

Comparing psychological constructs in early specializing and sampling male hockey players

Alexandra Mosher^{1,*}, Joseph Baker¹ & Jessica Fraser-Thomas¹

¹ School of Kinesiology and Health Science, York University, Toronto, Ontario, Canada

* Corresponding author: School of Kinesiology and Health Science, York University, 4700 Keele St., Toronto, Ontario, Canada

Tel: +1 (416) 736 210020596

E-Mail: moshera@yorku.ca

ORIGINAL ARTICLE

Article History:

Submitted 7th January 2019

Accepted 6th March 2020

Published 19th March 2020

Handling Editor:

Martin Kopp

University of Innsbruck, Austria

Editor-in-Chief:

Martin Kopp

University of Innsbruck, Austria

Reviewers:

Reviewer 1: anonymous

Reviewer 2: anonymous

Citation:

Mosher, A., Baker, J. & Fraser-Thomas J. (2020). Comparing psychological constructs in early specializing and sampling male hockey players. *Current Issues in Sport Science*, 5:004. doi: 10.15203/CISS_2020.004.

Introduction

In recent years there has been a growing trend in western nations for young people participating in sport to specialize early (Feeley, Agel, & LaPrade, 2016; Jayanthi, Pinkham, Dugas, Patrick, & LaBella, 2013) and considerable research over the past two decades has focused on the potential benefits and negative outcomes associated with early specialization. Much of this work has been guided by the Developmental Model of Sport Participation (DMSP; Côté, 1999; Côté & Fraser-Thomas, 2016; Côté & Hay, 2002), which proposes two different athlete trajectories towards an elite level of performance. In the first, athletes participate in many sports as a child and progress to specialize and invest in one sport (i.e., early sampling trajectory). In the second, athletes bypass the sampling

ABSTRACT

Athletes who specialize early often invest more into their sport from a young age. It has been suggested early specializers feel greater pressure to perform and, as a result, have higher levels of anxiety or on the contrary may have developed better coping strategies than their sampling peers. This study focused on understanding differences between early specializers and samplers on relevant psychological constructs (competitive state anxiety, competitive trait anxiety, and personality). Participants were divided into groups based on a modified version of the Developmental History of Athletes Questionnaire (Hopwood, Farrow, MacMahon, & Baker, 2015) and independent sample t-tests considered between group differences. There were no significant differences between early specializers and samplers for competitive state anxiety, competitive trait anxiety, or the big five personality traits. Results highlight the need for further investigation into differences between early specializers and samplers.

Keywords:

Early specialization – youth – sport – competitive anxiety – personality

stage and begin with sport specialization during childhood (i.e., early specialization) (Côté & Fraser-Thomas, 2016). While there is no consistent definition of early specialization, a commonly adopted one suggests early specialization is year-round training in a single sport at the exclusion of other sports, occurring during the ages of 6-12 (Wiersma, 2000). In 2015, the American Orthopedic Society of Sport Medicine (AOSSM) convened a think tank of experts on early specialization and released a consensus definition. Early specialization was defined by three criteria: (a) participation in intensive training and/or competition in organized sports greater than 8 months per year, (b) participation in one sport at the exclusion of participation in other sports, (c) involving prepubertal (roughly age 12) children (LaPrade et al., 2016). The rationale for early specialization comes from the influential deliber-

ate practice framework (Ericsson, Krampe, & Tesch-Römer, 1993). Ericsson and colleagues (1993) noted that expert musicians spent more time in practice aimed at improving performance than their non-expert counterparts. The authors suggested this specific type of training (i.e., activities that were highly effortful, designed for the purpose of improving performance and do not provide instant gratification), which they labeled 'deliberate practice', was the key difference between experts versus non-experts across domains. Importantly, this framework promotes that in order to become an expert, one must engage in a large quantity of deliberate practice, and the more time spent in deliberate practice, the higher the attained level of performance. Further, the authors suggested that if someone starts deliberate practice at a later age, they would be at a disadvantage compared to their peers who began earlier as they would have potentially had less opportunity to accumulate the same amount of deliberate practice hours. Whether it is beneficial in terms of expertise for an athlete to specialize early is a complex and unresolved issue in the field. However, all would agree that becoming an elite athlete requires practice. In a review of literature on sport skill acquisition, researchers concluded that high amounts of deliberate practice are integral to developing expertise across sporting domains (Baker & Young, 2014). This theory underpins the rationale for early specialization; the sooner one begins sport specific deliberate practice, the more likely they are to reach a high level of skill.

There is, however, growing concern, that early specialization can be detrimental to the physiological and psychosocial health of youth. Early specializers experience higher rates and risk of injury as well as higher levels of emotional exhaustion, dropout and burnout (Fraser-Thomas, Côté, & Deakin, 2008; Jayanthi et al., 2013; Strachan, Côté, & Deakin, 2009). Despite the strong consensus statements that have been advanced concerning early specialization (e.g. LaPrade, et al., 2016) very little is known about the differences between athletes who specialize and those who do not, with the exception of the injury and training pattern research mentioned above. In the current study, we examined differences in two key psychological constructs - personality and anxiety - which have been largely overlooked in this area.

Personality generally reflects stable psychological characteristics that differ between individuals (Larsen & Buss, 2008). The most widely employed model of personality is the five-factor model (FFM) proposed by McCrae and John (1992). The FFM suggests there are five personality traits that everyone possess; openness to experience, conscientiousness, extraversion, agreeableness and neuroticism. Openness to experience manifests in behaviours such as being intellectual, imaginative and creative. Behaviours such as being organized, practical, and prompt are markers of someone who is highly conscientious. Extraversion can be classified by behaviours such as being talkative, social, and assertive. Someone who is high on agreeableness, will display behaviours such as being sympathetic, kind, warm and sincere. Finally, neuroticism, is defined as low emotional stability, and being moody and insecure. While the examination of personality traits among athletes has a long history (e.g., Allen, Greenless, & Jones, 2011; Egloff & Gruhn, 1995; Kirkcaldy, 1982; McKelvie, Lemieux, & Stout, 2003; Pied-

mont, Hill, & Blanco, 1999), no research has focused specifically on personality traits in relation to children and youths' sport trajectories.

Similarly, sport-related measures of anxiety have been largely overlooked in examinations of the consequences of early specialization. Athletes competing in individual sports have reported higher levels of competitive *state* anxiety (CSA) than those competing in team sports (Flowers & Brown, 2002) and athletes higher in competitive *trait* anxiety (CTA) respond to competition with greater levels of CSA compared to those with low CTA (Hanton, Mellalieu, & Hall, 2001). Of particular concern are the negative outcomes associated with high competitive anxiety such as decreased performance and increased fear of failure (Aoyagi, Burke, Joyner, Hardy, & Hamstra 2009; Rainey & Cunningham, 1988). It has been suggested that early specialization could lead to higher levels of competitive anxiety, given athletes invest more time and may feel greater pressure to succeed (Baker, Cobley, & Fraser-Thomas, 2009). On the contrary, because of the amount of time spent in a single sport, athletes may be more accustomed to the pressure and may, therefore, have lower levels of competitive anxiety than their non-specializing peers (e.g., those who sample several sports). Additionally, past research has shown competitive anxiety and personality are important factors influencing sport outcomes (Egloff & Gruhn, 1995; Piedmont et al., 1999; Rainey & Cunningham, 1988). As such, this study examined differences between early specializers and samplers on measures of personality and anxiety to determine whether significant differences exist between groups on these outcomes.

Methods

Participants

Participants included 77 male peewee ice-hockey (subsequently referred to as hockey) players (i.e., ages 11-12; no body checking) from seven different teams in the Greater Toronto Area (GTA), Canada. Toronto is arguably one of the most competitive regions in the world to develop as a hockey player as it has produced the greatest number of athletes to make the NHL in North America (Benjamin, 2017). Participants competed at the three highest levels of hockey (i.e., 51.9% played at the A level, 29.9% played at the AA level, and 18.2% played at the highest AAA level). The majority of the sample was Caucasian (81%), having a mean start age in hockey of 5.33 years old ($SD = 1.40$). Twenty teams were asked to be a part of the study, with coaches of seven teams agreeing for their team members to be approached to participate. Of the potential 119 athletes on these teams, 71% of athletes participated and completed the study.

Procedure

After receiving institutional ethics approval, parental consent, and athlete assent, data were collected from parents and players towards the end of the hockey season (i.e., January and February of

2017). Parents completed a survey that included demographic information (modified from the Developmental History of Athletes Questionnaire (DHAQ) a tool that has been shown to have very good to good reliability and validity (Hopwood, 2013). Extensive information regarding involvement in hockey and other organized sports over the past 2 years was collected to determine sport trajectory. Specifically, for each "in season" (i.e., September to March) or "off season" (i.e., April to August), parents were asked to list all the types of organized hockey activities their child participated in and the total hours per week their child participated in these organized hockey activities. Parents were then asked to list all other (non-hockey) organized sports their child was involved in, the number of months their child was involved in each organized sport, and the average number of hours per week that their child was involved in each organized sport. Average hours per week in other sports was summed for each year, to establish a crude estimate of the maximum number of hours each child was participating in other sports (Strachan et al., 2009), which was then compared to the number of hours they were participating in hockey.

Specialization classification was guided by the three criteria suggested by LaPrade and colleagues (2016): participation in intensive training and/or competition in organized sports greater than 8 months per year, (b) participation in one sport at the exclusion of participation in other sports, (c) involving prepubertal (roughly age 12) children. As the age of participants was 11-12 years old, they all met the criteria of being prepubertal. A participant was deemed an early specializer if they only participated in hockey for the duration of the hockey season (i.e., seven months; similar to the 8 months suggested but adapted for a hockey season), and spent a greater amount of time in ice hockey than in other sports over the two past years (i.e., from August 2015 - March 2017) as this was considered participation in one sport to the exclusion of others. In contrast, an athlete was deemed a sampler if they participated in a least one sport other than hockey during the hockey season and spent an equal or greater amount of time in other sports in comparison to hockey over the past two years as this would not meet the criteria of exclusion of other sports.

Measures

Players completed surveys measuring competitive state anxiety, competitive trait anxiety and personality in a separate room from parents (i.e. dressing room), with the principal investigator and a least one coach present, to ensure surveys were completed accurately.

The Competitive State Anxiety Inventory-2 Children's form. The CSAI-2C (Stadulis, MacCracken, Eidson, & Severance, 2002), is a 15-item scale that measures three specific components of competitive state anxiety (i.e., cognitive anxiety, somatic anxiety, and self-confidence). Each subscale contains five items that are assessed on a 4-point scale from 1 ("not at all") to 4 ("very much"). The CSAI-2C has been found to be psychometrically sound, with

strong reliability, validity, and the same original three-factor structure found as the original CSAI-2 (Stadulis et al., 2002).

The Sport Anxiety Scale-2. The SAS-2 (Smith, Smoll, Cumming, & Grossbard, 2006), measures both somatic (physical) and cognitive trait anxiety in competitive settings. The SAS-2 is a 15-item measure that contains three subscales (i.e., somatic anxiety, worry, concentration disruption), each containing five related items. The items are scored on a scale from 1 ("not at all") to 4 ("very much"). The SAS-2 is preferable to the original Sport Anxiety Scale (SAS; Smith, Smoll, & Schutz, 1990) because it has been shown to be more valid in younger populations (Smith et al., 2006). The SAS-2 has shown strong construct validity and reliability in the desired population (Smith et al., 2006).

The Mini International Personality Item Pool Scale. The Mini IPIP (Donnellan, Oswald, Baird & Lucas, 2006), was created from the International Personality Item Pool (Goldberg, 1992) and contains 20 items, with four items for each of the five assessed traits: (a) *Openness to Experience*, (b) *Conscientiousness*, (c) *Extraversion*, (d) *Agreeableness*, and (e) *Neuroticism*. Donnellan and colleagues (2006) showed acceptable internal consistencies and high test-retest reliability, while an exploratory factor analysis of the Mini IPIP indicated the presence of five factors, adding additional support to the structure of the tool (Cooper, Smillie, & Corr, 2010).

Analyses

All analyses were performed using SPSS 24.0. Total scores were calculated for each subscale of CSA (i.e., cognitive anxiety, somatic anxiety, confidence), CTA (i.e., somatic anxiety, worry, concentration), each subscale of personality (i.e., openness, conscientiousness, extraversion, agreeableness, neuroticism). Cronbach's alpha was calculated to determine the internal consistency of the scales followed by independent sample t-tests to determine if there were significant differences in anxiety (both CTA and CSA) and/or personality traits between early specializers and samplers.

Results

Descriptive statistics are provided in Table 1. Based on the criteria noted above, 43 of 77 (55.8%) participants were classified as early specializers. As expected, there was a significant difference between groups in terms of hours spent in other sports per week for both years $t(78) = 4.1, p < .001$ and $t(78) = 5.1, p < .001$. As the players were on the same teams or competing at similar skill levels, there were no significant differences in terms of hours per week spent in hockey. Having the groups be similar in terms of their hockey participation meant that we could be more confident that any differences found between groups in anxiety scores or personality would be a result of the breadth of sport participation (i.e., single versus multiple sport engagement).

Table 1. Descriptive Statistics of Study Variables by Early Specializers and Samplers.

	Early Specializers (n = 43)			Samplers (n = 34)		
	M	SD	%	M	SD	%
Demographic						
Ethnicity (Caucasian)			81.39			82.35
Birth Year 2005			55.8			61.76
Birth Year 2004			44.2			38.24
Specialization						
Start age of hockey	5.32	1.40		5.33	1.49	
Competitive Level						
(A)			46.51			58.82
(AA)			32.56			26.47
(AAA)			20.93			14.71
Hours/Week in Sports						
Hockey (2016/17)	8.93	2.84		8.84	2.82	
Other sports (2016/17)	3.65	4.14		7.72	4.77	
Hockey (2015/16)	9.03	3.12		8.59	2.56	
Other sports (2015/16)	3.32	3.42		7.63	4.12	
Personality						
Openness	14.57	2.68		14.03	2.44	
Conscientiousness	13.11	3.62		12.46	2.78	
Extraversion	15.20	3.24		14.22	3.29	
Agreeableness	14.24	3.28		13.90	2.90	
Neuroticism	11.02	3.35		10.65	2.67	
Anxiety						
CSA	23.90	6.77		24.33	5.70	
Somatic	8.11	2.86		7.81	2.17	
Cognitive	8.09	2.84		7.97	2.52	
Confidence	7.60	2.50		8.71	3.59	
CTA	23.32	7.31		21.64	4.35	
Somatic	7.68	2.55		6.97	1.79	
Worry	9.15	3.95		8.24	2.41	
Concentration	6.81	1.99		6.42	1.37	

Note: All personality subscales have a possible score from 5 to 20; CSA and CTA anxiety subscales have a possible score of 5 to 20

Cronbach's alphas showed good internal reliability for CTA and CSA (.89 and .82 respectively). Independent sample t-tests indicated there were no significant differences on any of the CSA subscales (somatic anxiety, $t(73) = -.34$, ns; cognitive anxiety, $t(74) = -.01$, ns; or self-confidence, $t(75) = 1.51$, ns). Similarly, for CTA, there were no significant differences on the subscales of somatic anxiety $t(72) = -1.11$, ns; worry, $t(72) = -.89$, ns, or concentration, $t(72) = -.98$, ns. Further, there were no significant differences on any of the personality sub-scales, indicating no differences between early specializers and samplers.

Discussion

This exploratory study examined measures of state and trait competitive anxiety and the "Big 5" personality traits between early specializers and samplers. No significant differences were found for any of the outcomes. This was intriguing as researchers have noted several relationships between personality and different aspects of sport in the past. For instance, studies have found that athletes have higher levels of extraversion compared to the general population (Egloff & Gruhn, 1995; Kirkclady, 1982), as well as significantly lower scores of neuroticism and higher scores of conscientiousness (Kajtina, Tušak, Barić, & Burnik, 2004; McKelvie et al., 2003). Furthermore, this combination of personality traits (higher conscientiousness and lower neuroticism) has also distinguished higher performing and more dedicated athletes from lower level less dedicated athletes (Allen, Greenless, & Jones 2011; Piedmont et al., 1999). A possible explanation for our lack of significant effects may be the age of participants. Specifically, since there are mean-level age differences in the Big Five traits across the life span (Soto, John, Gosling, & Potter, 2011), extroversion, conscientiousness, and neuroticism may manifest themselves differently in relation to training, practice, effort, and investment among older athletes than younger athletes, making differences in sport trajectory based on these traits less prevalent. Further, past research has shown parents are the key influencers in their child's sport participation (Greendorfer & Lewko, 1978). Given the young age of the participants, parents may have still been playing a primary role in selecting the child's sport activities, making children's personality a less influential factor in their sport trajectory.

As noted earlier, this exploratory design focused on examining psychological differences between athletes who specialize versus sample during their early sport careers. As a result of its exploratory nature, there were several limitations that should be considered in future work. First, the age range of participants in this study was exclusive (i.e., ages 11 and 12) and future research should examine older athletes who were early specializers to see if there are any differences in competitive anxiety and personality traits once personality becomes more stable. Potentially, athletes who specialized early and now compete at a higher level may have developed higher levels of neuroticism from the added pressure of investing all their time in one sport or learned to better manage their competitive anxiety with experience. Studying a wide age range would help to better understand differences between early

specializers and samplers in terms of competitive anxiety and personality traits.

Second, a key challenge in this study surrounded the categorization of athletes as early specializers or samplers, which was based on parental report and understanding of the information required. Although this study used questions from the DHAQ (Hopwood et al., 2015), a well validated questionnaire, and our categorization was built upon a recognized definition of early specialization (LaPrade et al., 2016), future research may consider developing a more effective categorization tool – specifically ensuring instructions and questions are brief, simple, and clear, to enhance parents' readability and accurate completion. If athletes are not being categorized properly, this could lead to groups being too homogenous and would in turn result in researchers not being able to find differences between groups that might exist had they been accurately sorted.

It is possible previous research has overstated the psychosocial differences between early specializers and samplers and that there are more similarities than differences. Identifying areas of difference and similarity will be important as this field continues to evolve. As mentioned previously, the definition of early specialization and the subsequent classifying of athletes as early specializers is neither clear nor consistent across this area of research. This limitation has been noted by several researchers; for example, Ferguson and Stern (2014) stated "there is no standardized definition for early sport specialization, with authors providing their own interpretation.... The lack of a concrete definition has led to confusion over what qualifies as early sport specialization" (p. 377-378). Similarly, Buckley et al. (2017) noted "in 2017, the topic of single-sport specialization remains poorly defined, with many unanswered questions" (p.1). Some examples of the different definitions of early specialization include an "early starting age in highly structured and intensive activities with the explicit goal of improving performance in a sport" (Mendes et al., 2018, p. 2) while others have used "year-round intensive training in a single sport at the exclusion of other sports" (Post et al., 2017, p.1405) or even "the time when the athlete defined one sport as being more important than other sports" (Moseid, Myklebust, Fagerland, & Bahr, 2019, p. 461). The lack of a coherent definition means the markers for early specialization vary based on study design. While most researchers agree that early specializers pursue primarily one sport from a young age, the "cut off" age for single sport involvement varies depending on the sport and guiding sport participation model (e.g., LTAD, Canadian Sport for Life, 2019; DMSP, Côté, 1999; Côté & Fraser-Thomas, 2016). Further, while some suggest length of training is a key marker (e.g., increased frequency and increased duration of training; Wiersma, 2000), others focus on time spent in activities (e.g., year-round; Hill & Hansen, 1988). Questions remain as to what constitutes "year-round training" or "single sport participation". In the current study, group categorization was operationalized using criteria from Baker and colleagues' (2009) definition, but future research needs to establish a consistent definition of early specialization as well as the best method to accurately measure key markers. An important step forward will be to determine what is meant by "early" "intensive" or "year round", for example.

This research is timely given the growing trend towards early specialization within youth sport programs, and the potential consequences of early specialization (Fraser-Thomas, Côté, & Deakin, 2005; Law, Côté & Ericsson, 2007; Strachan, et al., 2009). While findings of this study did not find differences in competitive anxiety and personality according to sport trajectory, continued research in the area of sport trajectories is important for understanding the effect of different types of sport participation on youth development and athlete achievement.

Funding

The authors have no funding or support to report.

Competing Interests

The authors have declared that no competing interests exist.

Data Availability Statement

All relevant data are within the paper.

References

- Allen, M. S., Greenlees, I., & Jones, M. V. (2011). An investigation of the five-factor model of personality and coping behaviour in sport. *Journal of Sports Sciences, 29*(8), 841-850. doi: 10.1080/02640414.2011.565064.
- Aoyagi, M. W., Burke, K. L., Joyner, B., Hardy, C. J., & Hamstra, M. S. (2009). The associations of competitive trait anxiety and personal control with burnout in sport. *Athletic Insight, 11*(1).
- Baker, J., Cobley, S., & Fraser Thomas, J. (2009). What do we know about early sport specialization? Not much! *High Ability Studies, 20*(1), 77-89.
- Baker, J., & Young, B. (2014). 20 years later: deliberate practice and the development of expertise in sport. *International Review of Sport and Exercise Psychology, 7*(1), 135-157.
- Benjamin, C. (2017). Study: Toronto produced more NHL players than any city and it's not even close. Retrieved from <https://www.cbssports.com>
- Buckley, P. S., Bishop, M., Kane, P., Ciccotti, M. C., Selverian, S., Exume, D., ... & Ciccotti, M. G. (2017). Early single-sport specialization: a survey of 3090 high school, collegiate, and professional athletes. *Orthopaedic journal of sports medicine, 5*(7).
- Canadian Sport for Life. (2019). Long-term Development in Sport and Physical Activity. Retrieved from <https://sportforlife.ca/wp-content/uploads/2019/06/Long-Term-Development-in-Sport-and-Physical-Activity-3.0.pdf>
- Cooper, A. J., Smillie, L. D., & Corr, P. J. (2010). A confirmatory factor analysis of the Mini IPIP five-factor model personality scale. *Personality and Individual Differences, 48*(5), 688-691.
- Côté, J. (1999). The influence of the family in the development of talent in sport. *The Sport Psychologist, 13*, 395-417.
- Côté, J., & Hay, J. (2002). Children's involvement in sport: A developmental perspective. *Psychological foundations of sport*. Boston MA: Allyn & Bacon
- Côté, J., & Fraser-Thomas, J. (2016). Youth involvement and positive development in sport. In P.R.E. Crocker (Ed.). *Sport psychology: A Canadian perspective, 3*, 256-287. Toronto: Pearson Prentice Hall.
- Donnellan, M. B., Oswald, F. L., Baird, B. M., & Lucas, R. E. (2006). The mini-IPIP scales: tiny-yet-effective measures of the Big Five factors of personality. *Psychological Assessment, 18*(2), 192-203.
- Ericsson, K.A., Krampe, R.T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review, 100*, 363-406.
- Flowers, R. A., & Brown, C. (2002). Effects of sport context and birth order on state anxiety. *Journal of Sport Behavior, 25*(1), 41.
- Feeley, B. T., Agel, J., & LaPrade, R. F. (2016). When is it too early for single sport specialization? *American Journal of Sports Medicine, 44*(1), 234-241. doi: 10.1177/0363546515576899
- Fraser-Thomas, J. L., Côté, J., & Deakin, J. (2005). Youth sport programs: An avenue to foster positive youth development. *Physical Education & Sport Pedagogy, 10*(1), 19-40.
- Fraser-Thomas, J.L., Côté, J., & Deakin, J. (2008). Examining adolescent sport dropout and prolonged engagement from a developmental perspective. *Journal of Applied Sport Psychology, 20*, 318-333.
- Goldberg, L. R. (1992). The development of markers for the Big-Five factor structure. *Psychological assessment, 4*(1), 26.
- Greendorfer, S., & Lewko, J. (1978). Role of Family Members in Sport Socialization of Children. *Research Quarterly. American Alliance for Health, Physical Education and Recreation, 49*(2), 146-152. doi: 10.1080/10671315.1978.10615519
- Hanton, S., Mellalieu, S. D., & Hall, R. (2002). Re-examining the competitive anxiety trait-state relationship. *Personality and Individual Differences, 33*(7), 1125-1136.
- Hill, G. M., & Hansen, G. F. (1988). Specialization in high school sports—The pros and cons. *Journal of Physical Education, Recreation & Dance, 59*(5), 76-79.
- Hopwood, M. (2013). The Developmental History of Athletes Questionnaire: Towards a comprehensive understanding of the development of sport expertise. (Unpublished doctoral dissertation). Victoria University. Melbourne Australia.
- Hopwood, M. J., Farrow, D., MacMahon, C., & Baker, J. (2015). Sibling dynamics and sport expertise. *Scandinavian journal of medicine & science in sports, 25*(5), 724-733.
- Jayanthi, N., Pinkham, C., Dugas, L., Patrick, B., & LaBella, C. (2013). Sports specialization in young athletes evidence-based recommendations. *Sports Health: A multidisciplinary Approach, 1941738112464626*.
- Kajtna, T., Tušak, M., Barić, R., & Burnik, S. (2004). Personality in high-risk sports athletes. *Kineziologija, 36*(1), 24-34.
- Kirkcaldy, B. D. (1982). Personality profiles at various levels of athletic participation. *Personality and Individual Differences, 3*, 321-326. doi:10.1016/0191-8869(82)900526

- LaPrade, R. F., Agel, J., Baker, J., Brenner, J. S., Cordasco, F. A., Côté, J., ... & Hewett, T. E. (2016). AOSSM early sport specialization consensus statement. *Orthopaedic journal of sports medicine, 4*(4), 2325967116644241.
- Larsen, R. J., & Buss, D. M. (2008). *Personality psychology: Domains of knowledge about human nature*. Boston: McGraw Hill.
- Law, M. P., Côté, J., & Ericsson, K. A. (2007). Characteristics of expert development in rhythmic gymnastics: A retrospective study. *International Journal of Sport and Exercise Psychology, 5*, 82–103.
- McCrae, R. R., & John, O. P. (1992). An introduction to the five-factor model and its applications. *Journal of Personality, 60*(2), 175-215.
- McKelvie, S. J., Lemieux, P., & Stout, D. (2003). Extraversion and neuroticism in contact athletes, no contact athletes and non-athletes: A research note. *Athletic Insight, 5*(3), 19-27.
- Mendes, F. G., Nascimento, J. V., Souza, E. R., Collet, C., Milistetd, M., Côté, J., & Carvalho, H. M. (2018). Retrospective analysis of accumulated structured practice: A Bayesian multilevel analysis of elite Brazilian volleyball players. *High Ability Studies, 29*(2), 255-269.
- Moseid, C. H., Myklebust, G., Fagerland, M. W., & Bahr, R. (2019). The association between early specialization and performance level with injury and illness risk in youth elite athletes. *Scandinavian journal of medicine & science in sports, 29*(3), 460-468.
- Piedmont, R. L., Hill, D. C., & Blanco, S. (1999). Predicting athletic performance using the five-factor model of personality. *Personality and Individual Differences, 27*(4), 769-777.
- Post, E. G., Trigsted, S. M., Riekena, J. W., Hetzel, S., McGuine, T. A., Brooks, M. A., & Bell, D. R. (2017). The association of sport specialization and training volume with injury history in youth athletes. *The American journal of sports medicine, 45*(6), 1405-1412.
- Rainey, D. W., & Cunningham, H. (1988). Competitive trait anxiety in male and female college athletes. *Research Quarterly for Exercise and Sport, 59*(3), 244-247.
- Smith, R. E., Smoll, F. L., & Schutz, R. W. (1990). Measurement and correlates of sport-specific cognitive and somatic trait anxiety: The Sport Anxiety Scale. *Anxiety Research, 2*(4), 263-280.
- Smith, R. E., Smoll, F. L., Cumming, S. P., & Grossbard, J. R. (2006). Measurement of multidimensional sport performance anxiety in children and adults: The Sport Anxiety Scale-2. *Journal of Sport and Exercise Psychology, 28*(4), 479.
- Soto, C. J., John, O. P., Gosling, S. D., & Potter, J. (2011). Age differences in personality traits from 10 to 65: Big Five domains and facets in a large cross-sectional sample. *Journal of personality and social psychology, 100*(2), 330.
- Stadulis, R. E., MacCracken, M. J., Eidson, T. A., & Severance, C. (2002). A children's form of the competitive state anxiety inventory: The CSAI-2C. *Measurement in Physical Education and Exercise Science, 6*(3), 147-165.
- Strachan, L., Côté, J., & Deakin, J. (2009). "Specializers" versus "samplers" in youth sport: Comparing experiences and outcomes. *The Sport Psychologist, 1*, 77-92.
- Wiersma, L. D. (2000). Risks and benefits of youth sport specialization: Perspectives and recommendations. *Pediatric Exercise Science, 12*(1), 13-22.

