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Original scientific paper

Effects of two Different 5 Weeks Training Programs on the Physical Fitness of Military Recruits

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A B S T R A C T

The purpose of this study was to compare the effects of programmed continuous endurance and relative strength training (CERS) with the basic military physical readiness training (BMPR) on the physical readiness. Croatian military recruits (21.3±1.9 years) were divided in the CERS (N=48) and BMPR (N=76) groups. Training sessions were conducted three times a week for a total of 5 weeks. The t-test determined positive training effects for both training programs. Significant positive changes in BMPR group were measured in almost all measured variables. In CERS group, besides the 20 m dash run, statistically significant positive changes were not determined in standing horizontal jump, pull-ups and sit and reach test. The positive training effects in both training groups were achieved because of the low initial physical readiness level of the recruits and a short training period in which the statistically significant differences between programs could not be achieved.

***Key words**: strength training, military, impact, endurance*

Introduction

The Armed forces of the Republic of Croatia adopted a long term development plan for the period between the years 2006 and 2015. One of the main components of that plan is to improve the morphological, fitness and physiological profile as well as basic and specific military skills of the Armed forces recruits. In the last decades, a tendency of increased obesity has been observed with military personnel[1]. The effects of excess body weight raise a variety of concerns relevant to the health and field performance of members of the military[2]. The overall physical fitness is under the influence of body composition and it has been proven that soldiers with larger body mass have worse results in muscular endurance tests[3], and have worse results in distance run times, since the law of allometry dictates the running capacity[4]. Sustaining an increased exercise program of physical training is an essential component of comprehensive weight reduction strategy for overweight personnel[2,5,6]. A well-developed training program also covers the management of both physical stimuli and eating habits, in order to maintain a wanted ratio of fat free body mass and fatty tissue[2,7].

One of the most important objectives of the military is to achieve and maintain a high fitness level while minimizing injury risk[8]. The risk of injuries arises as the training frequency and intensity of physical activity becomes higher[8–15]. The critical element of success for new recruits who enter basic combat training has been identified as the physical fitness[16]. Physical fitness can be defined in number of ways, but it can be described as one's state which allows the completion of most demanding physical tasks set in various situations. Improvements of the physical fitness are specifically related to the type of training performed[1,17]. In order to achieve high fitness levels and to reduce injury risks the development and application of an optimal physical training program is required. The physical training program is designed to prepare a soldier for the physically demanding tasks performed in various military operations according to the requirements of the deployment[18].

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The physical fitness consists of several components which include endurance, strength and mobility[8]. Each component of physical fitness can be identified through the application of various tests. The physical fitness of the military personnel including recruits is mainly assessed by muscle endurance tests and distance coverage tests in which mainly the aerobic power is assessed through the calculation of the VO_{2max}, the maximum rate of oxygen consumption expressed per unit of body mass[4,19]. There is a wide specter of tests used to assess the endurance of military personnel which can be divided in two different categories. The first category consists of tests which include running tasks with load and the second category consists of tests which do not[20]. A strong preference exists towards the tests without load since such tests do not require transport, storage, securing and maintaining of the equipment[20].

The effects of various training programs on the anthropological state of military personnel have been observed in many studies[1,17,20–28]. The most important findings[1,17,20,24–28] are presented in Table 1. However, none of these studies assessed the effects of a Continuous Endurance and Relative Strength (CERS) training program on the physical fitness profile of military recruits. The main purpose of this study was to determine if the five week CERS training modality has a significantly greater impact than the Basic Military Physical Readiness program (BMPR) on the physical fitness of the recruits.

Methods

The population from which the sample of this study was selected is the third generation of Croatian Armed Forces military recruits. A number of 124 male and female military recruits with an average age of 21.3±1.9 years, participated in this study. Their pretesting physical activity ranged from sedentary to active which included in some cases weight based and aerobic training. Recruits voluntarily participated in the study, were carefully informed about the study and signed a written consent before the experiment. Recruits underwent physical and medical examinations to ensure that they had no physical and health problems. All experimental procedures were approved by the Ethics Committee of the Faculty of Kinesiology, University of Zagreb.

The participants were divided in two groups, the Basic Military Physical Readiness group (N=100) and the Continuous Endurance and Relative Strength group (N=80). Participants which did not take part in every test either initial or final testing, were excluded from the study. The participants which did not complete the planed training program were also excluded from the study. The research took place over an 8 week period (Table 2) and each group had a different training program. The training programs were performed in the period of 5 weeks because the first and last week were reserved for the initial and final testing. The seventh week was also

TABLE 1
RESULTS OF PREVIOUS STUDIES

Study	State	N	Training program	Results after the training program
Brock and Legg (1997)	England	73	Effects of 6 weeks basic military training on physiological attributes and strength.	Aerobic power 2.2% Strength 15.9% and 10.1% Body fat ↓ 3.3%
Faff and Korneta (2000)	Poland	39	Effects of 18 months of basic military training on aerobic and anaerobic capacities, on power, agility, and strength	Anaerobic power 5.9% Aerobic power 9.7% Body fat ↓ 1.9%, muscular endurance and power 32%
Kraemer et al. (2004)	United States of America	35	Effects of 12 weeks of endurance and resistance training on different military demands with four groups (1. – resistance with the whole body and endurance, 2. – resistance of upper body and endurance, 3. – resistance, 4. – endurance)	Push-ups in all groups Groups 1 and 2 – sit ups 4 group – time in 2 miles ↓ 1 and 2 group – time in 2 miles 1 group – strength of lower body
Williams (2005)	England	45	Effects of 12 weeks of basic military training of regular soldiers on aerobic capacities.	VO_{2max} 13.1 % Body mass ↓ 1.3 kg
Drystad et al. (2006)	Norway	107	Effects of 10 moths of obligated military service on VO_{2max}, push-ups, sit ups, chin ups and 3 kilometer test.	VO_{2max} , push-ups and sit ups
Wescott et al. (2007)	United States of America	83	Comparation of 12 week of endurance training and circular strength training.	A significant increase in the observed values of participants in the circular training.
Harman et al. (2008)	United States of America	32	Comparation of 8 week training with relative and without relative load	Training programs have the same effects.
Santilla et al. (2008)	Finland	72	Effects of 8 week basic military training, endurance training and strength training on functional parameters	VO_{2max} ST 12%, ET 8.5%, BT 13.4% Body fat ↓ with all the leg strength ST 9.1% and ET 12.9%

TABLE 2
TRAINING PROTOCOL OVERVIEW FOR THE BMPR AND CERS GROUPS

Mesocycle	1	2	3	4	5	Σ
Calendar duration	21.09. – 26.09.	28.09. – 2.10.	5.10. – 10.10.	12.10. – 17.10.	19.10 – 23.10.	/
No. of days	5	5	5	5	5	25
Days of training	3	3	3	3	3	15
No. of training	3	3	2	2	3	13
Hours of training	6	6	4	4	6	26
Extension of training days	1.2	1.2	0.66	0.66	1.2	0.984
Rest days between cycle	0	0	1	1	0	2
Testing days	Initial testing			14.09. – 19.09.		
	Final testing			2.11. – 6.11.		

excluded from the study due to the encampment which did not allow the application of training programs for the development of physical fitness. The participants trained for 1.5 to 2 hours per day, including the warm-up and stretching. The total number of trainings which recruits performed in the BMPR group is the same as the number of trainings performed in the CERS group.

Basic Military Physical Readiness group (BMPR). The group followed a standardized training program which is defined in the Basic program of Military Recruits. Such program was conducted with the first two generations of Croatian Armed Forces Military Recruits. The standardized training program was conducted by leaders of each individual unit. The trainings conducted in the units were mainly oriented to the development of muscular endurance and aerobic power. The running sessions consisted of both interval and continuous running modalities.

Continuous Endurance and Relative Strength group (CERS). The trainings in the CERS group were conducted by P.E. teachers from the Faculty of Kinesiology University of Zagreb. The training program in the CERS groups was mainly oriented towards the development of the aerobic power by inducing the participants to running sessions of continuous type, calisthenics and exercises in pairs.

Initial and Final testing. Physical fitness testing of the Military recruits took place in Centre for Army Basic Training in Požega. The initial testing took place at the beginning of the study and lasted 6 days. The testing was conducted by 8 specialists from the Sports Diagnostic Centre of Faculty of Kinesiology. The specialists were responsible for all measurements that were performed. The final testing lasted 5 days and was also conducted by the same 8 specialists from the initial testing.

Physical fitness tests

The Scraping and skipping (SAS) co-ordination test is performed indoors in a minimum of 9x2 m surface dimensions. It requires four Swedish box frames horizontally placed on the ground and set 1.5 meters apart. Starting/finishing and turning line are 7.5 m apart. Participants are requested to scrap and skip four frames alternately (skip the first and scrap the second frame and so on in alternately manner), turn on the turning line and scrap and skip back to the starting/finishing line as fast as possible.

The Running eights with bending (REB) co-ordination test is performed indoors on a minimum of 6x3 m dimensions hard surface. Two 1.2 m high banisters are placed 4 m apart with elastic rubber band stretched between them. The height of the rubber band was set on the height of the participant's highest pelvis point. The participants are requested to run eights around the two banisters as fast as possible and bend their bodies each time they are crossing beneath the rubber band.

The 20 yard shuttle run[29] (20YSR) was conducted to determine the agility of military recruits. The Medicine ball throw (1 kg) from sitting position (MBT1KG) was performed to test the throwing power. For the assessment of jumping power four tests were used. The Countermovement jump (CMJ), the Maximal countermovement jump[30,31] (MCMJ) test and the Continuous jumps with straight legs (CJSL) were performed on a force platform on which vertical jump height and power were measured (Quattro Jump, Kistler Switzerland, Paren Co.). The standing horizontal jump[20,30] (SHJ) was also conducted. For the assessment of sprinting performance the 20 meters dash (S20M) test was performed indoors using photocells (Photo-cell system by RS, Croatia). Muscular endurance tests included push-ups in 2 minutes (PU2), sit-ups in 2 minutes (SU2), pull-ups (PULL) and squats in 1 minute (SQ1). To determine the muscular strength the Maximal Bench Press (BP) was conducted. Flexibility was assessed with the Sit and reach test (S&R) with the standard measuring method[32,33]. Anaerobic power was assessed indirectly[34] through the 300 yards shuttle run test (300Y) and Aerobic power was tested through the 3200 m run (3200M) which is a commonly used test by Military Forces for testing physical fitness as it is included in the Army Physical Fitness Test (APFT) battery[20].

Statistical analyses

The results are presented as X±SD. After the initial states have been determined and after the participants have been divided in the BMPR and CERS groups, a t-test was used to determine initial differences. The t-test was also used to determine the differences between the groups in the final testing and differences within groups after the conducted training programs. Statistical significance was set at $p<0.05$. Effect sizes (ES) were calculated by Cohen's suggested method[35] for the magnitude of treatment effects within groups. The Statistica 7.0 for Windows statistical package (Statsoft Inc., Tulsa, Oklahoma) was used to process and report the data.

Intraclass correlation coefficients (ICC), and Cronbach's alpha reliability coefficients (α) were used to determine between-participant reliability of repeated tests at the initial and final testing[36]. The ICC coefficients and á coefficients of the repeated tests in the initial and final testing varied between 0.89 and 0.99 (95% confidence interval, 0.94–0.97).

Results

180 participants began and 124 participants completed the study. From the initial number of 100 participants in the BMPR group only 76 finished the study and of 80 participants in the CERS group, 48 finished the study. The results from the initial testing are presented in Table 3 and the results from the final testing are presented in Table 4.

The training program applied in the BMPR group made significant improvements to Military recruits physical fitness. If coordination is observed after the final testing, participants have made a progress of –7.6% (ES= –0.48, $p<0.05$) in the SAS test, –2.2% (ES=–0.32, $p<0.05$) in the REB test, –8.8% (ES=–1.35, $p<0.05$) in the 20YSR test. In terms of power, the participants showed significant progress in almost all tests. A 6.7% (ES=0.39, $p<0.05$) increase was determined in the MBT1KG test, a 9.2% (ES=0.59, $p<0.05$) increase in the CMJ test, a 7.4% (ES=0.54, $p<0.05$) increase in the MCMJ test, a 5.7% (ES=0.35, $p<0.05$) increase in the CJSL test, a 4.1%

TABLE 3
PHYSICAL FITNESS BEFORE THE TRAINING PROGRAM

	X±SD	
	BMPR	CERS
SAS (sec)	14.4±2.3	14.8±3.2
REB (sec)	18.1±1.3	18.2±1.4
20YSR (sec)	5.7±0.4*	5.3±0.3*
MBT1KG (cm)	79.7±13.4	76.7±13.8
CMJ (cm)	38.0±5.9	38.1±4.8
MCMJ (cm)	47.5±6.5	48.1±6.8
CJSL (cm)	33.5±5.4	32.4±4.7
SHJ (cm)	209.3±24.8	211.2±24.0
S20M (sec)	3.8±0.3	3.9±0.3
PU2	31.7±14.1	30.2±13.7
SU2	48.4±15.0	49.4±15.6
PULL	5.0±8.9	4.3±3.1
SQ1	44.3±8.9	45.1±8.6
BP (kg)	62.4±18.3	63.9±13.2
S&R (cm)	9.8±7.1	9.2±6.4
300Y (sec)	66.9±5.4	68.1±6.8
3200M (sec)	944.3±211.2	983.3±148.5

SAS – Scraping and skipping, REB – Running eights with bending, 20YSR – 20 yard shuttle run, MBT1KG – Medicine ball throw (1 kg) from sitting position, CMJ – Countermovement jump, MCMJ – Maximal countermovement jump, CJSL – Continuous jumps with straight legs, SHJ – Standing horizontal jump, S20M – 20 meters dash, PU2 – push-ups in 2 minutes, SU2 – sit-ups in 2 minutes, PULL – Pull-ups, SQ1 – Squats in 1 minute, BP – Maximal Bench Press, S&R – Sit and reach, 300Y – 300 yards shuttle run, 3200M – 3200 m run.
* $p<0.05$ for BMPR *vs.* CERS, BMPR – Basic Military Physical Readiness group, CERS – Continuous Endurance and Relative Strength group

TABLE 4
PHYSICAL FITNESS AFTER THE TRAINING PROGRAM

	X±SD	
	BMPR	CERS
SAS (sec)	13.3±2.0	13.6±1.9
REB (sec)	17.7±1.0	17.7±1.1
20YSR (sec)	5.2±0.3	5.2±0.2
MBT1KG (cm)	85.0±14.2	84.3±11.9
CMJ (cm)	41.5±5.1	42.0±4.9
MCMJ (cm)	51.0±7.1	51.0±5.5
CJSL (cm)	35.4±4.7	36.9±5.5
SHJ (cm)	217.8±23.5	215.7±16.5
S20M (sec)	3.8±0.3	3.8±0.3
PU2	53.1±15.0	54.6±16.1
SU2	69.4±11.7	68.7±15.1
PULL	5.5±3.7	4.8±3.7
SQ1	50.5±7.2	50.3±6.3
BP (kg)	76.8±18.9	73.7±15.2
S&R (cm)	12.4±6.5	10.3±6.2
300Y (sec)	65.4±4.2	64.8±4.8
3200M (sec)	856.2±84.6	851.0±73.5

SAS – Scraping and skipping, REB – Running eights with bending, 20YSR – 20 yard shuttle run, MBT1KG – Medicine ball throw (1 kg) from sitting position, CMJ – Countermovement jump, MCMJ – Maximal countermovement jump, CJSL – Continuous jumps with straight legs, SHJ – Standing horizontal jump, S20M – 20 meters dash, PU2 – push-ups in 2 minutes, SU2 – sit-ups in 2 minutes, PULL – Pull-ups, SQ1 – Squats in 1 minute, BP – Maximal Bench Press, S&R – Sit and reach, 300Y – 300 yards shuttle run, 3200M – 3200 m run.
* $p<0.05$ for BMPR *vs.* CERS, BMPR – Basic Military Physical Readiness group, CERS – Continuous Endurance and Relative Strength group

(ES=0.35, p<0.05) increase in the SHJ test and no significant increase was determined in the S20M test. In muscular endurance participants showed significant improvements in all tests. A significant increase of 67.5% (ES=1.51, p<0.05) was noted in the PU2 test, a significant increase of 43.4% (ES=1.4, p<0.05) in the SU2 test, a 10% increase in the PULL test and 14% (ES=0.70, p<0.05) increase was noted in the SQ1 test. In the muscular strength test the participants of the BMPR group showed an increase of 23.1% (ES=0.79, p<0.05). In terms of flexibility, the participants of the BMPR group achieved a significant improvement of 26.5% (ES=0.37, p<0.05) in the S&R test. Anaerobic power which was measured by the 300Y test was improved by –2.2%, and aerobic power which is assessed through the 3200M test was significantly improved by –9.82% (ES=–0.42, p< 0.05).

The training program applied in the CERS group also made significant improvements to Military recruits physical fitness. In coordination, participants have made significant progress of –8.1% (ES=–0.37, p<0.05) in the SAS test, –2.7% (ES=–0.37, p<0.05) in the REB test and –1.9% (ES=0.33, p<0.05) in the 20YSR test. In terms of power, the participants showed significant progress in four of the six tests. A 9.9% (ES=0.55, p<0.05) increase was determined in the MBT1KG test, a 10.2% (ES=0.81, p<0.05) increase in the CMJ test, a 6.0% (ES=0.43, p<0.05) increase in the MCMJ, a 13.9% (ES=0.96, p< 0.05) increase in the CJSL test, and no significant increase in the results of SHJ test and in the 20 meter dash test. In muscular endurance participants showed significant improvements in there of four tests. A 80.8% (ES= 1.78, p<0.05) increase was noted in the PU2 test, a 39.1% (ES=1.24, p<0.05) increase in the SU2 test and 11.6% (ES=0.60, p<0.05) increase was noted in the SQ1 test. No significant increase was noted in the PULL test. In the muscular strength test the participants of the CERS group showed a significant increase of 15.3% (ES= 0.74, p<0.05). In the S&R test the participants of the CERS group did not achieve a statistically significant improvement. Anaerobic power which was measured by the 300Y test was improved by 4.89% (ES=–0.49, p<0.05), and aerobic power which is assessed trough the 2 mile run test was improved by 13.46% (ES=–0.89, p<0.05).

The t–test showed no significant difference between the participant's initial states in the two groups except in the 20YSR test. After analyzing the final state of the participants, the t-test showed no statistically significant difference between the groups in any test.

Discussion and Conclusion

The purpose of this study was to investigate the effects of programmed CERS and BMPR training on the physical readiness of Croatian recruits. Both training programs in general elicited positive training effects on the physical readiness.

Coordination can be defined as the ability to activate and organize the effective action of several muscles, or muscle groups in order to achieve a purposeful movement. In the SAS and REB tests the participants of the CERS group achieved higher but not statistically different enhancement than the BMPR group. Both training programs provided positively effective training stimuli in terms of co-ordination, but either the low initial level of coordinative abilities in both groups or the short training period did not allow statistically significant differences between groups in the final measurement. Previous researches reveal very little information regarding the changes of the co-ordination as most of the physical readiness evaluations were made using Army Physical Fitness Test (APFT) battery. However, a few investigators evaluated physical readiness training programs through recording times of completing more or less demanding military obstacle courses. Even though most of the researches confirmed that aerobic endurance and repetitive strength[20,37] mostly determine the successfulness in completing the obstacle course, coordination is more important when running through short courses with no additional load where the influence of aerobic capacities and repetitive strength is not so high[37,38]. Therefore, the results obtained in this research can only be compared with the results of the previous investigations containing obstacle course times. In a study[20] improvements were obtained in obstacle course times both in army standardized physical training (16%) and weight-based training group (10%). The authors conclude that the improvements in obstacle course time depend on improvements in aerobic endurance and strength. However the structure of the coordination tests used in this research could not propose improvements based on the enhancement of the other abilities such as aerobic endurance and repetitive strength. Positive training effects assessed in the coordination tests are probably due to the various types of exercises imposed on the participants. Self-defense training, obstacle courses, swimming and cross country conditioning for the BMPR group and relative strength exercises and exercises performed in pairs for the CERS group obviously were positive coordinative stimuli which elicited statistically significant changes. It can also be concluded that participants enter military training with very low level of learned movement skills and therefore, any programmed physical training, which did not have to be directly oriented toward enhancing coordination such as CERS training, can produce positive changes.

The CERS training program can be considered as a type of concurrent training in which both endurance and strength training are performed on the same day following the same aforementioned sequence. On the other hand, the BMPR training program can also be considered a type of concurrent training, but unlike in the CERS training program, the endurance and strength trainings are performed on alternate days and specific military movement patterns such as military walking, self-defense, cross country training and obstacle course training were also included in the program.

In terms of agility a statistically significant improvements were obtained for both groups. Moreover, positive

change in agility in the BMPR group was higher than in the CERS group, but the differences induced by the training program were not found statistically significant. There is certain evidence in the current literature that concurrent strength and endurance training may alter motor unit recruitment patterns associated with maximal voluntary contractions[39]. It is also documented that continuous distance running can impair the increase of rate of force development when added to strength training[40]. The researchers found that concurrent training group (endurance and strength training program) did not achieve the same gains in rapid force production as strength only training group[40]. In this study both groups elicited positive gains in agility, but CERS type of concurrent training was obviously more limiting to improvement in rapid force development which is crucial for agility movements[41,42]. Specific military movements conducted through cross country, obstacle course and self-defense training performed in agile and explosive manner seem to have led to higher increase in agility in BMPR group when compared to CERS group. On the contrary, higher volume of specific explosive movements did not elicit higher improvements in power tests in BMPR group. It seems that specific military training influenced slightly better improvements for BMPR group only in agility as the higher improvements in power test were obtained for CERS group. The amount of endurance training conducted through distance running in both groups obviously impaired the ability to rapidly generate force in some extent, but more specific training in BMPR group elicited slightly better improvements in agility and more basic CERS training produced little higher improvements in power tests.

Muscular endurance is of key value to any member of the military. By inspecting both applied training programs it can be concluded that they were oriented towards the development of muscular endurance, which was proven successful. Significant achievements have been noted in all tests of both groups, except for the CERS group in the pull-ups test. The participants of the BMPR group showed higher improvements in the four conducted tests. This can be explained with higher volume of endurance training conducted in the CERS group and the execution sequence of two concurrent training segments. The most consistent finding to emerge from the concurrent training literature is that increases in strength and power during concurrent training are reduced when compared with strength training alone[43]. As the CERS training program was consisted of continuous distance running and relative strength training only, the total volume of endurance training was definitely higher than in the BMPR training program. The higher amount of total endurance training probably limited the development of strength in CERS group more than it was the case for the BMPR group. Furthermore, the modality of endurance training was also emphasized as a limiting factor of strength gains in concurrent trainings[43]. Concurrent training studies which incorporated running as an endurance training modality have demonstrated an inhibition in strength development[43]. The endurance training modality for CERS group was distance running exclusively whereas for the BMPR group, besides running, the endurance component was comprised of circuit military training, cross country training, military walking, and obstacle course training. The modality of endurance training performed in BMPR group could therefore enable slightly higher improvements in their muscular strength when compared to CERS group. Additionally, residual fatigue from the endurance component of concurrent training could be responsible for reduced strength training gains[43]. Inhibition was documented in a study[44] in lower body strength development when endurance sequence of concurrent training preceded strength training sequence. It is also documented in the literature that the concurrent training performed on alternate days produced larger strength gains than concurrent training performed on the same day[43,45]. The CERS training program included endurance training sequence prior the strength training sequence and both training sequences were conducted on the same day within a single training session. Unlike the CERS group, the BMPR group mostly conducted endurance and strength training sequences on alternate days and if sometimes both sequences were conducted on the same day, the schedule of sequences would often been reversed on different training session. Slightly larger muscular strength gains in BMPR group can be explained by aforementioned mechanisms.

The same mechanisms are probably responsible for slightly larger improvements in anaerobic and aerobic capacities of the CERS group. Although both training programs elicited significant endurance gains in general and did not differ significantly over time, it is worth mentioning that CERS training program did however slightly excided the BMPR improvements. The same mechanisms responsible for inhibition of strength training gains in CERS training group were probably the main reason for better endurance adaptive responses. Namely, more endurance training oriented sessions conducted through distance running only are one of the reasons for larger endurance gains in the CERS group. Modality of endurance training (running only) probably also contributed to better improvements in endurance tests, moreover because both test were performed through running. Additionally, the endurance training sequence in the CERS group was always executed prior strength training sequence which was not the case for BMPR group. As mentioned before, in the current literature there is evidence that residual fatigue from the prior training sequence can compromise the following training sequences' gains[43]. A study[46] revealed the impairment of aerobic fitness gains when strength training precedes the endurance training sequence. Therefore, the BMPR group could easily be affected by this mechanism as sometimes the strength training sequence was executed prior endurance training sequence.

The flexibility is the ability which allows one or multiple joint systems in the body to achieve maximum amplitude of movements. A statistically significant improve-

ment in lower back flexibility has been registered for the examinees in the BMPR training group whereas in the CERS training group improvements were not statistically significant. The CERS training program did not include specific stretching exercises and major flexibility improvements were not expected upon conclusion of the program. Nonetheless, 10–15 minutes stretching was implemented in the warm-up section of each training session and prescribed exercises were completed before the endurance training sequence. Warm-up program included all major body joints stretching through the dynamic stretching exercises. On the other hand, besides stretching during the warm-up, the BMPR training program included 2 separate training sessions oriented specifically towards improvements in flexibility. One of the main goals of the BMPR training program was actually improvement in flexibility as it is known from the literature that flexibility deters injuries during physical activities[47]. The statistically significant improvements in flexibility for the BMPR group were, therefore, probably due to the larger total volume of the stretching executed and more flexibility oriented training program.

Military recruits have showed very poor results in the initial testing in almost all variables except for standing horizontal jump and pull-ups. This could be explained by the fact that participants have become familiar with these tests and that they had often similar exercise. Therefore, their maximum capacity was showed in the initial measurement. Furthermore, the period of 5 weeks is very short for the improvements in flexibility measured by sit and reach test, since the sensitive stage for the development of this ability has been finished for our recruits. Another reason is that the training program in both groups was focused on continuous distance running and relative strength training exercises while flexibility was represented only in the introduction part, in form of stretching.

The applied 5-week training programs were used to determine significant improvements on the physical fitness of military recruits which could eventually be called up for deployment. It was of extreme importance to prove whether such short lasting programs can cause advancements in the physical fitness of the observed military personnel. The participants of this study have shown statistically significant progress in almost all tests after the applied training programs. The training program of the BMPR group established greater advances in some motor abilities comparing to the CERS group. However the training program of the CERS group achieved greater advances in both endurance tests. There were no practical differences between the effects of the two training programs at the final testing. Such occurrence can be explained with the fact that both training programs targeted the majority of physical fitness components at the same time. One of the limitations of this study is also that it lasted only 5 week, which is relatively short to prove any significant differences between conducted training programs. It is especially emphasized when the programs are conducted on low physically prepared examinees as was the case in this research. The number of trainings performed during the training program can also be lined as a limitation to differentiate the transformational effects between the two groups. The participants had shown a poor physical fitness profile in the initial testing which point out to the fact that their pretesting physical activity was poor. Applying a targeted conditioning training program on any population which is physically inactive will show improvements, but will trigger only the first physiological responses and adaptation processes to physical activity.

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UTJECAJ DVAJU RAZLIČITIH PETOTJEDNIH PROGRAMA TRENINGA NA FIZIČKU SPREMU VOJNIKA NOVAKA

S A Ž E T A K

Cilj ovog istraživanja bio je usporediti utjecaj programa treninga kontinuirane izdržljivosti i relativne snage (CERS) s uobičajenim vojnim treningom (BMPR) za fizičku pripremu. Hrvatski vojni novaci (21,3±1,9 godina) podjeljeni su u CERS (N=48) i BMPR (N=76) skupinu. Program treninga je bio izvođen tri puta tjedno tijekom pet tjedana. T-testom je utvrdjen utjecaj treninga kod oba programa. Značajne pozitivne promjene su zabilježene kod BMPR skupine gotovo u svim varijablama. U CERS skupini, osim u trčanju na 20 m, statistički značajne promjene nisu primijećene kod horizontalnih skokova u uspravnom stavu, zgibovima i testu sjedećeg pretklona. Pozitivan utjecaj treninga je utvrđen kod obje skupine zbog slabe početne pripremljenosti novaka i kratkog perioda treninga u kojem nije moglo doći do statistički značajne razlike.