

Physical fitness of some Cameroon division one soccer players: a comparative study

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ABSTRACT

The aim of the present study was to measure some anthropometric and physiological parameters of some Cameroon division one soccer players. The results obtained were compared to those of studies previously undertaken in the United Kingdom, Canada and Norway. Our results show that the height (174.6 ± 4.6 cm), weight (70.4 ± 4.7 kg), maximal heart rate (177.6 ± 10.7 beats.min⁻¹) and maximal oxygen consumption (56.9 ± 3.7 ml.kg⁻¹.min⁻¹) of Cameroonian players are significantly lower ($P < 0.01$) than those of European of same category. On the other hand, their energy cost (5.5 ± 0.1 kJ.km⁻¹.kg⁻¹) and hydric loss (3.86 % of body weight) are significantly higher ($P < 0.01$) as compared to their western counterparts of the same and even of lower categories (under 16 and under 18 years). These differences in anthropometric and physiological values might be related to the environmental conditions, the known poor nutritional status frequent in developing countries and to an insufficient level and intensity of training of Cameroonian local soccer players as compared to Westerns.

Key words : Soccer players - Anthropometric parameters - Physiological parameters- Physical fitness -Cameroon

RESUME

Certains paramètres anthropométriques et physiologiques ont été mesurés chez trente footballeurs du championnat camerounais de première division âgés de 19 à 25 ans. Les résultats obtenus ont été comparés à ceux de travaux similaires effectués en Angleterre, au Canada et en Norvège. Des résultats de notre étude, il ressort que la taille moyenne ($174,6 \pm 4,6$ cm), le poids ($70,4 \pm 4,7$ kg), la fréquence cardiaque maximale ($177,6 \pm 10,7$ beats.min⁻¹) et la consommation maximale d'oxygène ($56,9 \pm 3,7$ ml.kg⁻¹.min⁻¹) des camerounais sont significativement inférieurs à celles des footballeurs occidentaux ($p < 0,01$). Parallèlement, le coût énergétique ($5,5 \pm 0,1$ kJ/km/kg) et les pertes hydriques (3,86 % du poids corporel) chez les footballeurs camerounais sont significativement plus élevés ($p < 0,01$) que chez leurs homologues européens et américains de même catégorie, voire de catégories inférieures. Les différences anthropométriques et physiologiques observées ont été interprétées comme liées à une alimentation moins riche en protéines et vitamines et à un entraînement dont le niveau et l'intensité sont insuffisants chez les footballeurs du championnat d'élite camerounais.

Mots clés : Footballeurs - Paramètres anthropométriques - Paramètres physiologiques - Aptitude physique - Cameroun

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INTRODUCTION

Soccer is recognised world-wide as the most popular sport nowadays. Hillis (1998), estimated that about 40 billion television spectators watched the final phase of the World Cup in 1998.

Several researchers recognise today that talent is not any more the only determining criteria in performances and that talent must go with endurance. They find that some anthropometric and physiological norms considered as indicators of physical fitness should be necessarily taken into consideration in the selection for high level competition (Tumilty, 1993; Wisloff *et al.*, 1998; Reilly *et al.*, 2000a,b; Bunc and Psotta, 2001; Cometti *et al.*, 2001). Moreover, the knowledge of these norms and standards can help in the discrimination between players of equal talent, prediction of positions on the field (defender, midfielder, attacker) as well as in the follow-up and intensity of training.

Cameroon local division one teams that are supposed to provide players to the National team, have poor results in African club competitions as compared to their Maghrebian counterparts, such as Egypt, Tunisia and Morocco where semi-professionalism is already established. This is paradoxical when one consider the high performance of the Cameroon national team

The lack of scientific studies related to anthropometric and physiological parameters of African football players in general and Cameroonian in particular is remarkable. The aim of this study was to measure some of these parameters in Cameroonian local soccer players, to compare them with values found in the literature and to see if they could explain the insufficient performances of local players.

MATERIAL AND METHODS

Subjects

Forty-two football players of three clubs: Tonnerre, Canon and Olympic Mvolyé of the Cameroon division one championship gave an informed consent to participate in this study; thirty of them completed all the experimental protocol and constituted the final sample of our investigation. They originate from the various Cameroonian provinces. A number of them have been practising soccer for about ten years and have participated in African competitions during the last two years. These players are amateurs, with a monthly salary hardly reaching 170 US \$. Our subjects

practice five training sessions of three hours each per week, consisting of footing, sprinting, muscle conditioning and exercises with a ball.

Parameters studied

The parameters considered in this study are:

- Anthropometric parameters: height and weight.
- Physiological parameters: maximal heart rate (HRmax), maximal ventilation (VEmax), maximal oxygen consumption ($\dot{V}O_2$ max), hydric losses (Δm) and energy cost (EC).

Experimental procedure

All subjects went through a preliminary pre-test by performing the same exercises as during the experiment proper, to get familiarised to the treadmill and other laboratory equipment.

Anthropometric parameters

Each subject was weighed undressed and the height was measured using an electronic scale SECA-delta 707, provided with a fathom, before starting the physical trial.

Determination of maximal oxygen consumption ($\dot{V}O_2$ max) maximal ventilation (VEmax), and maximal heart rate (HRmax).

The experiment for determining $\dot{V}O_2$ max, VEmax and HRmax, consisted of a physical trial made up of series of runs of 6 min each on a treadmill (Gymrol 1200) at 0%. The trial started at 8 km.h⁻¹. The speed was progressively increased by 1 km.h⁻¹, until exhaustion. Consecutive levels of running were separated by an inactive pause of 2 min (Vogelaère, 1984).

The oxygen consumption ($\dot{V}O_2$) and ventilation (VE) were directly measured during the physical trial with subjects connected to a respiratory gases analyser MIJNHARDTS OXYCON 4. This apparatus uses the principle of infrared fractionation and is provided with a paramagnetic cell. $\dot{V}O_2$ and VE were recorded all 30 seconds on an alphanumeric printer connected to the respiratory gases analyser.

The heart rate (HR) was recorded at the end of each level by mean of a scapular belt cardiofrequency meter PE 300.

Recovery period

At the end of the physical trial (exhaustion), each subject underwent a period of an inactive recovery by laying on folding lab bed. During this period the heart rate was recorded every 4 min. for 20 min.

Determination of hydric losses and energy cost.

At the end of the recovery period, each subject was weighed undressed for determination of hydric losses using the following formula:

Hydric losses (Δm) = $m_0 - m_f$ (where m_0 is the weight at the onset of physical trial and m_f weight at the end of the recovery period) (Mandengue *et al.*, 1996).

The energy cost EC (in $\text{kJ.km}^{-1}.\text{kg}^{-1}$ of body mass) was considered as the energy expenditure to move on a given distance unit (here in km) and was calculated by the simplified expression of Di Prampero (1986): $\text{EC} = \dot{V}O_{2\text{max}} / \text{maximal speed (Speedmax)}$.

Statistical analysis

Results are given as mean \pm standard deviation. The results were compared to those of studies found in the literature, using the paired t test of small sample when necessary. Differences were considered significant at $P < 0.05$.

RESULTS

The mean age of soccer players of the sample studied is 22.5 ± 2.9 years. The mean height and weight are respectively, 174.6 ± 4.6 cm and 70.4 ± 4.7 kg.

The physiological parameters (Table 1) gave the following values: maximal heart rate (HRmax) 177.6 ± 10.7 beats.min^{-1} ; maximal ventilation (VEmax), 133.6 ± 15.7 l.min^{-1} and a maximal oxygen consumption ($\dot{V}O_{2\text{max}}$) 56.9 ± 3.7 $\text{ml.kg}^{-1}.\text{min}^{-1}$.

The energy cost was 5.5 ± 0.1 $\text{kJ.km}^{-1}.\text{kg}^{-1}$ corresponding to a mean maximal speed of 13.0 ± 0.7 km.h^{-1} . The hydric losses are 0.9 ± 0.4 kg, corresponding to 3.86% of the mean body weight.

The mean height of our subjects (174.6 ± 4.6 cm) and weight (70.4 ± 4.7 kg) are respectively lower than those of Norwegians of same age category (180.9 ± 4.9 cm and 76.9 ± 7.0 kg) ($P < 0.01$); and they instead correspond to those of the Canadian under-18 and English under-16 categories. (Table 2).

The $\dot{V}O_{2\text{max}}$ (56.9 ± 3.7 $\text{ml.kg}^{-1}.\text{min}^{-1}$) of our sample is significantly lower ($P < 0.01$) than Norwegian's of the same age category (63.7 ± 5.0 $\text{ml.kg}^{-1}.\text{min}^{-1}$) and that of English under-16 (59.3 ± 3.8 $\text{ml.kg}^{-1}.\text{min}^{-1}$). The $\dot{V}O_{2\text{max}}$ of Cameroonian is also lower than those of the Canadian under-16 (59.0 ± 3 $\text{ml.kg}^{-1}.\text{min}^{-1}$) and under-18 (57.7 ± 6.8 $\text{ml.kg}^{-1}.\text{min}^{-1}$) (Table 2).

DISCUSSION

Our results show that Cameroonian local soccer players weigh significantly less than Norwegian players of the same category. This is equally the case with the height. Yet, their height and weight are nearly similar to those of Canadian under-18 and English under-16.

Beyond genetic considerations, we can suggest that these morphological differences are due to early age diet. In fact, Abe *et al.* (1999) compared architectural characteristics of muscles between black and white American college soccer players and found that blacks had a significantly greater quadriceps, biceps and abdomen. Their standing height and body weight were similar but the ratio of leg length to standing height was significantly greater in blacks compared with whites. Indeed, Cameroon is considered as a poor country where most families earn less than 1 US dollar per day. The majority of talented football players emerge from poor families where childhood diet is characterised by noticeable insufficiency in high quality body building nutrients. Besides this, they are amateurs with a monthly salary hardly reaching 170 US \$. One consequence of this fact is a less pronounced somatic development as compared to their European or Canadian counterparts.

Our analysis shows that Cameroonian football players have a significantly lower mean $\dot{V}O_{2\text{max}}$ than Norwegian's of same age category and even less than English under-16 and Canadian under-18. This value is also significantly lower than the standard norm of 60 $\text{ml.kg}^{-1}.\text{min}^{-1}$ recommended nowadays for high level soccer player; (Tumilty, 1993; Wisloff *et al.*, 1998; Reilly *et al.*, 2000a,b; Bunc and Psotta, 2001). This reveals that Cameroonian local football players have signifi-

Table 1 : Physiological parameters studied.

VEmax (l. min^{-1})	$\dot{V}O_2$ max ($\text{ml.kg}^{-1}.\text{min}^{-1}$)	HR max (beats. min^{-1})	Speed max (km.h^{-1})	EC ($\text{kJ.km}^{-1}.\text{kg}^{-1}$)	Δm (kg)
133.6 ± 15.7	56.9 ± 3.7	177.6 ± 10.7	13.0 ± 0.7	5.5 ± 0.1	0.9 ± 0.4

Table 2: Comparison of anthropometric and physiological parameters of Cameroonian to some values of literature.

Country	n	Age (years)	Height (cm)	Weight (kg)	HR max (beats. min ⁻¹)	VO ₂ max (ml.kg ⁻¹ .min ⁻¹)
Cameroon	30	22.5 ± 2.9	174.6 ± 4.6	70.4 ± 4.7	177.6 ± 10.7	56.9 ± 3.7
Norway (Wisloff et al., 1998)	29	23.8 ± 3.8 ns	180.9 ± 4.9 P<0.01	76.9 ± 7.0 P<0.01	192.0 ± 7.6 P<0.01	63.7 ± 5.0 P<0.01
Canada (Leatt et al., 1987)*	8	15.4 ± 0.5 P<0.01	171.0 ± 4.0 ns	62.7 ± 2.8 P<0.01	-	59.0 ± 3.2 ns
Canada (Leatt et al., 1987)*	9	16.7 ± 0.5 P<0.01	176.0 ± 4.0 ns	69.1 ± 3.4 ns	-	57.7 ± 6.8 ns
England (Franks et al. 1999)*	64	< 16 P<0.01	176 ± 6 ns	69.9 ± 6.3 ns	-	59.3 ± 3.8 P<0.01

n = number of subjects

ns = not significant

*in Reilly (2000a)

cantly lower aerobic metabolism and endurance capacity than western players of same category and even lower categories. These VO₂ max differences can be attributed to somatic development differences already mentioned above and to different level and intensity of training. Indeed, several studies show that the VO₂ max is significantly improved by training Rowell *et al.*, 1964)(Ekblom, 1969; Lacour and Flandrois, 1997; Rieu, 1986; . The Cameroonian first division championship being of amateur nature, its physical training intensity and muscle conditioning are lower than those of western elite professional clubs, which in addition benefit from a rigid follow up by a specialised personnel.

The majority of Cameroonian clubs lack laboratories to perform scientific control and follow-up of physiological and anthropometric parameters of their players. As a result, their coaches are unable to appreciate the physical fitness of players, based on internationally accepted standards for improvement. Consequently, talent remains the primordial selection criterion in local teams.

The energy cost of our subjects (5.5 ± 0.1 kJ.km⁻¹.kg⁻¹), corresponding to a maximal speed of 13.0 ± 0.7 km.h⁻¹ is significantly high as compared to the estimations of Hagan *et al.* (1980). According to this author, the energy cost of individual weighing 70kg (like our subjects) and running between 8.88 and 16.9 km.h⁻¹ should be 4.7 kJ.km⁻¹.kg⁻¹. Margaria *et al.* (1963) previously suggested almost the same value (4.19 kJ.km⁻¹.kg⁻¹). Bunc and Psotta (2001) found recently that

the energy cost of 8 years old football players running at speeds superior to 12 km.h⁻¹ at 5% treadmill inclination was less than 4.20 kJ.km⁻¹.kg⁻¹. Our results indicate that Cameroon local football players energy output is feeble. This is probably related to their low level of training and could also explain their limited endurance capacity as well as their insufficient physical fitness for high level competitions.

Hydric losses in our subjects (3.86% of body weight) fall within the 3 to 5% interval. According to Debrinay (1981), this level of dehydration can reduce the maximal endurance by 20 to 40% in adult football players.

CONCLUSION

The present study have shown that Cameroonian local players of the division one championship are physically less fitted than those of the same age category of western countries in general. Their anthropometric and physiological parameters correspond more to those of the westerners under-18 and sometimes to the under-16. This is still unsatisfactory for selection for high level competition and confirms the findings of Bunc and Psotta (2001), Reilly *et al.*, (2000a,b), Wisloff *et al.*, (1998) and Tumilty (1993), who propose that physiological and anthropometric norms can intervene as discriminatory criteria for selection besides talent.

Our study also brings some understanding to the high performances of the Cameroon national team in Africa, given that for the past decade, this team is exclu-

sively constituted by professionals of high level European teams, whereas many other African national teams are usually made up with a considerable number of local players.

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