South African Journal for Research in Sport, Physical Education and Recreation, 2019, 41(3): 117 - 127.
Suid-Afrikaanse Joernaal vir Navorsing in Sport, Liggaamlike Opvoedkunde en Ontspanning, 2019, 41(3): 117 - 127.
ISBN: 0379-9069

PSYCHOLOGICAL FACTORS MAY COUNTERBALANCE PHYSICAL DISADVANTAGE OF LATE MATURATION AMONG AFRICAN JUNIOR SOCCER PLAYERS

Linda VAN DEN BERG[1], Heinrich W. GROBBELAAR[2],
Julius JOOSTE[1], Suzanne JACOBS[1]
[1] *Department of Sport, Rehabilitation and Dental Sciences, Faculty of Science, Tshwane University of Technology, Pretoria, Rep. of South Africa.*
[2] *Department of Sport Science, Faculty of Medicine and Health Sciences, Stellenbosch University, Stellenbosch, Rep. of South Africa.*

ABSTRACT

Biological growth and maturation influence the selection of young athletes to teams as early developers (EDs) tend to be selected above average developers (ADs) and late developers (LDs), due to their size, speed and power advantage. The aim was to determine differences in the sport psychological skill levels of African junior soccer players of different maturation levels. Male football players (N = 149) with a mean age of 16.24 ± 1.10 years participated in this study. Based on a synthesis of previous research a biological maturation questionnaire was used to classify the participants as EDs (n = 27), ADs (n = 77), and LDs (n = 45). The Athletic Coping Skills Inventory-28 was used to measure their sport psychological skills. The LDs had significantly higher coping with adversity (p = .032, d = 0.35), as well as goal setting and mental preparation (p = .014, d = 0.76) scores than the EDs. Psychological factors could potentially have counterbalanced some of the physical disadvantages of late maturation. Coaches, selectors and talent scouts should be careful not to exclude later maturing soccer players from talent development programmes.

***Keywords*:** Football; Growth; Sport Psychology; Talent development.

INTRODUCTION

Fitness and skills test results are regularly used to detect and select young athletes who possess the desired physical attributes for success in a specific sport (Vaeyens *et al*., 2008), but problems may arise when these results are used to identify talented players too early (Williams & Reilly, 2000; Vaeyens *et al*., 2013). This approach assumes that adolescents, who possess physical characteristics deemed important for success in adult sport, will retain those attributes and become successful elite adult athletes (Morris, 2000).

At the junior sport levels, success is often the result of the physical dominance of an individual over other players from the same age group, which is related to their growth and relative degree of maturation (Helsen *et al*., 2000). In this regard, Brown (2001:6) noted:

> *Talented athletes who excel in their sports or perhaps even dominate their peers exist at every age level. They may be bigger, stronger, faster, or simply better than other children. Such children are great age-group athletes, nothing more and nothing less. They are good at what they do right now. There is no guarantee that because an athlete is good at 10 he or she will be good at 14, 16, or 18.*

Adolescence is subsequently a critical phase for talent development and many physical changes occur that may affect the eventual performance potential of a talented player (Feichtinger & Höner, 2015). The physical qualities that distinguish between elite adult athletes and those who do not reach the top level, may not be apparent until late adolescence (Abbott & Collins, 2004). Furthermore, less successful athletes during the developmental stages often excel once they reach the senior level (Güllich & Emrich, 2006). These tendencies have implications for both talent identification and talent development programmes (MacNamara & Collins, 2013). Consistent with this view, Abbot and Collins (2004) recommended that talent identification models should focus on determining and developing the various components that affect an individual's long-term performance capacity.

The identification and development of the psychological factors that distinguish outstanding soccer players from their peers has been a topic of great interest (Salmon *et al*., 1994; Lowther *et al*., 2002; Johnson *et al*., 2004; Thelwell *et al*., 2006). However, the typical approach to identify these factors entail comparing the psychological characteristics of high and low achieving teams (Panda & Bisivas, 1989; Coetzee *et al*., 2006; Jooste *et al*., 2014) and/or elite and non-elite players (Ashrafi & Hemayattalab, 2015).

Gould *et al*. (2002) explored the development of psychological characteristics in Olympic champions and found that athletes who achieved greater long-term success made more consistent use of psychological skills than their less successful counterparts did. Furthermore, Höner and Feichtinger (2016) observed that certain psychological skills and dispositions among 12-year-old talented soccer players were related to their soccer motor performance at the age of 16.

Despite the importance of psychological factors in sport performance, talent identification and development practices often overlook these factors (Vaeyens *et al.*, 2008). Williams and Reilly (2000) mainly ascribed this problem to the lack of a single psychological inventory with sufficient predictive power to distinguish between players with more or less potential. They also pointed towards insufficient knowledge about the way in which the psychological characteristics considered important for long-term sporting success develop over time. In this regard, Regnier *et al*. (1993) and Morris (2000) found no evidence to suggest that psychological characteristics will remain stable between the start of adolescence and adulthood. Subsequently, Morris (2000) recommended that psychological skills development programmes for youth athletes should include a broader range of players than those selected at that particular point in time due to having the best physical and physiological attributes.

Malina *et al*. (2004) noted a change in behavioural characteristics due to physical growth and biological maturation. The role of psychological characteristics in developing sporting excellence may vary according to the needs and requirements of the athletes during the different stages of their development (MacNamara *et al*., 2010a; 2010b). Whilst the same characteristics appeared to be important throughout the development process, they were utilised differently, depending on the individual's age, developmental status, and maturational level.

Using a small sample, Van den Berg *et al*. (2012) reported early developing rugby players to have superior sport psychological skills than their average developing counterparts at the chronological age of 15 or 16 years. The whole sample in this longitudinal study received top level coaching and conditioning programmes during the next two years. When tested again at the age of 17 or 18 years, these differences were no longer evident as the late developing players matured and caught up physically. Contrary to the changes observed in these psychological skills, Feichtinger and Höner (2015) found no individual changes in personality among talented soccer players from 12 to 14 years, leading them to speculate that such changes would only become evident towards the end of adolescence.

The physical characteristics associated with superior performance in youth soccer (speed, power) tend to favour players who are advanced in their biological maturity status (Siegel *et al*., 1996; Malina *et al*., 2004). The selection of early and average developers at a younger age, due to their physical advantage remains common practice, rather than identifying and developing those players who will eventually develop into elite players (Malina *et al*., 2004). This practice may affect the self-perception, motives, beliefs and ultimately the behaviour of these young players (Cumming *et al*., 2006).

PURPOSE OF RESEARCH

The aim of this study was to compare the sport psychological skill levels of early, average and late developing African junior soccer players. Exploring potential differences among youth players of varying maturation levels may provide further insight into the role of these factors with regard to selection to representative teams and the nurturing of players with potential.

METHODOLOGY

Research design

A cross-sectional, quantitative design was utilised in which the participant's sport psychological skill levels and biological maturity status were established and between-group comparisons made. Longitudinal studies would provide better insight into the developmental process. However, time, financial and logistical constraints (the participants in this study hailed from 10 African countries) made this impossible. Whilst the limitations of cross-sectional research designs are acknowledged, this approach was deemed suitable for this exploratory study.

Participants

Male African junior soccer players (N=149) who competed in the 2010 Copa Coca-Cola soccer tournament held in South Africa took part in the study. The participating countries were Botswana, Kenya, Malawi, Namibia, Nigeria, South Africa, Tanzania, Uganda, Zambia and Zimbabwe. The participants had a mean age of 16.24±1.10 years. This sample is selective (national teams), which may influence the findings of the study.

Instruments

Maturation status

Assessing the onset and progression of biological maturation are important for talent identification, because this information has immediate clinical application when interpreting growth status that is considered related to sport success (Sun *et al*., 2002). The appearance of

secondary sexual characteristics and the development of reproductive functionality characterise puberty (Luciano *et al*., 2013). Self-assessment on the degree to which these physical changes has occurred is a reliable way to assess sexual maturation status. Duke *et al*. (1980) reported that boys could assess their own genital and pubic hair development accurately by means of Tanner's standard photographs/illustrations (kappa coefficients between 0.81 and 0.91).

Schmitz *et al*. (2004) observed more than 85% agreement within one Tanner stage for most measures when these self-assessments were validated against a physician's reports and bone density measurements. Subsequently, numerous studies have assessed sexual maturity by means of the five Tanner stages (Berg-Kelly & Erdes, 1997; Schubert *et al*., 2005; Chan *et al*., 2008; Monteilh *et al*., 2010; Rabbani *et al*., 2013; Rasmussen *et al*., 2015). Reasons for the popularity of this method to evaluate sexual maturity in biological maturity and growth studies include that it is easy to apply, cheap and less invasive than methods like wrist radiography (Luciano *et al*., 2013).

A biological maturation questionnaire was compiled from previous studies that demonstrated the predictive and discriminate validity of self-interpreted sexual maturity based on the five Tanner stages (Duke *et al*., 1980; Rickey *et al*., 1988; Malina *et al*., 2004; Leone & Comtois, 2007). The respondents had to indicate (a) their current genital hair development from the five Tanner stage illustrations (ranging from Figure 1 that illustrated minimum genital hair development to Figure 5 that illustrated mature genital hair development), and (b) which of the five line diagrams represented their own genital development best (Faulkner, 1996). If consensus was not reached on the maturity status using these two methods, additional information pertaining to the ages at which their voices broke, they started shaving and developed underarm hair was used to classify them into the following three groups, namely early developers (Eds: n=27), average developers (Ads: n=77) and late developers (LDs: n=45).

Psychological skills

The Athletic Coping Skills Inventory-28 (ACSI-28) of Smith *et al*. (1995) was used to measure the psychological skills. The ACSI-28 consists of 28 items describing the experiences of other athletes, which prompts participants to indicate their frequency of similar experiences. Responses are given on a four-point scale with anchors ranging from (0) *almost never* to (3) *almost always*. Reversed scoring applies to six items [(3) *almost never* to (0) *almost always*]. Four items contributed to each of the subscales listed below.

Subscale scores are expressed as percentages, with higher values indicating better skills. The seven subscale scores are averaged to yield the composite coping skills score. Smith *et al*. (1995) reported a test-retest reliability of r=0.87 over a one week period for a sample of 97 college athletes for the composite coping skills score. The internal reliability indices for the current sample were as follows: coping with adversity (α=0.443), peaking under pressure (α=0.573), goal setting and mental preparation (α=0.667), concentration (α=0.402), freedom from worry (α=0.572), confidence and motivation (α=0.564), and coachability (α=0.365). A Cronbach's alpha value of 0.632 was obtained for the composite coping skills score by using the seven subscale scores. The poor internal reliability indices limit the generalisability of these results.

Procedures

The tournament organisers approved the study. All coaches and participants received an information letter explaining the aim of the study. Participation was voluntary and confidentiality assured. The participants signed informed assent forms and their guardians signed informed consent forms.

Statistical analysis

The SPSS (Statistical Package for the Social Sciences [Version 23], 2015) software programme was used for the statistical analysis. A one-way analysis of variance (ANOVA) with Scheffe post hoc test were used to determine differences with regard to the sport psychological skills between the three groups based on their maturity levels. Statistical significance was set at $p \leq 0.05$. Cohen's *d*-values (indicating practical significant differences) were calculated, using the pooled standard deviation method, which accounts for group size differences.

Ethical considerations

The Ethics Committee of the Tswhane University of Technology granted ethical clearance (approval number: 2010/07/005).

RESULTS

Table 1 reflects the chronological age for each of the three groups. These results indicate that the EDs were on average five months older than the ADs, and 12 months older than the LDs. The ADs were nine months older than the LDs.

Table 1. **DESCRIPTIVE STATISTICS OF CHRONOLOGICAL AGE OF EARLY, AVERAGE AND LATE DEVELOPERS**

Maturity group	Number	M±SD
Early developers (ED)	27	16.75±1.07
Average developers (AD)	77	16.36±1.02
Late developers (LD)	45	15.73±1.06

M=Mean SD=Standard Deviation

Table 2 reports the descriptive statistics and between-group differences with regard to the sport psychological skill levels of the three maturity cohorts. The LDs had statistically significant higher coping with adversity scores (p=0.032, d=0.35), as well as goal setting and mental preparation scores (p=0.014, d=0.76) than the EDs did.

Likewise, small to large effect sizes indicating practical significant differences were observed with the LDs scoring higher than the EDs for the composite coping skills score (d=0.43), peaking under pressure (d=0.42), concentration (d=0.39), confidence and motivation (d=0.95), as well as coachability (d=0.20). The EDs experienced less worries than the LDs (d=0.67).

Table 2. **DESCRIPTIVE RESULTS AND SPORT PSYCHOLOGICAL SKILL DIFFERENCES BETWEEN EARLY (ED), AVERAGE (AD) AND LATE (LD) DEVELOPERS**

Variables	Maturity Group	Descriptive statistics (%) M±SD	(%) Min	(%) Max	Differences maturity groups EDs/ADs	ADs/LDs	EDs/L
Composite coping skills score	EDs	62.92±12.00	38.10	84.52	$F_{2, 146}$=1.666; p=0.193		
	ADs	64.83±11.56	41.67	91.67	p=0.757	p=0.403	p=0.228
	LDs	67.72±10.81	44.05	88.10	*d*=0.16	*d*=0.26[a]	*d*=0.43[a]
Coping with adversity	EDs	56.48±17.35	25.00	91.67	$F_{2, 146}$=3.549; p=0.031*		
	ADs	64.83±19.48	25.00	100.00	p=0.139	p=0.575	p=0.032*
	LDs	68.52±17.93	33.33	100.00	*d*=0.44[a]	*d*=0.19	*d*=0.35[a]
Peaking under pressure	EDs	59.88±23.69	8.33	100.00	$F_{2, 146}$=0.433; p=0.650		
	ADs	60.61±22.69	8.33	100.00	p=0.989	p=0.710	p=0.742
	LDs	64.07±20.78	25.00	100.00	*d*=0.03	*d*=0.16	*d*=0.42[a]
Goalsetting and mental preparation	EDs	58.64±22.11	8.33	100.00	$F_{2, 146}$ =5.045; p=0.008*		
	ADs	64.39±24.95	8.33	100.00	p=0.513	p=0.052*	p=0.014*
	LDs	74.63±16.57	41.67	100.00	*d*=0.24[a]	*d*=0.46[a]	*d*=0.76[b]
Concentration	EDs	64.51±21.63	25.00	100.00	$F_{2, 146}$ =1.252; p=0.289		
	ADs	61.15±18.22	25.00	100.00	p=0.745	p=0.302	p=0.886
	LDs	66.85±20.53	16.67	100.00	*d*=0.18	*d*=0.30[a]	*d*=0.39[a]
Freedom from worry	EDs	57.10±23.99	0.00	100.00	$F_{2, 146}$ =1.127; p=0.327		
	ADs	52.27±19.88	0.00	100.00	p=0.618	p=0.741	p=0.327
	LDs	49.07±23.92	0.00	100.00	*d*=0.23[a]	*d*=0.15	*d*=0.67[b]
Confidence and motivation	EDs	70.68±20.72	33.33	100.00	$F_{2, 146}$ =1.202; p=0.304		
	ADs	77.60±21.00	16.67	100.00	p=0.309	p=0.957	p=0.497
	LDs	76.48±18.06	41.67	100.00	*d*=0.33[a]	*d*=0.06	*d*=0.95[c]
Coachability	EDs	73.15±18.39	41.67	100.00	$F_{2, 146}$ =0.107; p=0.898		
	ADs	72.94±17.05	33.33	100.00	p=0.999	p=0.902	p=0.955
	LDs	74.44±18.15	41.67	100.00	*d*=0.01	*d*=0.09	*d*=0.20[a]

M=Mean SD=Standard Deviation Min=Minimum Max=Maximum * p≤0.05 *d*=practical significance
[a] Small practical significant difference ($d \approx 0.3$) [b] Moderate practical significant difference ($d \approx 0.5$)
[c] Large practical significant difference ($d \approx 0.8$)
ED=Early Developers AD=Average Developers LD=Late Developers

DISCUSSION

Talent identification practices in youth soccer systematically exclude later maturing boys in favour of those who develop early or normally (Malina *et al*., 2000; Malina *et al*., 2004; Cumming *et al*., 2006; Figueiredo *et al*., 2009). However, factors other than physical size and physiological superiority probably contributed to the selection of these players to their respective national teams, since the current sample included a large proportion (30.20%) of late developers.

Although cause and effect cannot be inferred, the current results suggest that the EDs were either less resilient to adversity and/or that the LDs learnt to cope better with adversity. Symptoms of psychological distress has been related to pubertal timing in boys (Alsaker, 1992; Graber *et al*., 1997), with early developers tending to be more vulnerable to additional stressful events than those who develop later (Ge *et al*., 2001). Abbott *et al*. (2002) in part ascribed the phenomenon that early maturers are no longer selected for teams once the late maturers catch up physically, to a lack of opportunities to overcome the physical challenges to which the later maturing players were initially exposed. Being physically underdeveloped at a young age requires that late maturers develop the work ethic and resilience to compete for places on a team against the physically and technically superior early maturers.

Collins and MacNamara (2012:907) proposed that "talent needs trauma", arguing that eventual adult performance could be facilitated through supporting young athletes whilst they experience challenging life events, by debriefing these events afterwards, and/or through deliberately subjecting talented young athletes to a variety of appropriate challenges within existing talent development structures. In moderation, adverse experiences (non-selection, significant sporting failure, injuries, personal life challenges) play a vital role in the psychological and performance development of elite athletes as it could result in adaptive behavioural responses and increased resilience (Sarkar *et al*., 2015). Extended to the current study, it seems plausible that the LDs learnt to cope with the effects of their delayed physical maturation.

Although speculative, it seems as if the LDs could have made greater use of goal-setting and mental preparation to counter the superior physical and technical abilities of the EDs. In this regard, Locke and Latham (2002) noted that using goal setting could compensate for AND overcome weaknesses through directing attention and prolonged effort to important performance related tasks. Elite youth soccer players had better self-regulatory skills than non-elite players (Toering *et al*., 2009), which entails that they set more realistic goals and put greater effort into training to improve their weaknesses (Elferink-Gemser *et al*., 2011).

Overall, the LDs' self-reported psychological skill levels were higher than that of the EDs for all the measured variables apart from freedom from worries. These between-group differences provide insight into the possible role of sport psychological skills to the talent development of African youth soccer players. Collectively, it seems as if the superior psychological skills of the LDs contributed to their selection to their national teams, whereas the EDs relied more on their physical and physiological superiority to be successful.

CONCLUSIONS

The results suggest that psychological factors could possibly have counterbalanced the physical disadvantages of late maturation. Coaches, selectors and talent scouts should be careful not to exclude later maturing soccer players from talent development programmes. These findings are consistent with the belief that successful progression to the elite sport levels requires adequately developed psychological skills (Van Yperen, 2009), and that this progression occurs through unique, individual pathways (Phillips *et al*., 2010).

There remains a paucity of information about the development of psycho-behavioural skills from adolescence to adulthood and the extent to which these skills eventually contribute to elite sport performance. Prospective studies should explore the stability of psycho-behavioural skills during adolescence, the mechanism through which these factors develop over time, as well as the most effective ways to develop these skills within existing talent development systems.

REFERENCES

ABBOTT, A. & COLLINS, D. (2004). Eliminating the dichotomy between theory and practice in talent identification and development: Considering the role of psychology. *Journal of Sports Sciences*, 22(5): 395-408.

ABBOTT, A.; COLLINS, D.; MARTINDALE, R.J.J. & SOWERBY, K. (2002). *Talent identification and development: An academic review*. Edinburgh, Scotland: SportScotland.

ALSAKER, F.D. (1992). Pubertal timing, overweight, and psychological adjustment. *Journal of Early Adolescence*, 12(4): 396-419.

ASHRAFI, S.V.S. & HEMAYATTALAB, R. (2015). A comparison of elite and non-elite athletes sport imagery ability. *International Journal of Sport Studies*, 5(4): 488-491.

BERG-KELLY, K. & ERDES, L. (1997). Self-assessment of sexual maturity by mid-adolescents based on a global question. *Acta Paediatrica*, 86(1): 10-17.

BROWN, J. (2001). *Sports talent*. Champaign, IL: Human Kinetics.

CHAN, N.P.T.; SUNG, R.T.Y.; KONG, A.P.S.; GOGGINGS, W.B.; SO, H.K. & NELSON, E.A.S. (2008). Reliability of pubertal self-assessment in Hong Kong Chinese children. *Journal of Paediatrics and Child Health*, 44(6): 353-358.

COETZEE, B.; GROBBELAAR, H.W. & GIRD, C.C. (2006). Sport psychological skills that distinguish successful from less successful soccer teams. *Journal of Human Movement Studies*, 51(6): 383-401.

COLLINS, D. & MACNAMARA, Á. (2012). The rocky road to the top: Why talent needs trauma. *Sports Medicine*, 42(11): 907-914.

CUMMING, S.P.; BATTISTA, R.A.; STANDAGE, M.; EWING, M.E. & MALINA, R.M. (2006). Estimated maturity status and perceptions of adult autonomy support in youth soccer players. *Journal of Sports Sciences*, 24(10): 1039-1046.

DUKE, P.M.; LITT, I.F. & GROSS, R.T. (1980). Adolescents' self-assessment of sexual maturation. *Paediatrics*, 66(6): 918-920.

ELFERINK-GEMSER, M.T.; JORDET, G.; COELHO-E-SILVA, M.J. & VISSCHER, C. (2011). The marvels of elite sports: How to get there? *British Journal of Sports Medicine*, 45(9): 683-684.

FAULKNER, R.A. (1996). Maturation. In D. Docherty (Ed.), *Measurement in pediatric exercise science* (pp. 129-158). Champaign, IL: Human Kinetics.

FEICHTINGER, P. & HÖNER, O. (2015). Talented football players' development of achievement motives, volitional components, and self-referential cognitions: A longitudinal study. *European Journal of Sport Science*, 15(8): 748-756.

FIGUEIREDO, A.J.; GONÇALVES, C.E.; COELHO, E.; SILVA, M.J. & MALINA, R.M. (2009). Characteristics of youth soccer players who drop out, persist or move up. *Journal of Sports Sciences*, 27(9): 883-891.

GE, X.; CONGER, R.D. & ELDER, G.H. (2001). The relation between puberty and psychological distress in adolescent boys. *Journal of Research on Adolescence*, 11(1): 49-70.

GOULD, D.; DIEFFENBACH, K. & MOFFETT, A. (2002). Psychological characteristics and their development in Olympic champions. *Journal of Applied Sport Psychology*, 14(3): 172-204.

GRABER, J.A.; LEWINSOHN, P.M.; SEELEY, J. & BROOKS-GUNN, J. (1997). Is psychopathology associated with the timing of pubertal development? *Journal of American Academy of Child and Adolescent Psychiatry*, 36(12): 1768-1776.

GÜLLICH, A. & EMRICH, E. (2006). Evaluation of the support of young athletes in the elite sport system. *European Journal for Sport and Society*, 3(2): 85-108.

HELSEN, W.F.; HODGES, N.J.; VAN WINCKEL, J. & STARKES, J.L. (2000). The roles of talent, physical precocity and practice in the development of soccer expertise. *Journal of Sports Sciences*, 18(9): 727-736.

HÖNER, O. & FEICHTINGER, P. (2016). Psychological talent predictors in early adolescence and their empirical relationship with current and future performance in soccer. *Psychology of Sport and Exercise*, 25(July): 17-26.

JOHNSON, J.; HRYCAIKO, D.; JOHNSON, G. & HALAS, J. (2004). Self-talk and female youth soccer performance. *The Sport Psychologist*, 18(1): 44-59.

JOOSTE, J.; STEYN, B.J.M. & VAN DEN BERG, L. (2014). Psychological skills, playing position and performance of African youth soccer teams. *South African Journal for Research in Sport, Physical Education and Recreation*, 36(1): 85-100.

LEONE, M. & COMTOIS, A.S. (2007). Validity and reliability of self-assessment of sexual maturity in elite adolescent athletes. *Journal of Sports Medicine and Physical Fitness*, 47(3): 361-365.

LOCKE, E.A. & LATHAM, G.P. (2002). Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. *American Psychologist*, 57(9): 705-717.

LOWTHER, J.; LANE, A. & LANE, H. (2002). Self-efficacy and psychological skills during the amputee soccer World Cup. *Athletic Insight*, 4(2): 23-34.

LUCIANO, A.P.; BENEDET, J.; DE ABREU, L.C.; VALENTI, V.E.; DE SOUZA ALMEIDA, F.; DE VASCONCELOS, F.A.G. & ADAMI, F. (2013). Median ages at stages of sexual maturity and excess weight in school children. *Reproductive Health*, 10(1): Article no. 56.

MACNAMARA, Á.; BUTTON, A. & COLLINS, D. (2010a). The role of psychological characteristics in facilitating the pathway to elite performance. Part 1: Identifying mental skills and behaviors. *The Sport Psychologist*, 24(1): 52-73.

MACNAMARA, Á.; BUTTON, A. & COLLINS, D. (2010b). The role of psychological characteristics in facilitating the pathway to elite performance. Part 2: Examining environmental and stage-related differences in skills and behaviors. *The Sport Psychologist*, 24(1): 74-96.

MACNAMARA, Á. & COLLINS, D. (2013). Do mental skills make champions? Examining the discriminant function of the psychological characteristics of developing excellence questionnaire. *Journal of Sports Sciences*, 31(7): 736-744.

MALINA, R.M.; BOUCHARD, C. & BAR-OR, O. (2004). *Growth, maturation, and physical activity*. Champaign, IL: Human Kinetics.

MALINA, R.M.; REYES, M.E.P.; EISENMANN, J.C.; HORTA, L.; RODRIGUES, J. & MILLER, R. (2000). Height, mass and skeletal maturity of elite Portuguese soccer players aged 11–16 years. *Journal of Sports Sciences*, 18(9): 685-693.

MONTEILH, C.; KIESZAK, S.; FLANDERS, W.D.; MAISONET, M.; RUBIN, C.; HOLMES, A.K.; HERON, J.; GOLDING, J.; MCGEEHIN, M.A. & MARCUS, M. (2010). Timing of maturation and predictors of Tanner stage transitions in boys enrolled in a contemporary British cohort. *Paediatric Perinatal Epidemiology*, 25(1): 75-87.

MORRIS, T. (2000). Psychological characteristics and talent identification in soccer. *Journal of Sports Sciences*, 18(9): 715-726.

PANDA, B.N. & BISIVAS, N. B. (1989). Personality adjustment of high and low achieving football players: A comparative study. *Indian Journal of Psychometry and Education*, 20(): 97-100.

PHILLIPS, E.; DAVIDS, K.; RENSHAW, I. & PORTUS, M. (2010). Expert performance in sport and the dynamics of talent development. *Sports Medicine*, 40(4): 271-283.

RABBANI, A.; NOORIAN, S.; FALLAH, J.S.; SETOUDEH, A.; SAYARIFARD, F. & ABBASI, F. (2013). Reliability of pubertal self-assessment method: An Iranian study. *Iranian Journal of Pediatrics*, 23(3): 327-332.

RASMUSSEN, A.R.; WOHLFAHRT-VEJE, C.; DE RENZY-MARTIN, T., HAGEN, C.P.; TINGGAARD, J.; MOURITSEN, A.; MIERITZ, M.G. & MAIN, K.M. (2015). Validity of self-assessment of pubertal maturation. *Pediatrics*, 135(1): 86-93.

REGNIER, G.; SALMELA, J. & RUSSEL, S.J. (1993). Talent detection and development in sport. In R.N. Singer, M. Murphey & L.K. Tennant (Eds.), *Handbook of research in sport psychology* (pp. 290-313). New York, NY: Macmillan.

RICKEY, L.; WILLIAMS, R.L.; CHEYNE, K.L.; HOUTKOOPER, L.K. & LOHMAN, T.G. (1988). Adolescent self-assessment of sexual maturation: Effects of fatness classification and actual sexual maturation stage. *Journal of Adolescent Health Care*, 9(6): 480-482.

SALMON, J.; HALL, C. & HASLAM, I. (2008). The use of imagery by soccer players. *Journal of Applied Sport Psychology*, 6(1): 116-133.

SARKAR, M.; FLETCHER, D. & BROWN, D.J. (2015). What doesn't kill me...: Adversity-related experiences are vital in the development of superior Olympic performance. *Journal of Science and Medicine in Sport*, 18(4): 475-479.

SCHMITZ, K.E.; HOVELL, M.F.; NICHOLS, J.F.; IRVIN, V.L.; KEATING, K.; SIMON, G.M.; GEHRMAN, C. & JONES, K.L. (2004). A validation study of early adolescents' pubertal self-assessments. *Journal of Early Adolescence*, 24(4): 357-384.

SCHUBERT, C.M.; CHUMLEA, W.C.; KULIN, H.E.; LEE, P.A.; HIMES, J.H. & SUN, S.S. (2005). Concordant and discordant sexual maturation among U.S. children in relation to body weight and BMI. *Journal of Adolescent Health*, 37(5): 356-362.

SIEGEL, S.R.; KATZMARYZK, P.T. & MALINA, R.M. (1996). Somatotypes of female soccer players 10–24 years of age. In E. Bodzsar & C. Susanne (Eds.), *Studies in human biology* (pp. 277-285). Budapest, Hungary: Eotvos University Press.

SMITH, R.E.; SCHUTZ, R.W.; SMOLL, F.L. & PTACEK, J.T. (1995). Development and validation of a multidimensional measure of sport-specific psychological skills: The Athletic Coping Skills Inventory-28. *Journal of Sport and Exercise Psychology*, 17(4): 379-398.

SPSS (2015). IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.

SUN, S.S.; SCHUBERT, C.M.; CHUMLEA, W.C.; ROCHE, A.F.; KULIN, H.E.; LEE, P.A.; HIMES, J.H. & RYAN, A.S. (2002). National estimates of the timing of sexual maturation and racial differences among US children. *Pediatrics*, 110(5): 911-919.

THELWELL, R.C.; GREENLEES, I.A. & WESTON, N.J.V. (2006). Using psychological skills training to develop soccer performance. *Journal of Applied Sport Psychology,* 18(3): 254-270.

TOERING, T.T.; ELFERINK-GEMSER, M.T.; JORDET, G. & VISSCHER, C. (2009). Self-regulation and performance level of elite and non-elite youth soccer players. *Journal of Sports Sciences,* 27(14): 1509-1517.

VAN DEN BERG, L.; PIENAAR, A.E. & GROBBELAAR, H.W. (2012). The role of biological maturity in sport psychological skills of young rugby players: An explorative investigation. *African Journal for Physical, Health Education, Recreation and Dance,* 18(Supplement 1): 332-343.

VAN YPEREN, N.W. (2009). Why some make it and others do not: Identifying psychological factors that predict career success in professional adult soccer. *The Sport Psychologist,* 23(3): 317-329.

VAEYENS, R.; COELHO E.; SILVA, M.; VISSCHER, C.; PHILIPPAERTS, R. & WILLIAMS, A. (2013). Identifying young players. *Science and Soccer: Developing Elite Performers,* 3(January): 289-306.

VAEYENS, R.; LENOIR, M.; WILLIAMS, A.M. & PHILIPPAERTS, R.M. (2008). Talent identification and development programmes in sport. *Sports Medicine,* 38(9): 703-714.

WILLIAMS, A.M. & REILLY, T. (2000). Talent identification and development in soccer. *Journal of Sports Sciences,* 18(9): 657-667.

Corresponding author: Dr. Linda van den Berg; **Email:** vandenbergL1@tut.ac.za

(*Subject editor: Prof. Ankebé Kruger)*