

BODY COMPOSITION OF RUGBY UNION FOOTBALL PLAYERS

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The components of body composition were studied in 56 second class rugby union football players: 28 forwards and 28 backs. Forwards were found to have 19.5% TBF (TOTAL BODY FAT) and 80.5% LBM (LEAN BODY MASS); backs 12.2% TBF and 87.8% LBM. It was felt that greater attention should be given to the ratio of TBF to LBM in determining body weight and that there should be an increased emphasis of the LBM at the expense of TBF.

INTRODUCTION

Body size and composition are important characteristics of the practicing athlete. It is well known that successful participation in competitive sport is to some extent determined by size. It is only fairly recently, however, that the functional importance of body composition in athletes has emerged. As a consequence a variety of athletic groups have now been studied.

One of the groups for which there is a limited amount of information is the rugby union football player. Estimates of lean body mass and total body fat have previously been assessed for a college group (Bell, 1973a) using the equations of Wilmore and Behnke (1969). Forwards were found to have higher lean body mass and total body fat values than backs. The distribution and comparison of skinfolds has also been made between forwards and backs. Forwards were found to have consistently larger skinfold values than backs at a number of sites (Bell, 1973b). Because of the limitations of these studies the objective of the present investigation was to describe and analyse the components of body composition of a group of second class rugby union football players.

METHODS

Subjects were selected from a student population and consisted of those players who over a three year period had been regular playing members of the senior squad.

A total of 56 players were studied: 28 forwards and 28 backs. Each player was classified according to his playing position. For forwards the positions were prop, hooker, lock, flanker and number 8; for backs, scrum-half, outside-half, centre-threequarter, wing three-quarter and full-back. The mean age of the group was 21.0 years.

Anthropometric measurements

Anthropometric measurements were taken according to the recommendations of Weiner and Lourie (1969). Total body mass was measured to the nearest 0.1 kg. Skinfold thicknesses were taken on the left hand side of the body at the biceps, triceps, subscapular and supra-iliac sites.

Body density

Measurements of body density were determined by hydrostatic weighing. Each subject was seated in water heated to within 30-35°C. A forced maximal expiration was made before underwater weight was recorded. A minimum of 10 determinations were taken because of the known learning effect associated with repeated trials (Katch, 1969). The mean of the last 3 trials was used as the final underwater weight.

A correction was made for residual volume using the closed circuit 3-breath nitrogen dilution technique of Rahn, Fenn and Otis (1949). Triplicate measurements were made and the mean used as the final value. Where measurements did not show good agreement additional values were taken.

The content of the re-breathing bag was analysed using a O₂ analyser (Servomex A0250) and an infra-red CO₂ analyser (P.K. Morgan). Both instruments were calibrated frequently using determined gas mixtures. Nitrogen was obtained by subtraction.

Total body fat (TBF) was calculated from body density using the equation of Siri (1956):

$$\text{Fat \%} = \left[\frac{4.95}{\text{density}} - 4.50 \right] \times 100$$

Lean body mass (LBM) was found by subtraction of TBF from the total body mass.

Statistical techniques

To test for differences between the playing positions themselves one-way analyses of variance were made separately within the forward and back positions. Where no differences existed between the positions in any variable the data were pooled. Tests of significance (t - ratio) were then applied between the forwards and backs in these variables. Where an F -test was significant post hoc differences were identified using the Scheffe test.

RESULTS

The mean values and standard deviations of variables in the forward positions are given in Table I. The weight of the LBM was the only variable found to be significant ($P < 0.05$). This was due to the differences between the positions of hooker and lock.

TABLE I

Mean values and standard deviations of body composition measurements for forwards

	Prop (N = 6)	Hooker (N = 6)	Lock (N = 5)	Flanker (N = 6)	No. 8 (N = 5)
Body Mass (kg)	85.35 4.63	73.21 6.25	89.92 4.97	86.44 4.49	83.28 5.46
Density (10^3 kg.m^{-3})	1.044 0.009	1.046 0.008	1.049 0.005	1.047 0.012	1.050 0.010
TBF (%)	20.96 3.25	20.24 2.29	18.82 1.74	19.80 4.53	16.90 3.83
TBF (kg)	17.93 3.25	14.86 2.68	16.95 2.03	16.99 3.60	13.87 2.43
LBM (%)	79.04 3.27	79.76 2.92	81.18 1.74	80.20 4.53	83.10 3.83
LBM (kg)	67.42 3.94	58.35 4.88	72.97 3.84	69.45 6.86	69.41* 7.83

* $P < 0.05$

Values for backs are listed in Table II. There were no significant differences identified between positions in any of the variables ($P < 0.05$).

Because of the uniform nature of measurements between the positions within the back division it was possible for the data to be combined. Apart from the weight of the LBM this was also true for forwards.

Tests of significance were made between the forwards and the backs. Differences were found in all variables except the weight of the LBM ($P < 0.05$). Mean values and standard deviations of variables for forwards and backs are given in Table III.

TABLE II

Mean values and standard deviations of body composition measurements for backs. All values $P > 0.05$.

	Scrum half (N = 5)	Outside half (N = 4)	Centre (N = 7)	Wing (N = 7)	Full back (N = 5)
Body Mass (kg)	71.02 6.80	70.87 4.84	74.09 2.89	73.65 3.83	78.49 4.67
Density (10^3 kg.m^{-3})	1.062 0.009	1.079 0.007	1.067 0.007	1.068 0.009	1.063 0.012
TBF (%)	14.01 3.45	8.14 2.62	12.20 2.70	11.89 3.33	13.87 4.42
TBF (kg)	9.89 2.25	5.85 2.23	9.02 1.95	8.77 2.65	11.03 4.13
LBM (%)	85.98 3.45	91.85 2.62	87.79 2.70	88.10 3.33	86.12 4.42
LBM (kg)	61.13 6.47	65.02 2.73	65.07 3.53	64.88 3.76	67.46 2.38

TABLE III

Mean values and standard deviations of body composition measurements for forwards and backs

	Forwards (N = 28)	Backs (N = 28)
Body Mass (kg)	83.43 7.72	73.76 ** 4.87
Density (10^3 kg.m^{-3})	1.048 0.01	1.067** 0.01
TBF (%)	19.49 3.76	12.17 ** 3.90
TBF (kg)	16.17 3.31	9.02 ** 3.17
LBM (%)	80.51 3.76	87.83 ** 3.90
LBM (kg)	67.26 7.67	64.74 NS 4.77

** < 0.001 NS = not significant

DISCUSSION

Forwards have been shown to be distinctly different from backs in the components of body composition. The mean density value of forwards was $1.048 (10^3 \text{ kg.m}^{-3})$ giving 19.49% of the body weight as fat (range 14%-26%) and 80.51% as the LBM. For backs the mean density value was $1.067 (10^3 \text{ kg.m}^{-3})$ providing

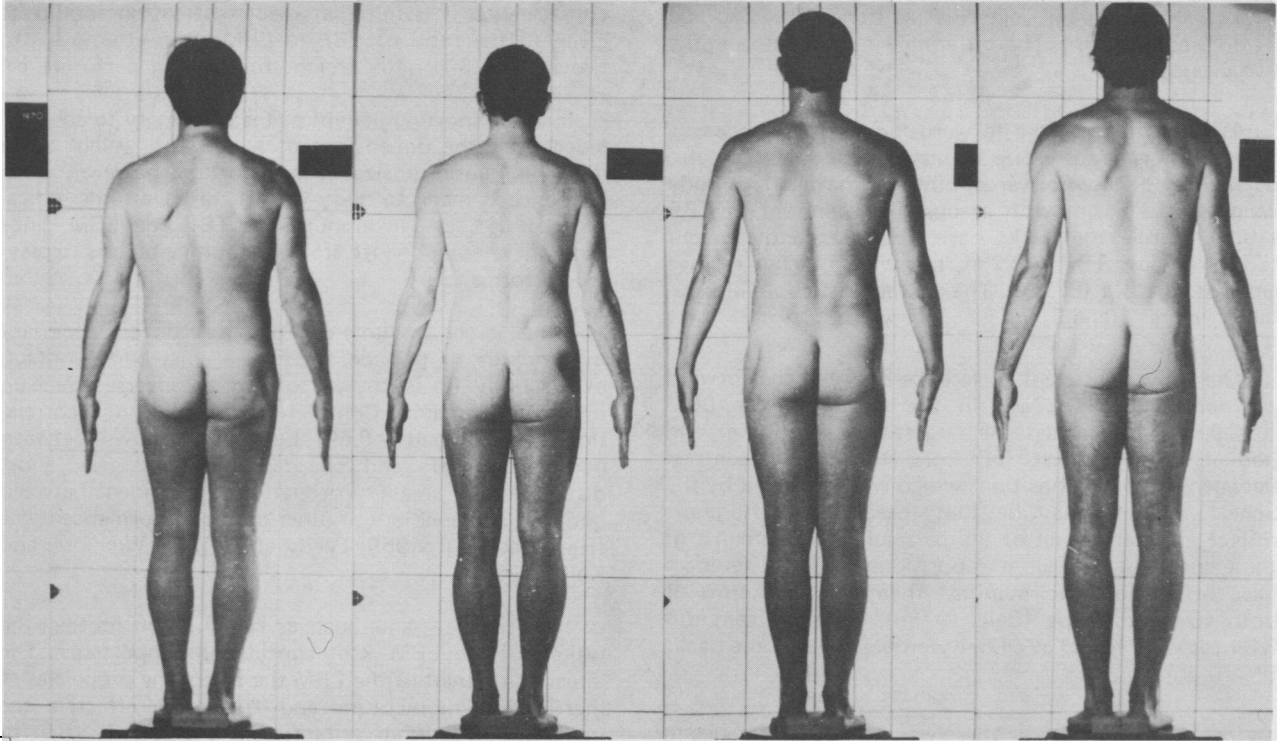


Figure 1 Forwards: hooker, flanker, No. 8, and lock.

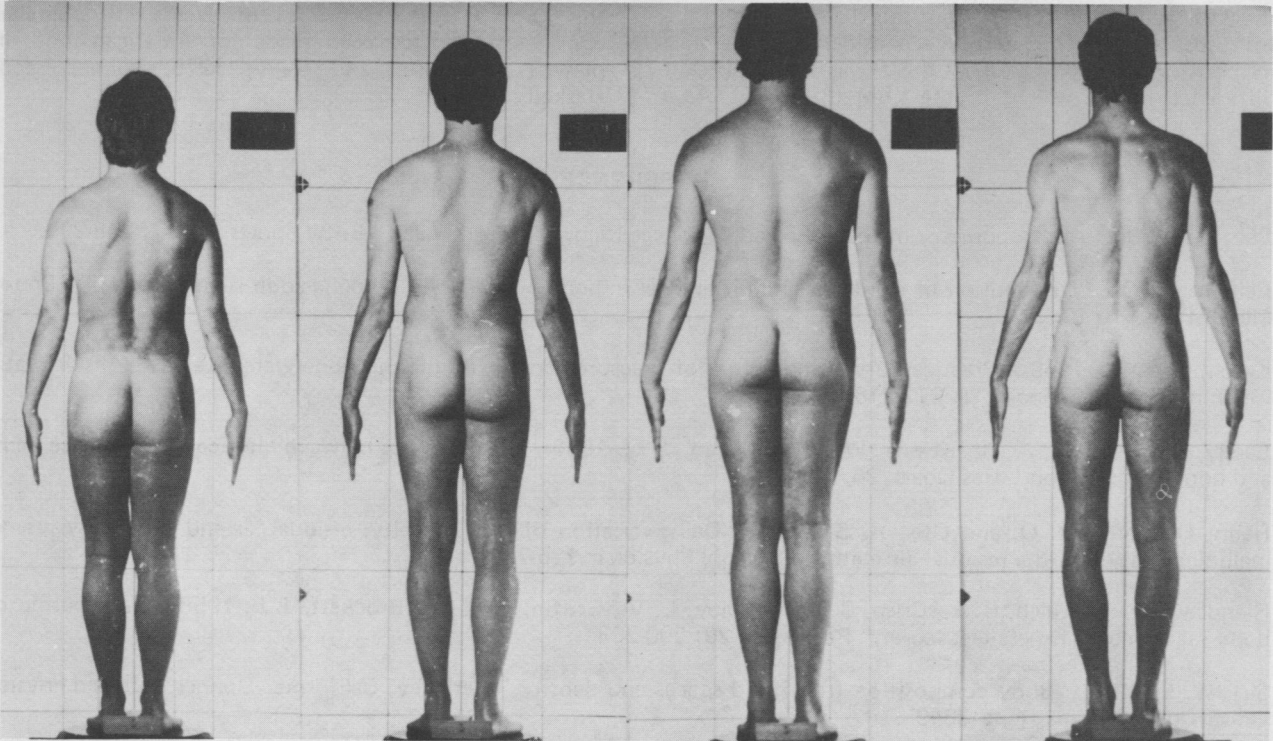


Figure 2 Backs: scrum-half, outside-half, centre and wing.

12.17% of the body weight as fat (range 6%-22%) and 87.83% as the LBM. The difference in TBF between the two groups was 7.3%.

As a playing unit the forwards appear to consist of a fairly homogeneous group of players; the same can also be said for backs. Forwards, however, have a large body weight (83 kg) but with a substantial amount of TBF (19.5%) while the backs have a smaller body weight (73.8 kg), less TBF (12.2%), but with a higher relative amount of LBM (87.8%). The characteristics are illustrated in figures 1 and 2.

The only significant difference between the forward positions themselves was in the weight of the LBM ($P < 0.05$). Locks had the largest values (73 kg) and hookers the smallest (58 kg). It was the contrast between these two positions which was identified by the Scheffe test. It may be that these LBM differences reflect another aspect of the particular requirements of these specialist ball-winning positions. Other differences have been shown to manifest themselves in terms of both size and shape (Bell, 1973b). No significant differences were found at all between positions in the backs ($P > 0.05$).

In the present sample there was a 9.7 kg difference in body weight between forwards and backs. The weight of the TBF accounted for 7.2 kg of this difference, and the LBM just 2.5 kg. Thus despite a considerable difference in body weight ($P < 0.001$) there was no significant difference in the weight of the LBM ($P > 0.05$). As a

consequence it is felt that greater attention should be given to the ratio of TBF to LBM when attempting to provide optimal body weight for playing performance.

In most sporting activities it is customary to acknowledge only the dimensions of height and weight when describing absolute size. It is important, however, when reference is made to body weight, to have some indication of the relative amounts of TBF and LBM, since both these components are contributory factors to playing performance.

While larger amounts of TBF are probably necessary in forwards to provide a buffer against body contact, excess body fat is known to have an adverse effect on motor performance. Considerable sized negative correlations (-0.52 and -0.69) have been shown between percentage TBF and speed of running over short distances; and smaller correlations are evident between body fat and a variety of other motor performance items (Riendeau et al, 1958; Leedy et al, 1965; Wickkiser and Kelly, 1975).

In a contact game such as rugby union football the weight of the LBM is of considerable importance. The larger the weight of the LBM the better the properties of inertia and momentum and the more effective the impact at or during contact; this is especially true for forwards. There should thus be an increased emphasis of the LBM at the expense of of excess TBF. Similar considerations have been made for American football players (Wickkiser and Kelly, 1975; Wilmore and Haskell, 1972).

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OBITUARY

Dr. Peter John BURROWS, MA, MB, BChir, DObstRCOG

The sudden and tragic death of Dr. Burrows, only a few days before he was due to attend the BASM's annual sports medicine course, has been shattering news to us all, especially as his death occurred after he collapsed while jogging. He was a keen exponent of physical fitness, and of the value of exercise in the prevention and treatment of degenerative disease. Although not in good health at all times, he continued to set an example to his friends and colleagues, and especially to the players of Luton Town Football Club, to whom he was the medical adviser. He was also medical adviser to the Football Association, to whom he gave sound service over many years. He was medical adviser to the Bedfordshire Amateur Boxing Association as well, and his death will leave a big gap in sporting circles in the county.

Dr. Burrows obtained his BA and subsequently MA at the University of Cambridge, and did his clinical studies at St. Bartholomew's Hospital, where after qualifying in 1955 he served as a house officer in paediatrics, obstetrics and gynaecology, then accident and orthopaedic surgery. He continued his interest in traumatology as a clinical assistant at the Luton and Dunstable Hospital, where he was able to extend his interest in sports medicine. To his widow and children we offer our sincere condolences, and hope, with his colleagues, that his sad death will not hinder the growing interest in fitness preservation in the community, though warning doctors that care must be taken when prescribing exercise as with any other therapy.

H. E. Robson