

# Analysis of the Change of Health Status Among the Republic of Korea Air Force Soldiers During Military Service

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**Objectives:** The aim of this study was to investigate whether the health status of Republic of Korea Air Force (ROKAF) soldiers changed after one year of military service.

**Methods:** We selected 483 ROKAF soldiers from the 11 749 recruits who participated in the 2011 physical examination. The selected soldiers underwent another physical examination in 2012 for advancement to senior airman. Data from 2011 and 2012 were merged. To collect data on lifestyle, a questionnaire was sent to all included subjects via the military intranet e-mail service.

**Results:** The percentage of recruits with an abnormal alanine transaminase level (normal range <40 IU/L) decreased from recruitment (13.7%) to the following year (2.7%). Moreover, the percentage of obese soldiers (body mass index  $\geq 25$  kg/m<sup>2</sup>) decreased from recruitment (20.5%) to the following year (10.4%). There was a significant change in mean duration of exercise carried out each day before ( $0.8 \pm 1.3$  hours) and after ( $1.0 \pm 0.7$  hours) joining the ROKAF service.

**Conclusions:** These ROKAF soldiers were generally in good health before and after joining the armed service. After one year of military service, the health status of most soldiers improved, especially with respect to body mass index and alanine transaminase level.

**Key words:** Military personnel, Life style, Body mass index, Alanine transaminase

## INTRODUCTION

Living in a standardized military environment diversely affects the health status of soldiers in their early or mid- twen-

ties because they are accustomed to living in diverse surroundings in general society. The Republic of Korea (ROK) armed forces carry out physical examinations on draftees within five days of recruitment to judge their qualifications for military service.

The ROK Air Force (ROKAF) also carries out physical examinations at the event of the Airmen Advancing Camp, which is performed before one can advance to the post of Senior Airman.

Until recently, analyses of physical examinations were made on military officers [1,2] and there were analytical data on the results of physical examinations for generally enlisted personnel at boot camp [3]. Nevertheless, no study has compared the data from the physical examinations at recruitment to the

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data attained a year after their military service. Understanding the types of physical changes these ROKAF personnel undergo after a year of the military services may be of value scientifically or in developing related policies. Thus, this investigation attempted to examine the effect of military service on the physical health of ROKAF personnel by utilizing the data from the Air Force that includes comprehensive physical examinations at recruitment and before advancing to a senior airman.

## METHODS

Physical examination data on 11 749 soldiers who had undergone physical examinations from January to July 2011 were collected by visiting the ROKAF Education and Training Command where the physical examinations for Air Force recruitment were carried out. Collected data included measurements of height, body weight, and alanine transaminase (ALT) level. And then we selected six Air Force units not to have any regional disproportion and 600 ROKAF soldiers, 100 from each unit by random sampling, who were deployed in those units. These 600 soldiers also underwent physical examinations for advancement to Senior Airman in 2012 and these data were also collected. Using each soldier's registration number for the physical examination and their military service number, we merged the physical examination data from 2011 and 2012. In addition a questionnaire was sent via e-mail using the military intranet to collect information on smoking history, duration of exercise and sleep, and subjective body score (on a scale of 10 with 10 as the maximum score). The 483 soldiers out of 600 who responded to the e-mail questionnaire were included as our final subjects of study.

Each subject voluntarily agreed to participate in the study after being informed of the purpose and methods before proceeding with the survey. This study was approved by the Korean Armed Forces Medical Command's institutional review board (ROK-MND-2012-KMMRP-021) before commencement of this study.

The SPSS version 18.0 (SPSS Inc., Chicago, IL, USA) was used for all data analyses. Paired *t*-tests were used to compare the results of the physical examination and questionnaire before and after joining the military service. The McNemar's test was also used to compare the results of nominal variables before and after joining the military service.

## RESULTS

### Differences in Health Measures Before and After Enlisting in the Military

The results of the 2011 and 2012 physical examination showed that mean body mass index (BMI) and mean ALT level significantly differed ( $p < 0.05$ ). Mean BMI was 22.5 and 22.2 kg/m<sup>2</sup> and mean ALT level was 23.8 and 15.3 IU/L in 2011 and 2012, respectively.

The mean  $\pm$  standard deviation (SD) duration of exercise per day was 0.8  $\pm$  1.3 hours before joining the military service, and significantly increased to 1.0  $\pm$  0.7 hours after joining the military service ( $p = 0.003$ ). However, the mean  $\pm$  SD duration of sleep per day was 7.4  $\pm$  1.8 hours before joining the military, but significantly decreased to 7.1  $\pm$  1.0 hours after joining the military service ( $p = 0.005$ ).

Out of a maximum score of 10, the mean  $\pm$  SD subjective score was 6.6  $\pm$  1.8 points before joining the military service and 7.3  $\pm$  1.4 points after joining the military service ( $p < 0.001$ ) (Table 1).

### Comparison Between Normal and Abnormal Health Measures Before and After Enlisting in the Military

Of the 483 ROKAF soldier analyzed, 66 (13.7%) were found to have an abnormal ALT level ( $\geq 40$  IU/L) at recruitment, but only 13 soldiers (2.7%) had an abnormal ALT one year after recruitment ( $p < 0.001$ ).

For BMI, 99 (20.5%) were obese ( $\geq 25$  kg/m<sup>2</sup>) at recruitment,

**Table 1.** Comparison of health and lifestyle measures before and after enlisting in the military (n=483)

	Before enlistment		After enlistment		p-value <sup>1</sup>
	Mean	SD	Mean	SD	
Body mass index (kg/m <sup>2</sup> )	22.5	3.4	22.2	2.4	<0.001
Alanine transaminase (IU/L)	23.8	22.6	15.3	10	<0.001
Average amount of exercise per day (h)	0.8	1.3	1	0.7	0.003
Average amount of sleep per day (h)	7.4	1.8	7.1	1	0.005
Subjective health status <sup>2</sup>	6.6	1.8	7.3	1.4	<0.001

SD, standard deviation.

<sup>1</sup>Tested by paired *t*-test.

<sup>2</sup>Scored out of ten (maximum).

**Table 2.** Comparison between normal and abnormal health measures before and after enlisting in the military (n=483)

	Normal	Before <sup>3</sup>		After enlistment		Total	p-value <sup>1</sup>
				Normal	Abnormal		
Body mass index (kg/m <sup>2</sup> )	<25 <sup>2</sup>	Before <sup>3</sup>	Normal	376	8	384 (79.5)	<0.001
			Abnormal	57	42	99 (20.5)	
			Total	433 (89.6)	50 (10.4)	483 (100.0)	
Body mass index (kg/m <sup>2</sup> )	<23 <sup>4</sup>	Before <sup>3</sup>	Normal	252	30	282 (58.4)	<0.001
			Abnormal	78	123	201 (41.6)	
			Total	330 (68.3)	153 (31.7)	483 (100.0)	
Alanine transaminase (IU/L)	<40	Before <sup>3</sup>	Normal	411	6	417 (86.3)	<0.001
			Abnormal	59	7	66 (13.7)	
			Total	470 (97.3)	13 (2.7)	483 (100.0)	
History of smoking	-	Before <sup>3</sup>	Yes	92	20	112 (23.2)	0.38
			No	27	344	371 (76.8)	
			Total	119 (24.6)	364 (75.4)	483 (100.0)	

Values are presented as number (%).

<sup>1</sup>Tested by McNemar's test.

<sup>2</sup>According to the Asian Pacific category of obesity by World Health Organization.

<sup>3</sup>Before enlistment.

<sup>4</sup>According to the Asian Pacific category of overweight by World Health Organization.

**Table 3.** Comparison of lifestyle factors between before and after enlistment among groups divided by the changing state of body mass index (n=483)

	n (%)	Variable	Before enlistment		After enlistment		p-value <sup>1</sup>
			Mean	SD	Mean	SD	
Group I <sup>2</sup>	366 (75.8)	Average amount of exercise a day (h)	0.8	1.4	1.0	0.7	0.003
		Average amount of sleep a day (h)	7.4	1.8	7.1	0.9	0.002
		Subjective health status <sup>3</sup>	6.7	1.8	7.4	1.5	<0.001
Group II <sup>4</sup>	117 (24.2)	Average amount of exercise a day (h)	0.9	0.8	1.0	0.8	0.55
		Average amount of sleep a day (h)	7.1	1.8	7.1	1.1	0.89
		Subjective health status <sup>3</sup>	6.5	1.8	6.9	1.3	0.02

SD, standard deviation.

<sup>1</sup>Tested by paired t-test.

<sup>2</sup>These soldiers improved their body mass index (from obesity to overweight or normal, from overweight to normal) or maintained a normal body mass index.

<sup>3</sup>Scored out of ten (maximum).

<sup>4</sup>These soldiers worsened their body mass index (from normal to overweight or obese, from overweight to obese) or remained obese or overweight.

according to the World Health Organization Asia Pacific Standards, but the number of obese ROKAF personnel significantly decreased to 50 soldiers (10.4%) the following year ( $p < 0.001$ ). In addition, the number of overweight or obese soldiers ( $\geq 23$  kg/m<sup>2</sup>) was 201 (41.6%) at recruitment, but this number decreased significantly to 153 soldiers (31.7%) the next year ( $p < 0.001$ ).

Of the 483 subjects that responded to the survey questionnaire, 112 (23.2%) reported smoking before joining the military, and 119 (24.6%) smoked cigarettes after joining the mili-

tary service, but this finding was not statistically significant ( $p = 0.382$ ) (Table 2).

### Analysis of Lifestyle Factors Among Groups Divided by the Changing State of Body Mass Index

We further analyzed this study population by dividing the soldiers into two groups according to the changes to their BMI before and after recruitment. For group I, the state of BMI was improved (from obesity to overweight, 36 soldiers; from obe-

sity to normal, 21 soldiers; from overweight to normal, 57 soldiers) or maintained normal (252 soldiers). Among this group, mean duration of exercise per day significantly increased ( $p=0.003$ ), and the mean duration of sleep per day significantly decreased ( $p=0.002$ ) after joining the military service.

For group II, the state of BMI was aggravated (from normal to overweight, 30 soldiers; from overweight to obese, 8 soldiers) or maintained obese (42 soldiers) or overweight (37 soldiers). Among this group, no significant difference for the mean durations of exercise or sleep per day before and after joining the military service was found.

Those with a subjective health scores at 10 points (maximum) significantly increased after joining the military service regardless of groups divided by the changing state of BMI (Table 3).

## DISCUSSION

In this study, the mean ALT levels for soldiers included in the 2011 and 2012 physical examinations were both within normal levels [4]. In addition, the mean BMI in 2011 and 2012 were 22.5 and 22.2 kg/m<sup>2</sup>, respectively, which fall within the normal range (18.5 to 22.9 kg/m<sup>2</sup>) according to the Asia Pacific Standards of the World Health Organization. In comparison with the BMI of short-term active duty and noncommissioned officers of the ROK army in 2007, our results were lower than their mean BMI of 23.4 kg/m<sup>2</sup> [5]. However, it is of no surprise that the results from the physical examination among recruits were within normal ranges since the Korean Military Manpower Administration only recruits men who are deemed healthy and able. Moreover, the mean values of the physical examination results one year after recruitment were also within normal ranges; therefore, our data suggests that the military service did not negatively affect the health of these soldiers.

The comparative analysis of simple values of test results obtained before and after joining the military service showed that there were numerical differences of each test items between before and after. However, these values largely were changed within normal levels. Thus, the analysis of how much did the proportion of soldiers with abnormal test levels (the values that went out of the normal range for each test item) change, would be the more logical approach in the assessment of health effects of military service.

The percentage of soldiers with a BMI of more than 25 kg/m<sup>2</sup> (obese) was 20.5% in 2011 and 10.4% in 2012. Our results are

lower than that of the general male population in the ROK between the ages of 19 to 29 years obtained from the 2011 Korea National Health and Nutrition Examination Survey (26.2%) [6] and that of 18-year-old applicants to the United States military (27.1%) [7].

Among these recruits, the proportion of soldiers with an abnormal ALT and high BMI level significantly decreased the following year. In Israel and the ROK, military system service is compulsory for all able men. In a study on Israeli soldiers, 12% of subjects who were within a normal BMI range at enlistment became overweight, and 21.7% of subjects who were overweight at enlistment became obese [8]. One previous-reviewed study on ROK active duty officers on a compulsory military system for a short term [5] also showed BMI increase rather after their active services. The life of general military service of ROK for enlisted men seems to be somewhat helpful in maintaining a proper level of BMI, in comparison with that of either foreign military services or ROK military officers.

In this study, we found that the average amount of exercise and sleep per day significantly changed among the subjects whose BMI improved or remained normal. In contrast, no significant change to the amount of exercise or sleep was found among the subjects whose BMI increased or remained overweight or obese. One may make assumption that the change of lifestyle through the military service such as quantitative increase in exercise exerted a favorable influence on the state of BMI. There were some previous studies revealed a similar association between physical activity and BMI [9,10]. In the case of sleep duration, previous studies have suggested that short sleep duration is associated with an increased body weight, but the category of short sleep was varied [11,12]. Therefore, we feel that it is reasonable to interpret the changes of sleep duration as changes to the soldiers' lifestyle rather than a detrimental decrease of amount of sleep.

Various previous studies also revealed that BMI increase, namely obesity and overweight increased ALT levels [13-16]. So we may assume that the change of lifestyle including increase of physical activity, abstain from alcohol during military service caused the improvement of BMI and decrease ALT level at last.

Among all of our subjects, an improved subjective health status was found after joining the military when compared with their subjective status before joining the military. This result will provide the opportunity to avoid wrongful bias against the military service and to carry on the military duties with more positive and invigorated attitude.

One limitation of this study was that the measured items from the 2011 physical examination at recruitment and 2012 physical examination for advancement to senior airmen were slightly different, which may have affected our comparative analysis. Furthermore, this investigation was not a systematically structured cohort study; rather, it integrated the existing data, gathered from the physical examination for recruits and that of senior airmen, to which a survey questionnaire was supplemented. And we left gender, the period of service and the age of subjects for study out of consideration when we collected data because all of the subjects were male, in the same age group (20 to 29 years old), and had the same period of service (11 to 12 months, from the time of the recruit to senior airmen). Thus, these authors were not able to utilize more diversified analytical approach including multivariate analysis. Notwithstanding these limitations, this study suggested various results of physical examinations for the group of males in their early and mid twenties, who carried on a well-regulated life (regular meal, regular sleep, abstain from alcohol, etc.) in a limited environment called "the military service." Therefore, the outcome of this study has the high validity for applications in comparative analysis of studies targeting on other population group in the days ahead. Furthermore, we found that physical body conditions among soldiers were improved both objectively and subjectively through the military service. We hope that these aspects may have contributed to improve awareness of military service.

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## CONFLICT OF INTEREST

The authors have no conflicts of interest with the material presented in this paper.

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