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THE INFLUENCE OF TRAINING LOADS ON THE SPORTS RESULTS OF ATHLETES WITH VISUAL IMPAIRMENTS IN THE 800 AND 1500 M RACES

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Abstract

Introduction. The increased level in competition and growing interest in sports for the disabled means that the training process of these people is the subject of studies and analysis. The main objective of this study was to identify the structure of the training loads in athletes with visual impairments in the 800 and 1500 m runs, in relation to sports performance. ***Material and methods***. Seven annual trainings cycles of two groups (A, n=8, B, n=5) of athletes with visual impairments (medalists and participants of the Paralympic Games, World Championships, European Championships and multiple Polish masters), engaged in the 800 and 1500 m races, from the years 1998-2000 and 2003-2008 were evaluated. To analyze and evaluate the training loads, based on training logs two methods were used: Method I – based on an analysis of training documentation developed in the Department of Theory of Sport at the University of Physical Education in Warsaw. Method II – based on an assessment of the energy cost incurred for the implementation of training. ***Results***. The analysis showed significant differences in the training process of the athletes of the two groups. The training of athletes from group A, was carried out mainly with the directed training method (61% of total load – TL) with low intensity – range 1 on a 5 point scale (74% TL), while group B – with special training method (76% TL) in second (2) range of intensity (71% TL). ***Conclusions***. Training carried out by athletes from group B better reflects the specifications of middle distance runs, in comparison with group A, which could lead to a higher level of performance presented by the athletes of group B.

Key words: training loads, middle distance runs, visual impairment

Introduction

Increasing level of competition, and the dynamic development of sport for disabilities, resulted in the need to seek both technological and methodological solutions for improvement of sports performance. In a sport for disabilities this is very important but on the other hand difficult, because of different methods, forms and training methods that can be used and will depend on the type and level of disability [1].

The specificity in the functioning of people with visual impairments requires a diagnosis of the appropriateness of undertaking physical activity. Many authors dealing with medical issues, for the purpose of their research, assess the effectiveness of various training programs [2, 3, 4], in which the training loads (e.g. volume, intensity) are the subject of analysis.

At the level of rehabilitation the relationship between the type of disability or illness, and the volume of the training load demands attention; it is also noted in the specific type of response to exercise, which may be affected by disability or disease [5].

The specificity of making physical activity and, consequently, sports for people with visual impairments, according to Osvath et al. [6], requires strong theoretical and methodological support and cooperation of experts from other fields. Such efforts should aim for the creation of a theory of sports training, specific to persons with disabilities (including visual impairments). Models of training that are not copies of the solutions used in able-bodied sport, but take into account the type and degree of disability is an area of research which, according to Nixon [7], should be the subject of examination. Thus, the objectives of this study were:

1. Recognition of the structure of training loads in athletes with visual impairments in the 800 and 1500 m runs, in relation to sports performance.
2. Comparison of training loads in the training of athletes with visual impairments in the 800 and 1500 m runs in the years 1998-2000 and 2003-2008.

Answers to the following questions were sought:

1. What was the structure of the training loads completed by the athletes with visual impairments in the 800 and 1500 m runs?
2. To what extent do the volume and structure of the training loads of visually-impaired athletes reflect the requirements associated with the energy structure of middle distance runs?
3. Which of the training methods carried out by disabled

athletes had a significant correlation with their sports results?

4. Are there differences in the training loads in middle distance runs between able-bodied and visual impaired athletes?

Material and methods

Seven annual cycles of training of the two groups of athletes with visual impairments (medalists and participants of the Paralympic Games, World Championships, European Championships and multiple Polish masters), engaged in the 800 and 1500 m runs from the years 1998-2000 (group A, n=8) and 2003-2008 (group B, n=5) were evaluated. Athletes with a visual impairment are classified according to the degree of disability in three groups: T11 (blind), T12, T13 (partially sighted) (Tab. 1). The records of 2239 training units were analyzed.

Table 1. Characteristics of the study groups

No.	Age (years)	Training intership (years)	Start class	Competition	Body mass [kg]	Body height [cm]	Years
Group A (years 1998-2000)							
1	17	3	T12	800, 1500 m	65	180	98/99
2	23	7	T12	800, 1500 m	62	178	98/99
3	19	5	T12	800, 1500 m	64	174	98/99
4	22	3	T11	800, 1500 m	58	174	98-00
5	35	10	T12	1500 m	71	180	98-00
6	36	15	T12	800, 1500 m	68	180	98-00
7	31	8	T12	1500 m	67	183	98-00
8	33	10	T12	800, 1500 m	64	183	98-00
Group B (years 2003-2008)							
9	22	7	T12	800, 1500 m	63	184	03-08
10	20	7	T12	800, 1500 m	68	180	03-08
11	22	7	T13	800, 1500 m	63	182	03-08
12	19	4	T12	800, 1500 m	65	181	03-08
13	21	5	T12	800, 1500 m	64	180	03-08

Data according to the last cycle.

To analyze and evaluate the training loads, based on training logs, two methods were used: Method I – based on an analysis of training documentation developed in the Department of Theory of Sport Physical Education in Warsaw [8]. This method allowed for the examination of the training load, taking into account the classification according to the type of preparation (informative area – training means: general (G), directed (D), special (S) and the range (1-5) the intensity of effort – energetic area). This method was designed for able-bodied athletes, nevertheless the register of training methods contains those that are used by athletes with visual impairments. Method II – based on an assessment of the energy cost incurred by the implementation of training in terms of Ważny [9], assuming the interdependence of time, effort and intensity. Training intensity (range 2-5) was assigned the average cost of energy expressed in kcal/min: 20.4 kcal/min (range 2), 61.7 kcal/min (3 range), 141 kcal/min (4 range), 294 kcal min (5 range).

For objectivity and the possibility of comparing the results achieved by the athletes, they were converted based on IAAF scoring tables of athletics [10].

To assess the normality of distribution of the trainings components in groups A and B the Kolmogorov-Smirnov test was used . Due to the lack of normal distribution to evaluate the differences between them, nonparametric Kruskal-Wallis test were used. Statistical significance was estimated with the Mann-Whitney test ($\alpha<0.05$). To determine the relationship between the parameters of the training loads and sports results, the Spearman correlation test was used. MS Office Excel and IBM SPSS ver. 19th programs were used in calculations.

Results

The training structure (average values) for the whole of the periods in groups A and B, both in the informative and the energetic area is shown in Table 2. Please note the reversal in proportion of training realized by the athletes of group A and B with directed (D) and special (S) training methods. The situation is similar in the case of training realized in the 1st and 2nd range of intensity.

Table 2. The trainings structure (informative. and energetic area) realized by athletes with visual impairments in the years 1998-2000 (group A) and 2003-2008 (group B)

	Group A (years 1998-2000)		Group B (years 2003-2008)	
Type of preparation	Infirmative area			
	[t] $\bar{x}\pm$SD	[%] $\bar{x}\pm$SD	[t] $\bar{x}\pm$SD	[%] $\bar{x}\pm$SD
General	114.6±27.8	26.7±8.8	41.3±6.7	18.1±3.4
Directed	274.8±78.2	61.0±9.0	12.9±2.7	5.6±1.2
Special	53.4±15.8	12.3±4.5	175.6±16.3	76.3±4.3
TL [t] $\bar{x}\pm$SD	442.9±71.2		229.9±12.4	
Range of intensity	Energetic area			
	[t] $\bar{x}\pm$SD	[%] $\bar{x}\pm$SD	[t] $\bar{x}\pm$SD	[%] $\bar{x}\pm$SD
1	334.4±88.8	74.4±9.3	8.5±2.3	3.7±1.0
2	86.5±24.7	20.5±8.3	163.8±14.0	71.2±3.2
3	9.9±4.4	2.2±0.7	40.9±7.6	17.8±3.2
4	3.4±1.5	0.8±0.4	14.3±5.3	6.3±2.6
5	8.6±5.4	2.1±1.5	2.2±1.9	1.0±0.8

G – General, D – Directed, S – Special, TL – Total Load

The differences in the volume of work done in annual cycles, by type of work (informative area) realized by athletes of both groups were mostly statistically significant (Tab. 3). In the tables, the following cycles of training are assigned numbers from 1 to 2 for group A (1998-2000) and from 1 to 5 in the case of group B (years 2003-2008).

Table 3. The significance of differences in the volume [t] and the proportions [%] of training loads in the informative and energetic area between group A and B (in the table represent Z)

Informative area (type of preparation)										
General				Directed				Special		
[t]		[%]		[t]		[%]		[t]		[%]
-8.421*		-7.281*		-8.241*		-6.881*		-7.261*		-7.261*
Energetic area (range of intensity)										
1		2		3		4		5		
[t]	[%]	[t]	[%]	[t]	[%]	[t]	[%]	[t]	[%]	
-8.221*	-8.141*	-6.142*	-7.181*	-7.281*	-8.351*	-8.359*	-7.282*	-8.821*	-2.152	

* – $p<0.002$

Also, the analysis of the energy cost (method II) of the training load completed by players of group A and B showed a reverse proportion of training in the 1st and 2nd range of intensity, as well as a greater share of work in the 3rd and 4th range by athletes of group B. Differences between groups were statistically significant in all ranges of intensity (Tab. 4).

Table 4. The energy cost of the training in the range of intensity realized by the athletes of group A and B (%) (mean $\overline{x}\pm SD$) and the significance of differences between groups (in the table represent Z)

	Range of intensity				
	1	2	3	4	5
Group A	42.0±11.4	32.8±8.9	8.6±3.5	6.1±2.6	10.5±5.3
Group B	1.0±0.2	48.8±4.6	27.9±5.6	20.3±7.0	2.1±1.5
A vs. B	-7.295*	-7.895*	-8.020*	-8.921*	-7.451*

* – p<0.002

Knowledge about the "energy" structure of the discipline/competition should enable the selection of methods, forms and training methods that suits its character, shaping the adaptive mechanisms by which an athlete is able to meet the need to start. In Table 5 the percentage of aerobic and anaerobic training volume, completeded by athletes with visual impairments, is shown, against indicators related to the energy of middle distance runs.

Table 5. The share of aerobic and anaerobic training volume of athletes of group A and B, in the light of studies concerning able-bodied middle distance runners

Authors	Share of energy in 800 and 1500 m runs	
	Aerobic [%]	Anaerobic [%]
Maciantowicz [11]	50	50
Maughan et al. [12]	60-80	40-20
Spencer et al. [13]	70-83	30-17
Ważny [9]	50-70	50-30
Sobczyk [14]	30-60	70-40
Żołądź [15]	50-65	50-35
Group A	**75.0**	**25.0**
Group B	**49.9**	**50.1**

According to the training of athletes, and taking into account the sports result in relation to the training loads, in group A, there was a significant correlation between the training realized in the 2nd and 3rd range of intensity and the sporting results achieved in 1999. In next cycle their athletic performance was most strongly correlated with training realized at the highest intensity (Tab. 6).

Table 6. Correlation of the training loads volume (in the range of intensity) with sports performance in group A (1998-2000)

Years			1999	2000
Range of intensity	2	[hours]	0.26	- 0.02
		[kcal]	0.39*	- 0.14
	3	[hours]	0.55*	- 0.39*
		[kcal]	0.43*	- 0.27*
	4	[hours]	- 0.13	0.33*
		[kcal]	- 0.24	0.45*
	5	[hours]	- 0.29*	0.51*
		[kcal]	- 0.24	0.49*

* – p<0.05

In Group B, the impact on athletic performance in all cycles has a training completed in 2nd, 3rd and 4th range of intensity (Tab. 7).

Table 7. Correlation of the training loads volume (in the range of intensity) with sports performance in group B (2003-2008)

Years			2004	2005	2006	2007	2008
Range of intensity	2	[hours]	0.52*	0.45*	0.54*	0.51*	0.63*
		[kcal]	0.54*	0.43*	0.53*	0.48*	0.58*
	3	[hours]	0.70*	0.52*	0.61*	0.57*	0.64*
		[kcal]	0.69*	0.52*	0.62*	0.57*	0.65*
	4	[hours]	0.59*	0.53*	0.66*	0.46*	0.54*
		[kcal]	0.60*	0.53*	0.66*	0.47*	0.55*
	5	[hours]	- 0.02	- 0.09	- 0.10	- 0.18	- 0.22
		[kcal]	0.00	- 0.08	- 0.10	- 0.15	- 0.19

* – p<0.05

Discussion

In terms of effective training time, the results of this study show that the athletes of group A worked an average of 443 and the B – 230 hours (Tab. 2). According to Lilge [16], 17-year-olds engaged in athletics endurance competition should train about 300 hours in the annual cycle. The volume of training loads of runners of group B (age 17-22), correspond to their athletic development phase. Effective training time in the case of older athletes can be up to 500 hours [16], which was observed in group A (age 27±7.5 years). The share of training by type of training methods in groups A and B was as follows: general (27 and 17%), directed (61 and 6%), special (12 and 76%) of the total load (Tab. 2). Visual impaired athletes training was based mainly on a directed (in group A) and a special (in group B) means of training (Tab. 2). In group B a characteristic increase in the share of a special means of training in the analyzed period (from 74 to 81% of training loads) was observed. At relatively constant values of training loads in this group, an increase in the share of training in the intensity ranging from 3 to 5, (from 21 to 30% of training loads) was observed, which corresponds to a progressive training assumptions [17, 18]. Sozański and Siwko [19], Sobczyk [20] (Tab. 8), and Listos [21] criticize the fact of overusing the general methods of training by able-bodied middle distance runners.

Table 8. The share of training realized by able-bodied middle distance runners in the informative area (type of training) in studies by other authors (%)

Type of preparation	Prusik [22]	Prusik [22]	Sozański, Siwko [19]		Sobczyk [20]	Sobczyk [20]
			juniors	seniors		
General	14	24	92	92	92	89
Directed	1	10	5	4	4	6
Special	85	66	3	4	4	5

In the light of this, the results of this study confirm the validity of the training concept completed by athletes with visual impairments from group B. Similar to these results are observations by Maciantowicz [11], who analyzed the training of able-bodied middle distance female runner, who trained mainly with the directed and special means of training (74%). Training completed by athletes of group A and B in the informative area (type of training) did not differ from training of the able-bodied.

The volume of training in the ranges of intensity indicates the largest share of training realized at the lowest intensity in the case of athletes of group A (74%), but in case of those of group B, in the 2nd range (71%). Compared to able-bodied middle distance runners training data (Tab. 9), only the training of athletes of group B was similar in this aspect.

Table 9. The share of training realized by able-bodied middle distance runners in the energetic area (intensity) in studies by other authors (%)

Range of intensity	Prusik, Mroczyński [23]	Prusik [22]	Prusik [23]	Sozański, Siwko [19]		Sobczyk [20]	Sobczyk [20]	Esteve-Lanao et al. [24]
				juniors	seniors			
1	9	8	26	23	24	86	75	71
2	85	85	64	72	70			
3	4	5	7	3	5	6	14	21
4	1	1	2	1	1	6	7	8
5	1	1	1	1	0	2	4	

Conclusions

The results of this study allow for the following cautious conclusions, due to the complexity of the problem of the sports preparations of athletes with visual impairments in athletics endurance competitions, as well as due to the limited research material:

1. Significant correlations between training realized at the intensity corresponding to the energetic profile of middle distance runs and sporting results obtained in 2003-2008 (group B) may indicate a proper structure of training (such significant correlations were not observed in training of athletes in the years 1998-2000 – group A).
2. The dominant group of training methods used by group B, better reflect the specifications of the training used in middle distance runs in comparison to a group A.
3. The volume of training loads, due to the energy cost, in group B responded to the "energetic structure" of competition, indicating a similarity in the preparation of able-bodied athletes to athletes with visual impairments.
4. Transformation of the effective time of training into energetic cost, reverses the proportion of training realized with low and high intensity. Such an approach in the evaluation of training loads better reflects the requirements of the middle distance runs.

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