

ANTHROPOMETRIC, PHYSICAL, MOTOR, AND GAME-SPECIFIC PROFILES OF ELITE U 16 AND U 18 YEAR-OLD SOUTH AFRICAN SCHOOLBOY RUGBY PLAYERS

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Abstract:

At present, little is known about elite schoolboy rugby players in South Africa and internationally. To obtain the profile of elite schoolboy rugby players, young players must be tested and monitored to compile norms for them. The aim of this study was to identify the characteristics of the elite U 16 and U 18 schoolboy rugby players in South Africa with reference to anthropometric variables, physical and motor abilities, and game-specific skills. The research group consisted of U 16 year-old ($n = 71$) and U 18 year-old ($n = 75$) elite South African school boy rugby players, also known as the Green Squad of the South African Rugby Union (SARU). The two elite groups were tested during 2003 and 2004 on six anthropometric variables, seven physical and motor ability tests and five game-specific skill tests. Descriptive statistics and practical significant differences (d -values) between the 2003 and 2004 season for the two age groups were computed. Regarding game skills there was a decrease in passing skills in both age groups from 2003 to 2004. Norm scales were compiled for further use by sport scientists and coaches in talent identification.

Key words: rugby union, anthropometry, motor abilities, U 16 players, U 18 players

Introduction

Rugby union is a popular sport played in more than a 100 countries worldwide. In South Africa rugby is a major sport compared to other playing countries such as Australia, England, France, Ireland and Scotland where it is only third, fourth or fifth most popular sport (SARFU, 2003c, p. 11). Rugby consists of various motor activities that require certain anthropometric, physical and motor as well as rugby-specific components. These components are specific to the positional requirements in rugby (Craven, 1974; De Ridder, 1993; Noakes & Du Plessis, 1996; Malan & Hanekom, 2001; Van Gent, 2003). Du Randt and Headley (1993, p. 112) stated that the process of talent identification in South Africa was uncontrolled and in the beginning phase. Since then scientific research on talent identification of young rugby players in South Africa has been done by De Ridder (1993), Pienaar and Spamer (1995, 1998), Hare (1997) and Van Gent (2003), to name just a few. Research has been done regarding positional requirements (Van Gent, 2003) in the adolescent rugby player category. However, still little is known about the elite schoolboy rugby players in South Africa and internationally.

One of the reasons for South Africa being the leader in world rugby is the neglect of one of the most important components of the present day rugby game, namely, conditioning of young

players (Gilbert, 2004, p. 21). In 1994, after the empowerment of the African National Congress (ANC), priority was given to sport development. A policy was compiled in 1995, highlighting the need and importance of a scientific identification and development programme of talented sportspeople (South Africa, 1996). According to News24.com, SARFU has identified the under-16 (U 16) age group schoolboys as the first level of talent identification (SARFU, 2003b, p. 1). With this new player identification and development strategy, the aim was to deliver the majority of Super 12 and Springbok players, and to carry SA rugby through to the 2011 World Cup. In South Africa, U 19 and U 21 year-old players represent the country internationally, therefore, it is important to identify talented rugby players at an early age. To achieve this, a junior and youth programme was implemented at school level. The programme includes game-related core competencies such as talent rugby tournaments, coaching and team selection (SARFU, 2003a, p. 2).

An outcome of this study is the compilation of a profile of the U 16 and U 18 rugby players, with reference to anthropometric variables, physical and motor abilities, as well as game-specific skills which will serve as a guide to school, provincial and international coaches on team selection and individual training programmes. A further contri-

bution is that this research will support SARU in the process of identifying and developing young rugby players. Furthermore, this study also forms a part of an international research project on the talent identification and the development with elite young rugby players at school level between South Africa, New Zealand and England. On the results of the comparison of these international data will be reported later.

The aim of this study was to identify the characteristics of U 16 and U 18 elite rugby players in South Africa with reference to anthropometric variables, physical and motor abilities, as well as game-specific skills.

Methods

The research group consisted of all the U 16 ($n = 71$) and all U 18 ($n = 75$) elite South African rugby players, also known as the Green Squad of SARU (U 16 means fifteen-year-olds and U 18 refers to seventeen-year-olds). The Green Squad was chosen at the end of the U 16 (Grant Khomo) and U 18 (Craven Week for High Schools) rugby week in 2003. The Green Squad consisted of all population groups and had representation in all provincial teams in South Africa. The test protocol (anthropometric, physical and motor, as well as game-specific) as compiled by SARU was used and this battery of tests was executed during the mid-season of 2003 and 2004 at each age group. Qualified sport scientists received formal training in the specific test method that was used and in the recording thereof. The Green Squad followed a training programme, compiled by SARU, during the mid-season (August 2003 to February 2004). The training programme consisted of four training sessions per week, of sixty (60) minutes each. Training sessions constituted weight training twice a week, cardiovascular training and running skills three times per week, plyometrics once a week and handling skills twice a week. The first weight training session was with free weights whilst the second weight training session was comprised of deadlifts, power cleans, power shrugs, military press and lateral pull-downs. During the weekends, players were encouraged to do swimming, spinning or treadmill running. During this period the Green Squad attended two National training camps at a central venue. After the training camps, the training programme was followed by the players in their respective provinces. The same players that were tested in 2003 were also tested during 2004. Unfortunately, a small number of the elite players were injured during the 2004 testing period and were not evaluated.

The battery of tests consisted of the following:

- 1) anthropometric data according to Lohman, Roche, and Martarell (1988) and Ross and Marfell-Jones (1991):

- body mass (kg),
- stature / body height (cm),
- sum of seven skinfolds (triceps, biceps, subscapular, suprailiac, calf, thigh and abdominal skinfolds – in millimetres),
- body fat percentage,
- girths (flexed upper arm, calf, sub-gluteal, midthigh, knee and forearm – in centimetres),
- breadths (humerus, femur – in centimetres),
- muscle mass (%) and
- somatotype (endo-, meso- and ectomorph);

- 2) the physical and motor tests:

- speed (10-m and 40-m running) (Hazeldine & McNab, 1991) - in seconds,
- explosive leg power (vertical jump) (Thomas & Nelson, 1985) - in centimetres,
- agility (Illinois-test) (AAHPER, 1966) - in seconds,
- strength (1RM bench press - in kilograms; pull-ups and push-ups - in number per minute) (Thomas & Nelson, 1985) and
- speed endurance (multistage shuttle run - in seconds) (Lèger & Lambert, 1982).

- 3) rugby-specific skills tests:

- ground skills ability (pick-up and place) (Australian Rugby Football Union, 1990) - in seconds,
- passing for accuracy ability over 4 m (Pienaar & Spamer, 1995) – number,
- passing for distance ability (AAPHER, 1966) - in metres,
- kicking ability (kicking for distance) (AAPHER, 1966) - in metres,
- catching ability (catching and throwing over the cross-bar) (Hare, 1997) - number.

Descriptive statistics (mean, standard deviation, minimum and maximum values) were used as well as practical significant differences (d -values) (Cohen, 1988). To comment on practical significance, the standardised difference between the means of two populations, i.e. the difference between the two means divided by the highest standard deviation was used. The measure that was introduced is called the effect size. The effect size makes the difference independent of units and sample size, and relates with the spread of the data (Steyn, 1999, 2000).

Results and discussion

Although the aim of this study was to compile a status profile of the U 16 and U 18 elite school-boy rugby players as well as a physical and game skills profile for different playing positions of the U 16 and U 18 elite rugby player category in South Africa, for this discussion of the results attention will be given to the three major components, i.e.

anthropometric, physical and motor, and game-specific components for the two different age groups as a whole. This will be done by means of descriptive and inferential statistics (Tables 1, 2 and 3). In the discussion of the results of this study on elite South African fifteen- and seventeen-year-old players the data will be compared with a few similar studies which used the same battery of tests that were done in South Africa and England.

According to the characteristics of anthropometric variables of U 16 and U 18 players in Table 1 no medium or high practical significant changes were found amongst U 16 year-olds for all the variables that were measured from the 2003 to the 2004 season. If the mean values of the different components were compared to other research, the following can be reported.

The average stature of 178.1 cm that was recorded during the 2004 season for the U 16 year-olds compared well with the results of Van Gent (2003) who recorded an average of 180.8 cm among elite provincial players and also with the study of Hare (1997) who recorded 177.6 cm among fifteen-year-old regional players in South Africa. Comparing body mass of this study (\bar{x} =79.5 kg) with the studies of Van Gent (\bar{x} =76.6 kg) and Hare (\bar{x} =72.8 kg) shows that the U 16 South African national elite rugby players were heavier than their regional counterparts. Both the studies of Van Gent (\bar{x} =15.9%)

and Hare (\bar{x} =18.7%) showed a higher percentage of fat than the elite South African boys (\bar{x} =15.0%).

In summary, the results of this study, together with the other similar studies on U 16 national elite rugby players, revealed that the elite South African players were taller and heavier than the talented players in Hare's study (1997), heavier than their counterparts in Van Gent's study (2003), but the elite regional players in Van Gent's study (2003) were 2.7 cm taller. The South African U 16 elite rugby players in this study also had a lower fat percentage than their counterparts in Van Gent's and Hare's study. Thus, it showed that the national elite players had less body fat percentage than the provincial elite players.

Table 1 also displays the anthropometric results of the U 18 year-old elite South African player. As with the U 16 year-old players, no medium or high practical significant differences were found between 2003 and 2004. Comparing with other similar research, the provincial players in Van Gent's study (2003) presented a taller stature (\bar{x} = 184.1 cm) as did the U 18 year-old elite English player of the South West region (\bar{x} = 183.6 cm) and the Northern Bulls high school Craven week players of South Africa (\bar{x} = 181.9 cm) in a study by Spamer and Winsley (2003b). Also, Spamer and Winsley (2003b) found that the average body mass (87.4 kg) for elite English players and the Northern Bulls high school

Table 1. Descriptive statistics and practical significant differences (*d* - values) of anthropometric variables for the U 16 and U 18 elite rugby players for the 2003 and 2004 seasons

U 16 year-olds (N=71)									
VARIABLES	2003 (N=71)				2004 (N=69)				Practical significance (<i>d</i> - values)
	\bar{x}	SD	Min	Max	\bar{x}	SD	Min	Max	
Body height (cm)	175.41	8.09	150.30	195.00	178.17	7.57	154.8	198.00	0.34
Body mass (kg)	76.17	11.74	45.20	110.50	79.50	13.63	46.20	115.00	0.24
Sum of 7 skinfolds (mm)	67.61	28.29	35.00	177.30	73.51	39.07	37.10	301.40	0.15
Muscle %	63.53	5.29	45.89	78.90	61.34	6.34	31.44	75.61	0.35
Body fat %	14.33	3.94	8.61	24.29	15.04	4.18	8.93	33.03	0.17
Endomorphy	2.91	1.28	1.40	6.80	3.15	1.52	1.48	10.69	0.16
Mesomorphy	5.48	1.17	3.51	9.87	5.71	1.24	3.25	9.18	0.19
Ectomorphy	2.11	1.01	0.10	4.36	2.21	1.08	0.10	4.46	0.09
U 18 year-olds (N=75)									
VARIABLES	2003 (N=75)				2004 (N=71)				Practical significance (<i>d</i> - values)
	\bar{x}	SD	Min	Max	\bar{x}	SD	Min	Max	
Body height (cm)	180.27	9.21	160.90	200.00	180.43	9.04	161.50	203.00	0.02
Body mass (kg)	85.07	12.45	61.50	115.90	86.83	13.86	62.90	119.60	0.13
Sum of 7 skinfolds (mm)	76.87	28.31	36.80	194.70	70.76	36.80	39.50	211.80	0.17
Muscle %	62.04	7.41	31.33	85.53	61.80	3.53	53.68	70.14	0.03
Body fat %	15.14	3.40	9.04	26.41	14.65	4.06	9.46	27.87	0.12
Endomorphy	3.23	1.14	1.56	7.65	3.10	1.50	1.53	8.34	0.09
Mesomorphy	5.82	1.89	3.76	9.46	5.52	1.90	0.08	9.38	0.16
Ectomorphy	1.86	1.06	0.10	4.12	1.66	1.11	0.10	3.99	0.18

High practical significance: $d \geq 0.8$

Medium practical significance: $d \geq 0.5$

Low practical significance: $d < 0.5$

Craven Week team (87.8 kg) was higher than the national elite South African players of this study.

The mean percentage of body fat in this study was lower than the U 18 year-old players (14.8%) in Van Gent's study (2003) as well as the English eighteen-year-old elite players (22%) and the Northern Bulls Team (15.8%) in the study by Spamer and Winsley (2003a).

It can be concluded that the elite U 18 South African players in this study are shorter than their counterparts in Van Gent's (2003) and Spamer and Winsley (2003a) studies. The players in this study are also lighter than their counterparts, but have lower fat percentage.

In Table 2 the physical and motor abilities of U 16 and U 18 elite players are shown. No high practical significant difference ($d \geq 0.80$) occurred from the 2003 to the 2004 season for U 16 players. However, improvement in all physical and motor abilities occurred, except in the Illinois agility test. The medium practical significance was recorded in the two speed tests (10-m run, $d = 0.67$; 40-m run, $d = 0.55$) and speed endurance ($d = 0.50$) and pull-ups ($d = 0.73$). The U 16 players in this study recorded in 2004 a faster time over 10 m than the elite provincial players in Van Gent's study ($\bar{x} = 1.89$ s) and also faster than the sixteen-year-olds by Hane-kom ($\bar{x} = 2.2$ s) in his study on the elite provincial players. Increases in strength component, namely,

bench press and push-ups, from the 2003 to 2004 season also recorded low to medium practical significance differences, respectively.

Referring to U 18 year-olds, only one medium practical significant improvement was recorded in bench press ($d = 0.50$). Something that was not expected, however, of low practical significance, was the decrease in performance over 40 m, Illinois Agility Test and speed endurance. This can be due to the content of the training programme that was followed. However, the elite players used in this study, still outperformed regional players used in the study of Van Gent (2003) in 10-m run speed ($\bar{x} = 2.02$) and the Illinois Agility Test ($\bar{x} = 17.15$). Taking the improvement in strength components into consideration, it seems that muscle development had increased amongst U 18 elite players tested in this study from 2003 to 2004. It must also be noted that U 16 players recorded faster times in the two speed tests than the U 18 year-old group.

The characteristics of the game-specific skills of U 16 and U 18 elite players are shown in Table 3.

The U 16 year-old group as a whole, showed no highly practical significant difference from 2003 to 2004 expect for two medium significant improvements (catching and throw, $d = 0.68$ and passing for distance, $d = 0.68$). Improvement in performance was showed in all game-specific skills,

Table 2. Descriptive statistics and practical significant differences (d -values) of physical and motor abilities for the U 16 and U 18 elite rugby players for the 2003 and 2004 season

U 16 (N=69)									
VARIABLES	2003 (N=71)				2004 (N=69)				Practical significance (d - values)
	\bar{x}	SD	Min	Max	\bar{x}	SD	Min	Max	
Speed (s) 10-m run	1.90	0.09	1.77	2.22	1.84	0.07	1.72	2.02	0.67
Speed (s) 40-m run m	5.54	0.21	5.16	6.23	5.42	0.22	5.09	5.96	0.55
Illinois Agility Test (s)	15.07	0.96	13.93	19.51	15.43	1.09	13.92	18.88	0.33
Speed endurance (n)	81.41	19.09	43.00	122.00	91.00	17.00	56.00	129.00	0.50
Bench press absolute (kg)	75.52	1.50	50.00	115.00	82.89	15.87	40.00	125.00	0.46
Pull-ups (n)	9.46	1.08	0	18.00	11.33	4.72	2.00	25.00	0.40
Push-ups (n)	38.84	11.18	12.00	69.00	48.20	12.87	21.00	77.00	0.73
U 18 (N=72)									
VARIABLES	2003 (N=75)				2004 (N=71)				Practical significance (d - values)
	\bar{x}	SD	Min	Max	\bar{x}	SD	Min	Max	
Speed (s) 10-m run	1.87	0.11	1.72	2.18	1.85	0.08	1.70	2.02	0.18
Speed (s) 40-m run m	5.43	0.33	4.97	6.23	5.45	0.28	4.98	6.58	0.06
Illinois Agility Test (s)	14.97	0.72	13.94	17.27	15.36	0.95	13.80	18.35	0.41
Speed endurance (n)	96.00	17.37	63.00	133.00	93.07	16.79	54.00	130.00	0.17
Bench press absolute (kg)	95.24	18.58	50.00	155.00	105.94	21.38	60.00	165.00	0.50
Pull-ups (n)	10.40	5.45	1.00	34.00	12.41	5.32	2.00	28.00	0.37
Push-ups (n)	50.74	27.28	16.00	96.00	58.19	14.12	32.00	109.00	0.27

High practical significance: $d \geq 0.8$

Medium practical significance: $d \geq 0.5$

Low practical significance: $d < 0.5$

Table 3. Descriptive statistics and practical significant difference (*d*-value) of game-specific skills for the under-sixteen and under-eighteen elite rugby players for the 2003 and 2004 season

U 16 year-olds									
VARIABLES	2003 (N=71)				2004 (N=69)				Practical significance (<i>d</i> - values)
	\bar{x}	SD	Min	Max	\bar{x}	SD	Min	Max	
Catching ability (catching & throwing over crossbar) (n)	12.82	2.94	3.00	18.00	15.22	3.55	9.00	22.00	0.68
Ground skills (pick up & place) (sec)	3.12	0.18	2.81	3.60	3.18	0.20	2.73	2.52	0.30
Passing for accuracy Left (L) (4 m) (n) Right (R)	2.37	1.20	0	5.00	2.61	1.33	0	5.00	0.26
	2.29	1.22	0	5.00	2.51	1.25	0	5.00	0.18
Passing for distance (m)	25.39	2.56	21.29	31.90	27.95	3.74	19.80	40.50	0.68
Kicking for distance (m)	42.85	7.08	24.48	59.50	45.13	6.33	34.00	59.30	0.32
U 18 year-olds									
VARIABLES	2003 (N=75)				2004 (N=71)				Practical significance (<i>d</i> - values)
	\bar{x}	SD	Min	Max	\bar{x}	SD	Min	Max	
Catching ability (catching & throwing over crossbar) (n)	13.94	3.27	6.00	19.00	13.80	3.11	6.00	10.00	0.04
Ground skills (pick up & place) (sec)	3.13	0.20	2.70	3.84	3.18	0.21	2.89	3.60	0.24
Passing for accuracy Left (L) (4 m) (n) Right (R)	2.81	1.16	1.00	5.00	2.12	1.33	1.00	5.00	0.57
	2.68	1.37	0	5.00	2.46	1.20	1.00	5.00	0.16
Passing for distance (m)	24.39	2.69	19.90	28.70	26.23	2.37	22.80	31.50	0.79
Kicking for distance (m)	42.77	16.00	9.78	60.00	44.71	4.66	36.10	51.43	0.24

High practical significance: $d \geq 0.8$

Medium practical significance: $d \geq 0.5$

Low practical significance: $d < 0.5$

except for ground skills. Although the national elite South African players recorded a slower time from 2003 ($\bar{x} = 3.12$ s) than in 2004 ($\bar{x} = 3.18$ s) with regard to ground skills, they still performed better than the regional players tested by Van Gent in 2003 ($\bar{x} = 3.62$ s). The average score for passing over 4 metres (left and right) at the end of the 2004 season was a shocking ($\bar{x} = 2.55$). Some players scored 0 out of 10, which was not expected from elite national players.

The U 16 players involved in this study also showed better results in kicking for distance than their counterparts in the studies by Van Gent (41.4 m) and Hare (38.0 m). The same tendencies were found in passing for distance. It can be noted that passing and kicking for distances involved muscle strength and that the improvement in these skills can be due to training programmes and growth.

Table 3 also indicated that with reference to U 18 players the results showed an improvement in only two game-specific skills, namely, passing and kicking for distance. The other skills recorded poorer results from 2003 to 2004. This is a great matter of concern and the conclusion can be made that not enough time was spent on skills improvement for this group. To verify this statement, the following examples can be made. In kicking for distance, the study by Plotz (2004) reported a mean value of

48.4 m for the Blue Bulls Squad and 47.2 m for the Leopards Provincial Squad. The same result was reported in passing for distance in the study by Plotz (2004) for the Blue Bulls ($\bar{x} = 28.4$ m).

The only conclusion that can be made is that the training programme did not make enough provision for handling skills in the 2004 season. The South African Rugby Union should take cognizance of this problem.

Conclusions and recommendations

The aim of this study was to look at the anthropometric, physical and motor, and game specific profile of the U 16 and U 18 elite rugby player as identified by the South African Rugby Union as talented and which have to develop to represent their country at international level in U 19, U 21 and senior teams. This project was started in 2003 and these results are the first of its kind to be reported on a national elite group of South African or international talented young players. The results will help to identify shortcomings and make suggestions for coaches as well as to present norm scales for the two age groups which can help for future identification of talented players. The following conclusion and recommendation can be made from this study.

- With reference to anthropometric variables, no big changes were experienced over the two-sea-

son period in both age groups. Compared with other similar studies as referred to in *Results and discussion*, the players in this study showed better physique in the sense of having a lower body fat percentage. The improvement, however, not of high practical significance, could also be the result of normal growth and development of the adolescents at that age.

- Physical and motor abilities showed a number of medium and high practical significant improvements of the elite players. The decrease in speed among U 18 year-olds can be the result of a lack of specific exercises in the training programme on these areas.
- According to game-specific skills, the biggest problem was recorded. Especially the handling skills of these elite players, both U 16 and U 18 year-olds, were worse than those of regional players. It was expected that the elite group

players in the study should have shown the best handling skills. The reason for this might be a shortage of game-specific skills in the programme, especially in the 2004 season. The national coaches must make changes to their development programmes to ensure the necessary improvements.

- The average scores that were reported in this study could serve as norm scales for future talent identification at these age levels. Coaches, talent scouts and sport scientists can use this data to evaluate newly talented players.
- The results reported in this study are a part of a longitudinal research programme on talented young rugby players nationally and internationally. These groups of players will be monitored for at least a further six years. The data can help scientists to develop scientific methods to identify and develop talented young players.

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