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Do Birds of a Feather Flock Together? Exploring Personality Characteristics as an Indicator of Person-Environment Fit in Competitive Sports

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Abstract

Athlete selection is a complex and difficult process that coaches and scouts are tasked with consistently. One area that has received little attention is how an athlete may 'fit' within the sport environment they perform in. Fit is considered the compatibility between the individual and their environment, which integrates traits, styles, and orientation. The aim of the current study was to explore if athlete personality dimensions formed distinct clusters as an indicator of athlete-environment fit, and whether the type of sport (team vs. individual) reflected the cluster into which athletes were grouped. Using K-means clustering technique, athletes were grouped based on their personality dimensions using the International Personality Item Pool (IPIP; Goldberg, 1992) and their type of sport (team vs. individual). Results indicated there were no statistical relationships between personality dimensions and the type of sport, with minimal differences in scores across each personality dimension in team and individual sport athletes. These findings could suggest that fit is a multidimensional concept influenced by both sport-specific factors and psycho-social interactions between individuals in the environment.

Keywords

sport personality, K-means clustering, athlete selection, sport type, athlete-environment fit

Introduction

Person-environment fit (PEF) is defined as the compatibility between an individual and the environment they operate within (Kristof-Brown et al., 2005). The concept of PEF originated during the interactionist movement from industrial organizational psychology and involves different characteristics of the individual (i.e., skills, abilities, personality, values) and the environment to create a perception of fit (Hunt, 1975). From organizational psychology, PEF distinguishes between supplementary fit, where the individual shares similar characteristics with the environment and may facilitate alignment and cohesion, and complementary fit, where an individual can support the environment by providing the characteristics it lacks (Kristof-Brown et al., 2005). This could mean that an individual could have similar abilities with their

colleagues, but differ in personality dimensions (i.e., classification of their personality traits). However, personality dimensions do not consistently align within a strict dichotomy between supplementary and complementary fit. Rather, the relevance of similarity or dissimilarity in personality dimensions with fit is likely to be context-dependent, varying according to environmental structure, task demands, and role expectations. These forms (e.g., supplementary/complementary) of fit are not mutually exclusive and may operate differently based on the contextual demands required. Although the concept of fit has not received much attention in sport science, there are indications that 'fit' is relevant to athlete interpersonal experiences and perceptions of their environment.

In the sporting environment, the fit between the coach and athlete (often termed the coach-athlete dyad or relationship) plays an important role in the athlete's development and perceptions of well-being (Benish et al., 2024; Jowett et al., 2012; Nicholls et al., 2016). For example, a perceived coach-athlete fit has been shown to have a positive effect on trust and athlete satisfaction in collegiate athletes (Beattie & Turner, 2022; Lee et al., 2023). In their work, Beattie and Turner (2022) asked 257 collegiate athletes to complete a modified version of the Perceived Person-Environment Fit Scale (PPEFS; Chuang et al., 2016), a single item of athlete satisfaction, and the Sport Team Socialization Tactics Questionnaire (STSTQ; Benson & Eys, 2017). Interestingly, the quality of the athlete-coach fit (i.e., perceived compatibility related to values, personal traits, behaviours, and leadership) explained 19.3% of the variance in athlete satisfaction in their sample. Similarly, Lee et al. (2023) had 190 soccer players between the ages of 14 years and 23 years old complete a survey involving a modified version of PPEFS (Chuang et al., 2016), Trust in Leadership scale (Dirks, 2000), and the coach-athlete relationship questionnaire (CART-Q; Jowett & Ntoumanis, 2004). Their findings showed that coach-athlete fit had a positive effect on trust within the coach-athlete relationship, and that the degree of trust demonstrated had a significant mediating effect on fit and the coach-athlete relationship. Both studies demonstrate the significance of compatibility between individuals and their sporting environments.

According to previous research, an athlete's personality can be an important factor in coaches' impressions of athlete fit during evaluation and selection decision-making. For example, Johnston and Baker (2022) explored the selection of elite distance runners and found that coaches will use intuitive judgments ('coach's eye' or 'trained eye') from years of experience of working with athletes to make judgments in two related areas: (1) the fit of an athlete to the team; and (2) athlete's personality. The degree of fit of an athlete to the team was interpreted as an important criterion for selection, as coaches often conveyed that a mismatch between athlete and team could result in a disruption of team dynamics. Coaches varied in describing how they identified fit, ranging from specific values, characteristics, leadership, or social comfortability, highlighting the uniqueness of fit to each coach. Athlete personality was an emergent theme for coaches to consider in selection as multiple coaches described favourable traits such as kindness, work ethic, and initiative-taking for potential athletes to select to their elite teams (Johnston & Baker, 2022). However, athlete personality was perceived and determined by the coach from an intuitive and/or 'gut feeling' perspective rather than a formal personality measure (e.g., Big Five; Goldberg, 1992).

Empirically, personality reflects the "psychological systems that contribute to an individual's enduring and distinctive patterns of experience and behaviour" (Cervone & Pervin, 2022, p. 6). There are three main areas that contribute to an individual's personality, including dispositions, traits, and psychological states, all of which are influenced by the environment an individual is interacting with. The Big Five (Goldberg, 1992) is a widely used personality framework comprising five global traits such as extraversion (i.e., outgoing and sociability), conscientiousness (i.e., being responsible, organized, and hard-working),

openness to experience/intellect (i.e., open-minded and curious), agreeableness (i.e., kindness and helpful), and neuroticism/emotional stability (i.e., sadness or worrying). Previous personality research in sport has demonstrated mixed findings as it relates to differentiating between team and individual sport athletes. For example, athletes in both individual and team sports who compete in national or international competition reported higher levels of conscientiousness and agreeableness and lower levels in neuroticism compared to athletes competing in club or regional competition (Allen et al., 2011; Piepiora, 2021). Findings from Allen et al. (2011) and Piepiora (2021) suggests high-level athletes are more likely to be purposeful, dependable, competitive, and emotionally stable when it comes to training and competition. Similarly, Steca et al. (2018) found that athletes in track and field, basketball, and soccer who performed at a high-level were more conscientious, emotionally stable, and agreeable than lower-level athletes. However, Allen et al.'s (2011) scoping review highlighted that only 11.9% of their studies tested whether team sport participants differed from individual sport participants in levels of extraversion. Only 33.3% of those studies found that team sport athletes were more extraverted than individual sports athletes; however, 55.5% of studies found no difference, and the quality of studies scored low. Similarly, Nia and Besharat (2010) did not find a difference between individual and team sport athletes in levels of extraversion, neuroticism, and openness, but individual sport athletes scored significantly higher on conscientiousness than team sport athletes. In the higher levels of competition, personality dimensions and characteristics have been argued to be significant contributors to the level of performance, where higher levels of conscientiousness, selfishness and ruthlessness regarding sport engagement, and obsessiveness and perfectionism were demonstrated by super-elite athletes compared to elite (Hardy et al., 2017). Given that the type of sport was not examined in relation to athlete-environment fit, it is unclear if personality dimensions would differentiate individuals from the type of sport they participate in. While this is not indicative of PEF, it can be assumed that personality can contribute to compatibility with the contextual demands of the environment. As such, personality research in sport has provided mixed findings generally. Coaches may find these traits appealing in prospective athletes given the association with improved performance; however, the relevance of this information for developing athletes is unclear as this could influence athlete selection and team composition.

Given coaches' self-reports on the importance of personality when assessing athletes' fit in making selection decisions, the current study sought to examine personality dimensions among athletes in a competitive population as a potential single indicator of PEF. Although the value of personality in sport is unclear, there are gaps in our understanding in how athletes' personalities fit their environment (i.e., type of sport). Given the context-dependent nature of PEF, individual characteristics such as personality may contribute to perceptions of fit in different ways across sporting environments, yet this has not been explored empirically. This information can be favourable for coaches who consider personality in their interpretation of fit while making selection and team composition decisions. Correlation or mean comparisons describe how personality dimensions relate to one another across an entire sample, but they consider these dimensions in isolation. Fit, by comparison, is a property of the whole person, where an athlete's compatibility with an environment depends on how their personality dimensions combine rather than on any single trait on its own. Cluster analysis is one approach to explore this, which aligns conceptually with the notion of supplementary fit, where individuals who share similar characteristics are expected to group together. If personality contributes to athlete-environment fit in the way that has been described by coaches, there is potential that athletes with similar personalities may cluster together, and those clusters may correspond with the environments they occupy. The present study addresses this gap by

exploring if athletes' personality dimensions form distinct clusters as an indicator of athlete-environment fit, and whether the type of sport (team vs. individual sport) reflect the cluster athletes are grouped into. The present investigation used K-means clustering, which is an unsupervised machine learning approach that does not require group membership to be specified and allows groupings to emerge from the data (i.e., personality dimensions; Open Data Science, 2018). Informed by existing research (Allen et al., 2011; Piepiora, 2021; Steca et al., 2018), the present investigation explored two hypotheses with adolescent athletes including whether: a) team sport athletes would cluster together with higher levels of extraversion and agreeableness compared to individual sport athletes, and b) individual sport athletes would cluster together with higher levels of emotional stability and conscientiousness compared to team sport athletes. This is consistent with previous research suggesting that team sport environments reinforce socially oriented traits like cooperation and communication with one another, whereas individual sport contexts would require greater levels of self-regulation without teammates used as a buffer (Nia & Besharat, 2010).

Methods

Participants

A total of 300 participants from a large high-performance athlete development system in southern Ontario, Canada from 30 different sport programs participated in this study (female = 180; male = 116; unspecified = 4). Participants were categorized by the type of sport they performed in involving either individual or team sport. The present study operationalized and categorized athletes into either team sports, where individuals compete in a team setting (e.g., ice-hockey, soccer, basketball) or individual sports, where individuals mainly perform in competition by themselves (e.g., athletics, alpine skiing, snowboarding). This approach was favourable as individual and team sport athletes would experience the training/competition environment experiences differently, which is of particular interest to explore if personality dimensions contribute to selecting/participating in that sport. Individual sport athletes made up 44.1% (female = 51.5%; male = 48.5%) of the sample with team sport athletes making up 55.9% (female = 67.9%; male = 32.1%). Five participants were not included in the analyses as they completed information incorrectly (e.g., did not indicate sport [n = 2] and did not indicate sport and age [n = 3]). The mean *(SD)* age of athletes with valid age responses was M_{age} = 18.6 (SD = 4.55/ n = 276) (see Table 1). Statistical significance was defined as $p < 0.05$.

Procedure

The study received institutional ethics approval from participating universities. During data collection, participants were asked to review the testing requirements with their respective sport team/organization and complete a confidentiality and consent form. After informed consent was obtained, athletes provided demographic information including age, sport, and sex. Athletes then completed the Big Five personality test either at home on a computer or in-person at their training camps with a laptop provided by the research team. Participant data were stored on a password encrypted database and data were de-identified before researchers accessed the data, only alpha numeric codes were used, and only researchers part of the project had access to the data.

Measures

Personality

Personality dimensions were measured using the International Personality Item Pool (IPIP; Goldberg, 1992). This study used the 50-item IPIP (Goldberg et al., 2006) measure that consisted of 10 items per Big Five personality factor including extraversion, agreeableness, conscientiousness, emotional stability, and intellect, which demonstrated good internal reliability for this sample (α = .88, 95% CI [.86 - .90]). Each personality domain varied in the frequency of positively and negatively framed items. For example, items that were asked included (but were not limited to), "I am relaxed

most of the time", "I get stressed out easily", and "I feel little concern for others". Participants were asked to respond to items on a five-point Likert scale from very inaccurate (1) to very accurate (5) (Goldberg, 1992) for positively framed questions, and negatively framed questions were reverse scored. Total domain scores in each domain fell between 10 and 50.

Statistical Analyses

Clustering

Data analyses were performed using R (R Core Team, 2022), using the NbClust and factoextra packages (Charrad et al., 2014; Kassambara & Mundt, 2016). To group similar data points together, a clustering approach was used to highlight similarities and dissimilarities in the personality dimensions. K-means clustering, a popular partition-based clustering approach that assigns data points to distinct number of centers (K) by minimizing the Euclidean distance between data points and their respective centroids (Charrad et al., 2014; Wagstaff et al., 2001). This method was determined to be appropriate as it is an unsupervised machine learning approach that evaluates every data point individually, while other clustering approaches would differ by considering similar clusters or points nearby (Open Data Science, 2018). The clustering process was created based on the personality dimensions of the Big Five and did not include any demographic information (i.e., age). K-means created temporary centroids and evaluated each repeatedly to determine the optimal number of clusters. This compared more than 30 indices to determine the optimal number of clusters, which was determined to be two according to the majority rule (see Figure 1 for a visual representation of the Dindex and Hubert Statistic).

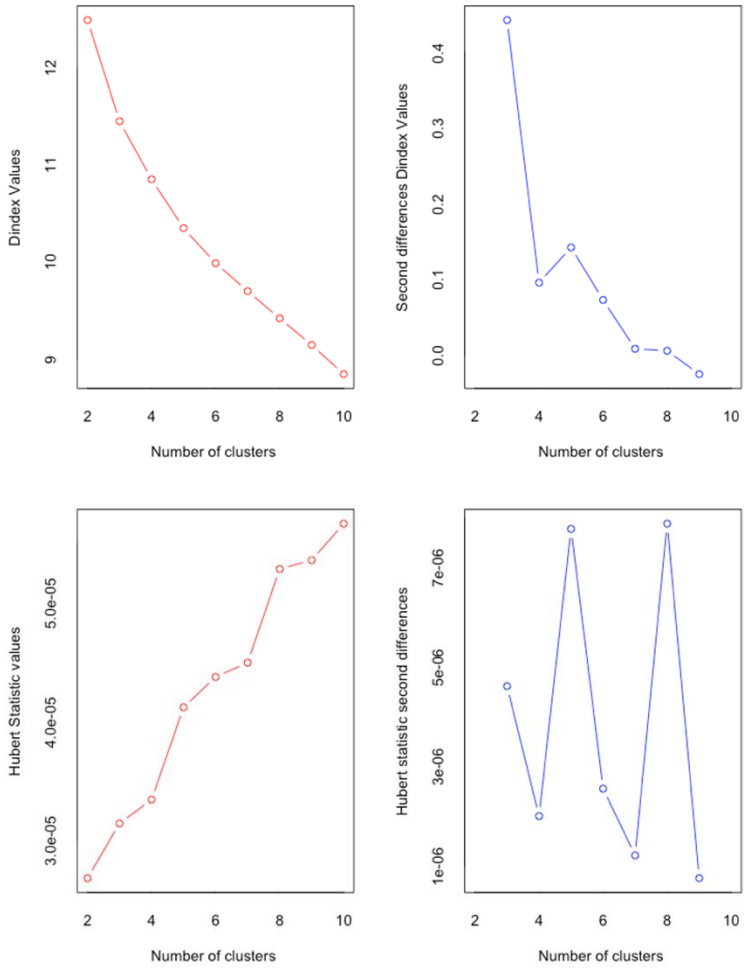

Figure 1. Dindex and Hubert Statistic for Optimal Number of Clusters

Results

Each personality dimension followed a normal distribution; results are presented with means and standard deviations found in Table 1. Following the cluster analysis, clusters were allocated to each participant to permit the ability to analyze sport type by cluster. To test personality dimensions relative to sport type, chi-square tests ($\chi 2$) compared sport types (i.e., team and individual) by using two cluster comparisons. Two-cluster K-means are presented in Table 2. Results demonstrated that Cluster 1 had higher levels across all personality dimensions. The largest differences between these clusters were in emotional stability (28.4%) and extraversion (27.3%), followed by conscientiousness (19.1%), agreeableness (12.3%), and intellect (12.2%). Cluster 1 comprised relatively more team sport athletes (n = 97; 58.8%) compared to individual sport athletes (n = 68; 41.2%), where cluster two consisted of a similar proportion of team sport athletes (n = 68; 52.3%) and individual sport athletes (n = 62; 47.7%).

For the two-clusters, a chi-square test was used to determine if there were any asymmetries in the proportion of athletes within each cluster and sport type (see Table 3). Results indicated no significant difference between sport types.

Table 1. Descriptive Statistics for Big Five of Sample

Variable	Mean	Standard Deviation
Age* (years)	18.60	4.55
Extraversion	31.76	7.77
Agreeableness	39.78	5.96
Conscientiousness	38.20	6.72
Emotional Stability	31.81	7.69
Intellect	37.85	5.24

Note. Descriptive statistics for age are based on n = 276 participants who provided valid age response. Personality dimension scores reflect the full sample (N = 300)

Table 2. K-means Clustering with Two Clusters

	Extraversion	Agreeableness	Conscientiousness	Emotional Stability	Intellect
Cluster 1 (n = 133)	36.07	42.37	41.95	36.27	40.28
Cluster 2 (n = 167)	28.33	37.72	35.22	28.25	35.91

Note. Within cluster sum of squares by cluster: 32179.76; 20302.93 (between SS / total SS = 22.9%)

Table 3. Chi-Square Statistic for Two-Cluster Count Data

	Individual Sport	Team Sport	Total
Cluster 1	68	97	165
Cluster 2	62	68	130
Total	130	165	295

Note. $\chi 2$ = 1.24, df = 1, p = 0.27

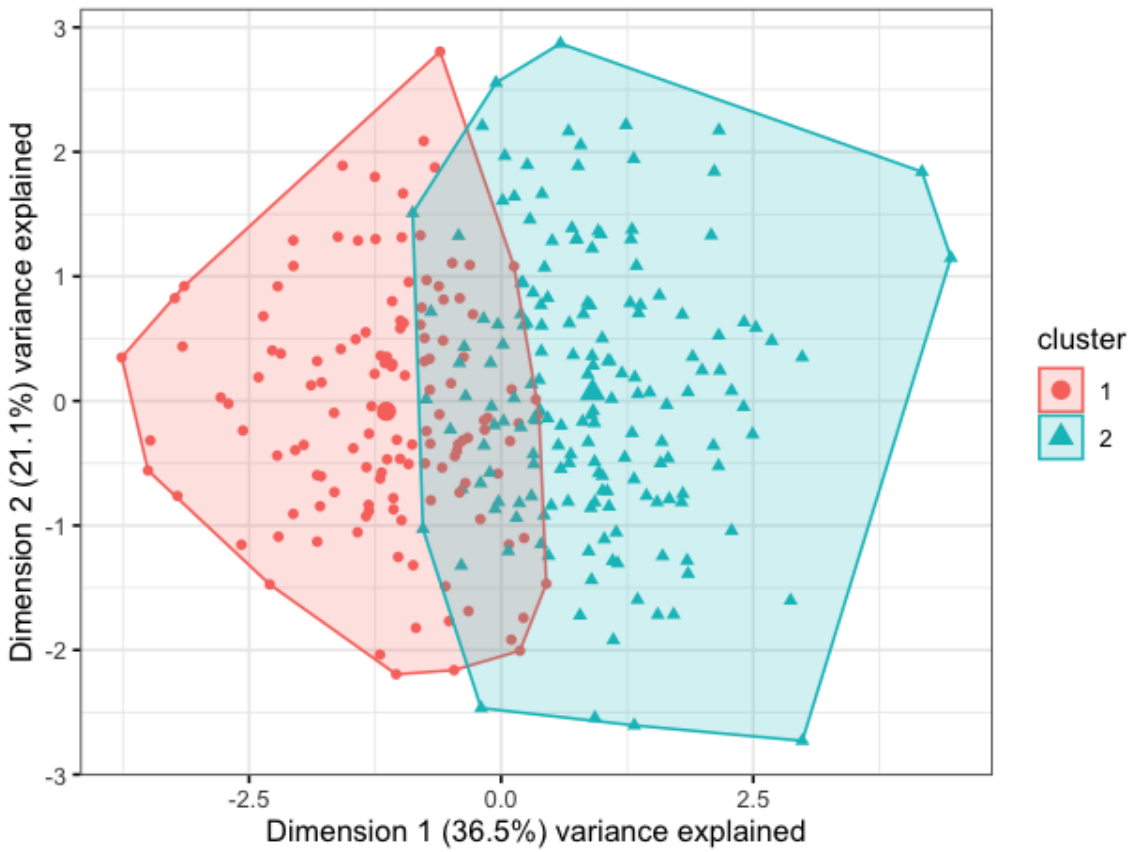

Figure 2. Two-Cluster Plot Visual

Discussion

This study examined the relationship between personality characteristics as an indicator of PEF through type of sport (i.e., team vs. individual sport). We found there to be no statistically significant relationships between personality using the IPIP and the type of sport an athlete played. Although previous research has suggested that the personalities of team sport and individual athletes differ (e.g., Allen et al., 2011; Eagleton, 2007; Nia & Besharat, 2010) these differences were not found in the current sample. With the present study, there were minimal differences in scores across each personality dimension among team sport athletes and individual sport athletes.

Through K-means clustering, no distinct grouping of athletes based on the type of sport emerged (see Figure 2). When exploring these clusters, there was a greater proportion of team sport athletes (n = 97) than individual sport athletes (n = 68) in cluster one, whereas in cluster two, there were similar counts of team sport athletes (n = 68) and individual sport athletes (n = 62). Between both clusters, the largest difference in personality was emotional stability (28.4%), followed by differences in extraversion (27.3%), conscientiousness (19.1%), agreeableness (12.3%), and intellect (12.2%). Given the minimal differences, these findings may not be extrapolated to all athlete populations; however, the small differences between personality dimensions can be further explored with larger samples. From a practical sense, these findings could suggest that coaches consider other relevant variables that could be more meaningful than personality dimensions as a significant indicator of PEF for at least this sample. This also raises the question for coaches, as they are considering athlete identification, development, and selection, of whether personality measures can provide useful information when the personalities of young athletes are still developing. Beyond

personality, our limited understanding of psychology of developing athletes makes it challenging for coaches, athletes, and practitioners to implement appropriate and valid tools in athlete development. For example, only 18.1% of studies in Baker et al.'s (2020) scoping review of talent research were adolescent athletes, suggesting the need for further research to provide the best support for adolescent athletes and the sport environment. Future work could explore creating sport-related measures that are developmentally appropriate for athletes rather than using measures or tools that are created for different ages or populations.

The participants in this sample are in a stage of development where their personalities are consolidating and continuing to evolve, which means using personality measures for this age may be useful only from an exploratory standpoint compared to practical applications for coaches. Additionally, examining personality as an indicator of PEF in the sport context may not fully capture the complexity of athlete fit, which suggests that using a multi-dimensional and an ecologically informed approach may provide more information. To date, there is no instrument or measure that explores athlete-environment fit in this suggested way. However, a potential solution could be use of an integrated measure of personality, such as the McAdams (2013) framework of personality. While this is not to cast aside the IPIP on the basis of these findings, it does suggest that athlete-environment fit in this context could involve variables that are not captured within this measure. McAdams (2013), for example, extends beyond dispositional traits and includes characteristic adaptations (i.e., motives, goals, plans, strivings, values), and life narratives (i.e., personal narratives or life stories). This approach to personality can help us learn about typical behaviour of individuals and how these individuals make sense of their experiences that inform their identity and perhaps discover insight into perceptions of fit related to their personality. Utilizing an integrated layered approach to personality could have more representation and deeper understanding of the athlete. Extending beyond dispositional traits (i.e., extraversion, agreeableness, conscientiousness, emotional stability, intellect) could help reveal important information related to athlete fit. McAdams's (2013) integrated framework has previously been used to explore an in-depth case study of a successful Olympic coach (Mallett & Coulter, 2016), 'mentally tough' athletes (Coulter et al., 2018), and personalities of serial winning coaches (Mallett & Lara-Bercial, 2016). Perhaps, this could be a favourable research approach in gaining in-depth information related to an athlete's perceptions of fit that current personality measures are not capable of capturing. While this is strictly speculative, it could be a potential way to explore how personality may relate to this under-researched area in athlete development (i.e., athlete fit) by providing rich description of their perceptions.

Importantly, previous research has used different measures to explore outcomes of fit (i.e., satisfaction, integration, athlete-coach compatibility) but did not include measures of personality. For example, modified versions of the PPEFS, athlete satisfaction, CART-Q, and STSTQ have been used compared to our use of IPIP. While these studies have provided positive and informative findings to the athlete development space, it is difficult to refute or confirm previous research with our findings. However, our findings can support the notion that fit may be more than a congruence of personality dimensions in the sporting context. Moreover, interpreting previous research findings involving PEF and our null findings, it would be important to understand the conceptual differences of fit in the specific environment, specific variables that contribute to the perception of fit and the interaction between the individual and their environment.

With respect to athlete personality, coaches highlighted that incongruent personalities involved in their environment can disrupt their long-term focus and the culture that coaches are cultivating. These coaches refer to previous experiences and their own mental models in this evaluation and assessment of fit (Johnston & Baker, 2022). Johnston and Baker (2022) found that coaches used team-bonding exercises to

observe athletes' behaviours and their interactions with teammates and coaches to understand favourable traits better (e.g., kindness, initiative-taking, and work-ethic), but also unfavourable traits (e.g., bullying). From a research standpoint, one may interpret that distance running coaches use the term personality colloquially, rather than in the empirical sense of researchers (i.e., Big Five dimensions), which may increase the ongoing challenges with the research-to-practice gap (Keegan et al., 2017). This misalignment and lack of clarity or consistency around language used in the athlete development space has become apparent and is a significant challenge (Dohme et al., 2017; Johnston et al., 2023; Tedesqui & Young, 2020). Furthermore, it is possible that measuring personality as an indicator of PEF is not appropriate to capture fit within the sport environment.

Limitations and Future Directions

Despite our attempt to explore personality dimensions across types of sport, several limitations should be noted. First, given the potential coach- and sport-specific effects, a larger sample would have allowed us to explore more interactions. Similarly, many sports were represented by only a few athletes (i.e., 1 to 4 athletes), which may have introduced too much variation within each of the crude sport-type categories.

Second, the IPIP may not be suitable for exploring athlete-environment fit, since fit likely involves variables outside of what personality inventories are supposed to capture. Previous research has drawn on different personality measures (i.e., NEO-FFI, Eysenck Personality Inventory A), but sport-level findings look similar across measures regardless of which one is used. In addition to this, there is a developmental argument against leaning too heavily on personality when participants are at a stage where personalities continue to evolve; therefore, treating personality scores as a stable criterion for selection would not be recommended. One approach would be to combine facet-level scales with tools built to capture context-specific information (e.g., roles in sport, teammate interaction, coach-athlete relationship). This information would better reflect how athletes fit within the environments in which they train and compete and would extend knowledge of an area that is not well understood in athlete development research.

Third, the absence of a formal person-environment fit measure, and the lack of other related outcomes (i.e., performance, satisfaction), suggest that the practical implications around athlete development should be considered with caution. However, there is value in future work that tries to quantify how much individuals differ from the team and what that heterogeneity means.

Last, the categorization of sport types was more challenging than anticipated. There were some individual sports involved in team-based training but individual competition, while others involved athletes who train and compete independently throughout. Future research should consider using Evans et al.'s (2012) sport team interdependence typology, as it distinguishes sport group environments based on the levels of structural interdependence. Structural interdependence can be described through task interdependence (e.g., integrated, segregated, or none) and outcome interdependence (e.g., group or individual). Combining these dimensions results in six sport team typologies: integrated, segregated, collective, cooperative, contrient, and independent. When team structure is absent, a "solitary/no team" typology is suggested. Integrated sports (e.g., hockey) require teammates to work together during competition with a clear group goal. Segregated sport teams (e.g., baseball) involve teammates participating in the competition but can have limited interactions with each other on the task of playing their sport. Collective sport teams (e.g., cross-country) include athletes performing the same task in the same competition, but individual performances contribute to determine an overall team outcome. Cooperative sport teams (e.g., wrestling) involve athletes competing in different events but contribute to overall team outcome. Contrient sport teams involve athletes competing individually against

teammates for personal outcomes, without a shared group performance goal (e.g., trampolinists). The independent typology can be described as athletes who may train together (e.g., triathletes) but compete separately, without a shared competition goal or team outcome. Solitary/no team refers to athletes that gather for events (e.g., races) but do not identify as a group. Although the current sample size and number of sports did not make it possible to analyze data based on this typology (Evans et al., 2012), future research on both personality type and fit may benefit from exploring sport type from this perspective.

Conclusion

Sport personality literature has influenced a variety of aspects in the sport environment such as coach-athlete relationship (Jowett, 2017), athlete fit (Beattie & Turner, 2022; Lee et al., 2023), and sport types/levels (Allen et al., 2011; Piepiora, 2021). In this study, through K-means clustering process and chi-square tests, the results indicated that there were no significant associations between personality and sport type. These findings may suggest that the use of a personality measure (i.e., IPIP) does not fully capture the complexity of PEF within the sporting context, especially with a sample in an important phase of personality development. With respect to fit, findings may suggest that athlete-environment fit is a multi-dimensional construct rather than personality congruence (Kandler et al., 2024; van Vianen, 2018). Future research should consider a multi-dimensional approach to capturing PEF in the sporting environment to include aspects such as the micro-macro-environment (e.g., coach-athlete interaction, organization, team-level, and roles).

Authors' Declarations

The authors declare that the data can be requested via email from the first author on reasonable request.

The authors declare that there are no personal or financial conflicts of interest regarding the research in this article.

The authors declare that the research reported in this article was conducted in accordance with the Ethical Principles of the *Journal of Expertise*.

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