IMPROVEMENT OF PSYCHOMOTRICITY FOR JUNIOR WRESTLERS USING STRENGTH TRAINING EXERCISES

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Abstract. *The use of objectifying skills and behavioural techniques of wrestlers in training and competitions is not that old. The measurement and evaluation of the predictability components of competitive performance in the sport of wrestling is more important, given that there are no clear elements for performance quantification in this category of sports. The conversion of these components into figures allows to obtain results through which we can define their share and impact on creating competition and training models and the selection model, planning, monitoring and evaluating the effectiveness of training methods and in particular developing refined solutions by which the most efficient ways of progress can be obtained. As the field of sports training becomes more intense and competitive, coaches and scientists in the field of sports training and competition direct their concerns towards developing the best training and education content in order to improve sports performance from an early age. Our opinion is that this potential for performance is not exploited, because we are currently going through an information crisis and especially a crisis of specialists who can use this information to increase the efficiency of training children in the sport of wrestling. This study highlights the role of strength exercises in the optimisation of skills whose impact is essential, we believe, in the technical training of Greco-Roman and freestyle wrestlers and an indispensable element of future competitive behaviour.*

Keywords: *exercises, strength, Greco-Roman wrestling.*

Introduction

The preparation of juniors from an early age for competitive activity in the Olympic Greco-Roman wrestling is today's promise of tomorrow's performance. The performance strategies of Greco-Roman wrestling are currently imposed by the increased requirements of high-level competitions compared to the limits of human nature but especially by the tendency of equalisation at a very high value level worldwide. As such, these components of the performance system involve not only rigorous selection at an early age but also the approach to training young athletes by emphasising the performance-generating components from an early age, in accordance with the specific psycho-physiological potential. The age at which this sport can be practised includes the category between 9 and 12 years.

Referring to the effects of working for the development of strength in this age group, Benjamin and Glow (2003) state: "Recent literature indicates that strength training will not have an adverse effect on growth. A few studies have shown positive growth effects as long as proper nutrition and age-specific physical activity guidelines were met. However, resistance training will not affect an individual's genotypic maximum. Parents can be assured that strength training (in moderation) will not have an adverse effect on growth. Training may actually be an effective stimulus for growth and bone mineralization in children, especially for those at risk for osteopenia or osteoporosis" (p. 24).

According to Ifrim (1986), the psycho-physiological characteristics allow expressing the requirements formulated by the selection and initiation of children's training at the end of the small school age and the beginning of middle school, respectively 11-12 years. In terms of wrestling, this age provides the nervous and locomotor substrates necessary for learning complex motor skills (improving the technique) and performing speed efforts, taking into account both the complexity of the fight imposed by the technical movements and the specific effort-related requirements of the Greco-Roman wrestling style.

Thus, wrestling can be classified as an intermittent combat sport that requires maximum strength and power of the whole body, with a high anaerobic demand for metabolic energy. It is also a sport with limitations in some weight categories. Competitors are matched to others by their size. "Competitive wrestling is extremely dynamic in nature, encompassing repeated explosive movements at a high intensity that alternates with submaximal work. Thus, the primary energy systems utilized are the anaerobic adenosine triphosphate-creatine phosphate (ATP-CP) and lactic acid systems, within the scope of the aerobic system. It has been demonstrated that there are no major physiological differences between wrestlers of both freestyle and Greco-Roman styles." (Mirzaei et al., 2009, p. 2339)

Given that the methodology of learning specific techniques is respected depending on the degree of complexity in close correlation with the elements of physical training (which not only prefigures the learning of new techniques by enriching children's motor background with new specific movements, simple skills and abilities, amplifying proactively the effects of motor transfer and increasing the expressive potential of exercise capacity), focusing on the sport-specific requirements becomes an indispensable priority for early specialisation in Greco-Roman wrestling. This statement by which we aim at the early specialisation in the preparation of children can be reproached that it is not exactly right (appropriate), given the low level of expression of the exercise capacity in this age category. Our response to this hypothetical reproach consists in the very great diversity of the means of combat and the possibility of gradually and variedly approaching the individual capabilities of children of this age until they can move to another level.

In childhood, when the formation of the most important systems and functions of the body takes place, it is very important to consider the most favourable periods for the development of certain physical abilities. Identifying the laws of their development is necessary to properly organize the sports training of children initiated in Greco-Roman wrestling. For Edouard et al. (2007), the development of motor skills in healthy children occurs gradually from birth to puberty. The various motor acquisitions allow the practice of more and more varied physical activities and sports. The practice of sport becomes effective from the age of nine, which corresponds to the acquisition of technical skills, and is truly complete only from the age of 12, the age of logical and deductive intelligence and of orderly and methodical reasoning.

All this information represented both landmarks in the organization and design of our experimental research and necessary elements for the theoretical and argumentative substantiation of our research.

Methodology

Our research aims to highlight the increase in strength parameters and its influence on motor ability in children. The beginning of this approach was based on the observations made on children during the Greco-Roman wrestling training. The main method used to conduct the research was the experimental method that consisted in applying a system of stimuli to influence the qualities of strength in a group of 14 children practicing Greco-Roman wrestling; the stimuli applied were appropriate as dosage and corresponded to the functional and psychological age characteristics of children. The initial and final results were statistically processed and highlighted by the graphical method. Central tendency indicators, variation indicators (standard deviation and coefficient of variation) and other indicators were used to determine the significance of the difference between the results of the initial and final tests. We used both the Student's t-test and the single-factor analysis of variance (ANOVA). The comparative analysis showed that the differences recorded in the two tests had a high significance for the Student's test in almost all investigated parameters, but not for the analysis of variance, as will be seen in the research results.

Assumption

Regarding Greco-Roman wrestling, Chirilă (2009) stated that the manifestation of high strength parameters allows not only easier learning of combat techniques but also practising competitive wrestling with superior efficiency in terms of stability in attack and defence. That is why we believe that focusing the sports training of young juniors on a methodology for developing specific strength in Greco-Roman wrestling will positively influence the general motor skills of children in all aspects of its manifestation. The use of weight training exercises that simulate combat behaviour in the training of young fighters will significantly enrich their motor potential, increase their physical abilities and significantly contribute to the development of children's motor skills in the desire to overcome obstacles (difficulties).

We also assume that the scientific and practical substantiation of the possibility of using training means to develop the motor ability of Greco-Roman wrestlers at the prepubertal age will increase their motor potential. This may have major implications for an earlier and more sustainable approach to Greco-Roman wrestling techniques, with beneficial effects on the performance of competitive behaviour.

Through this way of working, we will approach this area by rationally developing the means of action with an accessible dosage that does not overstress the exercise capacity of children and their insufficiently strengthened musculoskeletal system at the age of growth.

Experimental approach to the problem

Our experimental research is based on practical experience and theoretical knowledge. In this study, we addressed the effectiveness of developing general body strength through appropriate structures of means as independent variables and influencing the exercise capacity related to both the strength factor and general and specific coordination.

Conditions

To effectively conduct the experiment at the sports club where we work, we needed a gym equipped with a fighting mattress for training/competitions, disc dumbbells, scales and other sports equipment to develop motor skills. Practical lessons took place in the form of training sessions, taking into account the age characteristics of students. All training lessons were designed considering the abilities of children included in the training groups and respecting the principles of sports training as regards difficulty, conscious and active participation, accessibility, etc. During training, coaches and teachers had to pay special attention to safety rules. In the Greco-Roman wrestling training of young athletes, it is necessary to observe the continuity of tasks, means and methods in a strict sequence. Of particular importance is the continuity of training and competitive loads used. When performing the training, it is recommended to strictly observe the gradualness in the process of increasing the loads according to the age characteristics of juniors, their level of training and weight category.

"A key point in the program is to use the proper technique during all of the exercises and to pay full attention to correct posture and good body control" (Gioftsidou et al., 2015, p. 95).

Duration of the research

The time interval established for applying the independent variable to the experimental group was seven weeks. The reason that led us to choose this interval, namely two mesocycles, was that, if the duration of the research had been longer than two months, a significant part of the final gains might have been affected by the natural processes of growth and development. We also considered that applying the independent variable during a single mesocycle would not have been sufficient to obtain significant results in the absence of a second mesocycle.

Research subjects

The subjects of our experimental research consisted of a group of children (n = 14) aged 9-12 years practising Greco-Roman wrestling.

We mention that, in order to carry out the research, the parents of children participating in the training sessions of the Greco-Roman Wrestling Section were consulted and agreed on the content and operating procedures of the experiment. Also, the Board of Directors of the sports club where the research took place was informed and ordered the approval of all material resources for the proper conduct of the activity.

The health of children who were part of the experimental research was examined to determine the medical conditions that might have limited the normal conduct of the experiment. The age, height and weight indicators of the 14 children in the experimental group were also analysed (Table 1).

Table 1. *Statistical parameters of the experiment group (n = 14)*

Statistical indicators	Age (years)	Height (m)	Weight (kg)
Arithmetic (A.) mean	10.07	1.44	40.71
Median	10.50	1.47	37.50
Mode	11.00	1.26	47.00
Standard deviation (St. dev.)	1.59	0.16	10.69
Coefficient of variation (Cv) %	15.79	11.11	26.25

In terms of strength training, none of the tested children had any previous experience, so it is safe to say that, from this point of view, there was equality even if the group was heterogeneous. If, from the standpoint of the participants' age and height, there is a relatively high homogeneity given by the corresponding coefficients of variation, Cv = 15.79% for age and Cv = 11.11% for height, regarding the weight of children in the experimental group, there is a greater dispersion, the individual data being properly attested by the coefficient of variation, Cv = 26.25%.

Training content

Competitive behaviour in Greco-Roman wrestling is dominated by tactical and technical movements of various kinds. The competitive execution of these tactical and technical procedures that can be performed both in attack and defence is supported by very high parameters of strength and speed, when fighters develop a very high power in the shortest possible time while maintaining the structure coordination of the action taken, regardless of adverse efforts. For elite fighters, the requirements of major competitions are very high. That is why it is necessary to offer young wrestlers, from the very beginning and in parallel with technical training, the opportunity to increase their motor potential through a training system that mainly aims to increase the level of expression of general body strength.

Unfortunately, the issue of choosing rational means and methods to improve these qualities has not yet been resolved, as there is no standardisation in developing a unique training model for Greco-Roman wrestling in our country for initiation and different age and value categories. In this sense, we proposed, as an experimental independent variable, a set of exercises for seven weekly cycles, namely two mesocycles (Table 2), the reasons being explained in the lines above.

Table 2. *Means of action for the development of strength in children and ways of use*

Means of action	Contraction type	Frequency	Duration	Sets of repetitions	Loading	Pause
25-m Speed run	Dynamic	3 times/week	7 weeks	3 x 25 m	No	30 sec
Box jumps	Plyometric	3 times/week	7 weeks	3 x	Body weight	3 min
Flexed arm hang	Isometric	3 times/week	7 weeks	3 x 3-5 sec	Body weight	3 min
Lying-down press	Dynamic	3 times/week	7 weeks	3 sets x 12 reps	55-60% of 1RM in pre-test	2 min
Belt entry with detachment	Dynamic	3 times/week	7 weeks	3 x 15 sec	With a same-weight passive opponent	1 min
Jump squats	Dynamic	3 times/week	7 weeks	3 sets x 6 reps	No	20 sec
Rope climbing	Dynamic	3 times/week	7 weeks	5 x	Body weight	2 min
50-m Flat run	Dynamic	3 times/week	7 weeks	5 x	No	2 min

All research subjects participated in an introductory training session prior to testing procedures. During this time, they were taught the appropriate technique (for example, controlled movements and proper breathing) for each exercise and were answered any questions. A warm-up session of about 10-12 minutes of low- to medium-intensity exercises, movements for joint mobility and stretching of large muscles preceded all tests. The experimental group athletes were also specified the work objectives and means and were trained in the means and methods of work. Training sessions for this strength development programme took place three times a week and lasted two academic hours each, including current topics for each training.

It is noteworthy that, during the seven weekly microcycles of the experiment, there were very few absences of children in Greco-Roman wrestling training, which allows us to say that, from this point of view, the experimental conditions were met for all research subjects.

Analysing the structure of exercises for strength development, we observe a variety of means that address muscle groups belonging to the arms, torso and lower body with different contraction types, loads and number of repetitions. For the only means of developing strength using weights (dumbbells), we applied the "progressively variable loading" method depending on the evolution of individual abilities from one microcycle to another in order to ensure over time appropriate stimuli for the constant development of exercise capacity. It can also be noted that the "Flexed arm hang" test was used only twice a week with a dosage of 3-5 sec, given that the isometric contraction type is less recommended for children at this age due to possible disturbances in the dynamics of blood circulation and heart rate.

The initial and final results of the experimental research subjects were highlighted with a battery of tests by which we measured the motor ability components considered by us as specific and representative for Greco-Roman wrestling at this level of training.

Tests

1. Standing long jump - maximum length;
2. 5 x 10 m Shuttle run;
3. High jump;
4. Flexed arm hang - maximum timed time;
5. Lying-down press - 1 Repetition Maximum (1RM);
6. 200-m Flat run - timed;
7. Belt entry with detachment - 20 sec.

The results of initial and final tests were statistically analysed to highlight the values of central tendency, and the comparative analysis was done with the help of significance tests, namely the Student's t-test and the single-factor analysis of variance (ANOVA). The coefficient of variation was also calculated by relating the standard deviation to the arithmetic mean to highlight the homogeneity of the individual data recorded.

Results

For the measurements made at the end of the experiment, the same identical conditions were provided as for the initial testing.

Table 3. *Statistical indicators of the experiment group in the initial stage (n = 14)*

Statistical indicators	Standing long jump	5 x 10 m Shuttle run	High jump	Flexed arm hang	Lying-down press	200-m Flat run	Belt entry with detachment
A. mean	144.29	18.75	21.00	12.43	21.71	46.00	9.21
Median	142.00	19.05	22.50	8.00	20.00	46.50	9.00
Mode	177.00	17.40	30.00	4.00	20.00	228.00	47.00
St. dev.	26.12	1.57	10.57	10.73	6.56	2.69	1.67
Cv	18.10	8.37	50.33	86.32	30.21	5.85	18.13
t-test	-9.80	8.08	-7.92	-1.49	-7.87	6.96	-9.88
ANOVA	0.41	9.01	0.73	0.50	1.95	5.39	8.45

t test $\alpha = 0.05$ critical t-value = 2.16 ANOVA $\alpha = 0.05$ critical F-value = 4.42
t test $\alpha = 0.01$ critical t-value = 3.01 ANOVA $\alpha = 0.01$ critical F-value = 7.72
t test $\alpha = 0.001$ critical t-value = 4.22 ANOVA $\alpha = 0.001$ critical F-value = 13.72

Table 4. *Statistical indicators of the experiment group in the final stage (n = 14)*

Statistical indicators	Standing long jump	5 x 10 m Shuttle run	High jump	Flexed arm hang	Lying-down press	200-m Flat run	Belt entry with detachment
A. mean	150.57	16.85	24.50	13.36	25.57	43.43	11.14
Median	148.00	16.80	25.50	9.00	23.50	44.00	11.00
Mode	137.00	16.20	35.00	6.00	23.00	45.00	11.00
St. dev.	26.08	1.77	11.11	11.47	7.99	3.16	1.83
Cv	17.32	10.50	45.35	85.85	31.25	7.28	16.27
t-test	9.80	-8.08	7.92	1.49	7.87	-6.96	9.88
ANOVA	0.41	9.01	0.73	0.50	1.95	5.39	8.45

t test $\alpha = 0.05$ critical t-value = 2.16 ANOVA $\alpha = 0.05$ critical F-value = 4.42
t test $\alpha = 0.01$ critical t-value = 3.01 ANOVA $\alpha = 0.01$ critical F-value = 7.72
t test $\alpha = 0.001$ critical t-value = 4.22 ANOVA $\alpha = 0.001$ critical F-value = 13.72

Comparative analyses of the results obtained in the two phases of the experimental research showed that all subjects improved their performance after the seven weeks in which the means for strength development were applied.

Regarding the "Standing long jump" test, we notice an obvious progress between the average values of the two data sets included in Tables 3 and 4.

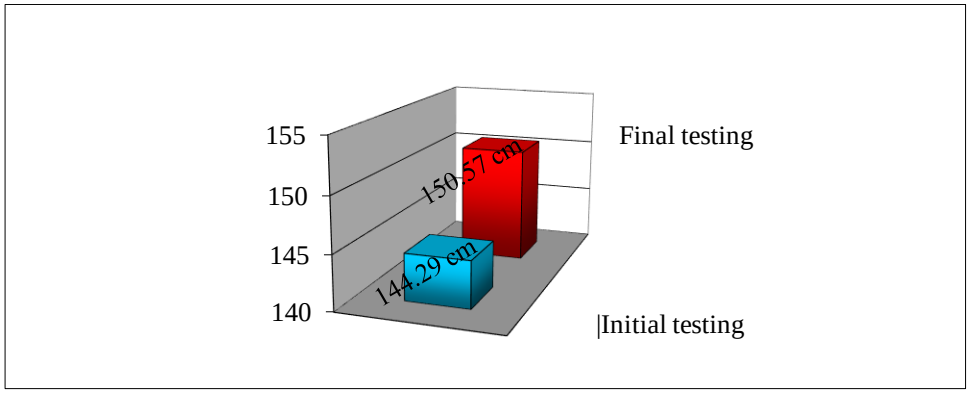

Figure 1. Average values for the "Standing long jump" test

With an average value of X = 150.57 cm in the final test compared to X = 144.29 cm as the arithmetic mean in the initial test, each of the research subjects improved their individual performance (Figure 1). The comparative analysis of the significance of differences between individual and average values of the two data sets corresponding to the two tests indicated, for the Student's test, a t-value = 9.80 ($\alpha = 0.001$ and critical t-value = 4.22) in favour of the final test. In this case, the value of significance categorically rejects the null hypothesis, the statistical causal link being very strong. But for more rigor, we compared the two individual and average data series by the single-factor analysis of variance (ANOVA), where F = 0.41 ($\alpha = 0.05$ and critical t-value = 4.42), which indicated an insignificant difference for the confidence interval P = 95% of the individual data recorded.

The "5 x 10 m Shuttle run" test, which is used to test the general skill level, showed improved individual values for all subjects in the final test, the average value being X = 16.85 sec (Table 4) compared to the initial test with an average value of X = 18.75 sec (Table 3). We observe, for each of the two tests, a high level of homogeneity corresponding to the coefficients of variation of Cv = 8.37% in the first test and Cv = 10.50% in the second test (Tables 3 and 4). Although the difference in mean values between the two tests seems relatively small (Δ = 1.9 sec), the comparative analysis for the Student's test indicates a t-value = -8.08 ($\alpha = 0.001$ and critical t-value = 4.22) in favour of the final results of the research subjects, which strongly validates the experiment hypothesis for the confidence interval P = 99.99%. (Figure 2)

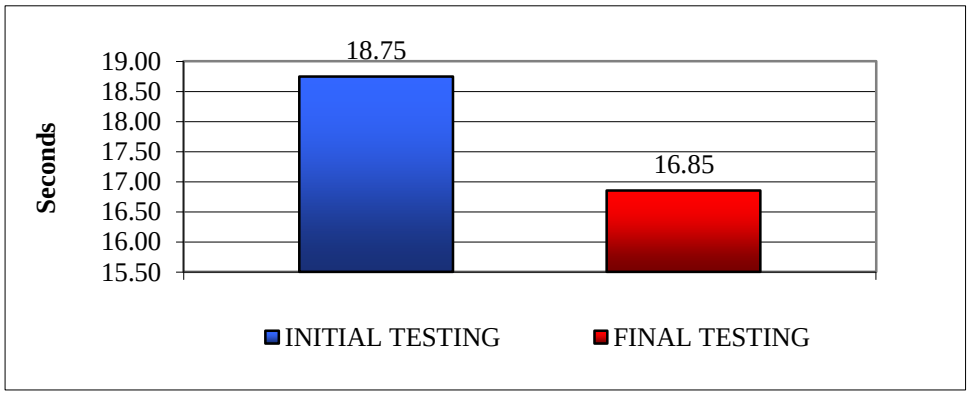

Figure 2. Comparison of average values for the "Shuttle run" test

We also observe that the experimental hypothesis is validated for this indicator by the values of the single-factor analysis of variance (ANOVA), with F = 9.01 ($\alpha = 0.01$ and critical t-value = 7.72), which indicates a significant difference in the level of confidence of P = 99%. This result may indicate that a relatively small improvement in strength parameters can significantly influence the results of skill tests.

For the "High jump" test, the individual results recorded an obvious increase between the two tests. In the initial test, the average value was X = 21 cm (Table 3) and, in the final test, the average of individual values was X = 24.50 cm (Table 4). We note, in both tests, high coefficients of variation for the research subjects, which make the individual results lack homogeneity, respectively an unrepresentative arithmetic mean. The comparative analysis provided a t-value = 7.92 ($\alpha = 0.001$ and critical t-value = 4.22) that validates the research

hypothesis, but for the single-factor analysis of variance (ANOVA), F = 0.73 (α = 0.05 and critical F-value = 4.42), the data and research hypothesis do not have enough arguments to convince. It seems that, from this point of view, the test requires different dosage (higher volume and/or workload) or the same dosage over a longer time. (Figure 3)

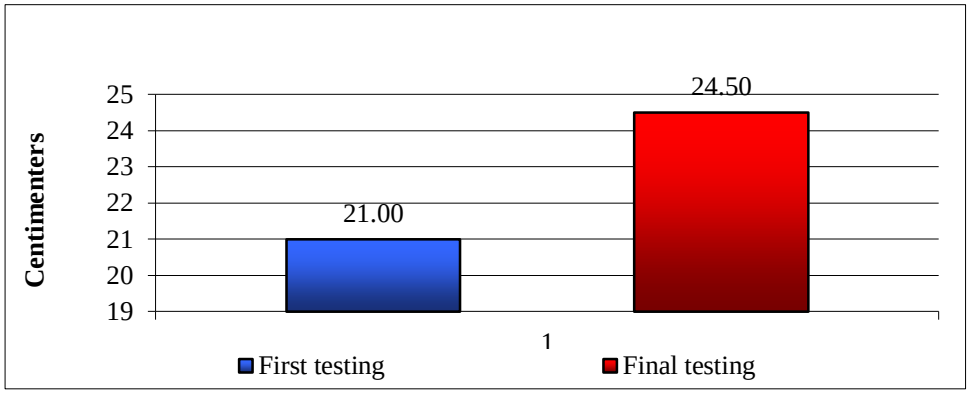

Figure 3. Comparison of average values for the "High jump" test

The "Flexed arm hang" test also indicated an increase in individual values during the experimental research. For the initial test, the mean value X = 12.43 sec with a coefficient of variation Cv = 86.32%, which makes the arithmetic mean totally unrepresentative due to the total lack of homogeneity; for the final test, the average is X = 13.36 sec with a coefficient of variation Cv = 85.85%, which also keeps for this moment a very large dispersion of individual results, which makes the arithmetic mean totally unrepresentative. (Figure 4)

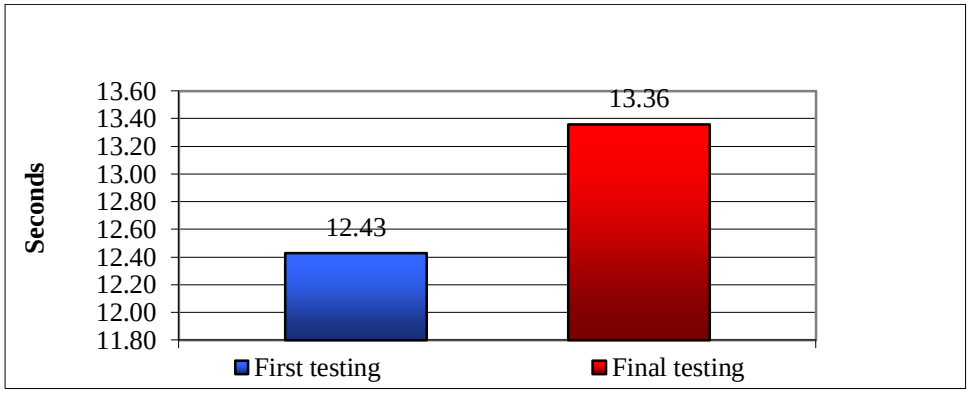

Figure 4. Comparison of average values for the "Flexed arm hang" test

The comparative analysis reveals, for the Student's test, a t-value = 1.49 (α = 0.05 and critical t-value = 2.16) in favour of the final test, indicating a lack of support in the progress made for the research hypothesis. With an F-value = 0.50 in the One-Way ANOVA significance test (α = 0.05 and critical F-value = 4.42), as in the case of the Student's test, the result does not validate the research hypothesis. We can say that the selective influence of this parameter of the experiment had a reduced volume compared to the other means of preparation, given a hypothetical negative potential for the health of research subjects.

For the "Lying-down press - 1RM" parameter, we noticed that all research subjects improved their individual and average results at the end of the experiment compared to the initial measurements. Each subject benefited from two or three attempts to perform the 1RM, being encouraged and motivated by both the coach and colleagues against a background of a high level of emulation. According to Faigenbaum (2003, p. 164), "Because untrained children and adults have more difficulty in activating their muscles, the performance of additional testing sets (with adequate rest between sets) may aid in the recruitment and coordination of the involved muscle groups. Anecdotal observations from our study suggest that a child's perception of a given weight (i.e., light, medium, or heavy) may waver during the first 3-5 testing sets. That is, as the weight load increased, some children perceived the load to be 'lighter' or 'easier' than the previous set. Further, 68% of the subjects who could not lift a given weight during their first attempt at a 1RM trial successfully completed the lift on their second attempt. Although speculative, a gradual increase in the weight used for testing, combined with additional testing sets (and a second attempt if necessary), may aid in the accuracy of strength testing in children." (pp. 164-165)

In this competitive environment, subjects were told that, when they felt they could no longer, they could do less, which led to considerable efforts made by children. Thus, the average of the final test was X = 25.57 kg compared to the initial test with an average of X = 21.71 kg. For this indicator, the coefficient of variation was Cv = 30.21% in the first test and 31.25 in the final test (Table 3, Table 4 and Figure 5), both with an average level of homogeneity.

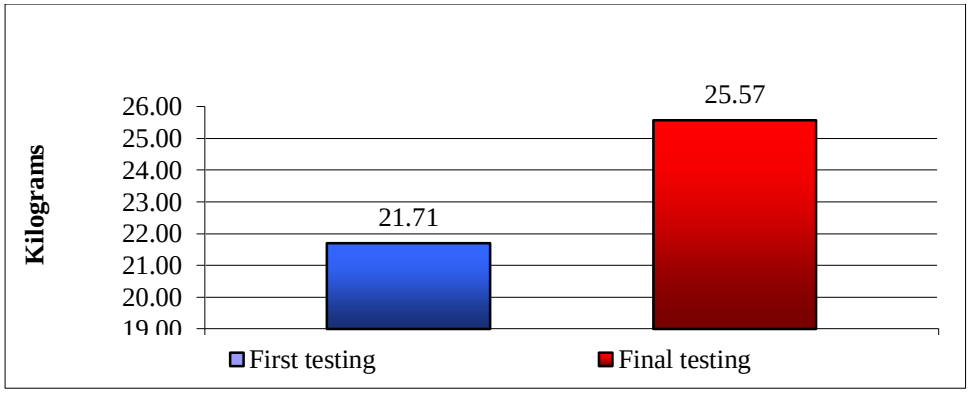

Figure 5. Comparison of average values for the "Lying-down press" test

The statistical comparison of the individual data corresponding to the two tests of the research subjects by the Student's test resulted in a t-value = 7.87 ($\alpha = 0.001$ and critical t-value = 4.22) in favour of the second test, under the conditions of a valid level for P = 99.99% of the estimated values, the null hypothesis being rejected.

The comparison of individual and average data corresponding to the two tests by the single-factor analysis of variance (ANOVA) resulted in an F-value = 1.95 ($\alpha = 0.05$ and critical F-value = 4.42), which indicates that the differences may be due to chance.

We believe that it is necessary to highlight that, both during training and the two tests, children reacted positively, developing a high degree of emulation throughout the research, in the absence of any case of injury or other incident.

For the "200-m Flat run" test, the results obtained in the first test increased for all subjects. Thus, the average value was X = 46 sec in the initial test and X = 43.43 sec in the final test (Table 3, Table 4 and Figure 6). For this means of action, the statistical calculations revealed a very high level of homogeneity of the athletes tested both at the beginning and at the end of the research by the following values: Cv = 5.85% in the first test and Cv = 7.28% in the final test (Table 3, Table 4 and Figure 6). The comparative analysis revealed a statistically attested difference with a t-value = -6.96 ($\alpha = 0.001$ and critical t-value = 4.22) for the Student's test and an F-value = 5.39 ($\alpha = 0.05$ and critical F-value = 4.42) for the single-factor analysis of variance (ANOVA), both significance tests validating the research hypothesis.

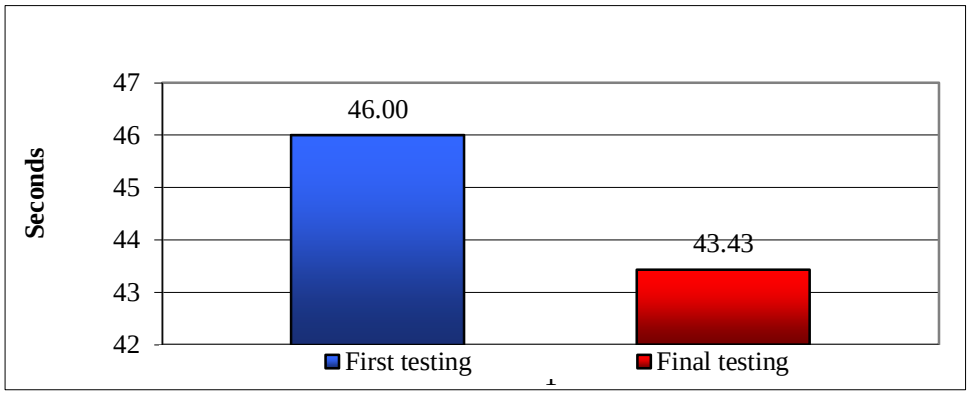

Figure 6. Comparison of average values for the "200-m Flat run" test

The "Belt entry with detachment - 20 sec" indicator was the only specific test with a solid base anchored in the specificity of Greco-Roman wrestling, being considered by us a test for specific strength, but especially for skills and coordination, because the execution of a single technique or its repetition over a period of time requires both great concentration and the orientation and rationalisation of movements, given that any movement in addition to the actual technique can lead to imbalance, desynchronisation with the partner/opponent, loss of timing, etc., and therefore a low level of mastery. During the experimental research, all athletes improved their individual performance between the two tests. In the initial test, the average value was X = 9.21 repetitions/20 sec and, at the end of the research, they recorded an average of X = 11.14 repetitions/20 sec (Table 3, Table 4 and Figure 7).

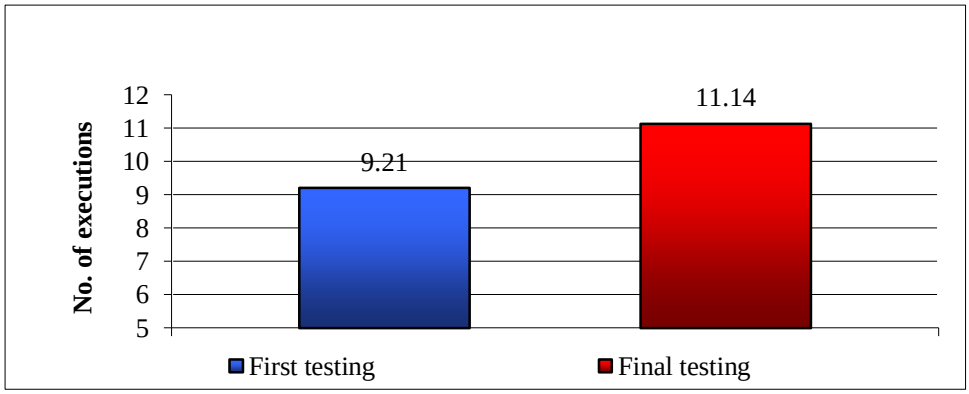

Figure 7. Comparison of average values for the "Belt entry with detachment - 20 sec" test

Analysis of the differences between the individual and average performance in the initial and final tests showed, for the Student's test, a t-value = 9.88 ($\alpha = 0.001$ and critical t-value = 4.22), a significantly high value that confirms the research hypothesis. For the One-Way ANOVA variance analysis, F = 8.45 ($\alpha = 0.0$ and critical F-value = 7.72) (Table 4), a significantly strong result that also confirms the research hypothesis.

Discussion

The methodological basis for the development of physical abilities and the proper planning of training loads must be carefully established and monitored by coaches in the training process to remove inherent risks that may occur at this age by overload.

"The physiological demand for combat sports is very high. Winning depends on the strength and power of the attacks and movements against the opponent. High levels of muscular endurance and ability to maintain high levels of muscle power, strength and speed in combat can contribute to the performance and efficiency of proper motor gesture, thus helping to improve the technical-tactical performance of athletes." (Marques et al., 2019, p. 39)

About the possibility of injury during work or tests for maximum strength in this age category, Faigenbaum et al. (2003) stated: "Growth plate fractures have not been reported in any prospective youth strength-training study that used maximal strength testing (e.g., 1RM testing methods on the leg press, chest press or arm curl exercises) to evaluate training-induced changes in children" (p. 162).

Such lesions are not usually observed in well-conducted programmes. In a study of 18 prepubescent boys undergoing a 14-week strength training programme, 13 scintigraphy assessments of the musculoskeletal system were normal. These findings suggest that, at least in the short term, the musculoskeletal systems of prepubescent children involved in a well-supervised training programme are not affected. However, long-term studies are lacking as to whether strength training affects or harms bone growth. (Tanner, 1993)

The Council on Sports Medicine and Fitness (2008) considers that, to achieve gains in strength, workouts need to be at least 20 to 30 minutes long, take place 2 to 3 times per week and continue to add weight or repetitions as strength improves.

In the same line, not only that the studies addressing this topic are relatively few, but they are also contradictory, as there are a variety of non-standard ways to conduct research: "Research that has investigated the development of strength and power has been typified by a considerable variation in the methods used. The scope of this variation makes comparisons difficult and hence definitive conclusions practically impossible" (Harris et al., 2007).

Also related to this age category in wrestling, the number of studies that refer to this type of approach is low, which has led us to address this very necessary topic in the competitive wrestling activity.

Regarding the number of strength training sessions for prepubertal children, there is a lot of research that refers to a different approach to the frequency of training per week. In general, the literature supports the effectiveness of strength training performed twice a week

(Faigenbaum et al., 2002) or three times a week (Ramsay et al., 1990). The effectiveness of strength training performed only once a week has not yet been explored in children.

There are a variety of reports from previous research on the results of strength training in children. Ramsay et al. (1990) report strength gains ranging from 25% to 35%, but over a period of 20 weeks of applying the research variables. Faigenbaum (2001) notes that gains in muscle strength of about 30% to 50% can be usually seen in the short term (after 8 to 12 weeks) with strength training programmes.

Conclusion

This study tried to determine if the development of general body strength could increase the motor ability of juniors aged 9 to 11 years. We can say that, throughout the experimental research (with few exceptions), the subjects participated in all Greco-Roman wrestling training sessions against the background of a high level of emulation. Also, given that all children's activity was permanently controlled and directed, no injuries were recorded during training or during the initial and final tests.

With the exception of the "Flexed arm hang" test, all the other indicators used to test strength confirmed the research hypothesis by significant high values for the Student's test. The single-factor analysis of variance (ANOVA) is a very sensitive test of significance and the results have partially validated the effectiveness of mostly working with strength-actuating means for the development of motor ability.

Due to the direct and powerful motivation of children to become stronger and have better muscles, as well as the requirements of Greco-Roman wrestling competitions, we think it is appropriate for these procedures to be standardised and generalised as a training model.

We also believe that further research is needed on this topic because the final results of the training using means for the development of general body strength create favourable predispositions for children practicing Greco-Roman wrestling.

References

Benjamin, H. J., & Glow, K. M. (2003). Strength training for children and adolescents. What can physicians recommend? *The Physician and Sportsmedicine, 31*(9), 19-26. https://doi.org/10.3810/psm.2003.09.482

Chirilă, M. (2009). *Modalități de evaluare a performanței luptătorilor în competiție: Curs de instruire pentru antrenorii de lupte* [Ways to evaluate the performance of wrestlers in competition: Training course for wrestling coaches]. București: CNFPA, FRL.

Council on Sports Medicine and Fitness. (2008). Strength training by children and adolescents. *Pediatrics, 121*(4), 835-840. https://doi.org/10.1542/peds.2007-3790

Edouard, P., Gautheron, V., D'Anjou, M.,-C., Pupier, L., & Devi, X. (2007). Training programs for children: Review of the literature. *Annals of Rehabilitation and Physical Medicine, 50*(6), 499-509. https://doi.org/10.1016/j.annrmp.2007.04.015

Faigenbaum, A. D. (2001). Strength training and children's health. *Journal of Physical Education, Recreation & Dance, 72*(3), 24-30. https://doi.org/10.1080/07303084.2001.10605847

Faigenbaum, A. D., Milliken, L. A., & Westcott, W. L. (2003). Maximal strength testing in healthy children. *Journal of Strength and Conditioning Research, 17*(1), 162-166.

https://doi.org/10.1519/1533-4287(2003)017%3C0162:mstihc%3E2.0.co;2

Faigenbaum, A. D., Milliken, L. A., Loud, R. L., Burak, B. T., Doherty, C. L., & Westcott, W. L. (2002). Comparison of 1 and 2 days per week of strength training in children. *Research Quarterly for Exercise and Sport, 73*(4), 416-424. https://doi.org/10.1080/02701367.2002.10609041

Gioftsidou, A., Barbas, I., Turlykhanov, D., Podlivaev, B., Tünnemann, H., Sahmouratov, Y., Curby, D., Mirzaei, B., Malliou, P., Beneka, A., Giannakou, E., Aggeloussis, N., & Godolias, G. (2015). Wrestling + new structures for youth wrestling. *International Journal of Wrestling Science, 5*(2), 93-97. https://doi.org/10.1080/21615667.2015.1107663

Harris, N., Cronin, J., & Keogh, J. (2007). Contraction force specificity and its relationship to functional performance. *Journal of Sports Sciences, 25*(2), 201-212. https://doi.org/10.1080/02640410600630910

Ifrim, M.(1986). *Antropologie motrică* [Motor anthropology]. București: Editura Științifică și Enciclopedică.

Marques, V., Coswig, V., Viana, R., Leal, A., Alves, F., Alves, A., Teles, G., Vieira, C., Silva, M., Santos, D., & Gentil, P. (2019). Physical fitness and anthropometric measures of young Brazilian judo and wrestling athletes and its relations to cardiorespiratory fitness. *Sports (Basel), 7*(2): 38. https://doi.org/10.3390/sports7020038

Mirzaei, B., Curby, D. G., Rahmani-Nia, F., & Moghadasi, M. (2009). Physiological profile of elite Iranian junior freestyle wrestlers. *Journal of Strength & Conditioning Research, 23*(8), 2339-2344. https://doi.org/10.1519/jsc.0b013e3181bb7350

Ramsay, J. A., Blimkie, C. J., Smith, K., Garner, S., MacDougall, J. D., & Sale, D. G. (1990). Strength training effects in prepubescent boys. *Medicine & Science in Sports & Exercise, 22*(5), 605-614. https://doi.org/10.1249/00005768-199010000-00011

Tanner, S. M. (1993). Weighing the risks: Strength training for children and adolescents. *The Physician and Sportsmedicine, 21*(6), 104-116. https://doi.org/10.1080/00913847.1993.11710386