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READINESS PROFILE OF JUNIOR CYCLISTS DETERMINED BY LEIPZIG TEST

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The aim of this paper was to define the readiness profile of junior cyclists determined by the Leipzig test. The second aim was to find out if there were differences in functional performance among cyclists in different disciplines, such as: road cyclists, mountain bikers and sprinters. All cyclists (n=18) were tested with Leipzig test protocol on a bicycle ergometer by increasing the load by 40W per minute, pedalling cadence 90-100rev/min. The hearth rate was measured at the beginning and at the end of the test, together with the maximal oxygen uptake (VO_{2max}). The results have shown that the maximal oxygen uptake among national junior cyclists in all disciplines was VO_{2max} 56.42±5.82 ml•min^{-1}kg^{-1}, among mountain biking cyclist VO_{2max} was 61.43±4.94, sprinters VO_{2max} 56.78±3.33 and for cross-country cyclists VO_{2max} 53.37±7.82. The statistical analysis of the functional performance results has snown that between subsamples of cyclists there were no significant differences on general level. However, the partial analysis has snown that there is a statistically significant difference between the groups in the hart rate values on an anaerobic threshold (F value 4.547, p=0.032). In conclusion, the tested cyclists were prepared using general training methods even if they had competitions in different disciplines. Therefore, the level of readiness shows that the training process for young cyclists which is used in Serbia is not specific for the competition level and discipline. *Acta Medica Medianae 2010;49(3):32-39.*

Key words: *cycling, testing, functional readiness, Leipzig testing protocol*

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Introduction

Competitive cycling is among the most strenuous sports which require the highest personal endurance, no matter the type of discipline. Today, elite competitors, successful cyclist usually cross between 3.500 to 45.000 km during one season of training and competition (1, 2). A bicycle can be ridden on the road, track, city streets, and the competitions are organized in the same conditions. According to the UCI, the competitions can be organized as road cycling, mountain biking, BMX competitions, trial competitions and others (3).

Generally, the most frequent cycling competition in the world and in the Republic of Serbia is road cycling. The usual distance in a one day road cycling competition is 280 km for the World Championships, 250 km for the World Cup and 200 km for other road cycling competitions. The distance in standard competitions vary from 200 km for sprinters on track, 4 to 10 days for stage competitions, or a three-week race at a distance of up to 5.000 km in the so-called tours such as the Tour de France, Giro d´Italia and Vuelta a Espana (1).

For cycling competitions, the category of cyclist differ according to age and gender, so the categories are as follow: cadets – 16 years of age, juniors – 17 years, under 23 years (from 19 to 22), elite from 22 years of age for male and 19 years of age for female, and masters from 30 years and up. Usually, the cyclist chooses one competition category, mountain biking, sprinter or road competitions (mostly on ground level), but in our country the cyclists compete in all disciplines and all kind of configurations. This was accepted because we do not have so many cyclists, the training conditions are not adequate, and we do not have enough coaches and educated staff (4). As the result of this situation, we had bad results in the competitions in the country and international competitions.

It is well-known that cyclists have the highest aerobic energy system (5-7), but for the best results in competitions the anaerobic system is also very important. The possibility to get maximal muscle strength in a short period of time, for instance in a mass start, mountain biking competitions at the end of a race when the cyclist sprints to the finish line (8,9), is one of the very important factors for the final result.

In the process of training, there are seasonal variations in the type of the training process and competitive preparation of the cyclists. The control of the actual readiness of cyclists by periodical testing using standard procedures, and special laboratory testing gives the best results (10-12). On the other hand, the laboratory tests are unspecific in relation to the general workload conditions, and in that way the data are optimal for estimating the level of functional development of tested subjects (13, 14).

One of the most important parameters for controlling the training process is the hart rate (HR) which represents the response of the cardiac and respiratory systems of the body to the intensity of training. However, the HR has little informative value if there is no data about the relation of the level of readiness to the function of recorded HR. One of the most frequently used tests for the investigation of the cyclist's level of readiness is the test of the cyclic ergometer - Leipzig Test (15, 16).

The protocol for this test means that cyclists, after the standard warming up, start with the initial load of 40 W per minute, pedaling cadence is 90-100 rev/min. After each minute, the load linearly increases by 40W. The test is interrupted if the cyclist is not able to pedal on exact cadence even if the cadence is under 90 rev/min. During the test for each load the following parameters are recorded: heart rate, level of oxygen uptake or lactate concentration (17, 16, 5).

Aim

The aim of this paper was to define the readiness profile of junior cyclists determined by the Leipzig test laboratory protocol before the competition. The profile will be defined, at the optimum analytic or diagnostic level, in different road cycling disciplines (sprinters, mountain biking cyclists, road cyclists). By using this test we will try to make the model for the readiness profile of junior cyclists.

Material and methods

Test protocol

The test was done using a standard procedure known as the Leipzig test (15) on the cycling ergometer Cosmed E 400HK (Cosmed, Rome, Italy). The protocol was as follows: after standard warming up and 5 minute rests, cyclists start with initial load of 40 W per minute. Every two minutes, the initial load increases by 40W. The cyclists pedal at the cadence of 90-100 rev/min (18). The test was interrupted if the cyclist was not able to pedal more than one minute on exact cadence (19).

During the test the values of hart rate were recorded, as well as the maximum level of oxygen uptake (VO_{2max}) at the end of the test. This testing was done at the Republic Institute for Sport in Belgrade at the beginning of 2006. The standard procedures for measuring the maximum level of oxygen uptake during the test and the anaerobic baseline value were used (14) and the test was done on the cycling ergometer Cosmed E 400HK (Cosmed, Rome, Italy).

Samples

Our study involved 18 cyclists – juniors, all from the list for the National team. The anthropometric characteristics were: age: 16±1.2, hight: 179.3±6.2cm, weight: 68.9±7.6kg, BMI: 21.60± 2.20kg/m^2, Fat %: 11.56±2.08%, LBW: 60.84± 6.14kg.

According to the specific discipline: 6 road cyclists, 7 sprinters and 5 mountain biking cyclists.

Variables

In this study, for defining the readiness profile of junior cyclists using the Leipzig test the following variables were used:

General variables:

- descriptive parameters and model dependant on the frequency of the heart rate and the level of load: 40W, 80W, 120W, 160W, 200W, 240W, 280W and 320W ($HR–W_{aps}$), in Hz/min;
- maximum level of oxygen uptake (VO_{2max}), in $ml \cdot min^{-1} \cdot kg^{-1}$;
- heart rate at the level of the anaerobic baseline value (HR_{AT}), in Hz/min.

Derived variables:

- descriptive parameters and model dependant on the frequency of the heart rate among cyclist on each level of loading as a relative value according to the weight : 40W, 80W, 120W, 160W, 200W, 240W, 280W i 320W ($HR–W_{aps}$), in Hz/min
- descriptive parameters and model dependant on the frequency of the of the heart rate among cyclist on each level of loading as a relative value according to the LBW : 40W, 80W, 120W, 160W, 200W, 240W, 280W and 320W ($HR–W_{aps}$), in Hz/min;
- absolute value of work capability on anaerobic threshold (W_{AT}), in W;
- relative value of work capability on anaerobic threshold (W_{AT}), in W.

Statistical methods

All data were tested using descriptive statistical analysis to define standard statistical parameters (Mean, Standard Error, Interval of truth is 95.0 %). The distribution of all variables was estimated using Kolmogorov-Smirnov test. The differences between subsamples of cyclists in the function of a discipline were tested by multivariate analysis of variance MANOVA. Differences between analyzed variables of subsamples were determined using the Bonferroni method (20). All models of workload – hart rate were defined by mathematical modeling using the function of two variables: y=abx (21).

Results

Descriptive results of general and derived variables are displayed in Tables 1 and 2.

Results of multiple variant analysis (Table 3) show that there are significant differences only in HR-W_{aps} connections, Wilks' Lambda value 0.031, F relations 4.068, p=0.006, but statistically significant differences were not found among other relations, HR-W_{rel}, HR-W_{LBM} and anaerobic threshold and maximal oxygen uptake (Table 3).

Results of partial differences among HR-W_{aps} show that there are statistically significant differences only between sprinters and mountain biking cyclists when using the Bonferroni test p=0.019, but not between other groups (sprinters vs. road cyclists, road cyclists vs. mountain biking cyclists).

The partial statistical differences were also found among subsamples of cyclists, in relation to the functional capability, within the value of the heart rate on an anaero bic threshold F value 4.547, p=0.032, but not between other variables (Table 4). Partial differences of heart rate according to the anaerobic threshold were found only between sprinters and mountain biking cyclists, (p=0.031), but not between sprinters and road cyclists or mountain biking cyclists and road cyclists (Table 4).

Table 1. Descriptive results of variables in relation HR–W_{aps}, HR–W_{rel} and HR–W_{LBM}

	Leipzig 40W	Leipzig 80W	Leipzig 120W	Leipzig 160W	Leipzig 200W	Leipzig 240W	Leipzig 280W	Leipzig 320W
Hill Type (HR)	113.3±3.5 (105.8–120.7)	127.3±4.1 (118.5–136.0)	148.3±3.8 (140.1–156.4)	157.8±5.7 (145.6–169.9)	170.8±5.3 (159.5–182.0)	184.0±4.8 (173.8–194.2)	190.3±4.5 (180.7–199.8)	199.0±3.3 (191.9–206.1)
Sprinter Type (HR)	126.9±2.5 (121.6–132.1)	136.5±2.9 (130.3–142.7)	151.5±2.7 (145.8–157.2)	169.4±4.0 (160.8–178.0)	182.5±3.7 (174.5–190.5)	194.3±3.4 (187.0–201.5)	199.3±3.2 (192.5–206.0)	207.0±2.3 (202.0–211.9)
Road Type (HR)	121.6±3.1 (114.9–128.3)	135.4±3.6 (127.6–143.2)	148.4±3.4 (141.1–155.7)	164.6±5.1 (153.7–175.5)	174.6±4.7 (164.5–190.5)	185.6±4.3 (176.4–194.8)	192.0±4.0 (183.5–200.5)	198.6±2.9 (192.3–204.9)
Hill Type (W_{rel})	0.603±0.032 (0.535–0.670)	1.203±0.061 (1.071–1.334)	1.805±0.092 (1.607–2.003)	2.405±0.123 (2.140–2.670)	3.010±0.155 (2.678–3.342)	3.608±0.185 (3.212–4.003)	4.210±0.217 (3.745–4.675)	4.810±0.248 (4.278–5.342)
Sprinter Type (W_{rel})	0.606±0.022 (0.558–0.654)	1.213±0.043 (1.120–1.305)	1.820±0.065 (1.680–1.960)	2.425±0.087 (2.238–2.612)	3.031±0.109 (2.797–3.266)	3.636±0.131 (3.356–3.916)	4.245±0.153 (3.916–4.574)	4.850±0.175 (4.278–5.226)
Road Type (W_{rel})	0.550±0.028 (0.490–0.610)	1.096±0.055 (0.978–1.214)	1.646±0.083 (1.469–1.823)	2.194±0.110 (1.957–2.431)	2.746±0.138 (2.449–3.043)	3.292±0.165 (2.938–3.646)	3.840±0.194 (3.424–4.256)	4.392±0.222 (3.916–4.868)
Hill Type (W_{LBM})	0.668±0.033 (0.598–0.737)	1.333±0.067 (1.190–1.475)	2.003±0.099 (1.790–2.215)	2.670±0.133 (2.385–2.955)	3.338±0.166 (2.982–3.693)	4.002±0.199 (3.576–4.429)	4.670±0.232 (4.172–5.168)	5.337±0.266 (4.768–5.907)
Sprinter Type (W_{LBM})	0.681±0.023 (0.632–0.731)	1.366±0.047 (1.265–1.467)	2.049±0.070 (1.898–2.199)	2.730±0.094 (2.529–2.931)	3.414±0.117 (3.162–3.665)	4.095±0.141 (3.793–4.397)	4.778±0.164 (4.172–5.168)	5.459±0.188 (5.056–5.862)
Road Type (W_{LBM})	0.632±0.029 (0.569–0.695)	1.262±0.059 (1.134–1.390)	1.898±0.089 (1.708–2.088)	2.530±0.119 (2.275–2.785)	3.162±0.148 (2.844–3.480)	3.792±0.178 (3.410–4.174)	4.428±0.208 (3.982–4.874)	5.060±0.238 (4.550–5.570)

Table 2. Basic descriptive results of variables for the estimation of work capabilities shown on the test by cyclists juniors

	HR_{AT}	W_{AT}	W_{relAT}	W_{LBMAT}	VO_{2max}
Hill Type (HR)	175.4±4.1 (166.6–184.1)	221.3±26.8 (163.4–279.2)	3.308±0.303 (2.654–3.396)	3.668±0.338 (2.938–4.397)	61.43±3.29 (54.32–68.54)
Sprinters Type (HR)	189.6±2.5 (184.3–195.0)	239.1±16.4 (203.7–274.6)	3.572±0.185 (3.172–3.973)	4.027±0.207 (3.580–4.474)	56.35±2.02 (52.00–60.71)
Road Type (HR)	184.6±3.1 (177.8–191.4)	254.4±21.0 (210.0–299.2)	3.465±0.223 (2.958–3.971)	3.984±0.262 (3.419–4.549)	53.87±2.55 (48.36–59.38)

Table 3. Results of multiple analyzed dependable variants

Multivariate Tests[d]						
Effect		Value	F	Hypothesis df	Error df	Sig.
Driving Type	Wilks' Lambda HR - W_{aps}	0.031	4.068a	16.00	14.00	0.006
	Wilks' Lambda HR - W_{rel}	0.088	1.583 a	18.00	12.00	0.210
	Wilks' Lambda HR - W_{LBW}	0.269	0.620 a	18.00	12.00	0.826
	Wilks' Lambda AT + VO_{2max}	0.212	2.112 a	10.00	18.00	0.080
a. Exact statistic; b. Computed using alpha = 0,05; d. Design: Intercept + Driving type						

Table 4. Results of multiple analyzed variants of the tested cyclists' capabilities

Tests of Between-Subjects Effects						
Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Driving type	HR_{AT}	448.85	2	224.43	4.547	0.032
	W_{AT}	2083.20	2	1041.60	0.484	0.627
	W_{relAT}	0.16	2	0.08	0.286	0.756
	W_{LBWAT}	0.29	2	0.15	0.427	0.661
	VO_{2max}	107.76	2	53.88	1.657	0.229

Table 5. Defined models in the function of the subsample

Subsamples of Cyclists	Dependence Model	Reliability
Hill Type Cyclist (HR-W_{aps})	y = 39.5256x0.2766	R2 = 0.9853
Sprinters Type Cyclist (HR-W_{aps})	y = 46.3618x0.2552	R2 = 0.9681
Road Type Cyclist (HR-W_{aps})	y = 48.1219x0.2422	R2 = 0.9837
Hill Type Cyclist (HR - W_{rel})	y = 126.2434x0.2766	R2 = 0.9853
Sprinters Type Cyclist (HR - W_{rel})	y = 135.2496x0.2552	R2 = 0.9681
Road Type Cyclist (HR - W_{rel})	y = 137.3313x0.2422	R2 = 0.9837
Hill Type Cyclist (HR - W_{LBM})	y = 122.6592x0.2766	R2 = 0.9853
Sprinters Type Cyclist (HR - W_{LBM})	y = 131.3177x0.2552	R2 = 0.9681
Road Type Cyclist (HR - W_{LBM})	y = 132.5243x0.2422	R2 = 0.9837

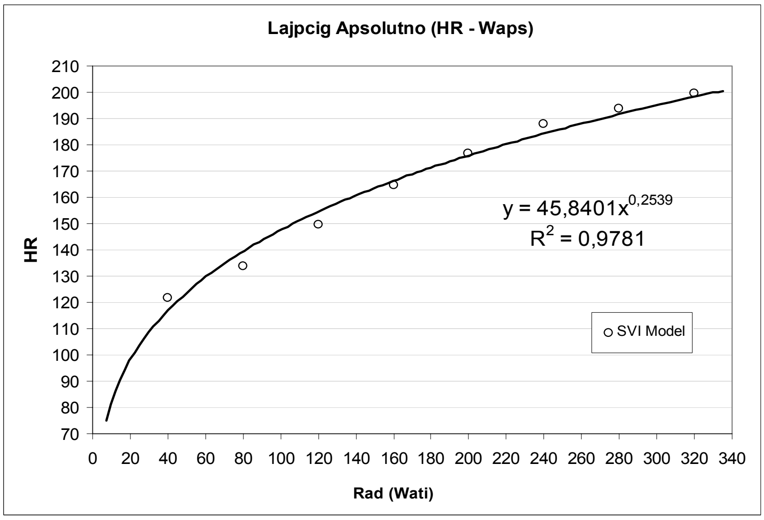

Figure 1. A general model of evaluating the readiness of junior cyclists in relations to the dependent HR – W_{aps}

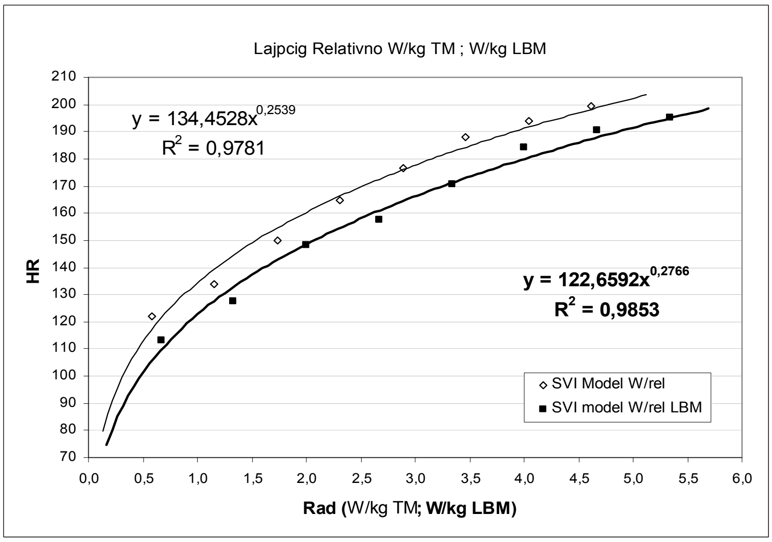

Figure 2. A general model of evaluating the readiness of junior cyclists in relations to the HR – Wrel i

The results show that defined models have statistical-predictive values in HR–W_{aps}, HR-W_{rel} and HR-W_{LBM} at the level of R2=0.9781 (97.81%), R2=0.9781 (97.81 %) and R2=0.9853 (98.53%). All models are displayed on Graphics 1, 2 and 3 (in relation to the general model) and in Table 5 (in relation to subsamples).

General model of estimating the readiness of cyclists in the HR–W_{aps} relationship has the following equation y=45.8401x0.2539, with an estimated error of 2.19% (Figure 1).

General model of estimating readiness of cyclists in the HR–W_{rel} relationship has the following equation: y=134.4528x0.2539, with an estimated error of 2.19%.

General model of estimating the readiness of cyclists in the HR–W_{LBM} relationship has the following equation y=130.3082x0.2539, with an estimated error of 2.19% (Figure 2).

Discussion

The results show that subsamples of tested cyclists have statistically significant differences only between HR-W_{aps}, Wilks' Lambda value 0.031 and F relations 4.068, p=0.006. Statistical significance on a general level was not found among all other relations HR-W_{rel}, HR-W_{relLBM}, personal potency at an anaerobic threshold and maximal oxygen uptake on a general level (Table 3).

Statistical difference was found in relation HR-W_{aps} between subsamples of mountain biking cyclists and sprinters p=0.019, only with initial load, at the load of 40W where the heart rate among mountain biking cyclist was 113.3±3.5 and among sprinters 126.9±2.5 (Table 1).

For variable HR_{AT} the statistically significant difference was found on a partial level for subsamples F=4.547 and p=0.032 in which case the sprinters have the highest values for heart rate at an anaerobic threshold in relation to mountain biking cyclists, p=0.031 (189.6±2.5 vs 175.4±4.1), while there were no differences between sprinters and road cyclists (189.6±2.5 vs 184.6±3.1), and also between mountain biking cyclists and road cyclists (175.4±4.1 vs 184.6±3.1) (Table 2).

According to the results from this study, it can be concluded that among the best national junior cyclists chosen for competitions in different disciplines in the Republic of Serbia, there are no essential differences in readiness.

Some investigators find that there are statistically significant differences between readiness and development of functional and organ systems. Salet et al. (22, 23) found that in respect to the level of competition and status of cyclists (whether they are in a national team or not) there are significant differences in all physiological parameters, especially in VO_{2max}. Cyclists in the national team (they are not in professional competitions) have VO_{2max} 73.9±6.7ml·min^{-1}kg^{-1}, but cyclists from an elite category (professional cyclists) have VO_{2max} 75.7±6.1ml·min^{-1}kg^{-1}.

When we compare professional cyclists and amateurs regarding the function of age, juniors had the lowest rate of VO_{2max} 65.5±3.9ml·min^{-1}kg^{-1} (24). The results of maximal oxygen uptake among junior cyclist from our national team in all disciplines were VO_{2max} 56.42±5.82ml·min^{-1}kg^{-1}, among mountain biking cyclists VO_{2max} was 61.43±4.94, sprinters 56.78±3.33, and cross-country cyclists 53.37±7.82ml min^{-1}kg^{-1} (Table 2).

This results show that the best juniors from the Serbian National Team had a low level of the anaerobic system in relation to juniors from other international teams, about 13.86% (9.09ml·min^{-1}·kg^{-1}). It means that according to the results of elite juniors from Spain which had VO_{2max} of 86.14% the results of our juniors were at a very low rate.

Menaspa (25) in his paper reports similar results. He compares the functional parameters and values of VO_{2max} 71.0±0.7ml·min^{-1}kg^{-1} from Italian junior cyclists with results of cyclists in the same category from other countries. Junior cyclists from Czech Republic had lower values of VO_{2max} 65.4±5.1ml·min^{-1}kg^{-1}. Menaspa concluded that those differences exist because cycling is not so popular in other European countries as in Italy. He brought out that cyclist in Italy during one year ride approximately about 20.000km in comparison to cyclists from Czech Republic which ride approximately between 11.000 to 13.000km per year. According to the results of Italian junior cyclists, Serbian junior cyclist had by 21.34% lower results (VO_{2max} 14.58ml·min^{-1}kg^{-1}). It means that Serbian junior cyclists are at the level of 79.46% compared to Italian junior cyclists, which are in the elite world group.

At this moment, we do not have data about the capability of yearly training of Serbian junior cyclists, but hypothetically, we can assume that the anaerobic mechanism of Serbian junior cyclists is between 13.86–21.34% which, in relation to the world elite juniors, is lower. This is because of lesser training programs during the year.

One very well-known investigator (26) in the world of cycling investigated the functional diffe-rences between three categories of cyclists: road cyclists (they primarily ride on open roads), sprinters and mountain biking cyclists. Mountain biking cyclists had the highest values of VO_{2max} with 78.2±5.0ml·min^{-1}·kg^{-1}, in relation to road cyclists whose VO_{2max} was 72.2±6.5ml·min^{-1}·kg^{-1}. In the same study, she found out that mountain biking cyclists had the lowest value of maximal strength during pedaling in regard to road cyclists. Sprinters showed the highest value of maximal strength during pedaling (W_{max}). Because of that, they can achieve the highest maximal speed in relation to all other categories and different disciplines (22).

As we mentioned before, according to the results from this study, it can be concluded that among the best national junior cyclists chosen for competitions in different disciplines in the Republic of Serbia, there are no essential diffe-rences in readiness (even if a significant difference in relation HR-W_{aps} was found, but only at initial burdening of 40W). Based on such data the conclusion can be that chosen cyclists had the same general training process. Practically, it means that all cyclists have the same level of readiness even if they compete in different disciplines. This was not reported among international junior elite cyclists.

This data also points out that the training process which we use in Serbia for cyclists does not include a specific training process for juniors in different disciplines (13). It means that the selection is made only according to the results during the competitions. All cyclists have the same training process and are involved in different competitive categories only according to the previous results in that category.

Conclusion

The sample of 18 junior cyclists, age – 16±1.2 years, height - 179.3±6.2 cm, weight - 68.9±7.6 kg, BMI - 21.60±2.20 kg/m2, fat % – 11.56±2.08 %, LBW – 60.84±6.14kg, were divided in three groups: road cyclists (N=6), sprinters (N=7) and mountain biking cyclists (N=5). This paper presented the readiness profile of junior cyclists determined by the Leipzig test. The results of the study show that statistically a significant difference exists only in the HR–W_{aps} relation, in Wilks' Lambda value 0.031 and F relations 4.068, p=0.006. Among other HR-W_{rel}, HR-W_{LBM} relations, anaerobic threshold and maximal oxygen uptake, there were no significant differences.

Results of partial differences in the HR-W_{aps} relation show a statistically significant difference only between subsamples of sprinters and mountain biking cyclists at the level of the Bonferroni test p=0.019, but between other groups (sprinters – road cyclists, road cyclists – mountain cyclists), the differences were not found.

On a general level, there were no statistically significant differences among subsamples of cyclists in relation to the anaerobic threshold and maximal oxygen uptake. Partial analysis shows a significant difference in heart rate on an anaerobic threshold between the given groups at the level of F value 4.547, p=0.032. This difference was found only in relation sprinters - mountain biking cyclists, (p=0.031), but was not found in relation sprinters – road cyclists, or mountain biking cyclists - road cyclists. For other tested variables, statistically significant differences were not found.

The value of maximal oxygen uptake among tested best national cyclists from the Serbian National Team was VO_{2max} 56.42±5.82ml·min^{-1}kg^{-1}, among mountain biking cyclists VO_{2max} 61.43±4.94, sprinters 56.78±3.33, and cross-country cyclists 53.37±7.82ml·min^{-1}kg^{-1}. On the other hand, junior cyclists from Italy had a maximal oxygen uptake VO_{2max} 71.0±0.7ml·min^{-1}kg^{-1}, and elite junior cyclists from Spain had VO_{2max} 65.5±3.9ml·min^{-1}kg^{-1}. In relation to our juniors, Italian juniors have by 21.34% (14.58ml·min^{-1}kg^{-1}), and juniors from Spain have by 13.86 % (9.09 ml·min^{-1}·kg^{-1}) higher level of VO_{2max}. This means that for VO_{2max} our junior cyclists are at the level of 79.46% in relation to Italian juniors, and 86.14% in relation to the best juniors from Spain.

This results show that tested cyclists from different clubs were trained under the same general procedure. It means that all cyclists were trained with the same trained procedure which is not specific according to the different disciplines in junior groups. The selection of cyclist is made only at the level of the results in competitions, but still there are no differences during the training process.

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PROFIL PRIPREMLJENOSTI BICIKLISTA JUNIORSKOG UZRASTA ODREĐEN PRIMENOM LEIPZIG TESTA

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Osnovni cilj ovog rada bio je da definiše profil pripremljenosti biciklista u kategoriji juniora određen primenom Leipzig testa. Sekundarni cilj bio je da se utvrdi da li postoje razlike u funkcionalnim pokazateljima kod biciklista koji nastupaju u različitim takmičarskim disciplinama: drumaši, brdski vozači i sprinteri. Svi biciklisti (n=18) bili su testirani primenom Leipzig testa na bicikl ergometru sa opterećenjem koje se povećavalo za 40W svakog minuta na kadenci od 90 – 100obr/min. U toku testa uzimali su se podaci o frekvenciji srca (HR) a na kraju i o maksimalnoj potrošnji kiseonika (VO_{2max}). Rezultati pokazuju da su izmerene maksimalne potrošnje kiseonika naših nacionalnih biciklista juniorske kategorije, bez obzira na disciplinu, bile VO_{2max} 56.42±5.82ml·min^{-1}kg^{-1}, gde je kod brdaša izmerena vrednost VO_{2max} bila 61.43±4.94, kod sprintera 56.78±3.33, a kod tempaša 53.37±7.82. Statistička analiza dobijenih rezultata pokazala je da između subuzoraka biciklista nije bilo značajnih razlika na generalnom nivou u odnosu na funkcionalne pokazatelje. Ali, parcijalna analiza je pokazala da ipak postoji statistički značajna razlika između grupa i to, kod vrednosti frekvencije pulsa na anaerobnom pragu (F value 4.547, p=0.032). Ovakvi rezultati navode na zaključak da su testirani sportisti trenirani primenom trenažnog rada opšteg karaktera, jer iako se dominantno takmiče na različitim disciplinama, nivo pripremljenosti ukazuje da trenažni proces koji se primenjuje u biciklističkom sportu u Srbiji kod juniora ne podrazumeva specifičnost trenažnog rada u funkciji takmičarske discipline. *Acta Medica Medianae 2010;49(3):32-39.*

***Ključne reči**: biciklizam, testiranje, funkcionalna sposobnost, Leipzig test protokol*