

The effect of short intermittent training and medium intermittent training on maximal aerobic speed MAS for senior handball players

تأثير التدريب الفتري القصير والتدريب الفتري المتوسط على السرعة الهوائية القصوى MAS لدى لاعبي
أكابر كرة اليد

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Abstract:

The study aimed to know the impact of the short intermittent training (IT) (10"-20") and medium IT (15"- 45") on the maximal aerobic speed (MAS) for senior handball players , the research sample consisted of two experimental groups each group contain 8 players, who were selected deliberately and using the experimental method and as tools for the study was used the physical tests (Yo-Yo intermittent test).

The data were statistically processed by SPSS, the results indicated that the effect of short IT bigger than the medium IT on maximum aerobic speed MAS and for senior handball players.

Keywords: short / medium intermittent training – maximal aerobic speed MAS – handball.

المخلص:

هدفت الدراسة إلى معرفة تأثير التدريب الفتري القصير (10"-20") والتدريب الفتري المتوسط (15"-45") على السرعة الهوائية القصوى والحد الأقصى لاستهلاك الأكسجين لأكابر كرة اليد.

تكونت عينة البحث من مجموعتين تجريبية كل مجموعة تحتوي على 8 لاعبين تم اختيارهم بطريقة عمدية وباستخدام المنهج التجريبي ملائمة طبيعة موضوع البحث واستخدمنا وكأدوات للدراسة الاختبارات البدنية (اختبار Yo-Yo الفتري، وتمت معالجة البيانات إحصائياً بواسطة برنامج SPSS، أشارت النتائج إلى أن تأثير التدريب الفتري القصير أكبر من التدريب الفتري المتوسط على السرعة الهوائية القصوى MAS لدى أكابر كرة اليد.

الكلمات المفتاحية: التدريب الفتري القصير – التدريب الفتري المتوسط – السرعة الهوائية القصوى MAS – كرة اليد.

1.Introduction and problematic of the study:

Handball is a very intense sport which requires an advanced level of technical, tactical and physical skills. It is a sport which integrates high intensity and short duration physical efforts of muscular power. (Moisés, and others, 2017, p142 - 151; Hermassi, and others, 2018, p53; Jorge Viaño, and others, 2017, p 1-16) and is one of the sports that consumes a lot of effort and therefore requires physical preparation and great physiological capabilities. LARS BOJSEN, and others. (2015) indicates that handball involves activities that require well-developed aerobic and anaerobic qualities. During the 60 minutes of match-play the players work intensely for short intermittent times, for (Marquez, Badillo, 2006, p565) and (Rhobi, 2019, p. 21-25) performance depends, to a large extent, on the aerobic and endurance capacities of the athlete, whose values of maximum oxygen consumption ($\dot{V}O_2\text{max}$) and maximal aerobic speed (MAS) are a fundamental determinant, it is necessary to develop the aerobic metabolism of handball players in order to maintain performance over an entire season, one of the key characteristics of handball performance is aerobic fitness (MAS and $\dot{V}O_2\text{max}$), it's essential to improve recovery kinetics between different efforts. (M. Buchheit, et al, 2009, p251-258)

knowledge of the maximum aerobic speed (MAS) have major interest for the trainer, because this speed will allow, in addition to monitoring the athlete's aerobic progress, and the precious determination of the training load. Also, $\dot{V}O_2\text{max}$ is a crucial performance index, representing for any age or level of training an indicator of good or bad general physical condition. The $\dot{V}O_2\text{max}$ is also decisive for any physical performance, allowing both higher training loads, a better quality of training and a more efficient recovery. (Aurélien and Olivier , 2012, p198), as well as the maximal aerobic speed MAS is the smallest running speed allowing to apply the $\dot{V}O_2\text{max}$ (Buchheit, 2005, p28), it gives us a

valuable indication for training because it determines the work intensities and a limit that we will try to push back. (Jean, Lacrampe, 2007, p112)

Physical training has become essential last years for any team or athlete seeking to access a higher level of practice and to optimize its performance, rationalization of training by determining methods to achieve the optimum expression of the athletic qualities of each player. (Kharoubi, and others., 2018). To improve the athletic performance level of the player and achieve championships and achievements in all sports and develop these aerobic qualities, athletes today use several training methods. The most recognized method in team sports called "intermittent -training" or "interval training". (Rhibi, 2019, p21-25; Tahri. R, 2020, p332), the IT has been proposed as a time-saving strategy to improve both aerobic power (maximal oxygen consumption, MAS) and anaerobic capacity. Therefore, IT has become a preferred method of endurance training for anaerobically dominant sports (handball and stop-and-go sports,). (Cavar, and others, 2018, p1-13)

IT is work that alternates between intense phases and phases of relaxation (effort and counter-effort). (Didier and Pascal, 2013, p141-143; DARSAU-CARRE, 2010, p5) and is an effective method of improving some of the determinant characteristics of success in handball. for instance, IT enhances aerobic capacity and the ability to perform high-intensity actions with a high solicitation of the anaerobic system, developing maximum oxygen consumption and MAS allows the player to improve his physical performance throughout the match by increasing the recovery speed between periods of high intensity effort. (Hermassi , and others, 2018, p50-56; Dellal A. , 2013, p117)

In modern training methodology, and for the development in the effectiveness of handball the importance of IT emerges as it represents the best way to simulate interval effort in handball through the nature of performance (Benaissa.F,

Kerfes.N, 2020, p516), which consists of short periods of effort. high intensity followed by incomplete rests that allow the athlete to properly prepare for an ideal performance during the match, in this context IT has several types and sections. In our study, we wanted to compare the effect of short IT running (10"-20") and medium IT (15"- 45") on maximal aerobic speed MAS for handball players.

Many of the previous studies have examined the effect of IT on aerobic performance, as these studies concluded that short IT significantly affects the aerobic capabilities of the athlete (El ouirghioui and others., 2016; Cometti, 2007; Gacon, 1996; Kharoubi, 2016; Micallef, Gregoire, 2007).

As well as the results of several researchers found that the inclusion of high-intensity exercises (100-120% of MAS) through phases of acceleration and deceleration has a positive effect on maximum aerobic capacity, MAS, and VO2max, which is a crucial element in some team sports, especially handball (Cregg, 2013; Hermassi and others., 2018).

In our study, we wanted to compare the effect of short IT and medium IT, in the aerobic performances represented on MAS for handball players.

In this context, we raised the following question:

Did the effect of short IT (10"-20") on the MAS differs from the medium IT (15" – 45") for handball players?

Research hypotheses

The effect of short IT (10"-20") on maximum aerobic speed MAS is greater than that of medium IT (15"-45") impact for handball players.

the importance of the research:

- Giving a clear picture of IT and its effect on maximum aerobic speed and maximum oxygen consumption Vo2max.

- Assisting coaches in determining the best training method for preparing athletes during the sports season in order to reach the highest levels.

objectives of the study

- Knowing the optimal IT method that effectively develops the maximum aerobic speed MAS.
- Knowing the efficacy of the two proposed training programs and their impact on the maximum aerobic speed MAS.

Previous studies

1- study of Kharoubi Mohamed Fayçal: Under the title of Study of the effects of intermittent training (short vs long) on the development of maximum aerobic speed in young footballers "Case of juniors", an article published in the journal *Revue Sciences and Practices of Physical Sports and Artistic Activities*, Where the research was conducted on the football players category U17 in the "division one" West region championship, The goal of this study was to compare the effects of two modes of intermittent work (short –long) on the Maximum Aerobic Speed. The research sample consisted of 20 players divided into two equal groups, pre and post physical exams were applied with the 8-week training program, at a rate of two sessions per week, For the researcher to find that the proposed program of intermittent exercises (15s / 15s) were more significant in the development of MAS compared to intermittent exercises (3mn / 3mn).

2- study of GILLES Cometti: Under the title of Study of the effects of different work sequences of the "intermittent" type, Where the research was conducted on the handball players category U17, the goal of this study was to identify Knowing the various physiological effects produced by applying four types of intermittent training. The research sample consisted of 8 players, pre and post physical exams were applied with the 8-week training program, For the

researcher to find that the short intermittent program (10-20) an effective method in developing maximum aerobic speed MAS more than the rest of long types of intermittent training.

3-study of BENCHETIOUI Abderrazak: Under the title of Effect of intermittent "short-short" on maximum aerobic speed and explosive force in volleyball players, an article published in the journal *Revue Sciences and Practices of Physical Sports and Artistic Activities*, the goal of this study was to propose a program which aims at the development of explosive qualities and aerobic qualities. The research sample consisted of 16 players junior category evolves in G-S-P it is made up of two groups; A control group and an experimental group; each group consists of 8 volleyball players for 12 weeks, After the twelve weeks He carried out a post-test for both groups, the results obtained after carrying out the proposed program show that there is a difference in the two groups depending on the type of work applied.

The significant terminology of the research:

Maximum aerobic speed (MAS):

The MAS is the smallest running speed allowing to apply the VO₂max (Buchheit, 2005 p28), it gives us a valuable indication for training because it determines the work intensities and a limit that we will try to push back. (Jean and Lacrampe, 2007, p112)

Knowledge of the maximum aerobic speed (MAS), and therefore of major interest for the trainer, because this speed will allow, in addition to monitoring the athlete's aerobic progress, and the precious determination of the training load. (Aurélien, Olivier, 2012, p220)

VO2max:

VO2max is a crucial performance index, representing the maximum capacity of the athlete to transport and consumption of oxygen during exercise, which reflects the level of fitness and is measured in liters per kg per second.(Derradji, Ait lounis , 2020, p19) for any age or level of training an indicator of good or bad general physical condition. The VO2max is also decisive for any physical performance, allowing both higher training loads, a better quality of training and a more efficient recovery. (Aurélien, Olivier, 2012, p198)

Intermittent training (IT):

Intermittent training is a training method characterized by the successive exchange of effort and rest allowances (Douida, Boureghda , 2020, p471) and is work that alternates between intense phases and phases of relaxation (effort and counter-effort). (Didier, Pascal, 2013, p141-143) has been proposed as a time-saving strategy to improve both aerobic power (maximal oxygen consumption, MAS) and anaerobic capacity and there are many types of training (short IT, medium IT, long IT....). (CAVAR, and others, 2018, p5)

The practical chapter:

1. Followed Methodologies:

The researchers used the experimental method. As one of the most appropriate scientific methods used in determine the causes of the phenomenon at hand and find additional solutions to the fact that it is the most honest and reliable approach with its results, as well as its compatibility with the nature of field tests applied to the research sample. (Bentoumia, and others, 2020, p209)

The research samples

Sixteen (16) male handball players participated in the study, for 6 weeks training with two sessions per week. The study sample, consists of players from the Noudjoum Bougaa – Setif - who was selected deliberately, and subdivided into

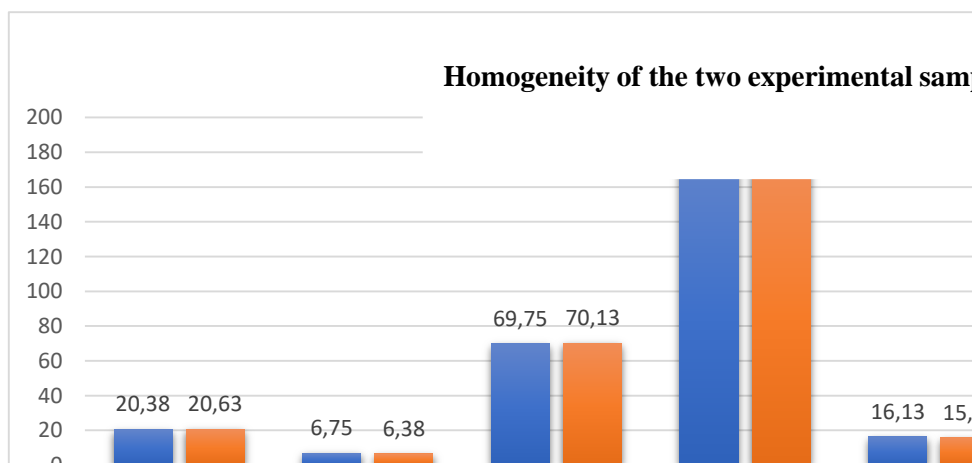
two experimental groups, with the same specifications (age, weight, height, result of yo-yo test), participant's characteristics are presented in Table 1.

Table 1. Participant characteristics (mean (M)±standard deviation (SD) / n=12/ training age (T.A)/ Experimental group (Ex group)

Groups	Sample (n=12)	Age (years)	T.A (years)	Weight (kg)	Height (cm)	Yoyo test (Km/h)
1 st ex group	8	20,38±1,3	6,75±1,49	69,75±7,59	177,25±6,56	16,13±0,876
2 nd ex group	8	20,63±1,85	6,38±2,2	70,13±9,87	174,88±6,55	15,75±0,925

Source: Designed by the researcher

Fig.1 Homogeneity of the two experimental samples



Source: Designed by the researcher

Materials

The collecting data materials used in the current study is the physical tests, the test is performed once during the pre-test period and the post-test period. The choice of tests was based on bibliographic sources; local and organizational conditions:

Yo-Yo test:

The Yo-Yo intermittent test have been designed to evaluate team sport player's ability to repeatedly perform and recover between intermittent exercise. The test focuses on the capacity to carry out intermittent exercise leading to a maximal activation of the aerobic system. (Bangsbo, and others., 2008, p37-51; Castagna, and others., 2019)

Yo-Yo intermittent test is commonly utilized during intermittent team sports due to its greater sensitivity in detecting changes in performance compared to $\dot{V}O_{2max}$. (Ritchard, and others, 2016, p43) It gives the max heart rate and gives the MAS and $\dot{V}O_{2max}$ per farm. (Bigard, and others, 2020, p323)

Test protocol:

The athlete must go for 20 m while keeping the rhythm given by the beeps of the audio cassette. This is a progressive shuttle test with an increment of the running speed every minute, that start at 8 and 8.5 km-h. The athlete will not be able to reach the mark at the time of the beep. This is called "stalling". The test must end and the last stage completed will allow the MAS to be extrapolated. (Dellal A. , 2008, p65; Castagna, and others., 2006, p323)

Design and Procedure

This study is conducted during the competitive phase of the season between January and Mars After looking at several references in the field of sports planning and intermittent training, we came up with two training programs, taking into account some basic principles that allow us to reach the achievement of previously established goals through the application of these two training programs, while preserving the health and safety of athletes and not to expose them to injuries.

These two programs were built on the basis of 6 weeks Plus two weeks for physical tests (pre-tests and post-tests) at a rate of 2 sessions per week (Saturday

and Tuesday), and the sessions were performed at 18:30 in the Bougaa multi-sports hall, in the wilaya of Setif. The implementation of this program was performed on the same days and at the time the team used to train.

The study begins with a series of one-week pre-tests that will be used to assess the athlete's maximal Aerobic Speed (MAS) and will serve as benchmarks for comparison with post-tests, for the first experimental group to which the first training program will be applied (short IT 10"-20") the intermittent sessions designed with a shuttle exercises at 100% of MAS intensity in the form of 10" seconds of running with 20" seconds of passive recovery for 8 minutes and 30 (8'30) of work and 8' minutes of active recovery between blocks (technical exercises) for 3 sets, and the second experimental group to which the second training program will be applied (middle IT 15" - 45") the load of training sessions was 15" seconds of running with 45" seconds of passive recovery and we kept the same intensity, and recovery periods between the blocks.

After the six-week training period comes the one-week post-test period, which will be done according to the same protocol and conditions as the pre-tests.

Statistical Analysis

All statistical analyses were performed using SPSS version 21.0 for windows. The results are expressed as the mean \pm standard deviation. Correlation coefficients were calculated between the two tests using a Pearson test, a Student's t test for paired samples was used, this statistical tool aims to define significant differences between the two compared tests. the level of significance was established at $p < 0.05$.

2- Analyses and result exam:

Discussion the hypothesis:

" The effect of short IT (10"-20") on maximum aerobic speed MAS is greater than that of medium IT (15"-45")."

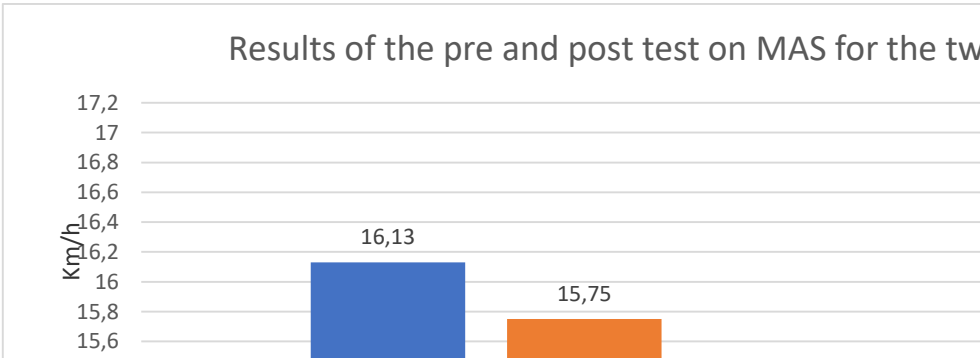
2.1- Analysis of the results of the pre-test and post-test of YO-YO on maximal aerobic speed MAS for the 1st and 2nd experimental group:

Table 2. shows the results of the maximal aerobic speed for the two experimental samples in Yo-Yo test

MAS	Pre test		Post test		“T” tabular	“T” calculated
	SMA	standard deviation	SMA	standard deviation		
1 st ex group	16,13	0,87	16,94	1,08	1.895	3,529
2 nd ex group	15,75	0,92	15,93	0,90	1.895	2,049

Source: Designed by the researcher

Fig.2. Shows the difference between SMA of the results of the pre and post-test of the two experimental groups on maximal aerobic speed



Source: Designed by the researcher

Through Table No. 2, which shows the comparison of the pre and post-test for the two experimental groups in the Yoyo test MAS, we found that the 1st group achieved in the pre-test an arithmetic mean of (16,13) and a standard deviation estimated at (0,87) while its arithmetic mean and its standard deviation in the post-test is (16,94) and (1,08) respectively.

While the 2nd group achieved in the pre-test an arithmetic mean of (15,75) and a standard deviation estimated at (0,92) and its arithmetic mean and its standard deviation in the post-test is (15,93) and (0,9) respectively.

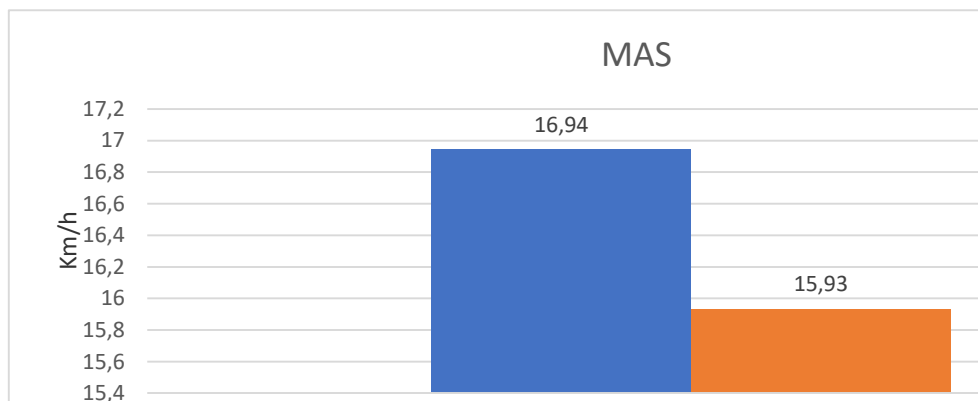
After statistical treatment of these data, we obtained the calculated T, which was estimated at (3,529) for 1st group and (2,049) for the 2nd group, which is greater than the tabular value, which was estimated at (1.895) at the level of significance (0.05) and the degree of freedom (7) so we say that there are significant differences between the two arithmetic averages (Pre and post-test) for the two experimental groups, and this is due to the proposed training programs on this samples.

Table 3. shows the results of the post-test on maximal aerobic speed MAS for the two experimental samples in Yo-Yo test

YO-YO test	1 st Ex group		2 nd Ex group		“T” tabular	“T” calculated
	SMA	standard deviation	SMA	standard deviation		
Post-test MAS	16.94	1.08	15,93	0,90	1.761	2.004

Source: Designed by the researcher

Fig.3. shows the results of the post-test on maximal aerobic speed MAS for the two experimental samples in Yo-Yo test



Source: Designed by the researcher

Through Table No. 3, which shows the comparison of the post test for the two experimental groups in a Yo-Yo test. The first experimental group achieved an arithmetic mean of (16.94) and a standard deviation of (1.08), while the second experimental group in the post test achieved an arithmetic mean of (15.93) and a standard deviation of (0.90).

After statistical treatment of these data, we obtained the calculated T, which was estimated at (2.004), which is less than the tabular value, which was estimated at (1.761) at the level of significance (0.05) and the degree of freedom (10),

From this, we conclude that despite the small numeric difference between the two arithmetic averages ($15.93 - 16.94 = 1.01$), there is statistical significance, meaning that the two proposed training programs, the short interval training program, and medium interval training program applied respectively to the first experimental group, and the second experimental group, developed the characteristic of the maximum aerobic speed (MAS) in the presence of statistical significance in favor the short intermittent training.

So, our hypothesis has been fulfilled, and thus it is accepted, so there are significant differences in the effect of the short IT program and the medium IT program on the MAS in favor of the short intermittent training for handball players.

3- Finding and propositions results

From the analysis and interpretation of the results obtained after the completion of the proposed programs, the results show that short IT (10-20) has a bigger impact than medium IT (15-45) on MAS and the aerobic performance of handball players, we found that there is a significant difference between the two arithmetic average of the two experimental groups in the post-test on MAS. Players who followed the short intermittent exercise program influenced the MAS Significantly (16,13 passed to 16,94 km/h) more than players who followed the medium IT program (15,75 passed to 15,93 km/h).

Our results confirm those of Kharoubi who sought that intermittent short exercises were more significant in developing MAS compared to long intermittent exercises in 8 weeks of training. (Kharoubi, 2016) and this is what was indicated by Assadi (2012), Gacon (1996), and other researchers that the short types of IT induce and develop the maximal aerobic speed MAS.

IT supramaximal type relies on the functionality of myoglobin and phosphagen stores. In addition, studies show a low concentration of blood lactate over the duration of exercise as well as a significant drop in muscle glycogen reserves, thus highlighting, after 6 to 8 minutes of exercise, a predominant demand for aerobic glycolysis. (Micallef, Gregoire, 2007)

El Ouirghioui (2016) and Gacon (1966) compared the effects between two training protocols (IT combined with explosive strength and IT running, the results showed an increase in aerobic parameters such as VO_2max , MAS and the quality of MAS test recovery.

Cometti stated that the short alternating training ran (10-10, 15-15, 10-20), etc. representing a type of training that develops maximum aerobic capacity (PMA) provided that the intensity is close to the maximum aerobic speed (V2).

Through the experimental work of Karlson et Coll which compared the load IT work which he showed that the short IT develops a great deal the MAS and VO₂max (Assadi, 2012).

Conclusion

In conclusion, is to answer the problem posed, the comparison of these two programs proposed (IT short /IT medium) for 6 weeks confirms that the short IT program have the bigger impact on maximum aerobic speed (MAS) than the medium IT program, this is due to the fact that short IT develop well the aerobic capacity through improves MAS and the respiratory efficiency as well as the muscles of breathing and helps to utilize the largest amount of inspiratory capacity, cardiac efficiency and circulation by increasing the stroke volume and the blood expelled from the heart and reducing the rate of the pulse at rest and exercise, as well as nerve harmony and increased coenzyme efficiency (Cometti, 2007; Assadi, 2012).

We can recommend using the results of this study by focusing on short IT running in the physical preparation process at the beginning of the season in order to develop the aerobic performance, which allows the trainer to shorten time and effort in the physical preparation process.

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