

Influence of Baromassage on the Performance and Functional State of the Locomotor Apparatus of 100-Meter Runners with Barriers

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Abstract: The article discusses the impact of baromassage on the performance and functional state of the musculoskeletal system of 100-meter hurdlers. In athletes specializing in 100 m hurdles, at the stage of sports improvement, the main load falls on the muscles of the lower extremities and torso. With the growth of the technical skills of female athletes, there is a tendency to increase local overloads of the musculoskeletal system (LMA).

Keywords: baromassage, functional state, musculoskeletal system, local overloads, blood circulation, muscle tone, joint mobility, special motor mode

The training activity of athletes specializing in 100 m hurdles at the stage of sports improvement is characterized by a significant increase in the volume and intensity of the training load with a predominance of running, jumping and strength-oriented exercises. Therefore, the main load falls on the muscles of the lower extremities and torso (17).

With the growth of the technical skills of athletes, there is a tendency to increase local overloads of the musculoskeletal system (MLA), which leads to a violation of blood circulation and muscle nutrition, and, as a result, a deterioration in their metabolism, which affects the intensity of the recovery processes. This leads to an increase in muscle tone, their soreness, and limited mobility in the joints. The consequence of this is the development of functional and organic disorders of the musculoskeletal system, an increase in injuries, a decrease in sports performance and premature termination of sports activities, which is confirmed by the data of a number of special studies conducted in this direction (4, 7, etc.).

With this in mind, scientists and experts recommend paying close attention to the prevention of functional disorders, diseases and injuries of the musculoskeletal system that occur when exposed to excessive physical exertion (7, 10, 11, etc.). The most common and effective ways to solve this problem include the systematic use of various restorative agents (14, 16).

Along with the focus on preventing functional disorders in the state of the musculoskeletal system, another no less significant aspect of the problem of using restorative means is the acceleration of restorative processes, as a necessary condition for the effective use of ever-increasing training loads (5, 13, 14).

Experts come to the conclusion that the problem of restoring the functional state of the musculoskeletal system of female runners at the stage of sports improvement becomes as important as the issues of programming and organization of training influences (5, 6).

Therefore, the rational management of recovery processes aimed at restoring special performance and preventing functional disorders in the state of the musculoskeletal system leads to an increase in the efficiency of both a separate training session and the entire system of training athletes (8).

It is noted that recovery means or their complexes should be applied taking into account indicators that objectively and reliably reflect the nature and degree of fatigue (14).

One of the most popular and effective means of recovery is baromassage, performed with the help of a pressure chamber. Kravchenko (12).

Included in the training process of 100-meter hurdlers, baromassage as a restorative means of ODA should give a positive result, as evidenced by both the results of our research and literature data (1, 2, 9, 10, etc.). It can also be assumed that its efficiency will increase even more when combined with a special motor regime (SDR).

Purpose: to evaluate the effectiveness of the effect of baromassage in combination with SDR on the effectiveness and functional indicators of the ODA of hurdlers for a mesocycle .

Research methodology. To conduct the study, we used baromassage with a regimen developed by Yu.P. Denisenko (1986). The essence of the mode: decompression was created three times in succession, equal to the height of 800 m, 1200 m and 1700 m on the altimeter scale, with an exposure of 60 seconds, after the first and second rise in the chamber for 15 seconds. a compression of 0.10 - 0.15 atm was created. After the 3rd rise, compression was not created.

In our work, we used SDR, which is understood as a set of special exercises that help eliminate local overloads of certain muscle groups. In 100 m hurdlers, the main load falls on the muscles of the lumbar spine, thigh and lower leg, which experience overload (3, 7). Therefore, athletes of this specialization were assigned a set of exercises developed by us. These exercises are aimed at strengthening the muscular corset of the lower spine and developing the strength of the muscle groups of the front and back of the thigh and lower leg. They are also aimed at stretching and relaxing these muscles in a dynamic mode to eliminate metabolic disorders and relieve muscle hypertension and, first of all, normalize blood supply and muscle trophism (12, 15), since these muscles are in a state of prolonged tonic tension.

In the course of the study, the dynamics of the special working capacity of female hurdlers was assessed in terms of the level of development of physical qualities (speed, special endurance, speed-strength indicators and mobility in the lower extremities).

In athletes, the indicators characterizing the functional state of the musculoskeletal system were also determined in dynamics. Such as the tone of the muscles of the thigh, lower leg and ipsilateral tension of the multifidus muscle of the lumbar spine; mobility of the lumbar spine and leg mobility in the hip and ankle joints in the sagittal plane; rheography of the leg.

When planning the use of these recovery tools in the training process of 100m hurdlers, we conducted a special study to evaluate the effectiveness of baromassage in combination with SDR when included in one of the four-week mesocycles. The 15 athletes who took part were divided into two groups. Athletes of the first group used baromassage once a week in combination with SDR included in the training process. Athletes of the 2nd group did not receive restorative agents and served as controls.

Research results. The indicators characterizing the state of the musculoskeletal system in the direction of their improvement during the training mesocycle are most pronounced in the athletes of the 1st group, in the athletes of the 2nd group these indicators either slightly improved, or remained unchanged, or even worsened. However, the dynamics of the studied indicators in athletes of the 1st group was not the same. Thus, the total mobility of the lumbar spine in the sagittal plane increased during the mesocycle in athletes of the 1st group by 8.1 ± 0.4 mm ($P < 0.05$) due to an increase in forward inclination by 4.5 ± 0.1 mm ($P < 0.05$) and back by 3.6 ± 0.1 mm ($P > 0.05$). In athletes of the 2nd group, the total mobility of the spine practically did not change, even acquiring a tendency to limit extension (Table 1).

The mobility of the right leg in the hip joint in athletes of the 1st group increased by $4.6+0.3$ degrees. ($P < 0.05$) and on the other $4.5+0.4$ deg. ($P < 0.05$). Athletes of the 2nd group showed a tendency to limit mobility in the hip joints: on the right by $0.8+0.2$ degrees. ($P > 0.05$), on the left - by $0.9+0.2$ degrees. ($P > 0.05$).

The mobility of the foot in the ankle joint also changed markedly during the mesocycle. Thus, the total mobility (flexion + extension) of the right ankle joint in athletes of the 1st group increased by $4.8+0.3$ degrees. ($P < 0.02$) almost uniformly due to an increase in extension by $2.2+0.2$ degrees. ($P < 0.05$) and flexion by $2.6+0.1$ degrees. ($P < 0.05$). In athletes of the 2nd group, the same indicators of the right foot acquired a tendency to decrease. The total mobility decreased by $0.9+0.08$ deg. ($P > 0.05$), due to the limitation as extension by $0.6+0.07$ deg. ($P > 0.05$), and bending by $3+0.06$ degrees. ($P > 0.05$). Similarly, the mobility of the left ankle joint in athletes of the corresponding groups changed.

The amplitude of the tone of the rectus muscle of the right thigh in athletes of the 1st group increased by $0.28+0.05$ relative units per mesocycle. ($P < 0.01$), athletes of the 2nd group by $0.11+0.02$ relative units. ($P > 0.05$). The amplitude of the tone of the biceps muscle of the same thigh increased in athletes of the 1st group by $0.35+0.04$ relative units. ($P < 0.01$), and the amplitude of the tone of the gastrocnemius muscle of the right leg increased by $0.38+0.03$ relative units, respectively. ($P < 0.01$). In athletes of the 2nd group, the amplitude of the tone of these muscles did not change significantly, there was only a slight tendency to increase (statistically unreliable), respectively, by $0.09+0.02$ relative units. ($P > 0.05$) and $0.09+0.02$ rel. ($P > 0.05$). Similar changes in the amplitude of the tone of these muscles were observed in the left limb.

Analyzing the amplitude of muscle tone, it can be seen that the most noticeable increase was observed in athletes of the 1st group who used restorative agents (statistically significant). This indicates an improvement in the functional state of the muscles. In athletes of the 2nd group, if a slight increase in the amplitude of muscle tone was observed, then this occurred either due to a decrease in muscle tone in a relaxed state (calf muscle), or due to a slight increase in muscle tension. Stabilization of the amplitude of the tone of the studied muscles, apparently, indicates the absence of growth in the functional capabilities of the lower extremities.

The dynamics of rheographic indicators indicates that the means of restoration significantly improve blood supply, by reducing the tone and tension of the walls of blood vessels, as well as increasing the tone of vessels of small diameter. Thus, the steepness of the slope of the systolic wave after the use of restorative agents increased on average in athletes of the 1st group by 4.9 ± 0.7 degrees. ($P < 0.05$), and in athletes of the 2nd group, who did not use special restorative agents, only $1.5 + 0.3$ degrees. ($P > 0.05$). The rheographic index, which also characterizes the tone of large vessels, has acquired a tendency to increase in all athletes, but not to the same extent. In athletes of the 1st group - $0.33+0.13$ rel.un. ($P > 0.05$), and in athletes of the 2nd group only by $10+0.06$ relative units. ($P > 0.05$). The decrease in the tone of large vessels in athletes during training sessions indicates the adaptation of the circulatory system to the increased needs of tissues in the blood.

The tone of medium and small vessels was judged by the dirotic index. It increased in group 1 athletes by $12.5+0.6\%$ ($P < 0.05$), and in group 2 athletes only by $4.0+0.8\%$ ($P > 0.05$).

The index of elasticity of the vascular wall, i.e. modulus of elasticity, during the experiment decreased in the athletes of the 1st group by $4.4+0.6\%$ ($P < 0.05$), in the athletes of the 2nd group, who did not use restorative agents, by $2.3+0.6\%$ ($P > 0.05$).

The results of studies on the effect of baromassage on the physical qualities of 100-meter hurdlers showed that all runners improved both the results in running at the main distance and the test results, but not to the same extent (Table 2).

Thus, the results in the 100-meter hurdles improved among athletes of the 1st group by 16+0.08 seconds. ($P > 0.05$), in athletes of the 2nd group by 0.06+0.09 sec. ($P > 0.05$), and in the 300 m run, respectively, by 2.84 + 0.21 sec. ($P < 0.05$) and 1.61+0.09 sec. ($P > 0.05$). The running time of 30 m from the move for the athletes of the 1st group decreased by 0.12+0.01 sec. ($P > 0.05$) and in athletes of the 2nd group by 0.04+0.01 sec. ($P > 0.05$). In a ten-fold jump from a place, the increase in the result for athletes of the 1st group was 62.3+4.4 cm ($P < 0.05$), for the athletes of the 2nd group it was 42.3+6.1 cm ($P > 0.05$). The results in shot throw improved by 56.2+6.6 cm ($P < 0.05$) and 23.7+3.2 cm ($P > 0.05$), respectively.

Table 1 Change in joint mobility indicators per mesocycle depending on the use of rehabilitation means, ($X \pm <x>$)

Group	Joint mobility indicators										
	In the lumbar region L			L e g s (deg.)		Right foot (deg.)			Left foot (deg)		
	Forward	Naza	Sum	Right	Left	feat ness	fold nie	bent over ie	feat ness	unbending nie	bending
II n = 7	4.5±0.1	3.6±0.1	8.1±0.3	4.6±0.3	4.5±0.3	4.8±0.2	2.2±0.1	2.6 ±0.2	4.4+0.2	2.4±0.1	2.0 ±0.12
	$P < 0.05$	$P > 0.05$	$P < 0.05$	$P < 0.05$	$P < 0.05$	$P < 0.05$	$P > 0.05$	$P > 0.05$	$P < 0.05$	$P > 0.05$	$P > 0.05$
III n = 7	1.1±0.07	1.0±0.05	2.1 ±0.09	0.8 ±0.04	0.9±0.02	0.9±0.06	0.6 ±0.03	0.3±0.03	1.1±0.03	0.8 ±0.1	0.3±0.04
	$P > 0.05$	$P > 0.05$	$P > 0.05$	$P > 0.05$	$P > 0.05$	$P > 0.05$	$P > 0.05$	$P > 0.05$	$P > 0.05$	$P > 0.05$	$P > 0.05$

Table 2 Change in competitive results and indicators of physical qualities for a mesocycle depending on the use of funds recovery, ($M \pm o$)

Groups	Time	Running 100 m ^A	Indicators of physical qualities					
			Running 30 m from the move (sec)	Long jump s/m (cm)	Triple jump s/m (cm)	Run 300 m (sec)	10 -fold jump from a place, (m)	Shot throw (m)
II n = 7	At the beginning of the mesocycle	14.36±0.07	3.50±0.05	261.5±4.2	776.2+10	43.11±0.09	23.69±0.43	12.46+0.22
	At the end	14.20±0.09	3.38±'0.03	276.2+3.81	802.4+12	40.21±0.11	24.31±0.38	13.02+0.14
		$P < 0.05$	$P < 0.05$	$P < 0.05$; $P < 0.05$	$P < 0.05$	$P < 0.05$	$P < 0.05$	$P < 0.05$
III n = 7	At the beginning of the mesocycle	14.30±0.06	3.46±0.04	258.6±3.8	780.3+12	42.94±0.12	23.71±0.51	12.45±0.17
	At the end	14.24±0.08	3.42±0.0	267.4±4.2	812.6+11	41.35±0.12	24.13±0.33	12.69±0.34
		$P > 0.05$	$P > 0.05$	$P < 0.05$	$P > 0.05$	$P > 0.05$	$P > 0.05$	$P > 0.05$

Note: Group I used baromassage with SDR; - the group did not use restorative agents. P - reliability of differences between the original and final values of the studied indicators

Conclusion. From all of the above, it can be stated that the use of the restorative agents proposed by us during the mesocycle (4 weeks) improves the functional state of the musculoskeletal system of 100-meter hurdlers by improving the blood supply to the lower extremities, mobility and tone.

Also significantly, by 1.5-2.5 times, the results in control exercises improved in comparison with athletes who did not use these restorative agents during training. However, the use of baromassage in combination with SDR improved the results to a greater extent - in the 30-meter run and shot throw, in the long jump and the triple from a place.

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