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BIOMECHANICAL ANALYSIS-CONTRIBUTION TO MUSCLE ELASTIC FORCE DEVELOPMENT SPECIFIC TO SPRINTING ATHLETES

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Abstract

At present, the importance of the development of the explosive muscular force in training the high performance sprinter is beyond discussion. The practical experience has been consolidated from this standpoint for more than a few decades. In exchange, the contents have considerably evolved for the last years. Initially inspired, for the greatest part, from the bar bells techniques, there have gradually appeared contents better adapted to the characteristics of the activity and consequently, more specific.

*Key words***:** explosive muscular force propulsive force, flying phase, support phase, muscular chains.

Introduction

The objective of the present exposition is to contribute to defining an assembly of exercises aiming at the development of the specific muscular force starting from a biomechanical analysis.

Our attention will be directed, in the present case, towards the phase of running in full speed (Trouillon, P).

In general, the runner's muscular activity will be organized around three main functional elements.

2. Means and methods

Propulsion: the runner acts upon the ground through the intermediary of a unilateral support (on a leg). During the interaction ground-sole, the propulsive forces are applied to the runner, and the muscular strain is maximal. The development of the muscular force may be deemed as a propitious means for obtaining the best efficiency of the motion. The present paper will mainly focus on the analysis of this functional element (Ionescu-Bondoc, D, 2007).

Equilibration (development of the muscular support pelvis –trunk): rigidity of the connection pelvis-trunk is determined as regards the efficacy of the support. As a matter of fact, the runner has to be considered as a deformable mechanical system (Şerban, M., Cotariu, D., 1970). At the moment of the support, the reaction forces of the soil may provoke the relative drive of certain elements of this assembly, some in relation to others (basin-trunk) (Center of Research for E.F.S). This effect is not to be desired to the extent in which it may totally or partially annul the dynamic effect of the soil reaction, leading this way to an objective aimed at. Driving the abdominal dorso-lumbar muscles may considerably reduce the deformation of the pelvis-trunk connection during the support phase, contributing this way to a better efficacy of the support (Center of Research for E.F.S). Consequently,

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the exercises of development of the muscular force, of the so-called "muscular support for the assembly pelvis-trunk ", will constitute a constant element of the specific work in sprint. Dynamic equilibrium of the body in motion and continuity (enlacement) of the actions: during the support phase, the central axis of the body carries out a rotation movement around the support leg (Pithip, V., Rozumowski, U, 2007). This rotation movement has to be at the same time extremely quick forwards and stopped at the end of the support for the maintenance of the general equilibrium of the body during the flight (aerial) stage which will follow.

The free segments (in the first place, the free, osculating leg and in the second place the arms) ensure great part of this double function. In the framework of the work of development of the muscular force there has to be taken into consideration the muscular strain which ensured the sequence of return forwards and of impending of the free leg (Zatsiorski, V.M, 2005).

The amplitude, the frequency of the running step and the "cycle of the step" stand for the most frequently used technical indicators in order to assess the efficacy of this step. The present study aims at specifying the modifications of the cinematic parameters of the running step in connection with the optimization of the frequency and/or of the amplitude during the running phase "in full speed" for the sprinters and hence deduce the new requirements that the muscular chains should answer to, which ensure the phase of support of the running. Eventually, we will infer out of this analysis a series of organizational principles for the development of the speed runner's specific muscular force.

Explosive force training in sprinters.

During the last 20 years, especially after the PG years, the training of explosive force in the sprinters has constituted one of the most important factors in achieving performance. In settling an optimal program, there have to be taken into consideration certain factors: the athlete's chronological age, his/her general physical development, the years of practicing the athletics, the level of training, the period of training (Zatsiorsky, V. M., 2000).

There was noted that during the last years, many trainers use the same ideas and theories. After 1977, there was used a new system in which there were made exercises with dumb bells, afterwards multiple jumps and which ended with short sprints. This system was used by the Italian trainer Carlo Viitori, and it is deemed to be erroneous. However, the practice has proved the contrary, the results not lingering, especially after having been adopted in the USA.

The reason for this style of work is simple, so that the sportsman should manifest an explosion, he/she has to work at maximum frequency during a long period of time, there also being avoided the accidents. The explanation for this system is the following: when there is executed the training with dumb bells, the contractions are concentric, therefore the muscle is rarely extended or elongated (Pithip, V., Rozumowski, U.). To this purpose there has been resorted to an experimental study upon the sprinters' behaviour through the method of the repetition of some series **of quick grazing step,** on different distances.

The research had been developed since the 15th of January up to the 15th of April 2007, in the framework of L.P.S. Brasov.

All the eight subjects at the beginning of the research were tested at the five events, plus the one we proposed (50 m running with quich razing step) : 30 m running downward start, 30 m running launched start, 100 m running downward start, long jump without running start, triple jump without running start, 50 m running with quick grazing step (proposed event).

3. Results

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Initial testing Table 1

SUBJECTS	30 m a.S.j	30 m a. S. l	100 m a.S.j	Long jump no running	triple no running	50 m running steps	
						Nr steps	time
S 1	4,32	3,1	11,8	2,35	8,29	22	8,9
S 2	4,35	3,3	12,0	2,3	8,25	23	9,01
S 3	4,32	3,24	11,85	2,35	8,27	22	8,91
S 4	4,2	3,1	11,5	2,4	8,35	20	8,89
S 5	4,4	3,3	12,4	2,34	7,93	23	9,11
S 6	4,3	3,21	11,75	2,38	8,3	21	8,9
S 7	4,26	3,1	11,7	2,4	8,3	21	8,91
S 8	4,2	3,12	11,5	2,45	8,35	22	8,9

Final testing Table 2

SUBIECT.	30 m a.S.j	30 m a. S. l	100 m a.S.j	Long jump no running	triple no running	50 m running steps	
						Nr steps	no running
S 1	4,27	3,08	11,61	2,46	8,39	20	8,5
S 2	4,2	3,25	11,92	2,35	8,36	21	8,8
S 3	4,28	3,21	11,63	2,41	8,39	21	8,7
S 4	4,1	3,05	11,31	2,61	8,45	19	8,4
S 5	4,27	3,27	12,05	2,39	8,2	21	8,8
S 6	4,25	3,18	11,5	2,49	8,39	20	8,4
S 7	4,2	3,07	11,45	2,5	8,4	20	8,7
S 8	4,1	3,05	11,3	2,64	8,45	20	8,5

4. Conclusion

As we note, from the final testing the program submitted for the rationalization and standardization of the working values has fulfilled the tasks proposed by:

- the working volume during the 4 months used for the development of the force, of the resistance, of the motric qualities prevailing in the event.

- working intensity upon effort stages as well as the speed for going through the different distances of training.

- the distances and the number of repetitions during the training used for the development of one of the mentioned motric qualities. Calculating the signification of the differences among the averages of the correlated samplings, at the initial testing and at the final testing, "t" calculated seemed to be higher than the "t" present in the "Fischer'a Table of values", which confirms the working hypothesis and rejects the void hypothesis, with a percentage of probability of 99,99%.

References

Şerban M, Cotariu D, *Biochimia contracţiei musculare*, Edit. Academiei Bucureşti, Belgium, 1970, p. 300-310.

Center of Research for E.F.S.: *Bazele ştiinţifice ale antrenamentului sportive* Scientific Bases of Sportive Training (11) A.T.A.M. vol.XIII

Center of Research for E.F.S.: *Antrenamentul sprinterilor în sportul de performanţă*, Sprinters' Training in Performance Sport, nr.182

Ionescu-Bondoc D, *Pregătirea specializată în atletism*, Editura Univ."Transilvania" din Braşov, 2007.

Pithip V, Rozumowski, U.: *Modelul teoretic al antrenamentului alergătorului* , Theoretical Model of the Runner's Training.

Trouillon P, *Antrenamentul în atletism, abordarea fiziologică în sportul de performanţă*, Training in Athletics, Physiological Approach in Performance Sport, nr.104

Zatsiorski V.M, *Ştiinţa şi Practica Antrenamentului de Forţă*, INCS., Bucureşti, 2005, p.94 -124.

Zatsiorsky V. M, *Biomechanics în sport*, Editura Blackwell Science, 2000, p.284-325.