15. KINANTHROPOMETRY (2)

O-086 A comparison of skinfold thickness measurements and dual-energy x-ray absorptiometry analysis of percent body fat in football players

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OBJECTIVE The method of Dual-Energy X-ray Absorptiometry (DEXA) is considered to be the 'gold standard' for the measurement of bone density and body composition. Skinfold thickness is a commonly used technique for assessing percent body fat, where accuracy depends on the prediction equation being specific to the population assessed. Results of skinfold measurements are occasionally interchanged with those of DEXA for convenience. The purpose of this study was to check the validity of skinfold thickness measurements by callipers as opposed to DEXA, in predicting percent body fat (%BF) in male elite English Premier League football players, and to establish a new prediction equation based upon skinfolds to estimate %BF.

METHODS Players from one Premiership football squad (N = 28; 81.94 ± 9.16 kg; 1.82 ± 0.06 m; 24.1 ± 5.4 years) %BF were assessed using DEXA, and skinfolds of triceps, subscapular, biceps, iliac crest, supraspinale, abdominal, front thigh and medial calf (Withers et al., 1998). Paired t-test and correlation coefficient were used to assess the relationship between the methods; linear regression was used to create new prediction equations.

RESULTS Values for %BF were: DEXA- 11.53 ± 1.61 % and skinfold- 11.20 ± 2.53 %. There was no difference in the players' % BF between the two methods ($P > 0.05$), which were highly correlated ($r = 0.700$; $P < 0.001$). A regression equation specific to elite male football was generated using 8 skinfolds (Equation 1), mean % BF being 11.52 ± 1.22 % ($r = 0.762$).

Equation 1: Fat % = (0.161 x triceps) – (0.033 x subscapular) – (0.005 x biceps) + 0.175 x iliac crest) – (0.123 x supraspinale) + (0.046 x abdominal) + (0.023 x front thigh) + (0.162 x medial calf) + 6.692

DISCUSSION The assessment of %BF can be estimated by skinfolds using the formula of Withers et al. (1998) The novel prediction equation increased the correlation and reduced the TEM, CV% and total absolute difference of %BF, improving accuracy in predicting %BF from skinfolds. In a future study the unexplained variants on repeated use of skinfolds shall be studied in this elite football population.

REFERENCES
Withers et al. (1998) *Journal of Applied Physiology* **85**, 238-245.

KEY WORDS Percent body fat, dual-energy X-ray absorptiometry, skinfold, football.

O-087 Relationship between isokinetic knee strength, anaerobic performance and sprint ability in players of American football

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OBJECTIVE American football has a complex composition and involves combination of factors like anaerobic performance, strength and sprinting abilities. During the game like many other field sports, players perform multiple sprints that require explosive muscular contraction which involve muscular strength and anaerobic power and capacity. The purpose of the study was to evaluate the relationship between isokinetic knee strength, anaerobic performance and sprint-ability in American football players.

METHODS A total of 28 American football players from a university team participated in this study. Isokinetic knee extension and flexion torques were determined at 60º.s-1, 150º.s-1 and 240º.s-1 (Cybex 770 Norm, USA). Wingate Anaerobic Power Test was used to determine the anaerobic performance, and sprint-ability of the players was assessed by single-sprint and repeated-sprint ability tests.

RESULTS Results indicated significant correlation between 60º.s-1 extension and peak (r=0.491) and mean (r=0.466) powers. Similarly 150º.s-1 knee extension was correlated with peak (r=0.559) and mean (r=0.522) powers.240º.s-1 knee flexion was found to be positively correlated with peak power (r=0.418) while 240º.s-1 knee extension was found to be positively correlated with peak r=0.581) and mean (r=0.502) powers.

Table 1. Peak isokinetic knee torques, anaerobic performance and sprint ability of American football players.

Variables	Means (SD)
Knee extension	
60º.s^{-1} (N/m)	134.78 (15.86)
150º.s^{-1} (N/m)	129.75 (20.88)
240º.s^{-1} (N/m)	125.28 (20.61)
Knee flexion	
60º.s^{-1} (N/m)	97.42 (14.29)
150º.s^{-1} (N/m)	94.64 (15.59)
240º.s^{-1} (N/m)	92.64 (14.57)
Peak Power (W)	825.51 (133.97)
Mean Power (W)	611.42 (74.95)
FI (%)	47.62 (10.44)
Single-Sprint time (s)	3.15 (0.36)
Best sprint time (s)	
0-10m	1.64 (0.13)
10-20m	1.35 (0.19)
0-20m	2.99 (0.32)
RSA Total Time (s)	
0-10m	21.16 (1.82)
10-20m	17.96 (2.31)
0-20m	39.12 (4.13)
Performance Decrement (%)	
0-10m	7.83 (3.94)
10-20m	11.59 (10.26)
0-20m	19.42 (14.20)

DISCUSSION Similar to previous studies (Baker et al 1999a and 1999b), the isokinetic knee strength, anaerobic power and capacity were significantly correlated

CONCLUSION As a conclusion it could be said that the isokinetic strength plays an important role in anaerobic power and capacity of American football players. However, these findings also suggested that factors other than strength might contribute to the sprint ability.

REFERENCES

Baker et al. (1999a) *Journal of Strength and Conditioning Research* **13,** 230-235.
Baker et al. (1999b) *Journal of Strength and Conditioning Research* **13,** 224-229.

KEY WORDS Isokinetic knee torque, anaerobic capacity, sprint performance, American football.

O-088 Australian football league draft camp test scores and career success

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OBJECTIVE In many professional football codes, rookie Draft Camps for aspiring players are held annually (McGee and Burkett, 2003; Pyne et al. 2005). Whether this testing process accurately identifies those players most likely to have future career success is not known. This study determined the degree of association between the test scores recorded at the Australian Football League (AFL) Draft Camp and future player success. This was defined as initially being drafted, then making their debut and lastly, by playing 40 (or more) games at AFL level. The level of association between different draft camp test scores was also assessed.

METHODS The AFL Draft Camp measures a number of player attributes. Test results for the years 1999-2003 were used and separated into anthropometric, physical, psychomotor and psychological categories. The association of these

scores with being drafted, draft rank position, number of AFL games played and AFL success (40 or more games) was then analysed.

RESULTS Only 64% of the players, who were tested, were later drafted, with 83% making an AFL debut. Only 39% have since achieved 40 or more games (1999-2001 only considered). Overall, the results produced inconsistent and limited significant associations (of small magnitude) between the AFL Draft Camp test scores and the variables of being drafted, draft rank position, games played and AFL success.

CONCLUSION A number of test scores loaded strongly together (sprints and psychomotor tests) suggesting that some test items are measuring the same ability. Some tests recorded no significant association with any of the success variables for the period studied. In conclusion, the AFL Draft Camp test scores have only a small and practically insignificant relationship with being drafted and future success.

REFERENCES
McGee et al. (2003) *Journal of Strength and Conditioning Research*, **17,** 6-11.
Pyne et al. (2005) *Journal of Science and Medicine in Sport* **8**, 321-332.

KEY WORDS Rookie testing, career success, Australian football, draft camp.

O-089 Chronological versus skeletal bone age in schoolboy footballers

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OBJECTIVE The ability to accurately measure and confirm skeletal age in young soccer players continues to be a challenge for professionals involved in injury prevention. We are unaware of any longitudinal studies published on biological age. The aims of this study were to determine the accuracy of chronological age compared to skeletal bone age, to establish skeletal bone age trends over a five year period and to investigate the proportion of early and late developers.

METHODS Repeated measures, longitudinal study was carried out, with volunteer schoolboys from an English Premier League Football Academy. Left wrist x-rays were taken and bone age assessed with the TW3 and FELs method. ANOVA, with pairwise follow up was carried out on the results. The number of measures was 336 for FELs and 588 for TW3 across a five year period from 2001 to 2005. The age range was 8-16yrs, all boys. Ethical approval and full consent was obtained.

RESULTS ANOVA, with pairwise follow up, showed chronological age and FELs differed significantly compared to the TW3 across all years ($p<0.05$). ANOVA between the eight age groups found significant mean differences for TW3 ($F=380$, $p<0.001$) and FELs ($F=162$, $p<0.001$). The percentage of measurements above, within and below chronological age were 57%, 28% and 15% for FELs and 31%, 32% and 37% for TW3.

CONCLUSION Mean analysis of TW3 and FELs revealed that biological age varied significantly for all age groups across the study period. The use of mean comparison has its strengths statistically but has limited utility in determining early & late developers. TW3 and FELs showed that chronological age is inaccurate to the extent that two out of three cases differ significantly by 12 months from biological age.

KEY WORDS Injury prevention, skeletal maturity, soccer.

O-090 Muscular strength and functional performances in elite and junior elite soccer players: What does preseason testing really teach us?

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OBJECTIVE Muscle strength and anaerobic power of lower extremities are neuromuscular variables that influence performance in many sports activities, including soccer. Despite frequent contradiction in the literature, it may be as-

sumed that muscle strength and balance play a key role in targeted acute muscle injuries. The purpose of the present study was to provide and compare preseason muscular strength and power profiles in professional and junior elite soccer players throughout the developmental years 15-21.

METHODS 57 elite and junior elite male soccer players were assigned to 3 groups: PRO, n=19; U-21, n=20 and U-17, n=18. Players benefited from knee flexors and extensors isokinetic testing consisting in concentric and eccentric exercises. A context of lingering muscle disorder was defined using statistically selected cutoffs . Functional performances were evaluated throughout squat jump and 10m sprint.

RESULTS PRO ran faster and jumped higher than the U-17 ($p<0.05$). Fl and Q absolute PT are shown in Table 1. Individual isokinetic profile permitted the identification of 32/57 (56%) subjects presenting lower limbs muscular imbalance. 36/57 players were identified as having sustained a lower limbs previous major injury. Of these 36 players, 23 still showed significant muscular imbalance (64%).

Table 1. Quadriceps and hamstring peak torques (means ± SD, in Nm) for all modes of contraction and angular velocities in professional (PRO, n=19), U-21 (n=20) and U-17 (n=18) soccer players.

	Quadriceps		**Hamstrings**		**Hamstrings**	
	C 60°.s^{-1}	C 240°.s^{-1}	C 60°.s^{-1}	C 240°.s^{-1}	E 30°.s^{-1}	E 120°.s^{-1}
PRO	224.2^{a} (38.8)	136.9^{a} (18.7)	136.8 (34.1)	100.8 (12.3)	200.1 (52.4)	197.6 (44.2)
U-21	231.7^{a,b} (30.4)	133.3^{a,b} (17.6)	147.1 (23.4)	102.2 (10.8)	194.2 (44.5)	196.8 (39.8)
U-17	194.7 (23.6)	120.3^{a} (15.8)	128.1 (18.8)	92.4 (15.3)	174.6 (36.7)	171.2 (41.6)

C=concentric; E=eccentric. a,b Values represent significant differences ($P < .05$) between modalities of assessment for PRO, U-21,or U-17 groups.

DISCUSSION New trends in rational training could focus more on the imbalance risk and implement antagonist strengthening aimed at injury prevention. Such an intervention would not only benefit athletes recovering from injury, but also uninjured players. An interdisciplinary approach involving the trainers, physical coach, and medical staff is important to consider in implementing a prevention program.

KEY WORDS Muscular strength, vertical jump, sprint, imbalance, injury prevention.

O-091 Physical characteristics and performances of Turkish American football players

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OBJECTIVE American football has been one of the most popular sports in North America within the past century and has recently received support and increased participation in Europe, as has been the case in Türkiye. Despite its development, there has been limited data about American football players attributes in Türkiye. The purpose of this study was to analyse the performance and physiological characteristics of a Turkish American football team, and to determine if body weight (BW), mean body fat (MBF), percent body fat (PBF), body mass index (BMI), flexibility, and playing experience(PE) were correlated with changes in performance in the following events: strength, power, speed, agility, and quickness.

METHODS Fifty-tree men American football players participated in the study. Body composition was evaluated by BIA. Strength was evaluated by max. rep. bench pres (BP) with 65kg. Speed and power were evaluated by 10(10m), 30-meter sprints(30m), vertical jump(VJ), broad jump(BJ) and phosphate recovery test(PR).Agility and quickness were evaluated short shuttle run(9.12m) and 3 Cone Drill tests(3c).

RESULTS Pearson product correlations were presented in Table 1. Increases in age were positively correlated with performance in BP and 9.12m. Increases in BF, MBF, PBF and BMI were positively correlated with increases in BP and PR performance, but negatively correlated with BJ, 10m and 30m performance. Increases in playing experience were positively correlated with performance BP and 9.12m (Table 1).

DISCUSSION These data provide a basic template for the performance characteristics of Turkish American football players and allow comparisons with other studies. Physical and performance properties of Turkish players has been determined as low, although, we have observed harmonious results to literature. Our results can be interpreted as performance of Turkish players will improve as long as training duration and PE are increased (due to correlation between age, P.E. and performance tests).

Table 1. Pearson product correlations.

	Age	Height	Weight	MBF	PBF	BMI	FLEX	PE
Bench pres	.47**	.13	.38**	.30*	.24	.38**	-.06	.48**
Vertical jump	-.07	.14	-.16	-.22	-.27	-.24	-.04	.09
Broad jump	.14	.10	-.31*	-.38**	-.37**	-.39**	.00	.34*
10 m sprint	.19	-.06	.40**	.43**	.39**	.48**	.01	-.03
30 m sprint	-.09	-.04	.45**	.47**	.45**	.52**	-.04	-.26
4.57 m shuttle run (right)	-.31*	.02	.08	.14	.14	.09	.09	-.28*
4.57 m shuttle run (left)	-.33*	.00	.13	.20	.22	.16	.06	-.29*
3 cone drill	-.05	.00	.02	.09	.08	.01	-.05	.10
Phosphate recovery	-.09	.09	.61**	.68**	.66**	.65**	-.08	-.15

MBF= mean body fat, PBF= Percent body fat, BMI= Body mass index, FLEX=Flexibility, PE=Playing experience, ** Correlation is significant at the 0,01 level, * Correlation is significant at the 0,05 level.

KEY WORDS American football, body composition, playing experience, performance characteristics.

O-092 Physical match performance and yo-yo IR2 test results of successful and unsuccessful football teams in the Danish premier league

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OBJECTIVE Recent studies have shown that intermittent exercise performance in tests (Yo-Yo IR1 and IR2) and during games is related to the level of competition (Mohr et al., 2003; Krustrup et al., 2006), e.g. Yo-Yo IR2 performance was higher for Danish Premier League than Second Division players (2). However, it is still unknown whether Yo-Yo results and match activities differ between top, middle and bottom teams in the same league. The aim of the present study was to investigate possible differences in match performance and Yo-Yo IR2 test performance between successful and unsuccessful teams in the Danish Premier League.

METHODS Players from top teams (TT, n=13), middle teams (MT, n=13) and bottom teams (BT, n=13) were video filmed during matches in the Danish Premier League for computerized time-motion analyses. The players were chosen with respect to playing position. Furthermore, 20 players from TT, 22 players from MT and 20 players from BT performed a Yo-Yo IR2 test. Differences were evaluated by one-way ANOVA tests.

RESULTS Yo-Yo IR2 results were 12% and 28% better ($p<0.01$) for players in TT than MT and BT, respectively, and 14% better ($p<0.05$) in MT than BT. In the most intense 5-min period, TT and MT sprinted 42-46% more ($p<0.01$) and ran 31-38% longer ($p<0.05$) at high intensity (≥15 km/h) than BT. Over 90 min, TT and MT sprinted 25-33% longer ($p<0.01$) than BT. Total distance covered was not different between groups.

CONCLUSION Successful teams performed better in the Yo-Yo IR2 test than unsuccessful teams in the same league. Moreover, players in successful teams perform more high speed running and sprinting in the most intense periods and more sprinting over 90 min. In line with previous studies (1,2), these findings suggest that the ability to perform intense intermittent exercise is an important component in elite football.

REFERENCES
Mohr et al. (2003) *J Sports Sci* **21,** 519-528.
Krustrup et al. (2006) *Med Sci Sports Exerc* **38**, 357-368.

KEY WORDS Yo-Yo intermittent recovery test, intermittent exercise, sprinting, level of competition.