Periodization of training load during preparatory and performance shaping phases of a 50 and 20 km race walker

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PERIODIZATION OF TRAINING LOAD DURING PREPARATORY AND PERFORMANCE SHAPING PHASES OF A 50 AND 20 KM RACE WALKER

Jaroslav Brodáni[1], Mária Czakova[2,3], Matej Tóth[3] and Ratko Pavlović[4]

[1] Department of Physical Education and Sports, PF UKF in Nitra, Slovakia
[2] Department of Physical Education and Sports, UMB Banská Bystrica, Slovakia
[3] Military Sports Center Dukla, Banská Bystrica, Slovakia
[4] Faculty Physical Education and Sport, University of East Sarajevo, Bosnia and Herzegovina

Original scientific paper

Abstract
Article points out special training periodization indicators during sports training and peaking performance of racewalker to 50 km and 20 km. We special focus on the period of the first peak of the season in the annual training cycle, which reached their personal best performances in a combination of both racewalker disciplines. Based on the results of the model has been created for special training indicators for racewalkers with performance to 20 km 1:21:00 hours and 50 km 3:40:0 hours.

Key words: *race walking, periodization, load, sports performance*

Introduction

Content periodization of training load during a one-year training cycle of a race walker depends on the type of on going phase of conceptual models used in the preparation, preferred events, number of peaks in the season, or rather systems of top-level events in one-year cycles, etc. A gradual transition from the accumulation phase through to the intensifying phase and towards the transformational phase guarantees quality sports performance with culmination at a planned sporting event (Bompa, & Haff, 2009; Laczo, 2004; Pupiš, et al., 2011; Viru, 1996).

The accumulation phase, is characterized by a consistent aerobic load, it should be followed by the intensifying phase and focuses on strength and endurance-strength load. Following this, is the transformational phase and it is characterized by intermittent training with gradual transition towards maximum sports performance in a culminating competitive phase. These individual elements do not exist separately. Their reversible rate in given phases are determined by the length of the phase, training load volume and training load intensity (Figure. 1). The conceptual foundation in the preparatory phase of race walkers forms a recommended training load volume with possible deviations (Table 1).

At the same time, performance improvement requires adequate content tapering towards special pace. The process of qualitative transformation of a race walker over a period of time requires the harmonization of both aerobic and anaerobic training. That confirms the importance of monitoring the changes in anaerobic threshold, or rather the efficiency of the individual training phases during a one-year cycle. Subsequently, changes in the level of anaerobic threshold require changes in the speed of all training means in individual bioenergetics zones (Laczo, 1996).

From the point of view of efficient improvement of long-term and medium-term endurance, it is important to stimulate both aerobic performance and aerobic capacity (Pupiš, 2009, 2011; Pivovarníček, et al., 2013). The level of aerobic performance and capacity in race walking directly limits the sports performance. While we are able to improve aerobic performance by 15-25%, we have even bigger possibilities with aerobic capacity. Optimal training stimulus for improving both aspects (aerobic performance and capacity) of aerobic endurance is found on the level of anaerobic threshold (3-6 $mmol.l^{-1}$). From the point of view of sports practice, the intensity between 90-100% VO_2max improves aerobic performance, whereas the intensity below 90% VO_2max improves aerobic capacity. The internal orientation dynamics of a training load model is determined by training methods. In race walking, we make use of quantitative (consistent, fartlek and circuit, focused on the improvement of aerobic and anaerobic strength) as well as qualitative methods (interval, repeating, circuit). Their application in the structure system of improving aerobic capacity and performance has an extensive variability and use. Diversity of variants is related to specific adaptation changes and competition needs (different track length, intensity variations, intensive and extensive parts, which are set in advance). The modelling method of competition load influences the adaptation from the psychological point of view. However, from the point of view of training practice, it is necessary to combine all the methods, means and forms, so they can complexly fulfil the tasks of every race walking element. The crucial element, which determines the performance in race walking, is the reached level of organism adaptation to long-term intensive work (Korčok, & Pupiš, 2006; Pupiš, 2005, 2007). To reach maximum performance, race walkers should walk 4000 - 6000 km every year (Čillík, et., 2003; 2004).

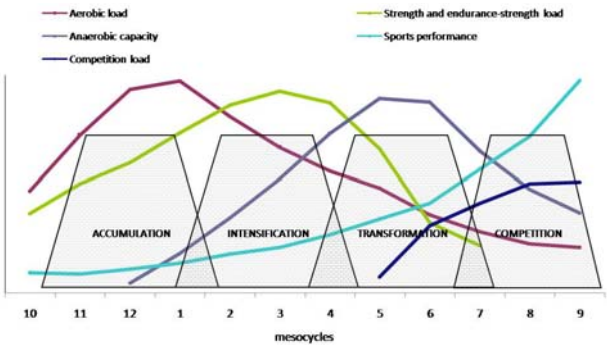


Figure 1. Conceptual one-year preparation model of a race walker in the various phases (adjusted according to Laczo, 2004)

Special endurance, which is related to the race distance, is the key motor ability from the point of view of sports performance in both 20 km and 50 km race walking events. Special endurance in a 20 km race walking event is realized through sports performance on the level of individual anaerobic threshold, whereas in a 50 km race walking event, the training load intensity reaches 93 - 97% of anaerobic threshold (Broďáni, 2007; Pupiš, 2011). The training load volume for special pace is highly individual. Dosage requires a complex and long-term approach, which is reflected in the specific dosage of stimuli over a period of time, respecting biological and pedagogical rules of adaptation, and identification of the recovery processes of the athlete himself. So far, we have discussed the periodization and conceptual foundations of sports preparation from the point of view of a one-year training cycle, which is focused on one peak in the season. It is much more difficult to control the training process in periodization of the training load during a season with two peaks, not to mention the orientation on two Olympic race walking events. Main goal of this research of the periodization of special training indicators during preparatory and performance shaping phases of an elite 50 km and 20 km race walker. This report focuses on the first peak of the season in a one-year training cycle, in which he reached the best personal performance, while combining both race walking events. The results allowed us to create a volume load model for special training indicators.

Table 1.Training load structure and strategy for creating training content for 20 and 50 km race walking.

		20km	50km
Bioenergetic share	**AER:ANA** VO_2max	**90:10%** 75-80	**95:5%** 80>
Aerobic load $^{-1}$ Speed 5:00 min.km and more	**Pace endurance 1** La: 0-2	**25**	**30**
	Pace endurance 2 La: 2	**30**	**35**
Aerobic-anaerobic load $^{-1}$	**Pace endurance 3** La: 2-4	**35**	**30**
Anaerobic-lactic $^{-1}$ Speed 4:05 min.km and better	**Špecial pace** La: 4-9	**8**	**3-5**
	Tempo pace La:9>	**3**	**-**

(Note: The walking pace in individual bioenergetic zones was adjusted according to the data in Matej Tóth's training logs from 2013.)

Methods

Between 2000 and 2013, a Slovak competition race walker Matej Tóth (M. T.) achieved progressive improvement in sports performance in race walking athletic events (Figure 2). Until 2009, he specialized in the following short race walking events; 10 km and 20 km races.

Since 2009, he has been combining the two longest race walking events on a regular basis. He achieved his best personal performances in a 50 km walk (3:39:46 h, March 26) and a 20 km walk (1:20:16 h, April 9) in 2011, at the beginning of a competitive phase, on the 23rd day after his return from the hypoxic environment of Melaga (1700 metres above sea level). M. T. has been using the method of the hypoxic effect regularly before top-level events since 2002 with noticeable effect (Broďáni, 2011b). The Hypoxic effect can be noticed 18,69 days later, on average (standard deviation 3,79 days).

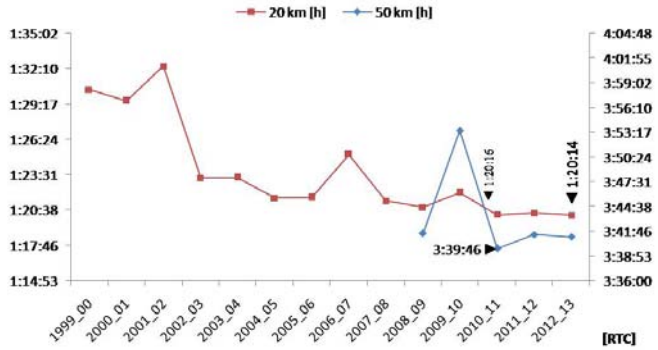


Figure 2. The dynamics of T.M's sports performance in a 20 km and 50 km race walking event between 2000 and 2013.

We recommend this phase as an example for race walkers, who combine both race walking events and make use of the hypoxic effect during preparation.

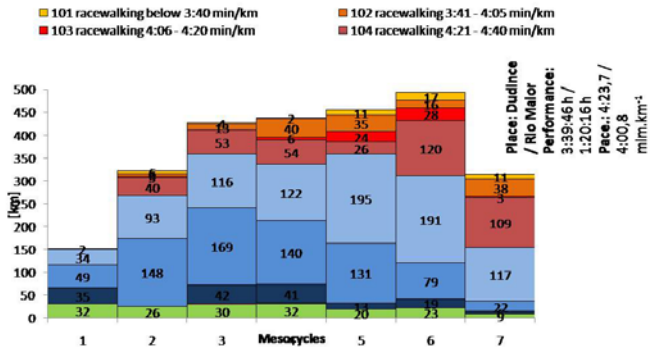


Figure 3. Dynamics of the training load volume of STI during the preparatory phase and following performance culmination during the competitive phase of M.T.

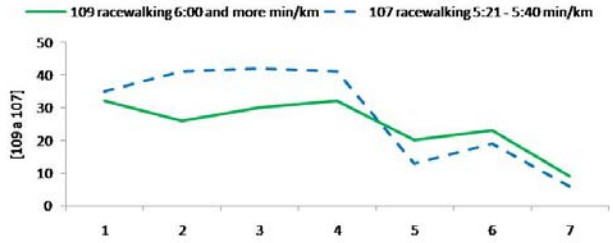
In 2013, he improved his personal performance in a 20 km walk by 2 seconds (Poděbrady 1:20:14 h) and in the same year, he finished 5th in a 50 km walk at the Race Walking World Championship in Moscow, with a performance of 3:41:07 h. According to intra-individual forecasts, his performance might reach the level below 1:20:00 h and 3:39:00 h in the coming years (Broďáni, 2011a). In this paper, we focus on the preparatory phase (October - April) and performance shaping phase, during which the athlete reached the best performances while combining a 50 km and 20 km walking distances with a short 15 day time lag.

The attempt to balance training content of both events should show the difficulty to harmonize both conceptual foundations. Their harmonization is based on the realization of training load in different bioenergetic zones, in which the 20 and 50 km race walking performance itself was realized in a short time lag. This type of approach requires a complex and a long-term intra-individual approach, which is reflected in the specific dosage of stimuli over a period of time, respecting both biological and pedagogical rules of adaptation, and an identification of the recovery processes of the athlete himself. Also, we evaluate special training indicators (STI) from the point of view of quantitative and qualitative continuity in the corresponding race walking speed zones (101-109). The training load volume was taken from the athlete's training logs and is stated in kilometres (refer to Figure 3).

Results and discussion

The first section of the results is focused on the global analysis of the load over the observed period of 7 mesocycles. The second part refers to the continuity of the individual special training indicators. The analysis results in a recommended model of load during both the preparatory and performance shaping phase for race walkers, who combine both race walking events with performances of 1:21:00 h in 20 km walks and 3:40:00 h in 50 km walks. Over the observed period of 7 mesocycles (in the first part of a one-year cycle), M. T. walked 2644 km in total.

The training load volume is gradually increasing, followed by a decrease in the performance shaping phase (Refer to Figure 3). From the percentage point of view, the race walker walked 42% in the aerobic load zone (1109 km), 50% in the combined aerobic-anaerobic zone (1334 km) and 7,6% in the anaerobic endurance zone (201 km).



Picture 4. Dynamics of STI 107 and 109.

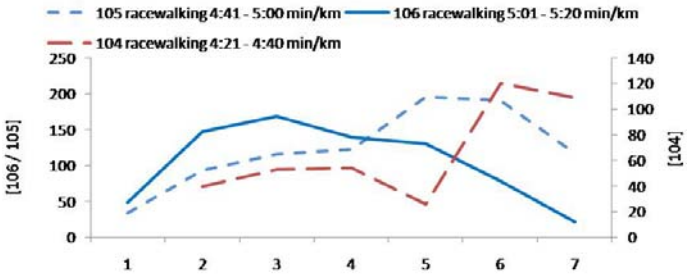


Figure 5. Dynamics of STI 104, 105 and 106.

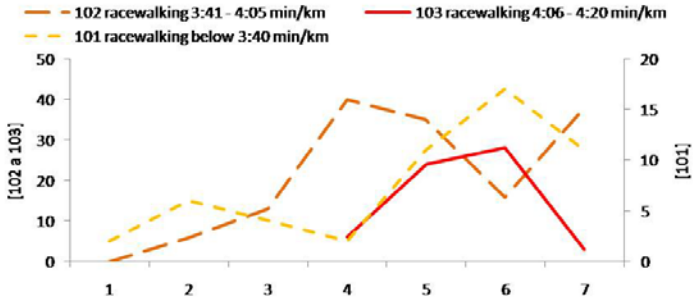


Figure 6. Dynamics of STI 101, 102 and 103.

M. T. implemented the highest training load volume in the 106 (738 km), 105 (868 km) and 104 (402 km) speed zones, which are characteristic for extensive and intensive speed endurance and extensive special pace. The training load volume in the zones 106 - 105 - 104 shows the intention to increase specific training load and create a functional potential for the 50 km and 20 km distances during the 2011 season with two peaks. Lower training load volume is found in the recovery zone of 109 (172 km), intensive aerobic endurance zone of 107 (197 km) and in tempo pace on the level of special pace for the 20 km distance 102 (148 km). M. T. walked "only" 64 km in the intensive special pace zone of 103. In the second section of the results, we do not evaluate the indicator 108 due to the low training load volume, which is approximately 2 km in the 3rd and 4th mesocycle. The realized structure of the training load in individual monthly mesocycles has its own internal dynamics and content orientation.

Each mesocycle has its goals, methods, forms and means to improve individual endurance skills qualities. Their continuity is displayed in the completed load of the individual speed zones and it corresponds with the conceptual foundations of the race walkers' sports preparation, or rather in their individual phases.

The Accumulation phase is characterized by increased aerobic potential during 4 mesocycles (1.-4. mesocycle). Realization of this intention with the increased training load volume is seen in the speed zones 109-106, refer to Figures 4 and 5. M. T. increased the anaerobic capacity possibilities of the organism, for later aerobic performance training on the level of anaerobic threshold, through high training load volume in the intensive pace endurance (STI of 106) on the level of aerobic threshold (See Figure 5). Additional aerobic training load volume (STI of 109) up to 40 - 60% VO_2max has an immune stimulating effect during the preparatory phase of a race walker. Practice shows that the long-term intensive load of more than 5 times a week above 80% VO_2max is immunosuppressive and manifests itself through lowered resistance of the upper airways. *The Intensifying phase* of a race walker oriented towards aerobic and endurance-strength potential (capacity) culminated in the 5th and 6th mesocycle (See Figures 5 and 6). However, it cannot be viewed in isolation. Building of the intensification foundations with low training load volume took place and proceeded gradually during the accumulation phase. At first, the progression appeared in the building of increased load of intensive pace endurance (105), which was subsequently *transformed* into extensive (104) and intensive special pace (103) in the 6th mesocycle. Training in the supra-threshold speed zones (STI 101 and 102) also proceeded continuously during all phases (see Figure 6). Increased training load volume at the end of the accumulation phase (4th mesocycle) in the speed zone of 102 had a dual effect. It created the basis for increased improvement of walking technique in the supra-threshold speed zone of 101 as well as the basis for interval training on the level of special pace (STI 103). The last 7th mesocycle was characterized by lowered training load volume and the *realization of sports performances*. The training load volume was realized especially in the extensive speed zones of 102 and 104, which means in the realization zones of 50 and 20 km sports performances. Competitive performances in 50 km and 20 km race walking are realized with a 15 day time lag, on the 23rd day after his return from the hypoxic environment of Melaga (1700 metres above sea level). Stimuli cumulation of the completed load supported by the hypoxic effect allowed M. T. to deliver his best performances while combining two events with a relatively short time lag. In the presented example, we managed to harmonize conceptual foundations of sports preparation and prepare the organism for special competitive load in different bioenergetic zones, which are characteristic of 50 and 20 km race walking events.

This type of approach requires a complex and long-term intra-individual approach, which is reflected in the specific dosage of stimuli over a period of time, respecting both the biological and pedagogical rules of adaptation, and the identification of the recovery processes of the athlete himself. This sports preparation example had its flaws as well. The difference between the training plan and realized volume was influenced by the duration of illness in the second mesocycle, or rather unsuitable climatic conditions and current organism readiness of the athlete for the actual training.

Due to the stated reasons, the training process had to be constantly adjusted according to the athlete's condition and needs. The deviations in the completed training load were eliminated by means of the statistical methods of trend modelling. The result is a model of volume training load of special training indicators in the preparatory and performance shaping phase for the first peak of the season (Refer to Table 2). Since the cycle is only 7 months long, we recommend to follow it in the first phase of a one-year training cycle, during the season with two peaks and combine it with the hypoxic training. When implementing the hypoxic training, one must consider the needs of the individual athletes as well as the super-compensation effects.

However, we must emphasise that this relates to the performance level of 3:40:00 h for 50 km walks and 1:21:00 h for 20 km walks. The model is based on a highly intra-individual load of an elite athlete. That is why we recommend to use volume load only as an indication during continuity planning of the training load and its intensification.

Table 2. Load model of STI for a race walker with performance of 1:21:00 h for 20 km walks and 3:40:00 h for 50 km walks during preparatory and performance shaping phases (km)

Mesocycle	109	107	106	105	104	103	102	101
1	29,3	37,9	53,9	43,9				3,8
2	30,6	39,6	137,1	70,9	40,0		6,0	2,1
3	30,2	38,3	167,4	113,4	53,6		13,0	3,6
4	28,0	34,0	158,0	155,7	53,8	6,0	40,0	7,0
5	24,1	26,9	122,4	182,2	59,6	24,0	35,0	10,6
6	18,5	16,7	73,7	177,1	119,8	28,0	16,0	13,1
7	11,1	3,6	25,5	124,8	109,2	3,0	38,0	12,8

Conclusion

This paper shows the periodization of special training load during preparatory and performance shaping phases of a Slovak competition race walker for the first peak of the season. In the presented example, we harmonized the conceptual foundations of sports preparation and shaping system in different bioenergetic zones for 50 and 20 km race walking events. It is an example of highly intra-individual periodization of load in relation to the observed runner. We cannot generalize it, nor apply it to other athletes. We can use the presented model only as an indication to plan the continuity of load and its intensification.

References

Bompa, T.O., & Haff, G. (2009). *Periodization theory and methodology of training.* Champaign: Human Kinetics.

Brodáni, J. (2011a). Vývoja a prognóza najlepších svetových výkonov v atletickej chôdzi mužov na 20 a 50 km [Development and prognosis of the world's best performance in athletic walking men 20 and 50 km. In Slovakian] *Exercitatio Corpolis Motus Salus: Slovak journal of sports science, 3*(2), 13-19.

Broďáni, J. (2011b). Laktátová odozva na tréningové zaťaženie chodca na 20 km počas dlhodobej športovej prípravy v hypoxickom prostredí Mexika [Lactic response to training load at 20 km walkers during long-term sports training in the hypoxic environment of Mexico. In Slovakian] In: *Závislosť adaptačných mechanizmov v oblasti špeciálnych schopností od štruktúry tréningového zaťaženia u vrcholových a talentovaných športovcov* (pp.49-56). Bratislava.

Čillík, I., Batovský, M., & Korčok, P. (2003). Analýza objemu špeciálnych tréningových ukazovateľov v štvorročnom olympijskom cykle u chodca na 50 km [Analysis of the volume of specialized training indicators in the four-year Olympic cycle for walkers to 50 km. In Slovakian] In *T.Kampmiller (Ed.), Problémy súčasnej atletiky* (pp.58-61). Bratislava, Slovakia: KA FTVŠ UK.

Čillík, I., Korčok, P., & Pupiš, M. (2004). Porovnanie štruktúry špeciálnych tréningových ukazovateľov v štvorročnom tréningovom cykle chodca na 50 km [Comparison of the structure of special training indicators in the four-year training cycle for walkers 50 km. In Slovakian] In *I. Čillík (Ed.), Pohyb šport zdravie* (pp. 20-29). University Matey Bel Banská Bystrica, Slovakia.

Drake, A. (2005). The training methods of olympic champion Ivano Brugnetti and Italian racewalkers. *The Coach*, (27), 55-61. Retrieved from http://www.surreywalkingclub.org.uk/.

Issurin, V.B. (2010). New Horizons for the Methodology and Physiology of Training Periodization. *Sports Medicine*, *40*(3), 189-206.

Kirckof, C. (2010). *Methods of Training: Sequencing of Programming and Organizing Training*. University of Minnesota Duluth, USA: College of Education and Human Service Professions.

Korčok, P., & Pupiš, M. (2006). *Všetko o chôdzi*. [Everything about walking. In Slovakian] University Matey Bel Banská Bystrica, Slovakia.

Kulichenko, V. (2000). Main scientific and methodical principies of the optimalisation and intensification of the training process in the cyclic sports. *Bulletin RDC IAAF Moscow*. *2*, 117-130.

Laczo, E. (1996). Biologické a pedagogické zásady adaptácie v tréningovom procese v behoch na stredné a dlhé vzdialenosti [Biological adaptation and pedagogical principles in the training process in runs, on medium and long distances. In Slovakian] In:*Teoretické a metodické problémy súčasnej atletiky* (13-28) Bratislava: FTVŠ UK.

Laczo, E. (2007). Vytrvalostné schopnosti a ich rozvoj [Endurance skills and their development. In Slovakian] In R. Moravec, T. Kampmiller, M. Vanderka & E. Laczo (Eds.), *Teória a didaktika výkonnostného a vrcholového športu* (pp.136-145). Bratislava, Slovakia: FTVŠ UK a SVSTVaŠ.

Matveyev, L.P. (1992). Modern procedures forthe construction of macrocycles. *Mod. Athlete Coach*. *30*, 32-34.

Mleczko, E., & Sudol, G. (2005). According to there searches of training condition of the polish walker. In J. Vidušková (Ed.), *Atletika* (pp.1-7). Retrieved from http://www.ftvs.cuni.cz/eknihy/sborniky/2005-11-24-25/index.htm.

Pivovarniček, P., Pupiš, M., Švantner, R., & Kitka, B. (2013). Úroveň limitujúcich pohybových schopností obrancov futbalovej reprezentácie slovenskej republiky do 21 rokov [Limiting the level of motor abilities defenders Slovak Republic national football team in 21 years. In Slovakian], *Exercitatio Corpolis Motus Salus: Slovak journal of sports science, 5*(2), 27-38.

Plis, S., & Stone, M. (2003). Periodization Strategies. *National Strength & Conditioning Association,* 25(6), 19-37.

Pupiš, M. (2005). Optimalizácia tréningového zaťaženia u chodcov po pretekoch na 50 km. [Optimization of training load for pedestrians along the 50 km race. In Slovakian] In M. Pupiš (Ed.), *Zborník z 11. ročníka celoslovenského kola ŠVA 2005*. (pp. 56-65). University Matey Bel Banská Bystrica, Slovakia.

Pupiš, M. (2007). Účinnosť tréningového zaťaženia na športový výkon v dlhodobej športovej príprave u chodca na 20km [The effectiveness of training load on athletic performance in long-term sports training for walkers on 20km. In Slovakian]. The efficiency of training load on athletics performance in longer-range preparation for the walkers on 20 km. *Studia kinanthropologica*. 8, (1), 37-44. České Budějovice: Jihočeská univerzita, České Budějovice.

Pupiš, M. (2009). *Športová príprava a súťaženie v chôdzi na 50km* [Sports training and competition in walking on 50 km. In Slovakian]. University Matey Bel Banská Bystrica, Slovakia.

Pupiš, M. (2011). Theintensity of Race Walker Load at Various Performace at 20 and 50 km. In M. Pupiš (Ed.), *World Race Walking Research* (pp.7-25). University Matey Bel Banská Bystrica, Slovakia.

Pupiš, M., Tonhauserová, Z., & Pavlović, R. (2011). The effect of intermittent hypoxic training on aerobic capacity and blood components of endurance athletes. *Acta kinesiologica*, *5*(2), 48-52.

Sudol, G., & Mleczko, E. (2011). Polish Representatives Start Effectiveness in Athens and Bejing Olympic Games in 50 km Race Walk and Traning Loads in Precompetetion Period in Olympic Years. In M. Pupiš (Ed.), *World Race Walking Research* (pp.95-104). University Matey Bel Banská Bystrica, Slovakia.

La Torre, A., & Vernillo, G. (2011). The Training for the 20 km. What has Changed and What Might Change? In M. Pupiš (Ed.), *World Race Walking Research* (pp. 80-94). University Matey Bel Banská Bystrica, Slovakia.
Verkhoshansky, Y. (2007). Topical problems of the modern theory and metodology of sport training. *Journal of Sport Strenght Training Methodology,* 1, 1-14.
Viru, A. (1986). Planning of macrocycles. *Modern athlete and coach*, 26, 7-10.

PERIODIZACIJA OPTEREĆENJA U TRENINGU ZA VRIJEME OBLIKOVANJA PRIPREMNE I IZVEDBENE FAZE UTRKA NA 50 I 20 KM HODANJA

Sažetak
Članak ističe posebne pokazatelje treningA periodizacije tijekom sportskog treninga i izvedbe utrke u hodanju na 50 i 20 km. Posebno je usredotočen osvrt na razdoblje od prvog vrhunca sezone u godišnjem trenažnom ciklusu, gdje su dostignute najbolje pspbne izvedbe u kombinaciji obje hodačke discipline. Na temelju rezultata stvoren je model za posebne pokazatelje osposobljavanja za izvedbu hodanja na 20 km za 1:21:00 sati i 50 km za 3:40:0 sati.

Ključne riječi: *utrka hodanja, periodizacija, opterećenje sportsska izvedba*

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Correspondence to:
Prof.Jaroslav Brodani, PhD
Matej Bel University, Faculty of Arts
Department of Physical Education and Sports
University Konstantina Filosofa
Trieda Andreja Hlinku 1
949 74 Nitra, Slovakia
E-mail: jbrodani@ukf.sk