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Comparison of Physical Fitness Status between Middle-aged and Elderly Male Laborers According to Lifestyle Behaviors

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Abstract. [Purpose] We sought to examine the relationship between lifestyle behavior and physical fitness in middle-aged and elderly laborers. [Subjects] In total, 2,469 male laborers between 45 and 64 years of age residing in eight cities in South Korea were studied between January and December 2007. [Methods] Age, height, and weight were evaluated as general characteristics. Lifestyle behavior items included exercise, dietary habits, smoking, drinking, and sleeping hours. Physical fitness was assessed by measuring muscle strength, muscle endurance, flexibility, reflexes, and agility. [Results] In terms of physical fitness status, all items except handgrip strength showed significant changes according to exercise frequency. Dietary habits were associated with significant differences in the Sargent jump and whole-body reaction time between groups. Smoking and drinking were associated with significant differences in sit-ups between subgroups. Sleeping hours demonstrated significant differences in the Sargent jump and whole-body reaction time between groups. [Conclusion] Although there were differences according to physical fitness status, exercise frequency, dietary habits, smoking, drinking, and sleeping hours showed significant associations with physical fitness. Thus, healthy lifestyle behaviors, such as regular exercise, regular dietary habits, not smoking, moderate drinking, and adequate sleep, are important for physical fitness management and work capacity improvement in middle-aged and elderly laborers.

Key words: Lifestyle behaviors, Middle-aged and elderly laborers, Physical fitness

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INTRODUCTION

South Korea has seen a rapid increase in its older-aged population due to its low birthrate and extended life span[4)]. An aging population will bring about diverse problems in individuals and society. As the number of main economically active people (aged between 25 and 49) and economically active people (aged between 15 and 64) decreases, the labor supply will decrease, affecting the nation's economic growth negatively[1)]. Also, generational imbalance will arise in the population composition, putting a heavier burden of supporting the elderly on young adults and middle-aged people[2)]. However, Korean Society has yet to prepare well for its aging population and low birthrate. The country has only one social security system consisting of a basic people's livelihood protection system for the poorest class, excluding the national health insurance scheme. Its postretirement national pension plan covers only 40% of the original income amount, falling short of being a fully reliable income support for the elderly.

The total employment rate for middle-aged and elderly laborers in South Korea is relatively high among those of the OECD members. This signals that the decrease in the country's labor force increased the ratio of older-aged employees at labor sites and that middle-aged and elderly people are trying to engage in labor-related jobs more actively for their livelihood as they face insufficient total incomes and social security levels[3)]. Such a trend of laborers aging could cause surging industrial accidents. Laborers over 50 are more vulnerable to industrial accidents than people in other age groups. In particular, they are involved in more work-related accidents and construction field accidents[1)]. This is because as people age, their reflexes, agility, balance, eyesight, etc., become weaker. Physical fitness of middle-aged and elderly laborers is an important factor in maintaining safety in the workplace and health after retirement.

Physical fitness means the ability to perform daily and physical activities. Physical fitness is a broader idea separated health-related physical fitness and performance-relat-

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ed physical fitness. Health related physical fitness includes cardiorespiratory fitness, muscular strength, muscular endurance, flexibility, and body composition. Performance-related physical fitness includes agility, balance, coordination, power, reaction time, and speed[5, 6]. Human physical fitness drops rapidly from between 35 and 39 years of age, and the physical fitness of middle-aged and elderly laborers is reduced by up to 10% compared with the peak level of the 20s[7].

An individual's physical fitness is determined by their own lifestyle behaviors[8]. Bad lifestyle behaviors hugely damage physical development and physical fitness and affect mental development as well. According to a previous study, people with sound desirable lifestyle behaviors maintain about 30 year younger physical health than those without[9]. As such, lifestyle behaviors function importantly in health maintenance or disease development.

It is important in managing health to take life cycle stage-specific approaches. The middle-age health status determines the older-age health status and beyond. Therefore, health management in middle-aged and elderly people needs to be improved[10]. In order to help middle-aged people follow sound lifestyle behaviors and receive regular medical checkups and other preventive medical services for personal health care, diverse public and private-level efforts are necessary including health education and public promotion, local community health projects, and office and workplace health management programs. Recognizing this, this research sought to examine the relationship between lifestyle behaviors and physical fitness by studying middle-aged and elderly laborers between 45 and 64 with a view of providing basic data for healthcare national policy establishment and private-sector protection structures.

SUBJECTS AND METHODS

In this research, 2,469 male laborers between 45 and 64 years of age residing in eight cities in South Korea were studied between January and December 2007. The subjects were selected as those within the normal blood pressure range who had no abnormality in heart rate during maximum oxygen consumption and after oxygen consumption had stabilized. The participants were a random sample of male laborers. The research subjects were informed about the research process and signed a consent form for research participation.

For general characteristics and lifestyle behaviors, we performed a survey to collect data. The general characteristic items were age, height, and weight. The lifestyle behavior items were exercise, dietary habits, smoking, drinking, and sleeping hours. Physical fitness was evaluated with a Mobile Helmas III system (O2run, Seoul, Republic of Korea) to look at muscular strength, muscular endurance, flexibility, reflexes, and agility. The measurement items were sit-ups, handgrip strength, sit and reach, the Sargent jump, and whole-body reaction time.

Handgrip strength was measured when the subjects gripped a dynamometer with their maximum strength. The dominant hand of each subject was measured twice, and the higher result was recorded. For sit-ups, the subjects sat up in response to a sound generated by a sensor, stopping when their elbows reach their thighs, this was repeated for 30 seconds. For sit and reach, the subjects sat with their legs straight out in front of them with their knees straight, bent their upper bodies forward as far as possible, and then maintained that position for at least 2 seconds. The position was measured twice, and the higher result was recorded. For the Sargent jump, the subjects stood on a mat with attached sensors and jumped, and the duration in the air was then measured. For the whole-body reaction time examination, the subjects stood on a jumping board with their knees slightly bent (120°–160°) in a position in which they were ready to jump and then quickly jumped vertically in response to a light or sound signal. The move was repeated 5 times to record the average in meters/second. Larger values for handgrip strength, sit-ups, sit and reach, and the Sargent jump indicate better performance, whereas smaller values in whole-body reaction time indicate better performance.

SPSS 18.0 was used for the data analysis. Descriptive statistics were used for the general characteristics. To compare physical fitness according to lifestyle behaviors, we performed the independent two-sample t-test, one-way ANOVA, and Duncan's post hoc test. A p value under 0.05 was considered significant.

Table 1. General characteristics of the survey participants

	45–54 years old (n=2,197)	55–64 years old (n=272)
Height (cm)	169.33 ± 5.35	167.20 ± 6.06
Weight (kg)	68.69 ± 8.29	66.15 ± 7.87

RESULTS

The characteristics of the participants are described in Table 1.

Exercise frequency-specific physical fitness statuses of the participants are shown in Table 2. Sit-ups results showed significant change among the three groups ($p<0.05$). Handgrip strength showed no significant change among the three groups ($p>0.05$). The Sargent jump results showed significant changes in the groups performing it at least 3 times a week and 2 times or less a week compared with the group that hardly ever performed it ($p<0.05$). Sit and reach results showed a significant change in the group performing it at least 3 times a week compared with the other two groups ($p<0.05$). Whole-body reaction time showed significant changes in the groups performing it at least 3 times a week and 2 times or less a week compared with the group that hardly ever performed it ($p<0.05$).

Dietary habit-specific physical fitness changes are shown in Table 3. The Sargent jump results and whole-body reaction time were found to change significantly between the two groups ($p<0.05$). The rest of the items showed no significant change among the groups ($p>0.05$).

Smoking-related physical fitness differences in the groups are shown in Table 4. Significant changes in perfor-

Table 2. Comparison of physical fitness measurements among the groups according to exercise frequency

	At least 3 times a week (n=199)	2 times or less a week (n=756)	Hardly perform (n=714)
Sit-ups (time)	19.30 (4.53)*,a	18.62 (4.05)b	17.16 (4.42)
Handgrip strength (kg)	43.67 (6.02)	43.49 (5.47)	42.99 (5.88)
Sargent jump (cm)	33.11 (7.87)*	33.13 (7.95)b	31.99 (7.81)
Sit and reach (cm)	13.34 (7.73)*,a	12.38 (7.67)	12.07 (7.69)
Whole-body reaction time (m/sec)	287.80 (95.87)*	288.28 (95.19)c	307.63 (122.80)

Values are means (SD). *p<0.05 for comparison of means among the three groups. aThe value for at least 3 times a week is significantly greater than those for 2 times or less a week and hardly perform. bThe value for 2 times or less a week is significantly greater than that for hardly perform. cThe value for 2 times or less a week is significantly lesser than that for hardly perform.

Table 3. Comparison of physical fitness measurements among the groups according to dietary habit

	Regular (n=1,805)	Irregular (n=664)
Sit-ups (time)	18.56 (4.36)	18.22 (4.65)
Handgrip strength (kg)	43.42 (5.85)	43.40 (5.73)
Sargent jump (cm)	33.04 (7.87)*	32.12 (7.92)
Sit and reach (cm)	12.81 (7.82)	12.30 (7.43)
Whole-body reaction time (m/sec)	289.74 (100.16)*	304.39 (114.94)

Values are means (SD). *p<0.05 for comparison of means among the two groups.

Table 4. Comparison of physical fitness measurements among the groups according to smoking habit

	Nonsmoking (n=870)	Smoking cessation (n=1,427)	Smoking (n=793)
Sit-ups (time)	18.71 (4.68)*,a	18.61 (4.52)	18.10 (4.13)
Handgrip strength (kg)	43.58 (6.18)	43.45 (5.66)	43.26 (5.78)
Sargent jump (cm)	32.98 (8.07)	32.48 (7.83)	33.11 (7.84)
Sit and reach (cm)	12.81 (7.44)	12.89 (7.66)	12.27 (7.99)
Whole-body reaction time (m/sec)	289.33 (98.88)	291.81 (100.89)	299.59 (113.24)

Values are means (SD). *p<0.05 for comparison of means among the three groups. aThe value for the non-smoking group is significantly greater than those for the smoking cessation and smoking groups.

Table 5. Comparison of physical fitness measurements among the groups according to drinking habits

	Nondrinking (n=750)	Twice or less a week (n=1,304)	At least 3 times a week (n=415)
Sit-ups (time)	18.07 (4.55)*,a	18.64 (4.42)	18.68 (4.28)
Handgrip strength (kg)	43.27 (5.95)	43.44 (5.80)	43.60 (5.67)
Sargent jump (cm)	32.29 (7.60)	32.96 (7.92)	33.16 (8.28)
Sit and reach (cm)	12.77 (7.62)	12.66 (7.84)	12.55 (7.549)
Whole-body reaction time (m/sec)	298.66 (108.79)	291.66 (104.406)	291.03 (96.62)

Values are mean (SD). *p<0.05 for comparison of means among the three groups. aThe value for the non-drinking group is significantly greater than those for the twice or less a week and at least 3 times a week group.

mance were observed for sit-ups in the nonsmoking group compared with smoking cessation group and smoking group (p<0.05). The rest of the items showed no significant change among the groups (p>0.05).

Drinking-related physical fitness differences in the groups are shown in Table 5. The nondrinking group showed significant differences in sit-ups compared with the group drinking twice or less a week and the group drinking at least 3 times a week (p<0.05). The rest of the items showed no significant change among the groups (p>0.05).

Table 6. Comparison of physical fitness measurements among the groups according to hours of sleep

	At least 9 hours (n=125)	7–8 hours (n=1,500)	6 hours or less (n=844)
Sit-ups (time)	18.19 (4.51)	18.464 (4.50)	18.53 (4.34)
Handgrip strength (kg)	43.36 (5.81)	43.41 (5.81)	43.45 (5.84)
Sargent jump (cm)	34.71 (8.10)*,a	32.71 (7.87)	32.66 (7.86)
Sit and reach (cm)	11.71 (6.71)	12.72 (7.78)	12.73 (7.74)
Whole-body reaction time (m/sec)	329.256 (126.68)*,a	289.77 (99.54)	295.36 (108.55)

Values are means (SD). *p<0.05 for comparison of means among the three groups. [a]The value for the at least 9 hours group is significantly greater than those for the 7–8 hours and 6 hours or less groups.

Sleep duration-related physical fitness differences in the groups are shown in Table 6. The group with at least 9 hours of sleep showed significant differences in the Sargent jump and whole-body reaction time compared with the group with 7–8 hours of sleep and the group with 6 or fewer hours of sleep ($p<0.05$). The rest of the items showed no significant change among the groups ($p>0.05$).

DISCUSSION

Modern industrial society development has brought new lifestyle behaviors including a lack of physical exercise, diverse stresses, smoking, and drinking, which undermine human physical functionality[11]. Physical fitness is affected not only by the aging process or genetic factors but also by health behaviors such as exercise, drinking, smoking, and diet[8]. According to previous research, a group exercising 3 times a week or more had higher flexibility and endurance than groups that did not[12], and the groups had better reflexes and agility as well[13]. This is consistent with the finding in the present research that the regularly exercising group showed a generally higher physical fitness status than the groups that did not. In a previous study on groups of male smokers and nonsmokers in their 40s, the male nonsmokers showed higher muscular endurance and muscular strength than the male smokers[14]. Flexibility and agility, too, were statistically significantly higher in the nonsmoking group than in the smoking group[14]. The present research also found the identical outcome, with the nonsmoking group having higher muscular endurance, muscular strength, flexibility, and agility than the smoking group. In previous research, a group with regular dietary habits showed larger physical fitness improvement than a group with irregular dietary habits[15], which is consistent with the findings of the present research. In this research, though not statistically significant, the nondrinking group showed lower physical fitness factors than the drinking group. In a previous study on the effect of drinking on physical fitness, the difference in physical fitness between drinkers and nondrinkers was not statistically significant. Rather muscular strength, muscular endurance, and agility were higher in the drinking group[16]. In regard to males, drinking frequency was found to be related to the basic physical fitness variables, and a moderate drinking group was found to have mostly higher basic physical fitness factors than other groups (nondrinkers and drinkers)[17]. In the case of South Korea, a moderate drinking level is considered not drinking more than 2 times a week, in principle. In this research, the drinking frequency in the subjects was 2 times or less a week. Regarding the relationship between sleeping hours and physical fitness as studied herein, it was found that all of the physical fitness items, excluding the Sargent jump, were lower in the group with 9 or more hours of sleep compared with the others groups. Excessively longer hours of sleep was rather related to fatigue and the feeling of powerlessness[18]. It was previously reported that 7.7 hours represents an adequate amount of sleep[19]. Consequentially, this research indicated that physical fitness could be improved by certain lifestyle behaviors including regular exercise, regular dietary habits, not smoking, moderate drinking, and an adequate amount of sleep. Reduced physical fitness in middle-aged and elderly laborers is unavoidable as a human aging process, but depending upon lifestyle behaviors such as exercise habits, dietary habits, smoking, drinking, and sleeping hours, the physical fitness levels of the middle-aged and elderly laborers were found to change in this research. The physical fitness indicators used in this research-flexibility, muscular strength, and muscular endurance are associated with a high risk of disease when undermined, as emphasized by many studies concerning the importance of physical fitness in middle-aged and elderly workers[20]. Improvement of the lifestyle behaviors of middle-aged and elderly workers can be regarded as having a significant effect on enhancement of physical fitness in them.

However, many middle-aged and elderly laborers in the labor field still seem not to receive systematic health management. Excessive work and stress cause accidents due to negligence or are associated with drinking, smoking, and insufficient hours of sleep and exercise, increasing occupational diseases such as cardiovascular diseases or musculoskeletal diseases[21]. In this situation, if middle-aged and elderly laborers receive appropriate exercise programs to follow to ensure that they get regular exercise and change their lifestyle behaviors so that they are more appropriate, their physical fitness would be expected to improve along with their work capacity as well.

This research was limited with respect to the range of participating subjects, as they were only male middle-aged and elderly laborers. In this sense, it may not be generalized to every case. For this reason, follow-up studies on office workers and female workers will be necessary. Since this is cross-sectional research, the accurate temporal order of

lifestyle behaviors and physical fitness is hard to analyze. In this respect, a forward-looking cohort study will also be needed in the future.

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