



# A Comparative Analysis of Physical Fitness in Korean Police Officers: Focus on Results between 2014 to 2019

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**PURPOSE:** Maintaining physical fitness is essential for police officers to perform various physical occupational tasks. However, only a few studies have focused on the physical fitness of Korean police officers. The purpose of this study was to perform a comparative analysis of the annual results of physical fitness tests for Korean police officers between 2014 to 2019.

**METHODS:** This study analyzed the data of 372 police officers (male: 334, female: 38) including body composition, 100 m sprint, push-ups, sit-ups, and handgrip strength.

**RESULTS:** In Korean male police officers, the 100 m sprint times and push-up and sit-up counts showed statistically significant differences according to the year of the test ( $p < .001$ ); in particular, the 100 m sprint times and push-up and sit-up counts were lower in 2019 compared to those from previous years. Among Korean female police officers, only the 100 m sprint showed a statistically significant difference by year ( $p < .01$ ); similar to the male police officers, the 100 m sprint times were slower in 2019 than those from previous years.

**CONCLUSIONS:** Our study showed that the physical fitness of Korean police officers decreased over the years. There has especially been a decrease in the physical fitness of male police officers.

**Key words:** Endurance, Korea police officers, Physical fitness, Strength

## INTRODUCTION

The profession of a police officer is physically demanding [1]. Although police officers frequently perform tasks sitting down, they have to quickly chase and apprehend criminals when necessary while carrying protective personal equipment, such as weapons, expandable batons, and body armor [2]. When criminals resist arrest, the officers have to overpower and place them in handcuffs or perform other tasks to protect the general public from danger [2,3]. If police officers cannot perform these tasks, it can have a negative effect on the general public, who depend on them for their safety and protection [4].

Therefore, police officers must be physically fit to successfully perform

their duties which involve physical tasks [5-7]. For this reason, Korean police officers undergo an annual physical fitness test; the records are stored and used as a reference for career promotion [8]. Additionally, the range of the interests of sports scientists has recently expanded to include tactical populations such as police officers [9]. These trends can be observed in reports by the National Strength and Conditioning Association (NSCA) [10-14]. The NSCA developed the 'Tactical Strength and Conditioning (TSAC) program' for tactical populations [10], and several studies have been published on the physical fitness of police officers [11-14]. These studies have highlighted the need for education on the importance and positive effects of physical fitness for police officers [5], as well as the need for training programs to improve and maintain physical fit-

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ness in police officers [14].

As described above, even though physical fitness is important and emphasized for police officers to perform their duties, there is still limited research on Korean police officers. As a result, unfortunately, it is difficult to even ascertain the status or level of physical fitness in Korean police officers. To the best of our knowledge, this is the first study which examined the results of the annual physical fitness tests for Korean police officers. The purpose of this study was to conduct a comparative analysis of the physical fitness tests for Korean police officers over 6 years in 2014-2019.

## METHODS

### 1. Participants

This study included 372 police officers (male: 334, female: 38) who took the physical fitness test between 2014 to 2019 while working at the Daegu Dongbu Police Station in Daegu. The participants were excluded who were dispatched or in training, pregnant or had given birth within the last year, unable to take the test due to an accident, disease, or physical or mental impairment, and unable to participate in the test for other reasons. The male police officers ( $n=334$ ) had a mean age of  $41.8 \pm 9.0$  years, height  $174.1 \pm 4.5$  cm, weight  $76.5 \pm 8.8$  kg, and body fat percentage of  $24.1 \pm 4.8\%$ . The female police officers ( $n=38$ ) had a mean age of  $33.9 \pm 6.8$  years, height  $163.6 \pm 3.6$  cm, weight  $56.6 \pm 7.0$  kg, and body fat percentage of  $29.3\% \pm 4.9\%$ .

### 2. Body composition

In this study, we measured body composition using a bioelectrical impedance analysis device (InBody270, InBody Co., Ltd., Korea). For precise measurement, the participants were asked to abstain from high-intensity physical activity or exercise, sauna, and caffeine or alcohol consumption the day before the measurements were taken.

### 3. Physical fitness test

The physical fitness test for the Korean police officers consists of four elements: 100 m sprint, push-ups, crossed-arm sit-ups, and handgrip strength. All procedures and methods for the physical fitness test were based on the manual currently used by the Korean National Police Agency.

#### 1) 100 m sprint

The 100 m sprint was used to assess the participants' speed and was

performed on an athletics track with clearly-marked white lines. The participants took a standing position at the start line and started running on the researcher's start signal; the time taken to cross the finish line was recorded.

#### 2) Push-up

Push-ups were used to assess the participants' upper-body endurance. The participants placed their hands at shoulder width with feet together, making a  $90^\circ$  angle with their arms while keeping their body horizontal. The female participants placed their knees on the ground to form a  $90^\circ$  angle. While maintaining a straight line from their heads, the participants bent their arms to bring their body and legs within 5 cm of the mat, and then returned to their original position. Completing this movement was counted as 1 push-up. The participants tried to perform as many push-ups as possible in 1 minute.

#### 3) Sit-up

Sit-ups were used to assess the participants' abdominal endurance. The participants lay on their backs on a mat with feet about 30 cm apart, knees bent at  $90^\circ$  and crossed both arms over their chest so that their fingertips touched the opposite shoulder. The participants lifted their upper body so that both elbows touched their knees, and then returned to a lying position. One sit-up was counted only when the participant precisely touched the top of both knees with their elbows. The participants tried to perform as many crossed-arm sit-ups as possible in 1 minute.

#### 4) Handgrip strength

Handgrip strength was used to assess the participants' strength. The participants gripped the handle of a dynamometer (TKK-5401, TAKEI, Japan) at the second knuckle. While maintaining the torso and arm at an angle of  $15^\circ$ , with the elbow extended straight, the participants pulled the dynamometer as hard as possible. During measurements, the participants avoided shaking the dynamometer or bending their elbow. The left and right hands were each measured twice, and the mean of the four measurements was taken as the final handgrip strength.

### 4. Statistical analysis

The results of the study are presented as mean  $\pm$  standard deviation (SD). A one-way analysis of variance (ANOVA) was used to compare physical fitness results by year. In the event of statistically significant differences by year, the Bonferroni method was used for post-hoc testing.

**Table 1.** Comparison of physical fitness test results by year for Korean male police officers

|                         | 2014 (n=295) | 2015 (n=299) | 2016 (n=316) | 2017 (n=315) | 2018 (n=320) | 2019 (n=327) | <i>p</i> | Post hoc test                         |
|-------------------------|--------------|--------------|--------------|--------------|--------------|--------------|----------|---------------------------------------|
| 100 m sprint (sec)      | 15.5±2.0     | 15.3±1.8     | 15.1±1.4     | 14.7±1.7     | 15.1±1.8     | 16±1.8       | .000*    | a > c, d, e; b > d; a, b, c, d, e < f |
| Push-up (reps/min)      | 43.1±7.3     | 42.4±6.7     | 43.3±6.5     | 42.8±6.6     | 40.6±6.7     | 38.5±6.0     | .000*    | a, b, c > e, f; e > f                 |
| Sit-up (reps/min)       | 46.8±5.6     | 46.4±6.9     | 46.7±5.8     | 46.2±6.5     | 45.6±6.1     | 44.9±6.0     | .001*    | a, b, c > f                           |
| Hand-grip strength (kg) | 52.9±6.9     | 53.3±7.2     | 54.1±6.3     | 53.7±5.4     | 53.7±5.6     | 54.4±6.4     | .058     | -                                     |

Values are Mean ± SD. Tested by one-way analysis of variance (ANOVA).

\*Significant between group ( $p < .001$ ); Post hoc test by Bonferroni; a: 2014, b: 2015, c: 2016, d: 2017, e: 2018, f: 2019.

**Table 2.** Comparison of physical fitness test results by year for Korean female police officers

|                         | 2014 (n=24) | 2015 (n=26) | 2016 (n=34) | 2017 (n=36) | 2018 (n=34) | 2019 (n=35) | <i>p</i> | Post hoc test |
|-------------------------|-------------|-------------|-------------|-------------|-------------|-------------|----------|---------------|
| 100 m sprint (sec)      | 18.7±3.2    | 18.3±2.5    | 17.5±1.3    | 17.6±1.6    | 17.8±1.9    | 19.1±2.0    | .009*    | c, d < f      |
| Push-up (reps/min)      | 42.7±4.3    | 42.3±3.3    | 42.5±3.6    | 41.9±3.1    | 41.4±3.4    | 40.4±2.7    | .094     | -             |
| Sit-up (reps/min)       | 39.1±6.3    | 39.8±6.5    | 41.8±6.4    | 42.2±6.4    | 40.9±5.7    | 39.9±5.5    | .299     | -             |
| Hand-grip strength (kg) | 36.4±7.0    | 36.9±6.1    | 36.2±5.6    | 34.9±2.5    | 34.3±3.5    | 34.7±3.4    | .193     | -             |

Values are Mean ± SD. Tested by one-way analysis of variance (ANOVA).

\*Significant between group ( $p < .01$ ); Post hoc test by Bonferroni; a: 2014, b: 2015, c: 2016, d: 2017, e: 2018, f: 2019.

The IBM SPSS Statistics ver. 21.0 (IBM Co., Armonk, NY, USA) was used for statistical analysis. The level for statistical significance was set at 0.05.

## RESULTS

Table 1 shows the results of the comparative analysis of the physical fitness tests by year for Korean male police officers. There were statistically significant differences according to the year of measurement of the 100 m sprint, push-up, and sit-up results ( $p < .001$ ). The 100 m sprint times decreased from 2014 to 2017 but became slower from 2018. The push-up repetitions were similar from 2014 to 2017 but decreased from 2018; they decreased even further in 2019. The sit-up repetitions also showed a decrease in 2019 compared to those from 2014-2016. However, handgrip strength showed no statistically significant differences by year ( $p > .05$ ).

Table 2 shows the results of the comparative analysis of the physical fitness test by year for Korean female police officers. There were statistically significant differences according to the year of measurement for the 100 m sprint ( $p < .01$ ). Specifically, the 100 m sprint times measured in 2019 were slower than those measured in 2016 and 2017. However, there were no statistically significant differences between years for push-ups, sit-ups, or handgrip strength ( $p > .05$ ).

## DISCUSSION

In this study, we performed a comparative analysis of the annual

physical fitness test results for Korean police officers between 2014 and 2019. The results demonstrated that, in 2019, male police officers had slower 100 m sprint times and lower push-up and sit-up counts, and female police officers also had slower 100 m sprint times than those in previous years.

Police officers need to fight against crimes which threaten the lives and property of the general public and therefore experience high stress and fatigue while performing tasks such as arresting and investigating criminals and patrolling to eliminate risk factors; physical fitness is important to successfully cope with these demands [2,6]. For this reason, several studies have reported that police officers need to maintain and improve their physical fitness in order to properly perform occupational tasks and ensure their own safety [5,15].

However, several studies have reported that police officers often fail to maintain the minimum levels of physical fitness and that physical fitness decreased when compared to previous years [16,17]. Lagestad et al. [16] compared the physical fitness of police officers after 16 years of service to when they graduated from the police academy and reported a decrease of 10-32% in the bench press and standing long jump results, with upper body strength showing an especially prominent decline. Sørensen et al. [17] reported that the physical fitness of police officers, measured by push-ups, sit-ups, pull-ups, and maximal oxygen consumption, significantly decreased after 15 years. Although there are some differences in the time of the comparison, measured variables, and methods, the results of these studies are similar to our own.

The main reason why police officers do not maintain or improve physical fitness is likely due to the environment in which they perform their duties. Police officers are exposed to situations with high levels of physical tension and repeated stress [18], and shift work results in irregular sleep patterns, so police officers spend more time sleeping on rest days to compensate for the lack of sleep [19]. These factors prevent police officers from maintaining physical fitness or free time to exercise. Moreover, a large proportion of police work involves riding in a patrol car or sitting down to complete paperwork [20]. Performing sedentary tasks for a long time reduces the time available for exercise and physical activity, and increases body fat [21,22]. Violanti et al. [20] reported that high body fat percentage in police officers was inversely proportional to the number of push-up and sit-up repetitions.

In order to prevent a decrease in the physical fitness of police officers, as observed in this study, regular training programs should be recommended. As an important strategy to prevent a decline in the physical performance of police officers, Lagestad et al. [16] proposed the need to provide opportunities for exercise during work, while Sørensen et al. [17] reported that regular systematic training could help middle-aged police officers maintain physical fitness. Teixeira et al. [9] reported that a regular strength and conditioning program, including power, core, and aerobic fitness, should be implemented for police officers to prevent a decline in performance and maintain physical capacity and occupational duties. Recently, Čvorović et al. [23] implemented a 12-week regular training program for police trainees and reported significant improvements in push-up and sit-up repetitions. However, the participants in the study by Čvorović et al. [23] were police trainees participating in an academic course, not currently active police officers. Thus, in future studies, it will be necessary to investigate the effects of regular training programs on currently serving police officers.

Our study had several limitations. First, we only examined police officers working at one police station in Daegu. Additionally, we did not examine the factors that could affect physical fitness, such as frequency of exposure to shift work, nutritional intake, smoking and alcohol consumption, physical activity and exercise participation, or psychological factors (stress and depression). These limitations should be considered in future studies.

## CONCLUSIONS

The results of our study demonstrate that the physical fitness of Kore-

an police officers in 2019 has decreased over the years. Male police officers especially showed a decline in various aspects of physical fitness. These changes could potentially interfere with the physical duties that need to be performed by police officers. Therefore, measures are needed to enhance fitness in police officers. It will be necessary to educate Korean police officers on the importance and positive effects of physical fitness and to prepare an environment or system that enables regular training programs to be implemented. Additionally, discussions are needed regarding an appropriate compensation system to encourage police officers to participate in training programs and improve physical fitness.

## CONFLICTS OF INTEREST

The authors declare no conflict of interest.

## AUTHOR CONTRIBUTIONS

Study design: SK, and JK; Data collection: SK; Data analysis: JK; Data interpretation: SK, and JK; Drafting manuscript: SK, and JK; Revising the manuscript content: JK.

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