

# The relationship between mental stress levels and physical fitness variables in adults and elderly persons

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## INTRODUCTION

- Regular physical activity (PA) is reported to have a positive effect on mental disorders such as depression, mental fatigue, and anxiety. It is also reported to improve cognitive function and reduce the risk of chronic diseases such as hypertension, cardiovascular disease, obesity, diabetes, and metabolic syndrome (1-3). Physical Activity Guidelines for Americans have presented strong evidence on the importance of PA in health management, as well as ample scientific evidence on the effect of PA on general health (4). Interestingly, recent studies have shown that psychological stress can inhibit participation in regular exercise (5-6). In addition, psychological stress can lead to depression, a more sedentary lifestyle, and decreased PA (7).
- Although the mechanism of the negative impact of psychological stress on participation in PA is not clear yet, the pathological mechanism of psychological stress suggests that it induces chronic disease by hypothalamus-pituitary gland-adrenal activation, long-term endotheliocyte malfunction, increased inflammation, and decreased autonomic neurological control. It also causes negative health-related behavior including lack of sleep, drinking, and smoking, resulting in an increased risk of developing chronic diseases (8). Thus, in addition to the general understanding that regular exercise has a positive effect on mental health by relieving stress, the converse relationship, that an increase in stress may result in less physical activity, needs to be investigated.
- PA is known to be closely related to fitness levels. Many studies have already reported that participating in regular PA promotes physical health and affects various physical fitness variables in adults (9). Although a number of studies have demonstrated that increased stress can reduce PA, it is necessary to evaluate the association by investigating whether PA is reduced by stress levels, which then leads to a decrease in fitness. Therefore, the purpose of this study was to examine the relationship between mental stress levels and physical fitness variables in adults and elderly persons by evaluating participants in a nationwide study conducted in Korea.

Table 1. Physical characteristics of the participants

Variables	Adults (N = 2,830)		Elderly (N = 628)		
	Men (n = 1,683)	Women (n = 1,147)	Men (n = 263)	Women (n = 365)	
Age (years)	38.17 ± 12.71	39.41 ± 13.10	72.19 ± 5.25	73.60 ± 5.87	
Height (cm)	173.11 ± 6.11	160.04 ± 5.69	165.81 ± 5.52	153.85 ± 5.49	
Weight (kg)	73.15 ± 9.71	56.99 ± 7.70	66.41 ± 7.97	56.67 ± 7.20	
Body mass index (kg/m <sup>2</sup> )	24.39 ± 2.85	22.27 ± 2.95	24.13 ± 2.43	23.94 ± 2.84	
Physical fitness	Grip strength (kg)	42.75 ± 9.09	25.01 ± 5.98		
	Sit-ups (reps/60 sec)	34.75 ± 11.94	21.00 ± 12.37		
	Standing long jump (cm)	197.71 ± 31.59	139.85 ± 26.26		
	The 50-m dash (sec)	8.89 ± 1.69	11.33 ± 2.00		
	Sit-and-reach (cm)	9.37 ± 8.42	14.72 ± 8.23		
	The 20-m shuttle-run (sec)	32.87 ± 17.15	18.16 ± 8.26		
	Grip strength (kg)			32.14 ± 7.71	20.48 ± 5.40
	Sit-ups (reps/60 sec)			13.21 ± 9.90	5.32 ± 7.44
	Sit-to-stand (reps/30 sec)			19.29 ± 7.76	16.22 ± 6.42
	Sit-and-reach (cm)			4.21 ± 8.92	10.61 ± 8.58
	Back scratch (cm)			-9.58 ± 12.28	-3.90 ± 10.13
	One-leg standing test with eyes open (sec)			32.78 ± 34.51	22.35 ± 25.91
	Six-minute walk (m)			552.86 ± 123.71	485.68 ± 135.59
Mental stress level	Very low or low	304 (18.1)	209 (18.2)	94 (35.7)	107 (29.3)
	Normal	950 (56.4)	674 (58.8)	139 (52.9)	209 (57.3)
	High or very high	429 (25.5)	264 (23.0)	30 (11.4)	49 (13.4)

Results are expressed as mean ± standard deviation or n (%).

Table 2. Differences in physical fitness variables based on mental stress levels in adult participants (aged 20 to 64 years)

	Group 1	Group 2	Group 3	Overall F	Overall p
Men (n = 304)	(n = 950)	(n = 429)			
Grip strength (kg)	42.00 ± 9.16	43.00 ± 9.02	42.74 ± 9.20	1.369	0.255 N/S
Sit-ups (reps/60 sec)	35.20 ± 14.01	34.95 ± 11.44	33.99 ± 11.41	1.237	0.290 N/S
Standing long jump (cm)	196.60 ± 33.97	197.47 ± 31.02	199.03 ± 31.10	0.589	0.555 N/S
The 50-m dash (sec)	8.93 ± 1.68	8.89 ± 1.77	8.87 ± 1.53	0.134	0.874 N/S
Sit-and-reach (cm)	10.08 ± 8.48	9.20 ± 8.59	9.26 ± 7.96	1.304	0.272 N/S
The 20-m shuttle-run (sec)	33.67 ± 18.70	32.71 ± 16.94	32.64 ± 16.49	0.414	0.661 N/S
Women (n = 209)	(n = 674)	(n = 264)			
Grip strength (kg)	25.10 ± 5.75	25.44 ± 6.05 N/S	23.83 ± 5.87 N/S	6.997	<0.001***
Sit-ups (reps/60 sec)	20.46 ± 12.98	21.07 ± 12.06	21.27 ± 12.68	0.268	0.765 N/S
Standing long jump (cm)	136.11 ± 26.37	141.18 ± 26.06 #	139.40 ± 26.48 N/S	3.035	0.048*
The 50-m dash (sec)	11.63 ± 2.19	11.27 ± 1.93	11.26 ± 1.99	2.857	0.058 N/S
Sit-and-reach (cm)	16.23 ± 7.31	14.42 ± 8.22 #	14.28 ± 8.80 #	4.383	0.013*
The 20-m shuttle-run (sec)	17.35 ± 9.19	18.50 ± 7.98	17.92 ± 8.16	1.673	0.188 N/S

Results are expressed as mean ± standard deviation

\*p < 0.05; \*\*p < 0.01; \*\*\*p < 0.001; tested by one-way analysis of variance

Group 1 = very low or low mental stress level; Group 2 = normal mental stress level; Group 3 = high or very high mental stress level

N/S, not significant; #p < 0.05 compared with Group 1; Tukey's post-hoc testing

Table 3. Differences in physical fitness variables based on mental stress levels in elderly participants (aged over 65 years)

	Group 1	Group 2	Group 3	Overall F	Overall p
Men (n = 94)	(n = 139)	(n = 30)			
Grip strength (kg)	32.09 ± 8.34	32.27 ± 7.56	31.66 ± 6.42	0.080	0.923 N/S
Sit-ups (reps/60 sec)	13.94 ± 10.58	12.50 ± 9.74	14.23 ± 8.39	0.765	0.466 N/S
Sit-to-stand (reps/30 sec)	18.39 ± 7.12	19.52 ± 8.13	21.00 ± 7.80	1.422	0.243 N/S
Sit-and-reach (cm)	4.59 ± 8.99	3.97 ± 8.70	4.16 ± 9.89	0.136	0.872 N/S
Back scratch (cm)	-9.00 ± 12.53	-10.69 ± 12.11	-6.28 ± 11.94	1.765	0.173 N/S
One-leg standing test with eyes open (sec)	30.07 ± 36.84	35.03 ± 33.79	30.89 ± 30.30	0.628	0.535 N/S
Six-minute walk (m)	548.67 ± 124.52	554.23 ± 127.82	559.67 ± 103.38	0.107	0.898 N/S
Women (n = 107)	(n = 209)	(n = 49)			
Grip strength (kg)	19.61 ± 4.02	21.01 ± 5.92	20.16 ± 5.52	2.499	0.084 N/S
Sit-ups (reps/60 sec)	6.07 ± 8.18	5.29 ± 7.37	3.80 ± 5.78	1.585	0.206 N/S
Sit-to-stand (reps/30 sec)	15.46 ± 6.05	16.72 ± 6.81	15.76 ± 5.27	1.528	0.218 N/S
Sit-and-reach (cm)	11.22 ± 7.98	9.90 ± 8.92	12.32 ± 8.19	1.969	0.141 N/S
Back scratch (cm)	-5.76 ± 9.86	-3.25 ± 10.16	-2.60 ± 10.22	2.660	0.071 N/S
One-leg standing test with eyes open (sec)	21.38 ± 27.43	22.62 ± 24.96	23.29 ± 26.98	0.118	0.889 N/S
Six-minute walk (m)	485.78 ± 131.27	490.60 ± 138.97	464.53 ± 130.79	0.733	0.481 N/S

Results are expressed as mean ± standard deviation

N/S, not significant; tested using the one-way analysis of variance

Group 1 = very low or low mental stress level; Group 2 = normal mental stress level; Group 3 = high or very high mental stress level

## CONCLUSION

There is little or no significant difference in the physical fitness variables of Korean adults and elderly persons under different levels of mental stress. We conclude that mental stress levels do not affect physical fitness variables among the Korean population.