This is a self-archived version of an original article. This version may differ from the original in pagination and typographic details.

Author(s): Santtila, Matti; Pihlainen, Kai; Koski, Harri; Vasankari, Tommi; Kyröläinen, Heikki

Title: Physical Fitness in Young Men Between 1975 and 2015 with a Focus on the Years 2005-2015

Year: 2018

Version: Accepted version (Final draft)

Copyright: © 2017 by the American College of Sports Medicine.

Rights: In Copyright

Rights url: <http://rightsstatements.org/page/InC/1.0/?language=en>

Please cite the original version:

Santtila, M., Pihlainen, K., Koski, H., Vasankari, T., & Kyröläinen, H. (2018). Physical Fitness in Young Men Between 1975 and 2015 with a Focus on the Years 2005-2015. *Medicine and Science in Sports and Exercise*, 50(2), 292-298.
<https://doi.org/10.1249/MSS.0000000000001436>

Physical Fitness in Young Men Between 1975-2015 with a Focus on the Years 2005-2015

Santtila M¹, Pihlainen K², Koski H², Vasankari T³ and Kyröläinen H^{1,4}

¹ Department of Military Pedagogy and Leadership, National Defense University, Helsinki, Finland

² Training Division, Defence Command, Helsinki, Finland

³ UKK-institute, Tampere, Finland

⁴ Faculty of Sport and Health Sciences, University of Jyväskylä, Jyväskylä, Finland

Corresponding author

Matti Santtila, PhD

Staffaksenkuja 7 C 10

01300 Vantaa

Tel. +358 50 530 9236

E-mail. matti.santtila@kolumbus.fi

Abstract

Purpose. The purpose of the present study was to investigate changes in physical fitness and anthropometry of young men entering the military service in Finland during the years 1975-2015. **Methods.** The study included the fitness test results of 627,142 healthy young male conscripts (age 19.1 ± 0.4 yrs.). Data included results of aerobic capacity, muscle fitness tests, and anthropometric characteristics. **Results.** The results show that the increase in mean body mass of young men has slowed down during the last ten years. However, the total increase in body mass was 6.8 kg (8.8%, $p \leq 0.001$) between 1993 and 2015. The mean distance achieved in the 12-minute running test decreased by 337 meters (12.2%, $p \leq 0.001$) between the peak in 1980 and 2015. The relative number of conscripts who ran less than 2200 meters increased from 3.6% to 25.9% ($p \leq 0.001$) between 1980 and 2015, and the proportion who ran more than 3000 meters decreased from 25.1% to 6.5% ($p \leq 0.001$). The relative number of conscripts who achieved an excellent or good muscle fitness index (MFI) decreased from 66.8% to 40.1% ($p \leq 0.001$) between 1992 and 2000, and remained unchanged between 2000 and 2010. However, the proportion who achieved a poor MFI increased from 8.1% to 31.4% ($p \leq 0.001$) between 1992 and 2010. **Discussion.** The present study shows that the increase in mean body mass of young male conscripts has slowed down during the last ten years. However, their aerobic capacity has still decreased during recent decades. In addition, the proportion of conscripts with poor muscle fitness has increased. From the national defense and health perspective, more initiatives are needed to encourage young men to increase their level of daily physical activity in order to be fit and ready for operations.

Keywords: Aerobic capacity, muscle fitness, body weight, body mass, BMI

1 INTRODUCTION

2 Regular physical activity, including training of aerobic capacity and muscle fitness, enhances
3 physical performance, well-being and functional capacity. All of the above-mentioned factors are
4 associated with a better quality of life, lower mortality, and lower risk of developing lifestyle-
5 related diseases (1, 2, 3). Several studies have demonstrated that across all age groups, the level of
6 daily physical activity is too low to even maintain health and physical fitness (2, 3, 4). Alarmingly,
7 a sedentary lifestyle combined with a lot of daily sitting time, especially TV-viewing, increases the
8 risk of premature death (2). Furthermore, inactivity has become an even bigger threat to human
9 health than obesity and smoking (4).

10

11 Inactivity seems to have a negative impact on the physical fitness of young soldiers. Santtila et al.
12 (5) reported that aerobic and muscle fitness of 20-year old men decreased and body mass increased
13 between 1975 and 2004 in Finland. This trend has also been observed in Norway, where researchers
14 found that the maximal oxygen uptake of conscripts entering military service decreased and the
15 proportion who were overweight increased between 1980 and 2002 (6). The same phenomena have
16 been observed in other Nordic Countries and in Germany (7, 8, 9). In addition, Tomczak et al. (10)
17 reported that the average time on the 1000 meter running test increased and pull-up performance
18 decreased in Polish Army recruits enrolled between 1971 and 2007.

19

20 Interestingly, some contradictory findings exist. For example, Sharp et al. (11) did not observe any
21 dramatic changes in the physical fitness of U.S. Army recruits between 1978 and 1998. However,
22 they found some increases in body mass, body fat%, fat free mass and muscle strength of the
23 recruits, but no changes in aerobic capacity. Some years later, Knapik et al. (12) reported slower
24 running test times, indicating a decline in aerobic fitness of recruits between 1987 and 2003.
25 However, they did not observe any changes in maximal oxygen uptake between 1975 and 1998.
26 Recently, Knapik et al. (13) reported that body weight increased, endurance performance declined
27 and muscle fitness remained unaltered or even increased in U.S. Army recruits between 1975 and
28 2013. Furthermore, Fain et al. (14) reported that grip strength of young U.S. men was lower than in
29 men of the same age 30 years previously. It should be kept in mind, however, that a comparison
30 between conscripts in compulsory military service and recruits in professional armies is not
31 appropriate because recruits from professional armies do not represent the general population of a

given age group. In general, there seems to be a lack of research concerning the physical fitness development of adolescents during the last ten years.

It is well known that military training and operations are mentally and physically very demanding, consisting of **tasks** like lifting or carrying heavy loads, digging and shoveling, climbing obstacles and sprinting, which necessitates a high level of physical fitness (15). General conscription service is still a foundation of the national defence in Finland. Annually, approximately 25,000 young men, which is about 70% of the age group, perform military service. The present study is a follow-up study related to the report of Santtila et al. (5), representing a population-based sample of Finnish men at the age of 20. The purpose of the present study was to investigate the secular changes in physical fitness and body anthropometry of young men entering compulsory military service in Finland between 1975 and 2015. The particular focus of the present study was the period between 2005 and 2015. Aerobic capacity data were collected between 1975 and 2015, muscle fitness data between 1982 and 2015, and body composition data between 1993 and 2015 among Finnish conscripts. Based on earlier trends of aerobic fitness of conscripts, we also computed future predictions of aerobic fitness levels up until the year 2030.

METHODS

Sample and data collection. The present dataset consisted of the fitness test results of 627,142 healthy young male conscripts. Mean ($\pm$ SD) age of the whole subject group was 19.1 ± 0.4 yrs. Data for aerobic capacity and muscle fitness included 627,142 and 513,067 test results, respectively. The present data were annually collected from all military units around Finland. The fitness tests were conducted by local educated fitness officers during the first two weeks of military service. After the tests, fitness officers imported the results to the data system according to the standards determined by the Training Division of the Defence Command. During the years of 1975-2004, the data were reported only by weighted means normalized to the number of subjects in each unit, the mean of units, and by the number of soldiers who were classified as poor-to-excellent. Thereafter, data archived to the database in the Training Division of Defence Staff. The database system was not the same during the entire study period. Therefore, the sample size of measured variables varied between years. Individual data were available between 2005 and 2015.

Aerobic capacity data ($n = 627,142$) were collected between 1975 and 2015. Muscle fitness index (MFI) data ($n = 513,067$) were collected between 1982 and 2010. Detailed information concerning the sample size of aerobic capacity and muscle fitness tests and body anthropometry between 1975 and 2004 have been published by Santtila et al. (5). The sample size of aerobic capacity test varied from 18,876 to 24,268 between 2005 and 2015. A sample size of MFI varied from 21,533 to 25,020 between 2005 and 2010. MFI data from 2011 to 2015 are not reported in the present study, as the testing protocol changed significantly in 2011. Body mass and height data were collected between 1993 and 2015, and sample size varied from 7507 to 27037. Individual data including body mass and height, body mass index (BMI), and results from the aerobic test and single muscle fitness tests were collected between 2005 and 2015.

The conscripts gave their written informed consent to participate in military service, including the present tests, after a physical examination by medical doctors. Fitness tests are an essential part of military training. Safety instructions were given to conscripts before each fitness test, and they were advised of their right to voluntarily interrupt the test at any time. The test termination criteria included the following indications: onset of angina-like symptoms, shortness of breath, wheezing, leg cramps, claudication, light-headedness, confusion, or nausea according to the Fitness Test Manual of the Finnish Defence Forces (16). All subjects were fully informed of the procedures and possible risks associated with the fitness tests. This study was conducted according to the 1975 declaration of Helsinki.

Measurements. Anthropometric measurements were performed by a physician during the medical check at the beginning of military service. The conscripts were barefoot and wore shorts during the measurements. Body mass was measured using commercial scales to nearest 100 g. Height was measured in a standing position using a tape measure with an accuracy of 5 mm. Thereafter, body mass index (BMI) was calculated.

All physical fitness tests, protocols and techniques were standardized according to the Fitness Test Manual of the Finnish Defence, which has been regularly updated since 1975. The tests were supervised and demonstrated by educated instructors. Endurance capacity of the conscripts was assessed using the 12-min running test (17). Tests were conducted on outdoor tracks during summer and on indoor circular tracks during winter. Conscripts were encouraged to run with maximal effort

at a progressively increasing running speed. The test results were recorded with an accuracy of 10 meters.

Muscle fitness tests consisted of five tests as follows: sit-ups and back for trunk and hip-flexor muscles; push-ups and pull-ups for the upper extremities; and standing long jump for the lower extremities. Results from sit-ups, back raises and push-ups were recorded as the number of repetitions completed in 60 s. The result for pull-ups was recorded as the number of continuous repetitions completed without a time limit. The result for standing long jump was expressed in meters from the longest jump of three trials, measured from the starting line to the landing point. The conscripts were advised to have at least a 5-minute recovery time between the tests. The results of each muscle fitness test were categorized from 0 (poor) to 3 (excellent). Thereafter, the sum of five muscle fitness test results formed the muscle fitness index (MFI). Detailed information about the muscle fitness tests and an MFI scoring table have been published by Santtila et al. (5).

Statistical analysis. Data are presented as means of the weighted means between 1975 and 2015, and with standard deviations ($\pm$ SD) from 2005 onwards. The analyses between 2005 and 2015 are based on values from individual conscripts. Logistic regressions were utilized when assessing the “good” or “poor” level as a function of year, with the first study year used as a reference. Regression analyses with linear or exponential fits were used for continuous variables and future predictions with three different prediction time spans. In addition, simple contrasts were used, to see if there was a change from the first year. Yearly averages of continuous variables were compared using ANOVA with Tukey Post Hoc test, when appropriate. Pearson correlation coefficients were calculated to find associations between the yearly means of the measured parameters. P-values less than 0.05 were defined as significant.

RESULTS

Body anthropometry. The mean ($\pm$ SD) body mass of the conscripts increased by **6.8 kg** (8.8%, $p \leq 0.001$) from 1992 to 2015. At the same time the mean height increased by **1.5 cm** ($p \leq 0.001$; Figure 1). Mean body mass remained unchanged between 2005 and 2015 (Table 1). Mean BMI values and the proportion of conscripts who were overweight and obese varied between 2005 and 2015 (Figure 2). During 2009 and 2013-2015, the proportions of overweight ($p \leq 0.001$) and obese ($p \leq 0.001$) conscripts were higher compared to 2005.

127 Aerobic capacity. The mean running distance achieved in the 12-minute running test improved
 128 between 1975 and 1979 (detailed results presented in Santtila et al. (5). Thereafter, the mean
 129 distance decreased by 337 meters (12.2%, $p \leq 0.001$) between 1980 and 2015 (Figure 3). During the
 130 years 2005-2015, the mean running distance decreased by 75 meters (3.1%, $p \leq 0.001$). The running
 131 test results from 2005 to 2015 are presented in Table 1. The relative number of conscripts who ran
 132 less than 2200 meters (poor fitness class) increased from 3.6% to 25.9% ($p \leq 0.001$) between 1980
 133 and 2015. At the same time (1979-2015), the proportion of conscripts who ran more than 3000
 134 meters (excellent fitness class) decreased from 25.1% to 6.5% ($p \leq 0.001$).

135

136 Muscle fitness. The relative number of conscripts who achieved an excellent or good MFI increased
 137 from 56.2% to 66.8% ($p \leq 0.001$) between 1982 and 1992, followed by a decrease to 40.1%
 138 ($p \leq 0.001$) between 1992 and 2000. Between 2000 and 2010, the relative number of conscripts who
 139 achieved an excellent or good MFI remained unchanged, varying between 40.1% and 45.2%
 140 (Figure 4). The relative number of conscripts who achieved a poor MFI decreased from 16.5% to
 141 8.1% ($p \leq 0.001$) between 1982 and 1992, and then increased to 31.4% ($p \leq 0.001$) between 1992 and
 142 2010.

143

144 The mean muscle fitness test results for standing long jump, sit-ups and push-ups during the years
 145 2005-2015 are presented in Table 1. No changes were observed in the mean values of the muscle
 146 fitness test results except for the standing long jump, which improved ($p \leq 0.001$) during the years
 147 2013-2015 compared to 2005-2012.

148

149 Associations and predictions. Body mass was inversely associated with 12-minute running test
 150 distance ($r = -0.85$, $p \leq 0.001$), running test class ($r = -0.80$, $p \leq 0.001$), and MFI class ($r = -0.65$, $p \leq 0.01$).
 151 BMI correlated inversely with mean 12-minute running test distance ($r = -0.38$, $p \leq 0.001$) and with
 152 MFI ($r = -0.28$, $p \leq 0.001$). Excellent/good class in MFI correlated inversely with mean 12-minute
 153 running test distance ($r = -0.64$, $p \leq 0.05$), whereas poor class in MFI correlated with a poor result on
 154 the 12-minute running test ($r = 0.85$, $p \leq 0.01$).

155

156 Predictions based on the mean values in the 12-minute running tests suggest that the aerobic
 157 capacity of conscripts will decrease between 2015 and 2030 (Figure 5). A shorter term prediction

158 model (2000-2015) led to a less steep angle of decline in running test results compared to longer
 159 term prediction (1975-2015). Based on the trend for 2000-2015, the mean running test values are
 160 predicted to decrease from 2480 to 2398 m by the year 2030. Based on the trend for 1975-2015, the
 161 mean values will decrease from 2667 to 2261 m by the year 2030.

162

163 **DISCUSSION**

164 The present study demonstrates that the mean body mass of young men (conscripts) entering
 165 Finnish military service has increased and aerobic capacity has decreased during the last 20-35
 166 years. In addition, the proportion of conscripts classified as having poor aerobic and muscle fitness
 167 has linearly increased up to 2015. Mean body mass increased by almost 7 kg between 1993 and
 168 2015. Importantly, no significant changes in mean body mass were observed between 2005 and
 169 2015, indicating a plateau in the long-term negative development of body mass in young men. The
 170 findings of the present study regarding body mass are in line with those of the FINRISK 2012
 171 study, which reported that Finland is one of the first countries to observe a flattening of the trend
 172 towards an increasing proportion of overweight adults during the years 2007-2012 (18). However,
 173 at the global level, the obesity trend is still increasing (19).

174

175 Aerobic capacity of Finnish conscripts has dramatically decreased since 1980. During this time, the
 176 relative number of conscripts with excellent aerobic fitness has decreased four-fold, with a
 177 concurrent seven-fold increase in the proportion of conscripts classified as having poor aerobic
 178 fitness. Furthermore, according to the prediction analysis performed in this study, aerobic fitness is
 179 expected to continue to decline in the future. However, our prediction based on extrapolating
 180 existing regression lines contains uncertainty, although it is known that the overweight and obesity
 181 epidemic of children and adolescents in Finland has not shown any improvements. Poor aerobic
 182 capacity was associated with higher body mass, BMI and lower muscle fitness based on yearly
 183 means of the measured parameters. Outside of Finland, declining physical fitness of military
 184 recruits/conscripts also seems to be a challenge, especially in Europe (5, 6, 7, 10).

185

186 One of the reasons for the decline in aerobic capacity might be an increase in physical inactivity
 187 combined with a sedentary lifestyle. Kyröläinen et al. (20) reported that levels of physical inactivity
 188 have increased, especially among young girls and boys between the ages of 15 and 21, which
 189 coincides with the mean age of the conscripts in the present study. In addition, Liukkonen et al. (21)

recently reported that objectively measured sedentary time (11-15 years) was very high among Finnish school-aged children, varying between 5 and 9 hours a day. At the same time, only 24% of children met the 60-min minimal recommendation for daily physical activity. Husu et al. (22) also reported that 7-14 year old school children spent on average 54% of their waking hours mainly sitting, which is consistent with the findings of Tammelin et al. (23), who also found that TV viewing time of adolescents has generally exceeded the recommendation of no more than two hours per day. In addition, only 23% of boys and 10% of girls met the minimal requirements for daily physical activity, which was at least one hour per day (23). Based on these findings, it seems likely that the decreasing aerobic fitness of young men is a consequence of an increasingly sedentary lifestyle before entering military service.

The relative number of conscripts with an excellent or good MFI decreased by 26% between 1992 and 2000. However, no significant changes were observed in MFI between 2000 and 2015. Concurrently, the relative number of conscripts with a poor MFI increased by almost four-fold. On the other hand, no changes were in the mean values of the individual muscle fitness test results between 2005 and 2015, except for improved standing long jump performance during the last three years. This indicates a plateau in muscle fitness of conscripts during the last ten years. Military tasks typically consist of carrying and lifting heavy loads, which necessitate an adequate level of muscle fitness. A good level of muscle fitness and higher fat free mass have been shown to correlate with better success in military training and operations (15).

Declining physical fitness of the conscripts entering military service is a challenge for the Finnish Defence Forces. In particular, it is difficult to select training methods to maximize the capability of soldiers in various military duties. There is also an increasing trend of premature discharge from military service for reasons such as being overweight and incurring musculoskeletal injuries (24). In the present study, 20% of conscripts entering military service between 1982 and 2015 had poor levels of aerobic and muscle fitness. Taanila et al. (25) found that low physical fitness and being overweight were risk factors for musculoskeletal injuries. In addition, Larsson et al. (26) found that the same factors also increased the risk of premature discharge from military service. The authors of both studies suggested pre-training programs for recruits to improve their physical fitness before entering military service. Taanila et al. (25) also reported that muscle endurance exercises 2-3 times a week at the beginning of military service decreased the incidence of low back pain symptoms and lower body injuries in conscripts.

Decreasing aerobic fitness and increasing obesity in early age can also be harmful to national health and the associated budget. A low level of aerobic fitness is known to be associated with a higher risk of cardiovascular diseases, premature mortality and various cancers (27). Thus, a 12 % decrease in aerobic fitness in Finnish young men could increase the incidence of cardiovascular diseases and even mortality (28). Compulsory military service represents an excellent opportunity to raise awareness, and to appeal to young men to improve their physical fitness, body composition and even health-related behavior. Santtila et al. (29) observed that previously inactive conscripts achieved the greatest improvements (19%) in VO_2max after 8-weeks of basic training. Accordingly, the difference in mean VO_2max values between previously active and inactive conscripts decreased in comparison to the pre-training values. Mikkola et al. (30) found positive changes in body composition of conscripts, which were also associated with improved aerobic fitness. In addition, these positive results were more pronounced among unfit and overweight conscripts. Therefore, the authors suggested that military service may have positive health effects at the population level, such as reduced incidence of overweight and morbidity. These beneficial health and physical performance related findings could also be used in communication or marketing to improve the intrinsic motivation of call-up age, especially those with higher body mass and lower levels of physical fitness.

The present study demonstrated population level changes in physical fitness of young Finnish men between 1975 and 2015. The sample sizes were representative during most of the reported years. However, large variation in the sample sizes between the years can be seen as a weakness of the present study.

CONCLUSION

The present study demonstrates that the mean body mass of young men entering Finnish military service has increased significantly since the early 1990's, although this trend has slowed during the last 10 years. At the same time, aerobic capacity has dramatically declined. In addition, the relative number of conscripts with poor aerobic and muscle fitness has still increased, whereby one in four young men have poor fitness levels at the beginning of military service. Decreasing physical fitness may be a big challenge for the military readiness of the Finnish Defence Forces. Physical training of conscripts before entering military service may be one possible solution. In addition, from the

254 national health perspective, more initiatives are needed to encourage adolescents to increase their
255 levels of daily physical activity, and improve their health awareness.

256

257 **Acknowledgements**

258 The authors are very grateful to Mrs. Elina Vaara for assistance with statistical analysis, and Dr.
259 Neil Cronin for language editing.

260

261 **Conflict of Interest**

262 There are no conflicts of interest, financially or otherwise, among any of the authors of this article.
263 The results of the study are presented clearly, honestly, and without fabrication, falsification, or
264 inappropriate data manipulation. All authors contributed to the formulation of the idea of the
265 present study and contributed significantly to the writing of, and also approved, the final article. The
266 results of the present study do not constitute endorsement by the ACSM.

267

268

269

270 **References**

- 271 1. Blair SN, Church TS. The fitness, obesity, and health equation. Is physical activity the
272 common denominator? JAMA. 2004; 292:1232-1234.
- 273 2. Ekelund U, Besson H, Luan J, et al. Physical activity and gain in abdominal adiposity and
274 body weight: prospective cohort study in 288,498 men and women. Am J Clin Nutr 2011;
275 93: 826–835.
- 276 3. Koster A, Caserotti P, Patel KV, et al. Association of sedentary time with mortality
277 independent of moderate to vigorous physical activity. PLoS One 2012; 7:e37696.
- 278 4. World Health Organization (editors). Global status report on noncommunicable diseases
279 2010. World Health Organization. ISBN 978 92 4 156422 9. 2010; Chapter 1. pp. 18-19.
- 280 5. Santtila M, Kyröläinen H, Vasankari T et al. Physical Fitness Profiles in Young Finnish
281 Men during the Years 1975–2004. Med Sci Sports Exerc. 2006; 38:1990–94.
- 282 6. Dyrstad SM, Aandstad A and Hallén J. Aerobic fitness in young Norwegian men: a
283 comparison between 1980 and 2002. Scand J Med Sci Sports. 2005; 15:298-303.
- 284 7. Leyk D, Rohde U, Gorges W, et al. Physical performance, body weight and BMI of young
285 adults in Germany 2000-2004: results of the physical-fitness-test study. Int J Sports Med.
286 2006; 27: 642-7.
- 287 8. Rasmussen F, Johansson M, Hansen H. Trends in overweight and obesity among 18-year-
288 old males in Sweden between 1971 and 1995. Acta Paediatr. 1999; 88:431-437.
- 289 9. Sørensen HT, Sabroe S, Gillman M, et al. Continued increase in prevalence of obesity in
290 Danish young men. Int J Obes. 1997; 21:712-714.
- 291 10. Tomczak A, Bertrandt J, Kłos A. Physical fitness and nutritional status of polish ground
292 force unit recruits. Biol Sport. 2012; 29: 277-80.
- 293 11. Sharp MA, Patton JF, Knapik JJ, et al. Comparison of the physical fitness of men and
294 women entering the U.S. Army: 1978-1998. Med Sci Sports Exerc. 2002; 34:356-363.
- 295 12. Knapik JJ, Sharp MA, Darakjy S, Jones SB, Hauret KG, Jones BH. Temporal changes in the
296 physical fitness of US Army recruits. Sports Med. 2006; 36:613-34.
- 297 13. Knapik J, Sharp M, Steelman RA. Secular Trends in the Physical Fitness of United States
298 Army Recruits on Entry to Service, 1975-2013. J Strength Cond Res. 2017; 31: 2030–2052.
- 299 14. Fain E, Weatherford C. Comparative study of millennials' (age 20-34 years) grip and lateral
300 pinch with the norms. J Hand Ther. 2016; 29: 483-488.
- 301 15. Rayson M, Holliman D, Belyavin A. Development of physical selection procedures for the
302 British Army. Phase 2: relationship between physical performance tests and criterion tasks.
303 Ergonomics. 2000; 43: 73-105.

16. Pihlainen K, Santtila M, Ohrankämmen O, Ilomäki J, Rintakoski M, Tiainen S. Fitness Test Manual of the Finnish Defence Forces. Prima Edita. 2011; ISBN 978951220534; 11-12.
17. Cooper K. A means of assessing maximal oxygen intake. Correlation between field and treadmill testing. JAMA 203:201–204, 1968.
18. Borodulin K, Vartiainen E, Peltonen M, et al. Forty-year trends in cardiovascular risk factors in Finland. Eur J Public Health. 2015; 25: 539-46.
19. Ng M, Fleming T, Robinson M, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. The Lancet 2014; 384: 766-81.
20. Kyröläinen H, Santtila M, Nindl BC, Vasankari T. Physical fitness profiles of young men: associations between physical fitness, obesity and health. Sports Med. 2010; 40: 907-20.
21. Liukkonen J, Jaakkola T, Kokko S, et al. Results from Finland's 2014 Report Card on Physical Activity for Children and Youth. J Phys Act Health. 2014; 11 Suppl 1: S51-7.
22. Husu P, Vähä-Ypyä H, Vasankari T. Objectively measured sedentary behavior and physical activity of Finnish 7- to 14-year-old children– associations with perceived health status: a cross-sectional study. BMC Publ Health 2016; 16: 338.
23. Tammelin T, Ekelund U, Remes J, Näyhä S. Physical activity and sedentary behaviors among Finnish youth. Med Sci Sports Exerc. 2007; 39: 1067-74.
24. Training Division of the Defence Command. The Register of Conscription 2015. The Reason for Interruption of the Military Service during the Years 1995–2015 (in Finnish), 2015.
25. Taanila H, Hemminki AJ, Suni JH, Pihlajamäki H, Parkkari J. Low physical fitness is a strong predictor of health problems among young men: a follow-up study of 1411 male conscripts. BMC Public Health. 2011; 25; 11:590.
26. Larsson H, Broman L, Harms-Ringdahl K. Individual risk factors associated with premature discharge from military service. Mil Med. 2009; 174:9-20.
27. Ross R, Blair B, Ross A, et al. Importance of Assessing Cardiorespiratory Fitness in Clinical Practice: A Case for Fitness as a Clinical Vital Sign. Circulation 2016; 13; 134 (24): e653-e699.
28. Kodama S, Saito K, Tanaka S, et al. Cardiorespiratory fitness as a quantitative predictor of all-cause mortality and cardiovascular events in healthy men and women: a meta-analysis. JAMA. 2009; 20; 301:2024-35.

- 336 29. Santtila M, Häkkinen K, Karavirta L, Kyröläinen H. Changes in cardiovascular performance
337 during an 8-week military basic training period combined with added endurance or strength
338 training. *Mil Med.* 2008; 173:1173-79.
- 339 30. Mikkola I, Keinänen-Kiukaanniemi S, Jokelainen J, et. al. Aerobic performance and body
340 composition changes during military service. *Scand J Prim Health Care.* 2012; 30: 95-100.

Figure legends

Figure 1. Mean body mass (left y-axis, solid black line) and height (right y-axis, dashed line) of the conscripts during the years 1993-2015.

Figure 2. The relative distribution of BMI values between 2005 and 2015, categorized as follows: overweight 25.01-30.00 and obese > 30.00. Bars marked with asterisks (**overweight and obese together**) differ significantly from all those without asterisks (*. $p \leq 0.01$).

Figure 3. Mean values from the 12-minute running tests (black solid line). The dashed line with black squares represents the relative distribution of excellent results. The dashed line with black dots represents those with poor results. All values were compared to the results from 1975.

Figure 4. The distribution of MFI results during the years 1982–2010. The solid black line represents excellent and good results combined. The dashed line with dots represents poor results.

Figure 5. Predicted 12-minute running test results for the years 2015-2030. The black solid line represents the measured mean values of the 12-minute running tests between 1975 and 2015. The longer dashed line represents predicted 12-minute running test distance based on results between 1975 and 2015, whereas the shorter dashed line represents a prediction based only on the data from 2000 to 2015.

Year	Body mass (kg)	Running distance (m)	Standing long jump (cm)	Sit-ups (reps/min)	Push-ups (reps/min)
2005	76±13	2493±368	217±25	37±11	31±13
2006	77±14	2486±371	216±25	37±11	31±13
2007	77±13	2464±367*	216±25	37±11	31±13
2008	77±13	2463±362*	216±25	37±11	31±13
2009	77±13	2474±358*	217±25	37±11	32±13
2010	77±13	2475±365*	217±26	37±11	32±14
2011	77±13	2467±360*	217±26	37±11	32±14
2012	77±13	2450±365*	219±27	37±11	33±14
2013	77±13	2440±362*	221±28*	37±11	33±14
2014	78±14	2428±369*	221±28*	37±11	33±15
2015	77±14	2418±369*	222±28*	37±11	32±14

Table 1. Mean ($\pm$ SD) muscle fitness test results between 2005 and 2015 (sample size, n, varied between 19,371 and 23,355; *, $p \leq 0.01$).

Figure 1.

Figure 2.

Figure 3.

Figure 4

Figure 5