

Physical fitness of students based on a test used to assess the physical fitness of soldiers of the National Reserve Forces

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Abstract

Background and Study Aim The purpose of this study was to analyze the physical fitness of students based on a test used to assess the physical fitness of soldiers of the National Reserve Forces.

Material and Methods The study included 30 students majoring in Physical Education, specializing in Physical Education in the Uniformed Services. The average age of the subjects was 23.53 years, where the youngest subject was 21.92 years old and the oldest was 28.67 years old (SD = 1.513). The National Reserve Forces (NSR – abbreviation using in Polish language) physical fitness test was used to assess the level of physical fitness of professional soldiers. Students completed a proprietary research questionnaire to investigate the level and type of additional physical activity of the subjects, their future career plans related to the uniformed services, and their level of satisfaction with their performance on the fitness tests.

Results It was shown that students who rated their level of preparation for uniformed service and satisfaction with their performance higher scored better on the NSR test. It was proven, equally, that students having a higher weekly volume of additional physical activity obtain higher scores in the fitness test. In addition, it has been demonstrated that better results in the fitness test are achieved by students who engage in physical activity at the level of active athletes.

Conclusions The recommendation to introduce classes similar to sports training under battlefield conditions into schools and universities preparing future uniformed officers is justified. This would give a simultaneous improvement in physical fitness along with an increase in the level of self-efficacy for combat operations. Those wishing to enter the selection process for uniformed formations should practice regular physical activity, preferably at an intensity and volume close to the competitive level. This significantly affects the result achieved in the fitness test.

Keywords: level of physical fitness, physical education students, physical education, military education, military fitness test

Introduction

Physical activity is one of the determinants of human functioning in daily life. Regular physical activity is supportive in the treatment and prevention of infectious diseases, delays dementia, contributes to the maintenance of normal body weight, and has a beneficial effect on mental health [1, 2, 3, 4]. In order to develop and function healthily, it is necessary to maintain an adequate level of activity and physical fitness throughout life, matching it with lifestyle and work [5, 6, 7, 8]. Previous studies have shown that physical activity is at a much lower level in schoolchildren and students on days when they do not have mandatory physical activity, and that problems with proper body weight are increasingly common [3, 4, 9, 10]. It has been proven that it would be reasonable to have integrated regulation at the school level, so that school-aged students would incorporate physical activities classified as compulsory into their daily lives and perceive them as routine in their daily

lives. This translated into their greater practice in physical activity and level of physical fitness [11]. It has been shown that in college students, the level of extra-curricular physical activity varies according to their gender and cultural backgrounds, and that their physical activity decreases with age [12, 13, 14, 15]. Uniformed formations are an occupational group where physical activity is one of the elements of the work environment, and the level of physical fitness is one of the factors influencing the effectiveness of the job [16]. So far, it has also been shown that, regardless of the uniformed formation, it is advisable for officers to have their own sports training to ensure that they are adequately prepared for duty [17], take care of nutrition during duty [18, 19, 20] and also prepare for fitness tests [21, 22, 23, 24]. In addition, the level of physical fitness has been shown to be related to how one functions in the military environment and positively affects adaptations to the work environment [24, 25, 26].

The authors in the present study set 2 hypotheses:

H1: Students who rate higher their level of preparation for uniformed service and their satisfaction with their performance, score better on

the fitness test.

H2: Respondents engaged in extracurricular physical activity, with a higher volume, achieve better results in the fitness test.

The purpose of this study was to analyze the physical fitness of students based on a test used to assess the physical fitness of soldiers of the National Reserve Forces.

Materials and Methods

In the present study, the authors analyze the level of physical fitness of students at the majoring in Physical Education (PE), specializing in PE in the uniformed services as individuals who are potentially interested in working in the uniformed services, after graduating from higher education.

So far, the physical fitness of students majoring in physical education, in a specialization that prepares them for work in the uniformed services, has not been analyzed. Therefore, a study was undertaken to analyze physical fitness as measured by the directional fitness test for the National Reserve Forces of the Polish Army. The relationships between the results achieved in the fitness test and the self-assessment of the level of fitness preparation for service in the uniformed formations and the level of satisfaction with the results achieved in the test, as well as the extracurricular activity practiced by students, its volume and nature, were examined.

Participants

The study involved 30 men, students of the Poznan University of Physical Education, majoring in Physical Education, specializing in Physical Education in the Uniformed Services. The study was conducted as part of field classes during the subject of fitness all-round events. The average age of the subjects was 23.53 years, where the youngest, tested was 21.92 years old and the oldest was 28.67 years old (SD = 1.513). The mean body height was 182 cm (SD = 0.072), the mean body weight was 79.2 kg (SD = 11.238), and the mean BMI of the subjects was 23.823 (SD = 2.269).

Research Design

The physical fitness test of professional soldiers of the National Reserve Forces (NSR - abbreviation using in Polish language) was used to assess the level of individual fitness [27].

To assess the fitness level of the students, based on the NSR test, the subjects had to perform four fitness tests:

- 1) a 3000-meter cross-country run,
- 2) pull-ups on a high bar, keeping arms straight during the descent and crossing the bar line with the chin while flexing the arms,
- 3) shuttle run over a distance of 10 x 10 meters (during which the test subject must cross each line to pass the test)
- 4) sit-ups for two minutes.

The results of each test were recorded and converted into points, according to the guidelines written in the Ordinance. A total of 100 points could be earned for all attempts. The respondents, for their tests, were evaluated as Z-category subjects, i.e., persons fit for professional military service or service as a candidate for professional soldier [28].

In addition, the respondents completed the author's research questionnaire. It included questions about the subjects' level of additional physical activity, their future career plans related to the uniformed services, and their level of satisfaction with their performance in fitness tests (Table 1).

Statistical Analysis

In the study, the mean and standard deviation (SD) were calculated. An analysis of the normality distribution of the data was performed using the W Shapiro-Wilk test. Based on its results, Pearson's r correlation was used to analyze the relationships involved, between the fitness trials. Spearman's rank correlation was employed to analyze the results obtained in the fitness tests and the subjects' responses from the research questionnaire. Statistica 13.3 software was used to analyze the results.

Ethical issue

The tests were performed as part of the Fitness All-Round Event subject, within which students are required to perform the analyzed samples of the NSR test to get a pass from the subject. The subject of All-Round Event is compulsory in the course of study of Physical Education, specialty "Physical Education in Uniformed Services".

Results

During the NSR test in the 3,000-meter cross-country run trial, the subjects scored an average of 13.22 minutes (SD = 1.729) and 36.4 points (SD = 7.232). 90% of the subjects passed this test. In the 10 x 10 m shuttle run test, the subjects scored an average of 26.43 sec (SD = 1.869) and 18.36 points (SD = 1.715). The pass rate for this trial was 100%. In the sit-ups test, the subjects obtained an average of 79 repetitions (SD = 15.605) and 14.72 points (SD = 2.268) and 96.67% of them passed this test. In the pull-up bar test, an average of 9 pull-ups (SD = 4.683) and 14.09 points (SD = 3.636) were obtained. The pass rate for this test was 76.67%. On average, 83.57 points (SD = 10.911) were obtained in the NSR test. The lowest score was 58 points, and the highest was 97.6 points. The pass rate for the entire fitness test was 66.67% (Table 2).

Responding to the research questionnaire, 30% of the students indicated a desire to work in uniformed services formations in the future, and 50% of the participants said they were satisfied with the result they received during the physical fitness tests. On a scale of 1 to 10, the respondents rated their level of fitness preparation at an average of 6.23 (SD =

Table 1. Research questionnaire

Please answer at the following questions. Your answers are completely anonymous and will be used only for scientific research. Thank you very much.	
1	Age (years and months)
2	Do you associate your future with work in uniformed services? YES NO
3	Are you satisfied with the results obtained during the fitness tests? YES NO
4	On a scale of 1-10, rate your level of physical preparation for service in uniformed formations, where 1 is completely unprepared and 10 is fully prepared. 1 2 3 4 5 6 7 8 9 10
5	At what level do you engage in physical activity in your daily life in your spare time? (you can choose two answers) - not involved in any physical activity apart from compulsory classes - recreation level - active athletes
6	How many days a week do you do additional (own) physical activity? - 0 - 1-2 - 3-4 - 5- 6 - everyday

Table 2. Results of fitness tests of students of specialization Physical Education in uniformed services

Variables	Average	Minimum	Maximum	Standard Deviation [SD]	Test passing [%]
A 3000 m cross-country run [min]	13.217	10.220	16.580	1.729	-
A 3000 m cross-country run [points]	36.400	20.000	44.000	7.232	90.0
Shuttle run 10x10 m [sec]	26.436	23.500	30.000	1.869	-
Shuttle run 10x10 m [points]	18.360	13.400	19.000	1.715	100.00
Sit-ups [numbers]	79.267	45.000	115.000	15.605	-
Sit-ups [points]	14.720	6.000	16.000	2.268	96.67
Pull-ups on a high bar [numbers]	9.267	2.000	19.000	4.683	-
Pull-ups on a high bar [points]	14.093	8.200	21.000	3.636	76.67
Sum of points in the NSR test [points]	83.573	58.000	97.600	10.911	66.67

1.716). 29 of the 30 respondents engage in additional (non-compulsory) physical activity, averaging 2.867 days per week (SD = 1.042). The least is 1 day and the most is 4 days per week. Detailing the nature of additional physical activity, 3.33% of respondents report that they do not do any physical activity at all outside of compulsory activities, 40% do physical activity at a recreational level, and 56.67% are active

athletes (Figure 1).

In analyzing the results obtained by the respondents in the fitness test, due to the fact that the respondents belonged to different age groups, for which they were entitled to a different grading scale in the NSR test, only the point scores and the respondent's obtaining a passing grade for a given test were used for statistical analysis. In addition,

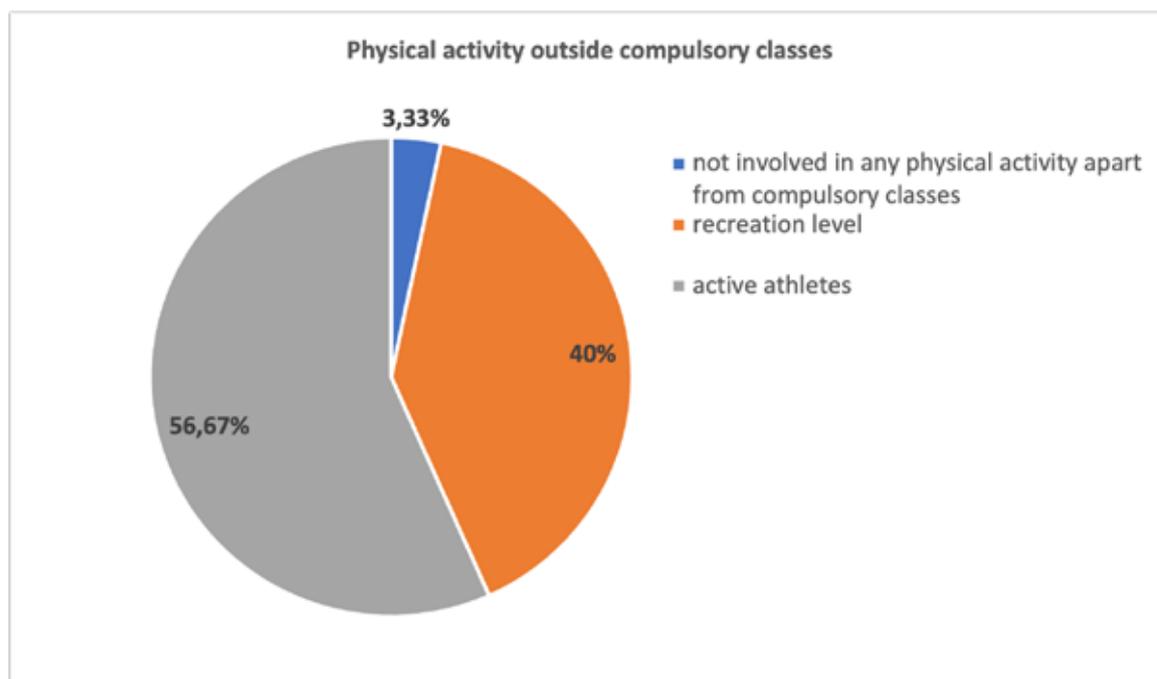


Figure 1. The nature of the physical activity practiced by the respondents outside of compulsory physical activities in their studies

due to the fact that all subjects passed the 10 x 10m shuttle run test, the variable of passing this test was not included in the statistical analysis. Based on the results obtained in the analysis, it was shown that students with a higher body weight obtained better results in the 3,000-meter cross-country run ($r=(0.6626)$; $p<0.000$). At the same time, it was shown that subjects with lower body weight performed worse in the backward bending test ($r=(-0.4455)$; $p<0.14$), the pull-up bar ($r=(-0.4382)$; $p<0.015$), the entire fitness test ($r=(-0.5414)$; $p<0.002$) and failed the test more often ($r=(-0.5745)$; $p<0.001$). It was also noted that those with a lower BMI performed more poorly in the 3,000-meter cross-country run ($r=(-0.3970)$; $p<0.030$), backward bending ($r=(-0.4485)$; $p<0.013$), the entire fitness test ($r=(-0.4060)$; $p<0.026$) and failed the test more often ($r=(-0.3820)$; $p<0.037$). Significant correlations were also found between individual fitness tests and between scores on individual tests and the overall test score. There was a correlation between the results obtained in the 3000m cross-country run and the 10 x 10m shuttle run ($r=(0.3896)$; $p<0.033$) and the backward bending ($r=(0.4018)$; $p<0.028$) as well as the 10 x 10m shuttle run and the backward bending ($r=(0.4777)$; $p<0.008$). Students who scored more points or passed individual trials obtained more points from the entire test. This relationship was not shown to be significant with passing the pull-up bar test. There was no significant effect on obtaining a passing score on the NSR test with the 10 x 10m shuttle run test (all subjects passed this test, so changes in the differences at this level may have been) and the passing of the backward bending test. The remaining

trials showed a significant effect on the final test score, and the highest was shown by passing the pull-up bar ($r=(0.7802)$; $p<0.000$), (Table 3).

Students declaring a higher level of satisfaction with their performance in fitness tests scored more points in the 3000m cross-country run ($r=(0.514)$; $p<0.01$) and more points in the entire NSR test ($r=(0.435)$; $p<0.05$). Respondents with higher ratings of their own fitness preparation for service in uniformed formations scored more points in the 3000m cross-country run ($r=(0.425)$; $p<0.05$) and from the entire fitness test ($r=(0.366)$; $p<0.05$). Those engaged in extra-curricular physical activity, with active status, scored more points in the 3000m cross-country run ($r=(0.448)$; $p<0.05$) and from the entire fitness test ($r=(0.432)$; $p<0.05$). Respondents declaring a greater number of days on which they engaged in additional physical activity scored more on tests such as 3000m cross-country run ($r=(0.468)$; $p<0.01$) and pull-up bar ($r=(0.572)$; $p<0.01$) and scored more on the entire NSR fitness test ($r=(0.481)$; $p<0.01$), (Table 4).

Discussion

The testing confirmed both research hypotheses. It was shown that students who rated their level of preparation for uniformed service and satisfaction with their performance scored higher on the NSR test. The respondents indirectly determined the sense of their effectiveness in the test they took and in relation to the possibility of their getting into the uniformed formation of their choice. It was proven that students who have a higher volume of

Table 3. Correlation of body weight, BMI of the subjects, scores and pass rates in individual tests in the NSR physical fitness test.

Variables	Body weight [kg]	BMI	NSR – A 3000 m cross-country run [points]	NSR - 3000 m cross-country run [passed / failed]	NSR – Shuttle run 10 x 10 [points]	NSR – Sit-ups [points]	NSR – Sit-ups [passed / failed]	NSR - Pull-ups on a high bar [points]	NSR – Pull-ups on a high bar [passed / failed]	NSR - sum of points	NSR – Result of the test [passed / failed]
NSR - A 3000 m cross-country run [points]	.6626 p=.000	-.3970 p=.030									
NSR - A 3000 m cross-country run [passed / failed]	-.2849 p=.127	-.3296 p=.075	.6626 p=.000								
NSR – Shuttle run 10 x 10 [points]	-.1590 p=.401	-.1023 p=.590	.3896 p=.033	.2425 p=.197							
NSR – Sit-ups [points]	-.4455 p=.014	-.4485 p=.013	.4018 p=.028	.5362 p=.002	.4722 p=.008						
NSR – Sit-ups [passed / failed]	-.2483 p=.186	-.3535 p=.055	.3656 p=.047	.5571 p=.001	.5462 p=.002	.7262 p=.000					
NSR – Pull-ups on a high bar [points]	-.3340 p=.071	-.1007 p=.596	.2980 p=.110	-.0472 p=.804	-.0131 p=.945	.2070 p=.272	-.1094 p=.565				
NSR – Pull-ups on a high bar [passed / failed]	-.4382 p=.015	-.1920 p=.310	.1374 p=.469	-.1839 p=.331	-.0131 p=.945	.1004 p=.598	-.1024 p=.590	.4686 p=.009			
NSR – Sum of points	-.5414 p=.002	-.4060 p=.026	.9069 p=.000	.5730 p=.001	.5092 p=.004	.6174 p=.000	.4427 p=.014	.5717 p=.001	.2352 p=.211		
NSR - Result of the test [passed / failed]	-.5745 p=.001	-.3820 p=.037	.5450 p=.002	.4714 p=.009	-.0335 p=.860	.4313 p=.017	.2626 p=.161	.3904 p=.033	.7802 p=.000	.5757 p=.001	

Table 4. Performance in the fitness test vs. research questionnaire (Spearman's R correlation)

Variables	NSR A 3000 m cross-country run [points]	NSR Shuttle run 10x10m [points]	NSR Sit-ups [points]	NSR Pull-ups on a high bar [points]	NSR sum of points [points]
Willingness to work in uniformed services	0.030	0.028	-0.065	0.106	-0.097
Level of satisfaction with the results obtained in fitness tests	0.514 p<0.01	-0.183	-0.081	0.275	0.435
Self-assessment of the level of fitness for service in uniformed formations	0.425	0.015	0.121	0.288	0.366
Lack of physical activity outside of compulsory classes	-0.271	0.073	-0.297	-0.130	-0.290
Additional and physical activity- Recreation	-0.353	-0.266	-0.191	-0.261	-0.330
Additional and physical activity- Active athletes	0.448	0.237	0.296	0.305	0.432
Number of days per week with non-compulsory physical activity	0.468 p<0.01	-0.126	0.053	0.572 p<0.01	0.481 p<0.01

additional physical activity per week obtain higher scores in the fitness test. In addition, a significant relationship on the improvement of scores in the fitness test was shown by physical activity at the level of an active athlete, in the sport practiced.

Previous studies have shown that a higher sense of self-efficacy significantly affects the desire to join the uniformed services [29]. The results obtained in the study show that students who were more satisfied with their performance in the fitness test achieved a significantly higher score in the 3,000-meter cross-country run and in the entire fitness test. Also, in the 3,000-meter cross-country run and in the entire test, higher scores were obtained by respondents who declared a better level of fitness preparation for service in uniformed formations. These results are consistent with a recent study analyzing the training process of applicants for Norwegian Armed Forces officer training. It was shown that cadets with higher feelings of self-efficacy and performance achieved better results on field exercises and were less likely to drop out [30]. In addition, studies indicating that cadets of uniformed formations characterized by higher levels of self-efficacy also have better levels of mental health [31] and are better able to cope with difficult situations, which is one of the elements of the profession, might serve to emphasize the importance of self-efficacy in the work/school environment [26, 32]. This indicates that a higher level of self-efficacy supports the recruitment and effectiveness of cadets in uniformed formations, characterized by a task-oriented and often variable work environment. However, despite the fact that cadets in the uniformed services are taught to cope with such situations from basic training it often still

seems insufficient and demanding [33]. This is also supported by studies showing that self-efficacy is linked to cadets' task-based approach to the process of their physical preparation for uniformed service [21, 22, 23, 34]. With the above in mind, according to the Authors, it would be reasonable to introduce into each uniformed formation and civilian University preparing potential candidates for service in such formations classes that shape the sense of self-efficacy in the future work environment. Bearing in mind the specifics of service in uniformed formations, they should combine physical activities with classes in skills for dealing with difficult situations (simulations), providing a basis for acquiring practical skills for acting in non-standard circumstances and raising the level of physical fitness.

It has also been proven that at present, the physical fitness of officers in uniformed formations should be shaped primarily in terms of their aerobic fitness and, typical of the tasks performed in their profession, strength. Since these qualities are opposite to each other, the preparation of recruits requires a specific training program [35]. This fact is confirmed by the results of a study in which the pull-up bar test was the only one that did not correlate with other tests, and the fact that it was the only one passed did not significantly affect the total points obtained in the whole test. This may indicate the need for additional activity dedicated to properly planned training to prepare for the recruitment process of the chosen uniformed formation.

Previous research shows that those wishing to serve in uniformed formations must be characterized by a high level of physical fitness and

maintain this level continuously, through regular training. In addition to maintaining the level of physical fitness, these trainings should be profiled to the work environment and give the greatest possible adaptability to future uniformed officers, while taking care of their health and work efficiency [33, 34, 36, 37, 38, 39]. In the studies conducted, it was proven that those with a higher weekly volume of additional physical activity scored significantly better in the 3,000-meter cross-country run, pull-up bar, and obtained a higher score on the overall test. Importantly, only the nature of the activity of an active athlete showed a significant effect on the test score and on the 3,000m test score. This may mean that in order for the educational process preparing for the uniformed formation to be effective it should be supplemented with one's own physical activity anyway, preferably at the level of sports competition. It has been shown in studies that competition, carrying rewards, can be a form of motivation for physical activity. In Russia, at Krasnoyarsk State Medical University, in order to increase mobilization for physical activity and spread pro-health habits in the academic community, scoring for such activities has been introduced. Both students and employees collected points for activities for various achievements and participation in sports and health-promoting events, which is taken into account by the Rector when awarding prizes and scholarships. At the University of Krasnoyarsk, this worked in the same way as grades and resulted in an improvement among the respondents in their level of physical activity [9]. The students surveyed, however, belong to a group that should be self-directed and aware that both before the selection process and during service this activity will be needed. They should be characterized by attention to their own level of fitness, in order to overcome and pass certain time standards, for the purpose of obtaining a passing grade in the subject (a present task - at college) and passing the selection process for uniformed service (a future task, for which they must be prepared). Confirmation of these suppositions, can be found in a model targeting those who could potentially be a uniformed officer in the future, which was studied in Ukraine. There, the task-readiness model was tested on high school students. It was shown that it is necessary to analyze and create tailored to the fitness, mental, psychophysiological and functional needs of the individual teaching models that are not based on a scheme that has remained unchanged for a long time, but require a significant level of activation of each person. The result of such education is faster adaptation to the future conditions of the professional environment [40]. According to the authors, in the education of students preparing for work in uniformed formations, it would be reasonable to introduce components of the above methodology, so as to teach to perform students

to diagnose the trained group and appropriately select adaptive measures to the conditions in the future professional work, such as setting goals and simulations of situations from the future work. In addition, it would give the student the opportunity to independently determine the ranges on which he or she needs to work further to be able to pass the recruitment process for the chosen uniformed formation. This coincides with research indicating the necessity of combining physical workouts with properly conducted education and individualization of the training process, which carries the highest results, even in the uniformed services. There, however, it requires a significant contribution of the cadets' own work who are in the process of implementing the preparatory process for service in the formation [41].

In addition, bearing in mind that the subjects who have a higher body weight and a higher BMI, achieve better results in individual fitness tests, it can be assumed that this is determined by their body composition and greater muscularity relative to body fat. According to the Authors, this may be due to their training volume and the nature of their extracurricular sports activities, but it would be advisable to analyze body composition as a form of diagnostic and information for a person preparing for a selection program for a particular uniformed service.

Taking into account the correlations shown in the above study, the authors make the claim that students wishing to serve in uniformed formations in the future should practice additional physical activity and try to acquire skills that give them the fastest possible adaptation to the future work environment. One of the more effective ways, also recommended for implementation in the curricula of schools and universities, will be to combine fitness activities and coping with difficult situations.

Conclusions

It has been shown that students who rate their level of preparation for uniformed service and satisfaction with their performance higher score better in the NSR test. It has been proven, equally, that students having a higher weekly volume of additional physical activity obtain higher scores in the fitness test. It is reasonable to recommend that schools and universities preparing future uniformed officers introduce classes similar to sports training in a battlefield training environment. This would give a simultaneous increase in physical fitness along with an increase in the level of self-efficacy for combat operations. In addition, those wishing to enter the selection process for uniformed formations should practice regular physical activity, preferably at an intensity and volume close to the competitive level, since this significantly affects the result achieved in the fitness test.

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