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UNIVERSIDADE DE COIMBRA
Faculdade de Ciências do Desporto e Educação Física

REPEATED SPRINT PROTOCOLS (RUNNING AND DRIBBLING):

Reproducibility and variation by competitive level

Mestrado em Treino Desportivo para Crianças e Jovens

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REPEATED SPRINT PROTOCOLS (RUNNING AND DRIBBLING):

Reproducibility and variation by competitive level

Thesis submitted to the Faculty of Sport Sciences and Physical Education of the University of Coimbra, for the degree of Master in Youth Sports Training.

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ABSTRACT

Soccer is a complex sport, requiring the repetition of many actions, and several tests are currently being used to assess the physical prowess of players. Repeated sprint ability (RSA) has been shown to be an important factor for determining success in soccer. Sprinting and dribbling on the same course are partly related, although the skill of dribbling is more complex than that of sprinting. The purpose of this study was to develop a repeated dribbling ability (RDA) test for young soccer players. Reproducibility of test and variability by competitive level were considered. The sample consisted of 67 young male soccer players (16.11±0.59 years) who were measured in RSA and RDA protocols within the following competitive level groups and according to the structure of Portuguese youth soccer under-17: local level (n=34) and national level (n=37). Pearson product-moment correlation coefficient was used to measure the linear correlation between different variables. The t-student was used to compare the means between different groups. The smallest worthwhile difference was set at Cohen's effect size of 0.2 and 0.5. Cohen's d effect sizes (ES) and thresholds (0.2, 0.6, 1.2, 2.0, 4.0 for trivial, small, moderate, large, very large and extremely large) were also used to compare the magnitude of the differences in anthropometrical characteristics and physical performance. Analysis of RDA reproducibility confirmed the future usefulness of the test (reliability coefficients: mean time = 0.83 total time = 0.83 and ideal time = 0.85). This study reinforces that RSA protocols associate better with competitive level group. Moreover, standard for smallest worthwhile differences between performance levels within these groups of youth players could assist the coach.

Keywords: youth soccer, sport skill, dribble performance, short-term maximal effort, field-testing.

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I - INTRODUCTION

According to FIFA (2012) there are 265 million soccer players, which represents 4% of the world population. Soccer is the most popular sport in the world and is performed by men and women, children and adults with different levels of expertise (Stolen, Chamari, Castagna, & Wisloff, 2005), also in Portugal soccer is the sport with more participants and this activity holds a position of great prominence because of the relevance of sports activity as educational strategy (Ramos, 2002). This allows soccer to enjoy a priority status in various programmes and institutions. With regards to youth sports, it is reasonably well established that there is a significant number of children and adolescents who participate in organized sports programs (Siegel, Peña Reyes, Barahona, & Malina, 2004).

The participation of children and adolescents in competitive sports has increased in the last years, and competitive soccer is one of the most popular sports among this population. Children's exercise is characterized by very shorts bursts of mild to intense efforts (Stolen et al., 2005; Thatcher & Batterham, 2004), conversely around 12-13 years old, during the transition to adolescence the number of practitioners decrease (Malina et al., 2005).

The ability to dribble the ball past opposing players is a hallmark of gifted players and hence is an of measured element of soccer skill (Ali et al., 2007; Haaland & Hoff, 2003; Hoare & Warr, 2000; Reilly & Holmes, 1983; Rosch, Hodgson, Peterson, Graf-Baumann, Junge, & Chomiak, 2000). A player might have good patterns of movement (technique) but if he does not perform the right action at the right time (skill) then he becomes an almost ''useless player'' (Knapp, 1977). The majority of dribbling actions involve acceleration, because players commonly cover short distances (Bangsbo, 1994b; Cometti, Maffiuletti, Pousson, Chatard, & Maffulli, 2001; Di Salvo et al., 2007; Mohr, Krustrup, & Bangsbo, 2003). It is concluded that during adolescence dribbling performance can assist in identifying the best players for the future (Huijgen, Elferink-Gemser, Post, & Visscher, 2010), result of the development of intellectual and motor skills (Gil, Gil, Ruiz, Irazusta, & Irazusta, 2007). The present study aims to examine the reproducibility properties of the repeated dribbling protocol and, in addiction, test the contribution of concurrent protocols (running and dribbling) to clarify young soccer players by competitive level.

II - REVIEW

2.1. Physical demands of the game

Traditionally, soccer has been viewed as a sport that demands a high level of aerobic capacity (Meckel, Machnai, & Eliakim, 2009) but the ability to perform short bursts of intensive activity (sprints) interspersed with less intense episodes is important (Rampinini et al., 2007). Speed and acceleration are important qualities in field sports, with running speed over short distances fundamental to success (Baker & Nance, 1999; Sayers, 2000), due to its acyclical nature and intensity, soccer is classified as a high intensity intermittent team sport (Bangsbo, 1994b).

High-speed actions are known to impact soccer performance and can be categorized into actions requiring maximal speed, acceleration, or agility (Little & Williams, 2005). A sprint bout occurs about every 90 seconds, each lasting an average of 2 to 4 seconds. sprinting constitutes 1– 11% of the total distance covered in a match, corresponding to 0.5–3.0% of effective playing time—that is, the time when the ball is in play (Wisloff, Castagna, Helgerud, Jones, & Hoff, 2004) in this short high-intensity sprints in the range of 10–30 meters are common in soccer and often precede decisive moments in a match (Coelho et al., 2010; Impellizzeri et al., 2008; Rampinini et al., 2007; Reilly, Bangsbo, & Franks, 2000). The capacity to perform this short-duration and high-intensity sprint-type actions (≤10 seconds) interspersed with brief recoveries (usually ≤60 seconds) is labelled repeated-sprint ability or RSA (Bishop, Girard, & Mendez-Villanueva, 2011; Buchheit, Mendez-Villanueva, Simpson, & Bourdon, 2010; Girard, Mendez-Villanueva, & Bishop, 2011).

Aerobic capacity is the predominant metabolic pathway in a soccer game, but many of the important game actions are likely anaerobic. Anaerobic power associated with muscular strength is important when shooting, passing and in individual duels that involve physical contact (Reilly, Bangsbo, et al., 2000).

2.2. Youth soccer demands

Usually young players tend to demonstrate lower values of VO2 max (<60 ml.kg^{-1}.min^{-1}), when compared with senior players (Stolen et al., 2005); still, some exceptions as (Helgerud, Engen, Wisloff, & Hoff, 2001) reported values of 64.3 ml.kg^{-1}.min^{-1} in junior soccer players. Stroyer, Hansen, and Hansen (2004), in a study with young soccer players aged 14 years old, reported superior VO2max values in midfielders and strikers (65 ml.kg^{-1}.min^{-}) when compared with defenders (58 ml.kg^{-1}.min^{-1}), the explanation for this cases are the specific tactical position, reported by Felci, De Vito, Macaluso, Marchettoni, and Sproviero (1995).

In terms of formal competition, young soccer players spend 63% of playing time under aerobic and 37% under anaerobic conditions. Adult values are different and the athletes spend 66% and 34% of play time under aerobic and anaerobic conditions, respectively (Stratton, 2004). However, all available data on children and young soccer players regarding the demands of youth soccer suggest some similarity with those reported for adult players.

2.3. Growth and maturation

Malina, Eisenmann, Cumming, Ribeiro, and Aroso (2004) report a study with three tests of functional capacity: running speed (30-m dash), explosive power (vertical jump) and aerobic resistance (yo-yo intermittent endurance test). With all the analyses was measured relatively the contribution of age, stage of sexual maturity, height, weight and years of formal training in soccer. The sexual maturity status was the primary contributor for variance in the aerobic resistance, height and weight were the primary contributors for the variance in the other two tests. The interacting processes of growth (enhance of body size), maturation (process of developing the different body functions aiming at biological maturity) and development (skills acquisition and qualitative behaviour) can significantly influence the functional capacity of children and teenagers.

2.4 Stature body mass and adiposity

Stature and body mass are two of the most frequently used dimensions to monitor the growth of children and adolescents (Malina, 2004). Eleven to twelve-year-old boys experience an increase in the rate of stature growth, which marks the beginning of the pubertal growth spurt (period of rapid growth that is highly variable among different individuals). The growth rate increases until reaching its peak, called peak velocity (PV). The increments of the stature depend on the increase in the trunk and lower limbs size, considering different growth rates. Malina, Bouchard, and Bar-Or (2004) reported that rapid growth of the lower extremities is a characteristic of the beginning of the puberty spurt, and the ages of the take-off to leg length and sitting height differ about 0.1 years. This evidence suggests that the growth stage of the trunk is longer. During the pubertal growth spurt, boys go through an increase in trunk/body fat and at the same time there is a decrease in limbs adiposity. This finding are reinforced by Malina, Bouchard, et al. (2004) indicating that boys over eleven show a decrease in the values of the limbs subcutaneous fat and a slight increase in the values of the trunk.

Considering body composition, and from a bicompartimental perspective, there is stabilization or a slight increase in fat mass in males during the pubertal spurt. However, there is a sharp increase of fat-free body mass during this period, as a result of the substantial increase in muscle and bone mass (Malina, Bouchard, et al., 2004) .

The equations of Slaughter et al. (1988) are the most widely used in studies of body composition in pediatric populations and in the FITNESSGRAM battery, specifically. In recent years, Slaughter has been the most referenced author of studies carried out with adolescents.

Slaughter et al. (1988) used three methods to predict the percentage of BF with specific groups of children and youngsters (65 prepubertal, 59 pubertal and 117 postpubertal) and 68 adults, aged 8 to 29, male and female, Caucasian and Black, using different assessment techniques based on a three compartment model and with crossed validity and anthropometric measurements based on the sum of two skinfolds, triceps with subscapular and triceps with medial calf.

2.5. Somatic maturation

The processes of growth and maturation are instrumental in the socialization of young athletes. Biological factors, such as body size and maturity status have been documented as predictors of athlete selection and performance in several sports (Malina, Bouchard, et al., 2004). The physical changes associated with growth and maturation may have a profound impact upon the self-perceptions, motives, beliefs and ultimately, behaviors of young athletes (Cumming, Battista, Standage, Ewing, & Malina, 2006).

To predict the adult stature from current age, stature, and weight of the youngster and mid parent stature (average height of biological parents) was needed. The method used was Khamis-Roche, (Khamis & Roche, 1994, 1995) developed during the Fels Longitudinal Study and the associated error was 2.2cm for boys between the predicted stature and the actual stature at the age of 18. For being a non-invasive method the acceptance was easier, the privacy was guaranteed and there's no exposure to radiation like in some other protocols used before to analyse maturation. Malina et al. (2005) used the determination of the predicted mature stature to classify a sample of American football players regarding maturation. The authors used the Khamis-Roche method and subsequently determined the z score for each athlete regarding the percentage of mature stature attained and grouped the sample subjects into late or delayed matures (if z score <-1.0), average or "on time" (if z score ≥ -1.0 and ≤ 1.0) and early or advanced matures (if z score ≥ 1.0). Also Cumming et al. (2006) adopted the same procedure in a study with young soccer players.

2.6. Repeated sprint ability (RSA)

Repeated sprint ability (RSA) has been shown to be an important factor for determining success in soccer (Impellizzeri et al., 2008; Rampinini et al., 2007). In top-level professional soccer players, significant correlations have been reported between running distances covered during a match and mean sprint times on an RSA test (Rampinini et al., 2007).

Pereira, Kirkendall, and Leite, (2007) reported that the attackers made most sprints, and also the forwards and offensive midfielders sprinted more with the ball than the others players. On young non-elite soccer players found that forwards were the fastest players in the 30-m straight and agility sprint, followed by midfielders (Gil, at al., 2007). In this both studies indicate that forwards are the best sprinters. Malina et al. (2005) showed that height is significant factor for running speed in a group of talented soccer players. The body mass is another contributor to performance in sports, which is related to body muscle percentage and body fat percentage. Some test batteries have revealed that athletes who perform better on change-of-direction sprint tests, also over short distances, tend to have a lower percentage of body fat (Gabbett, 2002; Meir, Newton, Curtis, Fardell, & Butler, 2001; Negrete & Brophy, 2000; Reilly, Bangsbo, et al., 2000). Practice is a major feature for the development of soccer skills (Ericsson, Krampe, & Teschromer, 1993; Helsen, Hodges, Van Winckel, & Starkes, 2000; Helsen, Starkes, & Hodges, 1998). Some previous cross-sectional research on talented youth soccer players has reported improvements on dribbling and sprinting tests with age (Gil, Ruiz, Irazusta, Gil & Irazusta, 2007; Kukolj, Ugarkovic, & Jaric, 2003; Rosch, Hodgson, Peterson, Graf-Baumann, Junge, Chomiak, et al., 2000; Vanderford, Meyers, Skelly, Stewart, & Hamilton, 2004).

2.7. Repeated dribbling ability (RDA)

Huijgen et al. (2010) reported that sprinting and dribbling on the same course are partly related, although the skill of dribbling is more complex than that of sprinting. Therefore, the fastest sprinters are not always expected to be the fastest on the dribble. Dribbling in soccer can be categorized into dribble actions while accelerating and dribble actions with quick changes of direction. Acceleration is of great importance, as soccer players only cover short distances (mean distance 10–20 m) at maximal effort (Cometti et al., 2001; Reilly, Bangsbo, et al., 2000; Spinks, Murphy, Spinks, & Lockie, 2007).

The ability to sprint and dribble at high speed is essential for performance in soccer, some previous research has indicated that the better players distinguish themselves by their running speed while dribbling the ball (Malina et al., 2005; Reilly, Williams, Nevill, & Franks, 2000; Vaeyens et al., 2006). Dribbling speed is considered critical to the outcome of the game, with elite soccer players performing 150–250 brief intense actions during a game (Mohr et al., 2003). Many actions in soccer involve repeated short sprinting or dribbling with changes of direction (Bloomfield, Polman, O'Donoghue, & McNaughton, 2007; Little & Williams, 2005; Sheppard & Young, 2006), but only 1.2 – 2.4% of the total distance covered is with the ball possession (Di Salvo et al., 2010).

III - METHODS

3.1. Sample

As stated by the Portuguese Soccer Federation (2012/2013), all soccer players can be registered "[…] according to respective age in the respective stage: under-7; under-9; under-11; under-13 (classified as *infantiles*); under-15 (classified as *initiates*); under-17 (classified as *juveniles*) and under-19 (classified as *juniors*)".

The sample comprised 67 young male soccer players within the following age groups and according to the structure of Portuguese youth soccer: under-17 (classified as *juveniles*, 15/16 years. National level players belong to teams affiliated to "Porto Soccer Association "and affiliated in the "Coimbra Soccer Association" the local level players belong to teams affiliated to "Aveiro Soccer Association" and affiliated in the "Coimbra Soccer Association". All the clubs are affiliated in the "Portuguese Soccer Federation". The study followed the established ethical standards for sports medicine (Harriss & Atkinson, 2009). The participation of the players was voluntary, and parents were asked for a written statement of consent. The sport entity was also informed about the whole experimental procedure.

3.2. Proceedings

This study comprises two different moments. In the first moment, all the test were recorded and the athletes were questioned about the perception of the all procedures. Them, two protocols were defined the RSA should be the first test to be applied, as well the other anthropometric and functional variables. Second the RSA should be done one week later in the same day and at the same hour interval. To prevent the "learning effect" in the sample one trial was included in the warm-up for all subjects. All tests were done with the control of temperature and humidity. Tests were also performed on the same day of the week (Wednesday) and at the same hour interval (18:00 – 20:00).

3.3. Variables

Anthropometry

A single individual trained in anthropometric assessment measured body mass, stature and two skinfolds (i.e., triceps and subscapular) following standard procedures (Lohman, Roche, & Martorell, 1988), also referred by Malina, Eisenmann, et al. (2004). Stature was measured to the nearest 0.1 cm with a Harpenden stadiometer (model 98.603, Holtain Ltd, Crosswell, UK) and body mass was measured to the nearest 0.1 kg with a SECA balance (model 770, Hanover, MD, USA). Skinfolds were measured to the nearest mm using a Lange caliper (Beta Technology, Ann Arbor, MI, USA). Technical errors of measurement for stature (0.27 cm), sitting stature (0.31 cm), body mass (0.47 kg), and skinfolds (0.47-0.72 mm) were well within the range of several health surveys in the United States and a variety of field surveys (Malina, Eisenmann, et al., 2004). Percentage of fat mass was estimated from triceps (T) and medial calf skinfold thicknesses using the protocol of (Slaughter et al., 1988):

$$0.735\ (Glm + T) + 1.0$$

Somatic Maturation

To calculate the percentage of predicted mature stature was used the protocol proposed by the Khamis and Roche (1994, 1995). The stature at the time and the body mass was measured, as well the mid-parental stature was collected, obtaining through photocopy of the identity card of each parent.

Field tests

Repeated Sprint Ability (RSA: 7 x 34.2-m / 25’’) and Repeated Dribbling Ability (RDA: 7 x 34.2-m / 25’’) were assessed as described by Bangsbo (1994a). The test included seven consecutive sprints (about 35 m with a slalom) with a recovery period of 25 seconds between sprints during which the player run/walked from the end line back to the starting line. A digital chronometer connected to photoelectric cells (Globus Ergo Timer Timing System, Codogné, Italy) was used to record the time for each sprint. This protocol provide: the best sprint, the worst sprint, the total time, ideal time (total theoretical time of accomplishment of the sprints with the best mark) and decrement score (Bishop, Spencer, Duffield, & Lawrence, 2001).

Repeated Dribbling Ability was assessed also with the 7-sprints protocol (Bangsbo, 1994a), but adding the soccer ball. In the beginning of the test there were 7 balls with the same air pressure and the same brand. The 25-second recovery period was performed without ball. The same indicators were extracted from this test.

Training and competition indicators

During the collecting data, some complementary information was also collected, as the number of years (sport seasons) of federated practice in sports activity, the specialized position in the activity.

3.4 Quality Control

Intra-observer technical errors of measurement (TEM, #1164) were 0.27 cm for stature and 0.47 kg for body mass. For skinfolds, triceps and medial calf, were 0.52 mm and 0.47 respectively. For circumferences was 0.45 cm for proximal, 0.38 cm for mid-thigh and 0.19 cm for distal. Corresponding values for front and posterior thigh skinfolds were 0.70 mm and 0.71 mm. These errors were within the range reported for in variety of studies (Malina, 1995) . Information about sport experience was obtained by interviews and confirmed at Portuguese Soccer Federation. Statistical significance was set to a p value < 0.05.

3.5 Statistical Analysis

All statistical analyses were completed using SPSS for MAC OS X (version 20.0). Descriptive statistics are presented as means ± standard deviations (SD, #1164). The

Pearson product-moment correlation coefficient was used to measure the linear correlation between different variables. The t-student was used to compare the means between different groups.

Several authors described large differences in anthropometrical characteristics and physical capacities between chronologically older and younger players within the same age group (Figueiredo, Goncalves, Coelho, & Malina, 2009; Malina, Eisenmann, et al., 2004; Vaeyens et al., 2006) , further analysis was conducted to identify smallest worthwhile differences between players from different competitive level, using the method outlined by Hopkins (Hopkins, 2000; Hopkins, Marshall, Batterham, & Hanin, 2009) . This approach represents a contemporary method of data analysis that uses confidence intervals in order to calculate the probability that a difference is clinically beneficial, trivial or harmful. The smallest worthwhile difference was set at Cohen's effect size of 0.2 and 0.5. Cohen's d effect sizes (ES) and thresholds (0.2, 0.6, 1.2, 2.0, 4.0 for trivial, small, moderate, large, very large and extremely large) were also used to compare the magnitude of the differences in anthropometrical characteristics and physical performance (Hopkins et al., 2009) .

IV - RESULTS

Descriptive statistics for the total sample are summarized in tables 1, 2, 6 and 7.

Table 1. Descriptive statistic for the total sample (n=67).

Variable	Units	Min	Max	Mean	St. error	(95% CI of mean)	SD
Training	years	2.00	12.00	8.10	0.27	(7.60 to 8.60)	2.20
Chronological age	years	14.67	17.22	16.11	0.07	(15.97 to 16.26)	0.59
APHV	years	10.56	15.08	12.11	0.09	(11.92 to 12.29)	0.74
EMS	%	93.20	100.0	98.4	0.18	(98.00 to 98.80)	1.50
Stature	cm	159.90	189.10	174.22	0.83	(172.56 to 175.87)	6.79
Sitting height	cm	65.30	99.90	90.22	0.66	(88.91 to 91.53)	5.37
Leg length	cm	74.70	100.50	84.00	0.69	(82.63 to 85.37)	5.62
Body mass	kg	50.80	100.10	65.85	1.18	(63.50 to 68.20)	9.64
Fat mass	kg	9.09	30.40	15.78	0.62	(14.55 to 17.01)	5.04
Fat mass	%	4.99	28.22	10.63	0.56	(9.51 to 11.76)	4.62
Fat free mass	kg	43.46	71.88	55.22	0.85	(53.53 to 56.91)	6.92
Thigh volume	L	3.27	11.82	4.94	0.17	(4.61 to 5.27)	1.36

SD (standard deviation); APHV (age at peak height velocity); EMS (estimated mature stature).

Table 2. Descriptive statistic for RSA and RDA outputs for the total sample (n=67).

Variables	Min	Max	Mean	St. error	(95% CI of mean)	SD
RSA 1	6.48	8.34	7.06	0.04	(6.98 to 7.13)	0.31
RSA 2	6.54	8.27	7.09	0.04	(7.01 to 7.17)	0.33
RSA 3	6.59	8.17	7.18	0.04	(7.09 to 7.26)	0.35
RSA 4	6.47	8.44	7.24	0.04	(7.15 to 7.32)	0.36
RSA 5	6.70	9.15	7.38	0.06	(7.26 to 7.50)	0.48
RSA 6	6.72	8.52	7.37	0.05	(7.28 to 7.46)	0.39
RSA 7	6.69	9.06	7.35	0.06	(7.23 to 7.46)	0.47
RSA_Ideal	45.29	57.19	48.84	0.25	(48.34 to 48.35)	2.07
RSA_Total	46.58	59.95	50.66	0.29	(50.08 to 51.24)	2.39
RSA_DS	1.03	10.17	3.72	0.25	(3.21 to 4.22)	2.07
RDA 1	7.49	10.46	8.83	0.08	(8.67 to 8.98)	0.62
RDA 2	7.83	15.56	8.98	0.13	(8.72 to 9.24)	1.08
RDA 3	7.60	11.49	8.84	0.09	(8.67 to 9.02)	0.73
RDA 4	7.66	11.40	8.84	0.08	(8.67 to 9.01)	0.69
RDA 5	7.55	12.18	8.93	0.11	(8.70 to 9.16)	0.94
RDA 6	7.60	12.81	8.87	0.11	(8.65 to 9.08)	0.87
RDA 7	7.27	12.07	8.93	0.10	(8.73 to 9.13)	0.83
RDA_Ideal	50.89	68.25	58.98	0.43	(58.12 to 59.84)	3.52
RDA_Total	54.17	77.70	62.22	0.56	(61.10 to 63.34)	4.60
RDA_DS	1.44	19.35	5.47	0.45	(4.57 to 6.37)	3.68

SD (standard deviation); RSA (repeated sprint ability); RDA (repeated dribbling ability); 1 – 9 (trial 1 to trial 9); RSA_Ideal (best sprint x 7 in RSA); RSA_Total (∑ of all trials in RSA); RSA_DS (decrement score in RSA); RDA_Ideal (best sprint x 7 in RDA); RDA_Total (∑ of all trials in RDA); RDA_DS (decrement score in RDA).

Table 3. Coefficients of correlation (95% CI) between RSA outputs and chronovariables and body size descriptors for the total sample (n=67).

Variables	RSA_Ideal	RSA_Total	RSA_FTB	RSA_DS
Training	-0.246 (-0.459 to -0.006)	-0.339 (-0.536 to -0.108)	-0.357 (-0.550 to -0.128)	-0.274 (-0.482 to -0.036)
Chronological age	-0.281 (-0.488 to -0.044)	-0.301 (-0.505 to -0.066)	-0.118 (-0.348 to +0.126)	-0.111 (-0.342 to +0.133)
APHV	-0.147 (-0.374 to +0.097)	-0.194 (-0.415 to +0.048)	-0.205 (-0.424 to +0.037)	-0.141 (-0.369 to +0.103)
EMS %	-0.163 (-0.388 to +0.080)	-0.146 (-0.373 to +0.098)	0.016 (-0.225 to +0.255)	+0.002 (-0.238 to +0.242)
Stature	+0.062 (-0.181 to +0.298)	+0.041 (-0.201 to +0.278)	-0.010 (-0.250 to +0.231)	-0.034 (-0.272 to +0.208)
Leg length	+0.028 (-0.214 to +0.266)	-0.047 (-0.284 to +0.195)	-0.194 (-0.415 to +0.048)	-0.170 (-0.394 to +0.073)
Body mass	+0.105 (-0.214 to +0.266)	+0.099 (-0.145 to +0.331)	+0.071 (-0.172 to +0.306)	+0.007 (-0.234 to +0.247)
Fat free mass	+0.058 (-0.185 to +0.294)	+0.051 (-0.192 to +0.288)	+0.068 (-0.175 to +0.303)	-0.005 (-0.245 to +0.235)
Thigh volume	+0.347 (+0.117 to +0.542)	+0.399 (+0.176 to +0.583)	+0.252 (+0.013 to +0.464)	+0.198 (-0.044 to +0.418)

APHV (age at peak height velocity); EMS (estimated mature stature); RSA_Ideal (best sprint x 7 in RSA); RSA_Total (∑ of all trials in RSA); RSA_FTB (fatigue time by Bangsbo: worst trial minus best trial); RSA_DS (decrement score in RSA);

According to Hopkins (2000), the relationships between RSA outputs and chronovariables and body size descriptors are trivial for almost all variables. Between RSA ideal time and chronovariables and body size descriptors the relationship is moderate for thigh volume. Analyzing the relationships between RSA total time, they are moderate for training years (0.339), chronological age (0.301) and thigh volume (0.399). The relationship between RSA fatigue time and those variables is only moderate in training years (0.357). Regarding dribbling capacity, table 4, the relationship between training years and ideal and total time is large, 0.568 and 0.600, respectively.

Table 4. Coefficients of correlation (95% CI) between RDA outputs and chronovariables and body size descriptors for the total sample (n=67).

	RDA_Ideal	RDA_Total	RDA_FTB	RDA_DS
Training	-0.568 (-0.711 to -0.380)	-0.600 (-0.734 to -0.420)	-0.309 (-0.511 to -0.074)	-0.287 (-0.493 to -0.050)
Chronological age	-0.458 (-0.629 to -0.245)	-0.451 (-0.624 to -0.236)	-0.107 (-0.339 to +0.137)	-0.171 (-0.395 to +0.072)
APHV	+0.032 (-0.210 to +0.270)	-0.027 (-0.265 to +0.215)	-0.177 (-0.400 to +0.066)	-0.103 (-0.335 to +0.141)
EMS	-0.271 (-0.480 to -0.033)	-0.315 (-0.516 to -0.081)	-0.065 (-0.301 to +0.178)	-0.200 (-0.420 to +0.042)
Stature	-0.255 (-0.467 to -0.016)	-0.170 (-0.394 to +0.073)	+0.064 (-0.179 to +0.300)	+0.022 (-0.219 to +0.261)
Leg length	-0.152 (-0.378 to +0.092)	-0.130 (-0.359 to +0.114)	-0.040 (-0.278 to +0.202)	-0.012 (-0.251 to +0.229)
Body mass	-0.106 (-0.338 to +0.138)	-0.027 (-0.265 to +0.215)	+0.196 (-0.046 to +0.417	+0.102 (-0.142 to +0.334)
Fat free mass	-0.176 (-0.399 to +0.067)	-0.133 (-0.362 to +0.111)	+0.070 (-0.173 to +0.305)	+0.005 (-0.235 to +0.245)
Thigh volume	+0.227 (-0.014 to +0.443)	+0.328 (+0.095 to +0.527)	+0.422 (+0.202 to +0.601)	+0.276 (+0.038 to +0.484)

APHV (age peak at height velocity); EMS (estimated mature stature); RDA_Ideal (best sprint x 7 in RDA); RDA_Total (∑ of all trials in RDA); RDA_FTB (fatigue time by Bangsbo: worst trial minus best trial); RDA_DS (decrement score in RDA).

Table 5. Coefficients of correlation between of RSA and RDA outputs for the total sample (n=67).

Variables	RDA_Ideal	RDA_Total	RDA_FTB	RDA_DS
RSA_Ideal	+0.501 (+0.296 to +0.662)			
RSA_Total		+0.646 (+0.480 to +0.767)		
RSA_FTB			+0.252 (+0.013 to +0.464)	
RSA_DS				+0.162 (-0.081 to +0.387)

RDA_Ideal (best sprint x 7 in RDA); RDA_Total (∑ of all trials in RDA); RDA_FTB (fatigue time by Bangsbo: worst trial minus best trial); RDA_DS (decrement score in RDA); RSA_Ideal (best sprint x 7 in RSA); RSA_Total (∑ of all trials in RSA); RSA_FTB (fatigue time by Bangsbo: worst trial minus best trial); RSA_DS (decrement score in RSA).

The relationships between RSA outputs and RDA variables are large for ideal time (0.501) and for total time (0.646). The relationships between fatigue time and decrement score in RDA and RSA protocols are small.

Table 6. Descriptive statistic of RSA and RDA outputs for the total sample (n=67).

Variables	Local (n = 34)			National (n = 33)			Difference		*t (65)*	*p*
	Mean	SD	(95% CI of mean)	Mean	SD	(95% CI of mean)	Value	(95% CI of mean)		
Training	6.76	1.83	(6.13 to 7.40)	9.48	1.56	(8.93 to 10.04)	-2.720	(-3.551 to -1.889)	-6.539	0.000
Chronological age	15.79	0.52	(15.61 to 15.97)	16.45	0.45	(16.29 to 16.61)	-0.662	(-0.899 to -0.425)	-5.585	0.000
APHV	12.19	0.65	(11.96 to 12.41)	12.02	0.83	(11.73 to 12.32)	+0.162	(-0.202 to +0.525)	+0.890	0.377
EMS	97.89	1.67	(97.31 to 98.48)	98.93	1.06	(98.56 to 99.31)	-1.038	(-1.722 to -0.354)	-3.040	0.004
Stature	172.67	6.86	(170.27 to 175.06)	175.82	6.42	(173.54 to 178.09)	-3.148	(-6.394 to +0.099)	-1.936	0.057
Leg length	83.54	5.98	(81.45 to 85.62)	84.48	5.28	(82.60 to 86.35)	-0.938	(-3.694 to +1.819)	-0.679	0.499
Body mass	62.72	9.93	(59.25 to 66.19)	69.08	8.29	(66.13 to 72.02)	-6.355	(-10.827 to -1.883)	-2.838	0.006
Fat mass %	15.85	4.74	(14.20 to 17.50)	15.70	5.40	(13.79 to 17.61)	+0.151	(-2.325 to +2.628)	+0.122	0.903
Fat mass	10.24	4.78	(8.58 to 11.91)	11.03	4.47	(9.45 to 12.62)	-0.788	(-3.049 to +1.474)	-0.696	0.489
Fat free mass	52.48	6.35	(50.26 to 54.69)	58.04	6.40	(55.77 to 60.31)	-5.567	(-8.678 to -2.457)	-3.574	0.001
Thigh volume	5.14	1.72	(4.54 to 5.75)	4.73	0.83	(4.43 to 5.02)	+0.418	(-0.245 to +1.080)	+1.258	0.213

SD (standard deviation); APHV (age at peak height velocity); EMS (estimated mature stature)

As expected, the two competitive level groups differed in years of training (t = 6.539, p <0.05), chronological age (t = 5.585, p <0.05), estimated mature stature (t = 3.040, p <0.05), body mass (t = 2.838, p <0.05) and fat-free mass (t = 3.574, p <0.05). Regarding functional capacities, presented in table 7, the two groups significantly differed for sprinting abilities outputs. RSA ideal time (t = 0.011, p <0.05), RSA total time (t = 0.001, p <0.05), RSA fatigue time (t = 0.010, p <0.05) and RSA decrement score (t = 0.023, p <0.05). No differences were found for dribbling abilities outputs.

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Table 7. Descriptive statistic of RSA and RDA outputs for the total sample (n=67).

Variables	Local (n = 34)			National (n = 33)			Difference		*t (65)*	*p*
	Mean	SD	(95% CI of mean)	Mean	SD	(95% CI of mean)	Value	(95% CI of mean)		
RSA_Ideal	49.47	2.38	(48.63 to 50.30)	48.20	1.46	(47.68 to 48.72)	1.265	(0.297 to 2.233)	2.610	0.011
RSA_Total	51.58	2.65	(50.65 to 52.50)	49.71	1.64	(49.13 to 50.29)	1.861	(0.786 to 2.937)	3.468	0.001
RSA_FTB	0.68	0.42	(0.53 to 0.82)	0.46	0.20	(0.39 to 0.53)	0.214	(0.053 to 0.375)	2.674	0.010
RSA_DS	4.28	2.53	(3.40 to 5.16)	3.14	1.26	(2.70 to 3.59)	1.140	(0.164 to 2.115)	2.348	0.023
RDA_Ideal	61.27	2.95	(60.24 to 62.29)	56.62	2.32	(55.80 to 57.44)	4.647	(3.351 to 5.943)	7.162	4.647
RDA_Total	65.34	4.17	(63.88 to 66.79)	59.01	2.16	(58.24 to 59.78)	6.326	(4.701 to 7.951)	7.821	6.326
RDA_FTB	1.51	1.22	(1.08 to 1.94)	0.86	0.46	(0.70 to 1.02)	0.649	(0.196 to 1.101)	2.899	0.649
RDA_DS	6.65	4.59	(5.05 to 8.25)	4.25	1.80	(3.62 to 4.89)	2.395	(0.686 to 4.103)	2.826	2.395

SD (standard deviation); RSA_Ideal (best sprint x 7 in RSA); RSA_Total (∑ of all trials in RSA); RSA_FTB (fatigue time by Bangsbo: worst trial minus best trial); RSA_DS (decrement score in RSA); RDA_Ideal (best sprint x 7 in RDA); RDA_Total (∑ of all trials in RDA); RDA_FTB (fatigue time by Bangsbo: worst trial minus best trial); RDA_DS (decrement score in RDA).

Table 8. Effect size for the total sample (n=67).

Variables	ES		SWD (0.2 *d*)		SWD (0.5 *d*)	
	d	Qualitative	Value	% mean*	Value	% mean*
Training	1.57	Large	0.54	6.71	1.36	16.78
Chronological age	1.34	Large	0.13	0.82	0.33	2.05
APHV	0.21	Small	0.03	0.27	0.08	0.67
EMS	0.73	Moderate	0.21	0.21	0.52	0.53
Stature	0.47	Small	0.63	0.36	1.57	0.90
Leg length	0.16	Trivial	0.19	0.22	0.47	0.56
Body mass	0.68	Moderate	1.27	1.93	3.18	4.83
Fat mass %	0.03	Trivial	0.03	0.19	0.08	0.48
Fat mass	0.17	Trivial	0.16	1.48	0.39	3.70
Fat free mass	0.86	Moderate	1.11	2.02	2.78	5.04
Thigh volume	0.30	Small	0.08	1.69	0.21	4.23
RSA_Ideal	0.63	Moderate	0.25	0.52	0.63	1.29
RSA_Total	0.83	Moderate	0.37	0.73	0.93	1.84
RSA_FTB	0.64	Moderate	0.04	7.51	0.11	18.76
RSA_DS	0.56	Moderate	0.23	6.13	0.57	15.32
RDA_Ideal	1.72	Large	0.93	1.58	2.32	3.94
RDA_Total	1.87	Large	1.27	2.03	3.16	5.08
RDA_FTB	0.69	Moderate	0.13	10.91	0.32	27.27
RDA_DS	0.67	Moderate	0.48	8.76	1.20	21.89

SWD (smallest worthwhile difference); * (overall mean for the total sample, n=67); APHV (age at peak height velocity); EMS (estimated mature stature); RSA_Ideal (best sprint x 7 in RSA); RSA_Total (∑ of all trials in RSA); RSA_FTB (fatigue time by Bangsbo: worst trial minus best trial); RSA_DS (decrement score in RSA); RDA_Ideal (best sprint x 7 in RDA); RDA_Total (∑ of all trials in RDA); RDA_FTB (fatigue time by Bangsbo: worst trial minus best trial); RDA_DS (decrement score in RDA).

Cohen's *d* effect sizes for pairwise comparisons within level of performance and the smallest worthwhile differences are summarized in (Table 8). National players tended to be faster than local players in the RSA (moderate differences: d = 0.56 to 0.63) and repeated-dribbling ability (moderate to large differences: d = 0.67 to 1.72). The smallest worthwhile differences noted for repeated-sprint total time were 0.73% and 1.84%, for a threshold of d = 0.20 and 0.50, respectively. The smallest worthwhile differences in the repeated-dribbling ability for the same threshold were 2.03% and 5.08%, respectively.

V – DISCUSSION

Soccer is a complex sport, requiring the repetition of many actions, and several tests are currently being used to assess the physical prowess of players (Rampinini et al., 2007), sports like soccer, field hockey and rugby require athletes to perform an invariable number of sprints, with periods of low-to-moderate activity or passive rest. This sprints are separated by active or passive recovery periods (>1 min), to recover, and have similar performance to previous sprint (Balsom, Seger, Sjodin, & Ekblom, 1992).

The term Repeated Sprint Ability (RSA), has the particularity that the time of recovery from sprint to sprint is usually shorter (<30 s), (Spencer, Lawrence, et al., 2004) and there is a negative effect associated in the next sprint. This was verified in laboratory, (Bishop & Spencer, 2004; Spencer, Bishop, & Lawrence, 2004) and in the field (Balsom et al., 1992; Spencer, Fitzsimons, Dawson, Bishop, & Goodman, 2006).

This ability to perform short duration sprints (< 6 s) with short recovery time (< 30 s) is part of fitness requirements of team sport athletes and several studies have suggested that repeated-sprint ability is an important determinant of performance in soccer and other intermittent team sports (Castagna et al., 2007; Rampinini et al., 2007; Spencer, Bishop, Dawson, & Goodman, 2005)

Looking back the literature there are a large number of protocols, differing from the time of recovery, from 24 second to 1 minute, this recovery time can also be spent in different methods (i.e. passive, walking, stretching), the number of repetitions from 4 to 40 and different sprint distances from 15 meters to 40 meters. Changing one of these variables, distance or the mode of recovery can change the results significantly.

The present study examined competitive-level variation in repeated sprint and repeated dribbling ability. RSA was evaluated using the protocol described by Bangsbo (1994) and RDA using the protocol assed by Duarte (2013) in his master thesis. Reproducibility of RDA was tested with 25 local young soccer players and results confirmed the reliability of the test with a reliability coefficient of 0.83 for the mean time, 0.83 for the total time and 0.85 for the ideal time of 7 sprints with ball (Duarte et al., 2013) .Similar reliability coefficient (0.88) was obtained with the RSA protocol in Figueiredo et al. (2009) study with young soccer players aged 11-14, using the same protocol, a reliability coefficient of 0.88 for the mean of 7 sprints. Duarte (2013) concluded that RDA protocol is a promising tool to combine physical fitness and soccer-specific control of the ball,

There are a huge number of data reported for RSA, however when the fitness of players is monitored, the assessment of skill is rarely included (Ali, 2011) .The interests of measuring a soccer skill are important to identify a soccer talent, to create strategies for acquisition of skill or just to maintain the skill performance, and in the dibbling chapter the literature is poorer.

Ali et al. (2007) reported validity coefficients of $r=0.78$ ($P<0.01$) and 95% confidence intervals of 0.08±6.43s (mean score 148.26s); the test was criticized for assessing the technique of dribbling rather than skill, and there's no systematic check for reliability. Moreover there is a greater confidence on sprinting ability rather than facets of perceptual, cognitive and motor skill that make up soccer skill (Bate, 1996) . Dribbling tests of Reilly and Holmes (1983) have high reliability coefficient but the validity coefficient has a large range and is in the limit of the acceptance to be considered high. About the slalom dribbles of Hoare and Warr (2000) there is no data reported. Multi-faceted tests of Zelenka, Seliger, and Ondrej (1967) no systematic check for reliability and no validity data reported. The Hoff test which is performed with the ball for 10 minutes, had correlations with the VO2 max tested in laboratory but this test has no direct implications in measure the skill of the player.(Chamari et al., 2005). The speed dribbling test used by Taskin (2008) to measure the coordinated speed dribbling under time pressure and speed was used to label soccer players by position and the results were statistically significant ($p < 0.01$) with means 15.49 ± 0.50 seconds for elite soccer and 18.34 ± 1.13 seconds for non-elite players(using Reilly &Holmes 1983 dribbling test). A recent study (Huijgen, Elferink-Gemser, Ali & Vissher, 2013) applied tests to that initially had been developed to ice hockey players (Lemmink, Elferink-Gemser, & Visscher, 2004), and the reported data was valuable, the main difference between the test used in his study is that in present study the player don't change the direction in 180 degrees.

This study reinforce the some previous studies about RSA results when comparing groups from different competitive level (Aziz, Mukherjee, Chia, & Teh, 2008; Impellizzeri et al., 2008; Malina, Eisenmann, et al., 2004). In other hand, the RDA values don't have sufficient power to be considered significant. The ability of dribbling has been studied recently but still a poor background when you associate the repetition. Few studies had been developed to measure the repeated dribbling ability to compare with our study. The largest improvement on peak dribble performance is from age 16 to age 17 ($p < 0.05$) (Huijgen et al., 2013), like we measure in our study, however the results were not significative with our test.

National players were taller and heavier than local players (small to large differences: $d = -0.28$ to -1.21). National players also presented small to large differences in body mass (11-15 years: $d = 0.38$ to 1.52), but not in height compared to local group. Table 8 reflects the magnitude of differences between RSA and RDA. This obtained differences can be a reflex of those obtained for the crhonovariables: years of training ($d = 1.57$, large) and chronological age ($d = 1.34$, large) and for performance variables: RDA total time ($d = 1.72$, large) and RDA ideal time ($d = 1.87$, large).

More studies should be done, with variation in the number of repetitions, time of recovery between each sprint, and also playing position, with the propose to create a protocol useful to measure dribbling ability and identify the development among ages.

VI - PRATICAL IMPLICATIONS

Assess the ability to repeat maximal sprint efforts with brief recovery periods with incorporation of the technical soccer specific dimension. Talent identification. Discriminant measures among soccer players. Moreover, standard for smallest worthwhile differences between performance levels within these groups of youth players could assist the coach.

V - FUTURE RESEARCH

Future research needs to consider additional parameters (number of steps to complete the 34.2-m course from trials 1 to 7 in the RSA and RDA protocols; number of contact with the ball in the RDA protocol) and probably variation on the number of trials. It is believed that high trained late adolescent and young adult soccer players would need 10 or 12 trials to attain fatigue. This effort to test protocols with larger number of trials may be combined with different distances and resting time.

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