

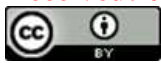
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The effect of varying training volumes on developing maximum speed, measuring certain mineral levels in the body, and performance in the men's 100-meter sprint

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Abstract

The importance of the research: This study aims to design training exercises that vary training volume from different starting positions over various distances, allowing sufficient time for physical recovery between repetitions and sets. Through the researcher's modest experience, a weakness was observed in the ability to reach maximum speed. Periodic laboratory tests, which assist coaches in assessing players' health status and have a direct impact on performance in the 100-meter sprint event, were also highlighted. The experimental program was used in the research procedures, and a sample of elite 100-meter male sprinters in Iraq, consisting of (12) athletes, was tested. The sample was divided into two groups: an experimental group and a control group, with (6) athletes in each. The most important finding was that the results demonstrated significant statistical effects of varied training volume exercises on the research variables, with a favorable difference in post-measurements. The researcher recommended that the Iraqi Central Athletics Federation organize training courses and present significant advancements in sports training science and related disciplines through modern studies and research. and this achieves one of the sustainable development goals of the United Nations in Iraq which is (Good Health).

Keywords

Training volume variation, maximum speed, mineral levels, 100-meter sprint performance.

Introduction:

Raising the level of training components in a standardized manner achieves high results in the race, and in order for the athlete to maintain their progress to a good level, it is necessary to take into account the contents of the training program and align it with the scientific foundations that help increase their physical and vital efficiency. This is because the ability to achieve maximum speed is related to the distance covered in the shortest possible time, and it has an effective connection to the type and specificity of training, ranging from the shortest to the longest distances. Emphasizing diversity and increasing the

difficulty in using the training load for the effectiveness of the 100-meter race enhances results, given that these elements have essential functions needed by the body to build new and healthy cells and maintain tissue function continuity. The focus here is on measuring mineral levels in the body (potassium, sodium, calcium, magnesium), which are involved in cellular structure and the formation of renewed red blood cells.

The importance of the research is to prepare training exercises that diversify the training volume from starting positions for different distances and provide sufficient time for physical

recovery between repetitions and sets, which directly contributes to the sustained vital function of body cells and delays the onset of fatigue. The research problem lies in keeping pace with advancements in the field of sports training science, especially in short-distance events generally and the 100-meter race specifically, as they require high physical capabilities and significant physiological and chemical adaptations.

Through the researcher's experience as a former athlete and a current coach in track and field, he observed a weakness in achieving maximum speed, which has a direct impact on performance in the 100-meter race event. The researcher believes that the training process should be accompanied by periodic laboratory tests that help coaches assess the health status of athletes to achieve high levels of athletic performance.

Research objectives: Preparing training exercises that vary the training volume to develop maximum speed, measure certain mineral levels in the body, and enhance the performance of the men's 100-meter race; identifying the effect of training exercises with varied training volume on developing maximum speed, measuring certain mineral levels in the body, and improving the 100-meter men's race performance.

Research hypotheses: Training exercises that vary training volume have a positive effect in developing maximum speed, measuring certain mineral levels in the body, and improving 100-meter men's race performance.

Research Fields:

- Human field: Elite runners in the 100-meter event for the 2024 sports season.
- Time field: The period from 1/5/2024 to 3/16/2024.
- Spatial field: The athletics track at the Ministry of Youth and Sports Stadium / Baghdad Governorate.

Methodology and Procedures:

The researcher used the experimental method as it suited the nature of the research, the target population, and its sample. The research population consisted of elite runners in Iraq tested for the effectiveness of the 100-meter race, with a total of (12) runners. The research sample was selected from this population intentionally, representing 83.33% of the total, and was divided into two groups: an experimental group and a control group, each with (6) runners.

Sample homogeneity:

Table .1 shows the homogeneity of the research sample

Variables	Measurement Unit	Arithmetic Mean	Median	Standard Deviation	Skewness Coefficient
Length	Cm	178.451	180.000	3.407	0.862
Weight	Kg	72.065	74.000	2.234	0.571
Age	Year	24.326	24.000	5.381	0.634
Training age	Year	8.341	8.000	1.564	0.621

The value of the skewness coefficient is between ± 1 , indicating that the population has a normal distribution.

Equivalence of the Research Sample Individuals:

Table .2 shows the equivalence of the research sample

Variables	Measurement Unit	Experimental group		Control group		Calculated (t) value	Error level	Statistical Significance
		AM	SD	AM	SD			
Maximum Speed (50 meters)	Sec.	5.704	0.767	5.801	0.892	0.771	0.091	Non-significant
Potassium	Mg/100 ml	3.912	2.942	3.703	1.453	1.870	0.312	Non-significant

Sodium	Mg/100 ml	139.21	3.475	138.43	1.126	0.194	0.067	Non-significant
Calcium	Mg/100 ml	8.432	0.901	8.326	0.865	0.532	0.424	Non-significant
Magnesium	Mg/100 ml	10763	1.663	1.621	1.703	0.958	0.572	Non-significant
100-Meter Performance	Sec.	10.701	0.878	10.852	1.836	0.462	0.278	Non-significant

Significant at a significance level of ≤ 0.05 and with 10 degrees of freedom

As for collecting information: Observation, tests and measurements, Arabic and foreign sources, and the International Information Network (Internet).

The tools and devices used in the research: Athletics track, 80 cones/markers, 12 stopwatches, 30-meter measuring tape, Sony video camera with a frequency of 250 images per second (1), Dell laptop, 1 electronic medical scale, spectrophotometer, French-made electronic spectrophotometer for measuring blood element levels, German-made water bath for preserving blood serum in the laboratory, German-made centrifuge for blood serum separation, medical syringes, glass tubes, medical cotton, and a refrigerated box for storing blood serum.

Tests used:

- 50-meter running test from a seated position (Eisa, F. A. W., & Qasim, A. M. A., (1))
- 100-meter sprint performance test (Issa, F. A. W., Mohaif, S. M., & Kadhim, M. J., (2))
- Measurement of mineral levels in the body post-exertion (Mcardle, W. D., (3))

A blood sample was taken from the upper arm (antecubital area) from venous blood in an amount of (10 ml) for each sample. The blood samples were placed in special tubes designed for blood storage. These tubes contain an anticoagulant and are numbered according to the sequence of the players, so that each number represents the player's identity. Afterward, the samples were separated using specific reagents (kits) and analyzed using a spectrophotometer. The results were recorded in a special form with

the assistance of a specialized physician and then transferred to the Elite Laboratories on Palestine Street for specific measurements.

Pilot Study:

The researcher conducted an exploratory experiment on January 5, 2024, on four 100-meter runners from the research sample to identify the mechanism for implementing the research procedures.

Pre-tests:

The researcher conducted the pre-tests on January 9, 2024, on the athletics track at the Ministry of Youth and Sports Stadium in Baghdad Governorate.

Training Program:

The training program prepared by the researcher included exercises with varied training volume using the repetitive training method, with intensity levels ranging from 90% to 100%, aimed at developing maximum speed and completing a 100-meter race. The intensity was calculated using the following formula: $\text{Maximum time} \times 100 \div \text{Required intensity}$. The program included 24 training sessions at a rate of 3 sessions per week, conducted on Saturdays, Mondays, and Wednesdays. The program was implemented during the special preparation phase and spanned eight weeks, from January 13, 2024, to March 13, 2024.

Post-tests:

The post-tests were conducted on March 16, 2024, on the athletics track at the Ministry of Youth and Sports Stadium in Baghdad Governorate.

Statistical Methods:

Statistical analysis was performed using the SPSS software package.

Results:
This section presents the pre-and post-test results for the research variables: maximum speed, mineral levels, and performance.

Table .3 Displays the results of the experimental pre-tests: maximum speed, mineral levels, and performance.

Variables	Measurement Unit	Pre-test		Post-test		DD	Calculated (t) value	Error level	Statistical Significance
		AM	SD	AM	SD				
Maximum Speed (50 meters)	Sec.	5.704	0.552	5.621	0.771	0.664	4.997	0.002	Significant
Potassium	Mg/100 ml	3.912	0.893	4.115	0.737	1.134	3.984	0.001	Significant
Sodium	Mg/100 ml	139.21	4.477	140.67	3.174	1.525	6.503	0.001	Significant
Calcium	Mg/100 ml	8.432	0.872	9.549	1.194	1.056	2.822	0.001	Significant
Magnesium	Mg/100 ml	1.763	1.834	2.587	1.705	1.156	7.361	0.001	Significant
100-Meter Performance	Sec.	10.701	0.738	10.610	0.554	1.363	2.551	0.000	Significant

Significant at a significance level of ≤ 0.05 and with 5 degrees of freedom

Presentation of pre- and post-test results, maximum speed, mineral levels, and performance

Table .4 It illustrates the pre-and post-test results for the control group, covering maximum speed, mineral levels, and performance.

Variables	Measurement Unit	Pre-test		Post-test		DD	Calculated (t) value	Error level	Statistical Significance
		AM	SD	AM	SD				
Maximum Speed (50 meters)	Sec.	5.801	2.862	5.721	1.953	1.244	3.981	0.000	Significant
Potassium	Mg/100 ml	3.703	3.827	3.912	1.177	3.585	2.653	0.000	Significant
Sodium	Mg/100 ml	138.43	1.704	139.51	1.704	4.432	4.454	0.003	Significant
Calcium	Mg/100 ml	8.326	1.547	8.987	1.822	6.297	3.878	0.002	Significant
Magnesium	Mg/100 ml	1.621	1.864	1.798	1.749	5.498	2.656	0.001	Significant
100-Meter Performance	Sec.	10.852	0.652	10.703	0.784	2.266	2.964	0.003	Significant

Significant at a significance level of ≤ 0.05 and with 5 degrees of freedom.

Presentation, Analysis, and Discussion of the Results of Maximum Speed Tests, Mineral Ratios, and Performance for the Experimental and Control Groups.

Table .5 It shows the post-test results for maximum speed, mineral levels, and performance in the experimental and control groups.

Variables	Measurement Unit	Experimental group		Control group		Calculated (t) value	Error level	Statistical Significance
		AM	SD	AM	SD			
Maximum Speed (50 meters)	Sec.	5.511	1.864	5.603	2.057	1.563	0.000	Significant
Potassium	Mg/100ml	4.826	0.917	4.356	0.628	3.013	0.002	Significant
Sodium	Mg/100ml	141.69	1.059	140.31	0.926	3.625	0.000	Significant

Calcium	Mg/100ml	10.002	2.744	9.567	3.655	2.974	0.001	Significant
Magnesium	Mg/100ml	2.821	1.366	1.997	1.592	3.765	0.001	Significant
100-Meter Performance	Sec.	10.610	0.734	10.703	1.396	1.583	0.000	Significant

Significant at a significance level of ≤ 0.05 and with 10 degrees of freedom

Discussion:

It is clear from Table (5) that there are significant differences between the experimental group and the control group in the post-tests, in favour of the experimental group in the research variables. This distinction for the experimental group is due to the use of training exercises that varied the training volume, which relied on repetition and speed of movement. These exercises had a positive effect on the performance and a direct impact on the level of fast running. The high intensity used to develop maximum speed was consistent with the requirements of the specificity of the 100-meter sprint effectiveness. This was confirmed by the study by Easa, F. A.: "Continuously monitoring the development of the training status in sprinters helps in distributing effort and regulating load levels" (4). This aligns with the findings of Gambetta, V. "The high intensity used to develop speed was consistent with the specificity requirements of the 100-meter sprint" (5). Further, Yorgan and Schiffer's study confirmed that "Speed is one of the essential elements for achievement levels and requires intensive training" (6).

Similarly, Al-Dulaimi, R. F., & Easa, D. F. A. W. concluded that "Proper planning for sports training mainly relies on the principle of training quality and the characteristics required by short-distance runners to facilitate proper connection at the moment of push, ensuring effort economy and achieving the shortest possible time" (7). The study by Tahir, S. A. also confirmed that "high load intensity at maximum speed for short-distance runners provides the sufficient energy needed for achievement, with this energy produced through the interaction of mineral compounds within the muscle." (8)

Additionally, Fahem Abdul Wahid Easa indicated that "anaerobic training led to body adaptation by increasing the capacity of fast muscle fibers" (9). Ali, A. N., Easa, F. A. W., & Abdul Ridha, B. K. concluded that "continued training increases anaerobic work capacity and maximizes energy production according to the athlete's ability to achieve the best performance" (10). This is consistent with Gambetta's statement that "mineral ratios play a major role in regulating acidity and alkalinity during muscle work, leading to increased muscle sensitivity for natural contraction." (11)

The researcher attributes the development of the 100-meter sprint performance to the high-intensity training program, a conclusion also supported by Matthew Fraser Moat, who stated: "The repetitive training method using high intensity, ranging between 90–100% of the runner's maximum ability, continues until the pulse returns to normal" (12). The main reason for using this repetitive training method is that it is both important and suitable for the training stage the research sample individuals had reached. This aligns with the findings of Easa, F. A. W., & Amara, S.: "Since the subjects have passed the general preparation stage and entered the special preparation stage and the semi-competitive phase, the training has led to improved achievement." (13)

Further support comes from Easa, F. A. W., Shihab, G. M., & Kahdim, M. J, who noted that "Increasing the intensity of training reveals a high degree of physical and vital adaptation" (14). The results demonstrated that training with varying training volumes on the research sample had a significant effect on the achievement in pre-

and post-measurements, favouring the post-measurement.

The researcher recommended that trainers consider functional and biochemical assessments to evaluate the training process and the level of the player's response to the training load.

The Iraqi Central Athletics Federation should open training courses to present major developments in sports training science through modern studies and research.

Author's declaration:

Conflicts of interest: None

We confirm that all tables and figures in this article are ours and written by the researchers themselves.

Ethical-Clearance: this manuscript approved by local ethical committee of physical education and sport sciences college for women on (September /2024)

Author's contributions:

All contributions of this study were done by the researchers (F.A.) who get the main idea and work on writing and concluding also with number of experts, the researcher himself in Statistics, Oliver Stoll in revision, Nour Riadh in translating, Mazin Hadi in proofreading

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Training Units Model

Week: First

Units: (1-2-3)

Intensity of Training Units: (90% - 100%)

Training Method: Repetitive Training Objective:

Maximum Speed

Training Unit	Exercises	Intensity %	Repetitions	Sets	Rest Between	
					Repetitions	Sets
Saturday	20-meter sprint starting from a seated position	%100	3	2	60 Sec.	120 Sec.
	30-meter sprint starting from a standing position	% 90	3	2	90 Sec.	180 Sec.
Monday	40-meter sprint starting from a seated position	% 100	4	2	90 Sec.	180 Sec.
	50-meter sprint starting from a standing position	% 90	3	2	120 Sec.	240 .Sec
Wednesday	30-meter sprint starting from a seated position	% 100	3	2	90 Sec.	180 Sec.
	50-meter sprint from a flying start	% 90	3	2	120 Sec.	240 Sec.

اثر تدريبات تنوع حجم التدريب في تطوير السرعة القصوى وقياس بعض نسب المعادن في الجسم وانجاز عدو 100

متر رجال

فاهم عبد الواحد

جامعة بغداد / كلية التربية البدنية و علوم الرياضة – العراق

مستخلص البحث

اهمية البحث اعداد تدريبات تنوع حجم التدريب من وضعيات الانطلاقات للمسافات المختلفة واعطاء فترة كافية لاستعادة الكفاءة البدنية بين التكرارات والمجاميع , ومن خلال خبرة الباحث المتواضعة لاحظ ضعف في قابلية السرعة القصوى واجراء فحوصات مختبرية دورية تساعد المدرب الى تقويم الحالة الصحية لدى اللاعبين التي لها تأثير مباشر على انجاز فعالية عدو 100 متر, حيث تم استخدام البرنامج التجريبي في اجراءات البحث , وتم اختبار عينة البحث من عدائي النخبة في العراق لفعالية عدو 100 متر رجال وبلغ عددهم (12) لاعب وتم تقسيم العينة مجموعتين مجموعة تجريبية ومجموعة ضابطة ولكل مجموعة (6) لاعب , وأهم ما تم استنتاجه انه قد اثبتت النتائج ان تدريبات تنوع حجم التدريب على متغيرات البحث ذات دلالة معنوية للقياسات القبلية والبعديّة ولصالح القياس البعدي , واوصى الباحث قيام الاتحاد العراقي المركزي بالعباب القوى بفتح دورات تدريبية وعرض التطورات الكبيرة في علم التدريب الرياضي والعلوم المرتبطة من خلال الدراسات والبحوث الحديثة . وهذا ما يحقق احد اهداف التنمية المستدامة للامم المتحدة في العراق (الصحة الجيدة).

تدريبات تنوع حجم التدريب ، السرعة القصوى ، نسب المعادن ، انجاز 100 متر

الكلمات المفتاحية