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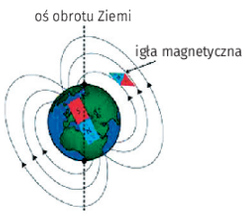

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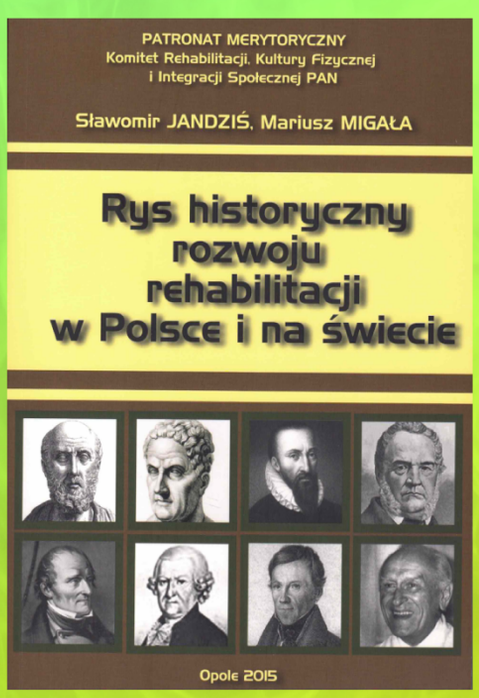

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Extensive interval training as alternative exercice for increase VO_2max of police candidate

Intensywny trening interwałowy jako alternatywny program ćwiczeń zwiększający VO_2max kandydata do służby w policji

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Abstract

The police is an agency of the state government whose job is to maintain security, order and public order (arresting people who break the law). The police play a role in maintaining public order and security, enforcing the law, and providing protection, protection and service to the community. To be successful as a police officer, special preparation is required to achieve the desired results. So far, the training program for police candidates has only focused on time-paced running. There has been no variety of interval training developed. Extensive Interval Training is an alternative exercise that police recruits can do to pass the Aptitude Test. The purpose of this study was to identify the effect of extensive interval training in increasing aerobic endurance (VO_2max) in prospective police students. Experiments were used in the design of this study. This study used only one experimental group, and the treatment was modified interval training. police subjects are candidates aged 19–21 years who attended 18 sessions of Extensive Interval Training. Coopert's test (12 minutes run) is the instrument used in data collection. In this study, Kolmogorov sminov was used to calculate data normality to ensure that the sample groups came from the same population. The hypothesis was tested using the SPSS 23 program by comparing the results of the first test with the final test, namely the 12 minute running test. The results of the study proved that there was an increase in the aerobic endurance of POLRI candidates after being given Extensive Interval Training, namely an increase in the percentage of aerobic endurance of police candidates after being given interval training of 10.21%.

Keywords

extensive interval training, VO_2max

Streszczenie

Policja jest organem władzy państwowej, którego zadaniem jest utrzymanie bezpieczeństwa, porządku i porządku publicznego (aresztowanie osób łamiących prawo). Policja odgrywa rolę w utrzymywaniu porządku publicznego i bezpieczeństwa, egzekwowaniu prawa, zapewnianiu ochrony i świadczeniu usług dla społeczności. Aby odnieść sukces jako policjant, kandydat potrzebuje specjalnego przygotowania, aby osiągnąć pożądane rezultaty. Do tej pory program szkolenia kandydatów na policjantów koncentrował się wyłącznie na biegach na czas. Nie opracowano żadnej wersji treningu interwałowego. Intensywny trening interwałowy to ćwiczenia, które mogą wykonywać kandydaci do służby w policji, aby zdać test umiejętności. Celem tego badania było określenie wpływu intensywnego treningu interwałowego na zwiększenie wytrzymałości tlenowej (VO_2max) u przyszłych studentów akademii policyjnej. W projekcie tego badania wykorzystano eksperymenty. W badaniu tym wykorzystano tylko jedną grupę eksperymentalną, która realizowała trening interwałowy. Uczestnikami badania byli kandydaci w wieku 19-21 lat, którzy uczestniczyli w 18 sesjach intensywnego treningu interwałowego. Test Cooperta (12 minut biegu) jest instrumentem używanym do zbierania danych. W tym badaniu test Kołmogorowa-Sminowa wykorzystano do obliczenia normalności danych, aby upewnić się, że grupy uczestników badania pochodzą z tej samej populacji. Hipotezę zweryfikowano za pomocą programu SPSS 23, porównując wyniki pierwszego testu z testem końcowym, czyli testem 12-minutowego biegu. Wyniki badań wykazały, że nastąpił wzrost wydolności tlenowej kandydatów po odbyciu intensywnego treningu interwałowego, a mianowicie wzrost odsetka wydolności tlenowej kandydatów do policji po treningu interwałowym o 10,21%.

Słowa kluczowe

Intensywny trening interwałowy, VO_2max

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Introduction

Police authorities must check the suitability of each candidate and employee for police service. Candidates and police officers are expected to have the stamina and strength to carry out their duties efficiently and optimally. Physical fitness is the ability to carry out daily activities without excessive fatigue. The police test includes a 12-minute run, pull-ups, sit-ups, push-ups and a shuttle run. There are elements of physical fitness in the test, including stamina, speed and strength.

The most important factor in increasing technique, strategy and mental agility is a person's physical condition. When sport is started as early as possible and is practiced consistently, time after time, gradually, and the principles of proper exercise are followed, then the physical element can reach its peak [1]. Physical condition refers to individual mental characteristics, body quality and functional abilities to achieve the best results in specific sports disciplines [2]. The development of a more optimal physical condition is the goal of specially designed fitness training through structured and patterned stages [3]. Due to the physical conditions that are the basis for learning technique, strategy and mentality, training participants must be in good physical condition [4, 5]. Each workout must have its own useful repetitions, as well as clear directions and goals. This allows for quick regeneration after injuries, reduces mental fatigue and improves concentration, facilitates quick regeneration after exhausting training and difficult challenges, rarely experiences painful muscles, and consequently good physical condition increases self-confidence [6].

Endurance becomes a prerequisite in preparing for the physical tests of police candidates. The ability of the heart and lungs to deliver oxygen to the muscles over a long period of time known as pulmonary endurance or respiratory circulation. After completing a series of tasks, a person with good cardiovascular endurance will no longer tire quickly. By knowing your cardiovascular endurance, you can improve your exercise programs. Regarding the method of measuring cardiorespiratory fitness, which is the total count of the maximum oxygen that can be used in units of MI/Kg BW/minute or is often referred to as VO2Max. Those who are physically fit are more likely to have higher VO2Max values than those who are not fit [6]. Physical fitness requires performance-enhancing training, including endurance aerobics. The interval training method is one of the endurance building strategies. Fewer young people registering with the police understand training intervals. Such people tend to run continuously, and this does not improve endurance.

Many of the participating police applicants had problems with the physical test of the 12-minute running test. One of the factors that may speak for success in the test is a good level of VO_2Max, but due to the lack of understanding of the training methods, there is no increase in VO_2Max endurance [7, 8]. Maximum aerobic power (VO_2Max) is an indicator of developing endurance. The training method to increase VO_2Max is interval training, it has been proven that longer training intervals result in a greater increase in VO2Max, because such work intervals maximize cardiorespiratory parameters, allow you to get closer to VO_2Max to a greater extent than shorter interval training, which leads to greater adaptation of the body to effort. Police physical examination, a 12-minute running test requires good VO_2Max endurance, which, if the training interval is selected incorrectly, may cause problems for police youth during the test [10–12].

The term "VO_2Max" is well known in the sports world. This refers to the maximum volume of oxygen that the body can process and use, which is transferred from the lungs for the passage of blood vessels to the muscles during physical activity such as walking, running and other physical activities until exhaustion occurs. When doing any physical activity, people with high VO_2Max get tired more slowly and can do other activities after cardio training, such as gym, swimming, etc. Typically, VO_2Max is related to physical fitness or lung and heart health. Physical characteristics such as a person's age, gender, height, and weight also affect the VO_2Max value. Although one's VO_2Max cannot be predicted, it can be improved by training systematically and in the right proportions. During exercise, the body will need oxygen, which is supplied by the heart and respiratory organs, in particular the lungs [12].

To achieve the intended goal, it is necessary to systematically and long-term conduct of organized exercises, gradual improvement and individual focus on the characteristic features of function and psychology. The trainee must know the elements of the training, namely 1) the duration of the training session called the training volume. Exercise volume that covers the big important parts, including: timed practice, how much load is used per unit of time, and repetition within a certain amount of time. With this method, the volume is estimated to consist of the total movements made within the activity. Volumes are sometimes considered to be the amount of work done in one activity. 2) Exercise intensity, exercise intensity can be calculated based on body weight or VO_2Max (maximum oxygen uptake). Heart rate measurement is one of the methods that are available on an ongoing basis to determine the use of body O_2 in determining the intensity of the sport. The higher the intensity, the more activity is performed per unit of time. 3) Repetitions, i.e. how many exercises we do. An improved plan with slightly more reps (1-6) for developing maximum muscle strength. To increase muscle endurance, a high number of repetitions (>10) seems to be more effective. Plan on 10 to 15 repetitions to increase endurance intensity (short duration), while more than 20 repetitions seem to increase low-level endurance intensity (length of duration). 4) A set is a grouping set performed continuously during exercise, followed by rest breaks. Sets consist of the sum of the repetitions performed in each exercise. 5) Density, i.e. duration divided into breaks and intervals. Training density (density) increases with time and longer intervals, while density training decreases with shorter recovery times and longer intervals. For example, while the training time (duration) of one pre-look meeting is three hours, density training (time-effective) may only last one hour three twenty minutes due to the short breaks and reduction in full recovery time. 6) Rhythm, i.e. appropriate movement with the order of movement exercises, rhythmic practice becomes a note of achieving order goals. During strength training, rhythmic exercises performed in a fast manner may cause a reaction that is not the same as performing rhythmic exercises in a slow manner. So in a training load, rhythmic practice is a measure of time so you can know how fast a given movement is being performed. In weighted

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exercises, the lifting or pushing motion of fast and slow is the embodiment of rhythmic practice. 7) Rest between sets, athletes and coaches need to understand the capabilities of the athlete's body, influence body functions when mixing training and recovery, so as to be able to develop a recovery strategy when time that becomes a multi-factor process. Basically, recovery time during exercise is what is referred to as recovery time.

In addition to the practical issue, a candidate for a police officer and a trainer should properly choose the type of training, which is, for example, practicing gymnastic aerobics. The exercise must be dynamic in nature, constantly engaging large muscles in order to develop cardiorespiratory endurance or aerobic fitness. Interval training consists of intermittent exercise with rest periods between work steps. Interval training is a practical method of developing the heart and lungs. There are four components to interval training: duration, intensity, rest time, and repetitions. Interval training includes: Interval running, Interval swimming, Circuit training, and Weight training.

The interval method has become the dominant exercise method for increasing endurance, and many exercise methods can fall within its scope [13]. Gradual training intervals emphasize the interval principle, i.e. exercise according to a training interval characterized by changes in load duration (distance length / number of exercise series), variation in load intensity (speed / adding load), changes in load intervals (long breaks) and rest depending on the chosen goal. Interval training is one of the types of training runs performed alternately with road running. There are two types of interval training: intensive and extensive. Intensive interval exercises are movement and technical exercises used alternately without breaks and maximum in one training session. In contrast, the practice of extended intervals is a technique that trains from resting sprint activity to relaxed [15, 16].

The intense method of exercise is a type of speed-increasing exercise using a low load. With a relatively low load, intense training is performed with an intensity of up to 90 percent, a duration of 30 to 60 seconds without rest. Such exercises have a beneficial effect on the functioning of the motor nerves. Rest in this case is passive rest, for example, sitting. However, the method of active rest (light activity) can also be used, e.g. running slowly [17]. Characteristics of the extensive interval training method: 1) Intensity level. Training intensity ranges from 60-80% and rest 50-70% of HRmax 2) Level of exercise. Exercise intensity measures the total time spent exercising. The number of repetitions is low due to the intensity of this method. 3) Rest. Since the intensity of the rest is high, it must be longer. For beginners, this can be done at a lower heart rate, which is between 110 and 120 beats per minute, or with a rest of 2 to 10 minutes. 1.5 to 3 minutes for athletes who have trained. 4) Time devoted to training. Due to the high intensity, the exercise with weight lasts only one minute. For example, running 100 meters takes about 15 seconds, and running 400 meters takes about 80 seconds.

Study [16] with title “Influence Interval Training To Aerobic Endurance Ability Futsal Player” explained that intervals training could influence increasing aerobic endurance ability Futsal Adrenaline Football Club Padang players. Exercise training intervals is something technique form of training pauses between breaks and sequences of repeated physics movements, method specified training intervals through gift load and time recovery. The heart rate should be between 120 and 130 beats per minute at rest between loads or breaks. The interval method can provide more volume and intensity to your workout than the duration method. Interval training consists of short (30 seconds) repetitions of maximum intensity (total) exercise punctuated by periods of passive recovery (1-4 minutes) [18-20].

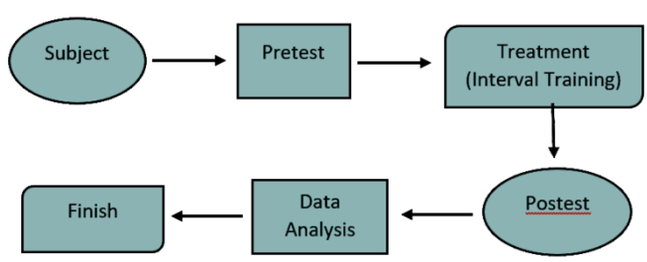
Research conducted by [19] entitled "Comparison of Physical and Physiological Effects of Continuous and Interval Running Training in Elite Adults" shows that the applied interval training program has a positive effect on body weight and endurance, interval training can be effective in terms of balance, flexibility, vertical and horizontal jumps and speed. Interval running training is a systematic variation of the recovery phase or high and low loads with the characteristics of repeating a series of exercises at specific intervals. Is it possible that the endurance-interval method could be used in terms of heart enlargement and at the same time increase aerobic carbohydrate metabolism and anaerobic capacity. Principle interval running is a training method which was first described in 1959 by Reindell & Roskamm 12 that alternates periods of high-intensity and low-intensity training and has a positive effect on various parameters such as health, performance and motor skills. In the interval training method, the effect may vary depending on the total workload, time, training intensity, recovery time, recovery intensity, and movement patterns [19, 20].

From the explanation above, research by [21] with the title “Influence method Interval Training Intensive and Extensive Intervals To Increase VO_2Max” suggests that there is a difference in a visible manner in the two VO_2Max group test method practice: intensive and extensive . Where approach training intensive is more superior than extensive interval training [23–25].

Matherial and method

Badano tylko jedną grupę, która została poddana zmodyfikowanym interwałom treningowym. Ocena po treningu jest ostatnim krokiem w procesie badawczym. Wynik przed i po treningu pokazuje, czy istnieje różnica w wydolności badanych (Figure 1).

There was used Kolomogorov-Smirnovtest in this study, for count data normality to ensure that group samples originate from the same population. The F test was used in this study for count homogeneity. There was used SPSS 23 program for testing hypothesis which consisted of from comparing results before and after training with use test 12 minute run.



Picture 1. Research Flowchart

All figures and table are developed by the authors

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Results

Pre- and posttest results of the aerobic endurance of police candidates are in the Table 1.

Table 1. Results of 12-minutes Run Test

Subject No.	Pretest Score	Postest Score	Difference
1	1965	2150	185
2	1675	1775	100
3	1675	1850	175
4	1850	2050	200
5	2050	2400	350
6	2150	2450	300
7	2200	2500	300
8	2550	2650	100
9	2525	2700	175
10	2150	2400	250
11	1650	1800	150
12	1950	2175	225
13	1650	1900	250
14	3000	3075	75
15	2400	2475	75
16	2050	2350	300
17	2050	2400	350
18	1950	2250	300
19	1850	2350	500
20	2500	2700	200
21	2025	2375	350
22	2125	2575	450
23	2850	2950	100
24	1995	2350	355
25	1990	2250	260
26	2025	2175	150
27	2525	2750	225
28	2125	2350	225
29	1775	2050	275
30	1950	2400	450
31	1850	2100	250
32	2975	3100	125

There were 32 respondents – candidates for policemen who were included in the tests. Based on data from the Table. 1 the test results are converted into statistical data (Table 2).

Table 2 . Statistical data

Statistics	Pretest	Posttest
N	32	32
Means	2126.56	2369.53
Median	2037.5	2362.5
Mode	1850	2400
Std. Deviation	365.11	335.51
Minimum	1650	1775
Maximum	3000	3100

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Table 2 shows that the police candidate's initial endurance test (Cooper test) averaged to 2126.56 meters and increased at the moment the test ended to 2369.53 meters. The next calculation of normally distributed test data applying Shapiro-Wilk with processing through the SPSS v20 program. The normality test is used to know influential variables in studies with normal distribution or abnormal spreads. Normality test results contains in Table 3.

Table 3. Normality Test

Data	p	Sig.	Information
Pretest	0.106	0.05	Normal
Posstest	0.432	0.05	Normal

The pre-test and post-test data for the aerobic endurance of police candidates have a p-value (Sig.) as in Table 3. > 0.05 will indicate a normally distributed variable.
Homogeneity test is useful for determining if the sample variant is uniform or not originating from the population using the sample similarity test method. homogeneity rule: if p is less than 0.05, the test is considered homogeneous. Test this then considered no homogeneous. Table 4 shows homogeneity test results as follows:

Table 4 . Homogeneity Test

Data	Sig.	Information
Pretest-posttest	0.625	Homogeneous

Aerobic endurance pretest-posttest police data candidates have significance value, in Table 4. p > 0.05 obtained that the data was uniform. If t count is bigger than t table and has significance values smaller than 0.05 then conclusion study is considered test means. The following table is made based on results data analysis:

Table 5. t-Test

Data	Average	t-count	t-table	Significance
Pretest	2127	3624.893	2.03951	0.000
Posstest	2369			

Table 5 shows that analysis produces results with an important level of 0.000, t count 3624.893 and t table (df 31) 2.03951. Those results show a significant difference with a significance level of 0.000-0.05 and t count more than 3624.893 big from t table 2.03951. The result, the alternative hypothesis (Ha) which states “There is a significant effect of Extensive Interval Training on increasing aerobic endurance (VO_2Max) candidate members of police” is accepted.
Analysis results of percentage increase in aerobic endurance of police candidate after extensive interval training explained as follows:

Table 6. Difference and Ppercentage increase in VO_2max

Data	Average	Difference	Percentage
Pretest	2127	242	10.21%
Posstest	2369		

Discussion
The use of extensive training intervals with low to high exercise levels is effective when training at a HR of less than 170 times per minute, with lots of sets, short intervals, and lots of repetitions. Training can be started from 800 meters to 1200 meters, which will translate into an increase in the police candidate's VO_2max. Low-intensity aerobic endurance increases aerobic capacity and burns body fat. In addition, practicing low-intensity aerobic stretching is able to increase capillary density and increase VO_2max capacity, as well as contribute to improving the oxidative capacity of muscles. Intensive interval training It becomes a very good method to increase VO_2max capacity. According to [9], repeated activity can increase positive response and stimuli that are hard to miss, this is consistent with research [24] which describes that the heart will be stimulated by high-intensity interval training with many repetitions and little recovery.
Extensive interval training is a type of alternating running and walking exercises over a certain distance and at predetermined intervals. Fast running (anaerobic) is the first part of this interval training followed by jogging (aerobics) [25]. In this regard, Rushall [14] suggests that joint interval training can develop aerobic and anaerobic abilities. The physical changes will be comparable to intense interval training. The changes discussed by Fox and Bower include: 1. Change in aerobics: As a result of

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endurance training, the body's cells undergo three important changes: (a) the addition of myoglobin as an O_2 binder; (b) greater VO_2max carbohydrate oxidative capacity by expanding the broad surface area and number of mitochondria; and (c) expansion of the enzyme cycle and electron transport system. c) Improved fat burning, especially during light sports. Fatty acids in the blood decrease, and the dependence of the muscular skeleton on fat as a source of ATP production increases. 2. Anaerobic changes This change is related to: a) an increase in the phosphagen expansion system, a consequence of ATP, miquinase and crenase creatine levels, (b) an increase in glycolytic capacity under the influence of phosphorutokinase activity, especially in sprinters and people using explosive movements in large amounts for a short time. 3. Changing muscle fibers: a) Increasing the glycolytic capacity of good fast or slow muscle fibers is more common in fast fiber muscles, and b) Hypertrophy and hyperplasia happens. Systemic changes in the cardio-respiratory system such as: a) Decrease in heart size and b) Decrease in heart rate.

App intensity is low to around 85 percent of your maximum heart rate, which is 130 to 170 beats per minute. Better than the intensive interval training method. Researchers found that the method of intensive interval training is very good for supporting the training process to increase the ability of police candidates, supported by relevant research and results, analysis of existing field data and facts. It can be used especially in preparation for training, where this practice has a positive effect on improving the maximum VO_2 capacity.

Conclusion

It can be concluded that Extensive Interval Training has an effect on increasing aerobic exercise endurance (VO2Max) for police candidates, the results of t count 3624.893 > t table 2.03951 and have a significance of 0.000 <0.05. After being given the treatment, the aerobic endurance training interval for police member candidates increased by 10.21 percent. The increase was higher than previous studies conducted on Wushu Sanda Tobasa athletes, namely with the interval training method, only 9.28 percent. It is hoped that the interval training program can be implemented properly by police candidates so that they pass the satisfaction test stage. The strength of the research is in the training program which is arranged according to the field of Sports Science and has been widely proven. However, this research is not free from limitations, namely respondents who did not fully participate in the treatment and other factors when taking posttest data. The author's suggestion for future research is to pay more attention to respondents and when collecting data and further research it can be combined with other training methods or other variations of the training program.

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