (annually) (1$ US=1,200 won)	≤ 700,000 won	164 (9.70)	276 (13.93)
	700,001 – 2,030,000 won	422 (24.97)	727 (36.68)
	2,030,001 – 3,500,000 won	696 (41.19)	506 (25.53)
	≥ 3,500,001 won	408 (24.14)	473 (23.86)
Region	Large city	708 (41.89)	946 (47.73)
	Small city	773 (45.74)	851 (42.94)
	Rural	209 (12.37)	185 (9.33)

Data are expressed as means ± standard deviations or n (%)

muscle strength. Grip strength was measured using a dynamometer (Grip-D, T.K.K. 5401, Takei, Niigata City, Japan), with the maximum value from 3 trials, recorded in units of 0.1 kg, used for analysis. The number of sit-ups completed was used as a measure of muscle endurance. Participants performed sit-ups with their arms folded across their chest, with their hands touching their shoulders, and sitting up until their elbows touched their thighs. The number of sit-ups completed in 1 min was recorded for analysis. The 50 metre dash run was used as a measure of speed. Participants ran the distance at their maximal speed and the time required was recorded for analysis. The sit-and-reach was used as a measure of flexibility. Flexibility was measured using the T.K.K.5111 sit-and-touch system (Takei, Niigata City, Japan). Participants assumed a long sitting position, maintaining their knees extended, and were asked to bend forward, reaching toward their toes. The maximum distance, measured to 0.1 cm, was recorded for analysis. The 20-metre shuttle run was used as a measure of cardiovascular endurance. Participants ran back and forth continuously between 2 lines, set 20 metres apart, until exhaustion, with the number of repetitions completed recorded for analysis. Lastly, the standing long jump distance was used as a measure of power. Participants were asked to jump forward as far as possible, starting from a standing position on both feet. The maximum distance, measured to a unit of 1 cm, was recorded for analysis.

Covariate Variables

Age and sex were entered as covariates for the analysis. The age and sex reported by participants in the National Fitness Award project was used without any modification.

Statistical Analysis

The pooled data for this study are presented as means ± standard deviations. Multivariate logistic regression analyses were performed to examine whether fitness level was related to occupation, household income and residence, adjusting for age and sex. The analyses were performed using SAS version 9.2 (SAS Institute, Cary, NC, USA). Statistical significance was set at $p<0.05$.

RESULTS

The results of the multivariate logistic regression analyses, to determine the odds ratio (OR) of being in the high physical fitness group, are reported in Table 2. All reported OR and 95% confidence interval (95% CI) are adjusted for age and sex. For all physical fitness variables tested, the reference groups were those with a physically active occupation, in the 1st quartile of annual income and living in a large city. The following significant ORs were identified.

Using the data from the 50-metre dash run, the ORs (95% CI; *p*-value) of being in the high physical fitness group were as follows: occupation, non-active 0.79 (0.66–0.96; $p=0.016$); household income, 2nd quartile 1.28 (1.00–1.63; $p=0.049$), 3rd quartile, 1.71 (1.34–2.18; $p<0.001$) and 4th quartile 1.86 (1.43–2.41; $p<0.001$); and residence, small cities 0.72 (0.61–0.84; $p<0.001$) and rural regions 0.70 (0.55–0.90; $p=0.005$).

Using the repetitions of shuttle run, the OR (95% CI; *p*-value) of being in the high physical fitness group were as follows: occupation, non-active 0.82 (0.68-0.99; $p=0.044$) or other 0.80 (0.65-0.97; $p=0.023$); household income, 3rd quartile 1.39 (1.09-1.78; $p=0.008$); and residence, small cities 27 (1.09-1.48; $p=0.003$).

Using the standing long jump distance, the ORs (95% CI; p-value) of being in the high physical fitness group were as follows: occupation, non-active 0.78 (0.65–0.94; $p=0.009$); household income, 3rd quartile, 1.44 (1.13–1.83; $p=0.003$) and 4th quartile, 1.43 (1.12–1.84; $p=0.005$); and residence, small cities 1.34 (1.15–1.56; –<0.001).

Using the sit-and-reach distance, the OR (95% CI; *p*-value) of being in the high physical fitness group were as follows: occupation, non-active 0.72 (0.60–0.87; $p<0.001$) or other 0.82 (0.67–0.99; $p=0.040$); and residence, small cities, 1.44 (1.24–1.68; $p<0.001$).

Using the number of sit-ups completed in 1 min, the ORs (95% CI; *p*-value) of being in the high physical fitness group were as follows: occupation, non-active 0.82 (0.68–0.99; $p=0.040$) or other 0.81 (0.67–0.98; $p=0.034$); household income, 3rd quartile 1.55 (1.22–1.97; $p<0.001$) and 4th quartile 1.52 (1.18–1.95; $p<0.001$); and residence, small cities 1.66 (1.42–1.94; $p<0.001$) and rural regions 1.70 (1.32–2.19; $p<0.001$).

Using grip strength, the OR (95% CI; *p*-value) of being in the high physical fitness group were as follows: occupation, non-active 0.63 (0.52–0.75; $p<0.001$) or other 0.63 (0.52–0.77; $p<0.001$); house hold income, 3rd quartile 1.66 (1.32–2.10; $p<0.001$) and 4th quartile 1.67 (1.31–2.14; $p<0.001$); residence, small cities 1.61 (1.38–1.87; $p<0.001$) and rural regions 1.59 (1.24–2.04; $p<0.001$).

DISCUSSION

This study examined the relationship between socioeconomic factors and fitness level in Korea. Our results indicate that people with physically active occupations had higher fitness levels than those with non-active and other occupations. As household income increased, the fitness level also tended to increase. On the other hand, people living in small cities and rural areas had higher fitness levels than people living in large cities.

The 50-metre dash run, which was used as a measure of speed, increased with the level of household income but decreased with residence in a rural area. Sit-ups, a measure of muscular endurance, and grip strength, a general measure of muscle strength, were significantly influenced by SES, being significantly higher among participants with physically active occupations, higher household income and residence in rural areas than in those with non-active occupations, lower income and residence in urban areas.

TABLE 2. Results of the Multivariate Logistic Regression Analyses for Physical Fitness Level in Relation to Occupation, Household Income and Location of Residence in Korean Adults

Variables		Physical fitness level vs. occupation, household income, and region																	
		50 m dash run			Shuttle run			Standing long jump			Sit and reach			Sit-ups			Grip strength		
		OR	95% CI	*P*	OR	95% CI	*P*	OR	95% CI	*P*	OR	95% CI	*p*	OR	95% CI	*p*	OR	95% CI	*p*
Occupation	Physically active	Reference			Reference			Reference			Reference			Reference			Reference		
	Non-active	0.79	0.66-0.96	0.016**	0.82	0.68-0.99	0.044*	0.78	0.65-0.94	0.009**	0.72	0.60-0.87	<0.001***	0.82	0.68-0.99	0.040*	0.63	0.52-0.75	<0.001***
	Others	0.98	0.80-1.20	0.859	0.80	0.65-0.97	0.023*	1.01	0.83-1.23	0.892	0.82	0.67-0.99	0.040*	0.81	0.67-0.98	0.034*	0.63	0.52-0.77	<0.001***
Household income	Quartile 1	Reference			Reference			Reference			Reference			Reference			Reference		
	Quartile 2	1.28	1.00-1.63	0.049*	1.03	0.81-1.31	0.831	1.17	0.92-1.49	0.199	1.07	0.84-1.37	0.572	1.15	0.90-1.45	0.263	1.23	0.98-1.56	0.078
	Quartile 3	1.71	1.34-2.18	<0.001***	1.39	1.09-1.78	0.008**	1.44	1.13-1.83	0.003**	1.04	0.81-1.32	0.772	1.55	1.22-1.97	<0.001***	1.66	1.32-2.10	<0.001***
	Quartile 4	1.86	1.43-2.41	<0.001***	1.20	0.93-1.55	0.152	1.43	1.12-1.84	0.005**	0.93	0.72-1.19	0.546	1.52	1.18-1.95	<0.001***	1.67	1.31-2.14	<0.001***
Region	Large city	Reference			Reference			Reference			Reference			Reference			Reference		
	Small city	0.72	0.61-0.84	<0.001***	1.27	1.09-1.48	0.003**	1.34	1.15-1.56	<0.001***	1.44	1.24-1.68	<0.001***	1.66	1.42-1.94	<0.001***	1.61	1.38-1.87	<0.001***
	Rural	0.70	0.55-0.90	0.005**	0.89	0.70-1.13	0.345	1.24	0.97-1.59	0.085	1.07	0.85-1.36	0.568	1.70	1.32-2.19	<0.001***	1.59	1.24-2.04	<0.001***

OR; Odds Ratio, CI; Confidence Interval

p<0.05, p<0.01**, p<0.001***; tested by multivariable logistic regression analysis that was adjusted for the covariate variables of age and sex*

This association between SES and fitness and health levels has previously been reported. People with lower SES are less likely to be physically active than those in higher socioeconomic groups and, therefore, to be at higher risk of lower physical fitness and of acquiring diseases related to physical inactivity.[18,19] A previous study reported that high school girls with a high SES were more likely than those with a low SES to be able to run 1 mile, which is a measure of cardiovascular fitness.[20] Mutunga et al. also reported higher cardiorespiratory fitness among adolescents with higher SES than among those with a lower SES.[21] In our study, adults with a higher SES were better able to perform the shuttle run, a measure of cardiorespiratory fitness, than those with a lower SES, with this difference reaching statistical difference from those in the 3rd quartile of household income. Children with a higher SES have greater levels of average daily energy expenditure ($p<0.01$) than those from lower SES, as well as spending more time in their day performing both moderate and vigorous activities ($p<0.05$).[22] Recently, several studies have suggested that families with lower SES have lower levels of physical activity and physical fitness than those with higher SES.[23–25] This is an important finding when we consider that physical activity level affects the lifetime fitness and health level.

Women at a disadvantage, both financially and with regard to living environment, are at higher risk for higher body mass index and coronary heart disease risk.[26] Women who live on a reduced household income, as well as those who are older and have less education, are at higher risk of lacking exercise.[27,28] In addition, lower physical fitness levels and higher rates of obesity have been reported for children in families with a lower household income than those in families with a high household income.[29] It was reported that low-income employees face significant work-related (long hours) and financial barriers to achieving physical activity goals.[30] Our results were consistent with those of previous reports. In addition, we reported that participants with a higher household income level had a significantly better performance on the 50-metre dash run (speed), sit-ups (muscular endurance) and grip strength (muscular strength) than the performance of those with lower household income levels.

With regard to children, those living in urban areas tend to be at higher risk for inactivity, obesity and decreased flexibility and muscle endurance than those living in more rural areas.[31] By contrast, men who live in rural areas tend to have lower fitness levels and to be at higher risk for obesity, smoking and hypertension than those who live in urban areas.[32] In our study, we identified a higher level of fitness (including the 50-metre dash run, sit-ups and grip strength tests) among adults living in small cities and rural areas compared to those who lived in larger cities. We also identified a benefit of a physically active occupation on fitness levels, muscle endurance and strength, over non-active occupations.

The main limitation of our study is that we did not consider confounding variables, such as metabolic syndrome, obesity, hypertension, and other medical condition. Furthermore, it is important to note that because of the cross-sectional nature of the data we extracted from the National Fitness Award project for analysis and the retrospective design of our study, only the interrelationship between socioeconomic factors and physical fitness could be evaluated, with no evaluation of cause-and-effect being possible. However, our data sample was representation of adults throughout the Republic of Korea, which is a distinct advantage over smaller regional studies that have previously been reported. Therefore, we believe that the results represent the true relationship between socioeconomic factors and physical fitness variables among Korean adults.

In conclusion, performance on the 50-metre dash run, sit-ups and grip strength exercises was significantly higher among adults with physically active occupations, higher household income and living in rural areas, compared to those with non-active occupations, lower household income and living in urban areas. Therefore, physical fitness may be affected by SES.

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