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Anthropometry, Physiological Characteristics and Motor Performances of Young Male Soccer Players in Cameroon According to Their Age Category and Playing Position

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Abstract: *Introduction*: This study aimed at examining the anthropometry, physiological parameters and performances of young footballers recruited and formed in Cameroon without data base and physical fitness assessments. *Methods*: 128 young soccer players from two training structures subdivided into 3 categories (46 U13, 41 U15 and 41 U17) and 6 playing positions participated in this study. Their height, body mass, body mass index (BMI), blood pressure and resting heart rate were determined prior to the linear sprints test (10m and 20m), vertical jump, and Léger's shuttle run test over 20m. Data analysis and comparisons between categories and playing positions have been carried out using Statview 0.5. Differences were considered significant for $p < 0.05$. *Results*: The mean values of anthropometric parameters and blood pressure significantly increased with age category whereas resting heart rate decreased. Central defenders and goalkeepers were respectively tallest and heaviest. In general, performances increased significantly from U13 to U15 and tend to stagnate between U15 and U17 with no significant difference between playing positions. *Conclusion*: This study provided preliminary references in the identification and follow up of young cameroonian talents belonging to their age categories and playing positions. Developing aerobic endurance is the main emergency particularly for U17 players.

Keywords: Soccer, Young Male, Assessment, Anthropometry, Physiological Characteristics, Performance, Playing Position, Cameroon

1. Introduction

Football is unquestionably the most popular sport on the planet today [1]. The Federation International of Football Association (FIFA) recorded around 270 million players, 301,000 clubs, 38,287,000 licensed including 121,983 professional players worldwide [2]. It is no longer just an ordinary spectacle. It has become both economic and political challenges [3]. To strengthen their teams, some countries request the nationalization of foreign successful players. At the professional level, successful players are rare and too expensive [1]. Most clubs therefore prefer to invest in the detection and training of talented young players [4] to improve the turn-over and results of their team, and to stabilize their budget. In addition, according to the FIFA, the training of young players will determine the future of national and world soccer. It thus invites its member associations and their clubs to create a training philosophy adapted to the peculiarities of their respective countries, for the development of their soccer [5]. The major football nations on a global scale such as Brazil, Germany, Argentina, France, and Spain have developed solid policies for structuring training centers for young footballers, thus allowing continuous and effective renewal of their teams. This policy has been developed in France for about forty years and involves clubs, federation, ministry concerned and local authorities [6]. Several studies have shown that physical and physiological aptitudes are crucial for football performance [7]. Among the determining parameters of the physical fitness of footballers are flexibility, speed, strength, anaerobic and aerobic power [1]. Good management should improve these factors from childhood. Effective training requires a scientific approach involving evaluation, planning, and training construction. Assessment is central to football training; besides allowing to draw up strengths-weaknesses profile and to determine the evolution of the athlete, it favors the optimization of training control. In addition, it is very difficult to achieve significant results without scientific methods and tools [8]. Many studies around the world are increasingly interested in the anthropometric, physiological and performance profiles of young footballers [9-18]. It emerges that performance is correlated with anthropometric parameters; they vary with the age category and each game position requires specific characteristics for better performance.

During their work on three clubs participating in the elite one championship in Cameroon during the 2017/2018 season, it was reported that the height of the players did not vary significantly according to their positions; the clubs with the best rankings are those with the best anthropometric and physiological characteristics [19]. Moreover, the characteristics of local elite soccer players were inferior to those of Caucasians (especially regarding height, maximum aerobic speed and maximum oxygen consumption). This would explain the poor results obtained over the past two decades by Cameroon's elite clubs on the continental scene.

Indeed, the professional clubs of Cameroon have very few financial resources to carry out good transfers of players. Their recruits are mainly formed in the country. Very few of these clubs have adequate infrastructures for the development and monitoring of their players or even contain training centers for young people. Mainly private academies invest permanently, according to their respective resources, in the detection, training and follow up of young footballers, and the most representative categories are those under thirteen (U13), fifteen (U15) and under seventeen years old (U17). Unfortunately, most of these structures do not have sufficient financial resources, qualified staff, and a consistent training policy.

The selection of talents is based on observations of technical and tactical qualities by the supervisors of these training centers regardless of methodical evaluations. Perhaps also because these supervisors are formed only for technical and tactical training, not for the evaluations of physical aptitudes and even less those physiological ones often left to researchers. In addition, the lack of infrastructures often leads some staff to make different categories work together, which impedes the emphasis of the training in some categories.

Furthermore, studies on anthropometric, physiological and performance levels of footballers playing in Cameroon are few. Results from those studies could not be applied to residents of local training structures. However, the data on the anthropometric, physiological characteristics and motor performance of young people in football training in Central Africa in general and particularly in Cameroon are unknown.

Resting heart rate and blood pressure can be indicators of cardiovascular abnormalities. Young people with blood pressure abnormalities have a high risk of manifesting them in adulthood. In addition, high blood pressure can be severe in young black people [20]. The variation in blood pressure and resting heart rate could also provide an indication about the training level [21]. However, the completion of appropriate medical examinations by Cameroonian footballers in general and young people in training is very rare. What are the characteristics and the motor skills of young people in football training in such a precarious context as in Cameroon? It is to answer this question and obtain preliminary data base that we undertook this study examining the anthropometric, physiological characteristics and motor performance of young footballers according to categories and positions. We hypothesized that the performances of young male soccer trained in Cameroun could be poor; moreover, their selection and the allocation of playing positions would not consider their characteristics and skills.

2. Materials and Methods

This cross-sectional study received an ethical clearance issued by the Institutional Ethics Committee for Human Health Research of the University of Douala (CEI-Udo) in January 2022 (No 2954 IERB-92 Udo/01/2022/T) and was carried out between January and February 2022.

2.1. Participants

We included all young boys in soccer training who regularly attended training sessions, had no recent injuries, volunteered for the study after through information on the purpose and protocol of the project, and whose parents or guardians had signed a written informed consent. All injured youths and those who failed to partake in all the evaluations were excluded. Using an exhaustive sampling method, we recruited 128 young boys from two soccer training centers in

Douala but coming from several regions of Cameroon. They were divided into three categories: 46 U13, 41 U15 and 41 U17 (under 13, 15, and 17 respectively). According to their positions, there were 6 goalkeepers (GB), 16 central defenders (DC), 29 full-backs (DL), 23 defensive midfielders (MD), 29 attacking midfielders (MO) and 25 forwards (AC). The designated soccer training centers were just structures created by some managers of major soccer clubs for the detection and development of young talents. Participants had no elite experience. Their competitions were limited to friendly matches, regional competitions of their categories and local tournaments. U17 had between 4 and 6 years of training, U15 between 2 and 4 years and, U13 between 1 and 2 years.

2.2. Design and Procedures

The study was conducted after the selection of the players of the year and before the start of the various youth championships. Physical performance was assessed at the start of the season to know the aptitudes and shortcomings of players in certain parameters to ameliorate the training. This could be subject to modifications in the sports year depending on the effects of the training on the participants in each category per training center. The various parameters were obtained at the training sites and at the usual training times. Resting parameters (Standing Height, Weight, Blood Pressure and, Heart Rate) were measured and body mass index (BMI) was determined for each participant. To assess their physical fitness, each participant took part in three field tests including the 10 m and 20 m sprint, vertical jump, and endurance. All participants were evaluated by the same people and with the same tools after their familiarization with each test. The evaluators had previously familiarized themselves with the material and methods through several trials.

2.3. Measures

Height in centimeters (cm) was determined using a fixed statiometer. Weight in kilograms (Kg) was measured using an electronic medical scale. The body mass index (BMI) was determined from the weight and height using the Quetelet formula: BMI = weight (kg) / $[\text{height (m)}]^2$ and the weight status was determined from the values obtained and the curves of BMI references for age of boys from the World Health Organization [22].

Blood pressure was obtained after at least 5 minutes rest in the sitting position while respecting standard conditions, using an approved digital sphygmomanometer (OMRON M2) whose cuff width was adjusted to arm circumference. For each participant, three measurements were done, and the lowest value was retained.

Heart rate was obtained using a polar V800 heart rate monitor (Finland). It was measured after at least 5 minutes of seated rest multiple times (5) and, the average heart rate was retained.

Three field tests were chosen for this study: the 10m and 20m sprint test, the vertical jump test, and the endurance test. To ensure familiarization and reduce variability between test trials, the participants completed trials at least a week before the tests [23, 24]. To carry out all the tests, all participants were required to respect at least two days rest with no significant physical exercise that could affect their aerobic fitness.

The 10m and 20 m sprint test was performed using electric photocells (Swift Speed Light brand, Australia) on a soccer field after 15 minutes warm-up period of active running at low intensity followed by dynamic stretching exercises for 5 minutes. Then, the two sprint exercises were performed from a standing start over marked distances of 10 m and 20 m respectively, with a passive recovery period of 5 minutes prior to the next lap. First, the 3 laps of 10 m sprint, then those of 20 m sprint. At the end of each sprint, each participant was required to decelerate to walking pace and then had a passive recovery period before the next. During this time another participant could start his turn. Ten seconds before the verbal "go" command (at the start position) was given, the participant assumed a ready position 1m from the start line and waited for a verbal command (steady, go). A standardized body position at the start of each sprint was used to minimize any variation across participants in sprint start technique. When crossing the start and finish lines, the participant was spotted by the light beams of the electric photocells and the time taken was recorded for each sprint [24]. The shortest time record was retained for analysis.

Vertical jump test was performed using an electronic device called a Psion (Ergojump Bosco System; Junghans GMBH, Schramberg, Germany), which consists of a digital timer (0.001 s) connected by a cable to a resistive platform placed on a rigid and flat ground as indicated by the manufacturer [25, 26]. During the test, from the moment the feet took off the platform to touch-down, the time taken was recorded as the flight time. The position of the jumper on the platform was the same from the take-off to the landing: the hands-on-hips jumper position. Horizontal and lateral movements were reduced to rule out confounding work output interferences. Vertical jump test chosen was the Counter Movement Jump (CMJ). During this test, the participants were in a standing position on the platform and prior to jumping, counter-moved until the knee was flexed approximately to 90°. The CMJ test was performed 3 times, with 2 minutes resting period between jumps to avoid fatigue and the best result was retained for analysis.

The Endurance test was done using Luc-Léger's 20m shuttle test to determine the maximal aerobic speed (MAS) and the maximal oxygen uptake (VO_2max). The test ended when the participant could no longer keep pace with the bleeps (get to the landmark at the same time as the sound signal), and the performance was recorded. The MAS obtained was used to deduce the VO_2max using a table of pre-established values. A table that gives the values according to the last stage reached, the number of seconds, and the age.

3. Statistical Analysis

The data collected was analyzed using Statview 5.0 software (StatView SE-Graphics, Abacus Concepts, Berkely, CA). The typical error of performance measures was presented as a percentage of the mean coefficient of variation (CV). Quantitative variables were presented as means ± standard deviation. The parameters analyzed were Age, Height, Weight, BMI, Heart rate, systolic and diastolic Blood Pressure, sprint duration over 10m and 20m, vertical jump height, maximal aerobic speed, and maximal oxygen uptake. Comparison of parameters at rest and during exercise per category was done using the analysis of variance (ANOVA) test for unpaired values and Fisher's post hoc test for paired. The differences were considered significant for $p < 0.05$.

4. Results

The results are given as the mean ± standard deviation.

Anthropometric parameters according to age categories

Table 1. *Anthropometric parameters according to age categories.*

	U13 (n=46)	U15 (n=41)	U17 (n=41)
Age (ans)	$11.13 \pm 0.69^{\$\$\$}$	$13.32 \pm 1.06^{+++}$	$15.85 \pm 1.44^{***}$
(Min-Max)	(10 - 12)	(11 - 14)	(14 - 16)
Height (cm)	$157.7 \pm 12.38^{\$\$\$}$	$169.4 \pm 7.24^{+++}$	$175.4 \pm 7.37^{***}$
(Min-Max)	(134 - 182)	(154 - 185)	(161 - 189)
Weight (Kg)	$46.11 \pm 10.14^{\$\$\$}$	$57.54 \pm 8.18^{+++}$	$66.51 \pm 7.9^{***}$
(Min-Max)	(28.7 - 64.6)	(37.1 - 74.4)	(49.8 - 83.3)
BMI (kg/m^2)	$18.35 \pm 2.34^{\$\$\$}$	$19.97 \pm 2.13^{+++}$	$21.58 \pm 1.93^{***}$
(Min-Max)	(14.3 – 28.0)	(15.1 – 25.4)	(17.1 – 25.3)
Normal weight (n)	43	36	33
Overweight (n)	3	5	8

$ difference between U13 and U15; * Difference between U13 and U17; + difference between U15 and U17; * gold + gold $ = p < 0.05; ** or ++ or $$ = p < 0.01; *** or +++ or $$$ = p < 0.001; (Min-Max): (Minimum – Maximum). Height, weight, and BMI increase very significantly with age category (P < 0.001). No case of obesity was observed in our study population. However, 12.5% were overweight, with a rate that also increased with age category (6.5%; 12.5% and 19.5% respectively for U13, U15 and U17.

Physiological parameters according to categories

Table 2. *Resting arterial pressures and resting heart rate by age category.*

	U13 (n=46)	U15 (n=41)	U17 (n=41)
SBP (mmHg)	$110.4 \pm 13.42^{\$}$	$116.3 \pm 11.16^{+++}$	$124.1 \pm 13.05^{***}$
(Min-Max)	(79 – 137)	(86 – 139)	(99 – 153)
SBP > 130 mmHg	2	4	14
DBP (mmHg)	$61.65 \pm 14.16^{\$\$}$	70.22 ± 14.48	$68.34 \pm 10.56^{*}$
(Min-Max)	(28 – 90)	(46 – 126)	(43 – 90)
DBP > 85 mmHg	2	5	1
RHR (bpm)	$74.09 \pm 13.38^{\$}$	68.56 ± 12.38	$66.71 \pm 13.63^{**}$
(Min-Max)	(46 – 113)	(47 – 98)	(48 – 107)
RHR > 100 bpm	2	0	1
RHR < 60 bpm	11	7	17

SBP: resting systolic blood pressure; DBP: resting diastolic blood pressure; RHR: resting heart rate; $ difference between U13 and U15; * Difference between U13 and U17; + difference between U15 and U17; * gold + gold $ = p < 0.05; ** or ++ or $$ = p < 0.01; *** or +++ or $$$ = p < 0.001; (Min-Max): (Minimum – Maximum).

SBP increased significantly with age [U13-U15 ($p < 0.05$) and U15-U17 ($P < 0.001$)]. Averagely, 15.6% of the participants had an SBP > 130 mmHg and its proportion increased with age (4.3% in U13, 12.2% in U15, and 34.1% in U17). U13 had a significantly higher DBP than U15 ($p < 0.01$) and U17 ($p < 0.05$). However, the DBP of U15 and U17 were not differing significantly. Only 6.2% of participants had a DBP > 85 mmHg [U15 (12.2%), U13 (4.3%), and U17 (2.4%)]. Resting heart rate significantly decreased with age [U13-U15 ($p < 0.05$) and U13-U17 ($p < 0.01$)], but no significant difference was observed between U15 and U17. Around 27.3% of participants had a resting heart rate < 60 bpm [U17 (41.5%), U13 (23.9%), and U15 (17.1%)].

Performance by age category

Table 3. *Speed performance, vertical relaxation and aerobic endurance by age category.*

	U13 (n=46)	U15 (n=41)	U17 (n=41)
V10 (s)	$2.05 \pm 0.22^{\$\$\$}$	1.79 ± 0.26	$1.72 \pm 0.15^{**}$
(Min-Max)	(1.73 – 2.69)	(1.09 – 2.40)	(1.33 – 2.12)
V20 (s)	$3.49 \pm 0.33^{\$\$\$}$	3.11 ± 0.30	$3.04 \pm 0.21^{**}$
(Min-Max)	(2.98 – 4.35)	(2.34 – 3.9)	(2.37 – 3.5)
DV (cm)	$38.31 \pm 8.17^{\$\$\$}$	$46.92 \pm 5.63^{++}$	$51.15 \pm 5.93^{***}$

	U13 (n=46)	U15 (n=41)	U17 (n=41)
(Min-Max)	(19.5 – 52)	(32 – 60.5)	(34 – 63)
MAS (en Km/h)	11.20 ± 0.8$^{\$\$\$}$	12.17 ± 0.6	12.40 ± 0.7***
(Min-Max)	(9.5 – 12.9)	(10.6 – 13.4)	(9.9 – 14)
VO_2max (ml/kg/min)	50.20 ± 3.98$^{\$}$	52.17 ± 3.43^{+}	50.31 ± 3.93
(Min-Max)	(42.1 – 60.2)	(45.1 – 58.9)	(37 – 59.9)

V10: duration of sprint over 10m; V20: duration of sprint over 20m; DV: vertical jump height; MAS: maximum aerobic speed; VO2max: Estimated Maximum oxygen consumption; $ difference between U13 and U15; * Difference between U13 and U17; + difference between U15 and U17; * gold + gold $ = p < 0.05; ** or ++ or $$ = p < 0.01; *** or +++ or $$$ = p < 0.001; (Min-Max): (Minimum – Maximum).

Running time over 10m and 20 m decreased with age category. Significant differences were observed between U13 and U15 ($p < 0.01$), and U13 and U17 ($p < 0.001$) without significant difference between U15 and U17. Vertical jump height increased with age [U13-U15 or U13-U17 ($p < 0.001$) and U15-U17 ($p < 0.01$)]. MAS also increased with age but only with significant differences ($p < 0.001$) between U13-U15 and U13-U17. Only the U15 had a significantly higher average VO2max ($p < 0.05$) than U13 and U17.

Anthropometric characteristics, resting heart rate and performance according to game positions

Table 4. *Anthropometric characteristics, resting heart rate and performance according to playing positions.*

	Age (ans)	Height (cm)	Weight (Kg)	BMI (Kg/m^2)	RHR (bpm)	t10 (s)	t20 (s)	DV (cm)	MAS (Km/h)	VO_2 max ml/Kg/min
AC (n=25)	13.1±2.1	165.5±12.8	55.2±12.7	19.9±2.4	67.8±14.1	1.8±0.2	3.2±0.3	44.7±9.8	11.7±1.0	50.5±4.3
DC (n=16)	14.0±1.8	179.1±7.07 $ $$ $$$ $$$$	65.2±9.9 $ $$ $$$ $$$$	20.2±2.6	68.3±16.2	1.8±0.2	3.1±0.2	47.3±6.4	12.1±0.5	50.8±3.3
DL (n=29)	13.1±2.3	165.0±10.0	55.9±10.9	20.2±2.3 ϕ	71.0±13.5	1.8±0.2	3.1±0.4	44.7±9.0	11.7±1.0	50.5±3.8
GB (n=6)	13.3±2.3	176.6±4.6 * ** *** ****	63.9±8.1 ****	20.4±1.7	72.5±9.7	1.84±0.1	3.1±0.0	51.4±4.9	12.1±0.8	52.1±6.1
MD (n=23)	12.9±1.8	166.0±11.6	56.6±13.4	20.2±3.3 θ	69.4±10.7	1.8±0.2	3.24±0.3	43.7±7.0	11.9±0.6	51.3±3.3
MO (n=29)	13.17±2.0	163.28±12.2	51.01±11.3	18.84±1.9	72.28±13.7	1.89±0.2	3.32±0.4	44.67±9.7	11.86±0.9	50.9±3.9

AC: attacker; DC: center-back defender; DL: full-back defender; GB: goalkeeper; DM: defensive midfielder; MO: offensive midfielder; BMI: body mass index; RHR: resting heart rate; t10: duration of sprint over 10m; t20: duration of sprint over 20m; DV: vertical jump height; MAS: maximum aerobic speed; VO_2max: Estimated Maximum oxygen consumption; $: statistically significant and superior ($p < 0.05$) compared to AC; $$: statistically significant and superior ($p < 0.05$) compared to DL; $$$: statistically significant and superior ($p < 0.05$) compared to MD; $$$$: statistically significant and superior ($p < 0.05$) compared to MO; *: statistically significant and superior ($p < 0.05$) compared to AC; **: statistically significant and higher ($p < 0.05$) compared to DL; ***: statistically significant and superior ($p < 0.05$) compared to MD; ***: statistically significant and superior ($p < 0.05$) compared to MO; ϕ: statistically significant and higher ($p < 0.05$) compared to MO; θ: statistically significant and superior ($p < 0.05$) compared to MO.

Center-back and goalkeepers were respectively and significantly taller and heavier than other players. No significant difference was observed in speed, vertical jump, and aerobic endurance performances according to the playing positions.

5. Discussion

The main results of this study are normal physical development of young footballers, a tendency for performance to peak between the ages of 15 and 17 and an absence of significant difference whatever the parameter evaluated between the different playing positions.

5.1. Anthropometric Parameters by Age Category

Height, weight, and BMI increased with age in our study population. These results agree with those reported for young Spanish, Algerians and Hungarians [17, 27, 28]. They are also consistent with WHO data on growth from 5 to 19 years old [22]. Indeed, during the development of individuals, their anthropometric parameters change linked to the growth and maturation of organs.

The present study showed participants of varied ages (before, during and after puberty). This could be explained by the normal development of young people in the city of Douala. The objective here was also to assess how the performance parameters varied with age. Performance comparison between ages helps us to assess performance gain with growth. However, the most important thing was to see if their physical development was like that of their age-mates in other cities around the world, especially young talented soccer players. This could make it possible to estimate future performance and guide the choice of an athlete. In the present study, the height and weight of U13

(157.7cm and 46.1kg) were higher than those of 12 years old Algerians (148 cm and 42.5 kg) reported by Tafiroult B. [27]. The height and weight of the U15 in the present population (169.4 cm and 57.5 kg) were higher than those of young south africans with an average age of 14.3 years [29]. 14 years old algerians had however, a lower height (167.7 cm) but with a higher weight (60.1 kg) comparing to U15 of our study (169.4 cm and 57.5 kg). U17 participants of our study (175.4 cm and 66.5 kg) were also taller and heavier than the chineses, belgians and algerians U17 [10, 16, 27, 30] respectively. While the height of young Algerians aged 15 and 16 (168.5 cm) in the study of Abdelatif H. [15] was lower than that of the U17 in our study, their weight (67.43 kg) was similar. The anthropometric characteristics of the U13, U15, and U17 in our study were greater than those of young Spanish of the same categories reported by Perez-Lopez and colleagues [17]. These results disagree with those noted by Fomini and colleagues [19] which presented a height of Cameroonian professional footballers lower than that of Algerians. This difference could be explained by the different modes of selection of soccer players and the quality of follow-up at the professional level in these countries. These morphological differences could also be linked to the difference in the biological maturity between the different studied populations. Indeed, young with early biological maturity also have a greater morphological development than their peers with moderate or later maturity. No case of obesity was observed, even though WHO data showed a prevalence of obesity increasing by about 20% among young people aged 12 to 19 years [31]. Indeed, the practice of sport can allow an increase in muscle mass and a reduction in body fat.

5.2. Physiological Parameters by Age Category

An increase in SBP and in DBP as well as a reduction in resting heart rate with age agrees with the results obtained in young Canadians [32]. The proportion of participants with High blood pressure values increased with age (4/46, 9/41, and 16/41 respectively in U13, U15, and U17). This corroborates with European and American data that show an increasing prevalence of essential Hypertension with age, becoming predominant from the age of 6 for the American Academy of Pediatrics or 10 for the Europeans Society of hypertension [33]. Although a few cases of tachycardia (3/128 participants) were observed, many heart rates were normal. Resting heart rates below 60 bpm (35/128 participants) could indicate cardiac abnormalities (bradycardia) or be linked to adaptations imposed by soccer practice.

5.3. Performance by Age Category

Sprint was chosen in order to assess participants' highest speed in the 10 m track and speed maintenance in the 20 m track. However, the vertical jump was chosen to assess each participant's ability in aerial play. Endurance running was used to assess maximal aerobic speed and maximal oxygen uptake.

Performances in sprint, vertical jump, and MAS increased significantly with age (except the differences in sprint and MAS which are not significant between U15 and U17). These results agree with those of Tafiroult B. [27]. An increase in performance with age category has also been reported in sprints over 10m and 20m as well as in vertical jump [17, 28]. This would also be linked to growth. Indeed, muscle growth and development would contribute to generating a relatively larger force for performance improvement. It was noted that vertical jump increases with sexual maturity [34]. However, a comparison of the VO2max at different age categories revealed a value of U15 significantly higher than that of U13 and U17. This different evolution of VO2 max compared to MAS suggests that the anthropometric changes caused by growth in adolescents would no longer be enough to confer better performance on U17 compared to U15. It is therefore important to include appropriate exercises to improve aerobic fitness in the training programs of the U17.

The vertical jump height values of young Algerians aged 12 and 14 (29.3 and 37.75 cm) reported by Tafiroult B. [27] were lower than those of the same age category (38.3 cm and 46.9 cm) in our study.

On the other hand, the MAS values of the U13 and U15 participants (11.2 and 12.2 km/h respectively) were lower than those of their Algerian fellowmen (12 km/h and 13 km/h) [27]. The Algerian U17 (15 and 16 years old) average sprint performance over 10m (1.71 s) was similar than that of U17 in the present study (1.72 s) even though that their vertical jump performance was poorer (42.2 cm) than that of U17 in our study (51.2 cm) [15].

The vertical jump performance of the U15 in our study was greater than those of the English and South Africans [18, 29]; their VO2max was higher than that of the Tunisian U16 reported by Hammami M. and colleagues, but lower than those of the U14 in the study by Carling C. and colleagues, as well as the 14 years old Hungarians in the study by Soós I. and colleagues [9, 13, 28]. Moreover, the vertical jump height of the U17 in our study was greater than those of the Chineses and Belgians reported respectively by Wong D. and Wong S., Vandendriessche and colleagues [10, 35]. Compared to the VO2max of the U14 in the study of Carling C. and colleagues, the 14 and 15 years old reported by Soós I. and colleagues [9, 28], that of the U17 in our study was lower.

These differences observed in the performances between our populations and youths in other studies also suggest that apart from the estimated VO2max, the differences observed between Cameroonian professional footballers and those of other countries are not the same among young people in training, and they would unfortunately be due to the modes of selection and quality of follow-up. Furthermore, the young people in the present study would be more subjected to exercises which improve the development of anaerobic skills than aerobic capability.

The importance of the differences between the minimum and maximum values within categories could be explained by the differences in chronological age, relative age and biological maturity between individuals of the same category. Indeed, for individuals of the same chronological age, those born months earlier may have developmental and performance advantages than those born later [36].

5.4. Anthropometric Characteristics, Resting Heart Rate and Performance by Game Position

Centre-back defenders and goalkeepers were significantly taller and heavier than players in other positions. These results agree with those of Junior E. and colleagues [37]. Other authors have noted a significant importance of height and weight among goalkeepers [15, 28, 38]. It was also found that defenders were statistically taller than midfielders and forwards for players under 12 years old [39]. However, a good size and substantial weight are assets for goalkeepers, central defenders, and attackers, who are regularly involved in physical duels.

No significant difference was observed regarding performance in speed, vertical jump, and aerobic endurance between the different playing positions. This disagrees with the data presented by several authors: regarding speed, Fomini and colleagues found attackers to be best while Abdelatif A. as well as Soós I and colleagues revealed better performance among goalkeepers [15, 19, 28].

The data in the literature are quite contradictory concerning the performance in vertical jump. Some have noted better performances in goalkeepers [1, 40] and others in defenders [15]. However, goalkeepers, centre-backs and forwards should show good performance in vertical jumping to enable them to be effective in aerial play.

Midfielders are known to cover the greatest distances in football matches [41, 42] and should therefore exhibit better cardio-respiratory fitness. Fomini and colleagues [19] also noted variability in Cameroon depending on the club: while in Coton Sport de Garoua the attackers and midfielders were more enduring than the other compartments, in the Aigle Royale de la Menoua it was the defenders who had the best aerobic endurance. These observations and the absence of significant difference concerning the performances in aerobic endurance by game station in the present study, would be due to the absence of specificity in the selection, the allocation of playing positions and the follow up of the players in our context since the training up to the professional level.

6. Conclusion

At the end of our study on the anthropometric, physiological profiles and performance of young people in football training in Cameroon, it appears that: the oldest categories have the most important anthropometric characteristics, the lowest resting heart rates, and a greater risk of arterial hypertension. The improvement of anthropometric characteristics is due to growth and would lead to an increase in muscle mass and performance in linear sprints over 10 and 20 m as well as in vertical jump with age. But this influence of growth would be limited for performance in speed and aerobic endurance, which level off between the U15 and U17 categories. The differences noted in other studies between the anthropometric characteristics and the performances of the footballers of the professional clubs of Cameroon and those of the footballers of other countries clubs, are not predisposed from adolescence. Emphasis should be made on improving cardio-respiratory capacities. The U17 category requires urgent care proportional to the morphological development associated with their level of maturity. In addition, the allocation of positions and the monitoring of young people should also consider their performance, in particular the vertical jump for goalkeepers, defenders and attackers, aerobic endurance for midfielders and sprints for attackers.

7. Strengths and Limitations of the Study

7.1. Forces

The anthropometric and physical data of this study can serve as references for the detection of young talents in Cameroon who must have values above the international average. This work has also made it possible to identify the weaknesses regarding the aerobic fitness of young people in general and those under 17, thus calling on specialists of strength and conditioning to consider specific and effective programs for the development of motor performances according to age categories and playing positions.

7.2. Limitations of the Study

The main limitations of this study are related to the reluctance of many training structures managers who do not have enough resources to afford experienced and equipped recruiters but remain in the empirical method of young talents identification and do not want to open up to scientific approaches either out of ignorance or out of a concern not to expose their shortcomings. We would wish having a larger population from several training structures.

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