Original research

Do physical qualities influence the attainment of professional status within elite 16–19 year old rugby league players?

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ABSTRACT

Objectives: The current study retrospectively compared the physical qualities of elite academy rugby league players (aged 16–19 years) by career attainment level (i.e., academy or professional).
Design: Retrospective cross-sectional and longitudinal design.
Methods: Eighty-one academy rugby league players were assessed for physical qualities (height, body mass, skinfolds, speed, momentum, vertical jump, Yo-Yo Level 1 and 1-RM squat, bench press and prone row) at the Under 17–19 age categories between 2007 and 2012. Player's career attainment level was determined in 2014. Longitudinal changes in physical qualities between Under 17 and 19s were compared by career attainment level.
Results: Professional players demonstrated moderate significant advantages for height ($d = 0.98$) and 1-RM squat ($d = 0.66$) at the Under 17s, 1-RM bench press ($d = 0.76$) at the Under 18s and 1-RM prone row ($d = 0.73$) at the Under 19s age categories when compared to academy players. When assessed longitudinally (Under 17s–19s), professional players significantly outperformed academy players for 1-RM squat ($\eta^2 = 0.20$). Professional players also demonstrated greater increases in body mass (8.2 vs. 2.9 kg) and 10 m momentum (47 vs. 17 kg s^{-1}) than academy players between the Under 17s and 19s.
Conclusions: Advanced physical qualities, particularly height and absolute strength, within 16–19 year old players may contribute to attaining professional status in rugby league. Further, the development of body mass and momentum for players within an academy is an important consideration in the progress towards professional rugby league. Therefore, practitioners should aim to identify and develop the physical qualities, especially size and strength, within academy rugby league players.

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1. Introduction

In recent years the focus on talent identification (TID) and development (TDE) of youth athletes has increased with many national governing bodies and professional clubs now investing considerable resources into this process.[1,2] TID and TDE research aims to provide an understanding of the factors that differentiate between playing levels (i.e., identification) and inform practitioners of the importance of certain characteristics to optimize training programme design (i.e., player development). Although these are the aims of TID and TDE research, most studies to date are limited as they only compare differing performance levels at one-off time points, usually within junior levels, using cross-sectional research designs (e.g., Refs. [3,4]). Such studies assume that current performance capabilities and discrepancies between performance levels in junior populations can therefore help predict potential success

in adulthood.[5] However, to advance our understanding of the factors that contribute to TID and TDE, player characteristics should be prospectively or retrospectively tracked from players who attain the highest possible level of performance (i.e., professional).

Recent research in rugby league[6] and soccer[7,8] has retrospectively tracked the career attainment (i.e., amateur, academy, professional) of players selected to a TID and TDE programme during adolescence into adult professional sport. For example, Till and colleagues[6] assessed anthropometric and fitness characteristics of junior rugby league players between 2005 and 2007 when players were aged between 13 and 15 years and tracked their career attainment in 2008 (players aged 16 years) and 2013 (players aged 21 years). Findings showed that advanced fitness characteristics (i.e., speed, lower body power and agility) at adolescent ages differentiated between those players that attained professional status compared with their amateur peers[6] which was also consistent with findings in youth soccer.[7] However, advanced size in adolescent rugby league[6] and soccer[7,8] did not differentiate between career attainment levels, therefore questioning the selection of youth players based on body size. Such research suggests that

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Table 1
Physical qualities between academy and professional players at the Under 17s, 18s and 19s age categories.

	Under 17s			Under 18s			Under 19s		
	Academy (n = 37)	Pro (n = 13)	Cohens d ± 90% CI	Academy (n = 41)	Pro (n = 19)	Cohens d ± 90% CI	Academy (n = 30)	Pro (n = 19)	Cohens d (90% CI)
Height (cm)	176.9 ± 5.5	181.8 ± 3.1**	0.98 ± 0.57	179.0 ± 5.3	181.8 ± 5.0	0.39 ± 0.66	180.5 ± 5.3	182.3 ± 5.2	0.34 ± 0.54
Body mass (kg)	79.9 ± 10.3	84.5 ± 5.2	0.50 ± 0.52	84.7 ± 10.3	87.4 ± 8.9	0.27 ± 0.47	87.5 ± 9.9	90.8 ± 9.7	0.34 ± 0.49
Sum of 4 skinfolds (mm)	37.1 ± 14.3	34.6 ± 6.9	0.19 ± 0.68	39.0 ± 13.6	36.1 ± 7.6	0.24 ± 0.47	38.4 ± 15.6	36.9 ± 8.5	0.11 ± 0.52
10 m (s)	1.81 ± 0.06	1.80 ± 0.05	0.17 ± 0.54	1.80 ± 0.06	1.79 ± 0.06	0.17 ± 0.47	1.80 ± 0.05	1.80 ± 0.09	0.00 ± 0.53
20 m (s)	3.12 ± 0.09	3.10 ± 0.09	0.22 ± 0.53	3.11 ± 0.10	3.06 ± 0.10	0.50 ± 0.48	3.10 ± 0.09	3.09 ± 0.14	0.09 ± 0.54
10 m Mom (kg s^{-1})	442 ± 54	470 ± 29	0.57 ± 0.53	466 ± 51	488 ± 46	0.45 ± 0.48	487 ± 51	503 ± 49	0.33 ± 0.54
Yo-Yo IRTL1 (m)	1436 ± 336	1553 ± 287	0.36 ± 0.54	1464 ± 354	1535 ± 322	0.21 ± 0.48	1475 ± 443	1443 ± 259	0.08 ± 0.53
Vertical jump (cm)	48.8 ± 6.1	49.5 ± 4.9	0.12 ± 0.53	50.2 ± 5.8	51.8 ± 5.2	0.29 ± 0.48	51.5 ± 5.2	53.3 ± 5.6	0.35 ± 0.54
Bench press (kg)	92.1 ± 13.1	96.6 ± 14.4	0.34 ± 0.56	100.8 ± 14.2	111.9 ± 15.7**	0.76 ± 0.49	111.8 ± 15.4	115.6 ± 18.0	0.24 ± 0.56
Relative bench press (kg kg^{-1})	1.15 ± 0.13	1.12 ± 0.16	0.22 ± 0.55	1.19 ± 0.14	1.26 ± 0.14	0.50 ± 0.50	1.28 ± 0.17	1.26 ± 0.15	0.12 ± 0.55
Squat (kg)	119.1 ± 19.5	131.0 ± 14.0*	0.66 ± 0.55	131.6 ± 14.2	139.6 ± 17.2	0.52 ± 0.50	135.7 ± 18.1	143.9 ± 20.1	0.44 ± 0.56
Relative squat (kg kg^{-1})	1.49 ± 0.24	1.53 ± 0.53	0.12 ± 0.54	1.56 ± 0.18	1.57 ± 0.17	0.05 ± 0.48	1.55 ± 0.20	1.57 ± 0.21	0.09 ± 0.54
Prone row (kg)	81.8 ± 9.9	88.3 ± 10.3	0.65 ± 0.55	89.6 ± 9.2	94.2 ± 11.1	0.47 ± 0.50	94.3 ± 11.5	102.8 ± 12.2**	0.73 ± 0.55
Relative prone row (kg kg^{-1})	1.02 ± 0.10	1.03 ± 0.11	0.10 ± 0.55	1.06 ± 0.10	1.06 ± 0.09	0.00 ± 0.49	1.08 ± 0.12	1.12 ± 0.10	0.35 ± 0.54

Significant differences between annual-age categories.
* $p < 0.05$.
** $p < 0.01$.

Table 2
Longitudinal development of physical qualities between academy and professional rugby league players.

	Academy (n = 15)			Professional (n = 10)			Level		Level × time	
	17s	18s	19s	17s	18s	19s	p	η^2	p	η^2
Height (cm)	179.8 ± 4.6	180.9 ± 4.5	181.6 ± 4.7	181.3 ± 1.8	182.8 ± 1.8	183.6 ± 2.3	0.24	0.06	0.41	0.03
Body mass (kg)	84.7 ± 11.4	86.6 ± 11.6	87.6 ± 11.2	84.3 ± 4.8	90.5 ± 2.1	92.5 ± 2.3	0.45	0.03	0.01	0.23
Sum of 4 skinfolds (mm)	42.3 ± 17.9	37.6 ± 15.6	35.9 ± 14.1	34.1 ± 6.3	37.7 ± 6.7	36.4 ± 7.5	0.62	0.01	0.03	0.18
10 m (s)	1.80 ± 0.06	1.80 ± 0.04	1.80 ± 0.05	1.79 ± 0.04	1.78 ± 0.06	1.79 ± 0.07	0.51	0.02	0.78	0.01
20 m (s)	3.10 ± 0.06	3.09 ± 0.09	3.09 ± 0.08	3.08 ± 0.09	3.08 ± 0.10	3.08 ± 0.12	0.72	0.01	0.86	0.01
10 m Mom (kg s^{-1})	470 ± 61	480 ± 63	487 ± 61	471 ± 31	507 ± 18	518 ± 20	0.33	0.04	0.01	0.24
Yo-Yo IRTL1 (m)	1252 ± 262	1433 ± 247	1674 ± 455	1512 ± 299	1459 ± 339	1560 ± 190	0.59	0.01	0.02	0.16
Vertical jump (cm)	48.1 ± 6.2	51.6 ± 6.1	52.1 ± 5.6	49.5 ± 5.5	52.1 ± 5.5	54.6 ± 4.4	0.52	0.02	0.29	0.05
Bench press (kg)	93.4 ± 13.4	106.8 ± 14.2	114.4 ± 15.6	100.0 ± 14.4	115.4 ± 15.4	120.5 ± 15.9	0.24	0.06	0.64	0.02
Relative bench press (kg kg^{-1})	1.10 ± 0.12	1.23 ± 0.11	1.31 ± 0.13	1.18 ± 0.16	1.27 ± 0.16	1.30 ± 0.16	0.52	0.02	0.07	0.11
Squat (kg)	117.3 ± 20.1	134.0 ± 14.1	140.8 ± 11.0	134.3 ± 12.8	145.7 ± 16.0	151.8 ± 16.0	0.03	0.20	0.40	0.03
Relative squat (kg kg^{-1})	1.39 ± 0.20	1.55 ± 0.13	1.62 ± 0.14	1.59 ± 0.14	1.60 ± 0.16	1.64 ± 0.14	0.12	0.10	0.02	0.18
Prone row (kg)	83.5 ± 12.3	93.0 ± 10.8	99.0 ± 11.6	90.1 ± 9.3	100.0 ± 8.7	107.4 ± 10.8	0.09	0.12	0.62	0.02
Relative prone row (kg kg^{-1})	0.98 ± 0.10	1.07 ± 0.08	1.13 ± 0.09	1.07 ± 0.09	1.10 ± 0.09	1.16 ± 0.11	0.22	0.06	0.02	0.18

advanced physical qualities within junior athletes can provide useful information for TID and TDE purposes. However, this research is only limited to athletes under 16 years of age. Instead, understanding the factors that may contribute to future adult attainment from within elite academy programmes (i.e., 16–19 years) may aid TID and TDE programmes further. Also, current studies rely on cross-sectional data that fails to examine the change and development of characteristics. Understanding how physical qualities improve over period of time may specifically inform training development practices in the development of future professional athletes.[9]

Rugby League is a collision sport played worldwide from local recreation to professional levels across a range of junior to senior age groups.[10] The sport involves frequent high-intensity activities (e.g., sprinting, tackling, ball carrying) separated by periods of lower intensity activity (e.g., repositioning).[10,11] Therefore,

players are required to have highly developed strength, speed, power, agility and aerobic fitness.[12,13] In the United Kingdom (UK), professional rugby league clubs employ an elite academy system whereby players aged between 16 and 19 years train and compete in the pursuit of a professional contract. A range of research is available within players of this age range (e.g., Refs. [14,15]) but no study has evaluated the impact of physical qualities within academy aged players on subsequent career attainment level in rugby league. Therefore, the aims of the current study were (1) compare the differences in physical qualities in 16–19 year old elite academy rugby league players between career attainment level, notably whether the player's highest level of performance was academy or professional level; and (2) evaluate the longitudinal development of physical qualities across three age categories (i.e., Under 17s, 18s and 19s) between career attainment level.