

FEATURES AND FUNCTIONALITY OF SPEED AND POWER CAPABILITIES OF ELITE CLIMBERS AND VARIOUS TYPES OF ROCK CLIMBING

Ryepko O.A.

Kharkov G.S. Skovoroda National Pedagogical University

Annotation. The purpose of this study was comparative and functional characterization of speed- force readiness elite athletes - representatives of climbing to the complexity, speed and climbers. The study involved 26 athletes: 10 masters of sports of international class (speed climbing), 10 masters of sports of international class (climbing difficulty), 6 world-class climbers. The age of the athletes was 19-22 years. Found that the different types of rock climbing have different requirements for the development of the components of speed- force readiness: speed climbing is more conducive to the development of explosive power and speed endurance, climbing on the complexity is more conducive to the development of power abilities and strength endurance in short time intervals. Taken in the study to compare climbing contributes to the development of strength endurance over longer intervals of time.

Keywords: rock climbing, mountain climbing, speed, strength, endurance, complexity selection.

Introduction

Rock-climbing is kind of sports, which contains basic movements of men, i.e. movements, which were have been being required by men for survival since primeval times. Such movements are: run, jumps, throwing and climbing. Besides, crawling is one of human ontogeny's stages (<http://www.canpol.ru/articles/advice/mothers/19/38>).

That is why it is not occasional that people strive for activation of senses, which originated their development. For example, children like to climb different vertical structures (bookcases, shelves and so on), natural objects (trees, stones, hills), while many adults strive for revival of such senses through mountaineering and rock-climbing. At present rock-climbing has become a popular kind of sports, prevalence of which has been increasing with every year [1, 12-15]. In this connection it has become urgent to develop theoretical methodic principles of training process's building in rock-climbing [1, 3, 12-15; for this purpose it is necessary to analyze its kinds, i.e. complex rock-climbing and speed rock-climbing, considering requirements to level of functional and physical fitness of sportsmen [2, 7-9].

The kinds of rock-climbing, having originated from one kind of sports, now are different by requirements to both: morpho-functional and psycho-physiological abilities of sportsmen [2, 7-9]. At present stage scientists only have started to study rock-climbing, considering peculiarities of its techniques, tactic and theoretical methodic principles of training process's construction. One of the tasks of theoretical-methodic principles' construction of rock-climbing [3-6, 10, 11] is analysis of adaptation abilities and speed-power fitness of different kinds' rock-climbers, their comparison with other kinds of sports, first of all mountaineering, which is gave birth to rock-climbing.

The research has been fulfilled as per topic of Ministry of education & science, youth & sports of Ukraine for 2011-2016, 91 "Theoretical-methodic principles of individualization in physical education and sports" (state registration No. 0112U002001) and by state financed topic 3-13 of Ministry of education & science, youth & sports of Ukraine for 2013-2014 "Theoretical-methodic principles of application of informational, pedagogic and medical-biological technologies for formation of healthy life-style" (state registration No. 0113U002003).

Purpose, tasks of the work, material and methods

The purpose of the work is to give comparative characteristics of functional abilities and speed-power fitness of sportsmen-representatives of different rock-climbing kinds and mountaineers.

The methods of the research: theoretical analysis and generalization of literature data, physiological methods (registration of heart beats rate, HBR, ortho-static test), pedagogic testing, including standard tests, which are used in rock-climbing for determination of speed-power level, methods of mathematical statistics.

26 sportsmen participated in the research: from them – 10 international masters of sports, specializing in rock-climbing, 10 masters of sports, specializing in complex rock-climbing and 6 mountaineers of international level. Age of sportsmen was 19-22 years old.

Results of the research

In order to reveal characteristics of functional and speed-power fitness of rock-climbers we analyzed results of elite sportsmen's testing, who specialized in different rock-climbing and advanced domestic mountaineers to compare indicators of rock-climbers with indicators of kindred sport.

We determined that by level of functional fitness the best indicators belong to mountaineers: their heart beats rate in rest is 48.67 ± 2.73 b.p.m⁻¹. This indicators of rock-climbers is 66.29 ± 5.81 b.p.m⁻¹, that is higher in comparison with "complex" rock-climbers (54.80 ± 7.04 b.p.m⁻¹) ($p < 0.001$) and mountaineers ($p < 0.001$) (see fig.1). The obtained result can be explained by specificity of training activity in different kinds of rock-climbing and in mountaineering. Training-competition functioning of mountaineers implies more intensive work of aerobic and anaerobic-glycolytic components of muscular functioning's energy supply in comparison with speed rock-climbing, in which kreative-phosphate mechanism of energy supply is dominating.

Mountaineers also have much better response to change of body in space. With changing of horizontal position to vertical the highest HBR was manifested by “complex” rock-climbers (19.60 ± 5.76 b.p.m⁻¹), that is confidently higher than indicators of “speed” rock-climbers ($p < 0.05$) and mountaineers ($p < 0.01$) (see fig.1).

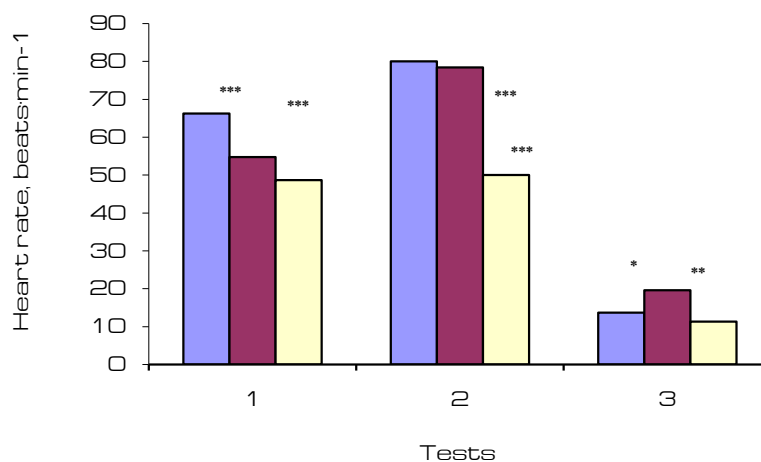


Fig.1. Indicators of ortho-static test of elite sportsmen, who specialize in speed rock-climbing (n=10), complex rock-climbing (n=10) and mountaineering (n=6):

Heart rate, b.p.m⁻¹ - HBR

1 – HBR in lying position, b.p.m⁻¹;

2 - HBR in vertical position, b.p.m⁻¹;

3 - HBR in vertical position - HBR in lying position, b.p.m⁻¹;

* - difference are confident at $p < 0.05$;

** - difference are confident at $p < 0.01$;

*** - difference are confident at $p < 0.001$;

■ Speed rock climbers

■ “complex” rock-climbers;

■ mountaineers

In spite of confident differences between indicators of cardio-vascular system’s functional state and differences between qualities of adaptation with changing of horizontal position in vertical we should note high level of functional fitness of all rock-climbers and mountaineers and adequate vegetative vascular regulation. The received results witness that rock-climbing, though being speed-power kind of sports, also requires development of organism’s functional abilities.

The greatest quantity of confident differences between indicators of different kinds of rock –climbing and mountaineers was registered in indicators of special physical fitness (see fig.2-4).

Indicators of speed-power fitness, registered by value of high jump, are the highest at “speed” rock-climbers (53.0 ± 2.94 cm), that is confidently higher ($p < 0.001$) comparing with “complex” rock-climbers (48.0 ± 1.76 cm) and mountaineers (39.67 ± 1.86 cm) (see fig.2). The obtained data, in combination with registration of confidently higher indicators of “speed” rock-climbers thigh circumference witness that speed rock –climbing sets the highest requirements to development of jumping abilities – one of basic characteristics of speed-power fitness.

The same results were received in test “Raising of legs to breast in hanging on hands positions – 20 times, seconds”: the best results had “speed” rock-climbers (25.86 ± 2.51 sec.) ($p < 0.001$) (see fig. 4).

The best indicators in test “Chin-ups 15 times for quickness” also belonged to “speed” rock-climbers (13.51 ± 0.96 sec.) comparing with mountaineers and “complex” rock-climbers (accordingly 19.43 ± 0.87 sec. and 17.28 ± 2.31 sec.), ($p < 0.001$) (see fig.4).

The obtained results witness about more expressed power endurance of rock-climbers, specializing in distances for speed, comparing with “complex” rock-climbers and mountaineers.

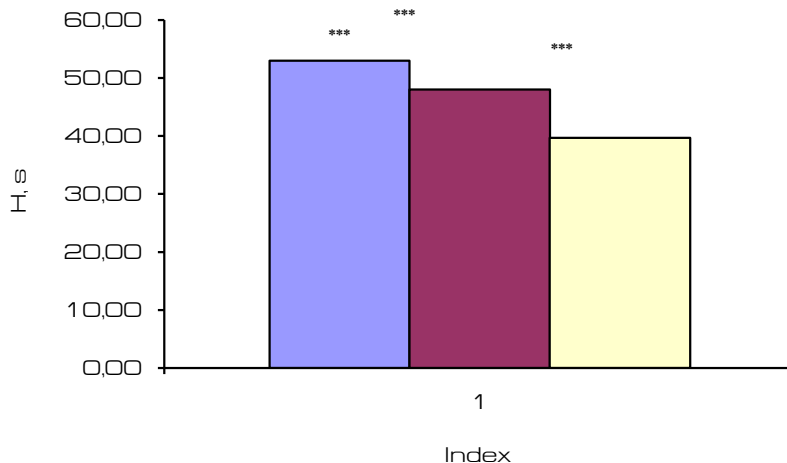


Fig.2. Indicators of test “high jump” of elite sportsmen, who specialize in speed rock-climbing (n=10), complex rock-climbing (n=10) and mountaineering (n=6):

H, s – height of jump, cm

*** - differences are confident at $p < 0.001$;

■ Speed rock climbers ■ 'omplex' rock-climbers; ■ 'hplex' rock-climbers;

Concerning poser and power endurance it should be noted that “complex” rock-climbers’ and in some cases mountaineers’ indicators are confidently higher (see table 2, fig. 3-4). The mountaineers’ time of hanging in hold of 1 m depth is the best (34.0 ± 9.67 sec.), and it confidently differs from the same indicators of “speed” rock-climbers (28.14 ± 3.39 sec.) ($p < 0.05$). The quantity of “complex” rock-climbers’ chin ups up to waist is confidently higher ($p < 0.001$) (13.4 ± 2.27 times, comparing with 9.71 ± 2.76 times of “speed” rock-climbers and 4.33 ± 2.65 of mountaineers), (see table 2, fig.4).

The received results witness about higher power and power endurance levels of “complex’ rock-climbers and mountaineers in comparison with “speed” rock-climbers.

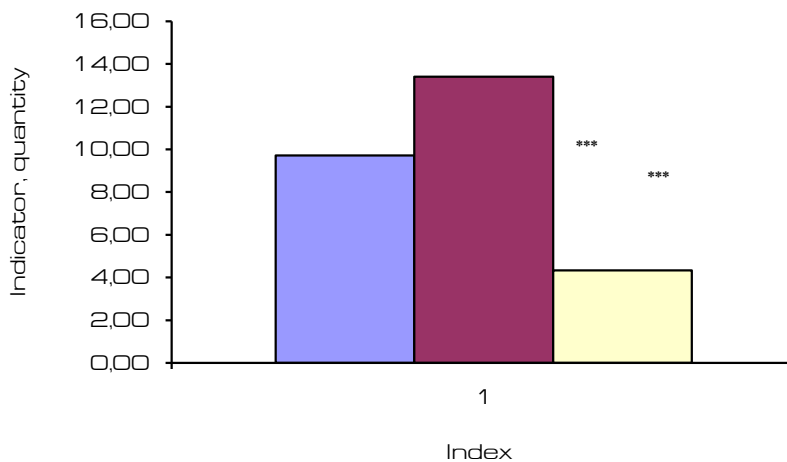


Fig.3. Indicators of test “chin ups up to the waist, for quantity of times” of elite sportsmen, who specialize in speed rock-climbing (n=10), complex rock-climbing (n=10) and mountaineering (n=6):

Indicator, quantity - chin ups up to the waist, for quantity of times

*** - differences are confident at $p < 0.001$;

■ - Speed rock climbers ■ 'omplex' rock-climbers; ■ 'hplex' rock-climbers;

In general, analyzing results of testing for special physical fitness of different kinds’ rock-climbers and mountaineers we can note that rock-climbing sets higher requirements to all components of speed-power fitness: explosive power, strength, power and speed endurance. With it these qualities are characteristic not only for large but

also for small groups of muscles that, in its turn, implies demand in perfection of body control in space. It should also be noted that peculiarity of speed-power qualities is their manifestation in non standard conditions, for example, in contrast to running, i.e. to cyclic movement, or jumps, i.e. movements with standard bio-chemical structure.

Considering total influence on all main groups of muscles, rock-climbing is a unique kind of sports of speed-power orientation. Besides, different kinds of rock-climbing set different requirements to development of speed-power fitness's components: speed rock-climbing facilitates more development of explosive power and speed endurance, "complex" rock-climbing develops more effectively strength and power endurance in short periods of time. Mountaineering, which was regarded by us for comparing, facilitates development of power endurance in longer periods of time.

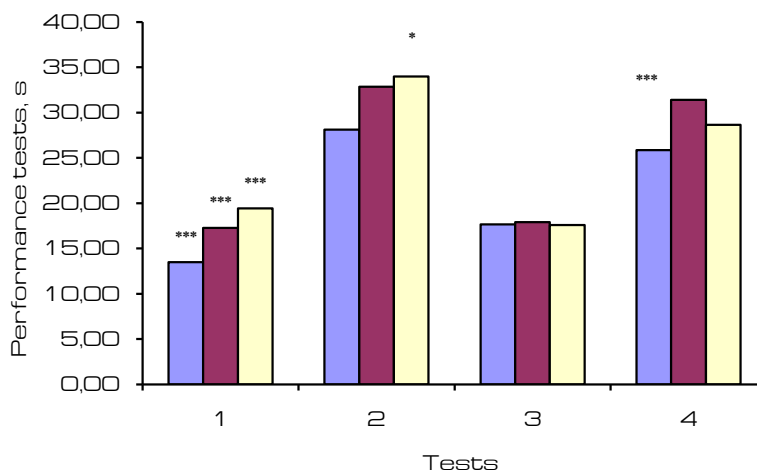


Fig.4. Indicators of test for special physical fitness of elite sportsmen, who specialize in speed rock-climbing (n=10), complex rock-climbing (n=10) and mountaineering (n=6):

- 1 - chin ups, 15 times, sec. ;
- 2 – hanging in hold of 1 cm depth, sec.;
- 3 –high jumps from sitting position, 15 times, sec.;
- 4 – picks of legs to breast in suspension, 20 times, sec.;
- * - differences are confident at $p < 0.05$;
- *** - differences are confident at $p < 0.001$;

■ - Speed rock climbers ■ "complex" rock-climbers; ■ "hplex" rock-climbers;

In this connection rock-climbing kinds can be recommended as a mean for development of all muscles groups' speed-power qualities, promising manifestation of these qualities in non standard conditions. As far as speed-power qualities are one of the most difficult problems of modern students' physical fitness, rock-climbing can be recommended as a mean for development of speed-power abilities of pupils and students. With it, it is necessary to work out scientific principles of training process's construction in rock climbing in structural elements of annual training cycle both for qualified sportsmen and for sportsmen at different stages of training.

Conclusions:

1. We have analyzed results of elite sportsmen's testing, who specialize in different kinds of rock-climbing as well as leading domestic mountaineers. It was found that by level of functional fitness the best indicators belong to mountaineers: they have the least indicators of heart beats' rate in rest and increasing of heart beats' rate with changing horizontal position into vertical one.
2. The highest indicators of speed-power endurance, registered by the value of high jump, belong to "speed" rock-climbers and are confidently higher in comparison with «complex" rock-climbers and mountaineers. The same results were registered in test "Raising of legs to breast in hanging on hands, 20 times, sec."; the best indicators of test "Chin ups 15 times for quickness" also belong to "speed" rock-climbers.
3. It was found that mountaineers had the best time of hanging in hold of 1 cm depth and it confidently differs from the same indicators of "speed" rock-climbers. The quantity of chin ups up to of "complex" rock-climbers waist is confidently higher.
4. It was determined that different kinds of rock-climbing set different requirements to development of speed-power fitness's components: speed climbing facilitates progressing of explosive power and speed endurance; "complex" climbing promotes development of strength and power endurance in sort intervals of time. Mountaineering, which was regarded by us for comparing, facilitates development of power endurance in longer periods of time.

The prospects of further researches imply studying of psycho-physiological abilities and structure of complex fitness of rock-climbers of different specializing.

References:

- 1 Bajkovskij Iu.V. O koncepcii klassifikacii vidov sporta i vidov deiatel'nosti po stepeni ekstremal'nosti [On the concept of classification of sports and activities on the degree of extreme]. *Ekstremal'naia deiatel'nost' cheloveka, problemy i perspektivy podgotovki specialistov* [Extreme human activities, problems and prospects of training], Moscow, 2007, pp. 7-13.
- 2 Bajkovskij Iu.V. Bleer A.N. *Fizicheskaia kul'tura* [Physical culture], 2011, vol.3, pp. 76-79.
- 3 Dvoenosov V.G. *Teoriia i praktika fizicheskoi kul'tury* [Theory and practice of physical culture], 2009, vol.7, pp. 87-91.
- 4 Kozina Zh.L. *Fizicheskoe vospitanie studentov tvorcheskikh special'nostej* [Physical Education of the Students of Creative Profession], 2009, vol.2, pp. 34-47.
- 5 Kozina Zh.L., Grin' L.V. *Fizicheskoe vospitanie studentov tvorcheskikh special'nostej* [Physical Education of the Students of Creative Profession], 2009, vol.4, pp. 60-68.
- 6 Kozina Zh.L., Iermakov S.S., Pogorelova A.O. *Fizicheskoe vospitanie studentov* [Physical Education of Students], 2012, vol.3, pp. 53-60.
- 7 Kravchuk T.A. *Teoriia i praktika prikladnykh i ekstremal'nykh vidov sporta* [Theory and practice of applied and extreme sports], 2008, vol.2(14), pp. 21-23.
- 8 Kravchuk T.A., Zhmakina T.N. *Fizkul'turnoe obrazovanie Sibiri* [Physical education of Siberia], 2005, vol.1, pp. 50-54.
- 9 Mavliutova S.Z. Bajkovskij Iu. V. *Teoriia i praktika prikladnykh i ekstremal'nykh vidov sporta* [Theory and practice of applied and extreme sports], 2010, vol.2, pp. 53-55.
- 10 Matveev L.P. *Teoriia i metodika fizicheskoi kul'tury* [Theory and methods of physical culture], Moscow, 1991, 544 p.
- 11 Platonov V.N. *Obshchaia teoriia podgotovki sportsmenov v Olimpijskom sporte* [A general theory of preparation of sportsmen in Olympic sport], Kiev, Olympic Literature, 1997, 584 p.
- 12 Sharafutdinov D.R. *Teoriia i praktika fizicheskoi kul'tury* [Theory and practice of physical culture], 2012, vol.5, pp. 35-37.
- 13 Burke S.M., Durand-Bush N., Doell K. Exploring feel and motivation with recreational and elite Mount Everest climbers: An ethnographic study. *International Journal of Sport and Exercise Psychology*. 2010, vol.8(4), pp. 373-393. doi:10.1080/1612197X.2010.9671959.
- 14 Kozina Zh.L., Ryepko O.A., Prusik Kr., Ciešlicka Mirosława, Psychophysiological possibility of mountaineers and climbers specializing in speed climbing and climbing difficulty. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2013, vol.10, pp. 41-46. doi:10.6084/m9.figshare.785784
- 15 López-Rivera E., González-Badillo J.J. The effects of two maximum grip strength training methods using the same effort duration and different edge depth on grip endurance in elite climbers. *Sports Technology*. 2012, vol.5(3-4), pp. 100-110. doi:10.1080/19346182.2012.716061.

Information about the author

Ryepko O.O.: ORCID: <http://orcid.org/0000-0001-6879-6015>;
Zhanneta.kozina@gmail.com; Kharkov G.S. Skovoroda National
Pedagogical University; Artema str. 29, Kharkov, 61002, Ukraine.

Cite this article as: Ryepko O.A. Features and functionality of speed and power capabilities of elite climbers and various types of rock climbing. *Physical education of students*, 2013, vol.6, pp. 60-65. doi:10.6084/m9.figshare.840505

The electronic version of this article is the complete one and can be found online at: <http://www.sportpedagogy.org.ua/html/anhive-e.html>

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (<http://creativecommons.org/licenses/by/3.0/deed.en>).

Received: 15.10.2013

Published: 30.11.2013