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Security Dimensions. International & National Studies nr 2 (18), 80-91

2016

Artykuł został opracowany do udostępnienia w internecie przez Muzeum Historii Polski w ramach prac podejmowanych na rzecz zapewnienia otwartego, powszechnego i trwałego dostępu do polskiego dorobku naukowego i kulturalnego. Artykuł jest umieszczony w kolekcji cyfrowej bazhum.muzhp.pl, gromadzącej zawartość polskich czasopism humanistycznych i społecznych.

Tekst jest udostępniony do wykorzystania w ramach
dozwolonego użytku.

SECURITY DIMENSIONS

INTERNATIONAL & NATIONAL STUDIES

NO. 18; 2016 (80–91)

CHANGES IN THE PHYSICAL ENDURANCE OF KICKBOXERS IN THE PREPARATORY PHASE

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ABSTRACT

The aim of the paper was to analyze: training effectiveness in the preparatory period, changes in contestants' aerobic and anaerobic capacity in the preparatory period, changes in contestants' motor abilities in the preparatory period, to compare the level of selected parameters of anaerobic capacity measured by means of Wingate test and aerobic capacity measured by means of Beep-test of kickboxing contestants with the results of contestants training similar martial arts. The research has been carried out on three contestants of UKS Gladiator Club who achieve high sports results. An analysis of obtained results shows that the training employed in the preparatory phase has been appropriately planned and effective enough. Both aerobic and anaerobic capacity in the preparatory phase has increased significantly. Anaerobic capacity of the examined contestants is higher than capacity of the contestants in the control group. Their aerobic capacity, on the other hand, is lower than in the control group. When planning further training in the future greater attention should be paid to developing aerobic capacity.

ARTICLE INFO

Article history

Received: 19.05.2016 Accepted 21.06.2016

Key words

martial arts, kickboxing, physical endurance

INTRODUCTION

Achieving high sports results and breaking ever new records requires cooperation of numerous specialists. Their achievements gathered in training methodology enable a good trainer to assist a sportsperson in obtaining excellent results. The theory and methodology of sport is a scientific discipline which draws on the expertise of anatomy, physiology, biomechanics, medicine, pedagogy, psychology and other sciences. A trainer has to be aware of the fact that he/she can train a champion, but also that incorrectly chosen training forms can result in injury or overtraining or simply discourage a sportsperson from doing sport. A training process is very complicated. In its course the possibilities of an organism are developed, motor skills are taken to a higher level, but personality changes as well. Regardless of its aim – whether it is victory in competitions or improving skills – one has to remember about fundamental training rules:

- Versatile physical development – it is preparation of an organism for further specialist work, but also an important factor in shaping a healthy and harmonious body.
- Development of specialist features – it is necessary to achieve high results in kickboxing, and its fundamental aim is to develop prominent features required in this sports discipline.
- Improving technique – basing on general and specialist physical fitness one may build and develop technique in standard and complicated conditions.
- Tactics – it is a very important element on the road to championship, it consists in purposeful employment of technique and competition of assumptions developed in advance to achieve success in a fight.
- Volitional features – self-confidence, courage, character often decide about victory in case of competitors' balanced physical abilities.

- Prevention – health examinations, treatment and prevention of injuries, rehabilitation after being injured – these are factors which are of great importance in a trainer's work.
- Enriching contestants' theoretical knowledge – a contestant who has fundamental knowledge of physiology, anatomy, the theory of training, nutrition, biological renewal is more aware of the above mentioned aspects. He/she will be aware of the fact that they are as important as developing motor features¹.

While drawing up a training plan in kickboxing one has to adjust it to the activity calendar. Periodization of training is made on its basis, namely the training plan is divided into smaller training periods that are easier to complete.

For the purposes of kickboxing contestants, two main periods in which trainers participate in contests are distinguished. A trainer should be at the top of its form in April-May because this is the time when the most important contests in season take place, e.g. Polish Championships, European Cup or World Cup and in September when European and World Championships are held. Selection of contestants to the national team takes place after each macrocycle. Contestants who have achieved the greatest success in the most important contests of the season are selected to the national team. Appointments to the team are sent after each macrocycle.

A preparatory phase in kickboxing lasts about 4 months and it can be divided into two smaller sub-phases: a general preparatory phase and specialist preparatory phase. The main aim of the general preparatory phase is preparing organism to further training by increasing the level of selected motor skills. In this phase one has to remember about developing the basic technique and tactical assumptions. Participation in contests in the preparatory phase is not reasonable. The main abilities developed in the general preparatory phase are strength and endurance. The special preparatory phase is a transition phase to the participation phase. The volume of effort is still high, but the majority of effort, 70-80%, is directed at specialist effect. The main developed abilities are dynamics, speed and speed endurance. In this phase sacks and Thai pads are used to repeat elements of technique. At the end of the specialist preparatory period, the volume of effort is low-

¹ K. Wiczorek, *Kick-boxing: podręcznik dla instruktorów* [Kick-boxing: a handbook for instructors], Siemiatczyce 1994.

ered for the benefit of its intensity. General development exercises still play an important role and constitute approximately 30% of training volume.

At the end of this phase it is advisable to start participating in less important contests in order to enter the participation period more easily.

The aim of training in the participation phase is to increase a contestant's level of abilities and his psycho-physical characteristics to the maximum. As many as 90% of exercises in this phase are targeted exercises. Training aims are achieved by using special loads and participation in contestants. Most exercises are done with a partner and include some element of competition. Exercises are done in proper clothing to create conditions as similar to the real fight as possible. Training intensity increases and load decreases. More and more time is spent on biological renewal and regeneration, which is to release craving for training and fight. We can distinguish between two sub-phases in the participation phase: pre-participation sub-phase and main contest sub-phase. In the pre-participation sub-phase contestants participate in testing competitions so that the trainer has a possibility to see a participant's abilities and introduce appropriate modifications into training in order to eliminate errors. The sub-phase of main competitions has to be directed at specialists physical development. In this phase contestants have to prepare for main competition. The fundamental forms of training are:

- hitting pads with the trainers,
- speed drills with tools,
- sparrings,
- general development exercises, often sports games.

The main tasks of the transition phase are full relaxation after training and participation load, biological and psychological renewal, treating injuries. The transition phase lasts from two to four weeks. In this phase training forms should be radically different from forms typical for kickboxing. Supplementary sports (skiing, water sports and swimming) can be used. An important element is changing the environment in which the contestants spends time (post-season camp). The transition phase is also the time to analyze the past season and prepare a plan for the next training cycle. At the end of the transition period intensity increases, which enables to enter the next macrocycle smoothly².

² *Trenerzy Kick-boxingu radzą* [Kick-boxing trainers give advice], K. Wieczorek (ed.), a collective work, Instytut Wychowania Fizycznego i Sportu - Towarzystwo Sportowe. Warszawa 2003.

The aim of the paper was:

- to analyze training effectiveness in the preparatory period,
- to analyze changes in contestants' aerobic and anaerobic capacity in the preparatory period,
- to analyze changes in contestants' motor abilities in the preparatory period,
- to compare the level of selected parameters of anaerobic capacity measured by means of Wingate test and aerobic capacity measured by means of Beep-test of kickboxing contestants with the results of contestants training similar martial arts.

MATERIAL AND METHODOLOGY

The research has been carried out on three contestants of UKS Gladiator Club who achieve high sports results: the silver medalist of World Cup in kickboxing kicklight -42kg, K.G., the bronze medalist of World Cup in lowkick -55kg, S.Sz. and W.N., a double gold medalist of Championship of Poland in lightcontact and kicklight, selected to represent Poland before 2013 European Championship. Contestants train in two sections of UKS Gladiator Club, in Binczarowa and Grybów.

The research has been taken three times for each contestants. Analysis of anaerobic capacity was conducted in the Faculty of Sport of the University in Presovie in Slovakia on 05.11.2013, 12.12.2013 and 12.01.2014. Anaerobic capacity was measured by means of a thirty-second wingate test, which was taken on Monark894E cycle ergometer. The measures parameters were: Pmax – maximum power (W/kg), Pavg – average anaerobic power (W/kg) and FI – power decrease index (%). What is more, on 06.11.2013, 13.12.2013 and 13.01.2014 in Grybów, Małopolskie Voivodeship, International Physical Fitness tests were taken as well.

RESEARCH RESULTS

When analyzing data in Table.1 it can be noted that the highest progress in anaerobic capacity was achieved by W.N. whose Pmax amounted to 11,25% at the time and its average value is 9,82 W. The lowest progress in maximum power has been observed in S.Sz., in case of whom this parameter increased only by 1,39% and its average value amounted to 10,68 W. A significant increase of Pmax has also been observed in K.Ś. His Pmax in the course of tests was 9,56% and its value amounted to 13,35 W. It

should be mentioned that a number of other factors such as regeneration, nutrition, involvement in training tasks and sport lifestyle influence training effectiveness.

TAB. 1. RESULTS OF WINGATE TEST

Examined contestants				
Test	Measured parameter	S. Sz.	W. N.	K.Ś.
1	PP	10,6	9,23	12,58
	AP	8,59	6,9	8,73
	FI	40,09	48,42	54,76
2	PP	10,69	9,83	13,56
	AP	8,56	7,27	9,57
	FI	41,06	54,2	49,23
3	PP	10,75	10,4	13,91
	AP	8,4	7,59	9,68
	FI	42,79	50,09	55,35

Average maximum power (P_{max}) [$W \cdot kg^{-1}$] of the examined contestants of UKS Gladiator Club is 11m28 W. In comparison to results of contestants training other sports, it is a surprisingly high result. P_{max} of judo contestants examined by means of wingate test was 11,6 W. However, it should be mentioned that these judo contestants are senior contestants. When comparing the obtained results with the results of the Polish Taekwondo National Team³ it turns out that P_{max} of the contestants of UKS Gladiator Club is higher by 0,83W. The results look even better in comparison with average results of Polish Kickboxing National team⁴, in this case they are better by 1,45 W (table 2).

³ B. Długołęcka et al., *Wydolność fizyczna zawodników uprawiających kick-boxing i taekwon-do* [Physical endurance of kick-boxing and taekwon-do contestants], „Medycyna sportowa”, 2006 vol. 22 p. 40–45.

⁴ E. Elegńczyk-Kot, J. Karolkiewicz, A. Nowak et al., *Metaboliczne konsekwencje wysiłków fizycznych o dużej mocy na przykładzie zawodników uprawiających kick-boxing*

TAB. 2. AVERAGE MAXIMUM POWER RESULTS OF THE EXAMINED GROUP AND OTHER MARTIAL ARTS

Group	Wingate test
	Pmax (W/kg)
UKS Gladiator	11,28
Taekwondo national team	10,45
Kickboxing national team	9,38
Judo	11.6

TAB.3. THE RESULTS OF PHYSICAL FITNESS TEST IN THE EXAMINED GROUP

Examined contestants				
Test	Test no.	S. Sz.	W. N.	K. Ś.
Cardiorespiratory endurance	1	1440	840	1280
	2	1440	840	1340
	3	1500	880	1400
Standing long jump	1	224	152	201
	2	226	163	200
	3	227	163	205
Hand grip strength test	1	33,5	28,1	49,5
	2	33,5	27,8	49,5
	3	33,8	28,1	50
Arm hang	1	16	0	38
	2	16	0	40
	3	18	0	42

[Metabolic consequences of great physical effort by the example of kick-boxing contestants], *Med. Sportiva*, 2003, 7 (3), p. 157–166.

4x10m run	1	9,43	10,56	9,56
	2	9,25	12,56	9,45
	3	8,66	12,56	8,7
Sit-ups	1	28	28	32
	2	28	30	32
	3	30	31	32
Forward bents	1	25	15	10
	2	25	15	11
	3	27	15	11
1000m(s) run	1	220	230	240
	2	220	228	235
	3	219	227	231

When comparing all contestants it can be noted that K.Ś. obtained the best results. In seven out of eight tests he improved his results and in cardiorespiratory endurance test the maximum distance run increased by as many as 120 m. The worst results were obtained by W.N., who improved her results only in case of four out of eight tests. In the remaining tests her results did not change or were worse, which can be caused by the fact that she did not participate in training because of sickness. The parameter which improved significantly in all contestants was cardiorespiratory endurance. Good results were obtained also in standing long jump test. The lowest improvement has been observed in suppleness and abdominal muscles test.

Table 4 presents a comparison of results of UKS Gladiator contestants with the results of contestants training different martial arts obtained in cardiorespiratory tests. The compared parameter was maximum oxygen consumption, namely VO_{2max} ⁵.

⁵ A. Ronikier, *Fizjologia sportu* [Physiology of sport], B.T. Warszawa 2001.

TAB.4. A COMPARISON OF MAXIMUM OXYGEN CONSUMPTION IN CONTESTANTS TRAINING DIFFERENT MARTIAL ARTS

Type of sport	Maximum oxygen consumption (ml/kg/min)	
	Men	Women
Box	60-65	-
Wrestling	60-65	-
Judo	55-60	48-52
Fencing	45-50	40-45
UKS Gladiator	44,13	40,43

Maximum oxygen consumption in UKS Gladiator Club points out to great differences between the research and the control group. Definitely the best results have been obtained by box contestants, their VO_{2max} amounts to even 60ml/kg/min. The lowest VO_{2max} rate in the control group was that of fencing contestants, which amounted to 45-50 ml/kg/min. The contestants of UKS Gladiator Club rank lower than the contestants of all control groups.

DISCUSSION

The preparatory phase plays an extremely important role in the training cycle. The manner in which a contestant spends this time will affect the whole season. It is the preparatory phase when such motor skills as strength, speed, endurance are developed. The initial ability of body adaptation to physical activity decides about the ability to endure hard effort. A good measure of its level are some physiological parameters which provide information about the contestant's current condition. Determining these values and their changes in the course of the preparatory phase can be helpful in predicting the effect of subsequent stages of training⁶. Because of the employed comparative analysis, it can be stated that with respect to changes determining aerobic capacity, whose fundamental pa-

⁶ A. Jaskulski, A. Jaskulska, *Podstawy fizjologii wysiłku fizycznego z zarysem fizjologii człowieka* [Introduction to the physiology of physical effort with an outline of human physiology], Wrocław 2006.

rameters is maximum oxygen uptake⁷, the contestants of UKS Gladiator obtained considerably lower average results than the contestants of the control group, in which the highest values of VO₂max were obtained by boxers. This is probably caused by the fact that the control group was in the participation phase, which is the time when contestants should obtain the greatest results, and the contestants of UKS Gladiator Club were in the preparatory phase, which is the time when form is developed. In anaerobic capacity tests the examined contestants obtained better results than almost all control groups, except for judo. Both groups train in the same club, they are subjected to the same training loads, which is reflected in similar values of changes in anaerobic parameters. In relation to standards, the result of K.Ś. comes under the “elite” category, the result of W.N. in the “above average” category and the result of S.Sz. in the “excellent” category. The results of anaerobic tests of other authors whose expertise are martial arts are similar, which points to similar training aims in different martial arts. Very similar results to the results obtained in this paper were obtained by the participants of the research by Batra⁸, who studied contestants of taekwondo ITF. When observing other results of motor tests, it can be noted that each time they were higher, which means that the employed training was effective. The greatest progress is observed in cardiorespiratory test and standing long jump test. The smallest training effects have been observed in suppleness tests and abdominal muscles test. In case of suppleness, this was surely caused by the fact that it is an ability which develops slowly, it takes more time to observe any effects. In the course of employed training abdominal muscles were trained very often and that is why such a low index of effectiveness of improving this feature is surprising. After inserting the results of International Physical Fitness Tests to scores by Pilicz⁹ it turns out that S.Sz. is characterized by a high level of physical fitness and W.N. and K.Ś. by average level of physical

⁷ R. Kubica, *Podstawy fizjologii pracy i wydolności fizycznej* [Introduction to physiology of work and physical endurance], AWF Kraków, 1999.

⁸ A. Batra, *Wydolność beztlenowa a poziom sportowy zawodników Taekwon-do ITF* [Anaerobic capacity and the level of sports skills of Taekwon-do ITF contestants], „Sport Wyczynowy”, 2012 nr 4, p. 117–123.

⁹ S. Pilicz, R. Przewęda, J. Dobosz, S. Nowacka-Dobosz, *Punktacja sprawności fizycznej młodzieży polskiej wg Międzynarodowego Testu Sprawności Fizycznej* [Scoring of physical fitness of Polish teenagers according to the International Physical Fitness Test], Warszawa, 2003.

fitness. It should be noted that after the end of the preparatory phase analyzed in this paper, W.N. won a silver medal in Polish Championships and two medals in the Polish Cup, as a result of which she was selected to the national team which will represent Poland in World Championships in Italy. However, sports results obtained in childhood cannot be treated as an explicit indicator of future sports possibilities and predispositions of a contestant. This is supported by that fact that only 20–25% of contestants maintain their position in sport after moving from teenage category to seniors¹⁰, and it is the task of trainers to train contestants in such a way which would increase this low figure.

CONCLUSION

An analysis of obtained results shows that the training employed in the preparatory phase has been appropriately planned and effective enough. Both aerobic and anaerobic capacity in the preparatory phase has increased significantly. Anaerobic capacity of the examined contestants is higher than capacity of the contestants in the control group. Their aerobic capacity, on the other hand, is lower than in the control group. When planning further training in the future greater attention should be paid to developing aerobic capacity. It is recommended to carry out such tests cyclically, which would enable to accurately determine training effectiveness, and thus modify the training process so that it is as beneficial to the contestant as possible.

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¹⁰ Z. Barabasz, E. Zadarko, E. Nizioł, *Nabór, selekcja i system szkolenia w sporcie wyczynowym dzieci i młodzieży – wybrane zagadnienia* [Recruitment, selection and the training system in competitive sports in case of children and teenagers – selected issues], PWSZ Krosno, 2009.

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CITE THIS ARTICLE AS:

T. Ambroży, A. Kwiatkowski, D. Mucha, J. Piwowarski, *Changes in the physical endurance of kickboxers in the preparatory phase*, “Security Dimensions. International and National Studies”, 2016, no 18, p. 80–91