

The role of biological maturity in sport psychological skills of young rugby players: An explorative investigation

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Abstract

The aims of this explorative study was to identify differences and possible changes in sport psychological skill levels of potentially talented rugby players with different maturity status over a two year period. The sport psychological skills were assessed using the Athletic Coping Skills Inventory-28 (ACSI-28). Eighteen rugby players (N=18) were classified into early developers (ED) (n = 4), average developers (AD) (n = 13) and late developers (LD) (n = 1), and were tested yearly from 2003 to 2005. Results showed that the ED attained borderline significantly better values than the AD in goal-setting and mental preparation ($p = 0.07$), as well as confidence and achievement motivation ($p = 0.09$) during 2003, whilst these differences were no longer evident in 2005. A significant improvement was observed in goal-setting and mental preparation ($p = 0.007$) among AD from 2003 to 2005. Although AD attained lower values in 2003 for coachability than ED, they showed significant improvements from 2003 to 2005 ($p = 0.063$), while ED did not change. The general coping skills score of ED remained unchanged over the two year period, while AD showed a significant increase ($p = 0.004$). From these results it was concluded that certain changes occurred in the sport psychological skill levels of ED and AD. Furthermore ED showed a bigger advantage at a younger age than AD regarding confidence, but that maturation contributed to the observed change in the confidence levels among AD.

Keywords: Maturity status, sport psychology, talent identification, confidence, rugby union, boys.

How to cite this article:

van den Berg, L., Pienaar, A.E. & Grobbelaar, H.W. (2012). The role of biological maturity on sport psychological skills of young rugby players: An explorative investigation. *African Journal for Physical, Health Education, Recreation and Dance*, December (Supplement 1:2), 332-343.

Introduction

It appears that the identification of individuals with the greatest potential to perform in sport at a later stage is a challenging task (Abbott & Collins, 2004). Regardless thereof, research indicates that players who are successful at senior level, can mostly be characterised by their psychological approach to their sport (Abbot & Easson, 2002). Their findings emphasise the importance of determination, initiative and concentration while learning new skills. Abbot and Easson (2002) further stated that talent identification in rugby tends to be based on physical and motor performance,

with less emphasis on the psychological factors of excellence. According to these researchers the main aim of talent identification should be to identify young players who exhibit the potential to develop into successful senior rugby players.

Success in professional sport is not dependent on the physical and tactical aspects alone, as psychological skills also play an important role (Cox & Yoo, 1995). Abbot and Easson (2002) recommend that sport psychological skills should also be included in talent identification models. In line with this notion Spamer (2009) indicated that despite various research projects being conducted on rugby in South Africa, little is known about a large number of variables that could play a role in talent identification, among which is the role of psychological factors.

The development of sport psychological skills plays an important role in the development of the modern day rugby player due to its association with performance (Golby & Sheard, 2004). Andrew, Grobbelaar and Potgieter (2007) indicated that there is a scarcity of information on the sport psychological skills of junior rugby players in South Africa and that research into sport psychological skills of rugby players is generally limited. Recently, Edwards and Edwards (2012) established preliminary South African high school norms for the Bull's Mental Skills Questionnaire (BMSQ). The study by Hare (1999) on 16 year old rugby players indicated psychological skills as an important predictor of rugby performance although this finding was not linked to the player's maturity status. Pienaar, Spamer, and Steyn's (1998) study on 10 year old rugby players speculated that increased body size (which is associated with early development) could have contributed to greater confidence levels among this group of players. In this regard Gouws, Kruger and Burger (2000) showed that early developers possess more confidence, pride and larger egos in relation to late developers who appear to be more irresponsible, childish and attention seeking. Louw and Louw (2007) indicated that those who mature later tend to be more anxious than those who mature earlier.

Birrer and Levine (1987) found that the dropout rate of sport correlates with a lack of confidence, uncertainty and feelings of guilt. This seems to be more prevalent among children whose onset of puberty has not started when they are included in teams together with children who are in or past their puberty stage. The assumption can, therefore, be made that it is important that young sportsman should be biologically and psychologically mature when they participate at top level.

Malina, Bouchard and Bar-Or (2004) indicated that at a younger age early developers are usually selected above average and late developers in sport types that requires strength (such as rugby). To the best of our knowledge, little research has been conducted to determine whether sport psychological skill levels are affected by biological maturity. Therefore, the aim of this study was to identify differences and possible changes in sport psychological skill levels of potentially talented rugby players of varying maturity status over a period of two years.

Methods

Research design

The study was approved by the Ethics committee of the North-West University (01M12). An information letter that explained the aim and procedures of the project was given to each participant. All participants provided informed assent, whilst a parent/legal guardian provided informed consent for participation in the study.

Participants

Twenty-three ($N = 23$) boys from high schools in the North-West Province were identified in 2003 as talented rugby players by a panel of selectors. This selection took place at the chronological age of 15 or 16 years. Thereafter, these players were exposed to top level coaching and conditioning for a period of two years so that by 2005 (the year in which they turned 18 years of age) a well conditioned provincial team could be delivered for participation in the Craven week. From this the group of players that were identified in 2003, five ($n = 5$) were no longer part of the group in 2005. The most common reason for the fallout of the players from the training group and study was injuries sustained during the two years. The remaining eighteen players ($N = 18$) were subjected to repeated measurements, with testing taking place once a year at the end of August (towards the end of the South African school rugby season). Skeletal as well as sexual maturity status, motor and physical abilities as well as sport specific skills were tested annually, while the sport psychological skills were tested in 2003 (in the beginning of the study) and again in 2005 (at the end of the study). The 18 players were divided into three groups, namely early developers (ED) ($n = 4$), average developers (AD) ($n = 13$) and late developers (LD) ($n = 1$) according to their skeletal age (see method below). As there was only one LD in the group, this participant was omitted from the research group and therefore, the data collected from the remaining 17 players were used for further analysis.

Determining skeletal age

An x-ray of the left wrist of each participant was taken annually from 2003 to 2005. Skeletal age, as described by the Gruelich Pyle (GP)-method (Malina et al., 2004), was determined by a trained radiologist. The same evaluator was used throughout the study. The results of the x-rays were analysed by the radiologist using the GP atlas method (based on yearly intervals). Interpolation was done by assessing bone-specific ages of individual bones based on descriptions of the maturity indicators for each bone in the hand-wrist x-ray (Faulkner, 1996). According to the results of the skeletal age the group was divided into ED, AD and LD according to the guidelines as presented in Malina et al. (2004). The participants with a skeletal age of more than one year higher than their chronological age, were identified as ED, while those with a skeletal age that differed by less than a year (greater or smaller) from the chronological age were classified as AD. The test subjects with a skeletal age of more than one year less than their chronological age were classified as LD.

Sport psychological skills

The sport psychological skills were measured by making use of the Athletic Coping Skills Inventory-28 (ACSI-28) developed by Smith, Schutz, Smoll and Ptacek (1995). The ACSI-28 consists of 28 items with four items contributing to each of the seven subscales. Item responses were scored along a four-point Likert type scale ranging from 0 ('Almost never') to 3 ('Almost always'). The ACSI-28 measures seven subscales which were described by Bourgeois, Loss, Meyers and Leunes (2003) as:

1. ***Coping with adversity.*** Athletes scoring high on this measure have learned to remain positive and enthusiastic even when things are going badly. When the heat is on, they tend to stay calm and controlled. They are also able to bounce back quickly from mistakes and setbacks.
2. ***Peaking under pressure.*** An athlete scoring high on this measure tends to perceive pressure situations as challenges as opposed to threats and frequently performs well under pressure. They tend to look forward to pressure situations and are considered "clutch performers" by their peers.
3. ***Goal-setting and mental preparation.*** Athletes scoring high on this measure have learned to set and work towards specific process goals (i.e., goals that are not measured in terms of the performance outcome). They plan and mentally prepare themselves for performance and have clearly identified "game plans" for the different situations they encounter.
4. ***Concentration.*** Athletes scoring high on this measure are not easily distracted and are able to focus on the task at hand. They are able to maintain their ability to focus even when unexpected or difficult situations occur.
5. ***Freedom of worry.*** Athletes scoring high on this measure have learned not to put extra pressure on themselves by worrying about performing poorly or making mistakes. In addition, they are relatively unconcerned with what other people will think about them if they do happen to make a mistake. They focus on what they want to happen rather than on what they don't want to happen.
6. ***Confidence and achievement motivation.*** Athletes scoring high on this measure have learned to be confident and positively motivated. They consistently give 100% and they also work hard to improve their skill levels.
7. ***Coachability.*** Athletes scoring high on this measure are open to and learn from instruction. They have learned how to accept constructive criticism without taking it personally and becoming upset.

Lastly, the mean values of the abovementioned seven subscales are calculated to provide a ***general coping skills score***. The results are expressed as percentage values, with higher values indicating better skill levels. Smith et al. (1995) reported the test-retest validity of the general coping skills score over a one-week period for a sample of 97 college athletes as $r = 0.87$. An internal consistency reliability of the general coping skills score of $r = 0.86$ was also reported.

The Cronbach Alpha values of the current dataset was calculated in 2003 and a validity quotient of $r = 0.75$ was found for the general coping skills score, whilst the following values were obtained for each of the subscales: coping with adversity ($r = 0.66$), peak performance under pressure ($r = 0.70$), goal-setting and mental preparation ($r = 0.72$), concentration ($r = 0.73$), freedom from worry ($r = 0.78$), confidence and achievement motivation ($r = 0.72$), and coachability ($r = 0.75$). Alpha values above $r = 0.60$ are considered good indicators of reliability (Cronbach, 1951).

Statistical analysis

The STATISTICA software program (StatSoft, 2008) was used for the statistical analysis of the data. The difference in improvement between the first (2003) and the last (2005) testing opportunity was used to indicate tendencies within each group, but also to analyse the differences between the groups. In order to determine the improvement in each group separately, a one way test on a 5% level of significance was conducted by means of the non-parametric Wilcoxon ranking list test. The difference between ED and AD groups was determined by testing for statistical significance as well as the difference in improvement obtained over the period and were compared by means of the Wilcoxon dual sample test. Descriptive statistics was reported to create a complete image of the changes in the sport psychological skill levels. Statistical significant differences between and within groups were set at $p \leq 0.05$ and borderline statistical significance at $p \leq 0.1$. Practical significant differences were also calculated and expressed as Cohen's d-value.

Results

Table 1 reflects the descriptive information of the chronological age as well as the biological age of the two groups (ED and AD) as determined in 2003 and 2005 by means of the GP-method. From this it appears that the biological age of the ED was 1.6 years higher than their chronological age in 2003, in contrast to the biological age of the AD which was five months higher than their chronological age. By 2005 these differences had decreased to six and two months respectively.

Table 1: Descriptive statistics of chronological and biological age of early and average developers

Age	Groups	2003				2005			
		M	SD	Min	Max	M	SD	Min	Max
CA	ED (n=4)	15.8	0.60	15.1	16.4	17.8	0.6	17.1	18.4
	AD (n=13)	16.3	0.27	15.7	16.6	18.3	0.27	17.7	18.6
BA	ED (n=4)	17.4	0.75	16.5	18.0	18.2	0.24	18.0	18.5
	AD (n=13)	16.8	0.32	16.0	17.0	18.1	0.20	18.0	18.5

CA= Chronological age; BA= Biological age, n = Number; M = Mean; SD = Standard Deviation; Min = Minimum; Max = Maximum

Table 2 firstly reports the descriptive statistics regarding the sport psychological skills as determined by the ACSI-28 and the differences between the ED and AD

in 2003 and 2005, respectively. Secondly, the table indicates the within-group changes between 2003 and 2005 for the ED and AD groups, respectively.

Table 2: Descriptive statistics, between-group differences (2003 and 2005) and within-group changes (2003 to 2005) regarding the sport psychological skills of early (n=4) and average developers (n=13)

Variables	Year	M	Min	Max	SD	2003	2005	Within-group changes (2003 to 2005) for ED and AD respectively	
						Between-group differences (ED vs. AD) p-values (d-values)	Between-group differences (ED vs. AD) p-values (d-values)		
General coping skills score	ED	2003	75.6	60.7	86.9	11.1	0.21	0.46	0.063 #
		2005	75.0	69.1	83.3	6.1	(0.62) ^o	(0.45) ^o	(0.05)
	AD	2003	68.7	57.1	68.7	8.8			0.004*
		2005	71.5	60.7	84.5	7.8			(0.32)
Coping with adversity	ED	2003	81.3	50.0	100.0	21.9	0.22	0.86	0.125
		2005	72.9	58.3	83.3	16.5	(0.70) ^{oo}	(0.11)	(0.38) ^o
	AD	2003	66.0	41.7	100.0	20.5			0.063 #
		2005	70.5	41.7	100.0	21.4			(0.22)
Peaking under pressure	ED	2003	72.9	41.7	91.7	21.9	0.52	0.86	0.500
		2005	75.0	50.0	100.0	21.5	(0.11)	(0.12)	(0.10)
	AD	2003	70.5	50.0	100.0	13.4			0.282
		2005	72.4	50.0	100.0	13.8			(0.14)
Goal-setting and mental preparation	ED	2003	81.3	66.7	100.0	14.2	0.07 #	0.69	0.438
		2005	72.9	58.3	91.7	14.2	(1.12) ^{oo}	(0.23)	(0.59) ^o
	AD	2003	62.8	33.3	91.7	16.5			0.031*
		2005	68.6	33.3	100.0	18.5			(0.35) ^o
Concentration	ED	2003	70.8	58.3	75.0	8.3	1.00	0.86	0.500
		2005	75.0	75.0	75.0	0.0	(0.18)	(0.13)	(0.51) ^o
	AD	2003	73.1	58.3	91.7	12.8			0.496
		2005	73.7	58.3	91.7	10.1			(0.05)
Freedom from worry	ED	2003	43.8	25.0	75.0	23.9	0.53	0.73	0.125
		2005	52.1	33.3	75.0	18.5	(0.42) ^o	(0.09)	(0.35) ^o
	AD	2003	53.8	16.7	83.3	22.2			0.410
		2005	54.7	8.3	91.7	28.8			(0.04)
Confidence & achievement motivation	ED	2003	93.8	83.3	100.0	8.0	0.09 #	0.13	0.500
		2005	93.8	83.3	100.0	8.0	(1.03) ^{oo}	(0.91) ^{oo}	(0.00)
	AD	2003	83.3	66.7	100.0	10.2			0.375
		2005	84.6	66.7	100.0	10.1			(0.13)
Coachability	ED	2003	85.4	75.0	91.7	8.0	0.28	0.61	0.125
		2005	83.3	58.3	100.0	18.0	(0.63) ^o	(0.28)	(0.26)
	AD	2003	71.2	33.3	100.0	22.7			0.063 #
		2005	78.2	50.0	100.0	16.9			(0.31)

M = Mean; Min = Minimum; Max = Maximum; SD = Standard deviation; ED = Early developers; AD = Average developers

* p ≤ 0.05 (Statistically significant difference);

p < 0.1 (Borderline statistical significant difference)

^o d ≈ 0.50 (Moderate practical significant difference)

^{oo} d ≈ 0.80 (Large practical significant difference).

When comparing the two groups at the start of the study (2003) various differences emerged. The ED showed higher mean values than the AD for the general coping skills score and five of the seven ACSI-28 subscales, namely, coping with adversity, peaking under pressure, goal-setting and mental

preparation, confidence and achievement motivation, as well as coachability, while the AD obtained higher values for concentration and freedom from worry. Borderline statistical significant differences (on a 10% level) occurred between the early and average developers for goal-setting and mental preparation, as well as confidence and achievement motivation, in which the ED exhibited better values.

In 2005 the ED obtained higher mean values for all the subscales except for freedom from worry. However, none of the inter-group differences were statistically significant ($p>0.05$).

When comparing the results of 2003 with the scores obtained in 2005, the ED exhibited no statistically significant improvement in any of the measured variables (Table 2). In fact, they showed a borderline decrease in their general coping skills score (on a 10% level), while the values obtained for the coping with adversity, goal-setting and mental preparation, as well as coachability subscales also decreased, albeit insignificantly so ($p>0.05$). They did exhibit insignificant improvements ($p>0.05$) for three subscales (peaking under pressure, concentration and freedom from worry). Their confidence and achievement motivation levels remained unchanged between 2003 and 2005.

In contrast the AD improved in all seven subscales and the general coping skills score between 2003 and 2005. Statistically significant improvements were evident for their general coping skills score and goal-setting and mental preparation, whilst their ability to cope with adversity and their coachability exhibited an improvement on a 10% gauge during this period.

Table 3 further elaborates on the changes (improvement or weakening) observed in both groups from 2003 to 2005.

Table 3: Differences in improvement between early and average developers regarding sport psychological skills between 2003 and 2005

Variables	Groups	Mean improvement	Difference in mean improvement	SD of difference in mean improvement	Significance of differences p-values (d-values)
General coping skills score	ED (n=4)	-0.593	2.246	8.39	0.171 (0.27)
	AD (n=13)	2.839		2.98	
Coping with adversity	ED (n=4)	-8.335	3.848	22.57	0.117 (0.17)
	AD (n=13)	4.487		9.39	
Peaking under pressure	ED (n=4)	2.083	0.161	22.95	1.000 (0.01)
	AD (n=13)	1.922		7.72	
Goal-setting and mental preparation	ED (n=4)	-8.330	2.560	0.01	0.007* (0.22)
	AD (n=13)	5.769		11.48	
Concentration	ED (n=4)	4.175	3.542	8.35	0.575 (0.28)
	AD (n=13)	0.633		12.49	
Freedom from worry	ED (n=4)	8.333	7.461	6.81	0.130 (0.50) ^o
	AD (n=13)	0.872		14.99	
Confidence and achievement motivation	ED (n=4)	0.000	1.282	6.810	0.836 (0.19)
	AD (n=13)	1.282		5.739	
Coachability	ED (n=4)	-2.085	4.966	20.84	0.952 (0.24)
	AD (n=13)	7.051		11.708	

SD = Standard deviation; ED = Early developers; AD = Average developers; * $p \leq 0.05$ (Statistically significant difference)

^o $d \approx 0.50$ (Moderate practical significant difference)

From Table 3 it is evident that the AD improved in all of the tested variables between 2003 and 2005, whereas the ED showed improvement in only three of the subscales (peaking under pressure, concentration and freedom from worry). The improvement of the ED in these three subscales was greater than that obtained by the AD, albeit insignificantly so. Inexplicably, the ED incurred lower values in 2005 than 2003 for four of the subscales, whilst their confidence and achievement motivation remained unchanged. As a result the AD exhibited greater improvement in the general coping skills score, coping with adversity, goal-setting and mental preparation ($p = 0.007$), confidence and achievement motivation, as well as coachability than the ED during the same period.

Discussion

The results showed that ED at approximately 16 years of age (then 1.6 years biologically older than their chronological age) in 2003 obtained borderline significantly (10% level of significance) better mean values than the AD for goal-setting and mental preparation, confidence and achievement motivation. These differences were, however, no longer significant two years later in 2005 when both groups' biological and chronological ages were almost identical. ED obtained higher confidence levels (93.8%) in 2003 compared to that of the AD (83.3%). Although hardly any literature could be found that investigated the relationship between maturity and psychological skills, the current results are supported by Gouws et al. (2000) who indicates that early developers possess a greater ego, more pride and confidence. Similarly, Louw and Louw (2007) noted that ED generally has better body image and higher self-esteem than AD and LD. The literature also indicated that boys who reach maturity early tend to be taller and heavier than players who reach maturity at a later stage (Bloomfield, Ackland & Elliot, 1994; Kemper, Post & Twisk, 1997). These players are then also considered more suitable for a sport such as rugby because the larger physique leads to greater strength abilities. Research by Pienaar et al. (1998) on 10 year old rugby players showed that physique related to early development contributed to greater confidence among these players. Andrew et al. (2007) and Hodge and McKenzie (2002) further indicate that the sport psychological skills of players at various levels of participation differ from each other in that the more successful player's exhibit greater confidence, coping with adversity and activation control levels than less successful players. It would, therefore, appear that emotional maturity is possibly influenced by biological maturity and that ED exhibit more confidence as a result of their physique and strength advantage which plays an important role in rugby. It is also possible that the group's improved confidence contributed to the better mean values observed in their goal-setting and mental preparation ability. The assumption is that, as a result of increased confidence, the ED group could have been more goal orientated and, therefore, more likely to achieve the goals they set.

The results further showed a significant improvement in the general coping skills score and goal-setting and mental preparation among the AD from 2003 to 2005 ($p \leq 0.05$). In contrast the general coping skills of ED decreased during this period. Although AD had lower ($p > 0.05$) coachability values in 2003 compared to ED, they also exhibited borderline significant ($p = 0.05$) improvements in this skill between 2003 and 2005, in contrast to the decrease observed among ED during this period.

From these results it could be argued that the observed development in the sport psychological skill levels over this period was influenced by changes in the player's biological maturity. It could be that they developed greater confidence

in their own abilities over this period which resulted in more clearly defined goals. Due to the growth that took place during this period, the physiques of the AD caught up to that of the ED, whereas the differences in the physiques between the two groups became less apparent (Van den Berg & Pienaar, 2012).

Conclusions

From the results it can be concluded that there were some differences in the sport psychological skill levels of early and average developing rugby players between the ages of 15 and 18 years, and that these differences become less visible as the differences in biological and chronological ages became smaller. ED had an advantage with regard to confidence and the setting of goals at a younger chronological age. The psychological skills of the ED did, however, not develop further during the period from 2003 to 2005, while the AD exhibited further improvement in certain skills. From this it can be assumed that ED at the age of 16 years already possessed the sport psychological skill levels that they exhibited three years later. At 16 years of age the AD possessed poorer sport psychological skills, but improved considerably in some of these skills to the extent that the two groups no longer differed at the end of 2005.

The observed differences reported among young rugby players in this study are especially relevant to talent identification and team selection in this sport. According to Hare (1999) sport psychological skills should be seen as important predictors of rugby performance as his study on 16 year old rugby players showed that psychological factors possess discriminant qualities, which enables one to differentiate between more and less talented rugby players. Andrew et al. (2007) confirmed this statement by indicating that successful and less successful rugby players can be distinguished on the basis of their sport psychological skill levels. The development of sport psychological skills by means of psychological skills training programmes, especially among those who develop later, should receive more attention during their preparation as rugby players.

The results of this study must be evaluated on the basis of the small sample size and that the group of early developers within this sample was very small. Caution should be applied when generalizing these results. Regardless, this exploratory study delivered insightful results and it is recommended that the role of biological maturity on sport psychological skill development of young rugby players should be investigated further. The one late developer (LD) in the study had to be omitted from comparisons, and it will therefore be interesting to determine possible differences between players of late maturity status and ED considering the differences found between ED and AD players in this study, and also because of the differences in physical characteristics reported in the literature between ED and LD players.

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