

The effect of interval training (short/short) on the development of explosive strength in the lower limbs and maximum aerobic speed of senior handball players. (A field study on the military national handball team)

Seraiaia Jamel*¹

¹ Institute of Sciences and Techniques of Physical Activities and Sports / University of Souk Ahras, d.seraiaia@univ-soukahras.dz

Received: 26/09 /2024 Accepted: 06/11 /2024 Published: 15/12 /2024

Abstract:

This study aims to maximum aerobic speed among advanced handball. The sample was deliberately chosen, representing the study population, which is 100%. Research tools: The researcher used a set of tools to achieve the objectives of his study, which included Arabic and foreign sources and references to gather the scientific material. Physical tests. The main findings reached: Interval training (short/short) positively. Keywords: handball; training program; interval training (short/short); explosive strength; maximum aerobic speed.

المخلص:

تهدف هذه الدراسة لتطوير القوة الانفجارية للأطراف السفلية والسرعة الهوائية القصوى لدى لاعبي كرة اليد فئة ذكور صنف اكابر. استخدم الباحث الطريقة التجريبية مع مجموعتين، مجموعة ضابطة وأخرى تجريبية، وكانت عينة البحث ممثلة بالمنتخب الوطني لكرة اليد، عينة البحث تقدر بـ 24 لاعب، استخدمنا اختبارات بدنية. أهم النتائج المتوصل إليها. يؤثر التدريب المنقطع (قصير/قصير) بشكل إيجابي على القوة الانفجارية للأطراف السفلية والسرعة الهوائية القصوى للاعبين كرة اليد. الكلمات الدالة: كرة اليد؛ برنامج التدريب؛ تدريب المنقطع (قصير/قصير)؛ القوة الانفجارية؛ السرعة الهوائية القصوى.

1. Introduction:

The rapid development in achieving high athletic levels in various sports, whether in team or individual sports, goes hand in hand with the technology of sports training sciences, and raising this level did not come from a vacuum, but rather scientific research was, became, and still is the basis, and hence efforts were continuing towards more A deeper understanding of what is included and achieve high levels. This requires shedding light on everything that is new and innovative in the field of sports training and its applications. (Al-Basati, 1998, p. 5)

In light of the above and what Mufti Ibrahim Hammad confirms, will be, in addition to training in the skill or performance in general at the same speed as performance in competitions and matches, which is very important,” so we shed light on this method by Designing the physical capabilities of senior handball players. Hence, we pose the general question: Does the proposed training program aimed at using intermittent training (short/short) contribute to developing the special physical qualities of senior handball players?

1.1. Study hypotheses:

1.1.1. General hypothesis:

The proposed training program using interval training (short/short) contributes to developing the special physical qualities of Akaber handball players.

1.1.2. Partial hypotheses:

- Intermittent training (short/short) within the purposeful training program positively affects the development of the explosive power of Akaber handball players.
- Intermittent training (short/short) within the targeted training program positively affects the development of maximum aerobic speed for senior handball players.

2- General objective of the study:

2.1. Subjective reasons:

- The desire to establish a training program using intermittent training for senior handball players.
- Seek a thorough understanding of interval training (short/short).
- The researcher’s tendency to study the physical aspect of handball.

2.2. Objective reasons:

- Highlighting the importance of interval training (short/short) in developing physical abilities.
- An attempt to benefit coaches in the field of handball with this study.

2.3. Objectives of the study:

- proposed training program of interval training contributes to developing the (VMA) of senior handball players.

2.4. Importance of the study:

2.4.1. Scientific aspect:

- Adding a scientific reference to the Algerian library as well as to trainers.
- Trying to suggest and stimulate the interest of specialists to formulate future hypotheses.

2.4.2. Practical aspect:

- Introducing the characteristics and importance of interval training (short/short).
- Conduct, collect, and analyze tests and compare sample results.
- Introducing modern training methods.
- Strengthening the status of this method in training.
- Providing a purposeful training program in the interval training method (short/short) to develop physical qualities.

3. Procedural definition:

3.1. Interval training (short/short)

3.1.1. Terminological definition:

Dellal also defined it as “a method that contains a very important form for improving maximum aerobic capacity in team sports through mixed aerobic and anaerobic energy stimulation” (Dellal, 2013, p. 14).

3.1.2. Operational definition:

Based on the above, it is difficult to imagine performing an exercise longer than 60-30, meaning (60 seconds of work at VMA intensity and a 30-second rest period). Here, be careful when using this type of training, as it is recommended to use it only with athletes who have great experience and high physical abilities, and it is not recommended to use this type of training with novice athletes.

3.2. Explosive power:

3.2.1. Terminological definition:

Explosive power is defined as: (the maximum resistance that can be overcome in the shortest possible time) (Al-Mandalawi, 1979, p. 45),

3.2.2. Operational definition:

Explosive force is one of the elements of muscular strength and is a basic requirement for performing most skills. It is defined as the highest possible force and speed at one time. It is the maximum instantaneous rapid force.

3.3. Maximum air speed:

3.3.1. Terminological definition:

Maximum aerobic speed, or VMA, is an abbreviation for the French phrase (vma), and in English it is vo2max.

3.3.2. Operational definition:

This method is considered the most accurate.

4. The methodological procedures used in the study:

4.1. Exploratory study

The applied work, we made a reconnaissance visit, during which we took a look and selected the appropriate team, which is (the center for gathering and preparing military sports teams in Ben Aknoun) to conduct the reconnaissance experiment, as well as the availability of means and capabilities.

4.2. Exploratory experiment

The exploratory experiment was conducted on a sample of (04) handball players, due to ease of communication and facilities provided by the center's leadership, during the period extending from 15/02/2015 to 05/03/2015.

4.3. Approach followed:

The researcher relied on that they rely on to explain.

4.4. Study variables:

4.4.1. Independent variable: using the intermittent training method (short/short).

4.4.2. Dependent variable: the maximum air speed.

4.5. Study population and sample:

4.5.1. Research community: represented by senior handball players Assembly and Preparation Center in Ben Aknoun, Algiers. They number 16 players according to Table No. 01 as follows:

Table No. 01: Distribution of members of the research community

The effect of interval training (short/short) on the development of explosive strength in the lower limbs and maximum aerobic speed of senior handball players. **Seraiaia Jamel**

Study population	
The National Military Handball	
Number	16
Percentage (%)	100

Source: Prepared by the researcher, 2024

4.5.2. Research sample: 16 players from the national military handball team were taken at the Assembly and Preparation Center in Ben Aknoun, Algiers, meaning 100% of the original community. They were chosen intentionally. They were group that included 6 players. Excluding the 04 players who participated in the reconnaissance experiment, as shown in Table No. 02.

Table No. 02: Distribution of members of the research community

The National Military Handball	
Group	number
G1	6
G2	6
Survey group	4
Total	16

Source: Prepared by the researcher, 2024

4.6. Homogeneity and equality of the study sample

4.6.1. Homogeneity: Before starting to implement the experiment, and in skewness factor as follows

Table No. 03: Shows the homogeneity of the individuals in the research sample:

Var.	Un. of M.	Arit. M.	D.	N. C.
Length	is 1 meter	0.7161	6.33	192
Weight	kg	0.6631	6.16	86.00
Year	age	0.6531	6.21	24.50

Source: Prepared by the researcher, 2024

The effect of interval training (short/short) on the development of explosive strength in the lower limbs and maximum aerobic speed of senior handball players.

Seraiaia Jamel

The table above shows that normal distribution.

4.6.2. Equivalence:

Table No. 04: Shows the parity of the individuals in the research sample

Tests	Experimental group		Control group		Calculated T value	Value SIG	Statistical significance
	Arithmetic average	Standard deviation	Arithmetic average	Standard deviation			
Maximum air speed VMA	16.05	1.09	15.66	1.16	0.952	0.818	Not a sign
Explosive strength of the lower extremities	43.10	3.28	41.50	3.20			
Significance level: 0.05			Degree of freedom: 10				

Source: Prepared by the researcher, 2024

4.7. Scientific foundations of data:

4.7.1. Test stability: first test for speed. Maximum aerobic activity on 02/15/2015, and repeated on 03/01/2015. It was later excluded (another sample belonging to the study population).

Table No. 05: Shows the reliability of the tests used

Tests	Experimental group		Control group		Stability coefficient	Value SIG
	Arithmetic average	Standard deviation	Arithmetic average	Standard deviation		
Maximum air speed VMA	15.41	.580	16.16	.510	.7180	0.05

The effect of interval training (short/short) on the development of explosive strength in the lower limbs and maximum aerobic speed of senior handball players.

Seraiaia Jamel

Explosive strength of the lower extremities	42.66	1.75	44.16	1.72	.9500	
Degree of freedom	03					

Source: Prepared by the researcher, 2024

Table (05) shows us that test indicates its stability.

4.7.2. Test validity: used self-validity by considering the truest experimental scores relative to the real scores that were free of impurities. By relying on this type of validity.

Table No. 06: Shows the validity of the tests used

Tests	Experimental group		Control group		Stability coefficient	Value SIG
	Arithmetic average	Standard deviation	Arithmetic average	Standard deviation		
Maximum air speed VMA	15.41	.580	16.16	.510	.7180	0.847
Explosive strength of the lower extremities	42.66	1.75	44.16	1.72	.9500	0.974
Degree of freedom	03					

Source: Prepared by the researcher, 2024

Table (06) shows us that these tests are characterized by a high degree indicates its stability.

4.8. Data collection tools:

Data collection tools are the axis on which the research is based and its employment is intended to reach the facts on which the study is built. This study was based on the following:

4.9. Physical tests:

4.9.1. Test name: SJ (conter movement jump)

- Means used: registration card, computer, Optojump device.
- Figure No. (01.
- shown in Figure No. (01.
- altitude, force, etc., and is read from the screen in a normal way.

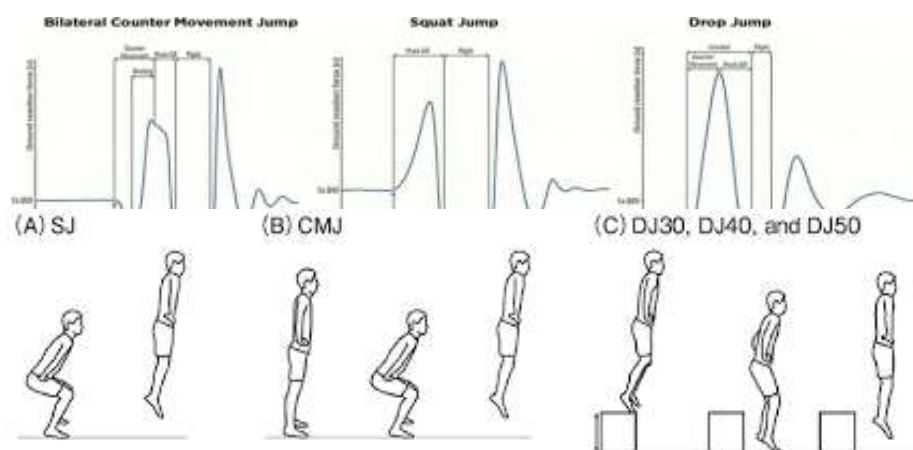


Figure No. (01): Movement characteristics of CMJ, SJ, and DJ MARS, measurement, analysis and reporting software Source: (Alexandre Dellal, 2013, p68)

4.9.2. Maximum aerobic speed test Vameval (Cazorla)

Purpose: Calculate maximum aerobic speed (VMA) and maximum oxygen consumption (VO₂max)

Testing tools: a radio, a test recording tape (vameval), a field of at least 200 metres, markers placed at a distance of every 20 metres, a whistle, and a results table representing the replicates obtained .

Performance specifications: Running while respecting the rhythm (running speed is controlled by the tape recording (Vameval) that emits sound at regular intervals, increasing speed by 0.5 km/hour every minute starting from 8 km/hour. At each test can be accepted with an accuracy of 2 m at most).

- **Speed increase:** 0.5 km/h

The effect of interval training (short/short) on the development of explosive strength in the lower limbs and maximum aerobic speed of senior handball players.

Seraiaia Jamel

- **Repeated:** 1 minute
 - **Distance between two lines:** 20 metres
 - (Place adhesive tape 2 meters away from each line to determine the space that must be reached at each signal)
- Location:** 200m square. (Aurélien Broussal Derval, 2016, p. 99)



Figure No. (01) shows the Vameval (Cazorla) maximum aerodynamic speed test.

4.10. The general framework:

In planning and building the general framework of the training program, we took into account the following:

Table No. 07: planning

a period Training	Classify Training	Training style	Intensity	Recovery period	Rest between groups
Week 1	Interval training (short/short)	(30/30)-5×4	100% of the VMA	10 seconds	2 minutes
Week 2	Interval training (short/short)	(15/15)-6×4 (30/30)-6×3 20/20	110% of the VMA	10 seconds	2 minutes
Week 3	Interval	(15/15)-6×3	90% of	15	3

The effect of interval training (short/short) on the development of explosive strength in the lower limbs and maximum aerobic speed of senior handball players.

Seraiaia Jamel

	training (short/short)		VMA	seconds	minutes
Week 4	Interval training (short/short)	(30/10) (25/5)	95% of VMA	15 seconds	3 minutes
Week 5	Interval training (short/short)	(30/30) 30×8	115% of the VMA	10 seconds	2 minutes
Week 6	Interval training (short/short)	(25/5) 30×10	120% of VMA	10 seconds	2 minutes

Source: Prepared by the researcher, 2024

-Statistical methods: Spss26

5. Presentation and Analysis of Results:

Table N^o. 10: results of the explosive strength

	Sample number	Pre-measurement		Dimensional measurement		"T" calculated	"T" tabular	Degree of freedom	SIG value	Significance level	Connotation
		Arithmetic average	Standard deviation	Arithmetic average	Standard deviation						
Experimental group	06	50.15	3.38	52.50	2.46	6.476	1.843	05	0.000	0.05	sign
Control group	06	44.50	3.25	44.75	3.20	7.005	2.020	05	0.001	0.05	sign

Source: Prepared by the researcher, 2024

□ Experimental group: mean in the pre-measurement reached 50.15 with a standard deviation of 3.38, while in the post-measurement the

The effect of interval training (short/short) on the development of explosive strength in the lower limbs and maximum aerobic speed of senior handball players.

Seraiaia Jamel

arithmetic mean reached 52.50 with a standard deviation of 2.46, while the calculated t reached 6.476,

□ Control group: the arithmetic mean reached 44.75 with a standard deviation of 3.20, while the calculated t reached 7.005,

5.1. Analysis of the Results of Post-Tests for the Experimental and Control Samples to Test the Explosive Strength of the Lower Limbs

Table No. 11: Shows a Comparison of the Dimensional Differences of the Explosive Power Test for the Control and Experimental Samples

	Sample number	Dimensional measurement		Degree of freedom	"T" tabular	"T" calculated	Connotation	Significance level	SIG value
		Arithmetic average	Standard deviation						
Experimental group	06	52.50	2.46	2.039	1.772	10	0.002	0.05	sign
Control group	06	44.75	3.20						

Source: Prepared by the researcher, 2024

According to the results shown in Table (11), the control group had a mean of 40.66.

5.2. Presentation, analysis, and discussion of the results of the first hypothesis.

Table No. 08: results of the explosive strength

Sample number	Pre-measurement	Dimensional measurement	"T" calculated	"T" tabular	Degree of freedom	SIG value	Significance level	Connotation

The effect of interval training (short/short) on the development of explosive strength in the lower limbs and maximum aerobic speed of senior handball players.

Seraiaia Jamel

		Arithmetic average	Standard deviation	Arithmetic average	Standard deviation
Experimental group	06	16.10	1.14	17.50	0.735
Control group	06	15.70	1.21	16.20	0.735
				3.878	6.389
				2.016	1.834
				05	05
				0.002	0.002
				0.05	0.05
				sign	sign

Source: Prepared by the researcher, 2024

- **Experimental group:** The mean in the pre-test measurement was 16.10.

- **The control group:** The mean in the pre-test measurement was 15.70.

5.2.2. Presentation and analysis speed test.

Table No. 09: results of the maximum aerobic speed test

	Sample number	Dimensional measurement		Degree of freedom	"T" tabular	"T" calculated	Connotation	Significance level	SIG value
		Arithmetic average	Standard deviation						
Experimental group	06	17.50	0.78						
Control group	06	16.20	1.13	2.733	1.762	10	0.003	0.05	sign

Source: Prepared by the researcher, 2024

Through group was estimated at 17.50 with a standard deviation of 0.78, while the control group's mean was 16.20 with a standard.

6. Discussion and interpretation of the results:

6.1. First hypothesis :

“intermittent training affects the development of maximum aerobic speed VMA.” Through the results presented in Tables (08) and (09). The use of short, intense interval sessions has improved the respiratory system's ability to adapt to high effort, contributing to an increase in maximum aerobic speed. Additionally, employing varying intensities and durations has enhanced endurance and the ability to respond effectively to the demands of maximum aerobic performance. By carefully determining rest periods, this has led to significant improvements in performance. Furthermore, diversifying the training sessions within the proposed program and directing them towards enhancing maximum aerobic speed has become a fundamental part of the interval training program. It led to continuous and varied stimulation of the respiratory organized appropriately with other elements of the comprehensive training program, such as good nutrition and recovery sessions like sauna and massage. In this regard, (Abu Alaa Ahmed Abdel Fattah) states that interval training contributes to improving maximum aerobic speed by stimulating the body's biological adaptation process. When the body is subjected to intensive training periods followed by active rest periods, the respiratory and cardiovascular systems adapt better for endurance and aerobic performance. This adaptation can include an increase in heart size and improved efficiency in oxygen utilization (Abu Alaa Ahmed Abdel Fattah, 1998, p. 15). If we return to previous and similar studies, we find that our study does not align with the study by Ben Aissa Faisal (2021/2022), which concluded that interval training is less effective in developing maximum aerobic speed than small-sided games training. On the other hand, the study by Nasser Bay Karima and Tahari Rabah (2019) found that interval training is more effective in developing speed-strength, which falls under the category of specific endurance. Thus, we confirm the validity of the first research hypothesis.

6.2. The second hypothesis:

It states that "interval training affects the development of explosive strength." Through the results obtained in tables (10) and (11), these differences are real.

through interval training, which stimulated muscle growth and enhanced overall body strength. This contributed to the development of explosive strength, activated the nervous system, improved movement coordination, and further stimulated the muscles, thereby enhancing the ability to execute quick and crucial movements. Additionally, the proposed interval training program improved muscular and metabolic endurance, allowing athletes to maintain high performance for extended periods during matches without excessive fatigue. In this regard, Ali Al-Bayek states that interval training provides players high explosiveness required for shooting, passing, and accelerating in various situations on the field. It is important that the exercises are carried out properly and under the supervision of specialized trainers to avoid injuries and ensure maximum benefit in developing explosive strength among handball players (Ali Al-Bayek, 1992, p. 78). If we refer to previous and similar studies, we find that our study aligns with the study by Nasser Bay Karima and Tahari Rabah (2019), which concluded that interval training positively affects speed-strength, which falls under the category of specific endurance. Additionally, the study by Ben Shtewi Abdul Razak (2017) found statistically. Thus, we confirm the validity of the second research hypothesis.

7. Conclusion:

After shedding light on the various theoretical and practical aspects of the study, we ultimately arrived at answers to all the previously posed questions, which enabled us:

- The proposed intermittent training program positively affects the improvement of other basic physical performance aspects.
- Interval training affects the development of explosive strength in senior handball players.

Suggestions and recommendations:

- The use of modern tracking devices such as fitness sensors and smart watches to record performance data and provide accurate feedback to coaches and players.
- Activating interval training in a balanced manner throughout the week, while ensuring adequate rest periods between sessions.

8. References used in the research:

The books:

1. Al-Basati, Amir Allah Ahmad.1998) Principles and Foundations of Sports Training and Its Applications. The Knowledge Establishment.
2. Bastoisi Ahmed; Foundations and Theories of Sports Training, (Cairo, Arab Thought House, 1999), p. 116.
3. Bastoisi Ahmed; The Introduction to the Meaning, Concept, and Importance of Plyometric Work, Episode One: (Athletics Bulletin, Cairo, International Amateur Athletics Federation, Regional Development Center, Issue / 18, 1996), p. 17.
4. Qasim Al-Mandalawi and Ahmed Saeed Ahmed; Training Between Theory and Practice: (Baghdad, University of Baghdad Press, 1979), p. 45.
5. Mohammad Hassan Alawi; Science of Sports Training, 12th edition: (Cairo, Dar Al-Ma'arif, 1992), p. 151.

Scientific research:

6. The study by Ben Shatiwi Abdel Razak (2017), titled "The Effect of Short/Short Interval Training on Maximum Aerobic Speed and Explosive Strength of Volleyball Players," is characterized by being a published research paper in the Journal of Sports and Artistic Physical Activity Sciences and Practices, Volume 06, Issue 02 (2016), University of Algiers 3.
7. A study by Nasser Bay Karim and Tahari Rabah (2019) titled: The Effect of an Interval Training Program on Developing Speed-Strength and Transitional Speed in Handball Players. The study is published in the Journal of Excellence in Physical Activity and Sports Sciences, Volume 4, Issue 2, pages. 185-202.

Doctoral dissertations:

8. The study by Ben Issa Faisal 2021/2022 titled: A Comparison Between the Effectiveness of Interval Training and Small-Sided Games Training in Developing Maximum Speed and Speed Endurance in Male Handball Players of the Senior Category (Doctoral Thesis, Institute of Physical Education and Sports / University of Algiers 03).

Foreign references :

9. Aurélien Broussal Derval : la préparation physique moderne, edition 4 trainer, paris, 2016, P99 .

The effect of interval training (short/short) on the development of explosive strength in the lower limbs and maximum aerobic speed of senior handball players.

Seraiaia Jamel

10. Alexandre Dellal, Une saison de préparation physique en football, édition De boeck, Bruxelles, 2013, p68 .

11. Gilles et Dominique Cometti, (2012), La pliométrie : méthode de restitution d'énergie au service de la performance sportive, Chiron, Vincennes, France.