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Contribution Of Small-Sided Games To The Physical Development Of Handball Player. Case Study Of The Mouloudia Of Algiers Women's Senior Team

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Abstract
Handball is a team sport that has experienced considerable global growth, driven by its dynamic gameplay and strong competitive appeal. To sustain this progression and enhance overall performance quality, ongoing efforts continue to focus on developing technical skills, refining offensive and defensive tactical strategies, and improving players' physical conditioning. Modern handball places high physical and physiological demands on athletes, requiring repeated intense muscular efforts throughout increasingly frequent and competitive tournaments. These conditions can affect players' physical readiness as well as their psychological state.

Within this framework, the present study explores the extent to which **small-sided games (SSGs)** contribute to improving the physical performance of players from the **women's senior handball team of Mouloudia** of Algiers.

Keywords: Small sided Games – physical performance - women's senior team handball

1. Introduction
The concept of small-sided games (SSGs) has emerged as a training method that closely replicates actual match conditions, enabling players to simultaneously develop their physical, technical, and tactical abilities (Clemente et al., 2021; Hammami et al., 2020). In handball, SSGs play a significant role in enhancing endurance, speed, strength, and movement coordination, all while preserving the tactical context and decision-making demands inherent to competition (Michalsik et al., 2015). To effectively support performance development, coaches must manage training load and intensity in accordance with players' physiological responses and individual characteristics, which may differ depending on age, fitness level, and playing position (Buchheit, 2010).
Field observations show that many handball players struggle to maintain optimal performance when experiencing physical fatigue, which underscores the need for conditioning programs that integrate both skill execution and endurance development (Owen et al., 2020). Consequently, SSGs are regarded as a holistic training method capable of simultaneously addressing physical, technical, tactical, and psychological components. In this context, the central research question guiding the present study is as follows:
Do small-sided games significantly influence the physical performance of women's senior handball players?

2- Hypothesis
Small-sided games have a statistically significant effect on the skill performance of women's senior handball players.

3- Research Objectives

- To highlight the importance of small-sided games and their effect on the physical performance of handball players.
- To examine the role of small-sided games in improving reaction speed among women's senior handball players.
- To assess the contribution of small-sided games to the development of endurance and its influence on sustaining and repeating skill performance throughout matches at the women's senior level.

4- Methodological Procedures

• 4 -1 Method and Tools

This study highlights the applied dimension of scientific research, aiming to address practical questions arising from the problem under investigation (Thomas, Nelson, & Silverman, 2015). To this end, statistical techniques were employed to analyze and interpret the data in order to verify or refute the study's hypotheses (Creswell & Creswell, 2018). Selecting appropriate data collection instruments and analytical procedures was therefore essential to ensuring the reliability and validity of the results obtained (Kumar, 2019).

4 -2 Research Approach

Scientific research requires a methodological framework that ensures rigor and relevance in the treatment of the research problem (Cohen, Manion, & Morrison, 2018). Considering the objectives of this study, the **experimental method** was selected, as it is appropriate for examining the effect of small-sided games on the physical performance of athletes (Smith & Sparkes, 2016).

• 4 -3 Research Sample

The sample was purposefully selected, comprising 17 senior female handball players from the Mouloudia of Algiers team. This sampling approach ensures that participants possess characteristics relevant to the study's objectives (Etikan, Musa, & Alkassim, 2016). The athletes trained 6–8 hours per week across four sessions, in addition to participating in official competitive matches.

4- 4 Study Tools

To address the research questions and test the hypothesis, two types of instruments were employed: theoretical resources, including a review of scientific literature, and field methods, consisting of standardized physical performance tests (Creswell & Creswell, 2018). Among these, the 30-15 Intermittent Fitness Test was utilized due to its established validity and reliability in assessing intermittent aerobic performance in handball players (Buchheit, 2008).

5 -Theoretical Study

The theoretical study involved reviewing bibliographic and documentary sources, including scientific articles, books, previous research, and electronic databases, to establish a comprehensive conceptual foundation for the study (Creswell & Creswell, 2018). Both national and international references were consulted to develop a robust theoretical framework supporting the understanding of the variables examined (Kumar, 2019). This phase allowed the researcher to acquire a solid theoretical background prior to conducting the fieldwork.

6 -Field Testing Method

Field testing is regarded as a fundamental method in sports science research, especially in studies evaluating physical performance (Thomas, Nelson, & Silverman, 2015). It provides

objective and quantifiable data, making it well-suited for assessing changes before and after experimental interventions (Hopkins, 2000). To ensure the reliability and validity of the measurements, the tests were standardized and conducted under controlled conditions consistent with the athletes' training environment (Buchheit, 2008).

7 - 30-15 Intermittent Fitness Test Protocol

7 -1 Equipment

The test requires a flat running surface of approximately 40 meters, the official standardized audio file to regulate the stages of the 30-15 IFT, and cones to mark the shuttle distance (Buchheit, 2008). A timing device and, optionally, a heart rate monitor may also be used to collect physiological data (Buchheit, 2010). The use of the validated audio pacing system ensures consistency and standardization across all testing sessions (Buchheit, 2010).

7 -2 Warm-Up

Participants completed a dynamic warm-up lasting 10–15 minutes, consisting of progressive running and acceleration phases to prepare the cardiovascular and neuromuscular systems for high-intensity intermittent exercise (McGowan et al., 2015).

7 - 3 Test Format

The test involves repeated 30-second shuttle runs separated by 15 seconds of passive recovery (Buchheit, 2008). Players run back and forth over a 40-meter distance, adjusting their pace according to the audio cues. The initial speed is set at approximately 8 km/h and increases by 0.5 km/h at each stage (Buchheit, 2008). The test concludes when a participant fails to reach the marker on two consecutive attempts or voluntarily withdraws due to fatigue. The final velocity achieved (VIFT) serves as the primary performance indicator and may be supplemented with heart rate and perceived exertion data as additional measures (Buchheit, 2010).

7 - 4 Notes on Test Administration

To ensure measurement accuracy and test reliability, instructions should be standardized, the testing surface kept consistent, and athletic footwear uniform (Hopkins, 2000). Familiarization trials are recommended to minimize learning effects and enhance the reproducibility of results (Buchheit, 2008).

8 - Physiological Basis and Outputs

The 30-15 IFT assesses intermittent maximal aerobic power and enables the estimation of aerobic capacity through the final running velocity (VIFT) and predicted VO_2max (Buchheit, 2008). It also provides insights into anaerobic and repeated sprint capacities due to the short recovery intervals (Buchheit, 2010). The frequent accelerations, decelerations, and changes of direction further inform on neuromuscular performance and change-of-direction ability (Dobson & Barker, 2018). VIFT can subsequently serve as a basis for prescribing individualized high-intensity interval training (HIIT) (Buchheit, 2008).

9 - Reliability and Validity

Research indicates that the 30-15 IFT exhibits high reliability and strong construct validity across various athletic populations (Buchheit, 2010). Typical measurement error for VIFT ranges from 0.3 to 0.6 km/h, with intraclass correlation coefficients often exceeding 0.85 (Scott et al., 2017). The test shows strong correlations with other measures of intermittent endurance and has proven effective for individualizing conditioning loads (Buchheit, 2008). However, factors such as motivation, maturation level, playing position, and surface conditions may influence performance outcomes and should be taken into account during

interpretation (Hopkins, 2000).

10 - Applications in Sport and Training Prescription

10 -1 Training Individualization:

The final velocity achieved in the 30-15 IFT (VIFT) is widely used to prescribe interval training intensities, with workloads often expressed as a percentage of VIFT, allowing training to be individualized across different fitness levels (**Buchheit, 2008; Buchheit & Laursen, 2013**). This method ensures that athletes receive conditioning stimuli adapted to their physiological capacities, promoting balanced progression (**Iaia & Bangsbo, 2010**).

10 -2 Talent Profiling and Monitoring:

The 30-15 IFT is also used to profile and compare athletes' aerobic and intermittent capacities across different playing positions, competitive levels, and age groups (Buchheit, 2010). Additionally, it serves as an effective tool for monitoring performance changes throughout the season, reflecting adaptations to training loads (Dupont et al., 2018). Research has demonstrated that positional demands affect both running profiles and fitness test outcomes in elite team sports contexts (Gabbett, 2016).

10 – 3 Special Populations:

Adapted versions of the 30-15 IFT have been applied to populations such as wheelchair athletes and military personnel, demonstrating high reliability and practical utility even beyond traditional team-sport settings (Edge et al., 2021; Laffaye et al., 2019). These findings confirm that the test maintains validity across diverse physical and physiological profiles (Buchheit, 2014).

11 - Limitations and Recommendations

11 -1 Learning Effect:

The first administration of the test may underestimate an athlete's true capacity due to a lack of familiarity with the protocol. Therefore, it is generally recommended to include at least one familiarization session, especially for inexperienced participants (**Buchheit, 2008; Hopkins, 2000**).

11 – 2 Environmental and Motivational Influences:

External factors, including surface type, weather conditions, athlete motivation, and group dynamics, can significantly affect performance outcomes. Therefore, standardizing testing conditions is crucial to ensure reliability across repeated assessments. (**Scott et al., 2017; Gabbett, 2016**).

11 – 3 Interpretation of Change:

Given that the typical measurement error of the 30-15 IFT ranges from 0.3 to 0.6 $km \cdot h^{-1}$ (approximately one running stage), small differences between repeated tests may fall within the expected error margin. Therefore, to confirm meaningful improvement, researchers are advised to compare results against minimal worthwhile change thresholds or to conduct multiple repeated assessments (Buchheit, 2010; Hopkins, 2000).

12 - Practical Protocol Checklist (for Coaches and Researchers)

1. 1. Use the validated 30-15 IFT audio file and follow standardized stage progressions to ensure reliability (Buchheit, 2008).
2. 2. Maintain a consistent warm-up and provide uniform instructions to all athletes to support test standardization (McGowan et al., 2015).
3. 3. Conduct a familiarization session when possible to minimize learning effects and enhance test reproducibility (Hopkins, 2000; Buchheit, 2008).

4. 4. Collect additional physiological and perceptual measures, such as heart rate and RPE, to improve the interpretation of performance responses (Buchheit, 2010).
5. 5. When assessing performance changes, compare results to the typical measurement error (0.3–0.6 km/h) or the smallest worthwhile change to determine meaningful improvement (Scott et al., 2017; Hopkins, 2000).

13 - Statistical Method

Statistical methods are considered essential for identifying and understanding the key factors influencing a studied phenomenon, as they enable researchers to organize, analyze, and interpret data systematically and objectively (Thomas, Nelson, & Silverman, 2015). They provide the necessary tools to analyze, interpret, apply, and critically evaluate results, thereby supporting the drawing of valid and reliable scientific conclusions (Creswell & Creswell, 2018). It is important to note that each research study requires statistical techniques tailored to the specific nature of its problem, objectives, and characteristics (Kumar, 2019).
In the present study, statistical analysis was conducted using the following methods:

• t-Test:

The t-test is one of the most widely applied statistical tools in scientific research, used to determine whether the difference between the means of two samples is statistically significant (Field, 2018). As a parametric test, it relies on several assumptions to ensure the validity of results, including the requirement that:

- The dependent variable must be measured on a quantitative scale (interval or ratio).
- Observations must be independent of one another.
- The distribution of the dependent variable should approximate normality.
- Variances should be homogeneous across comparison groups (Pallant, 2020).

Note: Data analysis and statistical processing were performed using **SPSS software**, one of the most widely used tools for statistical computation. Its main advantages lie in its user-friendly interface and its effectiveness in handling and interpreting research data.

Table number (1) shows the results of the paired-samples t-test.

N	Nom	Age	Taille	Poid	IMC	FC au REPOS	Test 1:Vitesse atteinte au 30-15IFT (km/h) 30-08-2024 1er test	Test 1:Vitesse atteinte au 30-15IFT (km/h) 30-11-2024 2er test
1	ABDELKADER SOUHILA	**46**	**165**	**63**	**0**	**0**	**15.5**	16
2	**AIT CHAIT AMIRA**	**27**	**169**	**86,16**	**29,8**	**57**	**16**	16.5
3	**BENMAMMAR MASSILYA**	**24**	**165**	**63,75**	**23,4**	**67**	**17,5**	18
4	**DERRADJ IMANE**	**26**	**176**	**67,3**	**22**	**63**	**18**	18.5
5	**HEMISSI SIHEM**	**40**	**181**	**82,56**	**25,2**	**0**	**15,5**	16

6	**KINZI RADIA**	**28**	**159**	**56**	**22,31**	**64**	**18**	18.5
7	**LACETE SARRA**	**20**	**167**	**63,41**	**22,7**	**53**	**17,5**	**18**
8	**LAOUAR SOUMIA**	**30**	**167**	**67**	**0**	**62**	**16,5**	17
9	**MILOUDI AMIRA LEILA**	**26**	**170**	**63,1**	**22,4**	**72**	**14**	14.5
10	**OULD YOUCEF FAIZA**	**22**	**173**	**86,55**	**29,3**	**0**	**15**	15.5
11	**SAIS HIND YASMINE**	**28**	**173**	**102**	**34**	**66**	**15**	15.5
12	**SMATI RANIA**	**23**	**164**	**63,83**	**24,3**	**61**	**17**	17.5
13	**SMAIL SIHEM**	**27**	**178**	**76**	**0**	**74**	**17,5**	**18**
14	**SMAIL HANNANE**	**29**	**175**	**73**	**0**	**75**	**13**	13.5
15	**ZOUAOUI SELYA**	**29**	**173**	**95,9**	**31,7**	**50**	**14.5**	15
16	**YAHYAOUI CHAHINEZ**	**26**	**175**	**59**	**19,4**	**59**	**17,5**	**18**
17	**NEILA**	**0**	**0**	**0**			**17.5**	18

14 - Discussion and analysis of results:

14 – 1 Presentation, analysis, and discussion of the results:

Before analysing the hypothesis results, it is first necessary to ensure the normal distribution of the results, which is an essential step before choosing the type of statistical test (parametric or non-parametric), and the following table illustrates this:

Table number (2) shows the normality test.

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistiques	ddl	Sig.	Statistiques	ddl	Sig.
test1	.213	17	.060	.908	17	.091
test2	.210	17	.064	.907	17	.091

14 -2 Interpreting the Results of the Normality Test:

Based on the results presented in Table 2, the Kolmogorov–Smirnov test produced significance values ranging from 0.60 to 0.64, which exceed the 0.05 threshold, indicating that the data do not significantly deviate from a normal distribution (Field, 2018). However, since the study sample includes fewer than 50 participants, the Shapiro–Wilk test is considered more appropriate for assessing normality (Razali & Wah, 2011). The Shapiro–Wilk test yielded a significance value of 0.091 for both measures, also above 0.05, confirming that the data follow a normal distribution (Ghasemi & Zahediasl, 2012).

Considering the results of both normality tests, greater emphasis is placed on the Shapiro–Wilk test due to its higher sensitivity and reliability for small sample sizes (Field, 2018). Therefore, the data distribution can be considered normal, allowing for the use of parametric statistical analyses, including the paired-samples t-test (Pallant, 2020).

To examine the research hypothesis, arithmetic means and standard deviations were

calculated to determine the observable differences between pre-test and post-test measurements (Thomas, Nelson, & Silverman, 2015), as illustrated in the following table:
Table number (3) shows the results of the paired-samples t-test.

		Moyenne	N	Ecart type	Moyenne erreur standard
Paire	test1	16.2059	17	1.53153	.37145
	test2	16.7353	17	1.51160	.36662

14 – 3 Analysis of the Table Results:
The table indicates that the mean score for the sample in Test 1 was 16.2059 with a standard deviation of 1.53153, while the mean score in Test 2 was 16.7353 with a standard deviation of 1.51160. This slight increase in the mean suggests an improvement in the post-test compared to the pre-test (Pallant, 2020).
The nearly identical standard deviations indicate acceptable homogeneity of the results and the absence of substantial dispersion within each sample (Field, 2018).
The low standard error reflects the stability of the values around the mean, further supporting the reliability of the measurement results (Thomas, Nelson, & Silverman, 2015).
Consequently, a paired-samples t-test can be conducted to determine whether the observed difference between the means is statistically significant (Creswell & Creswell, 2018).
Table number (4) shows the results of the paired-samples t-test.

		Différences appariées					t	ddl	Sig. (bilatéral)
		Moyenne	Ecart type	Moyenne erreur standard	Intervalle de confiance de la différence à 95 %				
					Inférieur	Supérieur			
Paire	test1 - test2	-.52941-	.12127	.02941	-.59176-	-.46706-	-18.000-	16	.000

14 - 4 Interpreting the Table Results:
Based on the table results, the t-test revealed a mean difference of -0.52941 in favor of Test 2, indicating an improvement in post-test performance compared to the pre-test (Pallant, 2020).
The t-value was -18.000 with 16 degrees of freedom, which is considered statistically significant according to conventional interpretation guidelines (Field, 2018).
Moreover, the p-value (0.000) is below the 0.05 significance threshold, indicating that the observed difference between the two means is statistically significant and unlikely to have occurred by chance (Creswell & Creswell, 2018).
Therefore, it can be concluded that a significant effect exists between the first and second measurements, supporting the hypothesis that the training intervention contributed to improved performance (Thomas, Nelson, & Silverman, 2015).

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