

The role of coordination training in optimizing anaerobic capacities among football players

دور تدريب التنسيق الحركي في تحسين القدرات اللاهوائية لدى لاعبي كرة القدم

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Abstract:

Background:

This study aims to investigate the role of motor coordination training in improving anaerobic capacities in football players. Which are the maximal running speed (MRS) or called also velocity in the intermittent fitness test (V_{IFT}) and the anaerobic speed reserve (ASR)

Participants and Methods:

The sample included 22 senior soccer players from the CROA (Club Riadhi Ouled Allal) amateur football club. An experimental approach was employed, where a training program was implemented for 09 weeks; the results were extrapolated from the application of the (30-15_{IFT}) test to assess both before and after a training program. The training program focused on enhancing motor coordination through specific exercises.

Data Analysis:

Calculating the mean ($\bar{X}$) and standard deviation (SD) for pre- and post-test measurements. Employing Pearson correlation coefficient to assess the relationship between motor coordination and anaerobic abilities.

Utilizing the Student T-test for dependent samples to compare pre- and post-test results within the intervention group. Performing the Student T-test for independent samples to compare the intervention group with a control group.

Results:

The findings indicated that the motor coordination training program led to improvements in both maximal running speed (MRS) and anaerobic speed reserve (ASR) in the intervention group. However, there was no significant difference between the intervention group and a control group in terms of MRS and ASR.

Keywords: Motor coordination; Velocity in the intermittent fitness test (VIFT) or Maximal running speed (MRS); Anaerobic speed reserve (ASR).

Introduction:

Modern football requires players to have high physical fitness. This is due to football data analysis which is used to analyze competitions and determine the exact factors that lead players to high level performance. Nowadays the physical aspect is one of the factors that contribute to increasing the degree of achievement in football players helping them reach a high level of fitness

Through the development in physical features that occurs today, players are very fit and quick. This is largely due to the staff providing the best training conditions (CATTENOY & GIL, 2002, p. 15). Physical preparation is considered a global, hierarchical, regular, and harmonious part of the training process that focuses on improving and utilizing the player's physical attributes (MARTINET & PAGES , 2007, p. 137)

The football match serves as an ideal indicator of a player's level, encompassing both physical, motor, and physiological aspects. Extensive research has focused on the development and impact of physical motor skills in various contexts, including their relationship with physical fitness and cognitive development. (LEGEARD , 2007, p. 137) A significant amount of data is delivered through quality analysis of football matches in official competitions. It has been noted that players typically perform between 120 to 200 sprints per match. The analysis of football players' physical activity has yielded several key statistics. Notably, modern football players cover distances ranging from 08 to 13 kilometers per match, with an average of approximately 11 kilometers per match. This intense physical exertion is accompanied by a heart rate averaging around 164 beats per minute (bpm) (DELLAL A. , 2008). Additionally Cazorla, Fahri, 1998 and Lacroix, Cometti 2002 counted high-intensity movements lasting between one to four seconds occur between 100 to 120 times during a match (Cometti, 2014). These findings are presented in both quantitative and qualitative aspects. The quantitative analysis provides comprehensive guidance for training programs, while the qualitative analysis allows for tailored training recommendations based on specific positional requirements and competitive demands. (DELLAL A. , 2008) All these motor behaviors are characterized by anaerobic actions; And this is the pattern of activity in football that determines the results this is why we have chosen to study.

Motor coordination is a pivotal attribute in football, closely linked to physical characteristics, aerobic and anaerobic capacities, and various motor skills. Its significance stems from its association with athletes; high motor coordination enables players to overcome diverse resistances efficiently, using minimal effort in less time without errors. This capability facilitates effective ball handling under varied conditions. Through lot of experiences as both players and coaches in sports fields, we have observed that athletes often face challenges in consistently performing motor skills, necessitating repeated efforts over short intervals.

Given that football performance is governed by two fundamental aspects namely; the motor-skill aspect specific to football and the physiological aspect. Researchers have endeavored to investigate the relationship between enhancing motor skills through motor coordination training and its impact on improving physiological performance in football, particularly anaerobic capacities.

Through posing the following question:

Is there an impact of motor coordination training on anaerobic capacities among football players?

1. Sub-Questions:

- 1.1 Is there a statistically significant difference in maximal running speed (MRS) / (V_{IFT}) between the control group and the experimental group?
- 1.2 Is there a statistically significant difference in anaerobic speed reserve (ASR) between the control group and the experimental group?

2. The primary hypothesis:

- 2.1 The motor coordination training has a significant impact on anaerobic capacities in football players?

3. Sub hypothesis:

- 3.1 There is a significant difference in maximal running speed (MRS) / (V_{IFT}) between the control group and the experimental group.
- 3.2 There is no significant difference in anaerobic speed reserve (ASR) between the control group and the experimental group.

4. The objective of the study:

This study aims to investigate the role of motor coordination training in enhancing anaerobic capacities among football players, specifically focusing on maximal running speed (MRS) / (V_{IFT}) and anaerobic speed reserve (ASR)."

5. Define the terminology of the study:

- 5.1 Football: «is first of all, a team game played between two teams, each with eleven players, including a goalkeeper. Four referees supervise the arbitration matches distributed as follows: one in the middle of the field, two assistant referees on the sidelines, and the fourth referee is a reserve» (BOUFRIDA, 2024, pp. 180-193)
- 5.2 Anaerobic physical qualities: the ability of the muscle to work at maximum intensity for a short period of time without the use of oxygen (O_2) to produce energy during performance. It includes two systems: the first is phosphate and the second is lactic. (Gasmi , 2016, pp. 169-189)
- 5. Motor coordination training: Is the ability to express a level of motor skills in a discipline and the ability to execute technical sequences efficiently to achieve the sporting task.

6. Previous and similar studies :

6.1 The first study:

GUESMI Abdelmalek: Comparison of the development of some physical characteristics (aerobic and anaerobic) among football players according to the three playing areas (defense, attack, midfield) under 21 years old. 2016 (Gasmi , 2016, pp. 169-189)

The aim of the study: Learn about the statistical differences in anaerobic and aerobic capacities among football players according to the playing lines (defense, midfield, attack)

The method used: descriptive.

Study sample: 21 players (Under21)

The most important results: Statistically significant differences exist in anaerobic capacity results between football players on the defensive line and midfield, as well as

between those on the offensive line and midfield. No statistically significant differences are found in anaerobic capacity results between players on the defensive and offensive lines. Statistically significant differences occur in aerobic capacity results among players across different positions: between defense and midfield, offense and midfield, and defense and offense.

6.2 Second study:

Matheus luis DA SILVA .Ricardo cesar alves FERREIRA : Anaerobic power analysis and training methods in professional soccer athletes ; 2019 (DA SILVA & FERREIR, 2019, pp. 198-202)

The aim of the study: An analysis of certain methods for training maximum anaerobic power and demonstrating its importance in professional football.

The method used: descriptive based on literature review

Study sample: The search returned 86 entries, from which 30 were filtered out and used in this review

The most important results: According to the authors mentioned in this review, during a soccer game, there are different variables that are important for the final score of the match, but the prominent players in a match may have a better influence in decisive situations (sprint, jumps, short accelerations). Therefore, training maximal anaerobic power is extremely important for this modality while still considering other variables. The training program must be well prepared, with adaptations of intensity, volume and density in the soccer training. Regarding maximal anaerobic power, it can be improved through training and neuromuscular adjustments.

For goalkeepers, plyometric training may be the most appropriate to improve this variable due to their demands during a soccer match. For outfield players, on the other hand, a mix of training methods seems to be more adequate, adapting the needs of the team. Training using the ball, thus being closer to the reality of the game, is a good strategy that increases competition and dispute during the training.

Through this research, it is possible to conclude that the training of this variable must be done with alternating methods within the proposals and needs of the team.

6.3 Third study:

Mustafa KOKSAL. Gazanfer K.GUL & all. : Effects of coordination training on the technical development in 10-13 year-old football players. 2021 (Köksal , Gazanfer , & all, 2021, pp. 497-504)

The aim of the study: Determining the effects of coordination training conducted with male football players aged 10 and 13 years on their performance in skills such as dribbling, passing, shooting, ball control, and wall volley.

The method used: experimental approach. Pre- and post-test measurements were compared by an ANOVA 2×3. A significant level of $P < 0.05$ was established.

Study sample: 45 male football players were divided into three 15 participants groups. The experimental group performed 30 min coordination training three days a week for ten weeks while the control group one continued their routine training and control group two performed unstructured football training

The most important results: All the skills, dribbling ($P<0.001$), passing ($P<0.001$), shooting ($P<0.001$), ball bouncing ($P=0.047$) and wall-volley ($P<0.001$), improved after ten weeks in the experimental group, while only passing ($P=0.006$), shooting ($P=0.007$) and wall-volley ($P<0.001$) improved in the control group one and none of the skills improved in the control group two ($P>0.05$). The improvement was significant in the experimental group in comparison with the control groups ($P<0.001$).

The implementation of coordination exercises in combination with structured football training has been shown to be effective in improving general football ability among 10-13 male players.

1. Motor coordination in football: (Times New Roman, size 12, bold)

1.1 Definitions:

1.1.1 «The simultaneous action of the central nervous system and skeletal muscle to execute a voluntary movement, ensuring a harmonious sequence among the various components of this movement» (DELLAL A. , 2008, p. 47)

1.1.2 «Coordination is the capacity for neuromuscular organization from the intake of information, its processing, to the execution of the motor task» (CASCUA & CHOQUE, 2003, p. 55)

1.2 Motor features:

Motor coordination is considered a well-established motor ability or capacity, closely linked to speed, strength, endurance, and flexibility. Beyond being merely an important element, it is critical not only for the requirements of technical and tactical skills and their mastery but also for applying these skills in unfamiliar situations.

Coordination becomes essential when an athlete is airborne or in unusual or previously unencountered situations, such as during vaulting on a horse or gymnastics box in various or diverse jump scenarios. It also gains importance when an athlete loses balance during sudden slips, landings, and rapid adjustments.

Developing neuromuscular coordination is one of the goals of physical education, according to some scholars. The importance of coordination is not limited to the athletic field; rather, individuals require it in their daily lives for activities such as walking and driving. Driving a car, for instance, necessitates coordination between the eyes, arms, and feet to complete the driving process.

Coordination relies on the integrity of integrated connectivity and interaction between the nervous and muscular systems ensuring precise movement and appropriate timing with adequate power to link the movement of participating limbs in performance according to the required motor pathways for task completion efficient movement and accuracy in performance

«The motor attributes are acquired characteristics influenced by the environment, with training and practice serving as their foundation. They develop according to an individual's physical, sensory, and cognitive capabilities. These attributes are interconnected with cognitive and physical abilities, and they are affected by well-being and health, exhibiting a reciprocal relationship where they increase with enhancement and are negatively impacted by decline» (Mekhnache & Merabet, 2024, pp. 65-78)

1.2.1 Types of motor coordination

- A. Inter-muscular coordination: This refers to the cooperation of multiple muscles in integrating a single movement. (BOMPA, 2008, p. 159)
- B. Intra-muscular coordination: This involves the simultaneous action of numerous neuromuscular units in executing a specific movement. (BOMPA, 2008, p. 159)
- C. General coordination: This refers to an athlete's ability to perform motor skills reasonably well, regardless of the specific sports activity. Versatility in training contributes to an athlete's overall coordination proficiency."
- D. Specific coordination: Reflects an athlete's aptitude for executing varied movements within a sport or activity. It is characterized by swift, facile, and precise execution and can be enhanced through extensive repetition of specialized skills throughout an athlete's career. Furthermore, specific coordination aligns with the nature of the particular activity. For instance, basketball exemplifies this type, highlighting ball exchanges between one hand or both hands along with maintaining a focused gaze on the basket. Similarly, in fencing, specific coordination involves harmonizing weapon movements with a specific point on the opponent's body to achieve the objective, and so forth for other diverse sports activities or events.

2. Anaerobic capacities in football:

2.1 Setting the term practically:

Anaerobic capacity is the maximum amount of work that can be performed during short-duration, high-intensity physical exertion; it reflects the ability to produce energy through anaerobic glycolysis. Anaerobic capacity is the ability of muscles to adapt to training in the form of short-duration physical activities of maximal and supramaximal intensity. Anaerobic capacity is essential in most sports, regardless of the specific discipline. One must be able to produce energy quickly and efficiently; the role of anaerobic metabolism in endurance sports should not be underestimated. It is a key factor if you want to run fast to reach the finish line or outpace your opponents through anaerobic training, you can improve your speed and power in addition to $VO_2\text{max}$ and lactate threshold with the help of your compatible smart watch from Garmin, as it is an effective way to increase muscle mass and burn calories. Simply put, anaerobic exercises are a powerful means to improve your physical fitness and performance.

It is also defined as “the maximum amount of adenosine triphosphate (ATP) resynthesized via anaerobic metabolism (by the entire organism) during a defined period of maximal, short-duration exercise. This review focuses on laboratory measures that attempt to quantify anaerobic capacity. It examines the evidence supporting or challenging the validity of these measures and provides research foci for future investigations. The discussion centers on anaerobic capacity as measured during running and cycling, where all reviewed data were collected using these exercise modalities” (Sözen & Akyıldız, 2018, pp. 331-337)

2.2 Physiological and bioenergetics support of anaerobic potential:

Recent scientific evidence has confirmed the existence of a strong and well-established relationship between the fields of physiology and training in football. This connection is largely due to the focus of physiologists on studying functional changes that occur in the athlete's body following physical exertion during training. (belaidi, bounneb chaker, &

bouneb, 2025) Physical activity results in energy expenditure and simultaneously aims to restore it. (RICHE, 1998, p. 06) Adenosine triphosphate (ATP) is the fundamental basis for muscular contraction, and its hydrolysis provides energy. (BAYER, 1983, p. 309) The interaction of ATP serves as the direct source of energy in muscular activity through the hydrolytic cleavage of its terminal phosphate bonds, thereby releasing energy. This process enables the conversion of chemical energy into mechanical work. (FOUTUNE, 2003, p. 82) The concentration of ATP in muscles remains relatively constant but low, approximately 04 to 06 mMoles per kilogram of muscle tissue, and it sustains maximal intensity activity for only 0.8 to 1.2 seconds, yielding approximately 50 kiloJoules (KJ) per Mole, or up to 20 seconds during low-intensity activities such as walking. (BAYER, 1983, p. 309) Sporting activities vary significantly in their energetic demands examples include jumping, sprinting over short distances, and marathon running which necessitate the production of necessary energy required by skeletal muscles for contraction during these activities. Consequently, there are three primary systems responsible for producing this energy.

2.2.1 ATP-CP system: It can refer to it as the anaerobic alactic system, given that oxygen (O_2) does not participate in the breakdown of ATP. However, according to Prévost and Reiss (2013), « Oxygen indirectly participates in the re-synthesis of ATP». (REISS & PREVOST, 2013, pp. 69 - 70) When neural oscillations occur, they stimulate muscle fibers and activate ATPase enzymes located at the myosin heads, allowing for the hydrolysis of ATP, upon completion of this process; other elements intervene to facilitate the re-synthesis of ATP, namely phosphocreatine (PCr). This compound donates ATP based on an intracellular energy reservoir through the action of creatine kinase. This enzyme catalyzes the hydrolysis of PCr, yielding inorganic phosphate (P_i) and creatine (Cr). The released energy is utilized to combine inorganic phosphate with adenosine diphosphate (ADP), resulting in resynthesis of ATP. (DOULRELOUX, 2013, p. 17) The muscular stores of phosphocreatine are moderate also, averaging approximately 16 to 24 mMoles per kilogram of muscle tissue. This supply can sustain intense physical activity for about 01 to 05-07 seconds. Phosphocreatine releases energy amounting to approximately 77 kiloJoules per Mole.

2.2.2 Anaerobic glycolytic system: This system operates in the absence of oxygen, with lactate production occurring at high intensities, typically during efforts lasting from 20 to 120 seconds. (SENNERS, 2003, p.277) «When the work exceeds 20 seconds, glucose is broken down anaerobically, resulting in the production of lactic acid and hydrogen ions (H^+).» (PEDROLETTI, 2013, p. 257) ATP regeneration occurs by the energy of glycolysis, which means the breakdown of glucose in the absence of oxygen. (SAVOLDELLI & LAIDET, 1998, p. 47) At the onset of exercise, anaerobic glycolysis intervenes, involving elements such as ADP, AMP, and particularly Calcium. These elements are byproducts of ATP hydrolysis and assist enzymes involved in the breakdown of glycogen or glucose into pyruvate. The decomposition of a glucose molecule does not yield the same output depending on the process used; Glycogenolysis produces three ATP molecules per glucose molecule, whereas glycolysis yields only two ATP molecules. This difference in ATP yield favoring glycogenolysis by one additional ATP is attributed to the fact that glucose produced from glycogen breakdown is readily available for use in glycolytic processes (REISS & PREVOST, 2013, pp. 82- 83)

2.3 Maximum aerobic power (MAP): It is the maximum amount of oxygen (O_2) that the body can utilize per unit time (specifically per minute); during a high-intensity muscular exercise lasting three minutes or longer. This parameter is related to aerobic capacity and reflects the efficiency of various physiological systems in delivering and utilizing oxygen called maximum oxygen uptake ($\dot{V}O_{2max}$). (THILL, CAZORLA, & all., 2009, p. 433) and it is the developed power, the unit of measurement is watts per minute. (SAVOLDELLI & LAIDET, 1998, p. 48)

2.4 Maximal running speed (MRS) or Velocity in the intermittent fitness test (V_{IFT}): are the same, it represents the result of the last completed level achieved in the 30-15_{IFT} test, and this result can then be used to determine individual running distances or durations of interval training sessions. Significantly represents most of the physiological determinants of performance in team sports, and can therefore be used to monitor athletic performance in team sports. (BUCHHEIT, 2008, pp. 26-28). Another positive aspect is that it is associated with Repeated Sprint Ability (RSA), which is good news because this is a fundamental physical attribute in team sports. (DAVIES, 2024) As the speed achieved will be higher than Maximal aerobic speed (MAS) due to the intermittent nature of the test. As athletes have a 15-second recovery between levels, their final velocity is called 'velocity in the intermittent fitness test (V_{IFT})' or (MRS) and is a 'composite velocity'. This also takes into account their anaerobic capabilities and change of direction ability, all of which contribute to field-based sports performance. (DAVIES, 2024)

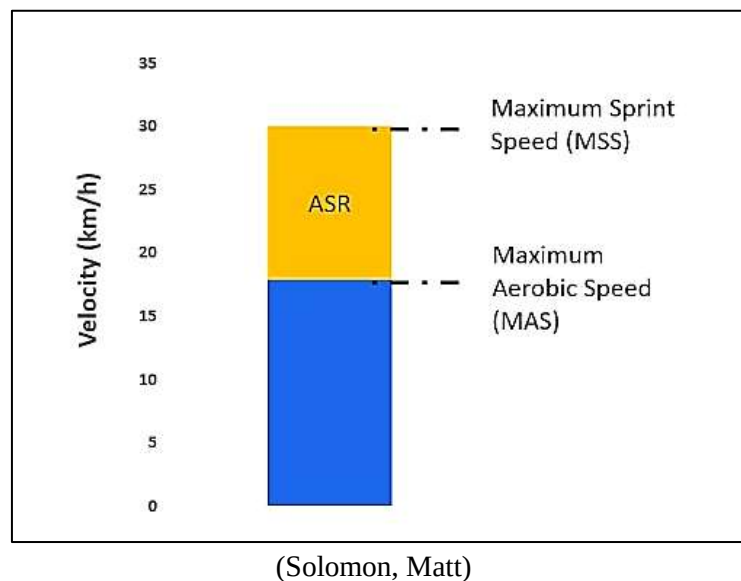
The final outcome in the 30-15_{IFT} [final velocity 30-15_{IFT}; (V_{IFT})] reflects maximal cardiorespiratory function, the anaerobic capacity. (Scott, Hodson, Govus, & Dascombe, 2017, pp. 2825–2831) There is a positive influence of change-of-direction ability (COD), repeated sprint ability (RSA), lower limb power measured using countermovement jump (CMJ), and aerobic power on VIFT (Silva, Alvurdu, & all., 2022, pp. 01-13)

2.5 Anaerobic speed reserve (ASR): Also referred to as 'anaerobic velocity reserve (AVR)' is the difference between an athlete's maximum sprint speed (MSS) and their maximal aerobic speed (MAS) (Sandford, Laursen, & Buchheit, 2021, pp. 2017-2028) the existing researches on this area confirm that athletes with a greater ASR show lower neuromuscular impairments and RPE during high intensity interval work. (Buchheit & Laursen, 2013, pp. 313-338) This makes sense, as athletes with a higher ASR will find each interval less physically demanding, and therefore it will be less costly per effort. (DAVIES, 2024) A study suggests that for shorter, more intense activities, focusing on anaerobic contributions (% ASR) is more valuable for predicting and understanding performance limitations than focusing on aerobic contributions (% MAS). (Blondel, Berthoin, Billat, & Lense, 2001, pp. 27-33) That is mean the Anaerobic Speed Reserve (ASR) is the difference between an individual's maximal sprint speed (MSS) and their maximal aerobic speed (MAS). % ASR would then be the percentage of this reserve being utilized during the exercise.

2.5.1 The relationship between ASR and sport performance: It represents the extent to which anaerobic metabolism is contributing to the effort. And the maximal aerobic speed (MAS) is the lowest speed at which a person reaches their maximum oxygen uptake ($\dot{V}O_{2max}$). % MAS is the percentage of this speed being used during the exercise. This

reflects the degree to which aerobic metabolism is contributing. As an interpretation we can say that in shorter duration, high-intensity exercises (up to 8 minutes), an individual's capacity to perform is more closely tied to their anaerobic capabilities (% ASR) than their aerobic capacity (% MAS). Given that a higher ASR is associated with increased running performance at the elite level. (DAVIES, 2024) As an implication we say that first of all; for training and performance assessment, it suggests that anaerobic capabilities are more critical for activities lasting less than 8 minutes. Secondly; monitoring % ASR during training might provide better insights into an athlete's fatigue and performance capacity in these types of activities.

Figure.1. the ASR physiologic zone



3. Methods:

3.1 The Fields of Study:

3.1.1 Time frame: This study was conducted (from November11, 2023 to January14, 2024)

3.1.2 Spatial domain: At the stadium complex, Chakfa municipality, Jijel province.

3.1.3 Human Field: Senior male players of CROA team.

Until the end of the division

3.2 Research method: The researchers employed the experimental method due to its suitability for the nature of the research. The experimental method is defined as "an attempt to control all factors affecting the dependent variables in the experiment, except for one factor that the researcher manipulates and changes in a specific way in order to determine and measure its effect on the dependent variables.

In other words, if the "independent variable" leads to changes or alterations in the dependent variable, the researcher then resorts to the appropriate method, which is the experimental research. The experimental researcher seeks to understand the impact of independent variables that may influence the dependent variables being studied by the researcher

3.3 Population and Sample of the Study: The research population consists of senior male football players in the pre-honor division in Jijel Province, totaling 212 players at the

beginning of the study. The sample was selected purposefully and consists of 22 senior players from the amateur sports club CROA. Which represent 10,37% of the study population

3.5.1 Study Variables:

3.4.1 Independent Variable: Sometimes referred to as the experimental variable, it is the variable that the researcher hypothesizes as the cause, or one of the causes, of a specific outcome. Studying this variable may lead to understanding its effect on another variable. In our research, the independent variable is “Motor Coordination training”

3.4.2 Dependent Variable: This refers to the phenomenon that exists, disappears, or changes when the researcher applies or manipulates the independent variable. In our study, the dependent variable is “Anaerobic Capabilities in Football”.

3.5 Statistical processing:

3.5.1 The mean ($\bar{X}$)

3.5.2 Correlation coefficient

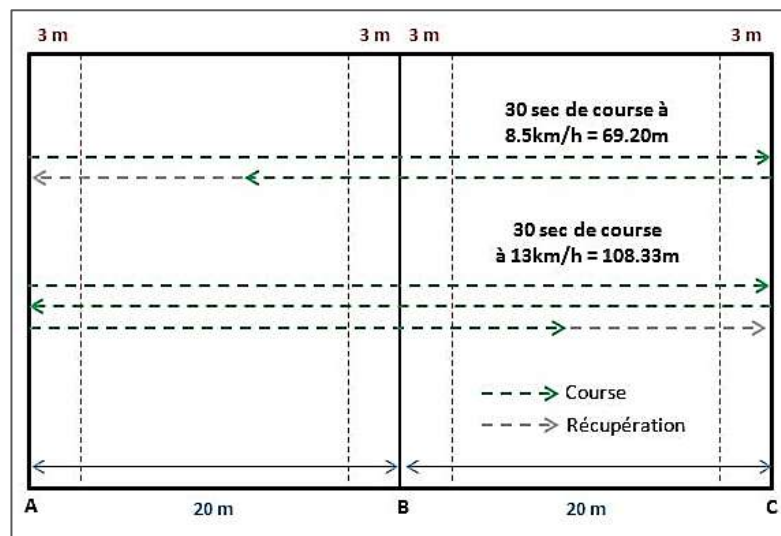
3.5.3 Student T-test

3.5.4 Standard deviation

3.6 Data collection tools:

3.6.1 The 30-15_{IFT} (Intermittent Fitness Test): Is about repeated 40 meters shuttle-runs during 30 second, interspersed with 15 second of active (walking) recovery, and a speed increment of 0.5 km/h per stage. The 30-15_{IFT} was ‘born’ in July 2000. (Buchheit, 2010)

Figure.2. Field division for 30-15_{IFT}



Source: (Buchheit, 2010)

3.6.2 Test of 40 meters maximum speed

3.6.3 The formula for calculating the estimated VO_{2max} based on the V30-15_{IFT} is as follows: $VO_{2max} \text{ at } 30-15_{IFT} = 28.3 - 2.15 \times (Gender) - 0.741 \times (Age) - 0.0357 \times (Weight) + 0.0586 \times (Age) \times (V30-15_{IFT}) + 1.03 \times (V30-15_{IFT})$

3.6.4 The formula for calculating ASR is as follows: $ASR = \text{maximum sprint speed} - \text{maximum aerobic speed}$. ($ASR = MSS - MAS$)

4. Results analysis and discussion:

4.1 Present and analyze the results of the homogeneity test for both samples:

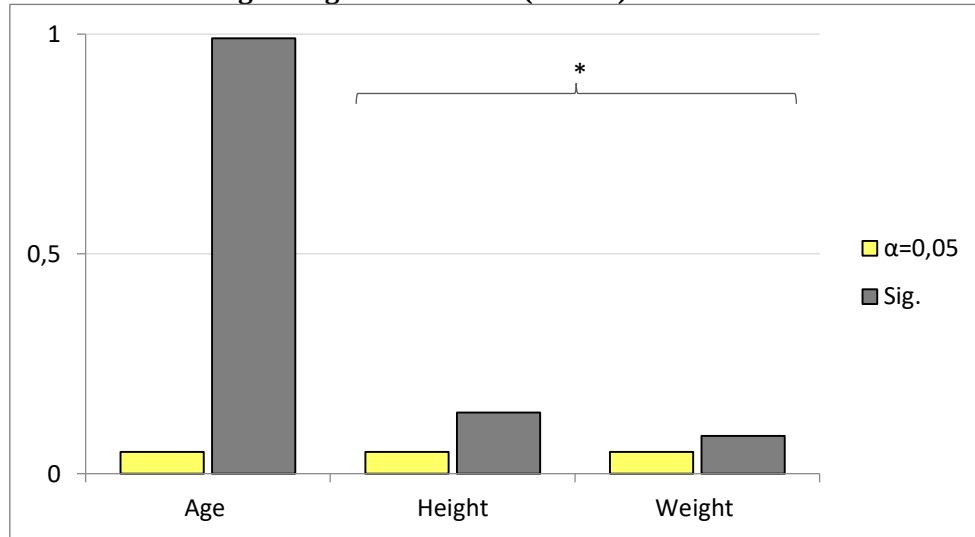
Table 1. The results of anthropometric and ages measurements for the research groups (control, experimental).

Source: ROUABI, & all.; from the current study.

Figure.3. shows the homogeneity for the research groups in anthropometric measurements* and

Axes Variables	Experimental group		Control group		Sig. Level	df	Sig.	statistical Index
	$\bar{X}$	SD	$\bar{X}$	SD				
Age	24,9	5,51	25,1	5,5	$\alpha=0,05$	20	0,990	Not significant
Height	176,7	6,75	174,7	3,93			0,139	Not significant
Weight	74,6	10,35	68	8,34			0,086	Not significant

age at significance level ($\alpha=0.05$) and $df=20$.



Source: ROUABI, & all. ; From the current study.

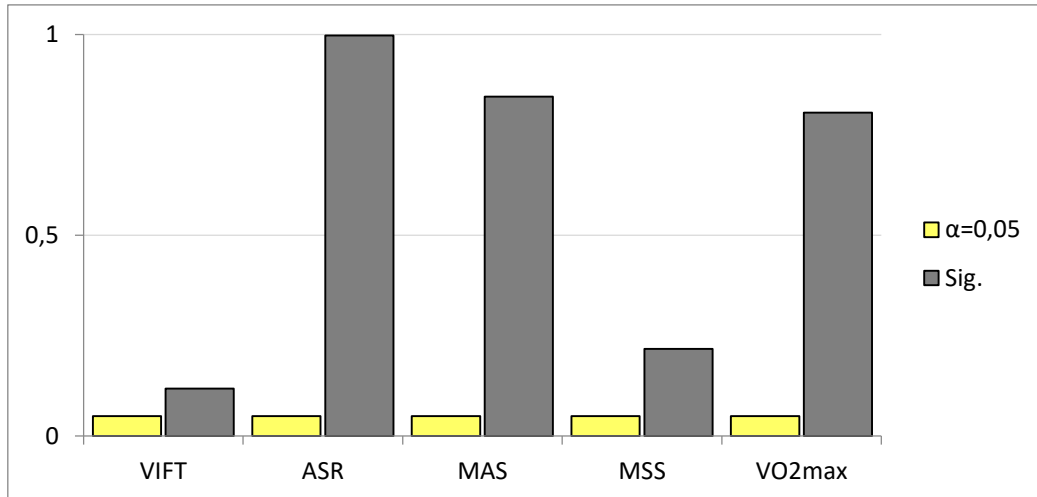
Table 2. The results of maximum speed sprint (MSS) and physiological measurements for the research groups (control, experimental).

Source: ROUABI, & all. From the current study

Figure.4. shows the homogeneity for the research groups in the maximum sprint speed (MSS)

Axes Variables	Experimental group		Control group		Sig. Level	df	Sig.	statistical Index
	$\bar{X}$	SD	$\bar{X}$	SD				
V _{IFT}	18,95	0,94	19	1,12	$\alpha=0,05$	20	0,118	Not significant
ASR	15,76	1,47	15,72	1,67			0,997	Not significant
MAS	14,89	0,79	15,03	0,94			0,845	Not significant
MSS	30,65	1,01	30,75	1,56			0,217	Not significant
VO ₂ max	52,12	2,77	52,6	3,32			0,805	Not significant

and the physiological measurements at significance level ($\alpha=0.05$) and $df=20$.



Source: ROUABI, & all. ; From the current study.

View and read results: It is evident from Tables 1 and Figure 3 which present the anthropometric and age-related characteristics of the participants in both the experimental and control groups. The table includes the means ($\bar{X}$) and standard deviations (SD) for age, height, and weight, along with the corresponding significance values (Sig.) obtained from independent samples t-tests. The level of significance was set at $\alpha = 0.05$, with 20 degrees of freedom. The results indicate that there were no statistically significant differences between the two groups in any of the measured variables. Specifically, the mean age of the experimental group was 24.9 years (SD = 5.51), while that of the control group was 25.1 years (SD = 5.5), with a p-value of 0.990. The average height was 176.7 cm (SD = 6.75) in the experimental group and 174.7 cm (SD = 3.93) in the control group, yielding a p-value of 0.139. Similarly, the average weight was 74.6 kg (SD = 10.35) for the experimental group and 68 kg (SD = 8.34) for the control group, with a p-value of 0.086. Since all significance values exceed the alpha threshold of 0.05, the observed differences are not statistically significant. These findings suggest that the experimental and control groups were homogeneous with respect to age, height, and weight prior to the intervention, thereby supporting the internal validity of the study.

Table 2 and figure 4 display the comparative results of selected physiological performance variables between the experimental and control groups. The variables assessed include V_{IFT} (Velocity in intermittent Fitness Test), ASR (Anaerobic Speed Reserve), MAS (Maximal Aerobic Speed), MSS (Maximal Sprinting Speed), and VO_{2max} (Maximal Oxygen Uptake). For each variable, the table presents the mean ($\bar{X}$), standard deviation (SD), significance level ($\alpha = 0.05$), degrees of freedom ($df = 20$), and the corresponding p-values (Sig.). The statistical analysis using independent samples T-tests revealed no significant differences between the two groups for any of the assessed variables: first of all the V_{IFT} The experimental group recorded a mean of 18.95 km/h (SD = 0.94), while the control group scored 19 km/h (SD = 1.12), with a p-value of 0.118. secondly, the ASR The experimental group had a mean of 15.76 km/h (SD = 1.47) compared to 15.72 km/h (SD = 1.67) in the control group, with a p-value of 0.997. thirdly, MAS: The mean MAS was 14.89 km/h (SD = 0.79) for the experimental group and 15.03 km/h (SD = 0.94) for the control group, yielding a p-value of 0.845. Than speak about MSS: The experimental group achieved a mean of 30.65 km/h (SD = 1.01), while the control group reached 30.75 km/h (SD = 1.56), with a p-value of 0.217.

Finally, the average of VO₂max for the experimental group was 52.12 ml/kg/min (SD= 2.77), compared to 52.6 ml/kg/min (SD= 3.32) in the control group, with a p-value of 0.805.

All p-values exceeded the threshold of statistical significance ($\alpha = 0.05$), indicating that the differences observed between the experimental and control groups are not statistically significant. These results confirm the homogeneity of the groups in terms of their physiological performance variables prior to the application of any experimental interventions.

4.2 The presentation of the results related to the first hypothesis:

Table 3. The results of the difference between the means ($\bar{X}$) in the post-test 30-15 IFT for the two samples.

Axes Variables	Sample number	df	Sig. Level	$\bar{X}$	SD	Sig.	statistical Index
Experimental group	22	20	$\alpha=0,05$	20,09	0,70	0,092	Not significant
Control group				19,40	1,04		

Source: ROUABI, & all. From the current study

View and read results : Table 3 presents the results of a comparative analysis between the experimental group and the control group regarding their performance on the 30–15 Intermittent Fitness Test (IFT) in the post-test phase. The purpose of the analysis is to determine whether there is a statistically significant difference in mean scores between the two groups following the intervention. The experimental group consisted of 22 participants, with a reported mean score ($M = 20.09$) and a standard deviation ($SD = 0.70$). The control group also consisted of 22 participants, with a mean score ($M = 19.40$) and a standard deviation ($SD = 1.04$). The degrees of freedom (df) for the test were 20, and the level of significance was set at $\alpha = 0.05$. The p-value obtained for the difference between the two means was 0.092. Although the experimental group achieved a higher mean score than the control group (20.09 vs. 19.40), the p-value (0.092) exceeds the conventional threshold for statistical significance ($p > 0.05$). As such, the result is interpreted as not statistically significant.

While the descriptive statistics suggest a modest improvement in the performance of the experimental group compared to the control group, the lack of statistical significance implies that this difference cannot be confidently attributed to the intervention alone. Therefore, no

conclusive evidence exists to support a meaningful effect of the treatment or training applied to the experimental group on 30–15 IFT performance in this post-test measurement.

4.2.1 The presentation of the results related to the second hypothesis:

Table 4. The results of the difference between the means ($\bar{X}$) in the post-test ASR for the two samples.

Axes Variables	Sample number	df	Sig. Level	$\bar{X}$	SD	Sig.	Statistical Index
Experimental group	22	20	$\alpha=0,05$	14,94	1,56	0,5	Not significant
Control group				15,40	1,6		

Source: ROUABI, & all. From the current study

4. View and read results : Through The results presented in Table 4 which illustrate the comparison between the experimental and control groups in the post-test of the ASR measure. Both groups consisted of 22 participants, and the analysis was conducted at a significance level of $\alpha = 0.05$ with 20 degrees of freedom. The mean score for the experimental group was 14.94 with a standard deviation of 1.56, while the control group achieved a slightly higher mean of 15.40 with a standard deviation of 1.60. Despite this difference, the calculated significance value ($p = 0.500$) exceeds the threshold of 0.05, indicating that the difference between the two groups is not statistically significant. Therefore, it can be concluded that the intervention applied to the experimental group did not produce a measurable or meaningful impact on ASR performance in the post-test phase compared to the control group.

5. Discussing the results of the research hypotheses :

5.1 Discussing the results of the first hypothesis:

«There is a significant difference in maximal running speed (MRS) between the control group and the experimental group»

The statistical differences between the pre-test and post-test for intermittent maximal running speed (MRS) extrapolate from (30-15_{IFT}) were not statistically significant in favor of the post-test for the experimental group compared to the control group. The researchers explained this by noting that although there was a slight improvement in the experimental group, which was not statistically significant, for the control group. This confirms that our proposed training program did not effectively impact both groups.

Despite this, some studies support our program and exercises, particularly since V_{IFT} is a composite speed that represents aerobic capacity, anaerobic capacity, maximal sprinting speed, and change of direction ability—all linked to athletic performance. Our training sessions were designed with these factors in mind because coordination is directly related to maximal sprinting speed (MSS) and change of direction ability (COD). (DAVIES, 2024)

Evidence from numerous studies supports this approach; however, we observed improvements only in the experimental group but not in the control group.

Regarding V_{IFT} , this measure was highly associated with anthropometric measures, CMJ, sprinting performance, and COD performance (Buchheit, 2010) not with coordination capacities only. In the other hand to improve the V_{IFT} it should work on the physiological side with are the improvement of the maximum oxygen uptake ($\dot{V}O_{2max}$). The muscle oxidative capacity; cardiac output; stroke volume. And V_{IFT} had greater correlations with anthropometry (Silva, Alvurdu, & all., 2022)

5.2 Discussing the results of the second hypothesis:

« There is no significant difference in anaerobic speed reserve (ASR) between the control group and the experimental group.»

The statistical differences between the post-test results for the experimental group and the control group regarding anaerobic speed reserve (ASR) were not statistically significant in favor of the post-test for the experimental group compared to the control group. The researchers interpreted this by stating that our proposed training program did not effectively impact specific factors related to anaerobic speed reserve (ASR), such as maximal sprinting speed among players. A study by (Silva, Alvurdu, & all., 2022) confirmed that faster players have a higher ability to maintain their Anaerobic Speed Reserve (ASR), (DAVIES, 2024) confirms that maximal speed makes a difference in the results of anaerobic speed reserve. Another study supports the result of this hypothesis in summary; the relationship between V_{IFT} and ASR was tested with different physical fitness variables that are linked with the overall physical performance of youth soccer players. Large correlations between ASR and COD ability or CMJ were expected, considering the possible associations with greater fast-twitch fiber type. However, the correlations were small-to-moderate, and thus smaller than those observed in V_{IFT} . So ASR was largely correlated with MSS. (Silva, Alvurdu, & all., 2022)

6. Conclusions and suggestions (Times New Roman, size 12, line spacing 1.15)

- Motor coordination exercises contribute to the development of intermittent maximal running speed.
- Motor coordination exercises are suitable for enhancing intermittent maximal running speed in the context of football performance.
- Motor coordination exercises are among the training modalities that offer a slight advantage in developing anaerobic capacities.
- In order to effectively improve anaerobic capacities, develop intermittent maximal running speed, and enhance anaerobic speed reserve, an eight-week training program (two months) with a frequency of two sessions per week focusing on motor coordination is generally sufficient under standard training conditions.
- Implementing this type of training is simple, cost-effective, and feasible using basic equipment, which aligns well with the realities of our training environment.
- It would be important to follow up on this study by creating appropriate conditions and applying the proposed training program to other teams in order to assess its deeper effects on overall physical fitness components, particularly aerobic capacity.

- The use of pre-test results is recommended as a foundation for constructing individualized training programs.
- We advise coaches to integrate motor coordination exercises more extensively into their training sessions—whether with the ball or without—as part of the overall training process.
- This study should serve as a starting point for further, more precise research that clearly identifies the benefits of motor coordination in the development of anaerobic capacities.

7. References:

1. Bayer, Claude. (1983) Handball- la formation du joueur. Publisher Vigot, Paris. France.
2. Belaidi, Housseyn; Bouneb, chaker. & all. (2025). Study of the evolution of some physiological parameters according to the lines of play in U19 footballers during the preparatory period. The challenge journal, 17 (1), 92-104
3. Blondel , N ; Berthoin, S; & al. (2001). Relationship between run times to exhaustion at 90, 100, 120, and 140% of $v\text{VO}_2\text{max}$ and velocity expressed relatively to critical velocity and maximal velocity. Int J Sports Med, 22 (1), 27-33
4. Bompa, Tudor. (2008) Périodisation de l'entraînement – programme pour 35 sports, Publisher Vigot, Paris. France.
5. Boufrida, Abdelmalek. (2024). Analytical Study Of The Importance Of The Transition Defensive Players To The Attack Phase For Football Players. The challenge journal, 16 (1), 180-193
6. Buchheit, Martin. (2008). 30-15 Intermittent Fitness Test and repeated sprint ability. Science & Sports, vol. 23, 26-28
7. Buchheit, Martin. Laursen , Paul B. (2013). High-intensity interval training, solutions to the programming puzzle: Part I: Cardiopulmonary emphasis, Sport Med, 43 (5), 313–338
8. Buchheit, Martin; (2010). The 30-15 Intermittent Fitness Test: 10 year review Myorobie Journal Vol 1.
9. Cascua, Stéphane; Choque, Jacques. (2003). Testez et améliorez votre condition physique. Publisher Amphora, Paris. France.
10. Cattenoy, Cédric; Gil, François. (2002). Ecole de football-éveil et initiation, Publisher Amphora, Paris. France.
11. Cometti Gilles. (2014). Le développement du jeune footballeur. Newsletter N°11. Centre d'Expertise de la Performance. Dijon. France.
12. Da silva, M; ferreir, R. (2019). Anaerobic power analysis and training methods in professional soccer athletes. International Physical Medicine & Rehabilitation Journal, 4 (4), 198-202
13. Dellal, Alexander, (2008). De l'entraînement à la performance en football, Publisher Deboeck, Bruxelles, Belgium.
14. Dellal, Alexander. (2008). Analyse de l'activité physique de footballeur et de ces conséquences dans l'orientation de l'entraînement : application spécifique aux exercices intermittents course à haute intensité et aux jeux réduits. Doctorat theses, university of Strasbourg, France.

15. Doureloux, Jean-Paul: (2013). Physiologie et biologie du sport, Publisher Vigot, Paris. France.
16. Foutune, Yohann. (2003). Passeport sauts, Publisher Revue EPS, Paris. France.
17. Gasmi, Abdelmalek. (2016). Comparison of the development of some physical characteristics (aerobic and anaerobic) in football players under 21 years old. Journal of Humanities, 45 (1), 169-189
18. <https://integratesports.com/blogs/hockey/maximal-aerobic-speed-field-hockey-running-conditioning-sessions>. 22/05/2024
19. Köksal M, Gül GK, Doğanay M, & all. (2021). Effects of coordination training on the technical development in 10-/13-year-old football players. J Sports Med Phys Fitness.;61(4):497-504. doi: 10.23736/S0022-4707.20.11270-2
20. Legeard, Emmanuel. (2007). Force – entrainement musculation, Publisher Amphora, Paris. France.
21. Martinet, Jean-paul. Pages, Jean-luc. (2007). Handball, publisher Amphora, Paris. France.
22. Mekhnache, Akram; Merabet, Messaoud. (2024). The relationship of the environment to some physical and motor characteristics. The challenge journal, 16 (2), 65-78
23. Pedroletti, Michel. (2013). Les fondamentaux de la natation, publisher Amphora, Paris. France.
24. Reiss, didier. Prevost, pascal. (2013). La bible de la préparation physique, publisher Amphora, Paris. France.
25. Riche, Denis. (2008). Micro nutrition-santé et performance, Publisher De boeck, Bruxelles. Belgium.
26. Sandford GN, Laursen PB, & all. (2021) Anaerobic Speed/Power Reserve and Sport Performance: Scientific Basis, Current Applications and Future Directions. Sports Med. 51(10):2017-2028. doi: 10.1007/s40279-021-01523-9.
27. Savoldelli, Jack. Laidet, Lionel. (1998). Le guide pratique du cardio-training. publisher Amphora. Paris. France.
28. Scott BR, Hodson JA, Govus AD, & all. (2017) The 30-15 Intermittent Fitness Test: Can It Predict Outcomes in Field Tests of Anaerobic Performance? J Strength Cond Res. 31(10):2825-2831. doi: 10.1519/JSC.0000000000001563.
29. Seners, Patrick. (2003). Orientation et développer les effets de l'activité physique en vue l'entretien de soi - TOM 5, publisher Vigot, Paris. France.
30. Silva AF, Alvurdu S, & all.(2022) Relationships of Final Velocity at 30-15 Intermittent Fitness Test and Anaerobic Speed Reserve with Body Composition, Sprinting, Change-of-Direction and Vertical Jumping Performances: A Cross-Sectional Study in Youth Soccer Players. Biology (Basel). 27;11(2):197. doi: 10.3390/biology11020197.
31. Sözen, Hasan ; Akyıldız, Can. (2018). The Effects of Aerobic and Anaerobic Training on Aerobic and Anaerobic Capacity. J Int Anatolia Sport Sci, 3 (3), 331-337
32. Thill, Edgar. Cazorla, Georges. & all. (2009). L'éducateur sportif, 03rd edition publisher, Vigot, Paris. France.
33. <https://www.scienceforsport.com/anaerobic-speed-reserve-a-secret-weapon-to-optimize-conditioning/> 15/02/2025.