



STUDY OF STRENGTH TRAINING IN 400 M SPRINT FOR GIRLS UNDER 18 YEARS

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ABSTRACT

Studying the different sides of 400 m sports preparation is a key factor for the proper development of sports results. Strength training is one of the most important parts of sprint running. The object of the study is sports training of athletes in the 400 m sprint, and in particular strength training. The subject is the content and volume of the annual preparation for girls under 18, specializing in 400 m sprint. We used the following methods: sports-pedagogical and technical-tactical analysis of athletes; interview; Case-study analysis; Mathematical and statistical methods. We analyzed: 16 macrocycles.

Girls under 18 years have a large set of auxiliary exercises for strength training-total of 52. Volumetric characteristics must be precisely used according to age and individual qualities. We established minimum, maximum, and average volume values of the various means in macro-, meso- and microcycles.

In conclusion, we can note the need for more scientific and methodological developments to help the process of applying specific volumes for the different strength exercises, during the different periods of annual preparation. With this study, we present relevant information for the volume and diversity of used athletic means used in practice and can help other coaches.

Key words: strength, sprint, annual preparation, women

INTRODUCTION

The specific features of the 400 meters make it one of the most attractive athletics disciplines. Achieving success in this discipline is influenced by a complex of technical and tactical factors (1, 2), combined and influenced by the moral-willed qualities of the given competitor (3).

Carrying out adequate and suitable for the individual characteristics of the athlete, sports training is a mandatory part of the sports-competitive activity (4). Management of sports training is a complex process, which should be understood as a complex of regulated actions/type, volume, and intensity of means, methods, and applicability, medical-organizational solutions, scientific-applied

apparatus for the analysis of training, pedagogical guidelines, social influences, sports regimen, nutrition, recovery, bio stimulation, etc./ on the athlete /system/, which lead to a certain sports-pedagogical goal (5, 6).

Leading a successful preparation is the main goal for every athlete and their coach. But that is not an easy task to do. Many factors are affecting the whole process. Sprint events require specific strength training depending on the length of the discipline (7). Our study is focused on 400 m for girls under 18 years of age. Different means of strength training are used in their preparation. We chose to analyze the means for strength development which are different from the running means. This includes auxiliary exercise like different kinds of jumps and exercises with external resistance. Most of the research data present less detailed information, so that is why our scientific interest led us to this matter.

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METHODS

The main aim of the study is to gather specific information about strength training in the preparation process of 400 m of the age group.

Volume values of strength drills must be very precisely done, especially for the age group under 18 years. These athletes are still growing and developing, and that is why coaches must be very careful about this side of the annual preparation. The data that we obtained is from the training diaries of athletes and their coaches. Many athletes of this age are still in the stage of establishing their main discipline, so we gathered information only from girls specializing in the 400 m dash. We managed to disclose the main training drills for the age group and present data for the absolute values in the different structural units in the annual macrocycle.

We suggest that there are specific similarities in the strength training according to the chosen types of exercises and amount of training load. As a starting point, we differentiate the strength exercises according to M. Buchvarov's theory of specialized variety (8), which divides all exercises into special, specialized, and auxiliary drills. The study concentrates on analyzing auxiliary drills used to improve strength.

We analyzed 16 macrocycles for girls under 18 years of age. The data from each separate training session is arranged in specially developed tables. Data is systemized from the tables and managed to establish the range of volume for all exercises. From the raw data, we can also point to the distribution of different drills and their inclusion or exclusion during different time periods of the annual preparation.

Table 2. Group types of exercises and measure unit

type of exercise	measure unit
exercise with external resistance and weights	ton
horizontal and vertical jumps	number of repetitions
basic exercise (crunches, push-ups, pull-ups, resistance bands, medicine balls)	number of repetitions
stair climbing	number of sessions
games	number of sessions

For the study, the following methods were applied: sport-pedagogical and technical-tactical analysis of athletes' preparation, case-study analysis; mathematical and statistical methods; interviews with athletes and coaches.

RESULTS

According to study data, athletes from this age group used up to 52 different types of strength exercises (**Table 1**). The average count from the included cases is 45 drills. This confirms the statement of different authors that this age group still needs a variety of exercises for overall development. The variety of drills can lead to a better level of development.

Table 1. Number of the used athletic means in preparation

age group	U18
number of drills	52
average of 45 different drills	

The information in **Table 2** represents the main types of exercises and their measurement unit. As mentioned before, we mainly deal with specialized and auxiliary exercises, and depending on the number of repetitions each exercise can lead to the development of different sport factor in the 400 m running. For instance, if we make a particular type of horizontal jump fast with up to 5-8 repetitions – this will improve the athlete's maximal speed. But if the same exercise is done with moderate speed but over 15-20 repetitions – this will improve the speed endurance and special endurance in 400 m.

The following tables gather the volume values through the annual preparation. Each table consists of two parts-one for the first macrocycle and one for the second macrocycle. Each macrocycle consists of several smaller structural units-mesocycles. Revealing the volume of the smaller units will give thorough information about the variation of the training load for strength. **Table 3** shows how many jumps, both horizontal and vertical, are obtained during training sessions for 400 m. Depending on the tasks of each training session the jumps are made before running sets, or after them. In our study, we even came across a drill that is for instance 300 m run in which the athlete finishes with a 50 m long jumping drill. This is extremely difficult for this age group and can even be a challenge for top athletes. If we pay attention to the first macrocycle, we can outline a tendency that from basic preparatory mesocycle to pre-competition mesocycle there is a gradual increase of the volume. Mean values start with over 200 jumps in the first mesocycle, then double in the second mesocycle. The special preparatory mesocycle consists of a slight increase and reached over 500 jumps. Then the mesocycle before competition

we estimated the largest number of jumps. The practical data follows theoretical suggestions for an increase in volume from the Unified programs for sprint and hurdle running. Logically in the competition mesocycle, there is a drop in the values because this mesocycle has an important task for an athlete – to show his full potential in the main competitions. If the athlete's work during training sessions is not calculated this can lead to exhaustion and the athlete's fatigue can show faster in the last meters of the 400 m run. And the desired effect of strength exercises is the opposite.

For the second mesocycle when the athlete is at a better level, because it has already been through the autumn-winter preparation of course the volume of this kind of work is bigger at the beginning. But the practical data shows a smaller volume of the mean value of the jumps through the following mesocycles compared to the mesocycle in the first macrocycle. We assume that this is due to incorporating more running for special and speed endurance which in a way can replace some of the jumps for these two factors of sports results.

Table 3. The volume of jump during in different mesocycles (number of repetitions)

First Macrocycle U18						
mesocycle	Basic Preparatory	Special Preparatory	Special Preparatory	Precompetition mesocycle	Competition mesocycle	Recovery +basic
month	IX	X	XI	XII	I	II
Xmin	167	260	304	396	271	237
Xmax	450	644	908	1018	686	584
\bar{x}	209	487	532,9	638	392	404,5
Second Macrocycle U18						
mesocycle	Basic Preparatory	Special Preparatory	Special Preparatory	Precompetition mesocycle	Competition mesocycle	Recovery +basic
month	II/ III	IV	V	VI	VII	VIII
Xmin	237	239	284	259	200	
Xmax	584	884	731	960	505	
\bar{x}	405	462	466	566	330	

The table below represents the volume of all exercises for strength training with external resistance. We can note the same tendency of

variation of the volume for the first macrocycle-slight increase in tone volume until the competition mesocycle.

Table 4. The volume of weight training in different mesocycles (tone)

First Macrocycle U18						
mesocycle	Basic Preparatory	Special Preparatory	Special Preparatory	Precompetition mesocycle	Competition mesocycle	Recovery +basic
month	IX	X	XI	XII	I	II
Xmin	5,78	8,87	11,75	11,76	10,31	7,68
Xmax	9,59	24,76	26,64	36,76	32,00	17,69
\bar{x}	7,68	15,90	18,04	26,31	19,43	12,05
Second Macrocycle U18						
mesocycle	Basic Preparatory	Special Preparatory	Special Preparatory	Precompetition mesocycle	Competition mesocycle	Recovery +basic
month	II/ III	IV	V	VI	VII	VIII
Xmin	10,50	6,80	11,21	8,85	4,05	
Xmax	52,02	27,58	30,85	16,70	15,70	
\bar{x}	23,44	16,28	20,54	12,27	10,13	

The figures that follow show the overall volume for the used strength exercises. **Figure 1** represents all the weight training work of the athletes. The first cycle of the preparation again marks higher values, compared to the second one. The mean total for the winter-autumn cycle is 99

tones and the mean total after the spring-summer cycle is 20 tones less. The athlete who managed to do the heaviest training load of this kind marked 275 tones, which is approximately 2 times higher than the average values.

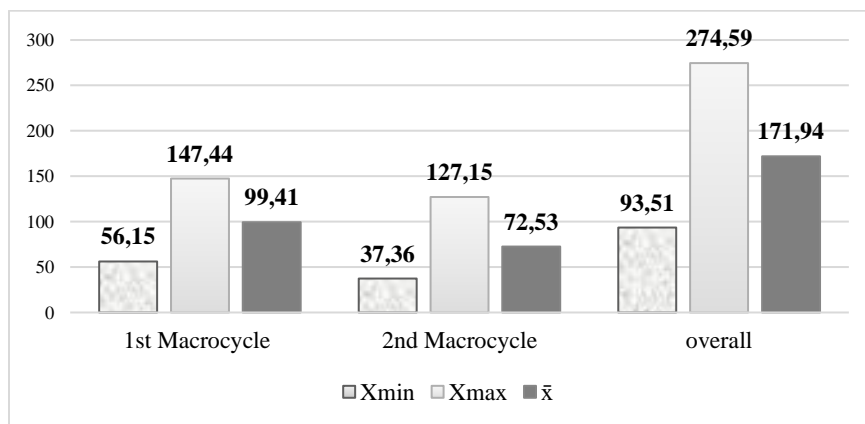


Figure 1. The overall volume of weight training during the first and second macrocycles

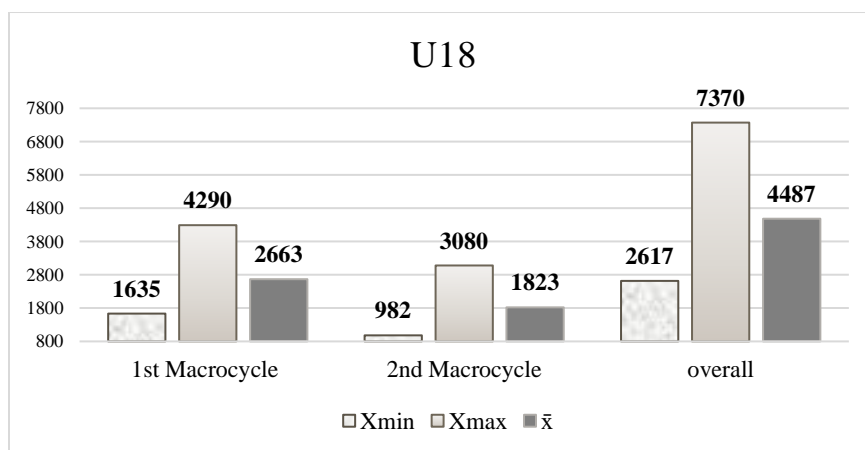


Figure 2. The overall volume of jumps during the first and second macrocycles

Analyzing **Figure 2** we can note that for the first macrocycle, the values are bigger compared to the second. The mean number of jumps in the first macrocycle is 2663 and for the second is 1823. The highest number of jumps done by an athlete is 4920 for the first macrocycle and 3080 for the second. The higher volume during the first preparation can be explained by the need for building a good base for the following hard work. Of course, the second preparation period is not as long as the first, so this is another reason for the decline in the volumes of vertical and horizontal jumps.

CONCLUSION

In this study, we try to give a starting point and important information about volume values for strength training in 400 m for girls under 18 years. Understanding the usage of particular drills, their implication in preparation, and especially the volume can provide a good prerequisite for better performance in the studied discipline. The presented data can be deemed as a framework and given the individual athletes' characteristics to be adjusted.

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