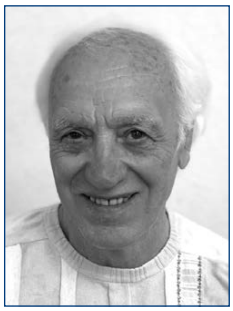
Manifestation of the maximum motor possibilities of a human in run in the second phase of ontogenesis

UDC 796.012.412.5



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Abstract

Objective of the study was to identify the features of changes in the indicators of maximum motor capabilities in running among veterans who regularly go in for sports based on their personal achievements in the age range of 35–105 years.

Methods and structure of the study. Data from the IAAF Sheet World Athletics World Record for Veterans in the 100m and 5,000m dashes were used, reflecting the display of speed and endurance.

Results and conclusions. In the age range of 35–75 years, the indicators of the maximum values of motor abilities in running decrease according to a linear law, approximately by 6–9% for each age decade or by 0.6–0.9% annually. After the age of 75, the values of both maximum speed and endurance indicators begin to decrease much more intensively. In the range from 75 to 85 years, this decrease is from 12.1 to 27.9%. In the age range of 85-95 years, an even more intense decrease in maximum motor abilities is observed: 26.2-40.6%. After the age of 95, the amount of regressive development of motor abilities can exceed 5% per year. The obtained patterns of the dynamics of maximum motor abilities in running (maximum speed and endurance) reflect the general biological pattern of the regressive development of locomotor functions in the second phase of human ontogenesis.

Keywords: *motor abilities, human ontogeny, sports veterans, athletics, 100m run, 5000m run, elderly people.*

Introduction. The ability to move is given to man by nature. This innate ability to move is called a motor or locomotor function and is described by motor capabilities, which are understood as a complex of morphofunctional features of the body, physical qualities, motor skills, abilities and health [2]. Motor function develops naturally from birth, up to about 18 years of age 20 years, and can be stimulated by sports exercises [1, 2]. After 30-35 years of age, a process of decrease in motor abilities is observed, which is especially noticeable after 60-65 years [1, 2, 4]. Professor V.K. Balsevich [1]. Although a lot of work has been devoted to the study of locomotor function after the age of 65, nevertheless, researchers have encountered significant difficulties. This is due to the fact that motor function is affected by its natural decline with age, as well as a sedentary lifestyle and diseases [2,4,5]. Recently, the highest achievements in athletics have been recorded among sports veterans in the age range of 35–105 years [3]. This opens up new possibilities in the study of motor function and its changes with age. It was assumed that the regularities of the dynamics of motor abilities at an older age can be identified by studying the maximum indicators obtained when setting world records by track and field veterans who continue to play sports regularly almost until the end of their lives.

Objective of the study was to identify the features of changes in the indicators of maximum motor capabilities in running among veterans who regularly go in for sports based on their personal achievements in the age range of 35–105 years.

Methods and structure of the study. We used data on the highest world achievements in athletics among veterans in the 100-meter run, reflecting the manifestation of speed, and in the 5000-meter run, reflecting the manifestation of endurance. For this, the IAAF Sports Veterans List was used [3]. Since the

result in a 100-meter run consists of several factors - reaction time, starting acceleration, the achieved running speed at a distance and its decrease at the finish line - only the Vmax indicator was used in the study - running speed in the middle of the distance, which is close to the maximum speed. This value in practice is estimated by a simple formula: Vmax = 100 / (T-Tlosses). For highly skilled runners, Tlosses is typically around 1 second. It was assumed that the loss of time for acceleration and at the finish line increases with age according to the same law as a sports result changes. Therefore, the formula for estimating Vmax in a 100m run was as follows: Vmax =100/(T100-0.1T100), where T100 is a sports result, s. To assess endurance, the distance running speed indicator is used, calculated by the formula: Vav = 5000m/T5000. The determination of the regression relationships of the studied indicators with age, as well as the assessment of their reliability, was carried out on the basis of the Excel application package.

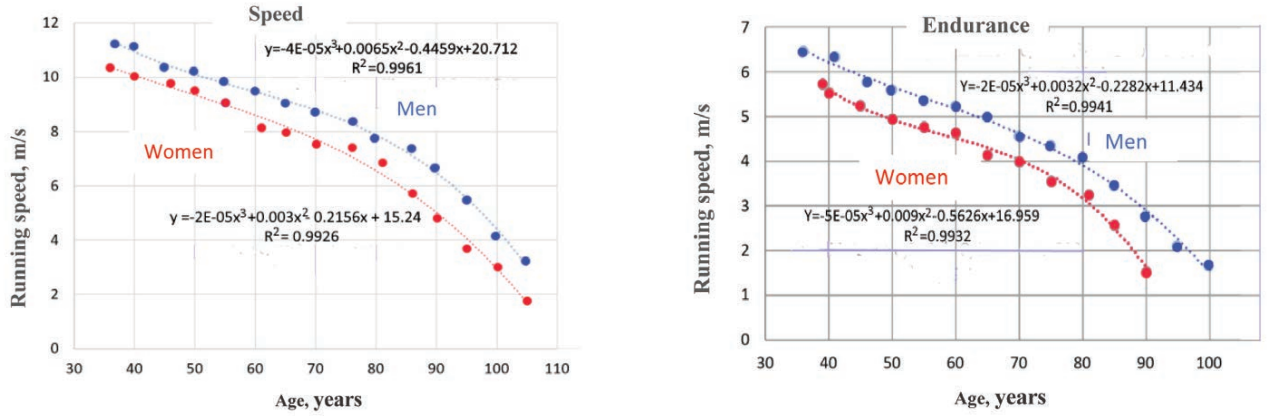
Results of the study and their discussion. It was revealed that the manifestation of maximum speed capabilities and endurance changes approximately according to the same law in the range of 35–105 years, with a high level of reliability described by a polynomial of the third degree (Table 1, figure).

The decrease in the studied parameters with age occurs unevenly. In the period of 35–75 years, the indicators of motor abilities decrease according to a linear law, approximately by 6–9% per decade or by 0.6–0.9% annually (Table 2). This pattern corresponds to the previously obtained by V.K. Balsevich [1] data on the regressive development of locomotor function at the age of 40–65 years. After the age of 75, the indicators of both maximum speed and endurance begin to fall much more intensively. From 75 to 85 years, this decline is from 12.1 to 27.9% per decade. In the age range of 85–95 years, the decrease in maximum motor abilities is even more intense: 26.2–40.6%. After 95 years of age, the amount of regressive development of motor abilities exceeds 5% per year. According to reviews [4–6], strength and speed of muscle contraction decrease with age, motor reaction time increases, and testosterone levels decrease by about 10% every decade in the range of 40–65 years. This explains the linear decrease in running speed. Age-related changes leading to a decrease in lung capacity by about 1% per year, a decrease in the ability to maximize oxygen consumption, a decrease in cardiac performance, an increase in resistance to peripheral blood flow, a decrease in the conductivity of the nerve fiber of the lower extremities and mitochondrial oxidative capacity by about 10% per decade explains a linear decrease in the manifestation of endurance at the age of 35 to 75 years [4-6].

However, a sharp drop in motor abilities after 75 years has not yet received a sufficiently substantiated scientific explanation. This is due to the fact that the study of age dynamics in this range is very difficult, since lifestyle, the level of physical activity, genetic

Table 1. *Dynamics of indicators of maximum speed capabilities and human endurance in the range of 35–105 years.*

Age, years	Maximum running speed, m/s		Average running speed for 5km, m/s	
	Men	Women	Men	Women
35+	11,18	10,34	6,47	5,72
40+	11,11	10,02	6,35	5,52
45+	10,36	9,79	5,78	5,23
50+	10,21	9,51	5,60	4,94
55+	9,83	9,07	5,37	4,76
60+	9,49	8,15	5,23	4,63
65+	9,02	7,98	5,00	4,14
70+	8,70	7,54	4,56	3,98
75+	8,38	7,41	4,36	3,55
80+	7,74	6,83	4,09	3,25
85+	7,37	5,73	3,46	2,56
90+	6,66	4,80	2,77	1,52
95+	5,44	3,68	2,09	
100+	4,15	3,02	1,66	
105+	3,22	1,76		



Dynamics of indicators of manifestation of maximum motor abilities (maximum running speed and endurance) in the age range of 30–105 years

predisposition, and the presence of diseases have a strong influence [2,4,6]. The data obtained on the basis of studying the world records of track and field veterans obviously reflect the biological pattern of the development of the human body in ontogenesis, since these data are not random outliers, but reflect the results close to the personal achievements of the elite group of track and field athletics veterans who lead a healthy lifestyle and maintain training process throughout life.

According to experts [4,6], negative age-related changes can be compensated to some extent by physical culture and sports. However, in our case, such compensation is hardly possible, since veterans of the sport, noted in the list of world record holders, have been training regularly for a long time and have been in the top group of the best world results for decades. Therefore, the dynamics of world records is close to the age dynamics of personal records of the strongest track and field athletics veterans.

Conclusions. The obtained patterns of the dynamics of maximum motor abilities in running (maximum speed and endurance) reflect the general biological pattern of the regressive development of locomotor functions in the second part of human ontogenesis: a linear decrease in the range of 35–75 years, approximately 1% per year, and then accelerated up to 105 -years of age (up to 5% per year).

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