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SHULHA O.*Dnepropetrovsk State Institute of Physical Culture and Sport*

About aspects of economic technique ascent the routes in the discipline of sport climbing “lead”

Abstract. Purpose: definition of parameters technique of motor actions athletes climbers, reflecting efficiency of the work in the discipline of climbing «lead». **Material and Methods:** the video resource official website of the International Federation of Sport Climbing (IFSC). **Results:** Pace and rhythmic structure of movement technique of elite athletes-climbers in a competitive activity were analyzed. Parameters of hand-movement pace while climber ascent the route, as well as the ratio of the different contact phases of interaction of hands with handholds were determined. **Conclusion:** the economic of technique movement while climber ascent the route dictated by the pace of hand-movements and the prevalence in the ratio of the rhythmic structure contact phase with one hand was found.

Keywords: sport climbing, lead, economic, movement, technique.

Introduction. Modern high-level sport is characterized by limiting physical and mental loads. Many experts mainly think about that functional (physical) training of athlete has reached its upper bound and in this case is no longer able to further improve athletic performance [2, 5]. These circumstances led to the activation and concentration of domestic and foreign specialists and scientists on the problems of finding and developing new approaches related to maximizing the individual capabilities of the athlete in a competition. One of such directions can be considered a problem of rational using of functional reserves by increasing the efficiency and economic of movement techniques. Solution of this problem is reflected in the works of many researchers of different kind of sports [1, 3, 6].

Quite topical today this issue is for sports disciplines with a predominance of special endurance, which include one of the types of sport climbing – «lead». As previously been shown in studies [7, 8, 9, 10] performance of climber (in lead) is determined by the capacity and power of anaerobic-glycolytic energy supply system, or in other words, the local strength endurance flexor muscles of the forearm. Therefore, in this case, a very important role in the process of ascent the route plays amount of muscular energy spent (and recovered) when climber performing each hand-movements.

Such factors suggests that the economic techniques of climber is one of the most critical aspects of his techniques of climbing which reflecting a high level performance. At the same time this issue lighted insufficiently in the modern scientific information space what makes it necessary this study.

Relations with the scientific programs, plans, themes. Work was carried out in accordance with the Consolidated Plan of SRW for 2011-2015 years on 2.6 “Theoretical and methodological basis for improvement of the training process and competitive activity in the structure of long-term preparation of sportsmen” and research directions of the department of Olympic and professional sports Dnepropetrovsk State Institute of Physical Culture and Sport on “Historical, organizational, law and theoretical and methodological foundations of non-Olympic sports in Ukraine and in the international space.”

The purpose this study is to identify the indicators of technique movements climbers which reflect the economic of the work performed in the discipline of climbing “lead”.

Material and methods. Video data of resource of official site of international federation of sport climbing (IFSC) were analysed in this research[4]: World Championship (2012) – final round, 8 ascents of men and 8 ascents of women; World Championship (2014) – 2 ascents of men and 2 ascents of women (finale and semifinal). Speed of the video recording made 25 fps.

In this study next variables were exposed to:

1)pace of climbing as an index of speed of moving, determined on the amount of hand-movements performed for 1 minute ($HM \cdot m^{-1}$). In this research every hand-movement performed by subjects (climbers) was examined as a separate movement action from one holds to other in case of it effective *grabbed*;

2)duration of contact phases measured as time fixation of holds by one hand or two hands simultaneously with precision to 0,04 sec. This variable used for to study rhythmic structure of hand-movements.

All variables were analysed by using biokinematics analysis software (Kinovea ver. 0.7.10) with method of stop-motion. The statistical processing of findings was conducted by package for data analysis of Microsoft Office Excel 2010.

Results and discussion. Moving of climber on the route determined by the use of different support positions and performed of hand and feet movements to achievement to next hand hold or foot hold. From position of structure and specific of competitive activity, by conditional unit in the sport climbing it is possible to express one hand-movement (grasping by hand of a hold), as the end-point is in this discipline, in accordance with the IFSC rules of realization in competitive climbing, determined on a height, by the attained hand. Thus, it is possible to suppose that the economy of movement technique of climbers ascent the route is determined by the amount of energy expended for one hand-movement.

To prove solvency of this supposition, the analysis of competition activity of high-level sport climbers who specialized in discipline “lead” was conducted.

On a fig. 1 average data of speed (pace) of hand-movements while ascents the route (final round) are presented. Characterizing data of figure 1, foremost, it is necessary to mark that the high-level sport climbers are distinguished by not very high pace of movement by the route.

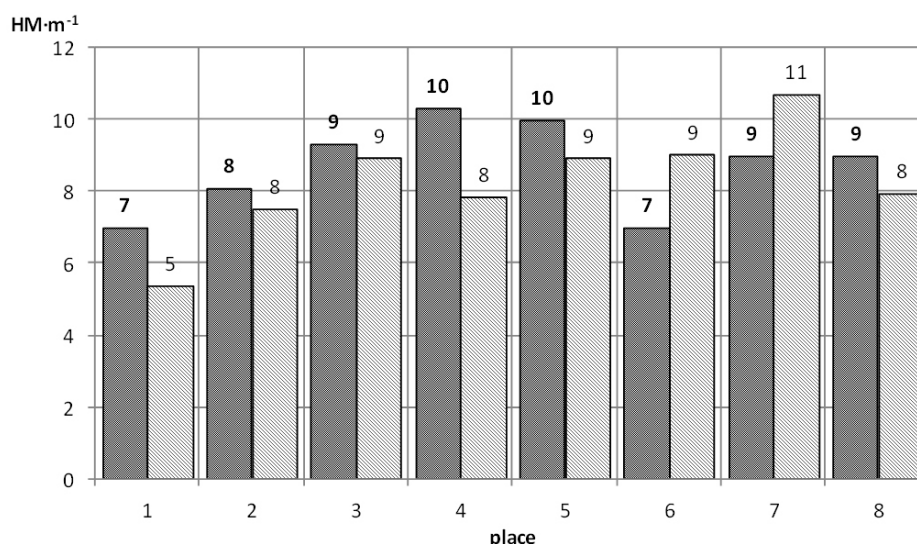


Fig. 1 Variables of pace of hand-movements of ascent the final route of subjects (elite climbers) World championships 2012, Italy: ■ men; ▨ women

Finding testify to relatively low pace of hand-movements: in a range from 5 to 11 hand-movements per minute. And such tendency is peculiar to both the men and women. Elite sport climbers do not aspire to rapid and intensive movements. It can be related to that increase of pace of movement in direct ratio to growth of power of executable work, consequently, and to the increase of energyexpense of functional resources of organism.

At the same time, it is needed to mark a certain tendency in the indexes of pace of movement (as for men and women): sport climber taking the 1-th place performed most amount of hand-movements (for men – 47, for women – 49) at the least index of average pace of hand-movements (men – 7,23 HM·m⁻¹, women – 5,37 HM·m⁻¹). Important to note that such data can be explained by the specific design of the route and construction of climbing wall.

Except for the higher noted parameters of movements of sport climber (pace), an significant role acquires the study of temporal (phase) structure of movement actions performed by hands which determines rhythmic parameters. As is generally known, a rhythm is characteristic for most of locomotins as a major index of economy of technique and can be used for the estimation of technique in sport disciplines in which is possible to correlate the phases of active and non-active movement actions of athletes.

While ascent the route for every sport climber can alternate loading on hands, moving from one hold to another and to choose adequate support positions of body on purpose to minimize loading on the muscles of upper body. The rationally accented alternation of loading from hand to hand gives possibility to the climber of redistribution of forces, recovery of capacity and decline factors of appearance of premature fatigue during ascent the route.

On purpose to study the features of rhythmic structure of movement actions performed by hands the comparative analysis of this parameter was conducted between the sport climbers of different qualification (fig. 2). In this case a rhythmic structure of motive actions is temporal relation of contact phases one-hand (left or right separately) and contact simultaneously by two hands during ascent the route.

Most interest for an analysis was presented the duration of contact two hands (simultaneously), as this parameter determines the economy of movement technique of climber in a greater degree. Data are presented on a fig. 2, allow to establish that for lower qualification sport-climbers (placed in the competitions: for women – 25 place, for men – 23 place) ascent the route requiers more time of contact by wo hands simultaneously (62 % and 52 % respectively), than of high level sport-climbers (1 place in men and women : 41 % and 43 % respectively). To our opinion, that explained by lower qualification sport-climbers faced with difficulty of choice of adequate support positions which possibility to release one hand from loading. At the same time, it can be contingently insufficient development of strenght separate muscular groups which would allow to accept effective body positions.

Analyzing the data in Figure 2, it can also be noted that high level sport climbers peculiar to more economical technique movement along the route. At the same time, for the low level sport climbers are characterized by high total load on both hands: long contact period with both hands simultaneously at high isometric tension of the muscles of the upper body resulting in an earlier depletion of functional resources, and as a result, the earlier development of fatigue in both hands .

Conclusions. The research allowed to identify several indicators characterizing the economy movement technique along the route in the discipline of sport climbing “lead”: the pace of hand movement, and the ratio of the rhythmic structure of movement actions of various phases of contact hands. High level sport climbers is characterized by lower values of the pace of hand movement while ascents the route, as well as shorter duration of contact phase simultaneously with both hands in a rhythmic structure of movement actions.

Therefore, perspectives further research are to develop a training program directed at improving the efficiency of movement technique ascent the routes sport climbers (formation of an adequate pace-rhythmic structure of movement actions) in the discipline of sport climbing “lead” on the basis of the results in this study.

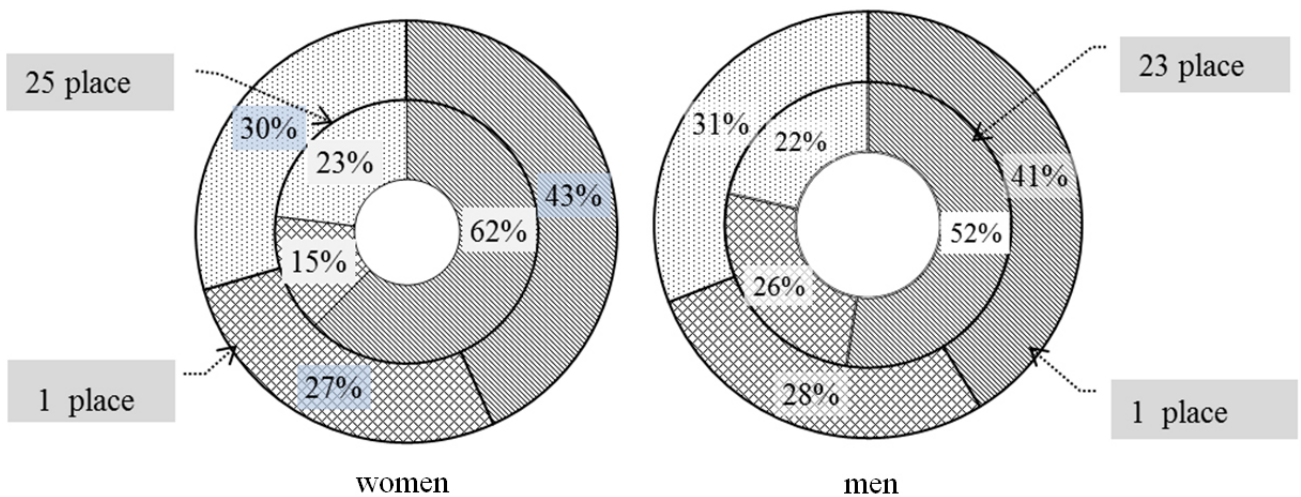


Fig. 2 Comparative analysis of rhythmic structure of movement actions (contact phases) of sport climbers

of different qualification (World championship 2014, Spain) :

contact a right hand;
contact a left hand;
contact two hands.

References:

1. Adashevskiy V. M., Shabanov V. A., Yermakov S. S. *Fizicheskoye vospitaniye studentov [Physical education of students]*, 2011, vol. 3, p. 3–7. (rus)
2. Akhmetov R. F. *Pedagogika, psikhologiya i mediko-biologicheskiye problemy fizicheskogo vospitaniya i sporta [Pedagogy, psychology and medical-biological problems of physical education and sport]*, 2011, vol. 1, p. 7–9. (rus)
3. Akhmetov R. F. *Pedagogika, psikhologiya i mediko-biologicheskiye problemy fizicheskogo vospitaniya i sporta [Pedagogy, psychology and medical-biological problems of physical education and sport]*, 2012, vol. 4, p. 9–11. (rus)
4. *Video-arkhiv mezhdunarodnykh sorevnovaniy IFSC [Video archive IFSC international competition]*, Access mode : [youtube.com/user/ifscchannel](https://www.youtube.com/user/ifscchannel) (rus)
5. Kashuba V. A., Litvinenko Yu. V. *Fizicheskoye vospitaniye studentov [Physical education of students]*, 2010, vol. 4, p. 40–44. (rus)
6. Tupeyev Yu. V. *Fizicheskoye vospitaniye studentov [Physical education of students]*, 2010, vol. 1, p. 106–108. (rus)
7. Goddard D. *Performance rock climbing* / D. Goddard, U. Neumann // Mechanicsburg, PA: Stackpole Books, 1993. – 208 p.
8. Grant S. *Anthropometric, strength, endurance and flexibility characteristics of elite and recreational climbers* / S. Grant, V. Hynes, A. Whittaker, T. Aitchison // *Journal of Sport Science*. – 1996. – № 14(4). – P. 301–309.
9. Mermier C. M. *Physiological and anthropometric determinants of sport climbing performance* / C. M. Mermier // *British Journal of Sports Medicine*, 2000. – № 34. – P. 359–366.
10. Watts P. B. *Physiology of difficult rock climbing* / P. B. Watts // *European Journal Appl. Physiol.* – 2004. – № 91(4). – P. 361–372.

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Olexii Shulha: PhD (Physical Education and Sport); Dnipropetrovsk State Institute of Physical Culture and Sports: Naberezhna Peremohy st. 10, Dnepropetrovsk, 49094, Ukraine.

ORCID.ORG/0000-0001-6214-5588

E-mail: olexiy.sh@gmail.com