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Physical activity, physical fitness and cardiometabolic health among Finnish military workers

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ABSTRACT

Introduction The Western lifestyle challenges national defence. Inactivity, obesity, high BP and elevated lipid and glucose levels as well as tobacco use all increase cardiometabolic risk. The present study was thus aimed at investigating the health and physical activity of employees in a military environment, concentrating on comparisons between soldiers and civilians.

Methods and design A total of 260 employees from 6 brigades were included in the present study. Health status was evaluated with body composition, cardiometabolic risk markers from laboratory samples and a questionnaire concerning lifestyle habits. Body composition was assessed by means of body mass, body mass index, fat percentage and waist circumference. Furthermore, physical activity was examined by the aid of accelerometer recordings for a 2-week period, and physical fitness via aerobic and muscle fitness tests. Finally, upper-quartile active and lower-quartile passive participants were compared, by incorporating mean daily step counts.

Results When standardised by gender, there were no differences between the soldiers and civilians except for the muscle fitness test, in which soldiers performed better. The mean (±SD) moderate to vigorous activity was 0.9±0.3 hours/day in male soldiers and 1.0±0.4 hours/day in male civilians, and respectively sedentary behaviour was 9.5±1.4 hours/day in male soldiers and 8.9±1.7 hours/day in male civilians. The mean (±SD) low-density lipoprotein values were 3.28±0.84 mmol/L in male soldiers and 3.36±0.86 mmol/L in male civilians. In comparing soldiers and civilians, statistically significant differences were observed in body composition, physical fitness, insulin, fasting glucose, triglycerides and high-density lipoprotein values between the upper-quartile active and lower-quartile passive participants, but no difference in low-density lipoprotein values was noticed.

Conclusions Sedentary behaviour and elevated low-density lipoprotein values seem to increase cardiometabolic disease risk among participants, even if they meet the weekly physical activity demands.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The occurrence of inactive lifestyles, overweight and decline of aerobic fitness among military personnel have been reported from various countries.

WHAT THIS STUDY ADDS

⇒ The present study showed that there was no difference in physical activity, cardiometabolic risk factors or aerobic fitness between soldiers and military civil workers in Finland but soldiers had better muscle strength than civilians.

⇒ In addition, both soldiers and civilians had high low-density lipoprotein (LDL) and raised sedentary behaviour, which increases cardiovascular risk despite their good physical activity and fitness status.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The study reveals a need for interventions to decrease daily sedentary time among military personnel and while the LDL was not dependent on physical activity, other measures such as dietary interventions should be considered to optimise the lipid profile of the military workers in Finland.

INTRODUCTION

The health and performance of personnel working in the military have an essential role in the proper function of national defence. Nevertheless, concerning results have been obtained from previous studies regarding the health of military workers round the globe. A wide survey conducted among military personnel in Finland shows that only 51% of employees exercise at least three times a week,[1] and reveals insufficient physical activity on the part of personnel. These issues of physical inactivity among military workers have also been detected among German soldiers, showing an increased portion of unfit as well as overweight soldiers. Moreover, studies of male soldiers in their mid-career and late career have revealed prevalences of cardiovascular risk factors comparable with the civilian population.[2] Similar findings with respect to overweight and aerobic physical fitness have been obtained from studies performed among US Army recruits.[3]

The soldier's daily tasks in the military require good physical and mental performance, while civil tasks contain mostly office or logistics work, thereby setting their physical fitness demands at the level of the general working-age population. Still, both health issues and physical inactivity on the part of employees may present risk for national defence, regardless of the profession.[4]

Furthermore, studies have shown the snuff use to be associated with negative outcomes for cardiovascular and oral health.[5–7] Likewise, the presence of even one of the risk factors, such as overweight, lack of exercise and smoking, have been indicated to reduce the physical fitness of young soldiers. Any

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further risk factor has also led to further decreases in physical fitness.[2]

Increasing the physical activity of military workers may be the solution to enhance their performance, while even elderly non-athletes have been shown to achieve high levels of performance by training regularly.[8] Also, even low exercise frequencies have been shown to compensate for the negative influence of overweight on physical fitness,[2] and physically active employees have been shown to perform better in their work tasks than their inactive counterparts.[9] A high volume of physical activity is also associated with healthy glucose and lipid metabolism,[10–13] as well as lower BP.[14]

While the previously described cardiometabolic risk factors can exert a negative effect on the health and performance of military workers, recognising these risk factors among them represents the first step towards improvement. Furthermore, physical activity has been indicated to promote health and physical fitness, leading to better working performance,[2 8–14] implying importance in investigating daily physical activity and its association with these cardiometabolic risk factors among military employees. The present study aims to identify the existing cardiometabolic risk factors, physical activity and fitness status of military personnel and investigate the differences between the professional groups with different performance requirements, as well as the connection between physical activity, cardiometabolic risk factors and physical fitness within this population.

METHODS AND DESIGN

Participants

A total of 260 voluntary participants took part in the present study. Altogether 176 male and 9 female soldiers together with 18 male and 67 female civil workers participated in the study. The participants were recruited from six military brigades in Finland. The participants worked in the Finnish Defence Forces (FDF) and participated in the annual fitness tests.[15] An occupational physician determined if the participant was able to perform the fitness tests concerned.

Measurements

The body composition measurements consisted of waist circumference, body height, body mass (BM), body mass index (BMI) and fat percentage (FAT%). Measurements were performed in the morning after fasting for at least 2 hours. BM, BMI and FAT% were measured by using the segmental multifrequency bioimpedance analysis assessment (BIA) (InBody 720, Biospace, Seoul, Korea). Waist circumference was measured by a tape measure in the midline of the lowest rib and iliac crest after exhaling. Smoking habits, snuff use, history of hypertension, antihypertensive medication, statin treatment and the use of anticoagulant medication were studied unsing an online questionnaire.

The cardiometabolic risk factors were also evaluated by using laboratory tests. The blood samples were collected after a 12 h fasting between 07:00 and 09:00. Glucose metabolism was evaluated by measuring blood fasting glucose (fP-gluc), glycated haemoglobin (HbA1c) and insulin (INS). Lipid metabolism was measured by analysing serum total cholesterol (TC), low-density lipoprotein (LDL) cholesterol, high-density lipoprotein (HDL) cholesterol and triglycerides. HDL, triglycerides, fP-gluc and HbA1c were analysed using a Konelab 20 XTi-device (Thermo Electron, Vantaa, Finland), and an isolated LDL fraction was used for direct measurement of LDL (Enzymatic Colorimetric Determination of Serum Cholesterol was used as a method). The sensitivity for fP-gluc and HbA1c are 0.1 mmol/L and 0.03 mmol/L, and the intra-assay coefficients of variance are 1.0% and 8.6%, respectively. The ranges for the total TC, triglyceride, HDL and LDL assays vary from 0.1 to 15 mmol/L, 0.09 to 11 mmol/L, 0.04 to 2.84 mmol/L and 0.3–8.9 mmol/L, respectively. Intra-assay coefficients of variance are 1.1% for TC, 1.0% for triglycerides, 3.4% for LDL and 0.5% for HDL, respectively. INS was analysed using chemical luminescence techniques (Immulite 2000, Siemens Healthcare Diagnostics, Camberley, UK) with an assay sensitivity of 2 mIU/L and interassay coefficients of variation 5.1%.

The accelerometer (UKK RM42; UKK Terveyspalvelut Oy, Tampere, Finland) recordings were used to measure the physical activity of the participants over a period of 2 weeks. The accelerometer was worn on a belt on the hip during the waking hours, except during showering and water-related activities. The stored accelerometer data were later analysed in the research institute. The accelerometer measured the acceleration of the device in three orthogonal x, y and z directions, at a sampling rate of 100 Hz. The resultant acceleration was determined using these three components, and the mean amplitude deviation of the resultant was analysed in 6 s epoch length.[16] Physical activity was categorised into light, moderate and vigorous, based on metabolic equivalents.[17] Steps were identified by the method described by Ying *et al*.[18] Time spent sitting and reclining position were combined to indicate sedentary behaviour (SB). Standing still was analysed separately. Under standardised conditions, standing can be separated from sitting or lying with 100% accuracy, through the application of tri-axial information from the accelerometer.[16] The daily averages of SB, light physical activity (LPA), moderate to vigorous physical activity (MVPA), standing and number of steps were calculated first for each participant, based on their recordings. Only those participants having data respective to 10 hours from at least 4 days were included for further analyses. The mean values for each participant were used in the analysis of group values.

The physical fitness of the participants was assessed by means of endurance and muscle fitness tests. To evaluate aerobic capacity, the participants performed a 12 min running test[19] or cycle ergometer test[20] or UKK 2 km walking test.[21] The aerobic capacity was expressed by reference to maximal oxygen uptake (VO_2max). Maximal power production of the lower extremities was evaluated by a standing long jump (SLJ), while the dynamic muscle endurance capacity of the trunk and upper extremities was evaluated via measurements of 1 min sit-ups and push-ups.[22]

Statistical analyses

Differences between soldiers and civilians were examined by using the Pearson's χ^2 test or an independent samples t-test. Associations between body composition, cardiometabolic risk markers, fitness test results and daily activity were analysed through univariable linear regression analysis. Results were shown by t-values with a limit value set as statistically significant (p value under 0.05).

Differences between the upper and lower quartiles of the mean daily steps count distribution were tested using independent samples t-testing. Statistical analyses were carried out with SPSS (SPSS, IBM, Armonk, New York, USA) V.27 and V.28. A two-sided p value <0.05 was considered statistically significant. No adjustment for multiple tests was applied, and t value and p value should be interpreted only exploratorily.

Table 1 Comparison between all soldiers and civilian employees studied, using independent samples t-testing (n=260).

	Soldiers		Civilians		
	N	Mean (SD)	N	Mean (SD)	P value
Age (years)	185	40 (8)	75	47 (8)	**<0.001**
Height (cm)	181	179.0 (7.1)	74	169.2 (7.6)	**<0.001**
Body composition					
Body mass (kg)	181	87.0 (14.0)	74	77.9 (17.3)	**<0.001**
Body mass index (kg/m²)	181	27.1 (3.8)	74	27.1 (5.2)	0.968
Fat percentage (%)	169	21.4 (7.8)	68	31.1 (9.9)	**<0.001**
Waist circumference (cm)	171	94.0 (11.4)	66	90.1 (13.5)	**0.042**
Cardiometabolic risk markers					
Total cholesterol (mmol/L)	159	4.90 (0.88)	72	4.96 (0.74)	0.647
High-density lipoprotein cholesterol (mmol/L)	159	1.44 (0.38)	72	1.62 (0.46)	**0.001**
Low-density lipoprotein cholesterol (mmol/L)	159	3.33 (0.85)	72	3.17 (0.72)	0.45
Triglycerides (mmol/L)	159	1.14 (0.60)	72	1.18 (0.99)	0.712
Haemoglobin A1c (mmol/mol)	156	34.7 (5.2)	72	34.3 (4.1)	0.555
Fasting glucose (mmol/L)	140	5.3 (0.7)	66	5.3 (0.9)	0.634
Serum insulin (mIU/mL)	159	5.7 (6.4)	72	5.9 (6.5)	0.772
Physical activity measurements					
Sedentary behaviour (hours)	171	9.4 (1.4)	68	9.0 (1.3)	**0.017**
Standing (hours)	171	1.7 (0.7)	68	1.9 (0.9)	0.177
Light physical activity (hours)	171	3.7 (1.0)	68	3.6 (0.8)	0.188
Moderate to vigorous physical activity (hours)	171	0.9 (0.3)	68	0.7 (0.4)	**0.001**
Steps (number/day)	171	7258 (2018)	68	6578 (2291)	**0.025**
Fitness tests					
Maximal oxygen uptake (mL/kg/min)	169	45.5 (8.4)	65	36.0 (10.4)	**<0.001**
Push-ups (rep/min)	167	39 (12)	63	30 (14)	**<0.001**
Sit-ups (rep/min)	167	41 (11)	64	28 (12)	**<0.001**
Standing long jump (m)	167	2.24 (0.28)	63	1.63 (0.37)	**<0.001**

Statistically significant p-values are presented in bold.
N, number of participants; rep, repetition.

RESULTS

Differences in characteristics between all soldiers and civilians

Characteristics of soldiers and civilians are presented in Table 1. Civilians were older than soldiers, while soldiers were taller and heavier, with wider waist circumference than civilians, who conversely had higher FAT% and serum HDL values than soldiers. The SB of the soldiers was longer compared with civilians, but the amount of MVPA was greater, and the daily step count was higher among soldiers compared with civilians. Soldiers performed better than civilians in the fitness tests for VO_2 max, push-ups, sit-ups and SLJ.

The snuff use was more common (p=0.024) among soldiers (16.1%) than among civilians (4.8%). No differences were detected in smoking habits (5.6% vs 4.8%), usage of antihypertensive medication (7.0% vs 11.1%), cholesterol medication (4.2% vs 4.8%), anticoagulant medication (0.7% vs 3.2%) or prevalence of hypertension (10.5% vs 12.7%).

Differences in characteristics between male soldiers and male civilians

Characteristics of male soldiers and male civilians are presented in Table 2. Male civilians were older than male soldiers, who also performed better in the muscle fitness tests. Furthermore, male soldiers had better push-up, sit-up and SLJ results than male civilians. In other variables, no differences between male soldiers and civilians were observed.

No statistically significant differences between the groups were found in smoking habits (5.9% vs 0.0%), snuff use (16.3% vs 12.5%) or antihypertensive medication (7.4% vs 6.3%), cholesterol medication (4.4% vs 6.3%), anticoagulant medication (0.7% vs 6.3%) or prevalence of hypertension (10.4% vs 0.0%).

Association of body composition, cardiometabolic risk markers and fitness test results with physical activity (all participants)

The results from the univariable linear regression analysis are presented in Table 3. Only triglycerides had strong associations (p<0.001) with all components of daily activity. FAT% association was strong with LPA, MVPA and both standing and step means (p<0.001), but weaker with SB (p<0.05). TC, LDL and HbA1c did not associate with physical activity. All fitness tests had strong associations with LPA, MVPA and number of steps (p<0.001), but not with SB or standing time. Furthermore, the associations between VO_2max and standing, VO_2max and step mean, push-ups and standing as well between push-ups and daily step mena were statistically significant (p<0.05).

All body composition measurements, and HDL, triglycerides and fP-gluc had strong associations with daily standing time (p<0.001). BMI, FAT%, waist circumference, TC and INS had strong associations with MVPA and the daily step count (p<0.001).

Table 2 Comparison between the male soldiers and male civilian employees using independent samples t-testing (n=194).

	Male soldiers		Male civilians		
	N	Mean (SD)	N	Mean (SD)	P value
Age (years)	176	40 (8)	18	48 (8)	**<0.001**
Height (cm)	173	179.6 (6.3)	18	179.3 (5.3)	0.844
Body composition					
Body mass (kg)	173	87.6 (13.8)	18	89.2 (15.6)	0.654
Body mass index (kg/m²)	173	27.1 (3.9)	18	27.8 (4.7)	0.533
Fat percentage (%)	161	20.8 (7.4)	16	24.4 (8.4)	0.07
Waist circumference (cm)	163	94.3 (11.4)	17	98.2 (13.9)	0.199
Cardiometabolic risk markers					
Total cholesterol (mmol/L)	150	4.93 (0.88)	17	4.83 (0.82)	0.661
High-density lipoprotein cholesterol (mmol/L)	150	1.42 (0.38)	17	1.33 (0.36)	0.34
Low-density lipoprotein cholesterol (mmol/L)	150	3.28 (0.84)	17	3.36 (0.86)	0.705
Triglycerides (mmol/L)	150	1.14 (0.62)	17	1.50 (1.71)	0.401
Haemoglobin A1c (mmol/mol)	147	34.8 (5.3)	17	34.3 (3.1)	0.678
Fasting glucose (mmol/L)	134	5.4 (0.7)	15	5.4 (0.6)	0.794
Serum insulin (mIU/mL)	150	5.8 (6.6)	17	5.4 (4.1)	0.836
Physical activity measurements					
Sedentary behaviour (hours)	163	9.5 (1.4)	16	8.9 (1.7)	0.145
Standing (hours)	163	1.7 (0.7)	16	1.5 (0.8)	0.378
Light physical activity (hours)	163	3.7 (1.0)	16	3.7 (0.9)	0.957
Moderate to vigorous physical activity (hours)	163	0.9 (0.3)	16	1.0 (0.4)	0.22
Steps (number/day)	163	7241 (2002)	16	7588 (2010)	0.509
Fitness tests					
Maximal oxygen uptake (mL/kg/min)	163	45.8 (8.3)	17	43.4 (10.9)	0.284
Push-ups (rep/min)	160	40 (12)	16	29 (15)	**0.002**
Sit-ups (rep/min)	160	41 (10)	16	35 (10)	**0.021**
Standing long jump (m)	160	2.26 (0.27)	15	2.02 (0.27)	**0.001**

Statistically significant p-values are presented in bold.
N, number of participants; rep, repetition.

Comparison between the most active and passive participants

Comparison was made between the most active and passive 25% of all the participants in accordance with the upper and lower quartiles of the steps distribution, using the mean daily step count. The analyses showed statistically significant differences between the groups in all body composition measurements and fitness tests (Table 4). When examining the differences between cardiometabolic risk markers, statistically significant differences were detected between the groups when comparing HDL, triglycerides, fP-gluc and INS. The results did not differ when male participants were exclusively included in the analyses (Table 5).

DISCUSSION

The present study revealed that the physical activity levels of both soldiers and civilians reached the recommended 150 min of MVPA per week,[23] and there was no statistical difference between the soldiers and civilians. Nevertheless, the results showed high average SB in both soldiers and civilians, and no statistically significant differences between the professional groups. Even though physical activity has been shown to partially diminish the harmful effects of SB on health, previous studies have shown that over 7 hours of SB in a day is detrimental to health, even when physical activity is taken into account. All-cause mortality increases markedly as people sit more during the day. Sitting 10 hours/day has been shown to increase the risk of all causes of mortality by 34%, even when physical activity is taken into account. Despite sufficient daily physical activity, SB is itself a health risk.[24]

There was no difference between the male soldiers and male civilians in aerobic fitness, but soldiers showed better muscle fitness compared with civilians. The LPA, MVPA and daily step count were associated with physical fitness. Furthermore, in comparing the upper quartile active and lower quartile passive participants, there was a connection between physical activity and fitness. Previous studies have shown a relationship between physical activity and fitness,[8 14] and the results are in line with the previous studies.

The FAT% and triglycerides were strongly connected with all-intensity physical activity. BMI, FAT%, waist circumference and INS had connections with MVPA and daily step count. In comparing the upper quartile active and lower quartile passive participants, the upper quartile active showed more optimal body composition, HDL, triglyceride, fP-gluc and INS values. The daily standing time was connected with improved body composition, HDL, triglycerides and fP-gluc. The results indicated that physical activity is associated with better body composition as well as exerting a positive effect on glucose and lipid metabolism. Physical activity has been shown to improve lipid profile by increasing the HDL and decreasing triglycerides.[10] It has also been shown to improve INS sensitivity, glycaemic control and decrease visceral fat in people with type 2 diabetes.[11–13] Additionally, replacing SB with standing or higher-intensity physical activity has been shown to result in a beneficial association with

Table 3 Univariable explanators for the LPA, the MVPA, SB, daily standing and daily steps mean (n=239)

		LPA mean	MVPA mean	SB mean	Daily standing mean	Daily steps mean
	N	t-value	t-value	t-value	t-value	t-value
Body composition						
Body mass	236	−1.387	**−2.584***	**4.097****	**−7.649****	**−3.356***
Body mass index	236	−1.889	**−4.399****	**3.440***	**−7.032****	**−4.285****
Fat percentage	219	**−4.033****	**−8.630****	**2.588***	**−3.755****	**−7.418****
Waist circumference	217	−1.535	**−3.726****	**3.444***	**−6.409****	**−4.244****
Cardiometabolic risk markers						
Total cholesterol	217	−0.107	−1.283	0.307	−0.517	−0.582
High-density lipoprotein cholesterol	217	1.601	**2.766***	−3.503*	**6.763****	**3.466***
Low-density lipoprotein cholesterol	217	−0.108	−1.683	0.427	−1.553	−1.020
Triglycerides	217	**−3.670****	**−3.618****	**4.794****	**−4.993****	**−4.175****
Haemoglobin A1c	214	−0.973	−0.050	0.198	−0.442	−0.476
Fasting glucose	195	**−2.676***	**−2.053***	**2.758***	**−3.747****	**−2.425***
Serum insulin	217	**−2.674***	**−4.497****	**2.901***	−3.008	**−4.672****
Fitness tests						
Maximal oxygen uptake	218	**3.910****	**7.800****	**−2.719***	**2.915***	**6.645****
Push-ups	213	**4.249****	**5.499****	**−1.968***	**1.963***	**5.304****
Sit-ups	214	**3.868****	**5.718****	−1.221	**2.218***	**4.775****
Standing long jump	213	**3.919****	**5.337****	0.681	0.162	**4.203****

All participants. Linear regression was used showing results by means of t-values.
*P<0.05, threshold |t=1.96|; **p<0.001.
Statistically significant values are presented in bold.
LPA, light physical activity; MVPA, moderate to vigorous physical activity; N, number of participants; SB, sedentary behaviour.

BMI, waist circumference and FAT%.[25] The results gained from this study are in line with these previous findings.

However, there was no difference in the LDL and HbA1c values when comparing the upper quartile active and lower quartile passive participants, which differs from the results from other studies showing association of physical activity with improved HbA1c and LDL values.[10 12 13] Also, the average of LDL levels was over the reference values of 3.0 mmol/L, despite physical activity status. Elevated LDL values have been considered as a significant cardiovascular disease risk factor.[26] These findings suggest that there are other factors affecting the LDL profile than just physical activity. Furthermore, the HbA1c values change slowly and provide an index of average plasma glucose concentration during the previous 2–3 months. People

Table 4 Comparison between the most active and passive participants (all) using the mean lowest quartile and highest quartile of the daily steps with independent samples t-testing

	Daily steps mean lower quartile		Daily steps mean upper quartile		
	N	Mean (SD)	N	Mean (SD)	P value
Body composition					
Body mass	59	90.5 (19.9)	58	80.7 (12.1)	**0.002**
Body mass index	59	29.2 (5.4)	58	26.2 (3.0)	**<0.001**
Fat percentage	55	31.1 (10.0)	54	20.1 (7.0)	**<0.001**
Waist circumference	50	99.2 (15.0)	53	89.6 (8.7)	**<0.001**
Cardiometabolic risk markers					
Total cholesterol	53	5.12 (0.80)	52	4.94 (0.77)	0.224
High-density lipoprotein cholesterol	53	1.40 (0.40)	52	1.62 (0.42)	**0.008**
Low-density lipoprotein cholesterol	53	3.38 (0.73)	52	3.20 (0.83)	0.254
Triglycerides	53	1.58 (1.17)	52	0.98 (0.35)	**<0.001**
Haemoglobin A1c	51	35.8 (6.6)	50	35.3 (5.3)	0.711
Fasting glucose	48	5.6 (1.2)	43	5.2 (0.6)	**0.022**
Serum insulin	53	9.7 (10.4)	52	3.8 (4.0)	**<0.001**
Fitness tests					
Maximal oxygen uptake	50	36.5 (9.8)	55	47.6 (8.7)	**<0.001**
Push-ups	45	29 (14)	55	41 (12)	**<0.001**
Sit-ups	46	29 (14)	55	41 (10)	**<0.001**
Standing long jump	46	1.86 (0.50)	55	2.18 (0.35)	**<0.001**

Statistically significant p-values are presented in bold.
N, number of participants.

Table 5 Comparison between the most active and passive male participants using the mean lowest quartile and highest quartile of the daily steps with independent samples t-testing

	Daily steps mean lower quartile		Daily steps mean upper quartile		
	N	Mean (SD)	N	Mean (SD)	P value
Body composition					
Body mass	35	97.6 (18.1)	46	83.6 (9.7)	**<0.001**
Body mass index	35	29.6 (5.3)	46	26.3 (2.4)	**0.001**
Fat percentage	32	26.3 (8.4)	43	17.7 (5.0)	**<0.001**
Waist circumference	31	103.7 (14.4)	43	90.5 (7.8)	**<0.001**
Cardiometabolic risk markers					
Total cholesterol	29	5.02 (0.86)	40	4.97 (0.85)	0.803
High-density lipoprotein cholesterol	29	1.22 (0.30)	40	1.54 (0.37)	**<0.001**
Low-density lipoprotein cholesterol	29	3.40 (0.77)	40	3.29 (0.89)	0.582
Triglycerides	29	1.81 (1.41)	40	1.00 (0.38)	**0.005**
Haemoglobin A1c	28	37.6 (7.7)	38	34.9 (5.2)	0.097
Fasting glucose	25	5.9 (1.1)	32	5.1 (0.6)	**0.002**
Serum insulin	29	11.1 (11.0)	40	4.0 (4.3)	**0.002**
Fitness tests					
Maximal oxygen uptake	31	40.5 (9.0)	44	50.1 (6.3)	**<0.001**
Push-ups	29	32 (14)	44	44 (10)	**<0.001**
Sit-ups	29	35 (11)	44	43 (8)	**0.001**
Standing long jump	29	2.12 (0.37)	44	2.31 (0.22)	**0.014**

Statistically significant p-values are presented in bold.
N, number of participants.

with type 2 diabetes can have normal HbA1c and still have increased cardiovascular disease risk,[27] so the results from the analyses considering HbA1c were not informative in terms of the actual cardiovascular risk.

The weakness of the study was the small sample size, involving only 2% of the total of 11 940 employees working for the FDF in the year the participants were recruited. Also, the accelerometer may not accurately recognise movements performed only with the lower or upper extremities (eg, gym exercises) and movements performed in the supine position (eg, pilates).[28] Additionally, the accelerometer was not water-resistant, so water activities were not included.

The strength of the present study was that physical activity and SB were measured with an accelerometer, which objectively assessed the amount of physical activity.[29] Despite the small sample size, the mean ages of soldiers (40 years) as well as civilians (47 years) participating in the study closely approximated the averages of the FDF workers in the recruiting year of the participants (soldiers 39.7 years and civilians 48 years). Also, the majority of the participants were men (74.6%), as were the employees working for the FDF in the recruiting year (81.9%). Furthermore, a majority of the participants of the study were soldiers (71.2%) as well as workers in the FDF in the recruiting year (66.0%).[30] This indicates that the sample in the study represents FDF workers quite well.

In conclusion, there was no difference in physical activity, cardiometabolic risk factors or aerobic fitness between soldiers and civilians. Soldiers had, however, better muscular strength compared with civilians, which benefits their physically demanding work tasks. Because of the more physically demanding work profile of soldiers, they should be in better aerobic condition and more physically active compared with civilian workers. To examine if these results are due to selection bias, this should be investigated in a wider perspective among FDF workers. Moreover, both soldiers and civilians had high LDL and SB, which establishes cardiovascular risk despite their good physical activity and fitness status. While the LDL was not dependent on physical activity, other measures such as dietary interventions should be considered to optimise the lipid profile.

Regardless of the small sample size, this study reveals health issues that should be investigated with larger sample sizes in further studies. This would help to develop targeted interventions to improve the health, well-being and performance of military personnel.

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