

POSTER PRESENTATIONS

26. PHYSIOLOGICAL TESTING OF FOOTBALL PLAYERS

P-001 Yo-Yo intermittent recovery performance test, body composition and biochemistry markers in young soccer players

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OBJECTIVE Some authors have described the importance of the anaerobic capacity for the performance of the soccer athletes. The Yo-Yo intermittent recovery test (BANGSBO, 1996) has been widely proposed to follow the anaerobic capacity of soccer athlete, during the season. The objective of the present study was to verify the performance of young athletes in Yo-Yo intermittent recovery test, body composition and the activity of creatine-phospho-kinase (CPK) in Brazilian young soccer players.

METHODS The subjects (n=24) 16,4 years old aged, were maintained in lodging of team, with daily training. The Yo-Yo intermittent recovery test, body composition and CPK enzyme was performed in the midway of season (August, 2006). The results (Table 1) were expressed as mean ± standard error of mean (SEM).

RESULTS

Table 1. Age (years), Yo-Yo intermittent recovery test (meters), body composition (W=weight, H=height and %BF=body fat percentual) and CPK activity (U/I) of the 24 Brazilian young soccer players in the midway season.

	Age	Yo-Yo	W	H	%BF	CPK
Mean	16,14	467,83	70,78	179,14	13,99	328,1
SEM	0,13	18,16	1,52	1,42	0,56	27,67
Minimum	17	280	86,7	189,5	19,75	150
Maximum	15	640	54,7	163,5	9,87	649

DISCUSSION The evaluation in the midway season showed median values high to CPK and for the %BF, the performance in Yo-Yo test was sustained during the season (previous results). In the global analysis that might be considered as positive because the players during the season was submitted to many matches, intensive training (high CPK) leading to a decreased performance.

REFERENCES

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KEY WORDS Yo-Yo recovery test, Brazilian young soccer players, body composition, creatine-phospho-kinase.

P-002 Oxygen uptake during soccer

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OBJECTIVE So far no study has provided accurate and valid data of measured oxygen uptake (VO₂) during soccer. The physiological demands have been determined mainly by monitoring heart rate (HR). Establishing the relationship between HR and VO₂ in the laboratory subsequently allows calculating VO₂ in a game. However, the validity of the HR-VO₂ relationship in intermittent exercise may be questionable Crisafulli et al (2006). According to (Stolen et al. 2005) new gas analysers (~500g) should allow accurate measurement of VO₂, but at present no such study has been performed. Therefore the aim of this study was to measure VO₂ with a portable gas analyser during real match play.

METHODS Two healthy amateur soccer players (24 and 25 years, 179 and 178 cm, 77 and 69 kg) participated in this study. During a friendly soccer match, VO_2 of each of the two subjects was measured with a portable gas analyser (Cosmed K4, 800g) for one half. HR (Polar) was continuously monitored over the whole time. $\text{VO}_{2\text{max}}$ was determined by an exhausting 600m-run performed directly after the halves.

RESULTS Subjects obtained a $\text{VO}_{2\text{max}}$ of 65.8 and 56.2 ml/(min*kg). The average VO_2 's during match play were 37.4 ± 6.8 and 34.3 ± 6.4 ml/(min*kg), corresponding to 56.8 and 61.0% of $\text{VO}_{2\text{max}}$. Average HR's were 167 ± 9 and 176 ± 11 b/min in the first half and 164 ± 10 and 179 ± 11 b/min in the second. Over the whole time average HR's were 166 ± 9 and 177 ± 11 b/min, corresponding to 87.4% and 87.7% of HRmax.

DISCUSSION The intensity of the play, given by %HRmax, was the same as reported by other studies (82-86%Hfmax) (Helgerud et al., 2001). The intensity, given by % $\text{VO}_{2\text{max}}$, in contrast differed from data reported in the literature (70-% $\text{VO}_{2\text{max}}$) (Bangsbo, 1994). However data from literature were only estimates of VO_2 from HR. The results of this study suggested that the accuracy of this method was questionable, thus further work with more players was required.

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Stolen et al. (2005) *Sports Medicine* **35**, 501-536.

KEY WORDS Soccer, oxygen uptake, heart rate.

P-003 Aerobic fitness in futsal players of different competitive level: a preliminary study

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OBJECTIVE Futsal or 5-a-side indoor soccer is a popular team sport played all over the world. However despite its popularity only limited scientific literature is available regarding the physiological demands of the game and players' fitness. The aim of this descriptive research-design was to examine the aerobic-fitness ($\text{VO}_{2\text{max}}$, VT, RE, Pate and Kriska 1984) level of players of different competitive levels in order to study whether aerobic fitness is a discriminative variable in Futsal success, and to establish normative data to be used to guide futsal coaches and fitness trainers, in designing specific training interventions

METHODS Participants were 24 male futsal players randomly chosen from three teams of different competitive levels: A Spanish professional top ranked second division team (PST n=11) a youth Spanish team (YST n=7, and a semi-professional Italian top ranked Third division team (IT, n=6). Treadmill gas analysis were performed using a portable gas analyzer (K4b2, COSMED, Rome, Italy).

RESULTS PST, YST and IT $\text{VO}_{2\text{max}}$ was 62.9 ± 5.34 , 68.6 ± 6.2 and 55.0 ± 7.1 ml $\text{kg}^{-1} \text{min}^{-1}$ respectively (YST vs IT, $p < 0.05$). RE was 34.1 ± 2.7 , 38 ± 3.1 and 32.4 ± 2.7 for PST, YST and IT respectively (YST vs IT, $p < 0.05$). PST, YST and IT attained VT at 70.5 ± 2.7 , 67.9 ± 5.2 and $71.3 \pm 5.2\%$ of $\text{VO}_{2\text{max}}$ respectively. Results showed that well-trained professional futsal players possessed a $\text{VO}_{2\text{max}}$ well above 60 ml $\text{kg}^{-1} \text{min}^{-1}$.

DISCUSSION For adult players (PST plus IT) to play successfully seems to require a $\text{VO}_{2\text{max}}$ between 55 and 60 ml $\text{kg}^{-1} \text{min}^{-1}$ (whatever the level is). Percentage of $\text{VO}_{2\text{max}}$ at VT seems not to be related to competitive level in Futsal. Once promoted a $\text{VO}_{2\text{max}}$ level around 55 ml $\text{kg}^{-1} \text{min}^{-1}$ training programs should be oriented to other components of performance

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KEY WORDS Training, maximal oxygen uptake, anaerobic threshold, 5-a-side soccer.

P-004 Technical performance during short term soccer specific exercise

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OBJECTIVE During a game soccer players perform intermittent exercise with changes in activity every 3-5 s involving jumps, turns, tackles, high speed runs and sprints. This has been shown to induce fatigue both temporarily during a match and towards the end of a game (Mohr et al., 2003). However, it is unclear to what extent intense short term intermittent exercise affects a player's technical skills. The aim of this study was to examine the technical performance of soccer players during 15 min of specific intermittent exercise resembling intense periods of a soccer game, and relate this to the technical performance without prior intense exercise and to the physical capacity of the players.

METHODS On separate days, a physical-technical test (PT-test) with ten long kicks separated by intense intermittent exercise, a control test (CON-test) with ten long kicks without intense exercise, and the Yo-Yo intermittent recovery test level 2 (Yo-Yo IR2) was performed (n=21). Each kick was evaluated from 0 (miss) to 3 (perfect), and also the relative test result (PT-test/CON-test) was calculated.

RESULTS The summed performance of the first five repetitions during the PT-test was higher ($p<0.05$) than for the last five repetitions (8.4 ± 0.6 vs. 6.9 ± 0.5). The summed performance in the PT-test was lower ($p<0.05$) than in the CON-test (14.8 ± 0.9 (\pm SE) vs. 22.5 ± 1.2). Thus, the performance difference (PT-vs.CON-test) was greater ($p<0.05$) during kicks 6-10 compared to kicks 1-5 ($42.9 \pm 0.61\%$ vs. $20.5 \pm 0.56\%$). Neither PT-test nor relative PT-test performance was related to the Yo-Yo IR2 performance.

DISCUSSION This study demonstrated that a player's ability to kick is progressively influenced by intense exercise resembling the most intense periods during a game where fatigue may occur. However, the Yo-Yo IR2 performance (Krustrup et al., 2006) was not correlated with any PT-test performance measures suggesting that the technical performance of a player is not solely dependent on the physical performance

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Mohr et al. (2003) *Journal of Sports Science* **21**, 519-528

KEY WORDS Technical performance, kick, Yo-Yo IR2, soccer.

P-005 Reliability of a repeated sprint ability test during simulated team-sport running activity on a non-motorised treadmill

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OBJECTIVE A crucial part of team sports is the ability to repeatedly generate maximal sprints (1-6s) interspersed with brief recovery periods (<21s). Several studies have examined the reliability of repeated sprint ability (RSA) using mainly a 5 x 6s sprint cycle test (McGawley et al., 2006). However, no study has examined the reliability of performing a pre-fatigued 5 x 6s RSA test during team-sport match activity. The purpose of this study was to assess the reliability of a 5 x 6s RSA test in a pre-fatigued state. To achieve a pre-fatigued state each subject completed a 30min team-sport simulation on a non-motorised treadmill (NMT), prior to performing a 5 x 6s RSA test. The protocol was designed to mimic the work profile of most team sports and was based on time-motion data of various football codes.

METHODS Eleven male athletes of various football codes completed three 30min team-sport simulations followed by a 5 x 6s RSA test on a NMT, 6 days apart. Reliability of RSA performance and fatigue variables were analysed using the methods of Bland et al. (1986). Decrement scores were calculated using the following equation: $100 - ([\text{total sprint performance} \div \text{ideal sprint performance} \times 5]) \times 100$.

RESULTS Table 1 shows the grand mean value for trials 2 and 3, coefficient of variation (CV), ratio limits of agreement, technical error of measurement (TEM) and intraclass correlation coefficient (ICC) for sprint performance and fatigue variables measured during the 5 x 6s RSA test. No significant differences in sprint performance or fatigue variables were found between trial 2 and trial 3.

Table 1. Measures of reliability of a 5 x 6 s RSA test completed at the end of a 30 min team-sport simulation on a NMT (N=11).

RSA Variables	Grand Mean(\pm SD)	CV (%)	Ratio Limits of Agreement	TEM	ICC
Performance Variables					
Sprint Distance (m)	155.3 \pm 8.2	3.1	1.04 \ast/\div 1.09	4.6	0.65
Sprint Work (kJ)	19.7 \pm 2.1	5.4	1.00 \ast/\div 1.16	1.0	0.76
MxSP (m·s ⁻¹)	6.2 \pm 0.4	2.5	1.02 \ast/\div 1.07	0.2	0.85
Fatigue Variables					
Distance Decrement (%)	9.2 \pm 4.6	30.2	0.96 \ast/\div 2.08	2.5	0.71
Work Decrement (%)	16.5 \pm 7.7	38.2	1.00 \ast/\div 2.45	5.7	0.48
MxSP Decrement (%)	8.8 \pm 5.0	31.3	1.05 \ast/\div 2.14	2.7	0.73

MxSP = mean maximal sprinting speed.

DISCUSSION In this study decrement calculations were found to have less reliability than performance variables. This is in agreement with previous research showing poor reliability of fatigue variables in cycling and running RSA tests (Hughes et al., 2006; McGawley et al., 2006). We suggest the use of performance variables such as the total work completed during the pre-fatigued 5 x 6s RSA test to measure and monitor RSA in team-sport athletes.

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Hughes et al. (2006) *International Journal of Sports Medicine* **10**, 923791.
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KEY WORDS Ecological reproducibility, ratio limits of agreement, match simulation, fatigue.

P-006 Comparison of anaerobic tests in young soccer players

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OBJECTIVE Wingate bicycle test and Bosco jump test were widely used to determine the anaerobic power and capacity. A limitation of wingate test was the lack of development and retrieval of stored-elastic energy due to lack of an eccentric phase. On the other hand, Bosco test was attractive for activities that involved repeated use of the stretch-shortening cycle in jumping motions of the lower extremity. The purpose of this study was to determine the relationships among different type of anaerobic power and capacity tests in young soccer players. 12 male young soccer players (age= 15.45 \pm 0.45 years) volunteered to participate in the 30 sec wingate bicycle ergometer test (WANT), 30 sec Bosco multiple jump (MJ) and repeated zigzag agility test (RHUFA).

METHODS WANT was determined by Monark 894E cycle ergometer with a load set at 7.5% relative to body weight whereas MJ with hands-on-hips method was conducted on a rectangular switching mat. Sprint time was measured by an electronic chronometer including seven gate in RHUFA test performed on the grass. Blood samples were obtained from each player before and after the tests.

RESULTS There were no significant relationships among peak power, average power and fatigue index obtained from the anaerobic tests. Significant differences were found among the anaerobic tests on the peak and average values of VO₂ and heart rate during the tests. Furthermore, post exercise peak lactate concentration and VO₂ were also significantly different among the tests (p<0.05).

DISCUSSION The results of this study revealed that Bosco multiple jump, Wingate and repeated zigzag agility tests, though these tests anaerobic in nature, appeared to determine the different aspects of anaerobic characteristics. Therefore, it was suggested that although the tests had the same durations they could not be used interchangeably to determine the anaerobic performance in young soccer players.

KEY WORDS Soccer, anaerobic power and capacity.

P-007 Anaerobic power of junior elite soccer players: A new performance

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OBJECTIVE Soccer performance depends upon a myriad of factors. Although aerobic metabolism dominates the energy delivery during a soccer game, the most decisive actions are covered by means of anaerobic metabolism. To perform short sprints, jumps, tackles and duel play, anaerobic energy release is determinant with regard to who is sprinting fastest or jumping highest. The purpose of this study was to assess the development of anaerobic power in junior elite players aged between 15-19 years and to validate a performance rating (IP) of anaerobic power qualities.

METHODS 186 players of Belgian junior national teams (U15, U16, U17, U18, U19) were evaluated. Anaerobic power testing session consisted of two mains parts: vertical jumps (countermovement jump (CMJ), countermovement jump free arms (CMJfr) 6 seconds jumping test (6sec) and sprint (20m with sprint times at 5m, 10m and 20m). IP is calculated in the following way: see Figure 1.

RESULTS Vertical jump and sprint time performances of U17 where significantly better than U15 performances (CMJ: +15%, $p<0.05$; CMJfr: +16%, $p<0.05$; Reactivity ratio: +15.6%, $p<0.05$; 20m time: -4.3%, $p<0.05$). Between U17 and U19 teams, only CMJfr showed significant difference (+7.6%, $p<0.05$). Figure 1 presents IP for each category. We observed significant relations ($p<0.001$) between IP and power values(LeGall et al. 2002).

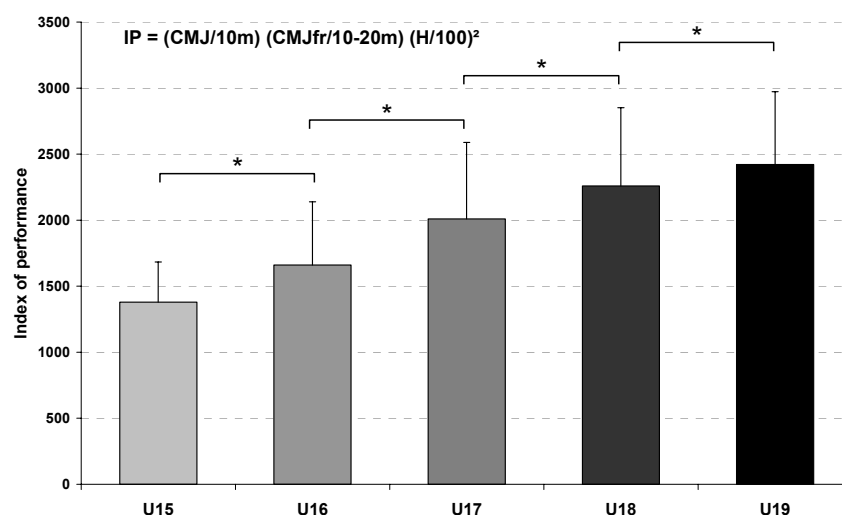


Figure 1. Performance rating (IP) of Belgian junior national teams (U15, U16, U17, U18, U19). CMJ: countermovement jump (cm); CMJfr: CMJ free arms (cm); 20m: 20m sprint (s); H: height (cm). * $p<0.05$.

DISCUSSION The analysis of the evolution of anaerobic power factors in junior elite soccer players between age 15 and 19 showed an increasing progression with the highest increases between age 15 and 17 for all factors. The performance rating, calculated starting from functional and anthropometric variables, appeared to be differential and allowed the identification of players with good anaerobic power potential.

REFERENCE

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KEY WORDS Anaerobic power, performance rating, vertical jump, sprint, junior players.

P-008 Validity of aerobic field tests in young soccer players

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OBJECTIVE Information about aerobic power and capacity generated from the field tests can be used to make appropriate adjustments to a player's training program. Although the aerobic power was accurately determined by indirect calorimeter, this form of assessment has disadvantages in terms of availability, cost, and time. The purpose of this study was to determine the relationships among different type of aerobic power and capacity tests in young soccer players. 36 male young soccer players (age= 16.6±1.2 years, VO₂max= 55.72±4.94 ml.kg⁻¹.dk⁻¹) volunteered to participate in the 12 min Cooper test (CT), Conconi test (ConT) and running test with a progressively increased workload protocol (PP).

METHODS All subjects were tested approximately in two weeks during the competition period of young soccer league. VO₂max was measured with Cosmed K4b2 portable oxygen analyser, and earlob-blood lactate concentrations were measured by YSI 1500 lactate analyser. Running velocities (RV) and HR corresponding to fixed lactate concentrations were determined from HR-Workload and Lactate-Workload graphics.

RESULTS There were no significant relationships in VO₂max between PP and CT. ConT threshold running velocity was significantly correlated with RV at 4 mMol.L⁻¹ during PP. Furthermore, significant relationship was found on HR values between the PP and ConT tests. The highest correlation was found between the maximum distance covered in ConT and RV at 3 mmol.L⁻¹ lactate in PP (r= 0.87; p<0.05).

DISCUSSION The results of this study revealed that VO₂max calculated from CT distance was not case sensitive to measured VO₂max during the competition period. In addition, max distance covered in ConT could be better to determine the running velocity at 3 mmol.L⁻¹ and 4 mmol.L⁻¹ lactate levels compared to the threshold velocity in ConT.

KEY WORDS Soccer, aerobic power, Conconi test, Cooper test.

P-009 Effects on training status and health profile of prolonged participation in recreational football: Heart rate response to recreational football training and match-play

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OBJECTIVE Much knowledge exists about the physical demands of match-play and training for elite football players as well as physiological adaptations to elite football training, whereas little is known about recreational football. A recent study revealed that the aerobic loading was high during recreational 5v5 indoor training (Castagna et al. 2006) and suggested that regular participation would promote cardiovascular health. The present study examined the heart rate (HR) response to recreational outdoor soccer 7v7 training and 11v11 match-play performed at natural grass pitches. The effects of prolonged participation in recreational football on training status and selected health parameters were also investigated. 3 teams (n=12-14 per team) were studied for 3 months (T1+T2+T3), and one team over 2 years (T4, n=12).

METHODS 52 untrained males (31±5 (±SD) yrs, 181±6 cm and 83.3±9.7 kg) participated. T1+T4 trained 2x120-min per week, T2 trained 2x60-min and played one 2x45 min game per week. T3 played two weekly games. HR was recorded during standard training sessions (T1+T2) and match-play (T3). Several anthropometric and physiological measurements were performed before and after the training period (Durnin & Womersley 1973; Eurofit 1988; Krstrup et al. 2004).

RESULTS Mean HR during training was 139±4 (T1) and 159±4 (T2) b.p.m. and match-HR was 157±4 b.p.m. (T3), or 74±1, 83±1 and 84±1% of HRmax. HR was >90% of HRmax for 15±5, 15±3 and 18±4 min. After 3 months, fat% and blood pressure was lower (p<0.05). In addition, balance test and Yo-Yo IE2 performance (42%) was better (p<0.05). After 2 yrs, body mass, fat% and sprint times (8%) were lower (p<0.05). In addition, lean body mass was 3.6 kg higher (p<0.05) and Yo-Yo IE2 performance was 133% better (p<0.05) (see Table 1).

DISCUSSION The study provided evidence that regular participation in recreational football training and match-play had several beneficial effects on training status and health profile for untrained males. The study also revealed that

match-play and training for recreational soccer players can be characterized as a combination of aerobic moderate and aerobic high-intensity training (Bangsbo et al. 2006).

Table 1. Effects of prolonged participation in recreational football training (A: 3 months; n=37; B: 2 years; n=12).

A:	Body mass (kg)	LBM (kg)	Fat %	Quadriceps mass (kg)	SBP (mmHg)	DBP (mmHg)	Balance(falls in 1min,n)	Yo-Yo IE2 (m)
Before	83.2 (1.7)	64.3(1.0)	22.0(1.4)	2.18 (.05)	146 (2)	87 (2)	5.3 (.9)	790 (68)
After	83.3 (1.7)	66.8(1.1)#	19.2(1.1)#	2.29 (.04)#	136 (3)	73 (2)#	2.9 (.5)#	1126(91) #
B:	Body mass (kg)	LBM (kg)	Fat %	30-m sprint (s)	100-m sprint (s)			Yo-Yo IE2 (m)
Before	82.4 (4.9)	59.2 (1.7)	25.6 (1.7)	4.83 (.13)	16.20(.45)			505 (72)
After	77.5 (3.1)#	62.8(1.5)#	18.2(1.5)#	4.65(.10)	14.94(.36)#			1180(167)#

Values are means (\pm SEM). LBM = Lean body mass. #: Denotes significant difference from before training. The Yo-Yo IE2 results correspond to improvements in VO_2max of $\sim 15\%$ (3-month group) and $\sim 40\%$ (2-year group).

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Krustrup et al (2004) *Pflügers Arch* **447**, 855-866.

KEY WORDS Fat percentage, muscle mass, blood pressure, balance, sprint ability, Yo-Yo intermittent endurance level 2 test performance.

P-010 Physiological effects of playing futsal in professional futsal players

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OBJECTIVE This study aim was to examine the physiological responses to Futsal playing in professional players (n=11, 22.8 \pm 1.5 years, weight 75.2 \pm 6.2 kg, height 178 \pm 7.4 cm, VO_2max 62.9 \pm 5.34 ml kg⁻¹min⁻¹).

Futsal is the indoor version of soccer that is officially sanctioned by FIFA and is played at professional, amateur and recreational level all over the world . However despite its current and growing popularity only limited studies have addressed the physiological responses of this indoor game. Furthermore the available literature only addressed amateur or recreational futsal cohorts (Barbero et al 2006, Castagna et al 2006

METHODS Eleven professional Futsal players (Generala IBI, Division de Plata) volunteered to this study. Players trained 10 times a week with a competition played during week-end. Physiological measurements were undertaken during highly competitive training-games (4x10min) and consisted in: game VO_2 (K4b2, COSMED, Rome, Italy), game earlobe blood-lactate concentration (random game-sampling) and game heart-rates.

RESULTS Players attained 73.6 \pm 8.4 and 89.7 \pm 3.1% of VO_2max and HRmax respectively. Peak game VO_2 and HRs were 96 \pm 2.9 and 95 \pm 9.1 % of laboratory maximal values, respectively. Average game VO_2 was 48.5 \pm 3.75 ml kg⁻¹min⁻¹. Players spent 37 and 37.2% of the playing time at exercise intensities higher than 80 and 90% of VO_2max and HRmax, respectively. Average blood lactate concentration was 5.3 \pm 2.6 mmol l⁻¹.

CONCLUSION These results show that Futsal played at professional level is a high-intensity exercise mode that heavily taxes the aerobic and anaerobic pathways. Maximal aerobic power levels higher than 55 ml kg⁻¹ min⁻¹ are advisable to play Futsal at professional level.

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Castagna et al. (2006) *Journal of Science and Medicine in Sport*, in press.

KEY WORDS Physiology, Training, Maximal Aerobic Power, Blood Lactate

P-011 Fitness profile of under-15 Brazilian soccer players by field position

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OBJECTIVE In young Brazilian soccer, the relation of the players' field position with its physiological profile is not well known. The aim of this study was to examine the differences in fitness profile of under-15 male soccer players in accordance to their field position.

METHODS The subjects were 56 Brazilian soccer players of under-15 category. The players grouped by field position as central defenders (n=14), lateral defenders (n=10), defensive midfielders (n=8), offensive midfielders (n=11) and forwards (n=14). The measurements included body mass, height, skinfold, YoYo Intermittent recovery test, 30-m sprint, Squat Jump and Countermovement Jump Test.

RESULTS Analysis of variance (ANOVA) revealed that there were no significant differences in the field position for body mass, sum skinfolds, YoYo intermittent recovery test, 30-m sprint, SJ, CMJ. The results indicate that significant differences ($p < 0.05$) could be observed in the height between field positions.

DISCUSSION The current findings are similar to those previously reported. Fogelholm (1994) reported daily energy intake of 2131 ± 400 kcal with a 111 ± 450 kcal energy deficit in normal weight female soccer players. Carbohydrate is the primary fuel substrate during soccer, and consequently high dietary intakes of 60-70% of total calorific intake have been recommended for footballers (Schokman et al., 1999). In the present study carbohydrate intake was significantly lower than these recommendations ($53.8 \pm 6.8\%$, $p < 0.05$), but fall within the range previously reported for female soccer players 47.8 ± 9.8 to $55.0 \pm 7.5\%$ (Clark et al., 2003; Scott et al., 2003).

Table 1. Descriptive parameters for the three groups and the results of the one-way ANOVA.

	Central Defenders	Lateral Defenders	Defensive Midfielders	Offensive Midfielders	Forwards	p
Age (yrs)	15,1(0,3)	14,9(0,4)	15,1(0,2)	14,9(0,3)	14,9(0,6)	0,5690
Body Mass (kg)	64,2(4,3)	61,76(3,3)	64,4(8,0)	62,1(5,5)	63,8(5,3)	0,6907
Height (cm)	178,2(3,6)	172,1(2,2)	175,4(6,9)	171,7(5,0)	174,2(7,0)	0,0261*
Sum skinfolds (mm)	16,5(2,3)	15,6(3,1)	16,1(3,5)	15,7(2,5)	18,4(4,8)	0,2364
YoYo (mm)	276,9(59,9)	276,0(47,9)	260,0(56,6)	250,9(44,1)	277,1(59,7)	0,7043
30-m sprint (s)	4,25(0,15)	4,28(0,18)	4,30(0,12)	4,24(0,16)	4,29(0,12)	0,8597
SJ (m)	31,0(2,8)	30,4(5,4)	30,2(2,8)	32,2(2,5)	30,6(3,0)	0,7146
CMJ (m)	34,9(3,6)	33,2(5,9)	34,1(3,5)	35,7(3,0)	34,0(2,8)	0,6251

* $p < 0.05$.

CONCLUSION In conclusion, recommendations for female soccer players are to encourage consumption of carbohydrate-electrolyte beverages to enhance carbohydrate intake and increase fluid intake, and ensure sufficient iron rich foods are included in the diet to meet the DRI.

KEY WORDS Soccer, anthropometry, anaerobic performance.

P-012 Running velocities and heart rate responses to fixed blood lactate concentrations in different divisions of professional soccer players

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OBJECTIVE The purpose of this study was to compare the running velocity (RV) and heart rate (HR) according to the fixed lactate concentrations (2.0, 2.5, 3.0, 3.5, 4.0, 5.0 mmol.l⁻¹) among the elite soccer players playing in Turkish Super League (TSL) and 2nd Division (SDL). Soccer is a game that includes both aerobic and anaerobic activities, demanding s whole energy systems. It is stated that most of the energy requirement (70-80%) is provided from aerobic system during a 90 minutes game. It is pointed out that some physiological parameters like heart rate and lactate (LA) whereas highly correlated with endurance performance.

METHODS 145 male soccer players (10 goalkeeper [GK], 48 defender [D], 53 midfielder [M], 34 forward [F]) from TSL and 141 players (18 GK, 38 D, 61 M, 24 F) from SDL were tested with incremental protocol which was started with 8 km.h⁻¹ and increased 1 km.h⁻¹ every 3 minutes until the players were exhausted. HR and RV responses at fixed LA concentrations were determined from LA-RV and HR-RV graphics.

RESULTS RV of TSL players corresponding to 3.0, 3.5, 4.0 mmol.l⁻¹ [LA] were significantly higher, whereas HR were significantly lower at 5.0 mmol.l⁻¹ [LA] than SD players. HR responses of midfielders from TSL were significantly lower than players at the same position of SD, whereas HR responses of other positions were similar.

CONCLUSION Endurance performances were significantly different at sub-maximal intensities among the players according to playing positions in the two leagues. However, endurance performances of players with different playing positions in the same league were similar.

KEY WORDS Soccer, lactate, heart rate, endurance, playing position.

P-013 Left ventricular hypertrophy by electrocardiographic point scoring criteria in professional soccer players and sedenters

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OBJECTIVE After collapse of 14 years old soccer player during a official match (Iskandar & Thompson, 2004), all media attention has returned to topic of sudden deaths in soccer field which was an terrifying event for either soccer players or spectators. It has become a clinical priority to precociously detect left ventricular hypertrophy by effective, low-cost screening, applicable to the population in general.

The main purpose of this study was to assess left ventricular hypertrophy (LVH) by electrocardiography point scoring criteria in professional soccer players and healthy sedenters. The secondary purpose of this study was to evaluate physiological and biochemical parameters of the professional soccer players.

METHODS Fifty healthy males with a mean age of 24,7±6,0 years old were evaluated. Soccer players were playing in Turkish Premier League. Physical examination, 12 leads resting electrocardiogram and biochemical assays (blood counts, lipids, cholesterol, LDL, VLDL, NA, K and Ca) were examined. Electrocardiographic “point scoring criteria” for determining LVH was calculated according to White-Bock equation (Gasperin et al. 2002).

RESULTS The results of the independent t test analysis of electrocardiographic point scoring criteria (EPSC) scores showed that there were no significant differences between soccer players and sedenters’ electrocardiographic pattern in terms of LVH evaluation, t=0,39, p>0,05.

CONCLUSION The electrocardiographic analysis (Gasperin et al., 2002) for LVH showed that professional soccer players did not show increased cardiac dimensions compared with healthy sedenters.

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KEY WORDS LVH, ECG, biochemical parameters, soccer.

P-014 Yo-Yo intermittent recovery test level 2 in evaluation of physical performance in different groups of athletes

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OBJECTIVE The Yo-Yo intermittent recovery test (YYIR) has been widely used in team sports to assess athletes’ abilities to repeatedly perform high-intensity exercise. Specifically, the Yo-Yo IR2 test was shown to be a sensitive tool

to differentiate between intermittent exercise performance of soccer players in different seasonal periods and at different competitive levels and playing positions. The aim of the present study was to compare the YYIR2 performance of different groups of athletes in relation to their competitive level and to the type of sport practiced.

METHODS YYIR2 test performances of several groups of male athletes competing in different sports (Soccer, Badminton, Australian Football (AF), Ice-hockey and Running) and at different competitive levels (Elite, Sub-elite, and Trained) were collected and subsequently examined for mean differences.

RESULTS The YYIR2 performance of elite male badminton players (1020 ± 53 m) was the same as elite soccer players (1060 ± 57 m), whereas sub-elite AF players had a similar level (720 ± 35 m) 1, 2 to sub-elite soccer players (830 ± 44 m). Performances of sub-elite ice-hockey players (510 ± 44 m) and moderate-trained marathon runners (460 ± 46 m) were significantly ($P < 0.05$) below the level observed for sub-elite soccer players.

DISCUSSION An athlete's ability to perform intermittent exercise was specific to the type of sport practiced with team-sport players being better than endurance runners. In particular, soccer players were exceptionally skilful in performing repeated high-intensity exercise. In conclusion, the YYIR2 was proven to be specific for the type of exercise observed in intermittent sports.

KEY WORDS Fitness testing, intermittent exercise, team sports.

P-015 Physiological responses of young soccer players to fixed lactate concentrations in playing positions

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OBJECTIVE The purpose of this study was to compare the running velocity, heart rate and oxygen consumption corresponding to the fixed lactate concentrations (2.0, 2.5, 3.0, 3.5, 4.0, 5.0 mmol.l⁻¹) of young soccer players with regard to among the playing positions. Physiological parameters like oxygen consumption, heart rate and blood lactate show differences according to playing position in soccer

METHODS 49 Young soccer players (Age: 17.2 ± 0.7 years) were tested with progressive incremental test with start running speed at 8 km.h⁻¹ for 3 min duration and 1 min rest intervals. Running velocities (RV), VO₂ and HR were assessed according to fixed [LA] were determined with third-order interpolation method from HR-workload, VO₂-workload and Lactate-workload graphics.

RESULTS Although RV of mid-fielders corresponding to fixed [LA] were higher, no significant differences were found on RV, VO₂ and HR at the fixed lactate concentrations among the playing positions. Furthermore, VO₂max values of mid-fielder were higher than other positions, but there were no significant differences between positions ($p > 0.05$).

CONCLUSION The results of the present study revealed that, the physiological responses of young soccer players were similar at sub maximal intensities for all positions.

KEY WORDS Soccer, Lactate, Heart Rate, Endurance, Playing Position

P-016 Fitness demands of soccer players

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OBJECTIVE The purpose of this study was to measure and compare the university football players' mental toughness and its sub scales (rebound ability, handle pressure, concentration, confidence and motivation) Doubtlessly physical education and sports differ in terms of? Among other sports football is one of the most popular one with for its beauty, attractiveness and toughness. Sports go through a preparatory phase including physical, technical, tactical drills, how-

ever, football coaches, usually ignore mental preparation. This is why this paper investigated mental variables of football players.

METHODS The sample was ninety male football players, ages 17-25 years who were selected from five universities among 36 south Indian universities. Mental Toughness Questionnaire was administered to measure mental toughness and five specific factors (rebound ability, handle pressure, concentration, confidence, and motivation) before the south Indian competition in 2005.

RESULTS The results showed that all of the university football players were below the average and moderate in mental toughness and its subscales. It seems they need to learn strategies to develop their mental skills, for enhancing optimal performance.

CONCLUSION The results of the study showed that the university football players should learn to stay relaxed under pressure concentrate on the match, and develop their self- confidence systematically. More studies are suggested.

KEY WORDS Mental toughness, football player, competition, preparation.

P-017 The comparison of sprint performances of left and right legged soccer players

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OBJECTIVE Although several tests aim at evaluating agility, there is a lack of information regarding the athletes dominant side to accelerate, decelerate and especially change direction of movement according to the changing requirements of the environment (Chamari et al.2004) Thus the aim of the present study was to investigate the dominant side (left or right leg) on the sprint performance (Özkara 2004). Sprint performance is considered an important fitness component of soccer physical performance and recent studies has shown that sprint performance is correlated to high intensity activity during actual match-play.

METHODS Eighteen male athletes (age 14 ± 2 , body mass 52.3 ± 13.7 kg, height 160 ± 1 cm) practicing soccer volunteered in this study. Eighteen male athletes were divided into two groups as left leg and right leg dominant soccer players. All the players performed three trials of 30m sprint test and 30m Hacettepe University Change Direction test with and without ball. The 30m sprint test and change direction test was performed both using right and left leg.

RESULTS According to the results, significant difference was found between left and right legged soccer players according to starting the 30m change direction test by left side and right side simultaneously with and without ball ($p<0.05$).

CONCLUSION The present test aimed at evaluating the athletes' ability react by their dominant side for the different starting procedures in sprint type tests. The test showed the lack of dominant side (right or left leg soccer player) that the starting position had effect on sprint performance depend on change direction types of exercises.

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KEY WORDS Change direction, right and left leg, dominant side, soccer.

P-018 Heart rate and perceptual responses to 2x2 and 3x3 small-sided youth soccer games

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OBJECTIVE During soccer training it is common to reduce the number of players of confronting teams. These small-sided games are common drills used by coaches, allowing to increase the frequency of game technical and tactical ac-

tions and to enhance specific physiologic adaptations (Hoff et al., 2002). Yet, more information on the overall impact of these training tasks in youth soccer is needed. The aim of this study was to examine heart rate and perceptual responses of two small-sided games (2x2 and 3x3), and also the effect induced by three drill modifications (verbal motivation from the coach; two touches per player and man-to-man defense).

METHODS Eight national standard players (age=15±0 years, height=173±6, weight=67±12) were evaluated in the following small-sided games: D1) 2x2 in a 30mx20m pitch with small goals. Players performed 2 reps with 90s of recovery time; D2) 3x3 with 2 reps of 3 min and equal characteristics. Heart Rate (HR) and Borg's Rate of Perceived Exertion (RPE, 6-20) were measured for all drill modifications.

RESULTS No significant differences were found for HR and percentage of maximal HR in both drills. However, there were significant differences for RPE in both drills ($p \leq 0.05$, see Table 1). Scheffe's post-hoc tests revealed differences in the analysed conditions (see Table 1).

DISCUSSION The small-sided games imposed substantial cardiovascular stress in the players. There were differences between the studies of Rampinini et al. (2006) conducted in adult players. The analysed drill modifications did not change the physiological impact of the small-sided games. However, results from RPE suggested that drill modifications did have an effect on overall drill intensity.

Table 1. Descriptive results ($\bar{x} \pm S.E.$), ANOVA and Post-hoc tests

Drill 2x2	Regular drill	Verbal motivation from coach	Two touches per player	Man-to-man defense	p	Post-hoc differences
RPE	14.1(0.65)	15.5(0.59)	16.8 (0.51)	17.1 (0.53)	≤ 0.05	all but (2T,MxM)
HR	164.0 (3.43)	169.2(3.73)	164.0 (3.60)	163.1 (2.35)	n.s.	
%HRmax	81.2 (1.24)	83.7(1.44)	81.2 (1.37)	80.8 (0.83)	n.s.	
Drill 3x3						
RPE	14.4 (0.50)	15.8 (0.19)	16.5 (0.46)	16.5 (0.50)	≤ 0.05	(R,2T) (R,MxM)
HR	160.3 (3.82)	162.2 (3.18)	162.2 (2.55)	162.3 (2.57)	n.s.	
%HRmax	79.8 (1.81)	80.8 (1.70)	80.8 (1.01)	80.8 (1.20)	n.s.	

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KEY WORDS Soccer, small-sided games, heart rate, perceived exertion.

P-019 Physical preparedness of soccer players in third and first Russian football leagues

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OBJECTIVE Physical preparedness of a soccer player can be assessed by a number of motor actions performed with sub maximal or higher intensity and their absolute parameters. All these motor actions are realized due to the activity of lower extremities' muscles, the most significant role being played by knee and ankle joints extensors. Objective of this study our work was to assess aerobic and alactic capacities of muscles-extensors of knee and ankle joints in laboratory conditions.

METHODS Soccer players in the 3rd league ($n = 35$) and the 1st league ($n = 50$) were studied. All the subjects were examined at the beginning of the preparation period (2 months before the start of the Championship of Russia). The examination was done in laboratory conditions and included anthropometry (height and body mass) and cycle ergometry (progressive exercise test and sprint test).

RESULTS No statistically reliable difference in anthropometric parameters was found. Reliable difference ($p < 0.05$) between players of the 3rd and the 1st leagues was found only in oxygen consumption (OC) at anaerobic threshold (An) and maximal oxygen consumption in forwards and half-backs. Players of the 1st league demonstrated a slightly higher level of alactic power, not statistically reliable ($p > 0.05$).

Table 1. Physical parameters of soccer players at the beginning of the preparation period. Data are means (SD).

	Height (cm)	Weight (kg)	Age (yr)	MAP Wt/kg	OCA _n l/min/kg	HR bpm	MOC _r ml/min/kg	MOC _p ml/min/kg
Third League								
Forwards	183 (5)	77 (8)	24 (4)	11(1)	37.8 (6.2)	153 (11)	60.7 (8.5)	71.0 (7.4)
Half-backs	177 (5)	72 (6)	22 (2)	12 (1)	31.8 (3.4)	146 (9)	52.3 (8.4)	71.7 (8.7)
Defenders	180 (6)	75 (1)	21 (7)	12 (1)	32.3 (2.1)	135 (6)	52.7 (1.1)	75.0 (10.0)
First League								
Forwards	181 (6)	75 (7)	22 (4)	12 (1)	53.9 (7.5)	162 (14)	70.5 (6.5)	81.2 (7.1)
Half-backs	179 (6)	73 (4)	23 (2)	12 (1)	54.2 (5.7)	158 (7)	77.2 (7.0)	84.6 (8.5)
Defenders	179 (5)	75 (2)	23 (3)	11 (1)	52.6 (3.3)	160 (9)	74.6 (5.7)	78.5 (6.4)

DISCUSSION This study indicated that a number of accelerations of maximal and submaximal intensity done in a match depended on the level of oxygen consumption at anaerobic threshold and maximal alactic power. Both parameters could be measured using a cycle ergometer in laboratory conditions. The reliability of the difference in these parameters between athletes of different qualification proved their informativeness.

KEY WORDS Physical preparedness, cycle ergometry, anaerobic threshold, maximal alactic power

P-021 Ability to repeat sprint and maximal aerobic power in young soccer players

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OBJECTIVE Maximal aerobic power (VO₂max) and Repeated Sprint Ability (RSA) are considered to be important sport-specific fitness components of young soccer players (Reilly et al. 2000). However research has reported conflicting results on RSA and VO₂max mutuality in adult team players. Furthermore, currently no research is available on the relationship between RSA and VO₂max in youth soccer players. The aim of this study was to investigate the possible relationships between VO₂max and RSA in a group of young regional-level soccer players. As working hypothesis we assumed the existence of a significant relationship between VO₂max and sprint decrement during RSA.

METHODS 19 players were randomly drawn from a population of players to participate in this study. VO₂max was assessed with a yo-yo endurance test and gas analyses performed with K4b2 gas analyzer (COSMED, Rome, Italy). RSA was assessed according to Reilly et al. (2000) where the soccer players completed 7x30m line sprints with 20s active recovery between bouts. RSA variables were calculated according to Fitzsimons et al (1993). Data is presented as mean and standard deviation. Relationships between variables were assessed using Pearson's product moment correlation. Significance was set at 5% (p<0.05).

RESULTS VO₂max was not significantly correlated to speed decrements (r=-0.40, p=0.12) and total sprint time (r=-0.29, p=0.26). Using the median split technique (VO₂max median=56.2 ml kg⁻¹min⁻¹) significant correlation was found between VO₂max and fatigue index (r=-0.77, p=0.02) in the players with low VO₂max (n=9, 52.3±3.4 ml kg⁻¹min⁻¹).

DISCUSSION Results suggested a mutual influence between VO₂max and RSA in youth soccer players with lower level of fitness (>56.2 mL•kg⁻¹•min⁻¹) and that RSA was possibly developed independent of aerobic-fitness once a threshold level of aerobic power was achieved. The present data also highlighted the importance of testing both VO₂max and RSA performance separately in prospective youth soccer players.

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KEY WORDS Training, fatigue, aerobic fitness, testing, intermittent high-intensity exercise.

P-022 The effects of a 10 week plyometric training intervention on 10 m sprint and vertical jump performance in elite junior professional soccer players

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OBJECTIVE The ability to produce explosive lower body power is an important determinant of performance in soccer. Plyometric training represents an effective method for the development of muscular strength and power. Little information, however, currently exists on the volume of plyometric training needed to induce improvements in performance. To examine the effect of one weekly structured plyometric training session over a 10 week in-season training period on 10 m sprint and vertical jump (VJ) performance in elite junior professional soccer players.

METHODS Twelve soccer players completed a 10m sprint [Limits of agreement (LOA) 0.01 ± 0.09 s] and VJ (LOA 0.7 ± 2.1 cm) test on two occasions, 10 weeks apart. Six players were randomly allocated to an experimental (Exp) or control (Cont) group. Over the 10 week period the Exp group completed one plyometric session per week in addition to normal training whilst the Cont group completed normal training only.

RESULTS The change in 10m sprint performance (Exp -0.04 ± 0.02 s, Cont 0.00 ± 0.02 s; $p=0.04$) was significantly greater in the Exp group following the 10 week training period ($p=0.011$). No difference in VJ performance (Exp 1 ± 1 cm, Cont 0 ± 1 cm; $p=0.028$) was observed between the two groups ($p=0.155$).

CONCLUSION The present findings demonstrate that one plyometric training per week over a 10 week in-season training period leads to significant improvements in 10m sprint time in elite junior soccer players. This training stimulus may act as an efficient training stimulus during the in-season period when training time is limited.

KEY WORDS Plyometric, Speed, Training, Frequency.

P-023 Impact of pre-cooling on soccer-specific exercise (SSE) performed in heat

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OBJECTIVE Hyperthermia is a likely cause of fatigue when soccer is played in the heat, as core temperature reaches a critical value (Nielsen et al., 1993). The principle of pre-cooling is that a reduction in core body temperature prior to exercise increases the margin for heat storage and the time before reaching a critical limiting temperature when a given exercise intensity cannot be sustained. The aim of this study was to examine the effect of pre-cooling on the physiological responses to soccer-specific exercise (SSE) and the subsequent impact on high-intensity exercise capacity when performed in the heat.

METHODS Twelve male soccer players performed SSE in the heat on two occasions (30.5°C and 42.2% r.h.). On one occasion subjects underwent pre-cooling (wearing a cooling vest for 1h before and during half-time). Core temperature, using heat-sensitive telemetry pills, and heart rate were measured continuously. The SSE was followed by a test of exercise capacity (Cunningham and Faulkner, 1969).

RESULTS Core temperature was significantly reduced following pre-cooling and mean core temperature during the entire protocol (Table 1). Heart rate was significantly lower following pre-cooling (mean heart rate with and without pre-cooling: 158 ± 3 and 164 ± 3 beats.min⁻¹ respectively (Table 1). Run time to exhaustion was significantly longer following pre-cooling (70.1 ± 8 s) compared to without (57.1 ± 5 s).

Table 1. Heart rate during the soccer-specific protocol with and without pre-cooling. * $P < 0.05$

	Heart rate (beats.min ⁻¹)					
	1-15 min	16-30 min	31-45 min	46-60 min	61-75min	76-90 min
Without pre cooling	151.6 (2.8)	161.6 (3.2)	165.7 (3.1)	163.1 (2.2)	168.0 (2.5)	171.8 (2.6)
With pre-cooling	144.3 (2.2)*	157.1 (2.9)	160.4 (3.0)	156.6 (2.9)*	163.2 (2.6)	168.1 (2.3)

CONCLUSION A period of pre-cooling prior to soccer-specific exercise significantly reduced core temperature and heart rate during exercise. In addition, pre-cooling significantly enhanced exercise capacity as indicated by a longer time to exhaustion during the high-intensity running test performed following the soccer-specific exercise. These changes were evident without any impact on metabolism.

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KEY WORDS Soccer-specific exercise, pre-cooling, core temperature, heart rate, exercise capacity.

P-024 Comparison of a new soccer-specific aerobic fitness test to other field and laboratory tests: Preliminary data

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University of Hull

OBJECTIVE The purpose of this study was to measure performance and physiological responses of the SAFT compared to an incremental treadmill test (ITT) to determine VO_{2max} , and the Yo-Yo Intermittent Endurance Test (YYIET). Whilst a number of laboratory and field based tests are available to measure soccer-specific endurance capacity, most fail to represent the intermittent and multi-directional nature of soccer match-play. The Soccer-specific Aerobic Fitness Test (SAFT) was developed to replicate the activity profile of soccer, based on data provided by notational analyses. The test is maximal and incremental with minimal space & equipment requirements.

METHODS Ten University 1st XI players performed the SAFT, the ITT and the YYIET on different days under standardised laboratory conditions. Performance of the tests was measured by VO_{2max} on the ITT, and distance covered (m) in the SAFT and YYIET. Heart rate was measured during each test. Expired gas analysis was measured using a portable system during the field-based tests in a sample of the subjects.

RESULTS The VO_{2max} was not correlated with performance of either the SAFT ($r = 0.18$, $P > 0.05$), or the YYIET ($r = 0.36$, $P > 0.05$). There was a moderate association between performance of the SAFT and YYIET ($r = 0.66$, $P = 0.077$). HRmax determined during the ITT, was attained in the SAFT (98.6 ± 2.1 %), but not in the YYIET (97.8 ± 2.2 %; $P < 0.05$). SAFT also elicited VO_{2max} (106 ± 4.9 % of ITT VO_{2max}).

DISCUSSION Performance of the field based SAFT was not associated with VO_{2max} , as expected and indicative of the varied physiological demands of match-play. SAFT performance was comparable with the YYIET. The physiological responses to SAFT (elicits HRmax and VO_{2max}) demonstrated that the test was both incremental and maximal in nature (Figure 1). The nature of the SAFT enhances its application to squad testing.

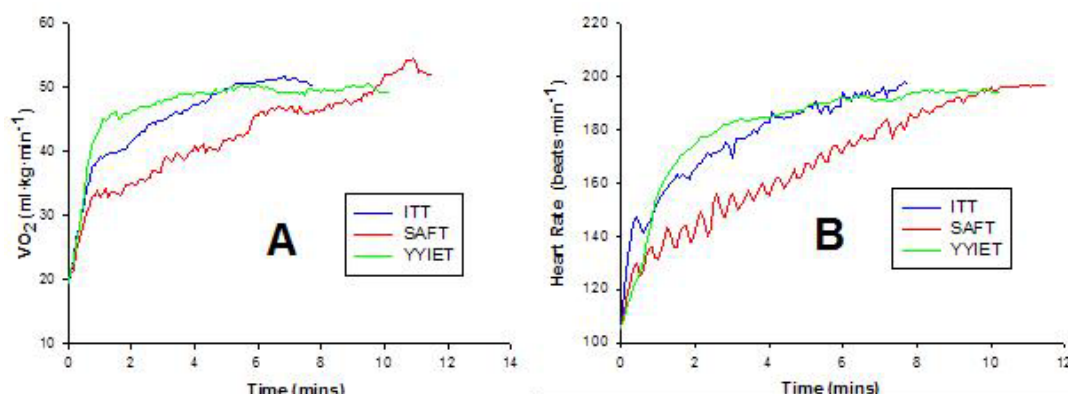


Figure 1. Example of the HR (A) and VO_2 (2) response to ITT, SAFT and YYIET.

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KEY WORDS Field test, soccer, physiological response.

P-025 Playing standard and position-specific differences in performance of a soccer-specific aerobic fitness test (SAFT): Preliminary data

Ric Lovell ✉, **Matt Greig, Simon Keatley and Jason Siegler**

University of Hull

OBJECTIVE The purpose of this study was to investigate the sensitivity of SAFT to the differences in aerobic training status attributed to playing standard and position. Players were characterised as either centre backs (CB), full-backs (FB), midfielders (MD), or forwards (FD). Whilst a number of laboratory and field based tests are available to measure soccer-specific endurance capacity, most fail to represent the intermittent and multi-directional nature of soccer match-play. The Soccer-Specific Aerobic Fitness Test (SAFT) was developed to replicate the activity profile of soccer, based on data provided by notational analyses. The test is maximal and incremental with minimal space & equipment requirements.

METHODS Twenty professional (PRO) and 12 elite youth players (EY) performed the SAFT in addition to an incremental treadmill test (ITT) to determine maximal oxygen uptake ($\text{VO}_{2\text{max}}$). The tests were randomised and undertaken in standardised laboratory conditions at the same time of day. Performance was recorded as the time to exhaustion (s) on the ITT, and the distance covered (m) in the SAFT.

RESULTS SAFT performance was greater in the PRO than EY players ($P < 0.01$). There were no differences between PRO and EY ITT performance and $\text{VO}_{2\text{max}}$ ($P > 0.05$). In PRO, MD showed a higher $\text{VO}_{2\text{max}}$ than CB ($P < 0.05$). In the SAFT, MD also covered more distance than FD ($P < 0.05$), and CB (NS; $P = 0.07$). There were no position-specific differences in $\text{VO}_{2\text{max}}$ or SAFT performance between EY players ($P > 0.05$).

CONCLUSION SAFT showed differences between playing standard and also playing positions, which were not observed in $\text{VO}_{2\text{max}}$. It was also observed that position-specific differences were not apparent in elite players at the age of 16-18. Whilst further data is required, this data suggested that SAFT could be used as a simple, practical and sensitive measure of soccer-specific aerobic status.

KEY WORDS Soccer, playing position, field test.

P-026 Physiological and health variables of sports trainers

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OBJECTIVE Coaching demands individuals with good abilities, which leads them to spend effort on their players. Literature in training field noticed many sudden death cases especially among trainers. As such, the aim of this study was to investigate the problems that confront trainers in different training fields, and identify the disease which attacked them at work.

METHODS Measuring was performed in the sample of 350 male trainers (57 football, 46 basketball, 40 volleyball, 34 handball, 31 gymnastic, 34 athletic, 28 swimming, 25 wrestling, 27 karate, and 28 judo) selected by purposive sampling method from some sports activity trainers in Egypt. Subjects were incurred to the questionnaire that included many points like (the scientific level, the practice level, and experience years).

RESULTS The results indicated (Table 1) that the problems confronted the trainers was competitions' irregular 88% sequence the unrecognizing in young players 86.3%. Next, there were not contracts between the administration and trainers 78%. In addition, the disease that confronted the trainers most was the hypertension 38.6%, and diabetic mellitus 31.7%. Also, injuries which confronted trainers was the cramp 38.9%.

Table 1. The problems that confront trainers.

Variables	Competitions' irregular	Unrecognizing in young players	Salary's weakling	The parents interpose in trainers' work	Private lessons	There're not a contract between the administration and trainers
% percent	88	86.3	84.3	49.7	53.7	78

DISCUSSION The results indicated that trainers were exposed to many diseases and injuries due to physical and psychological stress in the working zone. 278 cases (79.4%) were injured after working in the training field.

CONCLUSION In conclusion, stress comes from the administration, spectators, and did not acquire any achievement. Some injuries like cramp and sprain may be due to negation of warm up.

KEY WORDS Sports training jobs, injuries, diseases.

P-027 Relationships of body composition, anaerobic performance and isokinetic knee strength in American football players

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OBJECTIVE American football is gaining popularity throughout the world and is a game that is dominated by size and strength. Most players are overweight and have high body fat. Body weight, lean body mass and body fat is critical factors relative to anaerobic performance (De Ste Croix et al., 2001). The purpose of the present study was to investigate the relationship between body composition, anaerobic performance and isokinetic knee strength in American football players.

METHODS 28 American football players participated in this study voluntarily. For the determination of body composition, skinfold thickness was measured. Wingate Anaerobic Power Test was used for the determination of anaerobic performance, and peak isokinetic knee extension and flexion torques were determined at 60°, 150° and 240°.s⁻¹ (Cybex 770 Norm, USA).

RESULTS Fat mass, (FM) correlated with mean power (MP) ($r=.387$) and 60°.s⁻¹ extension ($r=.469$). Fat % correlated with 60°.s⁻¹ extension ($r=.414$). Lean body mass (LBM) correlated with peak power (PP) ($r=.672$) and MP ($r=.776$), 60 ($r=.474$), 150 ($r=.550$) and 240°.s⁻¹ extension ($r=.580$). PP correlated with 60 ($r=.491$), 150 ($r=.559$) and 240°.s⁻¹ extension ($r=.581$) and 240°.s⁻¹ flexion ($r=.0418$) while MP correlated with 60 ($r=.466$), 150 ($r=.522$) and 240°.s⁻¹ extension ($r=.502$).

Table 1. Body composition, anaerobic performance and peak isokinetic concentric extension and flexion of American football players.

Variables	Means (±SD)
Fat%	15.06 (6.2)
Fat Mass (kg)	13.01 (7.1)
LBM (kg)	69.70 (6.6)
Peak Power (W)	825.51 (133.9)
Mean Power (W)	611.42 (74.9)
Knee extension	
60°.s ⁻¹ (N/m)	134.78 (15.8)
150°.s ⁻¹ (N/m)	129.758 (20.8)
240°.s ⁻¹ (N/m)	125.28 (20.6)
Knee flexion	
60°.s ⁻¹ (N/m)	97.42 (14.2)
150°.s ⁻¹ (N/m)	94.64 (15.5)
240°.s ⁻¹ (N/m)	92.64 (14.5)

DISCUSSION Most of the studies indicate that anaerobic performance and muscular strength are highly correlated with LBM and muscle mass (Bourhard et al 1991).

CONCLUSION As a conclusion, the findings of the present study indicated that LBM and body fat percentage plays important role in anaerobic performance and isokinetic knee strength in American football players.

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De Ste Croix et al. (2001) *Journal of Sports Sciences* 19, 141-148.

KEY WORDS Body composition, anaerobic power and capacity, isokinetic knee extension, isokinetic knee flexion.

P-028 Aerobic and anaerobic fitness indicators in under 20 and elite Qatari soccer players

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OBJECTIVE Qatari National age-group soccer teams success have not been carried on at the Olympic and Full International levels. While objective assessment tools that measure tactical and technical competence would provide valuable insight into player development, the majority of soccer research has focused upon different skill related fitness attributes. A plateau in jump and sprinting performance plateau in Qatari National soccer player's late teens was recently reported. Therefore, the purpose of this study was to quantify and compare the aerobic and anaerobic fitness indicators in soccer players at different competitive levels, specifically at Qatar Under 20 (U20), and Elite (NAT) level.

METHODS Twenty-nine (16 U-20, 13 NAT) male athletes (aged 17-34 y) completed a test battery that included counter movement jumps, with (WAMJ) and without (CMJ) arm swing, six repetitive reactivity calf jumps (6J), a 20 m sprint test, and a Level 1 Yo-Yo Intermittent Recovery test. An independent t-test analysed differences between groups. Data was expressed as mean \pm SD with significance set at $p < 0.05$.

RESULTS There were no differences in height, weight or body mass index. CMJ (U20, 37.8 (4.5); NAT, 40.0 (5.4) cm), WAMJ and 6J performance was similar between groups. No differences in sprinting performance were noted at 2.5, 5, 10, and 20 m. The final stage and total distance (U20, 1762.5 (522.2); NAT, 1769.2 (342.2) m) completed in the YYIRTL1 test did not differ between the groups.

DISCUSSION Results revealed the aerobic and anaerobic fitness indicators in the Qatari players between the two competitive levels. Both groups had similar results in performing high intense intermittent exercise indicating similar high rate of aerobic and anaerobic turnover.

CONCLUSION In conclusion, the U20 players were in similar fitness category as their NAT counterparts.

KEY WORDS Soccer, field testing, physiological development.

P-029 Pre-season aerobic performance of elite Japanese soccer players

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OBJECTIVE Laboratory and field tests are useful to examine players' aerobic capabilities for performance. Most aerobic tests are continuous, whereas, in field sports such as soccer, exercise is intermittent and performance is related to the athletes' ability to repeatedly perform intense exercise. Therefore, field tests provide specific results and are more valid than laboratory tests for coaches. The aim of the present study was to employ two field tests to determine player position specific aerobic fitness indicators for 31 male elite Japanese soccer players (aged 21-29 y), who were all regular members of the national "A" squad of the Japan Football Association. A secondary aim was to make a comparison with other corresponding level data.

METHODS Players were allocated in goalkeeper (GK), defender (DF) and midfield (MF) groups. Strikers were evaluated, but not included in the analysis. The (45:15 sec) Intermittent Field Test (INT), and the Yo-Yo Intermittent Recovery Test Level 2 (YYIRTL2) were used to evaluate aerobic fitness. An ANOVA assessed between group differences. Data was expressed as mean \pm SD with significance set at $p < 0.05$.

RESULTS No differences were seen between groups in INT test in the maximal aerobic velocity. The total distance completed by GK in the YYIRTL2 test was significantly lower than the DF and MF (GK, 760.0 \pm 117.8; DF, 1062.2 \pm 98.2; MF, 1068 \pm 181.4 m). HR recoveries were similar between groups following both aerobic tests. No correlation existed between the INT and Yo-Yo tests ($r^2 = 0.22$).

DISCUSSION Japanese players appeared to have similar aerobic characteristics as other international players.

CONCLUSION In conclusion, these results may suggest that specific individualised fitness/skill training for the various positions revealed similar outcomes in terms of aerobic fitness levels. More research is necessary to provide fitness test data for elite players to streamline training specifically and elicit higher fitness levels.

KEY WORDS Soccer, field testing, intermittent exercise.

P-030 Physiological responses to submaximal and maximal exercise intensities: Field versus laboratory

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OBJECTIVE Physiological parameters such as oxygen consumption, blood lactate and heart rates may differ in lab and field situations, which can influence the relative intensity of endurance training. Although Lab situation provides valid and accurate responses to standard running velocities, soccer players perform endurance training in the field situation. The purpose of this study was to examine the physiological responses such as heart rate (HR) and blood lactate concentration (La) to submaximal and maximal exercise intensities which were obtained from treadmill (TR) and field running tests (FT) in young soccer player.

METHODS 14 male soccer player (Age: 17.5±0.5 years) participated in two running tests with a progressively increased workload protocol. All tests were performed separately in random order with two days interval. HR was recorded by Polar S610 throughout the tests whereas earlobe-blood lactate concentrations were measured by YSI 1500 lactate analyser within one minute rest intervals between the workloads.

RESULTS No significant differences were found in resting and peak La, resting and maxHR. Running velocities (RV) corresponding to 4 mmol.L⁻¹ in lab test were significantly higher whereas HR responses to 3.5 and 4 mmol.L⁻¹ [La] were significantly lower than the field test. During the field test the La values in RV of 14-17 km.h⁻¹ were significantly lower than those which were measured in the laboratory test.

CONCLUSION The results of the present study revealed that the physiological responses of lab and field test with same protocol were conflicting when assessing the endurance performance in young soccer players.

KEY WORDS Soccer, blood lactate.

P-031 Validity of a group intermittent-high-intensity test for repeated sprint ability

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OBJECTIVE Repeated sprint ability (RSA) has been suggested as an important component of team sport performance (Spencer et al., 2005). However, the RSA assessment requires testing protocol that are difficult to implement and are time consuming. The aim of this pilot study was to examine the validity of a new field intermittent high-intensity group test developed to assess RSA (GRSA) in soccer players. GRSA consisted in progressive speed 2x15m shuttle running bouts with 30s of passive recovery. Starting speed was 18 kmh⁻¹ with 0.5 km h⁻¹ increments every 8 bouts. GRSA performance was considered as the total distance covered during the test.

METHODS Eighteen amateur soccer players (age 21.8 (4.8) years) were tested in a random order for RSA (8x2x15m shuttle running with 30s recovery using photocells) and GRSA at least two days apart. Fingertip blood lactate concentration was assessed at rest and three minutes after the end of both tests. Heart rate was monitored throughout the tests using short range telemetry.

RESULTS RSA Total time and best sprint performance were significantly correlated with GRSA performance ($r=-0.83$, and $r=-0.77$, respectively $p=0.002$). Posttests Blood Lactate concentrations were not significantly different (13.25 (3.14) and 13.57 (4.34) mmol L⁻¹ for GRSA and RSA respectively, $p<0.05$). Peak HR were 93 (3.4) and 93 (3.0) % of HRmax for GRSA and RSA, respectively ($p<0.05$).

CONCLUSION The results of this study showed that GRSA test might be considered as an interesting test to assess RSA performance in groups of amateur soccer players without the operative limitation usually encountered during usual running RSA protocols.

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KEY WORDS Sprinting, field testing, shuttle running, soccer, fitness assessment.

P-032 Assessing aerobic and anaerobic power from a 90-s all-out isokinetic test versus the Wingate test in young female soccer players

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OBJECTIVE While the majority of energy during a competitive soccer match is provided aerobically, anaerobic energy production is essential for high-intensity efforts (Reilly, 1997). The 30-s Wingate test (WAT) has traditionally been used to provide anaerobic power indices to estimate anaerobic capacity (Inbar and Bar-Or, 1986). However, there is no evidence that WAT performance elicits VO₂peak, as derived from a standard incremental test. Since a 90-s all-out test provides a valid measure for VO₂peak with adolescents (Williams et al., 2005), 90 s may be a more appropriate duration than 30 s for assessing energy system interaction. By comparing 90-s all-out cycling performance with the WAT, the aim of the present study was to develop a single, short test that would assess both aerobic and anaerobic power in young female soccer players.

METHODS Eight female soccer players (mean (SD): age 11.9 (0.5) y; height 149.6 (7.8) cm; mass 40.8 (8.8) kg) performed an incremental test to exhaustion, a WAT and a 90-s all-out isokinetic test (ISO) in a random order using cycle ergometry. During each of the tests expired air was analysed breath-by-breath, HR and power indices were recorded and blood [La-] was measured pre- and 3-min post-exercise.

RESULTS Physiological and performance data are reported in Table 1. Power profiles for WAT and ISO are shown in Figure 1. Peak power (PP) was similar for the two sprint tests ($P>0.05$); mean power (MP), end power (EP) and fatigue index (FI) for WAT were similar to the corresponding values measured after 30 s during ISO (ISO_30) ($P>0.05$). VO₂peak values correlated across all three tests ($r>0.85$, $P<0.01$).

Table 1. VO₂peak, HRpeak, the change in blood [La-] (Δ [La-]) and power indices measured during the incremental test, the Wingate anaerobic test (WAT), after 30 s during the 90-s test (ISO_30) and at the end of the 90-s test (ISO_90)

	Incremental	WAT	ISO 30	ISO 90
VO ₂ peak (L·min ⁻¹)	1.98 (0.35) *	2.08 (0.26)	-	2.17 (0.34)
HRpeak (beats·min ⁻¹)	195 (11) *	184 (11)*	-	190 (9)
Δ [La-] (mmol·L ⁻¹)	4.90 (1.5)	4.75 (1.11)	-	5.38 (1.48)
Peak power (W)	-	340 (105)	-	306 (47)
Mean power (W)	-	271 (80) *	252 (51)*	179 (37)
End power (W)	-	201 (65) *	200 (55) *	127 (31)
Fatigue index (%)	-	42 (8)*	39 (9)*	58 (9)

* significantly different from ISO_90 ($P<0.05$)

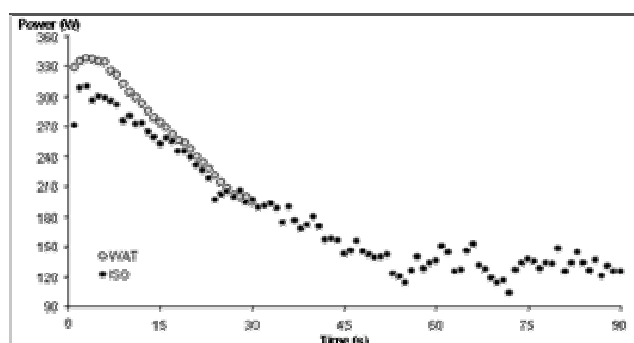


Figure 1. Typical power output profiles for one individual performing the WAT and the ISO.

DISCUSSION The data showed that ISO was able to provide the power measures conventionally derived from WAT to assess anaerobic performance. Unlike data previously reported for men and boys (Carter et al., 2005), the 90-s test elicited a greater VO_2 peak than the incremental test.

CONCLUSION It is concluded that a 90-s all-out isokinetic test was able to assess aerobic and anaerobic power in young female soccer players in one single test.

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KEY WORDS Maximal oxygen uptake, energy system interaction, exercise testing, cycling.

P-033 Season variation in repeated sprint ability of futsal players

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OBJECTIVE High-level futsal is an intense intermittent team sport that requires a well developed ability to repeatedly perform intense exercise. The repeated-sprint ability (RSA) is one of the most important fitness components of this activity (Barbero-Álvarez et al., 2006). However, there is no scientific information regarding futsal players' RSA across the sport season. In order to understand training effects in RSA performances, this study aimed to identify the RSA variation across the futsal season (pre, mid and post season), using a 10 maximal repeated sprints protocol of 24,2 m with a change of direction interspersed with 15s of active recovery.

METHODS Eight semi-professional players completed the test (age=21 (2), height=174 (4), weight=71 (6), 6h training/week). The three evaluations were performed after the first month of training (pre), after three months (mid) and after three months (post-season) since the beginning of the season. A 3 (season period: pre, mid, post) X 10 (trials) repeated measures ANOVA was carried out on subjects sprint times.

RESULTS The main effect of sprint trial was statistically significant, $F(9, 189)=2.65$ $P < 0.001$. Mean sprint times following the fourth trial became significantly slower. The main effect of season was non-significant, $F(2, 21) = 0.91$ $P = \text{n.s.}$ The two main effects were qualified by a non significant season X sprint trial interaction, $F(18, 189) = 0.75$ $P = \text{n.s.}$

Sprints / Season	Sprint 1	Sprint 2	Sprint 3	Sprint 4	Sprint 5	Sprint 6	Sprint 7	Sprint 8	Sprint 9	Sprint 10
Preseason	4,96 (0,10)	4,88 (0,10)	4,96 (0,10)	4,95 (0,10)	5,09 (0,10)	5,10 (0,13)	5,12 (0,10)	5,06 (0,11)	5,10 (0,10)	5,02 (0,09)
Midseason	4,89 (0,10)	4,95 (0,10)	4,97 (0,10)	4,94 (0,10)	5,13 (0,10)	5,13 (0,13)	5,05 (0,10)	5,12 (0,11)	4,98 (0,10)	5,07 (0,09)
Postseason	5,12 (0,10)	5,14 (0,10)	5,15 (0,10)	5,09 (0,10)	5,15 (0,10)	5,10 (0,13)	5,26 (0,10)	5,18 (0,11)	5,26 (0,10)	5,13 (0,09)

DISCUSSION Obtained results seem to suggest that futsal training: (1) maintained anaerobic capacity across the season but (2) was not efficient in delaying fatigue across the sprint trials.

CONCLUSION Coaches should be aware that this test can play an important role in repeated-sprint ability evaluation.

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KEY WORDS Futsal, repeated sprint ability, sprint test, semi-professional players.

P-034 Quantifying energy expenditure of dribbling a soccer ball in a field test

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OBJECTIVE The Hoff test has been used both as an aerobic training intervention program and a method for determining VO_2 max (Hoff et al., 2002). However, the extra energy cost associated with the soccer specific nature of the Hoff test has never been quantified. The study aimed at determining the extra energy cost associated with dribbling a soccer ball during a modified version of the Hoff Test, by examining various movements.

METHODS Skilled male players completed six trials of a modified Hoff Test. Each trial lasted eight minutes at 3 target speeds. Trials at each TS consisted of movement without a ball (NB) and with a ball (WB). The portable Cosmed K4b2 was used to measure the O_2 uptake and heart rate (HR) after 2 minutes of continuous work. Running speeds were verified from Global Positioning Satellites (GPS) data.

RESULTS Multivariate analysis identified a significant difference in oxygen consumption of NB and WB movements across all TS ($p < 0.001$). Oxygen consumption during running at $2.0 \text{ m} \cdot \text{s}^{-1}$ averaged 43.8 and $36.6 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ WB and NB respectively. Linear regression illustrates that the difference between NB and WB movements increases with speed of execution (Figure 1).

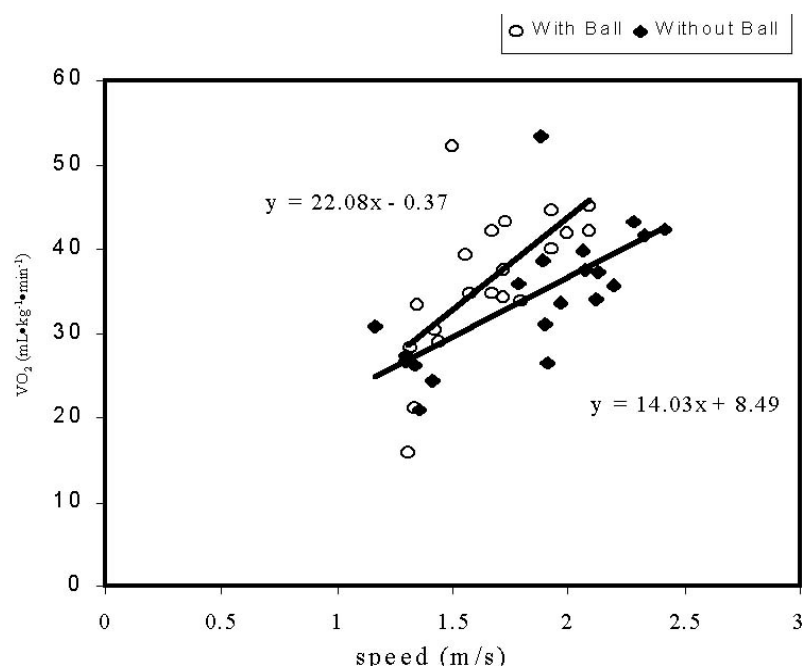


Figure 1. Oxygen consumption at TS.

CONCLUSION Oxygen consumption increases rapidly with running pace in the Hoff Test. Dribbling a soccer ball significantly increases the energy that players expend and more so at higher speeds. This may be due to changes in gait characteristics, at high speed running. This study also demonstrates that running with the ball in the Hoff Test raises O_2 consumption providing an effective training stimulus.

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KEY WORDS Oxygen consumption, Hoff Test, aerobic training.

P-035 Explosive strength performance of under-20 soccer players in different field positions

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OBJECTIVE The explosive strength used in soccer appears in some fast movements, fast direction changes, jumps, kicks and dribbles that are high intensity activity. By studying some soccer players, including some high intensity results obtained during a soccer match, it was suggested that the average of some races in a match was between 15 and 17 meters (Mohr et al., 2003). Explosive strength determines performance in soccer players and these magnitudes might change according specific function in game. The aim of this study was to analyze the explosive strength performance in different positions of backwards (BWD), left and right-backs (LRB), back middle fields (BMF), middle fields (MF) and forwards (FWD) for under-20 soccer players.

METHODS The sample was made by 44 male elite Brazilian soccer players grouped as: 9 BWD, 8 LRB, 8 BMF, 9 MF and 10 FWD. Explosive strength (ES) and elastic explosive (EES) was studied. The performances were assessed by SJ and CMJ tests (Bosco, 1994) in a contact carpet Jump Test. All results were analyzed through the descriptive statistic, one way ANOVA and Post-hoc LSD. The significance level was $p < 0,05$.

RESULTS Among the field places it was possible to verify some important differences to ES ($p=0,037$) and EES ($p=0,006$). In multiple comparisons of averages some differences were analyzed in ES between LRBxBMF ($p=0,010$), LRBxFWD ($p=0,033$) and BMFxMF ($p=0,017$); and EES between LRBxBMF ($p=0,004$), LRBxFWD ($p=0,015$), BMFxMF ($p=0,003$) and MFxFWD ($p=0,011$).

Table 1. Explosive strength performance description in the different field positions for under-20 soccer players.

Variables	BWD (n=9)		LRB (n=8)		BMF (n=8)		MF (n=9)		FWD (n=10)	
	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD
ES (cm)	34,40	(3,33)	32,05 ^{ab}	(3,88)	36,69	(2,16)	32,43 ^a	(4,23)	35,83	(3,82)
EES (cm)	38,36	(3,16)	36,54 ^{ab}	(3,32)	41,36	(1,85)	36,35 ^{ab}	(3,81)	40,51	(3,83)
EI (%)	11,72	(3,91)	14,56	(8,12)	12,85	(2,96)	12,46	(3,82)	13,22	(4,37)

a= statistically different from back middle fields; b= statistically different from forwards; EI= Elasticity Index.

DISCUSSION The results showed the existence of inferiority to the performance for left and right-backs explosive strength in relation to middle fields and forwards and also from the middle fields to back middle fields. Also, inferiority was noticed from left and right-backs elastic explosive strength performance and middle fields in relation to back middle fields and forwards.

CONCLUSION This data suggest that explosive strength is mobilized in different forms to perform high intensity actions depending of soccer player position.

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KEY WORDS Soccer, explosive strength, elastic explosive strength, under-20 athletics.

P-036 Effects of intermittent hypoxic exposure on haematological and performance in soccer players

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OBJECTIVE The present study observed the changes in haematological index and performance after intermittent hypoxic exposure in soccer players. The purpose of this study was to investigate the effects of intermittent hypoxic exposure using normobaric hypoxic house on haematological changes and performance in soccer players.

METHODS 16 male soccer players of a physical education department were randomly and equally divided into two groups of intermittent hypoxic training (IHE) and normoxic normbaric control (NNC).

RESULTS Haematological parameters were red blood cell (RBC), hemoglobin (Hb) and hematocrit (Hct), while performance included maximal O₂ uptake (.V O₂max) and Yo-Yo intermittent endurance test (Yo-Yo test). After acute hypoxic exposure for 10 hours, no significant changes were found in RBC, Hb and Hct. One week later of the hypoxic exposure, RBC ($P<0.05$) and Hb ($P=0.074$) increased.

DISCUSSION 4 weeks of intermittent hypoxic exposure improved performance, distance of Yo-Yo test in trained soccer players, in part, dependent on the increases of haematological changes and VO₂max.

KEY WORDS Intermittent hypoxic training; hypoxic house, haematological change, VO₂max, Yo-Yo test.

P-037 Effect of knee muscle strength on level of professionalism in soccer players

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OBJECTIVE In contact sports, which involve intense physical effort, the training environment appears to have a direct impact on athletic success. Richer football clubs have more resources for training equipment. The purpose of this study was to investigate whether football players at professional league level were associated with differences in isokinetic muscle strength in the knee.

METHODS The knee extensor and knee flexor strengths were measured isokinetically (60 °/s) in left and right knee with an Isomed 2000 isokinetic system in three groups of male soccer players (Turkish Super League, $n = 16$; Turkish Second League, $n = 18$) and a group of nonsoccer players (sedentary males, $n = 15$). Differences between the groups were evaluated statistically with the independent samples t-test.

RESULTS Isokinetic strength was found to be greatest in the Super League soccer players in all comparisons, but no significant differences were found between the Second League players and the control group in any of the comparisons ($p<0.05$).

Table 1. Knee isokinetic muscle strength (Nm) in the three groups of participants.

Groups	Flexion		Extension	
	RightMean (SD)	LeftMean (SD)	RightMean (SD)	LeftMean (SD)
Super League	158.38 (35.78)	151.25 (40.59)	233.88 (54.81)	212.81 (70.37)
Second League	93.76 (13.15)	93.32 (14.09)	147.47 (18.41)	153.89 (17.69)
Control group	87.8 (38.25)	102.8 (31.65)	157.27 (71.66)	161.27 (61.24)

DISCUSSION These results were consistent with the possibility that levels of physical training differ by professional league level. One explanation for this is that Super League players generally have more highly organized and intensive training programs.

KEY WORDS Football, exercise test, physical fitness.

P-038 Anthropometric parameters and manifestations of strength and speed in soccer players in ages of formation

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OBJECTIVE This study is a functional valuation of soccer players in ages of formation (under 13, under 15 and under 18) with the purpose to observe the relations between some anthropometric parameters (total muscular weight and muscular area of thigh) and manifestations of strength (explosive-elastic strength and explosive-elastic-reactive) and

speed (acceleration capacity). The purpose of this study was to make a conditional characterization in the categories of youth soccer and to describe the relation between the anthropometric parameters and the manifestations of strength and speed.

METHODS The strength was evaluated with Ergojump Boscosystem, making the measurement of the explosive strength (SJ), the explosive-elastic strength (CMJ) and the explosive-elastic-reactive strength of quadriceps (ABALA-KOV). Speed of 30 m. with exit from unemployed and a delayed foot were measured with infrared photoelectric cells (Byomedic System). Only the best of the two tests was retained.

RESULTS Based on the age, significant differences (** $p < 0.01$) in the weight, the stature, the muscular percentage, total the muscular weight, the muscular area of thigh and the capacity of acceleration. These differences also are observed in the manifestations of strength between U-14 and U-15 (** $p < 0.01$), but significant differences between U-15 and U-18 are not appraised.

DISCUSSION Data reflect the inadequate thing to use, like parameters of control of the training in ages of formation, data that come from adult professional soccer players. In relation to the age, a progressive growth of strength and speed was observed, that was accelerated between 15-16 years. The results suggested that the stage of formation corresponding to the category under 15 was decisive.

KEY WORDS Youth soccer, anthropometric, strength, speed.

P-039 Changes in speed, explosive strength and anaerobic power after application of two different training methods in soccer players

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OBJECTIVE High-level soccer requires a great amount of endurance, speed, agility, and power. Research has identified the intermittent high-intensity exercise as predominant and fitness improvements to this activity pattern have been defined as power endurance (Siegler et al., 2003). However, no studies were conducted to assess the effect of power endurance training on players' physical fitness along the season. The aim of this study was to assess the effect of the power endurance training method on semi-professional male soccer players' speed, explosive strength and anaerobic power as measured by the 15m and 30m speed tests, the Squat-Jump and Counter Movement Jump and the Bangsbo Modified Sprint Test (Wragg et al., 2000).

METHODS Forty semi-professional Portuguese players were divided in 2 groups: power endurance training group (PEG, $n=20$, age=27 (5), height=175 (5), weight=73 (5)) and continuous training group (CTG, $n=20$, age=27 (5), height=175 (6), weight=73 (7)). The evaluations were performed during the first training session of the season, six and twelve weeks after the beginning of the training program.

RESULTS Factorial ANOVA (group: PEG, CTG x moment: W1, W6, W12) showed that PEG was always faster than CTG in the 15m, 30m and Bangsbo Modified Sprint Test (see Figure 1); recovered better from intense efforts than CTG. Additionally, PEG showed higher values than the CTG in the Squat Jump and no significant differences were found in the Counter Movement Jump (see Table 1).

DISCUSSION The results suggested that both training modalities were able to maintain initial values of speed and explosive strength. However, the PEG exhibited higher improvements in anaerobic power. Therefore, the power endurance training (intermittent high intensity exercise) may be more beneficial to prepare soccer players according to the game cardiovascular and metabolic specific determinants.

REFERENCES

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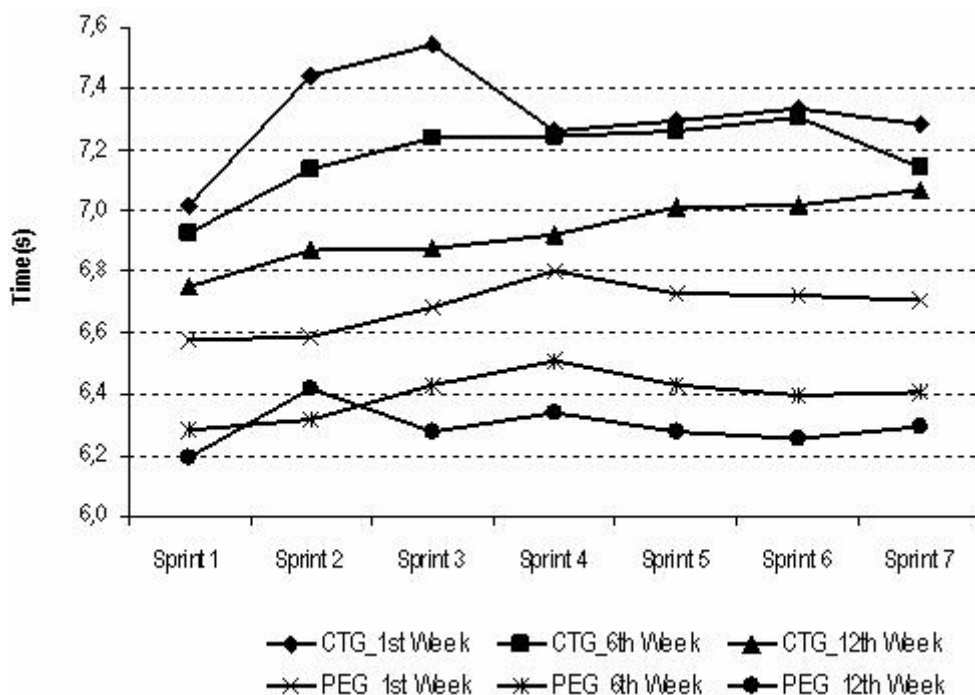


Figure 1. Sprint test results.

Table 1. Descriptive results (mean \pm SD) and Factorial ANOVA.

Test	Group Moment	1st Week	6th Week	12th week
15 m Speed *	CTG	2.30 (0.81)	2.31 (0.90)	2.30 (0.09)
	PEG	2.19 (0.08)	2.19 (0.06)	2.16 (0.05)
30 m Speed *	CTG	4.23 (0.25)	4.23 (0.25)	4.20 (0.26)
	PEG	4.02 (0.11)	4.03 (0.15)	3.97 (0.13)
Squat-jump *	CTG	39.9 (1.3)	38.6 (1.5)	39.1 (1.4)
	PEG	42.0 (1.3)	42.6 (1.4)	44.1 (1.3)
Counter-movement jump	CTG	38.3 (1.3)	40.2 (1.4)	40.1 (1.1)
	PEG	39.3 (1.2)	41.6 (1.3)	43.6 (1.0)
Bangsbo Modified Sprint Test * (Average time from 7 sprints)	CTG	7.31 (0.34)	7.19 (0.35)	6.93 (0.39)
	PEG	6.69 (0.20)	6.39 (0.19)	6.28 (0.20)
Bangsbo Modified Sprint Test * (Fatigue index)	CTG	0.48 (0.09)	0.44 (0.08)	0.37 (0.04)
	PEG	0.34 (0.08)	0.25 (0.07)	0.18 (0.04)

KEY WORDS Soccer, speed, explosive strength, anaerobic power.

P-040 Assessment of anthropometric characteristics and sprint velocity in soccer players from 5 different age groups

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OBJECTIVE There are many studies investigating similarities and differences in anthropometric characteristics and motor capacities of athletes of various age groups. In soccer, some of these studies were developed to provide a better interpretation of the aspects related to growth and maturation and their influence on those who practiced this team sport

regularly. The main objectives of this study were to identify the pattern of the anthropometric characteristics and sprint performance of Brazilian soccer athletes and to compare the values of these variables from a group of subjects divided according to their age in 5 different categories.

METHODS 753 athletes from the Londrina Esporte Clube were assessed between the years 2000:2005, including Anthropometric and motor variables: Height, Body mass, BMI, sum of 7 skinfolds (mm), and linear sprinting performance(s) recorded by a light electronic timing system placed at 0, 10 and 40 m intervals. The 5 categories were: Under 14 (N:100); 16 (N:87); 18(N:169); 21(N:167) and professionals (N:230).

RESULTS The results revealed that the only variables that showed means statistically significant among the five categories were BMI and Body Mass (Table 1). When analyzing the variables Height, Sum of 7 skinfolds and sprints for 10 m and 40 m the five categories presented significant differences among them.

Table 1. The results of anthropometric and motor variables.

Categories	Height (m)	Body mass(kg)	Bmi (kg.m ²)	Sum7skf (mm)	Sprint 10 m(s)	Sprint 40 m(s)
Under 14	1.57 (0.10a)	46.12 (8.61a)	18.50 (1.64a)	64.47 (23.05a/e)	1.78 (0.20a)	6.21 (0.40a)
Under 16	1.71 (0.83b)	61.08 (7.63b)	20.75 (1.54b)	56.15 (15.35b/d)	1.83 (0.44b/c)	5.65 (0.37b)
Under 18	1.74 (0.07c)	65.29 (7.12c)	21.44 (1.58c)	54.51 (13.31b/c/d)	1.79 (0.10b/c/e)	5.50 (0.23c)
Under 21	1.79 (0.06d/e)	71.02 (7.00d)	22.07 (1.61d)	53.49 (13.02 b/c/d)	1.71 (0.14d/e)	5.31 (0.26d/e)
Professionals	1.78 (0.06e)	73.73 (6.43e)	23.15 (1.61e)	60.38 (16.81a/b/e)	1.74 (0.11c/d/e)	5.31 (0.20e)

DISCUSSION The results demonstrated that aging showed significant differences among the five categories in both test and measurements. It seemed that the characteristics and the performances of the athletes were strongly influenced by maturational aspects, the pattern of growth and development as well as the time spent on the regular practice of soccer.

KEY WORDS Brazilian soccer athletes, anthropometric and motor variables.