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Evaluation of Physical Fitness and Motor Ability of Brazzaville's U19 Football Players According to the Playing Positions

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ABSTRACT: This study aims to evaluate the physical fitness and motor ability of Brazzaville's U19 footballers according to playing position. Method: A cross- sectional study was conducted with a total of 33 U19 football players aged 18.75 ± 0.95 years. Data collection consisted of anthropometric measurements, physical fitness (YYIR1 distance and VO_2max) and motor ability (agility, explosive power and upper limbs strength) and the playing positions. Agility, explosive power and upper limbs strength (Barrow moter ability test) whereas YYIR1 distance and VO_2max (YO-YO intermittent recovery level 1) were measured on three separate days. The data were analyzed using SPSS software 25.0. Results: Explosive powers as well as upper limb strength were significantly higher in goalkeepers than in midfielders, attackers and defenders ($p < 0.001$; $p < 0.001$). The distance covered by midfielders and VO_2max were significantly higher than that of defenders, attackers and goalkeepers ($p < 0.001$; $p < 0.001$). Conclusion: Physical fitness was high among midfielders while motor ability was high among goalkeepers. The different playing positions on the field are characterized by specific activities and physical requirements.

KEYWORDS: Football players, Motor ability, Playing position Physical fitness, U19.

INTRODUCTION

Football (FB) is nowadays played all over the world and has been part of Olympic competitions since 1900 [1]. According to these authors, it is classified as an intermittent sport which requires many types of physical tasks. Likewise, it is a multifactorial sport that requires players to have well developed physical, physiological, psychological, technical and tactical skills [2]. At the elite level, FB is very competitive and only a minority of players participates in the top leagues in the world due to its complexity of requirements, especially in its technical, tactical, psychological and physiological areas [3]. The physiological domain depends on the combination of physical fitness and motor ability acting on improving endurance and increasing speed [4]. Among the various parameters of physical fitness and motor ability for football players are agility, explosive power, upper limbs muscular strength, flexibility, endurance, velocity and throwing strength ball. All these parameters differ according to the playing position [5]. The literature review suggests that specific physiological demands are associated with different playing positions. In this regard, Gil et al.[6] have demonstrated that agility and jump tests were the most discriminating factors for attackers, while the key factors for midfielders were agility and endurance. Similarly, Mendez-Villanueva et al.[7] showed that central midfielders covered the highest total distance, while central defenders covered the lowest total distance.

A FB team consists of 11 players occupying the different playing positions, which reflect their location on the pitch and their different tactical roles during matches [8]. Among the positions occupied, goalkeepers (GK) perform the highest proportion of low-intensity actions, which differs from outfield players, who exhibit more running, ball possession and high- intensity activity [9]. During the development of football players in training schools like Gothia, specific skills or physical qualities may lead to the selection of players for certain playing positions due to variations in the tactical and physiological demands of those positions [8]. It has been observed that agility, explosive power, upper limbs muscle strength, ability to cover a great distance, VO_2max and

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frequency of game actions during the match vary by position and can contribute to the different physical demands faced by training schools [10].

In addition, the category of football players under 19 (U19) of the Gothia school (Republic of Congo), are supposed to have physical fitness and motor ability to excel in this sport in each position. Apart from nutrition and mental state, these two parameters mainly contribute to player supremacy and team performance in football [11–13]. However, these parameters are rarely researched in the Republic of Congo's U19 football players. In this sense, there is a dearth of general literature on the parameters of physical fitness and motor abilities in Congolese sports in general and in FB in particular. As it is almost impossible to apply the results of peers on Congolese football players according to environmental differences and social realities, undertaking a study to find out whether physical skills and motor abilities vary by playing position among Congolese U19 football players, could inform position- specific training and recovery strategies with the aim of optimizing performance in this understudied population. In addition, the results from this study could inform on the positions that perform inadequate loads during training as well as on the specific parameters to be taken into account for monitoring the load.

MATERIALS AND METHODS

Study setting

This cross-sectional study was carried out in Brazzaville (Capital of the Republic of Congo), precisely at the "Gothia" football school, located in the seventh urban district of Brazzaville named Mfilou-Ngamaba. It took place between June 10 and August 05, 2022. The choice of players in this U19 category is explained by their enthusiasm for playing football despite the absence of physical trainers. The procedures were in accordance with the ethical standards on human experimentation established in the Declaration of Helsinki (1964), updated in Fortaleza (2013). All players signed a statement of informed consent to participate in the study, approved by the scientific committee of the Higher Institute of Physical Education and Sports (ISEPS).

Sampling

This study involved 155 U16 and U19 footballers from the Gothia football school. The target population was made up of 65 U19 footballers. We used the reasoned choice non- probabilistic method to select 33 footballers in this category, namely: 4 goalkeepers, 13 defenders, 6 midfielders and 10 forwards. They were selected according to the following criteria: having provided the certificate of no contraindication to sport, being of the U19 category, having voluntarily participated in the tests, having signed a letter of consent. Any footballer who violated the study's rules of good conduct was excluded from the study.

Data collection technique

All measurements were arranged so that the previous one could not interfere with the next one. For this purpose, an interval of five minutes was allowed between the measurement steps.

Step 1:

Weight (kg) was measured to the nearest 0.1 kg by a Tanita BC-545N JAPAN brand electronic scale, height (m) was measured to the nearest 0.1 cm, the calculation of the BMI (kg/m^2) was carried out according to the standard method.

Step 2:

To assess the motor ability of football players, the Barrow General Motor Ability Test which consists of three tests named zigzag running (agility), standing long-jump (explosive power) and medicine ball throwing (upper limb strength) was used. Agility was used to measure direction change speed [14]. The football player started the race in a standing position behind the starting line and outside the first cone. He ran the course around the cones as quickly as possible. The time was recorded in second(s) via a stopwatch, from the start of the movement until the football player crossed the finish line. Next, explosive power was measured using standing long-jump test. For this test, the participant stood motionless on both legs, with their toes aligned at the starting line, before jumping as far forward as possible. Participants were allowed to use counter movement with arms and body swing. The jump distance achieved from the start line on takeoff to the heel position on landing was measured in meters using a double tape measure. The participant was allowed three attempts for each jump, with the longest distance jumped recorded for analysis. This test has proven to be reliable with intraclass correlations between 0.80 and 0.95[15]. Finally, upper limb strength was measured using the medicine ball throwing test (3 kg) by modifying the method reported by Lockie et al. [14]. The footballer stood facing the throwing area with his feet shoulder- width apart and his toes on the starting line. The ball was held above the head and with a single backward extension

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motion the throw was made forward. The horizontal distance was measured using a double tape measure between the starting line and the point of impact where the ball first touched the ground.

Step 3:

To assess the physical fitness of football players, the YOYO IR1 test which consists of the external load (performance or distance traveled) and the internal load (VO_2max) was used. The Yo-Yo IR1 test was used as previously described by Esen et al. [16]. Briefly, the test consisted of repeated 2 × 20 m runs, interspersed with a 10-second active recovery period, at gradually increasing speeds controlled by audio beeps from a portable audio system. The final distance successfully covered was recorded after the second attempt failed to cross the start/finish line in the allotted time. The VO_2max was estimated online taking into account the distance traveled and the running time.

Statistical analysis

Data were reported as mean ± standard deviation ($\bar{x} \pm \sigma$). The homogeneity test was performed on all variables. The differences between goalkeepers, defenders, midfielders and forwards in explosive power, upper limb strength, agility, distance traveled during the Yo–Yo IR1 test and VO_2max were analyzed using an ANOVA test. The significance level was set at $p < 0.05$. Data analysis was performed using the statistical program SPSS for Windows 25.0 (SPSS, Inc., Chicago, IL, USA).

RESULTS

Table 1: Characteristics of U19 football players

Variables	$\bar{x} \pm \sigma$	Mini	Maxi
Age (year)	17.18 ± 2	15	22
Heigh (m)	1.72 ± 0.06	1.60	1.86
Weight (kg)	50.97 ± 7.19	39	64
BMI (Kg/ m^2)	17.09 ± 2.12	13.82	23.14
Explosive power (m)	2.36 ± 0.27	1.80	2.90
Upper limb strength (m)	6.35 ± 1,05	4.25	8.50
Agility (s)	13.13 ± 0.66	11.69	14.38
Distance YYIR1 (m)	1150.90 ± 361.87	560	1980
VO_2max (ml/ kg/ min)	46.06 ± 3.03	41.10	53.03

Table 1 show that the explosive power was between 1.80 and 2.90 m, the upper limb strength between 4.25 and 8.50 m. The course with change of direction was achieved between 11.69 and 14.38 seconds. The distance covered in the YOYOIR1 test was between 560 and 1980 m. finally, the estimated VO_2max fluctuated between 41.10 and 53.03 ml/kg/min.

Table 2: Anthropometric characteristics by playing position of footballers

Variables	Goalkeepers n = 4	Defenders n = 13	Midfielders n = 6	Attackers n = 10
Age (year)	18.75 ± 0.95	16.85 ± 2.03	17.67 ± 2.33	16.70 ± 1.94
Heigh (m)	1.78 ± 0.33	1.72 ± 0.06	1.73 ± 0.06	1.70 ± 0.05
Weight (kg)	58.50 ± 2.38	51.15 ± 7.95	48.17 ± 4.35	49.40 ± 7.33
BMI (Kg/ m^2)	18.31 ± 0.75	17.27 ± 2.67	15.97 ± 0.78	17.05 ± 2.11

Table 2 shows that goaltenders tended to be older, leaner and heavier compared to players in other positions.

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Table 3 : Motor ability of football players by playing position

Variables	Gardiens n = 4	Défenseurs n = 13	Midfielders n = 6	Attaquants n = 10
Agility (s)	13.56 ± 0.45	12.98 ± 0.42	12.94 ± 0.37	13.26 ± 0.34
Explosive power (m)	2.65 ± 0.09*#†	2.33 ± 0.06	2.38 ± 0.03⁋	2.28 ± 0.06
Upper limb strength (m)	7.13 ± 0.11*# †	6.30 ± 0.19	6.45 ± 0.20 ϕ ⁋	6.04 ± 0.14

Legende: * indicates the significant difference between goalkeepers and defenders;
# indicates the significant difference between goalkeepers and midfielders ;
† indicates significant difference between goalkeepers and forwards;
⁋ indicates the significant difference between midfielders and forwards;
ϕ indicates the significant difference between defenders and midfielders.

Table 3 shows that there was no significant difference in agility according to playing positions. On the one hand, explosive power and upper limb strength were higher among goalkeepers compared to other positions ($p < 0.001$). On the other hand, upper limb strength was higher in midfielders compared to defenders ($p < 0.05$). Finally, explosive power and upper limb strength were higher in midfielders compared to forwards ($p < 0.001$; $p < 0.01$).

Table 4 : physical fitness of footballers by playing position

Variables	Gardiens n = 4	Défenseurs n = 13	Midfielders n = 6	Attaquants n = 10
Distance YYOR1 (m)	955 ± 90	1204.62 ± 102.12*⁋	1376.67 ± 119.61#†ϕ	1024 ± 77.12
VO_2max (ml/kg/min)	44.42 ± 0.75	46.51 ± 0.85*⁋	47.96 ± 0.86# ϕ †	45 ± 0.64

Légende: * indicates the significant difference between goalkeepers and defenders;
# indicates the significant difference between goalkeepers and midfielders ;
† indicates significant difference between defenders and midfielders;
⁋ indicates the significant difference between defenders and attackers;
ϕ indicates the significant difference between midfielders and forwards.

Table 4 shows that the distance covered by midfielders and VO_2max were significantly higher than that of defenders, attackers and goalkeepers ($p < 0.001$; $p < 0.001$).

DISCUSS

This study aims to evaluate the physical aptitude and the motor capacity of the U19 football players of Brazzaville according to the position. The original finding of the present study was that motor ability (explosive power and upper limb muscle strength) and physical fitness (distance YYIR1 and VO_2max) varied by position with a predominance among goalkeepers for the first and midfielders for the second. However, agility did not vary according to the position. Furthermore, our study showed that goalkeepers tend to be heavier than all outfield players. They were also significantly taller and heavier than defenders and midfielders. These results indicate that goalkeepers and midfielders respectively have more capacities and abilities to support the load related to their playing position.

Evaluation of muscular power according to playing position

We observed from the results from Table 3 that explosive power was higher among goalkeepers compared to players in other positions ($p < 0.001$). Likewise, the strength upper limbs were higher in midfielders compared to defenders ($p < 0.05$). Finally, explosive power and upper limb strength were higher in midfielders compared to forwards ($p < 0.001$; $p < 0.01$). These results are similar to those obtained by Al Taweel et al. [17] among elite footballers in the Kingdom of Saudi Arabia. Indeed, these authors reported that the explosive power of goalkeepers was significantly higher compared to that of defenders and attackers ($p < 0.05$). This superiority in the generation of explosive power in goalkeepers can be explained by the dynamic stability and strength of the

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lower limbs which contributed positively to jumping performance. This result is also consistent with the statement reported by Soós et al. [18], according to which goalkeepers score significantly higher than attackers, midfielders and defenders in assessing lower limb strength and performance. 5m and 10m sprint. In addition, we observed from the results from Table 1 that goalkeepers tended to be older, slender and heavier compared to players playing in other positions. This superior tendency can to a lesser extent explain the superiority of the explosive power of the guards. On this subject, Slimani et et al. observed that as players aged (U17–U19), explosive power also became important in discriminating elite forwards from other positions on the pitch.

Evaluation of muscle strength by playing position

Muscle strength is one of the keys to success in football. We observed from the results from Table 4 that upper limb strength was higher among midfielders compared to defenders ($p < 0.05$) and that upper limb strength was higher among midfielders compared to attackers ($p < 0.001$; $p < 0.01$). This result could be explained by the fact that the midfielders take part in a greater number of weekly football training sessions or their greater experience in football training, or that they have carried out programs strength training for their upper limb muscles compared to defenders and attackers.

Evaluation of the distance YOYOIR1 according to the playing position

We observed from the results from Table 4 that the goalkeepers traveled the shortest distance ($p < 0.001$). This result is similar to that reported by Soós et al. [18] indicating that goalkeepers received significantly lower scores than other players (attackers, defenders and midfielders only in the Yo-Yo test. This low distance covered is explained by its limited role in defending goals and actively cooperating with its partners in defensive and attacking situations. Moreover, the midfielders showed the value of the distance covered significantly higher compared to that of the midfielders positions ($p < 0.001$; $p < 0.01$).This result can be explained by the complexity of football, demanding both the aerobic and anaerobic systems, thus, to optimally support the demands of the distance traveled (performance) in a football game, a player must have an effective anaerobic component that combines strength, speed and power, in order to be able to perform short sprints, jumps and tackles.

Estimation of VO_2max in the YOYOIR1 test according to position

The value of VO_2max is considered to be the most important component of endurance performance. According to Soós et al. [18] the average VO_2max of elite football players generally ranges from 55 to 68 mL/kg/min and is influenced by playing position. In the present study, we observed based on the results from Table 1 that the VO_2max of players overall ranged between 41.10 and 53.03 ml/kg/min. Compared to other positions, midfielders had much higher VO_2max values ($p < 0.001$; $p < 0.01$). Similarly, defenders showed higher values of distance traveled and VO_2max respectively than goalkeepers and attackers ($p < 0.01$; $p < 0.001$). The above results were confirmed by a study by Strøyer et al. reported by Soós et al. [18] who observed higher VO_2max in midfielders and forwards compared to the value obtained by defenders. In this context, well developed aerobic capacity helps midfielders and forwards to maintain high- intensity repetitive actions during a football match, accelerating the recovery process and maintaining fitness at a good level until the end of the game [2]. In a study by Sporis et al. reported by Slimani et al. [2], Croatian midfielders had higher VO_2max values compared to forwards and defenders. According to the latter, this result was explained by the fact that midfielders cover more distance during a match. This strong aerobic component contributes enormously to their rapid recovery between intermittent bouts of high intensity work and to maintaining high endurance capacity over long matches.

Moreover, the literature review does not report unanimous results with regard to the difference in VO_2max between attackers, midfielders and defenders. While some studies have shown that attackers have the highest average VO_2max compared to midfielders and defenders Gil et al. reported by Slimani et al. [2], others have demonstrated that the VO_2max of midfielders and forwards was higher than that of defenders Lago- Penas et al. reported by Slimani et al. [2] and others further found that VO_2max did not differ significantly among players in different positions on the pitch [19]. In the present study, the result from Table 4 revealed that the midfielders presented the values of VO_2max much higher than the other positions ($p < 0.001$; $p < 0.01$) and that the defenders presented values of the VO_2max respectively higher than attackers ($p < 0.001$).

This contradiction could be explained by the fact that among elite footballers, forwards had higher average VO_2max values than young non- professionals playing in midfield and defense. Moreover, this contradiction could also be explained by the level of competition and the difference in age.

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Strengths and limitations

The main strength of this study was the creation of preliminary physiological profiles of Congolese U19 footballers. These profiles can facilitate the selection process and can be used to identify and eliminate potential problems in the training cycle. These profiles are solid indicators for selecting the best players who, after completing the full cycle at the Gothia training school, should join the various first division football clubs and, ideally, the national football team. The main limitation of this study was related to a relatively low number of U19 footballers by position. The development of complete physiological profiles requires that a future study be conducted with a large number of standardized variables and a sufficiently large sample. The current results were not representative of all Congolese footballers because the U19 footballers studied were mainly composed of young people from a single department of Congo.

CONCLUSION

Motor skills and physical abilities are key parameters for success in football. The main results of this study provide evidence that explosive power, muscular strength of the upper limbs, the distance traveled and the VO2max vary according to the position with predominance among goalkeepers for the first and midfielders for the second. In view of our results, we believe that good motor capacity and physical fitness are necessary to optimize football performance. Moreover, these results are of paramount importance and must be taken into consideration when developing shift training programs to optimize performance.

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