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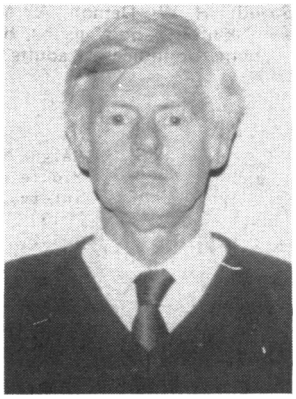

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AUSTRALIAN RULES FOOTBALL: AN ANTHROPOMETRIC STUDY OF PARTICIPANTS

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ABSTRACT

Anthropometric measurements and personal data were collected from 119 Australian Rules Footballers from Victoria. A top level professional league team, a second level association team, and an A-grade amateur association team were observed, representing three levels of ability. The profile of physical features of these athletes at the beginning of the season is presented.

A gradation of body size was observed between teams. The players in the top level team were slightly taller and heavier than those in the other teams. They had less body fat, as shown by lesser skinfold thicknesses, a smaller percentage body fat as determined by prediction equations, and a greater fat-free mass. The intermediate level team showed an intermediate level of body fat and the lower level team had the highest proportion of fat.

INTRODUCTION

Australian Rules Football has developed into a widely played sport in Australia, with major leagues existing in more than half the states. The game enjoys popular player and spectator involvement at levels from professional league to junior school. Like other codes of football, Australian Rules requires a combination of physical skills and qualities which include endurance, strength, power, agility and speed. The duration of the game is approximately two hours, with each quarter lasting twenty-five minutes plus a "time-on" period. Each team consists of eighteen players on the field plus two interchange players who are substituted throughout the game. Field positions include backs, forwards, rucks, who contest for the ball from an umpire's bounce, rovers or running players. The game favours a flowing, running style of play highlighted by leaping to punch or catch ('mark') the ball. Tackling and body contact are emphasised but no protective clothing is worn by players, other than on occasion, a light cyclist's helmet.

The body composition and anthropometry of elite athletes has been the subject of much research. The practising athlete might be expected to exhibit structural and functional characteristics that are specifically favourable for the sport, and thus separate him from the general population and from athletes involved in other sports. Such differences in body physique might reflect (a) genetic characteristics that have been selective in determining athletic pursuit and (b) changes due to the conditioning effect of high level training.

Different combinations of features that confer specific advantages to the physical performance may be observed in the elite athlete, according to the special skills required for that particular sport. Physical profiles of many groups of sportsmen have been reported; including basketball players (Parr et al, 1978), racquetball players (Pipes, 1979), volleyball players (Sodhi, 1980), hockey players (Sidhu and Sodhi, 1979), synchronised swimmers (Moffat et al, 1980), cyclists (Burke, 1980), weight trained athletes (Fahey, 1975) distance runners (Costill et al, 1970; Pollock et al, 1977) walkers (Franklin et al, 1981), wrestlers (Sinning, 1978) track and field athletes (Khosla, 1978), Canadian football players (Adams et al, 1982), Rugby players (Bell, 1973; 1980), American football players (Burke et al, 1980; Wickkiser and Kelly, 1975; Wilmore and Haskell, 1972), and soccer players (Raven et al, 1976). The extent of the differentiating effect of the body composition and anthropometry of the athlete might be related to the level at which the sport is played and performance achieved. That is, there may be a gradation in expression of the body physique characteristics according to the talent of the athlete or the level of the active participation in the sport.

Studies have found differences in the physical characteristics of first class and second class Rugby Union players (Bell, 1973), and between college and professional American footballers (Wickkiser and Kelly, 1975).

A preliminary study has looked at the anthropometric characteristics of Australian Rules Footballers (Burke, 1981) and following this, a more detailed study was begun on three groups of football players at different levels of competition, with the aim of building up a more detailed physical profile. It was aimed also to investigate a possible gradation of physical characteristics, according to the level of competition.

SUBJECTS AND METHODS

The subjects were 119 Australian Rules footballers, chosen from the senior team lists of three clubs at different levels of competition in Victoria.

Team 1: top level professional league (n = 44)
Team 2: lower level professional association (n = 42)
Team 3: A-grade amateur association club (n = 33)

Observations were made on training nights during the first weeks of the competitive season. Personal data were recorded including age, years of play, number of senior games, position of play, hours and type of training per week over the last month, occupation, and other sports played at high levels. It was felt that these last two items might account for other conditioning effects. The players were also asked their ideas about ideal playing weight.

ANTHROPOMETRIC MEASUREMENTS

A number of anthropometric characteristics were selected for study after considering the ease of taking the measurement, and its value in relation to expected characteristics and use in body composition prediction equations. The characteristics examined were:—

Height
Body mass
Circumferences: mid-upper arm, forearm, chest, mid-abdomen.
Skinfold thicknesses: triceps, biceps, mid-axillary, chest, subscapular, supra-iliac, abdomen, anterior thigh.
Diameter: wrist

Calculations were made of body mass index (weight divided by height squared) and of mid-arm muscle circumference (mid-upper arm circumference $-\pi$ x triceps skinfold).

Measurements were taken on the non-preferred side of the body, according to literature techniques (Durnin and Womersley, 1974). Harpenden skinfold calipers were used to take skinfold measurements and wrist diameter was measured using a vernier caliper.

CALCULATION OF BODY COMPOSITION

Laboratory assessment of body composition was not possible for this field study. An estimate of body density was obtained from anthropometric measurements using prediction equations from literature studies. The errors involved in this method, and the limitations of its application, are recognised (Sinning, 1980). Two prediction equations were chosen for our study. The first (Durnin and Womersley, 1974) was derived from a study of a general male population and is probably the best known and most widely used equation.

Body density (B.D.) = 1.163 − 0.0632 log (triceps skinfold + biceps skinfold + supra-iliac skinfold + subscapular skinfold)

The need for a population specific prediction equation is acknowledged. The second equation chosen (Wickkiser and Kelly, 1975) was derived from a study of American football players, who might be expected to share similar characteristics to the study group.

B.D. = 1.10148 − 0.00118 x mid-abdominal circumference − 0.00114 x triceps skinfold + 0.00044 x height.

The Siri equation (1956) was used to convert body density to percentage body fat.

$$\text{Percentage fat} = \left(\frac{4.95}{\text{Body density}} - 4.50\right) \times 100$$

The average of body fat percentages from these two equations was also calculated, and fat-free mass was estimated by subtracting the weight of body fat from total body mass.

RESULTS AND DISCUSSION

Player characteristics are shown in Table I. Team 1 had undertaken an intensive pre-season training schedule, and all players had been instructed to include weight training. Team 2 players had done a shorter preparation whereas for Team 3, many players had not been involved in any organised pre-season training. Weight training was not compulsory in these two clubs, and few players included this regularly in their exercise programs. When asked for their ideas about ideal playing body mass, it appeared that most players had little understanding of desirable physical features for athletic performance. A high body mass was prized by many, without distinguishing between body fat and lean body tissue.

Table I Characteristics of players: beginning of season.

	Team 1 (n = 44)		Team 2 (n = 42)		Team 3 (n = 33)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Age (yrs)	23.2	3.2	22.4	3.2	22.8	2.9
Years of play	4.8	4.0	3.3	3.0	3.9	2.5
Senior games	56.6	56.2	28.3	43.8	43.6	47.7
Training (hr/wk)	8.5	2.7	8.0	3.4	4.7	3.0

Results of anthropometric measurements are presented in Table II and body composition calculations are shown in Table III. Levels of significance were tested using Duncan's Multiple Regression Analysis.

Table II Anthropometric measurements on each of the three teams.

	Team 1 (n = 44)		Team 2 (n = 42)		Team 3 (n = 33)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Height (m)	1.81	0.07	1.79	0.07	1.78	0.06
Body Mass (kg)	80.2	6.9	77.4	5.9	77.1	6.8
Body Mass Index	24.3	1.3	24.2	1.8	24.2	1.8
Circumference (cm)						
– mid-upper arm	31.9	1.9	30.5	1.8	30.7	1.8
– mid-arm muscle	29.2	2.0	27.2	1.7	27.1	1.9
– forearm	28.8	1.4	28.2	1.0	28.1	1.2
– chest	100.5	4.7	98.2	4.1	97.3	4.0
– mid-abdomen	84.4	3.8	84.3	5.1	84.8	4.4
Skinfolds (mm)						
– triceps	8.5	2.9	10.4	4.4	11.4	4.8
– biceps	3.9	0.9	4.1	1.1	4.9	1.6
– mid-axillary	6.9	2.0	7.7	3.5	8.6	2.4
– chest	7.0	2.1	8.0	4.3	8.9	3.5
– subscapular	9.9	2.0	10.4	2.9	11.1	2.8
– supra-iliac	12.7	4.0	14.8	5.2	16.6	5.5
– abdomen	11.6	4.5	12.4	5.3	15.5	6.0
– thigh	8.4	3.4	10.1	4.0	11.2	5.0
Diameter (mm)						
– wrist	62.0	3.4	60.7	3.0	60.6	2.5

Table III Body composition as predicted from empirically derived equations.

	Team 1 (n = 44)		Team 2 (n = 42)		Team 3 (n = 33)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Body fat % (1) (Durnin and Womersley, 1974)	14.3*	2.5	15.7	3.3	16.9	3.4
Body fat % (2) (Wickkiser and Kelly, 1974)	11.7**	2.5	13.2	4.3	14.0	3.9
Body fat % mean of (1) + (2)	13.0**	2.5	14.4	3.7	15.4	3.6
Body fat (kg)	10.5	2.6	11.3	3.5	12.0	3.4
Fat-free mass (kg)	69.6***	5.3	66.1	4.3	65.1	5.1

* Team 1 < Team 3, $p < .01$ Team 1 < Teams 2 & 3, $p < .05$
** Team 1 < Team 3, $p < .05$
*** Team 1 > Team 3, $p < .01$

On examination, the players in the top level of the present study tended to be slightly taller and heavier although this difference is not statistically significant. Body mass index was consistent in all teams.

Skinfold measurements were consistently less in the top level team. Arm circumferences were greater in these players, and by subtraction of the lower subcutaneous fat measurements, larger muscle circumferences were indicated.

A gradation in body fat estimates was shown by both body fat prediction equations, with the lowest percentage in the top team. The difference between the calculated body fat from each equation is fairly consistent at all levels. Using equation 1, the predicted percentage body fat for Team 1 was found to be significantly less than Team 2 and 3 ($p < .05$) and significantly less for Team 1 and 3 ($p < .01$). Predicted percentage body fat using equation 2 was found to be significantly less for Team 1 than Team 3 ($p < .05$).

The predicted fat-free mass was found to be significantly higher in Team 1 than Teams 2 and 3 ($p < .05$) and higher in Team 1 than Team 3 ($p < .01$).

Table IV presents a comparison of the physical characteristics of players in this study with those reported in studies of other football codes. The Australian Rules footballers in comparison with players in other football codes appear to be lighter and slightly shorter than American, Canadian and Rugby Union forward players. However, they are taller and heavier than soccer players. Although body composition estimation methods vary, it would seem that percentage body fat at the professional level of the American, Canadian and Australian football codes (13-16%) is greater than for soccer players (10%). Fat-free mass is greater in American footballers and Rugby Union forwards, than soccer and Australian Rules players.

CONCLUSION

Anthropometric measurements and personal data were collected from 119 Australian Rules footballers from Victoria. The teams represented three levels of professionalism and standard of play: the top level professional league (Team 1), a second level association (Team 2) and the A-grade amateur association (Team 3). Within the present study group, a gradation in body size was observed between teams. The top level team players were slightly taller and heavier than the other teams. They had less body fat as shown by lesser skinfold thicknesses, a smaller percentage body fat as determined from prediction equations, and a greater fat-free mass. The intermediate level team showed an intermediate level of body fat and the lower level team the highest proportion of fat.

It would be of interest to continue such a study to document changes in anthropometry and body composition during the season and also to attempt an analysis of characteristics specific to field positions. The determination of specific regression equations to predict body fat in this population would also be advantageous.

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Table IV Body composition of players in different football codes.

Code	Level	Reference	Method	Height (cm)		Weight (kg)		Body fat (percent)		Fat-free mass (kg)	
				Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
American football	Small college	Wickkiser & Kelly, 1975	Underwater weighing	182.5	5.75	88.0	12.12	15.0	5.85	74.0	6.51
	Major college	Burke et al, 1974	Estimates from skinfolds	185.2	5.3	95.1	10.3	18.3	8.5	77.7	9.5
	Professional	Wilmore & Haskell, 1972	Underwater weighing	190.2	–	107.0	–	16.2	–	90.9	–
Rugby Union (forwards)	College	Bell, 1980	Underwater weighing	182.6	6.2	89.1	9.4	14.6	3.8	75.96	7.33
Soccer	Professional	Raven et al, 1976	Underwater weighing	176.3	–	75.7	–	9.59	0.73	68.3	–
Canadian football	Professional	Adams et al, 1982	Estimates from skinfolds	184.3	5.0	96.1	13.1	15.3	3.9	–	–
Australian football	Top Professional	Present study	Estimates from skinfolds	181	7	80.2	6.9	13.0	2.5	69.6	5.3
	Lower Professional			179	7	77.4	5.9	14.4	3.7	66.1	4.3
	Amateur			178	6	77.1	6.8	15.4	3.6	65.1	5.1