The effect of age on sprinting performance during acceleration in long jump athletes

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Abstract

Objective of the study is to study the peculiarities of the influence of the age factor on the manifestation of speed and strength qualities in the run–up phase of long jumpers.

Methods and structure of the study. The study involved 35 young athletes specializing in the long jump. The participants were divided into two age categories: the first group included athletes aged 15.5±0.6 years, and the second – 18.4±0.6 years. Using regression analysis methods, a measure of the influence (determination) of various factors on the result of the long jump was established. The indicators characterizing speed and strength qualities, flexibility, general and explosive strength, as well as the speed of sprinting were considered as predictors.

Results and conclusions. Over the years, the importance of sprint speed for the successful long jump has increased, due to a complex of biological changes. Predicting the results of long jumps for athletes of different age groups becomes more accurate when using tests that measure the explosive strength of the muscles of the lower body.

Keywords: *long jump, explosive force, run-up phase, repulsion, influence of age factor, jump efficiency.*

Introduction. Jumps are complex motor actions consisting of a run-up phase (cyclic movement), push-off phases, flight and landing (acyclic actions). The oldest jumping discipline in track and field is the long jump.

Scientific research has confirmed that a significant factor in achieving high results in long jumpers is the level of development of speed-strength qualities [4]. In highly qualified jumpers, the percentage of influence of speed qualities on the sports result is 89.5%, in jumpers of mass sports categories – 84.9% [5]. Among the special physical qualities of a long jumper, explosive strength is of the greatest importance.

The effectiveness of the jump is ensured by achieving the maximum run-up speed at the moment of push-off, which allows transforming the inertia of the run into the maximum push-off force. In highly skilled athletes, the running speed at the moment of placing the push-off leg on the take-off bar is 90-95% of the maximum sprint speed and reaches a level of 10.50 m/s to 11.23 m/s [5].

Using highly skilled long jumpers as an example, it was found that a higher level of maximum run-up speed is associated with a higher running speed one meter before the take-off [1].

The maximum speed that long jumpers strive to develop during the run-up is significantly inferior to the maximum speed of a sprinter [3]. Jumpers of mass sports categories show an insufficient level of development of speed qualities during the run-up. Therefore, training for their development contributes to the formation of athletic skills in a long jumper.

Objective of the study is to study the features of the influence of the age factor on the manifestation of speed-strength qualities in the run-up phase of long jumpers.

Methodology and organization of the study. The sample of subjects of the study consisted of 35 young male long jumpers, who, depending on age, were divided into two subgroups: 15.5±0.6 years (height: 171.0±7.83 cm, body weight: 57.8±5.3 kg);

18.4±0.6 years (height: 184.4±6.6 cm, body weight: 77.4±3.2 kg). The dependence of the results in long jump on the age factor was studied at the beginning, during and at the end of the age period of development. The subjects performed the following tests: long jump, medicine ball throw from a sitting position, medicine ball throw from a lying position, medicine ball throw backwards over the head, standing long jump, standing triple jump, standing high jump, shoulder twisting with a stick, forward bend while standing on a bench, splits, 20 and 30 m running.

The subjects performed each test twice with a pause of at least 3 minutes between repetitions. The best result of two attempts was counted.

Statistical analysis was performed using the SPSS version 21.0 package based on regression analysis. Statistical significance was determined at the level of $p<0.05$.

Research results and their discussion. According to the analysis of biomechanical characteristics, the long jump belongs to the group of complex spatial movements, and according to the type of motor activity – to natural movements without the use of technical devices. Of all the mechanical factors, the greatest influence on the level of results in long jumps is exerted by the run-up speed, the magnitude of the take-off impulse and the take-off angle [2].

A statistically significant influence of the age factor on the results of performances in long jumps was established; for 15-year-old athletes – at the level of 40.4%, for 18-year-old jumpers – at the level of 51.5% of the total variability. For 15-year-old boys, a statistically significant relationship between individual indicators was established in the tests – standing high jump, standing triple jump and forward bend while standing on a bench; for 18-year-old athletes, statistically significant values of the regression coefficients were found in the tests – standing high jump, 20 m run, throwing a medicine ball backward over the head, throwing a medicine ball from a sitting position, 30 m run and throwing a medicine ball from a lying position (Tables 1, 2).

The study found that a high level of speed abilities is a significant factor influencing the athletic performance of the long jump. With age, the positive effect of sprint speed increases, which can be explained by many factors that influence the indicators of speed abilities during biological development. During student age, when the full formation of basic motor abilities ends, the quality of the long jump is largely determined by the individual functional capabilities of the athlete.

A higher maximum run-up speed contributed to the generation of greater repulsion force and acted as an indicator of a higher explosive strength potential of the subjects.

With increasing age of the athlete, the number of exercises that have a statistically significant effect on the result of the long jump increases due to greater isolation of motor abilities and physical qualities. This means that they all act as independent factors influencing motor structures of varying complexity. With the expansion of the motor potential in the process of human biological development and sports training, the specificity of the manifestation of physical qualities significantly increases the number of factors determining the athletic result.

Conclusions. Based on the data obtained, it can be concluded that the basis of the special physical qualities of a long jumper is primarily the explosive

Table 1. Statistics of multiple regression analysis in a group of 15-year-old long jumpers

Indicator	R	R- square	β	betainc (p)	betainc (q)
Seated Medicine Ball Throw	0,42	0,06	0,01	0,45	0,93
Medicine Ball Throw from Prone Position	0,34	-0,12	-0,17	4,87	0,22
Medicine Ball Backward Overhead Throw	0,51	0,13	0,16	7,95	0,19
Long jump from a standing position	0,60	-0,8	-0,12	7,54	0,36
Triple jump from the spot	0,64	0,21	0,24	12,57	0,04
Standing high jump	0,63	0,36	0,45	22,09	0,06
Shoulder rolls with a stick	-0,7	-0,4	-0,3	0,21	0,59
Standing Forward Bend on a Bench	0,33	0,21	0,15	4,43	0,02
Sit in the splits	0,35	0,11	0,15	3,85	0,16
20m dash	-0,53	-0,12	-0,12	6,23	0,21
30m dash	-0,43	-0,09	-0,09	4,32	0,29

Table 2. Multiple regression analysis results in a group of 18-year-old long jumpers

Indicator	R	R- square	β	betainc (p)	betainc (q)
Seated Medicine Ball Throw	0,26	-0,16	-0,25	6,39	0,03
Medicine Ball Throw from Prone Position	0,38	0,15	0,26	7,76	0,04
Medicine Ball Backward Overhead Throw	0,45	0,24	0,22	8,26	0,02
Long jump from a standing position	0,49	-0,07	-0,05	2,73	0,58
Triple jump from the spot	0,55	0,13	0,15	7,62	0,04
Standing high jump	0,57	0,32	0,37	21,76	0,01
Shoulder rolls with a stick	-0,26	-0,22	-0,05	0,01	0,09
Standing Forward Bend on a Bench	0,26	0,13	0,11	2,62	0,14
Sit in the splits	0,17	0,09	0,05	0,73	0,42
20m dash	-0,35	-0,22	-0,24	7,42	0,12
30m dash	-0,41	-0,15	-0,14	5,43	0,08

power of the lower limbs of the horizontal and vertical type. The length of the jump directly depends on the running speed before the push-off phase, which allows us to build a predictive model of the run-up speed. Effective prediction of the results of long jump performance by athletes of different ages is possible based on the results of tests to assess the explosive power of the lower limbs.

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