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A comparative study between Small-Sided Games and Short Intermittent Exercise and their effects on Specific Physical Qualities in U17 Handball Players (Effects of a Sports Training Program)

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Abstract:

The Objective is to examine the current benefits and limitations of substitutes for intermittent training, specifically small-sided games, and to confirm that these methods can adequately engage the aerobic and anaerobic systems (Maximal Aerobic Power, Explosive Strength) in U17 Handball players. This experimental research was conducted from December to January 2022 on two experimental groups (IRBL Age: 16.08±0.77 - Height: 172.83±3.35 - Weight: 70.88±2.20), (IRCL Age: 16±0.80 - Height: 171.95±1.74 - Weight: 71.33±2.36) and a control group (CEL Age: 15.95±0.80 - Height: 175.66±2.16 - Weight: 72.3±2.17). The participants underwent tests for Horizontal Relaxation, 20m Speed, and Shuttle Run. In the Final phase of our study, we observed that both experimental groups were able to maintain their explosive strength and aerobic endurance (VMA). It was noted that small-sided games training can be considered as a form of physiological training similar to certain types of short intermittent runs.

Keywords: Small-sided games; Short intermittent; Explosive strength; VMA; Speed; U17.

Hadj Aissa Mohamed Tayeb

1. INTRODUCTION

HB is characterized by many short and explosive actions interspersed with recovery periods of variable duration. At the level of the intensities of efforts reached, the close succession of brief and violent efforts leads the handball player to solicit his Vo2 max between 5 and 10 min per match, which justifies the work of maximum aerobic power, the work goes in the direction of the improvement of the qualities of recovery at high intensity of effort, and thus an improvement of the capacities to repeat explosive efforts in a situation of incomplete recovery. (Buchheit, 2006).

It is well known that the adolescent's body is highly adaptable, particularly in the area of aerobic performance. This privileged stage proves to be favourable for developing endurance training and increasing the physical condition specific to each sport discipline. (Khiat, 2006, pp. 6-31)

The data from several researchers confirms the effectiveness of adaptation of children or adolescents' bodies in response to force-speed efforts, which improves the functional possibilities of the athlete. Zatsiorski, 1969 cited by (Helga & Al., 1983).

Intermittent work clearly outperformed continuous work and work that is exclusively based on continuous (lactic) physical effort. Recent research indicates that there is not only one way to improve the athletic abilities of handball players, particularly regarding intermittent shuttle running exercise. Indeed, small-sided games (SSGs) allow for sufficient solicitation of both the aerobic and anaerobic systems, which can lead to notable progress. SSGs can be used as a training method that integrates tactical, technical, and physical aspects by approaching intensities similar to those of short intermittent exercises. (Dellal, 2008).

All the data on integrated training is quite contradictory. Some authors reported that it did not allow for a significant approximation of match activity (Antonacci, & Al., 2007, pp. 418-21), while others claimed that the activity is equivalent (Rampinini, & Al., 2007c, pp. 228-35). Based on these observations, we asked ourselves the following questions:

What are the current advantages and limitations of Small-sided games compared to short-term intermittent training in the training process for specific physical qualities in U17 handball players?

• Can Small-sided games achieve similar intensities to those of short-term intermittent training in maintaining explosiveness in U17 handball players?

• Can Small-sided games achieve similar intensities to those of short-term intermittent training in maintaining speed in U17 handball players?

• Can Small-sided games achieve similar intensities to those of short-term intermittent training in maintaining maximum aerobic velocity (VMA) in U17 handball players?

Our hypothesis assumes that a rational choice of a training plan based on the method of Small-sided games and another based on short-term intermittent training can yield similar results in maintaining specific physical qualities (explosiveness, speed, VMA) in U17 handball players.

• Small-sided games will allow for explosive values equivalent to those obtained during short-term intermittent exercises in U17 handball players.

• Small-sided games will allow for speed values equivalent to those obtained during short-term intermittent exercises in U17 handball players.

• Small-sided games will allow for VMA values equivalent to those obtained during short-term intermittent exercises in U17 handball players.

Our research aims to examine the current advantages and limitations of alternatives to intermittently performed work, namely small-sided games (integrated PP), in order to confirm that these methods allow for sufficient aerobic and anaerobic system demand, as well as maximum aerobic power and explosiveness in U17 Handball players.

2. Definitions of terms

2.1 Handball

Handball is an Olympic team sport created in Germany in 1919. It is played worldwide, with approximately 60 million players in nearly 800,000 teams participating. It involves two teams, each consisting of 7 players on the field and 7 substitutes, competing for two halves of 30 minutes on a 40m long by 20m wide court. To win, each team seeks to score one more goal than their opponent (Maurelli, 2018).

2.2 Endurance

Endurance is a fundamental quality in Handball performance. Its development requires a precise methodology that must correspond to our objectives. Different methods can be used to develop and optimize it (Dellal, 2008, pp. 27-87).

2.3 Small-sided games

They can be described as a gaming situation where the rules have been altered (for example, by changing the size of the field, the number of players, the dimensions of the goal, the presence of a goalkeeper, or the number of goals) compared to a standard match. In this context, there may be a balanced or unbalanced numerical opposition (Hadj aissa, M.T et all, 2011, p11).

- Operational definition

By integrating it into the overall practice, it can improve speed, endurance, or muscle strengthening through specific forms such as games, fights, or exchanges. Reduced games are also perceived as an effective option instead of traditional training, especially for young athletes, as they have the ability to generate a more dynamic and participatory learning environment that involves children more

2.4 Short-term Intermittent training

This is a very interesting form of training for improving maximum aerobic power for team sports. Most of the time, it involves running sequences (5-15, 10-20, 15-15, etc.) at speeds close to maximum aerobic speed (Cometti, 2003, p. 3).

- Operational definition

Short-term intermittent training is a training method that combines periods of intense exercise with periods of rest, all taking place over a short period of time. This method can be beneficial for improving aerobic and anaerobic capacity, as well as muscle strength and endurance.

2.5 Specific Physical Qualities for Handball

From a physiological point of view, the physical evaluation of a handball player will be organized around the following performance factors:

- Explosiveness and speed qualities (later extended to strength qualities).
- Maximum aerobic power (MAP) qualities, objectified in running speed (VMA).
- Ability to repeat supra-maximal efforts in a situation of incomplete recovery (Buchheit, 2003, pp. 10-11).

3. Previous Work

3.1 Study: Martin Bouchheit, Small-sided games and repeated sprints for the

development of cardiorespiratory capacities in Handball: valid alternatives to intermittent shuttle run training, Handball Approach, No. 100, Faculty of Sports Sciences, France, 2007.

- Aim: To compare the cardiorespiratory responses observed during short periods of small-sided games (HB) to those recorded during an intermittent shuttle run exercise of the same duration, used as a reference exercise for the development of maximal aerobic power.

- Methods: Nine players (21.0±2.9 years, 181.0±4.6cm, 78.4±8.9 kg, and training 5.0±1.1 h/week + weekend matches, playing in national 3 or pre-national leagues, participate.

- Results: Small-sided games proved to be a valid alternative to intermittent shuttle run training, with lower values of lactate and perceived effort difficulty during small-sided games.

- Conclusion: Intermittent shuttle run training is not the only means likely to improve the athletic capacities of the handball player. Small-sided games, in fact, seem to be able to sufficiently solicit the aerobic system to induce notable adaptations and progress.

3.2 Study: Dellal. A, Chamari. K, Impellizzeri. F, Pintus. A, Girard. O, Cotte. T, Keller. D, Evolution of heart rate during small-sided games and intermittent exercises in high-level football players, 11th National Day of Sports Science, ACAPS, Brussels, Belgium, 2007**:**

- Methods: We performed an 8 vs 8 work with goalkeepers and one without goalkeepers.

- Results: This work involved different physiological implications (71.20% reserve HR without goalkeepers and 80.30% reserve HR with goalkeepers). Each element should be taken into consideration.

- Conclusion: Player activity will not be the same during an 8 vs 8 and a 1 vs 1. Using large or small goals, placing supports or not, the presence or absence of goalkeepers are all factors to consider. Similarly, these small-sided games must be rigorously planned. For example, a fitness coach would never propose a 1 vs 1 the day before a match because it is too physically demanding.

3.3 Study: Chamari. K, Hachana. Y, Caouech. F, Jeddi. R, Moussa-Chamari. I, Wisloff. U, Appropriate interpretation of aerobic capacity: Allometric scaling in adult and young soccer players, Br J Sports Med, 39(2):97-101, 2005**:**

- **Methods:** An eight-week training program consisting of dribbling and ball control.
- **Results:** This training increased VO2 max by 8.6% and improved running economy by 10% to 12% in 14-year-old young footballers.
- **Conclusion:** These values are only relevant to young players, but they demonstrate the impact of dribbling and ball control training on physical condition.

3.4 Commentary on previous and similar studies

For sports-related subjects, the nature of the physical activity practiced, the methods used, and the preparation period are parameters that influence the observed results during training for physical qualities (strength, speed, VMA). The methodology chosen in these studies could also have implications on evaluating the effects of integrated physical preparation and short intermittent training. For these reasons, we deemed it useful to provide a summary that includes previous and similar works to our study to demonstrate the real contexts of their execution: the protocol used, the chosen sampling, and the accompanying environmental conditions. Knowing the contexts of these studies' execution, we can objectively compare and discuss our results. These investigations, which have sometimes resulted in contradictory conclusions, have touched on the influence of small-sided games and short intermittent training on physiological and physical parameters and sports performance during different periods. The protocol of previous works by Martin Bouchheit and Chamari K et al consisted of comparing periods of play with a reduced number of players and intermittent shuttle running exercise. Martin Bouchheit's study showed that playing with a reduced number of players is a valid alternative to intermittent shuttle running. Additionally, Chamari K et al's work demonstrated that dribbling and ball handling training for eight weeks in 14-year-old soccer players had beneficial effects on their VO2 max and running economy. These results demonstrate the impact of dribbling and ball handling training on physical condition.

4. Methodology

4.1 Prospecting Domain

In the context of this study, it was impossible to directly observe the athletes during a Handball match, which would have provided valuable information on

performance. However, due to a lack of equipment and limited access to athletes during competitions, we had to turn to field tests to collect data. It was necessary to choose a limited number of samples to be able to perform an average of 3 tests per day for each team. Despite this limitation, this methodology allowed us to gather valuable information on the evolution of parameters and their interdependence.

4.2 Human resources (Sample)

In the context of our study, we focused on U17 handball players:

4.2.1 Studied population:

a- Targeted population:

- Experimental group N1 (14 Handball players).
- Experimental group N2 (14 Handball players).
- Control group N3 (13 Handball players).

b- Source population:

- Handball players from Itihad Ryadi Baladyat Laghouat (IRBL).
- Handball players from Itihad Ryadi Chabab Lagouat (IRCL).
- Handball players from Club Etoile Laghouat(CEL).

c- Subject selection:

Handball players who have the following characteristics :

- Age between 15 and 17 years old.

Weekly training volume of 4 to 6 hours per week in addition to competitions.

Table 1. Characteristics of the studied subjects

Averages Teams	Age (years)	Height (cm)	Body weight (kg)	Membership
IRBL	16.08	172.83	70.88	14
IRCL	16	171.95	71.33	14
ECL	15.93	171.66	72.3	13

Source: Hadj aissa M.T, 2022

4.3 Variables of the study

The presence of a control group, consisting of Handball players who did not receive training to improve their physical skills during the competition period, can be a source of methodological bias. According to Parlebas and Cyffers (1992), this control group allows for the evaluation of effects that are solely attributable to the

independent variable, and any differences between the experimental group and the control group can be attributed to differences in the values of the independent variable.

For our study, the independent variables are:

- **No.1**: Small-sided games
- **No.2**: Short intermittent training

The dependent variable is the specific physical qualities of Handball:

- Explosive strength
- Speed
- Endurance

4.4 Research Methods

4.4.1 Bibliographic Analysis

Bibliographic analysis is an essential tool for the study of a specific subject and is the basis for a good understanding of any research. Researchers always have at their disposal a set of information logically grouped and organized through a well-defined methodology. By doing so, researchers can feed their thinking and influence the process of knowledge creation (Gérald, 2012). This practice is important because it is sometimes the only way for a researcher to find the information they need. In addition, a researcher's bibliography provides a precise indication of the documentation phase, positioning, and argumentative choices they have adopted.

4.4.2 Experimental Method

- Experimental Protocol: The experimental study will be conducted over a period of 6 weeks. Two groups were formed: experimental group N1 (IRBL) with integration of the ball and experimental group N2 (IRCL) without integration of the ball. Both groups followed the same work rhythm: 10 seconds of work and 20 seconds of passive recovery per sequence, with a total duration of 7 minutes and 40 seconds. A rest of 7 minutes was taken between each set.

In order to evaluate the effectiveness of the program, various physical evaluation tests will be conducted in two stages: preliminary and final.

- Preliminary: during the competitive period (before the application of the program).

- Final: during the competitive period (after the application of the program)..

4.4.3 Physical Tests

The adequate evaluation of the physical development levels of young athletes requires the use of reliable, valid, and precise tests. To this end, this experiment consisted of testing and maintaining physical qualities during the competitive period, specifically the explosiveness of the lower limbs and VMA. To measure the explosive strength of the lower body, the Horizontal Jump test (Dekkar, & Al., 1990, P. 121). and the 20m Speed test (Dekkar, & Al., 1990, P. 127) were chosen, and the Shuttle Run test was designed to determine maximal aerobic power. It is important to note that Handba (Léger, & Gadoury, 1989, PP. 21-26).ll is an activity that requires short and intense efforts repeated with intensity and efficiency, which explains the choice of these specific tests. Additionally, due to the lack of equipment and the conditions of the test, the selected tests are

- The Horizontal Jump test
- 20m Speed test
- Shuttle Run test.

To ensure maximum consistency and reliability and to minimize the risk of measurement error, the examiner performed all measurements during the various stages of the experiment. A session was organized before the start of the tests to explain the experimental protocol and associated procedures to the subjects to be tested, along with the examiner. This allowed for any confusion or mishandling by the subjects during the test to be avoided, which could impact the test's smooth running.

4.4.4 Anthropometric measurement method:

The variables studied regarding morphological characteristics, among the anthropometric measurements characterizing athletes, we chose to take some characters on which the most obvious morphological differences between individuals rest:

- Stature: distance from the ground to the vertex. Also known as standing height in contrast to seated height. Height (in cm) is measured using a stadiometer.

- Weight: a medical scale of type (Kuhen et Fleichel) is used to weigh the weight with an accuracy of +/- 0.50 grs.

4.5 Analyses statistiques:

To ensure the accuracy of the data recorded during our analysis, we use a specific method that provides a more precise meaning of the results obtained. This

justifies the reliability and informative impact of the collected data. For this, we will use the following statistical indices:

- Arithmetic mean, Standard deviation, Student's t-test, ANOVA.

5. The applied aspect

5.1 Analysis and discussion

5.1.1 Previous results of the physical tests

A- Vertical Jump Test

Table 2. Comparing previous results of the vertical jump test between IRBL-IRCL-CEL

Group	N	Averages	Standard Deviation	F	Sig.
IRBL	14	220,59	12,71	0,14	0,87
IRCL	14	217,86	13,13		
CEL	13	216,46	30,95		
Total	41	218,35	19,97		

Source: Hadj aissa M.T, 2022

The one-way analysis of variance between the arithmetic means of the preliminary tests (Horizontal Jump) of the three groups (IRBL-IRL-CEL) recorded an F-value of 0.14, with a significance level of 0.87. Therefore, no significant difference was found at the $p < 0.05$ level. This result demonstrates the homogeneity between the groups in terms of explosive lower limb strength.

B- 20m Sprint Test

Table 3. Comparing previous results of the 20m Sprint test between IRBL-IRCL-CEL

Group	N	Averages	Standard Deviation	F	Sig.
IRBL	14	3,65	0,18	0,60	0,55
IRCL	14	3,67	0,19		
CEL	13	3,76	0,41		

Total	41	3,69	0,27		

Source: Hadj aissa M.T, 2022

The analysis of variance with one factor between the arithmetic means of the preliminary tests (20m Speed) of the three groups (IRBL-IRL-CEL) recorded an F value of 0.60, at the threshold of 0.55, therefore it was observed that no difference is significant at the threshold $p < 0.05$. This result proves the homogeneity between the groups regarding speed.

C- Shuttle run Test

Table 4. Comparing previous results of the Shuttle run test between IRBL-IRCL-CEL

Group	N	Averages	Standard Deviation	F	Sig.
IRBL	14	13,43	1,12	0,02	0,98
IRCL	14	13,50	1,07		
CEL	13	13,50	0,84		
Total	41	13,48	1,00		

Source: Hadj aissa M.T, 2022

The one-way analysis of variance between the mean scores of the preliminary tests (Shuttle) of the three groups (IRBL-IRL-CEL) recorded an F-value of 0.02, with a significance level of 0.98, indicating that no significant difference was found at the $p < 0.05$ level. This result demonstrates the homogeneity among the groups regarding the maximum aerobic power.

5.1.2 Discussion of previous results of (VJ-20SP-SR) between IRBL-IRCL-CEL

The one-way analysis of variance between the mean scores of the physical tests (Explosiveness - Speed - VMA) of the three groups (IRBL-IRCL-CEL) showed no significant difference among the groups in our sample (experimental groups and control group) regarding the performance factors in Handball (Explosiveness - Speed - VMA). This homogeneity allows us to adjust and control the study variables further to ensure the objectivity of the study and its results.

5.1.3 Final results of the physical tests

A- Vertical Jump Test

Table 5. Comparing final results of the vertical jump test between IRBL-IRCL-CEL

Group	N	Averages	Standard Deviation	F	Sig.
IRBL	14	220,89	12,53	3,16	0,05
IRCL	14	218,19	12,84		
CEL	13	202,92	30,12		
Total	41	214,27	20,96		

Source: Hadj aissa M.T, 2022

The one-way analysis of variance of the arithmetic means of the final tests (Horizontal Jump) of the three groups (IRBL-IRCL-CEL) produced an F value of 3.16 at a significance level of 0.05, indicating that explosive lower limb movements differ significantly. The players from IRBL displayed scores of 220.89, and those from IRCL reached 218.19. These results therefore support the third hypothesis of the study.

The maintenance of explosiveness in both experimental groups is likely due to the content of the training programs based on different 100-120% VMA runs. This is confirmed by (Dupont, & Al., 2003, pp. 548-554), and the coaching staff can choose the characteristics of this training carefully. "When the intensity is greater than VO2max, aerobic and anaerobic markers can be improved, while at intensities lower than VMA, only aerobic markers can be improved."

Once players are able to perform sessions at speeds above 90% of VO2max, they will be working on aerobic and anaerobic power (Billat, 2003). However, many authors have noted that anaerobic demand depends on the intensity of the work, and it should be at least 100% of VO2max (Dupont, & Al., 2003, pp. 548-554).

The two teams (IRBL-IRCL) underwent the same training programs, the only difference being the integration of the ball in the IRBL group. Our results in favor of the IRBL group are probably due to the reduced games conditions, (Hoff, & Helgerud, 2002) noted that specific training based on reduced games (5vs5) allowed

for approaching equivalent heart rate values to those obtained during short duration intermittent exercises. One of the main differences between these two training methods is the presence of the ball during the reduced games and all the variables that can be present and cause different physiological impacts: presence of goalkeepers, field size, nature of opposition, games with supports, game duration, number of ball touches, etc.

B- 20m Speed Test

Table 6. Comparison of final 20m speed test results of (IRBL-IRCL-CEL)

Group	N	Averages	Standard Deviation	F	Sig.
IRBL	14	3,65	0,18	14,32	0,00
IRCL	14	3,69	0,22		
CEL	13	4,11	0,33		
Total	41	3,81	0,32		

Source: Hadj aissa M.T, 2022

The analysis of variance for one factor between the mean values of the final tests (20m speed) of the three groups (IRBL-IRL-CEL) yielded an F value of 14.32, at a threshold of 0.00. Therefore, concerning speed, there is a highly significant difference with a p-value of < 0.001 in favor of the players of the club (IRBL) with a value of (3.65) and (IRCL) with a value of (3.69). These results support the third hypothesis of the research.

The maintenance of speed in the experimental group IRBL is probably also the result of training at 100-120% of VO2max and in reduced games that favor the development of VO2max. (Bangsbo, 1994b, pp. 5-12) had even demonstrated a correlation between sprint repetition capacity and VO2max. Optimization and maintenance of VO2max at an optimal level enable better sprint repetition and recovery between sprints (Bangsbo, 1994b, pp. 5-12), (Brown, & Al., 2007, pp. 186-190).

Both teams (IRBL-IRCL) underwent the same training programs, and the only difference is the integration of the ball in the IRBL group. Our results in favor of the IRBL group are likely due to the rules of reduced games (Mallo, & Navarro, 2008, pp. 166-71), the rules of the game, recovery and work intervals (Balsom, 1999), the availability of balls, the types of opposition, and their location in the

planning (Jones, & Drust, 2007, pp. 150-6). These factors condition the desired physiological effects.

C- Shuttle run test

Table 7. Comparing final results of the Shuttle run test between IRBL-IRCL-CEL

Group	N	Averages	Standard Deviation	F	Sig.
IRBL	14	13,96	0,69	7,73	0,00
IRCL	14	13,64	1,03		
CEL	13	12,65	0,94		
Total	41	13,44	1,04		

Source: Hadj aissa M.T, 2022

The results of the one-way analysis of variance between the mean scores of the final tests (Shuttle run) of the three groups (IRBL-IRL-CEL) showed an F value of 7.73, with a threshold of 0.00. The results indicate a highly significant difference at a p threshold of <0.001 in terms of maximum aerobic power, in favor of the players from the IRBL (13.96) and IRCL (13.64) clubs. These results confirm the third hypothesis of the study.

The data show that performance in VMA running was maintained in both groups, which is likely due to our physical work on movement and the positive impact of short intermittent exercise and reduced games on the development of aerobic endurance.

Our results are consistent with those of Briat (2006), who found that during the pubertal period (15-19 years), VMA development was achieved through coordination courses (such as ladders, cones, plyometrics, and feet-ball while moving the ball with hands on the course) in 10 sec/10 sec or 30 sec/30 sec at PMA, as well as with changes of direction.

Additionally, our results are likely due to the content of the reduced games program. Balsom's (1999) study, funded by the Swedish National Centre for Research in Sports, suggested that reduced games, like intermittent or continuous training, could be used for endurance training.

Both teams (IRBL-IRCL) underwent the same training programs, with the

only difference being the integration of the ball in the IRBL group. Our results in favor of the IRBL group are likely due to the rules of reduced games (such as field size, number of players, and the presence of a goalkeeper).

Field size greatly influences the players' cardiovascular responses. Tessitore et al. (2006, pp. 36-43) found that physiological impacts were significantly correlated with field size.

The number of players directly affects the physiological impact of a reduced game, in direct correlation with field size (Owen et al., 2004, pp. 50-53).

The presence or absence of goalkeepers greatly affects players' physical performance during reduced games. In fact, Mallo and Navarro (2008, pp. 166-71) found that in the absence of goalkeepers, players covered more distance and had a higher average heart rate for identical game conditions.

5.2 General Discussion

The increase in the number of matches and the lengthening of the competition period calls for reflection on the management of players in training and in matches. Players are increasingly solicited and have less and less time to prepare. In addition, they must face numerous media demands imposed by their respective clubs and federations. A reflection on the development of athletic qualities is more necessary than ever. (Maurelli, 2018).

It is widely accepted that the adolescent body has a great ability to adapt, particularly in the area of aerobic performance. Moreover, it is during puberty that the body undergoes the greatest morphological and functional changes. This privileged stage is conducive to developing endurance training and increasing the physical condition specific to each sport discipline. (Khiat, 2006, PP. 6-31).

We evaluated the physiological responses generated by small-sided games over short periods compared to those obtained during a similar duration intermittent shuttle run exercise, which is commonly used as a reference to improve the ability to repeat explosive efforts (Explosiveness - VMA).

The objective of these tests was to highlight the current advantages and disadvantages of small-sided games compared to intermittent work.

The analysis of variance with one factor, between the means (preliminary) of the physical tests (Horizontal Jump - Shuttle Run Test - 20M Speed) of the three groups (IRBL-IRCL-CEL), showed that there is no significant difference between the groups of our sample (experimental groups and control group) concerning the performance factors in Handball (Explosiveness - Speed - VMA). This

homogeneity allowed us to adjust the study variables and control them more to ensure the objectivity of the study and its results. The comparative analysis (T. student) showed that:

Regarding the explosive strength of the lower limbs, there is a significant difference at the threshold $p \leq 0.05$ in favor of the players of the club (IRBL) with a value of (220.89), and (IRCL) with a value of (218.19).

Regarding speed, there is a highly significant difference at the threshold $p < 0.001$ in favor of the players of the club (IRBL) with a value of (3.65), and (IRCL) with a value of (3.69).

Regarding maximal aerobic power, there is a highly significant difference at the threshold $p < 0.001$ in favor of the players of the club (IRBL) with a value of (13.96), and (IRCL) with a value of (13.64).

The results obtained are consistent with those of the work of (Dellal, & Al., 2008, PP. 118-122). There is a physiological correspondence between small-sided games and intermittent work in terms of the percentage of reserve heart rate and thus the central component. Thus, some small-sided games can be considered as physiological training similar to some short-duration intermittent exercises.

The analysis of variance with one factor, between the means (final) of the physical tests (Horizontal Jump - Shuttle Run Test - 20M Speed) of the two experimental groups (IRBL-IRCL), showed that there is no significant difference regarding the performance factors in Handball (Explosiveness - Speed - VMA). These results justify the third hypothesis of the research.

6. CONCLUSION

Our research aims to contribute to solving problems related to sports training in handball. The objective of this study was to determine the impact of two training methods (Small-sided games and short intermittent training) on the physical responses of U17 handball players.

The results of physical tests conducted on young U17 handball players revealed that the small-sided games method used in the experimental group (IRBL) is a valid alternative to the shuttle run intermittent training applied in the control group (IRCL).

In order to better adapt physical work to the specificities of the discipline, small-sided games can be interesting alternatives to effectively solicit the aerobic

system. There is a physiological similarity between small-sided games and short intermittent training with regards to the peripheral component. Therefore, some small-sided games can be considered a form of training that is physiologically comparable to some short intermittent exercises. Both methods combine anaerobic and aerobic metabolism. The proportion of energy provided by these two types of metabolism depends on the different characteristics of the exercises.

In conclusion, we have achieved our initial objective and confirmed our hypothesis that the methodical and rational choice of a training plan based on the small-sided games method and another based on short intermittent training, during the competitive stage, will have a similar influence on maintaining aerobic endurance and lower limb explosiveness in young U17 handball players.

However, it is important to conduct further studies on other populations such as adults and women to determine if similar effects can be observed during shuttle run intermittent exercise. The use of a larger sample size and the application of the program throughout the competitive period are also necessary to properly evaluate the effects of small-sided games. Furthermore, evaluation over multiple matches can provide more information on this method. From a practical standpoint, implementing this form of work can pose challenges for the coach and/or fitness coach as they must both ensure technical execution and compliance with instructions while monitoring the timer.

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