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The effect of jogging training with central axis resistance on some anaerobic capacities, Vo2max index, and 400-meter running performance under 20 years of age

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Abstract

The research touched on the use of resistances added to the central limb of the body to develop the special strength endurance of the general muscle groups in the lower limb in particular, and the resulting development of the special anaerobic capabilities and the Vo2 max index, in order to bring about the required physical improvement and demonstrate the extent of the impact of these exercises on some of the anaerobic physical capabilities specific to the performance stages. He ran 400 meters, which is related to the rate of special speed, speed endurance, and special endurance, as well as revealing and contributing to the development of achievement. The researcher used the experimental method and identified the research population in a deliberate manner, consisting of young 400 m runners at the Sports Talent Center affiliated with the Ministry of Youth and Sports, who were (10) under (20) years old. They were divided into two groups with (5) runners for each group. The first group carried out anaerobic training. By adding resistance (weighted clothing) to the central axis, and leaving the second group to their daily training, the experimental group carried out force-Endurance exercises for the various muscles of the lower axis limb by adding weights to the limb. These exercises took two months, with two training units per week, for a total of (16) training units, and the researcher arrived at A number of conclusions, the most important of which are that all anaerobic capabilities, the Vo2 max index, and performance have improved as a result of the exercises used.
Keywords: Vo2 max index, central limb, central weights, anaerobic capacity.

Introduction

The 400-meter competition is one of the short-distance running competitions in athletics. The time to cover the distance as short as possible is the determining factor for achievement, which the coach and competitor work to improve by preparing special exercises to develop the athletic level by focusing on developing the special physical abilities required to achieve excellence in this competition. Taking into account the type of training used and the physical capabilities specific to this competition .[1]

It is known that the dominant energy system for 400-meter runners is the anaerobic system. The focus on training the anaerobic capabilities of the competitors in this competition, using training methods and methods, inevitably leads to the development of special physical ability, especially special endurance. Repeating the steps with high efficiency without decreasing speed means continuing muscular work with the same intensity required to complete the requirements of this race according to the anaerobic energy system. Also, the physical abilities specific to the type of event and its training help the competitor to improve the production of the necessary strength despite the state of fatigue.[2] Anaerobic abilities of all kinds (such as special speed training, special endurance, strength endurance, and performance endurance within the competition time) are one of the most important physical abilities that a 400-meter racer needs, which can be improved by using special resistance added to the body mass and determining the central axis of the body and according to the anaerobic system associated with exerting effort. More continuous and in less time than the race distance .[3]

Strength endurance exercises for the muscles of the peripheral axis linked to the central axis that contribute to executing the physical effort using resistances added to the central axis (added weights) are among the most important exercises that develop the work of the muscle groups contributing to the performance of running movements in the lower peripheral axis for a relatively long period and with the highest possible intensity suitable for a 400-meter race distance. One meter is considered one of the effective exercises in physiologically adapting the working muscles and what it requires of continuing maximum muscle contraction throughout the time of the competition, as the muscles of the legs, arms or torso play a major role in the integration of the performance application with the highest efficiency ,[4] with the body weight participating in this. Absolutely exercises in a way that can affect the endurance of the lower limb muscles positively if they are used according to this mechanism.[5]

Hence the importance of research into using resistances added to the central limb of the body to develop the endurance of the special strength of the general muscle groups in the lower limb in particular, and the resulting development of the special speed and the Vo2mmax index, in order to bring about the required physical improvement and demonstrate the extent of the impact of these exercises on some of the anaerobic physical capabilities of the stages. 400-meter running performance, which is related to the rate of special speed, speed endurance, and special endurance, as well as revealing and contributing to the development of achievement. The problem of the research was crystallized in that the 400-meter running competition depends on the ability to endure strength and the continuation of muscle contraction for a relatively long time to ensure the continuation of rapid repetitive movements and a continuous force push to perform the steps with high effectiveness, and this requires focusing on developing the general muscles during running, the muscles of the lower limb, especially the one on which it falls. The burden of carrying the total mass of the body and overcoming external forces (such as gravity), so the researcher wanted to use resistances (weights) added to the central axis of the body and to use anaerobic exercises and reduce the stages of the competition to reach some scientific solutions that contribute to developing the special anaerobic capabilities for the 400 m competition for youth and the index. Vo2max and according to the performance of these movements, and the researcher believes that training using resistances added to the central axis may give a positive effect in developing the special muscular work of the peripheral axis during performance and creating a state of development in this work for a period that may reach the time of the competition, and thus the researcher worked on preparing special exercises for resistances. For the purpose of working to increase the mobilization of these muscles and stimulate them to work for the longest possible time that matches the time of the competition while continuing the physical effort.

The research aimed to prepare force-Endurance exercises for the various muscles of the lower axis extremity by adding weights to the central extremity of the research sample, and to identify the effect of using these exercises on some of the anaerobic capabilities of the 400-meter running performance stages and the Vo2max index of the research sample. The researcher assumed that there are statistically significant differences between the test (pre-post) in specific anaerobic abilities and the Vo2max index for the research sample. And there are statistically significant differences between the test (pre-post) in achievement for the research sample.

Research methodology and procedures

The researcher used the experimental method to suit the nature of the research. The researcher identified the research population in a deliberate manner from young 400 m runners to the Sports Talent Center affiliated with the Ministry of Youth and Sports, who numbered (10) under (20) years of age. The researcher divided the sample into two groups with (5) runners for each group. The first group carried out anaerobic training in addition to Resistors to the central axis, and left the second group to their daily training, and used the following research tools: content analysis, personal interview, technical observation and experimentation, tests and standards. He also used rhythm stopwatches that measure time to the nearest 0.01 of a second (4). Sony video device. Heavy equipment (heavy clothing).

Each group undergoes a pre-test to determine its condition before introducing the experimental variable, then applies the proposed exercises, and then conducts the post-test. The first group performs special strength endurance exercises for the muscles of the peripheral axis, while the second group performs regular endurance exercises. Both exercises are performed using a high-intensity interval endurance method.

Determine the measurements and tests used

1. 400 meter running test.
2. Special anaerobic capacity tests that include the following:
3. Run 70 meters test from a low start (special speed)
4. Test of running 200 meters from standing (special speed endurance)
5. Endurance running test, specifically running 500 metres
6. RAST Anaerobic Endurance Test (Fatigue Index)
7. Indirect Vo2max indicator test.

The researcher conducted the pre-tests over a period of three days, 11/2-4/2020. A 70-meter running test was conducted first, giving a rest for (20 minutes), then a 400-meter race was conducted for both groups on 11/2/2020, and running tests were conducted. 200 meters and 500 meters with an interval of (30 minutes) rest on the second day, 11/3. Then the researcher conducted a special endurance test (RAST) on the third day, 11/4/2020, for the two research groups.

The researcher used high-intensity interval training with resistance loading on the center (torso) to be applied to the muscles, joints, ligaments, and joints of the lower peripheral axis of the muscles working for the body parts. The resistances were determined according to the weights of the body parts and the total body weight, and the duration of the load was determined by determining the maximum times. Through the pre-tests, training is done for specific parts and

distances of the race distance according to the stages of performance, and a rest period is given between repetitions by adopting the rest time in relation to the effort time, and determining the intensity used according to the maximum times approved for the training distances that were specified within the pre-tests.

The training program for the experimental group was started using weights added to the central axis at a ratio of 0.03 of the total body weight with the approved running exercises, and the control group was left to the same running exercises without adding any weight. These exercises took two months (with two training units per week (every Sunday and Wednesday). That is, implementing (16) training units. The time of the training unit took (35-45) minutes, and the total training volume was standardized for the two groups. It was conducted under the same conditions as the pre-tests, on 1/2/4/2020 AD.

Results and discussions

Table 1. Shows the results of the pre- and post-tests regarding the anaerobic capabilities under investigation for the experimental group

Variables	Units	Mean Diff.	Std Diff.	(t) value*		Meaning of differences
				calculated	Sig.	
Special speed	Sec.	0.25	67.0	3.701	0.000	Sig.
Endurance speed	Sec.	0.45	0.872	5.615	0.002	Sig.
Endurance strength	Sec.	5	1.179	4.238	0.012	Sig.
Special Endurance	Sec.	1.95	0.378	5.156	0.000	Sig.
Anaerobic capacity	watt/s	4.5	1.384	3.251	0.005	Sig.
Vo2 max	ml / kg / min	7.4	2.385	3.102	0.008	Sig.
Achievement	Sec.	2.15	0.482	4.46	0.016	Sig.

* Significant at the significance level (0.05) and in front of degrees of freedom (5-1=4)

Table 2. Shows the differences between the results of the pre- and post-tests in the physical variables of the control group

Variables	Units	Mean Diff.	Std Diff.	(t) value*		Meaning of differences
				calculated	Sig.	
Special speed	Sec.	0.27	0.174	1.543	0.69	Non Sig.
Endurance speed	Sec.	0.47	0.191	2.460	0.078	Non Sig.
Endurance strength	Sec.	6	5.084	1.18	0.126	Non Sig.
Special Endurance	Sec.	1.90	0.564	3.365	0.008	Sig.
Anaerobic capacity	watt/s	1.5	1.154	1.30	0.102	Non Sig.
Vo2 max	ml / kg / min	2.8	0.894	3.120	0.032	Sig.
Achievement	Sec.	0.52	0.227	2.289	0.331	Non Sig.

* Significant at the significance level (0.05) and in front of degrees of freedom (5-1=4)

Table 3. Shows the differences between the control and experimental groups in the posttest in the physical variables under investigation

Variables	Units	Experimental group		Control group		(t) value*		Meaning of differences
		Mean	Std	Mean	Std	calculated	Sig.	
Special speed	Sec.	9,8	0.21	10.2	0.113	3.336	0.014	Sig.
Endurance speed	Sec.	27	0.336	29.2	0.698	4.571	0.003	Sig.
Endurance strength	Sec.	35	0.490	38.5	0.167	3.766	0.000	Sig.
Special Endurance	Sec.	69.75	0.618	72.31	0.894	4.448	0.035	Sig.
Anaerobic capacity	watt/s	8.2	1.25	13.5	2.31	5.310	0.000	Sig.
Vo2 max	ml / kg / min	50.9	4.61	46	3.65	3.685	0.003	Sig.
Achievement	Sec.	52.55	0,95	54.11	.0570	3.131	0.04	Sig.

* Significant at the significance level (0.05) and in front of the degree of freedom (4+4-2=6)

It is clear from Table (1) that the significance level values for all tests were less than the significance level (0.05) and in front of the degree of freedom (4), and this indicates the significance of the differences between the pre- and post-tests and in the physical variables and achievement for the experimental group.

It is clear from Table (2) that the significance of all of the control group was greater than the significance level (0.05) and in front of the degree of freedom (4) except for special endurance and (Vo2 max), and this indicated the non-significance of the differences between the pre- and post-tests and in the physical variables and achievement for this group. As for the differences in the results of the post-tests between both groups, significant differences appeared in all special physical abilities in favor of the experimental group. All special physical abilities were greatly affected by the special strength training of the experimental group members. The development that occurred in the results of these ability tests indicated the effect of these exercises in developing the general muscle groups in the movements of extension and flexion on the joints related to these movements ,[6] so that the time of contraction and relaxation force was as short as possible, which ensured a decrease in the running time (70 meters), which expresses the individual's ability to exert the highest rates of rapid and explosive force to obtain the lowest rate of acceleration. It reflects the athlete's achievement of the highest speed represented by a decrease in the time for covering this distance (the race distance), as most specialized studies indicate that the increase in force is inversely proportional to time. And directly with speed, with relative stability to mass .[7]

Rapid endurance training led to an increase in rapid and explosive muscle strength and a rapid response to produce the highest muscle power according to the type of resistance used and increasing it gradually. This means increasing its kinetic energy represented by increasing the speed of muscle frequency (contraction and relaxation) ,[8] which was reflected in the results of the tests. Dimensionally for this group, while the differences did not appear significant among members of the control group, as some researchers believe that muscle fibers have the ability to produce great force during the use of endurance and explosive force exercises that depend on body weight as a resistance force, and thus the number of working motor units will increase. Its ability to produce kinetic energy increases accordingly. [9]

This indicates the development of the efficiency of these muscles and within the ranges of movement specific to the performance, which was based on the principle of force change during the ranges of the joints responsible for movement, which gave an understanding of the extent of the development of the explosive and rapid strength of the members of this group through the large distance that was covered during a specific number of jumps. [10]

It was also expected that there would be an improvement in the speed endurance of the experimental group as a result of the use of peripheral resistances while performing running movements for different distances, compared to the control group. Regular speed was maintained as the differences were clear between the two groups, while the force endurance capacity increased, which is the most important ability to continue running efficiently. High as a result of training the peripheral resistances used by the experimental group during the various stages of running represented by the tests that the researcher used at the distances of 70 metres, 200 metres, and 500 metres, and achieving high efficiency of these abilities in the experimental group. Some studies indicated that it is best to develop momentum during the contact period. Short for the feet in the acceleration phase by using resistances linked to the body weight.[11]The experimental group who practiced special exercises had the best result in the VO2 index as one of the best indicators of cardiovascular fitness and aerobic endurance. Theoretically, the more oxygen you can use during high-level exercise, the more ATP energy you can produce in your body's cells. This is often the case with elite endurance athletes, who typically have very high VO2 values. [12]

Conclusions

1. A clear superiority emerged for members of the experimental group, which focused on achieving a starting speed over a distance of 70 meters for the first acceleration stage.
2. Training to develop speed endurance using weights added to the limbs of the body worked to integrate this ability.
3. The exercises used achieved development in the endurance level of the experimental group.
4. The athlete's access to regular speed and maintaining it for a distance greater than the race distance was due to the development of the muscle's endurance ability to continue running for the longest possible time due to the resistances used and to achieve better achievement.
5. Development of an indicator in the VO2 index as a result of the special strength training exercises for the experimental group.
6. The traditional stereotypical exercises were not effective in developing the special abilities of the control group.

Recommendations

1. In order to reach the highest speed, runners must definitely focus on developing their strength using peripheral resistance.
2. At the same time, they must make an effort to achieve a speed endurance commensurate with the high-effort muscle work using resistance.
3. Ensure strength endurance training because it has a clear effect in increasing the ability of the muscles to continue exerting force throughout the race distance.
4. Ensure that the mechanical foundations are known and understood optimally because they are linked to the training aspects and also linked to the integration of the physical characteristics of this competition in order to know the extent of development achieved during the use of training programs.
5. Emphasizing on the trainers and those in charge of the training process the necessity of periodically monitoring the particular force variable in determining the rate of speed.
6. Developing training curricula and planning them practically and on scientific foundations so that they benefit and reach the best high levels.

References

1. Ahmed Shaker Farman. The effect of a proposed training curriculum for special endurance on the achievement of running the 400 m freestyle among female students of the College of Physical Education - University of Baghdad, unpublished master's study, Baghdad, Iraq, 2006.
2. Azal Abdul Hussein Abdul Jalil. The effect of a proposed educational curriculum in teaching the effectiveness of the long jump using educational aids, unpublished master's study, University of Karbala, Iraq, 2014,
3. Bastawisi, Muhammad Othman. Encyclopedia of Athletics (Tactics - Training - Learning - Refereeing), 1st edition. Dar Al-Qalam and Distribution, Kuwait, 2000.
4. Haider Balash Jabr: The effect of two methods of aerobic training on the development of some functional and chemical indicators, muscle electrical activity, and achievement among junior middle-distance runners, doctoral thesis, University of Babylon, Iraq, 2009.
5. Frank Abdul Karim Al-Fadhli.The effect of variable resistance training in improving the work and ability of the leg muscles, published research, Journal of Physical Education, No. 1, Issue 12, 2003.
6. Sayed Abdel Maqsoud, Theories of Sports Training, Physiology of Strength Training, 1996.
7. Samir Musalat Al-Hashemi, Mathematical Biomechanics, Mosul, Dar Al-Kutub Publishing House, 2nd edition, 1999.
8. Qasim Al-Mandalawi and others, Training Foundations for Athletics Events, 5th edition, Higher Education Press, Mosul, Iraq, 1998.
9. Muhammad Sobhi Hassanain, Measurement in Physical Education and Sports, 2nd edition, Dar Al-Fikr Al-Arabi, Cairo, Egypt, 1995.
10. Muhammad Abdul Hassan Al-Hajami Special endurance and its effect on some functional variables and the level of achievement in running the 400 m, doctoral thesis, unpublished, College of Physical Education, University of Baghdad, Iraq, 1995.
11. Castiel Wilmore. Physiology of sports and exercise. Champaign: Human Kinetics. .2012.
12. Athab, N. A. (2019). An analytical study of cervical spine pain according to the mechanical indicators of the administrative work staff. Indian J. Public Health, 10(5), 1349.
13. Athab, N. A., Hussein, W. R., & Ali, A. A. M. (2019). A Comparative Study for Movement of Sword Fencing Stabbed According to the Technical Programming in the Game of Fencing Wheelchairs Class B. Indian Journal of Public Health, 10(5), 1345.
14. Jumaah, H., Ktaiman, A., Abdul, N., Athab, K., & Mohammed, A. (2008). The Effect of Using Pain Management Techniques in the Rehabilitation of Chronic Lower Back Injury in Athletes and Non-Athletes. Journal of Global Pharma Technology, 10(7), 78-82.