



## MACROSTRUCTURAL DISTRIBUTION OF THE SPECIFIC TRAINING TOOLS FOR CLASSIC MOUNTAIN RUNNING IN A COMBINED MODEL OF PREPARATION FOR "MAINLY UPHILL" AND "UP AND DOWNHILL" VARIANTS

K. Kisyov\*

Department of Athletics, Faculty of Teacher Education, National Sports Academy "Vasil Levski", Sofia, Bulgaria

### ABSTRACT

In researches it has been observed the distribution of the specific training tools, that coincide or are very close in their biomechanics and bioenergetics to the racing activity.

The aim of the research is to establish a basic model of the specific training tools volume, by weeks in the macrostructure for training aimed at classical mountain running in both variants - "Mainly Uphill" and "Up and Downhill".

Methods: a) research of the weekly volume of the training tools within the framework of the separate mezzo-cycles in the macrostructure and b) variation analysis of the data received from the training tools explored.

Conclusions:

1. Tools for development of the main achievement factors are focused mainly in the preparation period. After that in the first part of the racing period they are gradually replaced with tools for development of the sub-factor „specific endurance“
2. Tools for „special strength endurance“ are the most important element from the specific training.
3. Tools developing the sub factor “Specific endurance” are supporting element with primary importance for realization of the specific training in the racing period.
4. Tools developing the sub factor „specific speed“ are present at almost all stages of the training.

**Key words:** Mountain running, Trail running, Off-road running, Achievement factors, Classification of the training tools, Specific training tools, Model of annual periodization

### INTRODUCTION

Mountain running is a fast developing mass sport, with so many variations and formats that it is difficult to be listed. However, as part of the athletics mountain running disciplines have clear classification, which defines the technical parameters of every discipline. That gives opportunity for planning and conducting of highly specialized training, compliant with the specifics of the discipline itself. Having said that, we can admit that in the specialized methodological literature, there are not detailed

1700Studentski Kompleks, Sofia, e-mail:

*k.kisov@abv.bg*, authors phone +359 87 760 8891  
models on distribution of the training tools for training of mountain runners. Recent research is looking at that direction – creating of annual training model, based on the research of the training programs directed to European cup in variation „Mainly uphill“ in 36-th week of macrocycle and World cup in variation „Downhill and uphill“ in 39-th week.

The prepared by us model of achievement in mountain running, consisting main factors and hierarchically ordered subfactors, defining the level of the final sport result (**Figure 1**) (1), and classification of training tools for their development (2), are giving basis for creating models of distribution of the training tools.

\*Correspondence to: *Kostadin, Kisyov*,  
Department of Athletics, Faculty of Teacher Education, National Sports Academy "Vasil Levski" Sofia, boulevard "Sveti Kliment Ohridski"

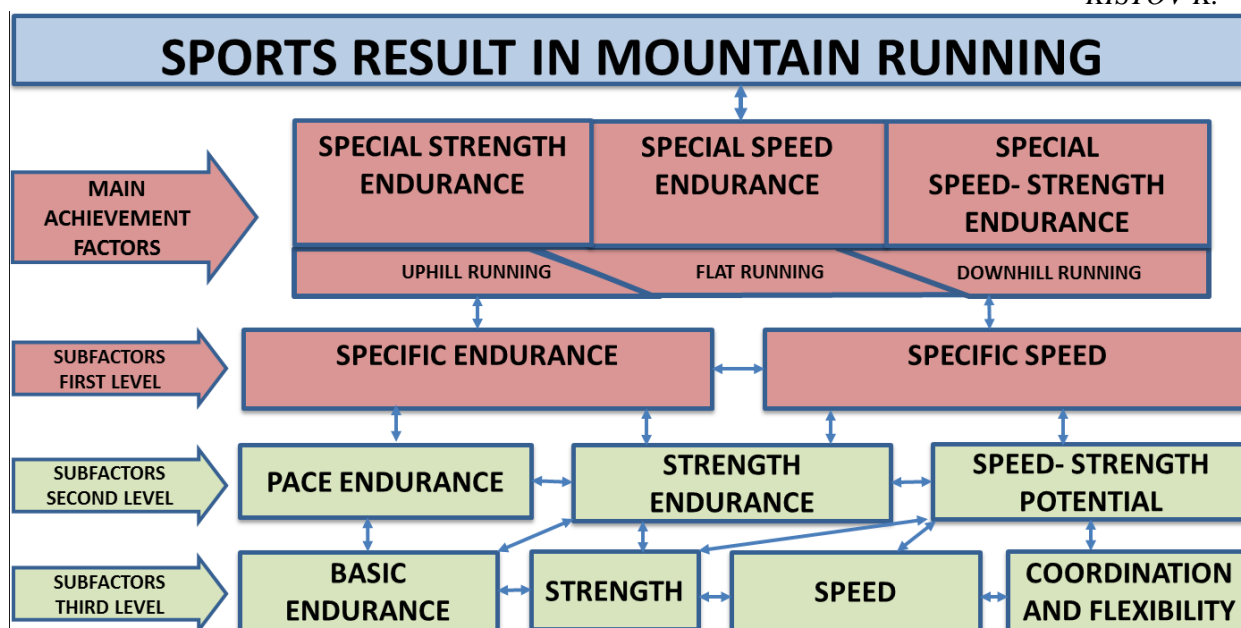


Figure 1. Model of the sports result in mountain running.

Modern trends in development of mountain running are requiring annual planning to be completed with purposeful preparation, according to the specific conditions of the major competitions. In that relation, the successful realization of the potential of the mountain runners, depends on high degree on the optimal usage and distribution of the

specific training tools, which coincide or are very close as biomechanics and bioenergetic to the racing activity. Those are the special tools, directed toward development of main factors of the achievement (**Table 1**) and diverse-specialized tools for development of sub-factors from first level (**Table 2**) (2).

**Table 1.** Special training tools for developing the main achievement factors, their bioenergetic regime and the conditions under which they are performed

MAIN ACHIEVEMENT FACTORS	BIOENRGY REGIME	SPECIAL TRAINING TOOLS	TERMS OF PERFORMANCE	
SPECIAL STRENGTH ENDURANCE	3. Aerobic-anaerobic regime	1. Control racing running 2. Paced extensive (interval) running 3. Long variable running (Fartlek) 4. Intensive long running	1. Up a small slope of 4 ° 2. Up a medium slope 8 ° 3. Up a big slope 12 ° 4. Up an extreme slope 16 ° 5. Mostly a flat section 6. Down a small slope 4 ° 7. Down a medium slope of 4 ° 8. Down a big slope of 12 ° 9. Down an extreme slope of 16 °	
SPECIAL SPEED ENDURANCE				2. Aerobic regime 2
SPECIAL SPEED-STRENGTH ENDURANCE				2. Aerobic regime
		5. Aerobic developmental running 6. Aerobic building running		

**Table 2.** Diverse-specialized tools for development of the first level sub-factors, the bioenergetic regime and the conditions under which they are performed.

SUBFACTORS FIRST LEVEL	BIOENRGY REGIME	SPECIAL TRAINING TOOLS	TERMS OF PERFORMANCE
SPECIFIC ENDURANCE	3.Aerobic-anaerobic regime	1. Control racing running 2. Paced extensive (interval) running 3. Long variable running (Fartlek) 4. Intensive long running	10. Crossed or mountainous terrain similar to the racing conditions
	2.Aerobic regime		
	2.Aerobic regime	5. Aerobic developmental running 6. Aerobic building running	
SPECIFIC SPEED	3.Aerobic-anaerobic regime	7. Over again running 8. Interval running	

**Purpose of the research** is defining of principal annual model of the distribution of volume of the specific training tools per weeks in combined preparation for variations of racing “mainly uphill” and “downhill and uphill” in classic mountain running.

## METHODS

### Research objectives:

1. Defining of the volume of the specific (special and diverse-specialized) training tools in macrostructure of the preparation and the application of those tools according to factors and sub-factors of achievement.
2. Analysis of the distribution of specific training tools per weeks in the macrostructure
3. Defining of conclusions

**Object** of the research is the training and sport-racing activity in the mountain running, and **subject** are the specific training tools, used in the preparation of mountain runners.

**Scope of the research** are 29 training programs of mountain runners.

**Methodology** of the research includes:

1. Analysis of the scientific-methodology literature for long running and mountain running.
2. Research of the weekly volume of the training tools in the frame of the separate mesocycles in the macrostructure of the trainings programs of the runners.
3. Variation analysis of the data for training tools in the macrostructure.

One part of the researched literature sources are looking at the problems of the specialized diversity of the training tools (3, 4), other part are considering the specific of the racing courses in the mountain running (5, 6) and training methodology (7-15). Total of 29 training schedules of highly qualified racers have been reviewed.

## RESULTS

In **Table 3 and 4** are presented the average values of the weekly volume distance and denivelation of the specific training tools in the researched training programs.

### *Analysis of the annual volume of the specific training tools*

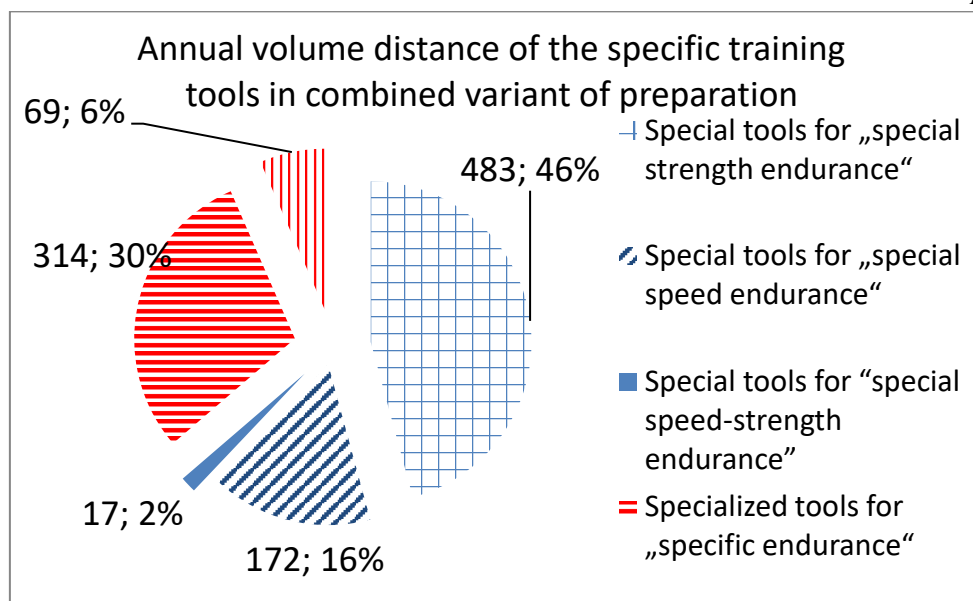
Research of the preparation of the mountain runners specialized in races for both variations „Mainly uphill“ и „Uphill and downhill“ shows, that average annual volume of the specific training tools in the researched trainings schedules is 1055 km. Almost half of them are directed for development of the main factor of achievement – „special strength endurance“. Second of magnitude of the volume are the tools for development of the sub-factor from first degree – „specific endurance“. They are with annual volume 314 km and comprise 30% of the specific tolls. Next are the special tools for development of the main factor „special speed endurance“. They have volume of 172 km, or 16% of the specific tools. Specialized tools developing “specific speed” are 69 km or 6% of the specific tools, and the special for “special speed-strength endurance” are just 17 km (**Figure 2**).

**Table 3.** Special training tools.

Weeks	Special tools for the development of the main achievement factors					
	Special strength endurance		Special speed endurance		Special speed-strength endurance	
	Distance in kilometers	Ascent in meters	Distance in kilometers	Descent in meters	Distance in kilometers	Descent in meters
1	5	510	1	60	0	0
2	11	1250	2	140	0	0
3	12	1310	2	130	0	0
4	13	1340	2	210	0	0
5	17	2270	3	270	0	0
6	14	1710	4	350	1	310
7	19	2320	3	260	0	0
8	25	3530	4	320	1	300
9	21	2040	4	310	1	290
10	19	2380	5	420	2	430
11	17	1590	6	510	1	280
12	23	3550	5	410	2	440
13	14	1410	5	390	1	240
14	20	2290	5	400	1	240
15	18	1990	6	480	1	230
16	20	2730	8	690	1	200
17	17	1710	9	700	1	230
18	18	1700	7	610	1	210
19	14	1620	10	630	1	220
20	11	1030	8	690	1	230
21	18	810	1	60	1	240
22	12	1090	12	700	0	0
23	10	910	10	810	0	0
24	8	680	8	560	0	0
25	6	540	6	540	0	0
26	2	140	0	0	0	0
27	3	220	0	0	0	0
28	5	510	6	510	0	0
29	1	80	0	0	0	0
30	0	0	0	0	0	0
31	0	0	0	0	0	0
32	6	570	6	570	0	0
33	0	0	0	0	0	0
34	12	1180	0	0	0	0
35	0	0	0	0	0	0
36	12	1160	0	0	0	0
37	0	0	0	0	0	0
38	0	0	0	0	0	0
39	6	610	6	610	0	0
40	0	0	0	0	0	0
41	6	600	6	600	0	0
42	6	580	0	0	0	0
43	12	570	0	0	0	0
44	6	560	0	0	0	0
45	0	0	0	0	0	0
46	1	80	0	0	0	0
47	4	70	4	70	0	0
48	1	90	0	0	0	0
49	1	70	0	0	0	0
50	2	180	0	0	0	0
51	12	130	5	130	0	0
52	3	280	3	280	0	0
Total	483	49990	172	13420	17	4090

**Table 4. Specialized training tools.**

Weeks	Specialized training tools for the development of first-level subfactors					
	Specific endurance			Specific speed		
	Distance in kilometers	Ascent in meters	Descent in meters	Distance in kilometers	Ascent in meters	Descent in meters
1	0	0	0	0	0	0
2	0	0	0	1	90	10
3	1	20	10	1	80	20
4	1	20	10	1	70	30
5	2	30	20	2	140	60
6	1	20	10	2	140	60
7	1	10	10	2	120	80
8	2	30	10	1	60	40
9	1	10	10	1	60	40
10	1	20	10	0	0	0
11	2	30	20	2	130	70
12	1	20	10	3	170	130
13	1	10	10	2	110	90
14	2	20	20	2	120	80
15	2	30	20	4	210	190
16	3	40	30	4	200	200
17	1	20	10	2	100	100
18	2	20	20	2	100	100
19	1	10	10	2	100	100
20	1	10	10	0	0	0
21	1	10	10	0	0	0
22	1	10	10	3	150	150
23	2	30	20	2	100	100
24	6	100	50	3	150	150
25	14	230	110	2	100	100
26	16	240	120	3	150	150
27	27	480	210	2	100	100
28	16	240	110	2	100	100
29	25	480	200	3	150	150
30	27	490	210	3	150	150
31	22	400	180	1	50	50
32	0	0	0	0	0	0
33	15	110	120	1	50	50
34	21	230	160	2	100	100
35	17	190	150	1	50	50
36	0	0	0	0	0	0
37	10	210	110	1	50	50
38	14	300	130	1	50	50
39	0	0	0	0	0	0
40	11	260	130	1	50	50
41	5	70	50	0	0	0
42	4	70	40	1	50	50
43	5	70	60	0	0	0
44	3	40	40	1	50	50
45	4	60	40	0	0	0
46	2	30	20	0	0	0
47	1	20	10	0	0	0
48	1	20	10	0	0	0
49	6	90	80	1	50	50
50	5	80	70	0	0	0
51	4	70	50	1	50	50
52	3	50	40	0	0	0
Total	314	5050	2790	69	3750	3150

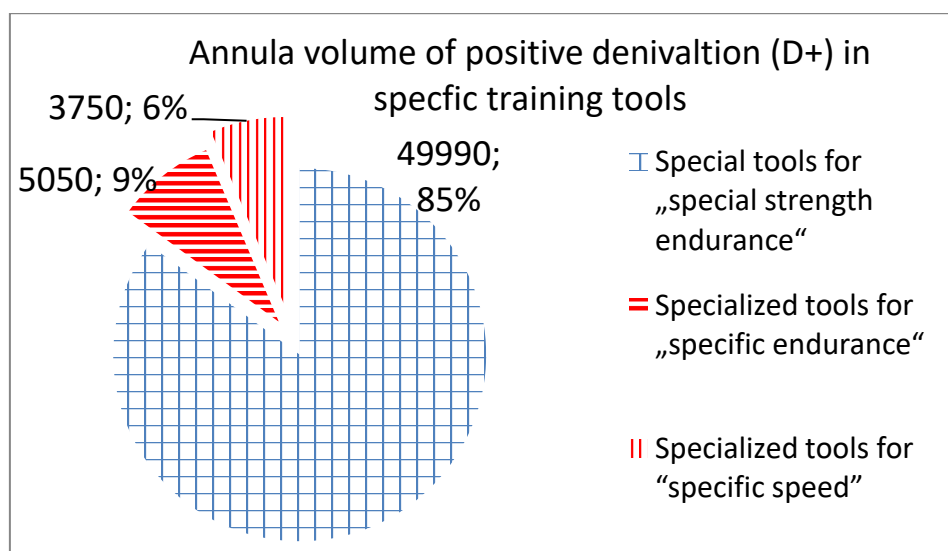


**Figure 2.** Annual volume in kilometers distance of the specific training tools according to their focus to the main factors and sub-factors from first level.

Beside kilometers distance, the volume of the specific training tools is measured also in meters denivelation.

Analysis of the researched by us training schedules shows, that the total positive denivelation in the specific training tools in the framework of the macrocycle is almost 59 000

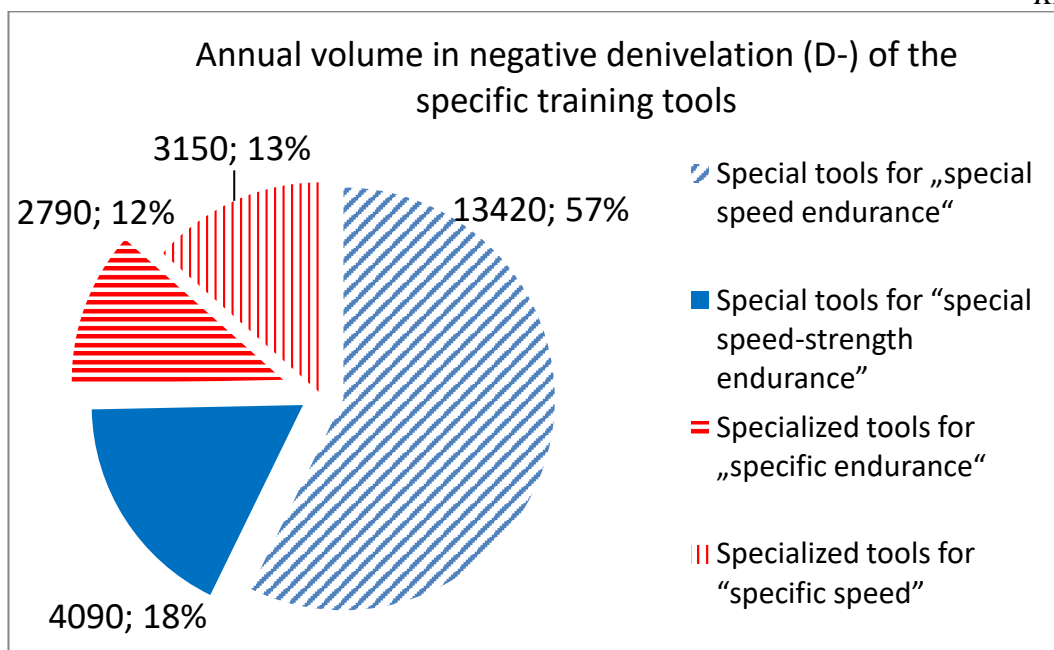
meters. The positive denivelation of the special tools for „special strength endurance“ is 85% from the total positive denivelation of the specific tools. And the positive denivelation of the specialized tools for „specific endurance“ and „specific speed“ is respectively 9% and 6% (**Figure 3**).



**Figure 3.** Annual volume in meters positive denivelation of the specific training tools according to their focus to the main factors and sub-factors from first level.

Annual negative denivelation in the specific training tools is 23450 meters. Figure 4 shows that 75% from the negative denivelation is from specific tools for development of the main factors of achievement. Biggest part is of the denivelation from the training tools for „special speed endurance“ – 57%. Tools for

special speed-strength endurance have 4090 meters negative denivelation, which is 18%. Negative denivelation in the specialized tools for „specific endurance“ is 3015 meters, and for „specific speed“ is 2890 meters, which is approximately 13% and 12% from the specific training tools (**Figure 4**).

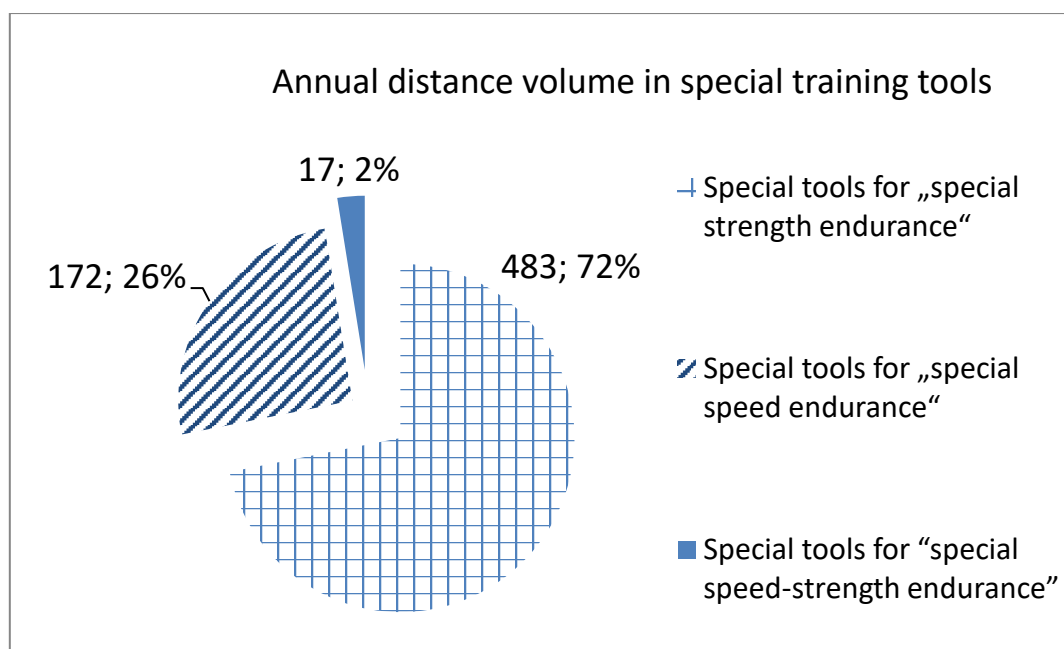


**Figure 4.** Annual volume in meters negative denivelation of the specific training tools according to their focus to the main factors and sub-factors from first level.

***Analysis of the annual volume of the special tools developing the main factors of achievement***

The special training tools are accomplished through uphill and downhill running in slopes of 4 degrees of steepness (**Table 1**) (15). 72%

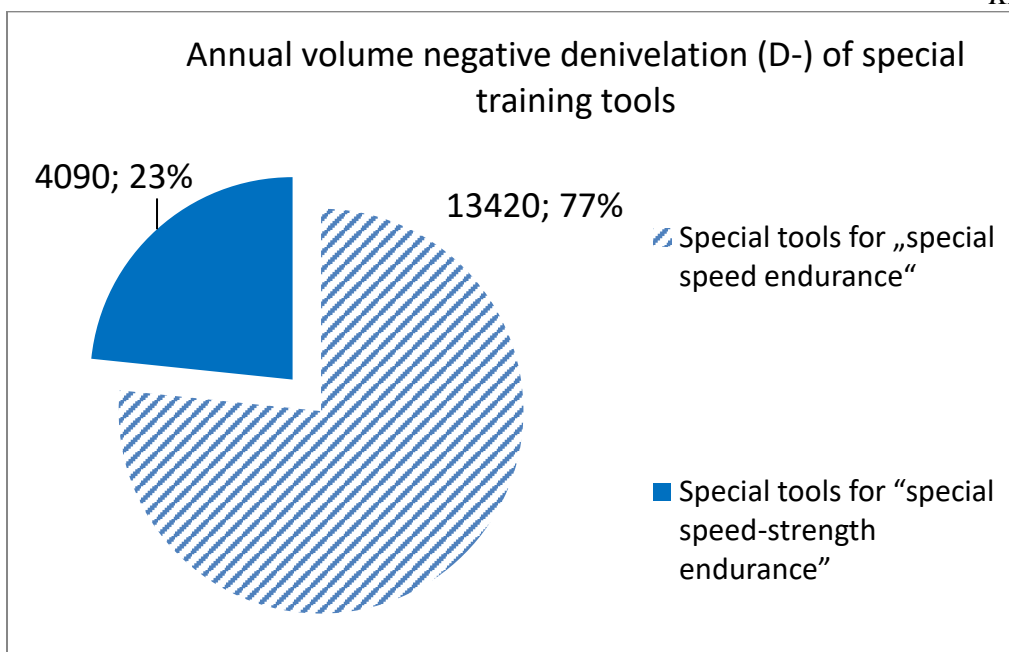
from the distance in these tools is directed to the factor „special strength endurance“. For „special speed endurance“ is 26%, and for „special strength-speed endurance“ is at least 2% from the distance of the special training tools (**Figure 5**).



**Figure 5.** Annual kilometer volume of special training tools according to their focus on the main factors.

The positive denivelation of the special training tools is 50 000 meters and is accomplished only through running uphill for developing of „special endurance“ (**Figure 3**).

Annual volume of the negative denivelation in the special tools is 17510 meters. It comes from the downhill running for developing of the factors „special speed endurance“ and „special strength-speed endurance“ in an average ratio of 3:1 (**Figure 6**).

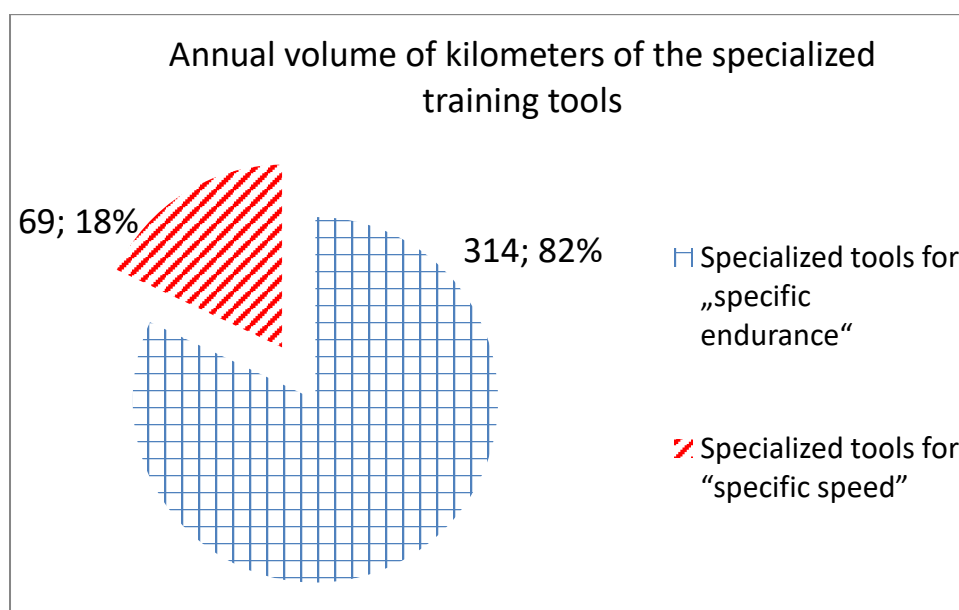


**Figure 6.** Annual volume in meters negative denivelation of special training tools according to their focus to the main factors.

***Analysis of the annual volume of the specialized tools developing the sub-factors of achievement from I<sup>st</sup> level***

The specific tools— running in rugged or mountain terrain imitating the racing conditions are divided in two directions. The first direction is directed to the development of the sub-factor „specific endurance“, where the annual volume in distance is 314 km, which is

82% from the total volume of specialized tools. Second direction tools is directed to the developing of sub-factor „specific speed“, which annual volume is 69 km. The ration in the distance between the tools for „ specific endurance “ и „ specific speed “ is 5:1, despite that training tools for specific endurance are used mainly in the racing and the transitory periods (**Figure 7**).

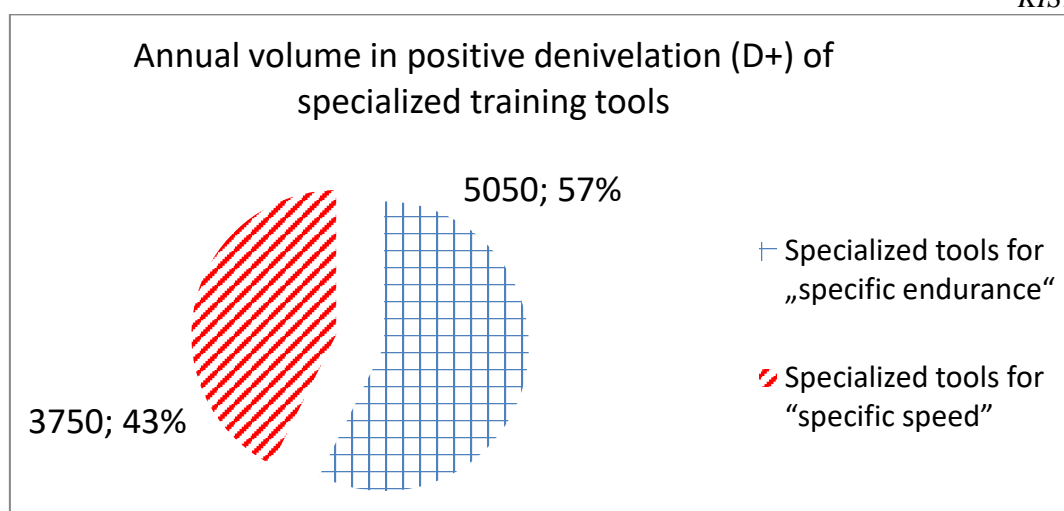


**Figure 7.** Annual volume of kilometers of the specialized training tools according to their focus to the sub-factors from first level.

Total positive denivelation accumulated for one year in the specialized tools for sub-factors from first level is 8800 meters, with 5050 m

for the „ specific endurance “, and 3750 m „ specific speed “ (**Figure 8**), which makes ratio of 57% / 43%.

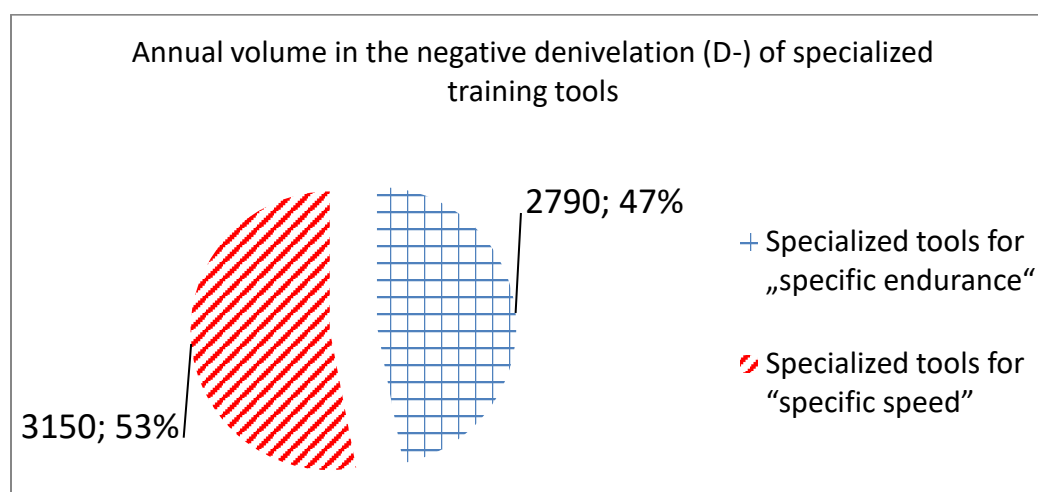




**Figure 8.** Annual volume in positive denivelation in meters of specialized training tools according to their focus to the sub-factors from first level.

Total negative denivelation accumulated for one year in the specialized tools for sub-factors from first level is 5910 meters, with 2790 m

for „specific endurance“, and 3150 m for „specific speed“ (Figure 9), which makes a ratio of 47% / 53%.



**Figure 9.** Annual volume in the negative denivelation in meters of specialized training tools according to their focus to the sub-factors from first level.

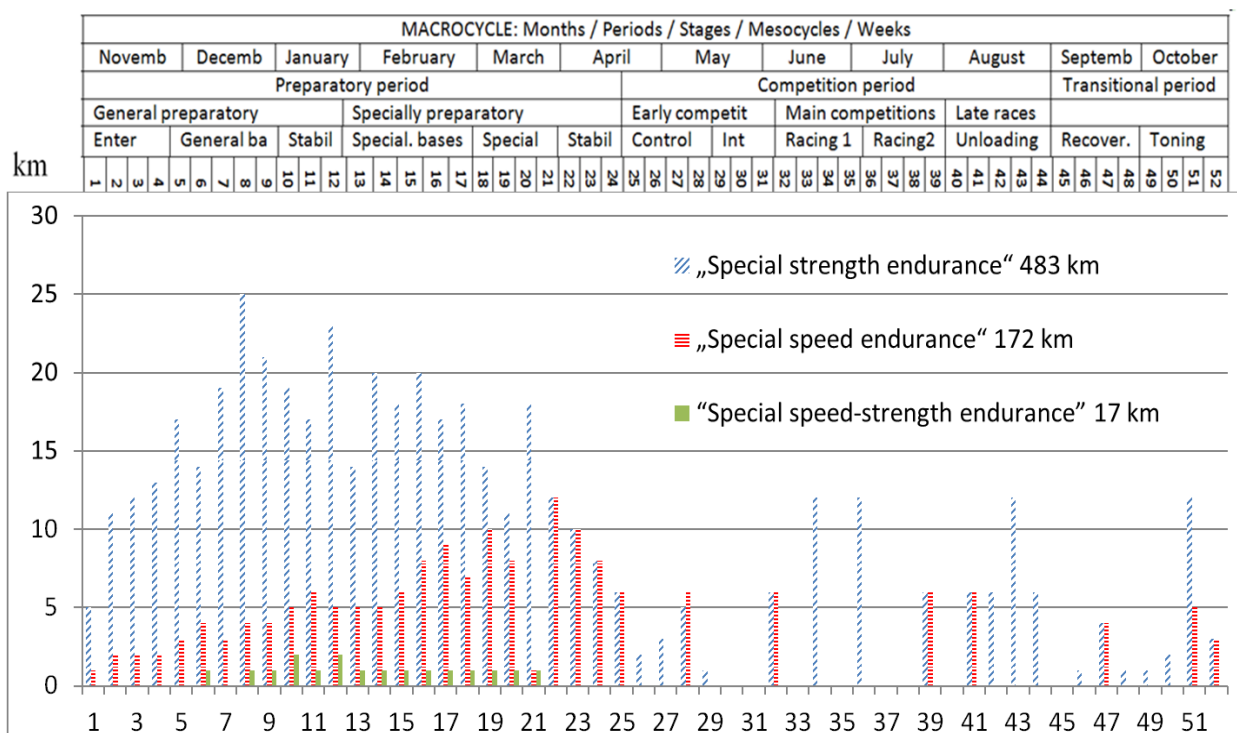
**Analysis of distribution of the volume of specialized tools developing main factors of achievement per weeks in the macrocycle**

Figure 10 shows how the volume of special tools for development of the main factors of achievement is concentrated predominantly in the preparation period and in the racing runs during the racing and the transient periods. It is visible, that highest values are achieved during second half of the general preparatory stage and in the first part of the special preparatory stage, where it mostly varies between 15 and 20 km weekly.

Tools that are directed to the development of the main factor „special speed endurance“ are also distributed mainly in the preparation

period and in the racing running during the racing and transient periods. But their volume in the beginning of the preparation period is minimal and increases gradually almost linear, and reaches maximal values at the end of the special preparatory stage. Most often the weekly volume is around 5-6 km, and only in the second half of the special preparatory stage it reaches around 10 km.

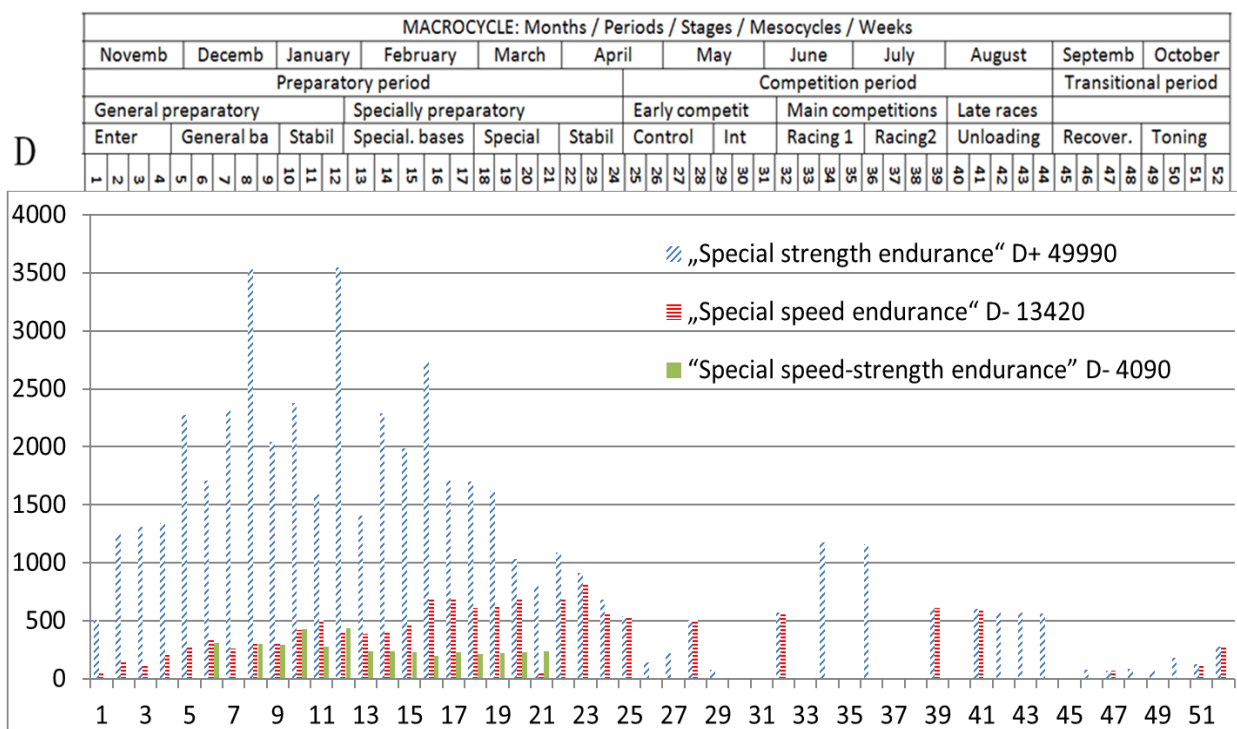
The volume of training tools for development of the factor „special strength endurance“ is minimal, in comparison with that of the other main factors and it is distributed in the second half of the general preparatory and the first half of the special preparatory stage. Weekly volume in that period is around 1 km.



**Figure 10.** In the frame of macrocycle on the abscissa is shown the weekly distribution of the kilometers of special tools for development of the main factors for achievement.

Distribution of the denivelation of the tools for main factors of achievement in the frame of the macrocycle is similar to the distribution of their distance, but still it is not identical. Biggest denivelation is accumulated in the

second half of the general preparatory stage and in the first two thirds of the special preparatory stage, where it often exceeds 2500 meters weekly (**Figure 11**).



**Figure 11.** In the frame of the macrocycle on the abscissa is shown the weekly distribution of meters denivelation of the special tools for development of the main factors of achievement.

**Analysis of the distribution of the volume of specialized tools for development of the sub-factors of achievement from I<sup>st</sup> level per weeks in the macrocycle**

Figure 12 shows how the training tools for development of „specific endurance “ are used mainly in the racing period, and their weekly volume very often varies between 15 and 25 km. In the transitory and the preparatory period

their usage is minimal – around 5 km weekly. The tools of the other factor from first level – „specific speed“ have relatively evenly distribution – about 2-3 kilometers weekly during preparatory period and first half of the racing period. After that in the stage of the late racing and in the transitory period their usage significantly decreases.

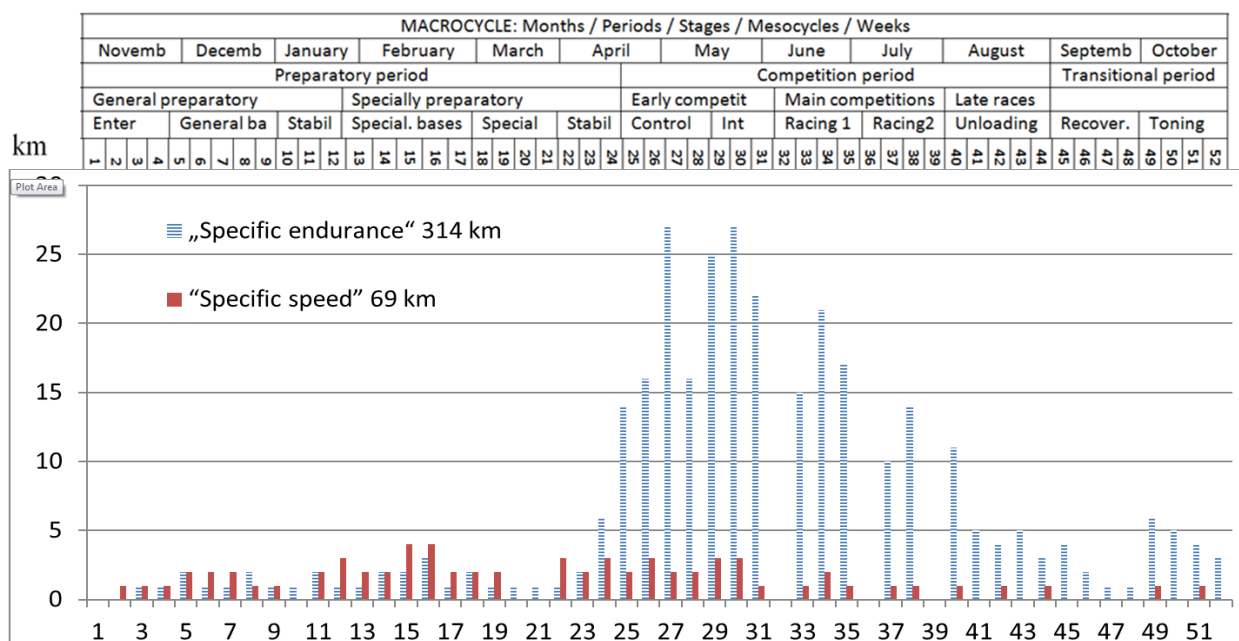


Figure 12 . In the frame of macrocycle on the abscissa is shown the weekly distribution of the kilometers of diverse-specialized tools for development of the sub-factors from first level.

In the diagram visualizing the distribution of the positive denivelation in the specific tools (Figure 13) it is visible, that in contrast with the indicator “distance” (Figure 12), the values of the denivelation in the tools for „specific speed“ are significantly closer to those of the tools for „specific

endurance“. And in the negative denivelation the “specific speed” has even higher values in accordance with the “specific endurance”. That happens because the negative denivelation of the tools for „specific speed“ keeps its volume, while in the „specific endurance“ it decreases (Figure 14).

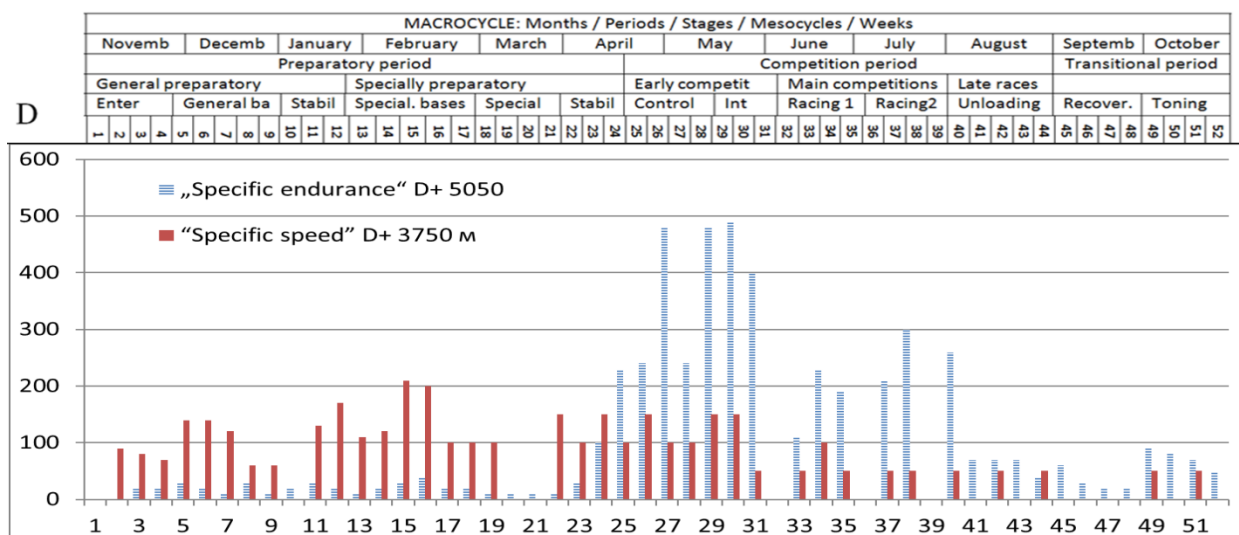
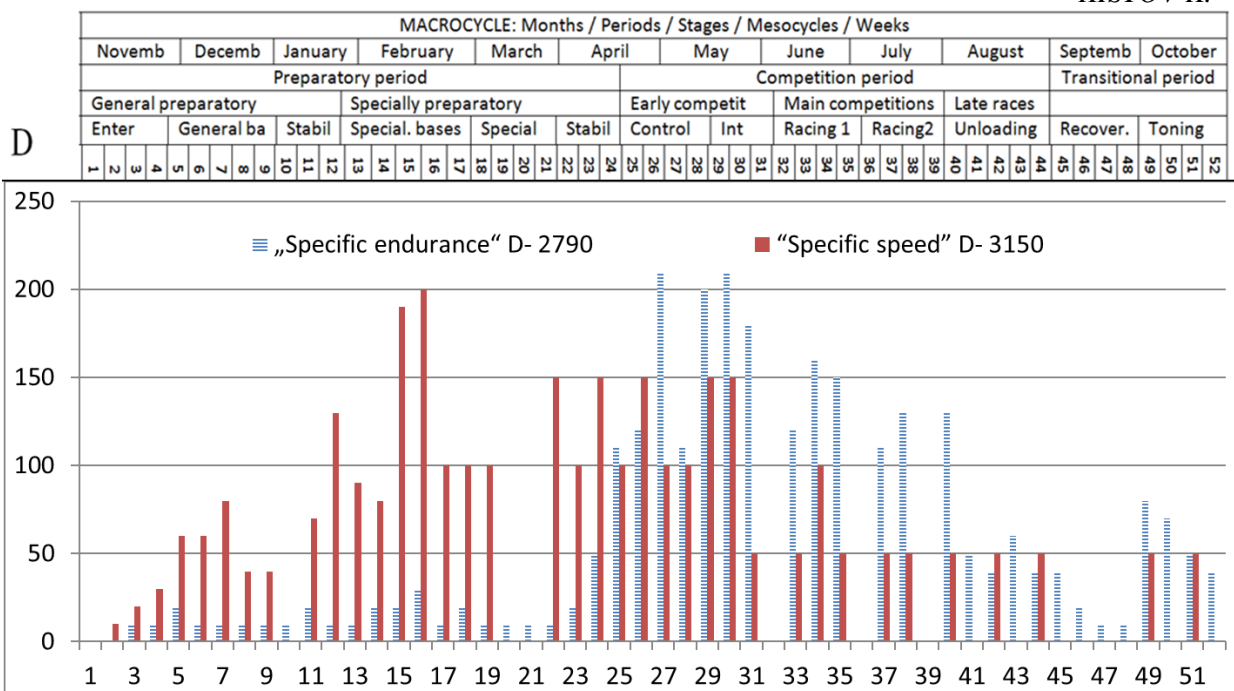


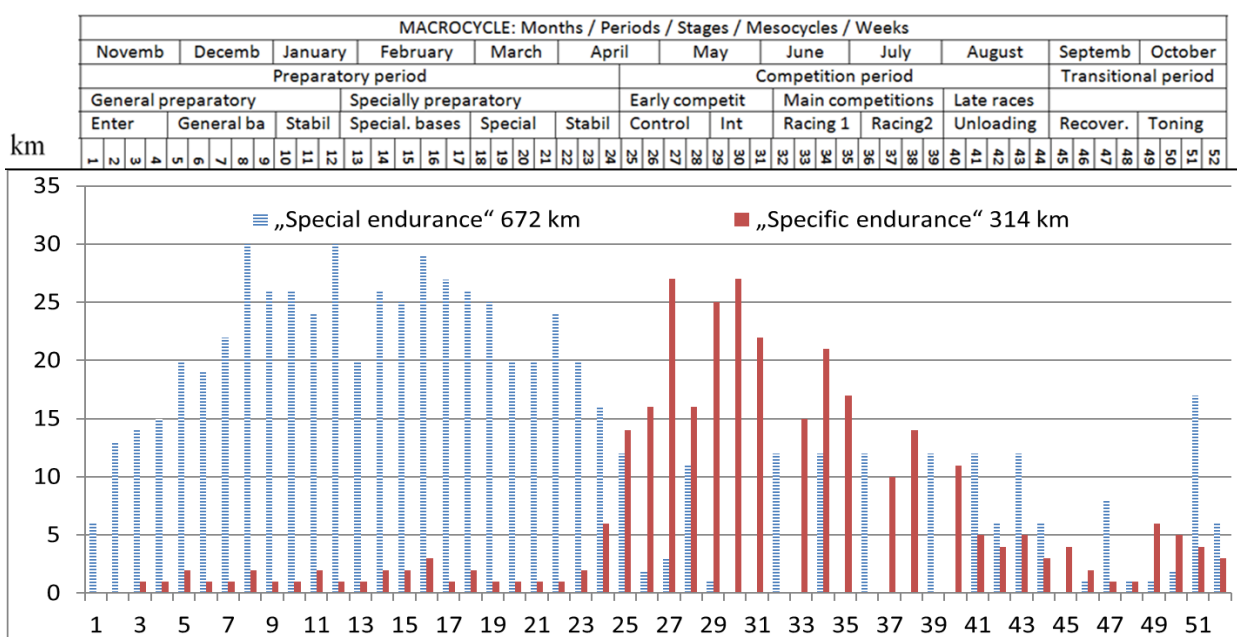
Figure 13. In the frame of macrocycle on the abscissa is shown the weekly distribution of meters positive denivelation of diverse-specialized tools for development of sub-factors from first level.



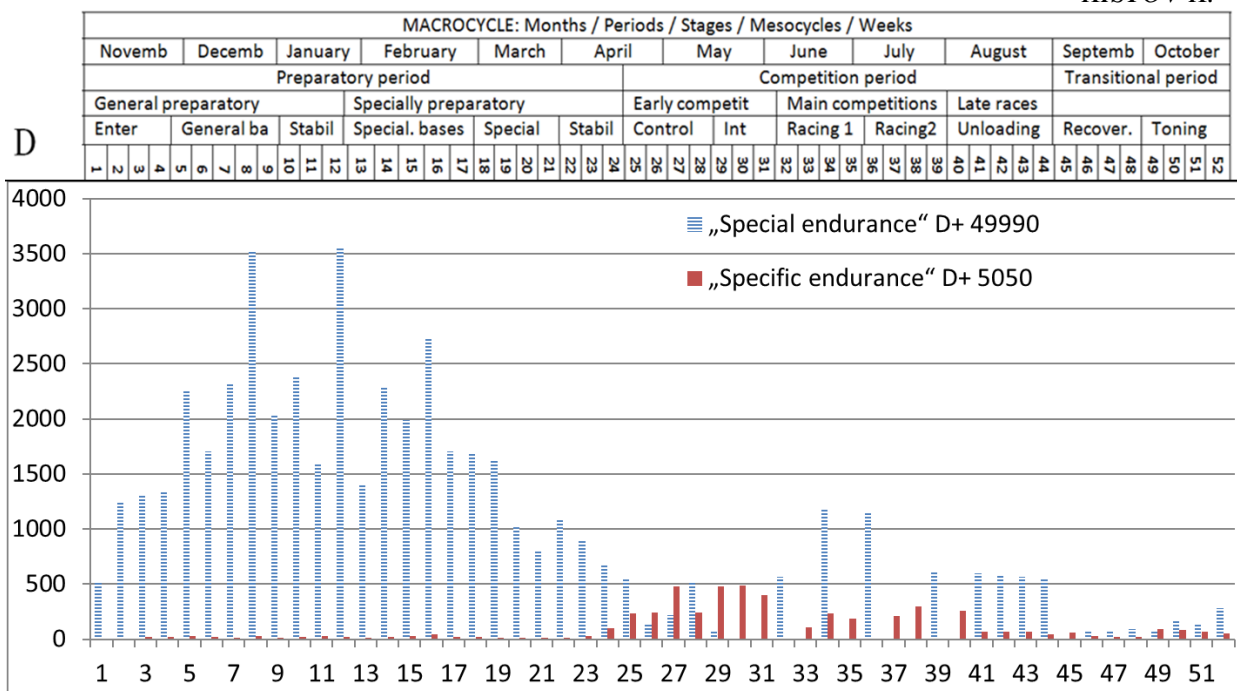
**Figure 14.** In the frame of macrocycle on the abscissa is shown the weekly distribution of meters negative denivelation of diverse-specialized tools for development of sub-factors from first level.

It is interesting to be examined the interconnection in the distribution of the tools for development of the main factors („special strength endurance“, „special speed endurance“ and „special speed-strength endurance“) and the sub-factor „specific endurance“. In the whole preparatory period tools for special endurance are significantly predominant. After that in the first half of the racing period the training running for special endurance gradually are replaced by auxiliary

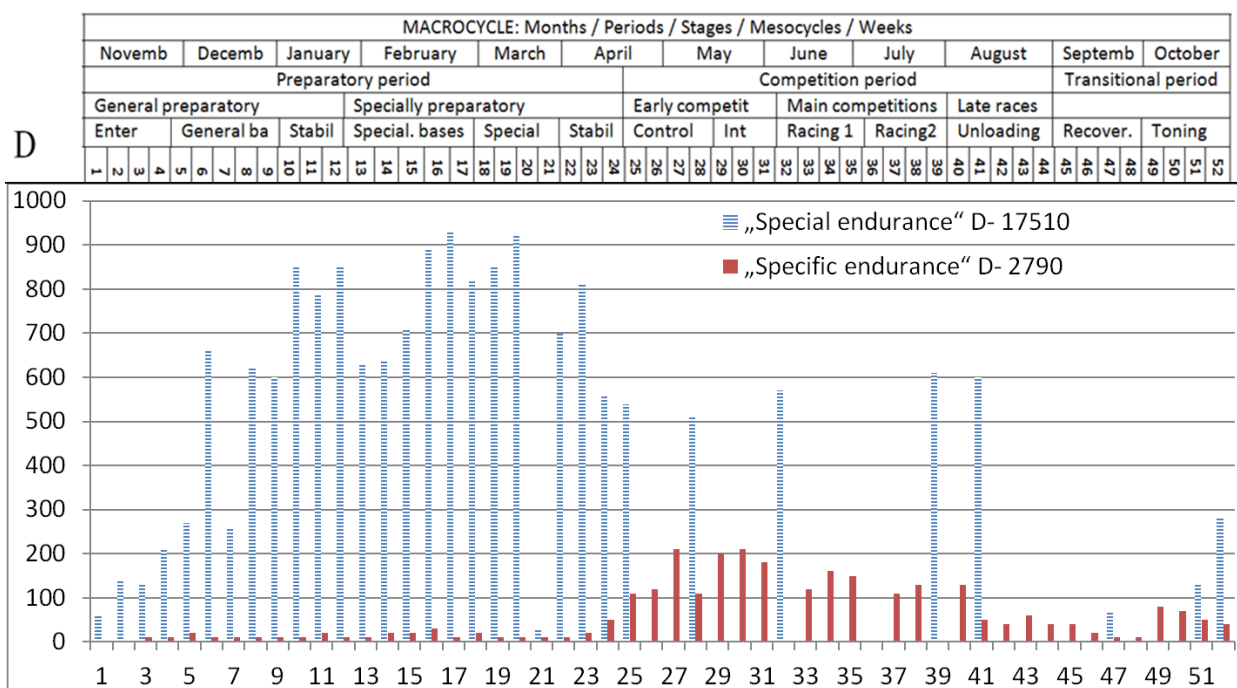
tools for development of the sub-factor „specific endurance“ (shown in Figure 15). Those are runnings imitating the racing model, but in a different degree relieved conditions through decreasing of the slopes and the denivelation in general. When comparing the indicators distance and denivelation (**Figure 15, 16 and 17**) it is visible significant decrease of the denivelation in the tools for sub-factor „specific endurance“.



**Figure 15.** In the frame of the macrocycle on the abscissa is shown the weekly distribution of the distance of the tools for „special endurance“ and for „specific endurance“.



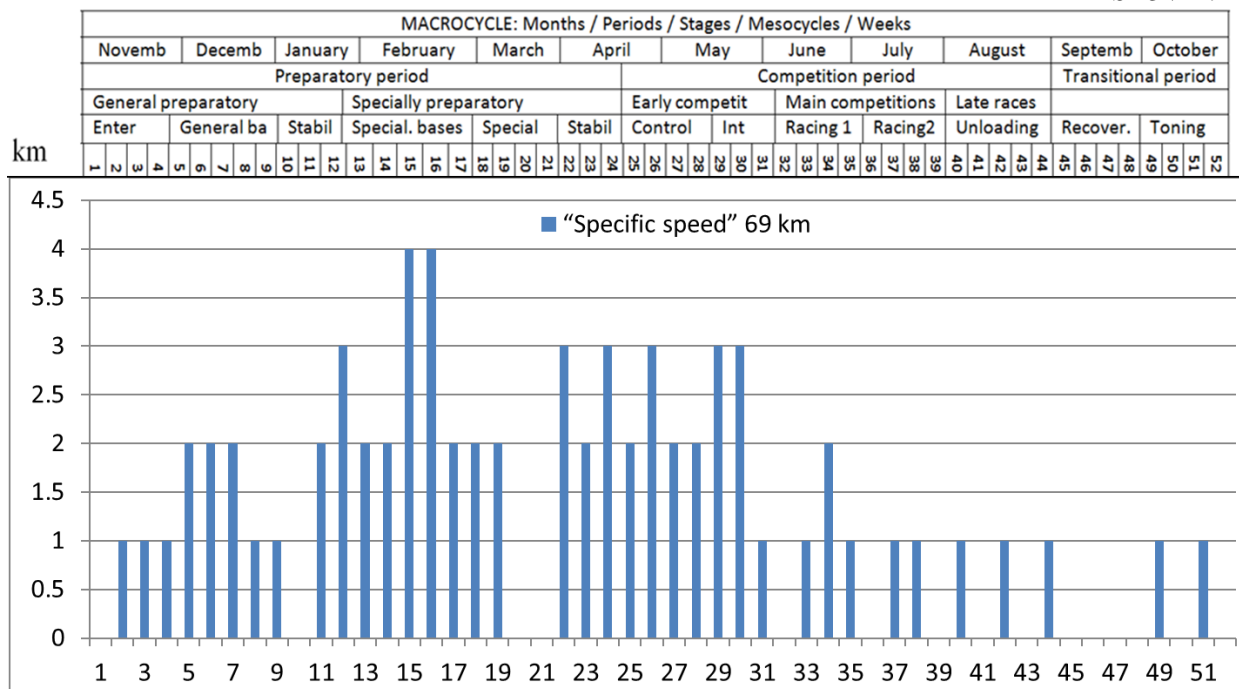
**Figure 16.** In the frame of the macrocycle on the abscissa is shown the weekly distribution of meters positive denivelation in the running for special endurance and for “specific endurance”.



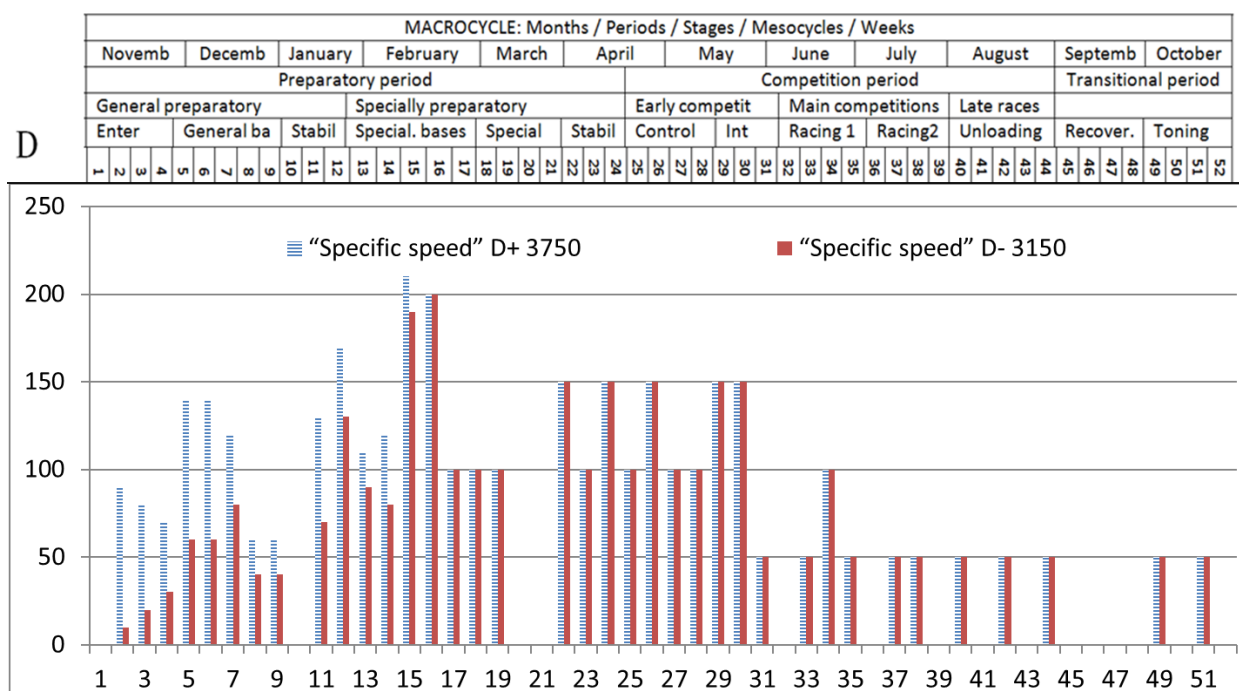
**Figure 17.** In the frame of the macrocycle on the abscissa is shown the weekly distribution of meters negative denivelation in the running for special endurance and for specific endurance.

Tools for development of the sub-factor „specific speed“ are present almost during all stages of the preparation, with highest values of denivelation achieved during special-preparatory stage and the stage of the early racings (Figure 18), and in the period of the

late racings and transitory stage their usage is the lowest. Almost identical is the distribution of the denivelation, with the difference that its highest values are in the general-preparatory stage and after that it gradually decreases (Figure 19).



**Figure 18.** In the frame of the macrocycle on the abscissa it is shown the weekly distribution of the distance of the tools for “specific speed”.



**Figure 19.** In the frame of the macrocycle on the abscissa is shown the weekly distribution of the positive and the negative denivelation in meters of tools for “specific speed”.

**CONCLUSION**

1. The tools for development of the main factors of achievement are concentrated mainly in the preparatory period. After that in the first part of the racing period they are gradually replaced with the tools for development of the sub-factor „specific endurance“.
2. The tools for development of the main factor of achievement „special strength

endurance“ are the most important element of the specific training in the combined preparation.

3. The tools developing sub-factor „specific endurance“ are the supporting element with first grade importance for realization of the specific preparation in the racing period.
4. The tools for development of the sub-factor „specific speed“ are present during almost all stages of the preparation, with highest

values of the distance reached during special-preparatory stage and the stage of the early competitions.

#### REFERENCES:

1. Slavchev, A. Kisyov, K. Model of sports result in mountain running. *Journal of Athletics and Science*, No. 1 (16), 2016, p. 62-65 ISSN: 1310-3393;
2. Slavchev, A/1., Kisyov, K/1., Slavchev, I/1, I., Simeonov/2, A., Radich/2, Z. Classification of the training methods in mountain running. *Research in Physical education, Sport and Health*. 2017, Vol. 6, No.1, pp.37-42 ISSN(Print):1857-8152; ISSN(Online):1857-8160
3. Buchvarov, M. Variety of special training - Sofia: Medicine and Physical Education, 1982;
4. Buchvarov, M. Specialized Diversity in Athletics 2007;
5. Kisyov, K. Kinematic characteristics of the discipline mountain running depending on the different slopes of the course.- *Athletics and Science Magazine*, 1 (13), 2013, p. 113 - 119;
6. Kisyov, K. Criteria for categorization of mountain running courses. *Athletics and Science*, No. 1 (14), 2014;
7. Belotti, V. Training prior to winning silver at the World Mountain Running Championships (uphill only) in Kamnik, Slovenia 2010.  
<http://www.mountainrunning.net/training/Valentina%20Belotti%20training%202010.pdf> 2010 г.;
8. Dematteis, M. Training prior to winning bronze at the World Mountain Running Championships (up and down) in Tirana, Albania 2011.;
9. Zavalov, K.V. Konovalov, V.N. Variants of the organization of special training / *Mountain running*. - M :, 2014. - № 1 (10) P.10-14
10. Zavalov, K.V. Features of the construction of the training process in mountain running. "- *Omsk Scientific Bulletin*, No. 6 (92), 2010, p.182
11. Zavalov, K.V. "The structure and content of training microcycles of the stage of special training among highly qualified mountain runners" - *Omsk Scientific Bulletin*, No. 4 (111), 2012, p. 250
12. Zavalov, K.V. "Model characteristics of training mesocycles of athletes specializing in mountain running" - *Omsk Scientific Bulletin*, No. 6 (82), 2009, p. 163
13. Gasperi, M. "Training prior to winning the World Mountain Running Championships (up and down) in Ovronnaz, Switzerland 2007"  
<http://www.mountainrunning.net/training/Marco%20De%20Gasperi%20training%202007.pdf>
14. Manzi, E. "Training specific to up and down mountain races: triangular fartlek"
15. John Harding, TRAINING FOR MOUNTAIN RUNNING,  
<http://www.mountainrunning.coolrunning.com.au>;