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# Associations between personality, sports participation and athletic success. A comparison of Big Five in sporting and non-sporting adults

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ABSTRACT

The present study investigates whether the Big Five personality traits are different among diverse sports populations. A sample of 881 male athletes and non-athletes completed a self-report questionnaire measuring their personality traits. The Exploratory Structure Equation Modeling (ESEM) approach is adopted to test measurement invariance and mean differences among groups. The results indicate that athletes who had experienced the most success in their sport scored higher than non-athletes in each personality dimension of the Big Five, with the exception of openness, while less successful athletes scored higher than non-athletes only in extraversion and agreeableness. The more successful athletes showed higher agreeableness, conscientiousness, and emotional stability than the less successful athletes. Individual-sport athletes were found to be more energetic and open than team-sport athletes. The current findings help clarify the relationships between personality traits, sports participation and athletic success.

## 1. Introduction

The study of personality in sports psychology is primarily focused on investigating the associations between personality, participation, and athletic achievement (Aidman & Schofield, 2004; Allen, Greenlees, & Jones, 2013; Allen & Laborde, 2014).

Previous research is either framed in the theory of the Big Five personality traits (Goldberg, 1993; McCrae & Costa, 1996) or Eysenck personality theory (Eysenck, 1970). The Big Five theory presents a model in which personality is organized into five factors: extraversion, agreeableness, conscientiousness, emotional stability and openness.[1] Meanwhile, the Eysenck personality theory states that personality is made up of three main factors: extraversion, neuroticism – corresponding to extraversion and emotional stability in the Big Five theory (Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993) – and psychoticism.

Although associations between personality traits and natural variations in physical activity have been consistently shown – for example, between participation in regular exercise and extraversion, conscientiousness, emotional stability, and openness (Rhodes & Smith, 2006; Wilson & Dishman, 2015) – the association between personality and participation in organized sports has received modest attention and remains less clear. Taken together, previous findings referring to the context of organized sports have suggested that athletes score higher on extraversion (Egloff & Gruhn, 1996; Paunonen, 2003), conscientiousness (Kajtna, Tušak, Barić, & Burnik, 2004; Malinauskas, Dumciene, Mamkus, & Venckunas, 2014), emotional stability (Egan & Stelmack, 2003; Kajtna et al., 2004; Mckelvie, Lemieux, & Stout, 2003), and openness (Kajtna et al., 2004) than non-athletes. Moreover, further results have suggested that personality traits are also related to the participation in specific types of sports. More specifically, individual-sport athletes demonstrated higher conscientiousness, openness and emotional stability as well as lower levels of extraversion than team-sport athletes (Allen, Greenlees, & Jones, 2011; Eagleton, McKelvie, & De Man, 2007).

In sports psychology, investigation of the association between personality and athletic success is a very attractive issue that permits an understanding of whether and which personality traits coincide with greater levels of success. The association is rather complex, and a variety of motivational and dispositional variables that are correlated with sports performance and success has been investigated (e.g., Baretta, Greco, & Steca, 2017). Athletic success has mainly been operationalized in terms of the competition level at which athletes compete (Allen et al., 2013), and previous results on the Big Five have shown that high-level athletes (e.g., athletes competing at a national or international level) are more agreeable, conscientious, and emotionally

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[1] Several names have been used in referring to the Big Five factors. Such names include (1) extraversion vs. introversion (or energy, or surgency); (2) agreeableness (or friendly compliance vs. hostility, or friendliness); (3) conscientiousness (or will); (4) neuroticism vs. emotional stability; and (5) openness to experience (or culture, or openness, or intellect).

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stable (Allen et al., 2011; Kirkcaldy, 1982) than low-level athletes (e.g., athletes competing at a county or regional level).

Although previous findings evidenced associations among personality and various sporting populations, some critical flaws limit the conclusions that can be drawn from the available research. A first concern regards the sample sizes adopted in previous studies. While research regarding personality and physical activity usually involves hundreds or even thousands of participants per study (Rhodes & Smith, 2006), research on personality and sports participation uses sample sizes that barely exceed 200 participants (Allen et al., 2011; Malinauskas et al., 2014; Paunonen, 2003) and, in the worst cases, can amount to a mere 40 subjects per sports population (Eagleton et al., 2007).

Second, samples involved in previous studies were extremely heterogeneous because various sports were included in each study (Allen et al., 2011; Eagleton et al., 2007). Sports differ from each other in several ways, and each sport has its own specificity and requirements. For instance, sports may differ in terms of pressure (i.e., some sports are performed on multiple trials while other ones are one-shot trials against time) and in terms of intensity and duration (i.e., some sports last few seconds or minutes, while other ones may last hours). This type of heterogeneity affects comparisons between different studies because the sports considered are not equivalent. Thus, it is possible to argue that various results may be due, at least partially, to distinctive features that characterize each sport. An extreme example illustrating the lack of consideration placed on sport specificity involves cases in which the types of sports considered in studies are not even mentioned (Allen et al., 2011; Kirkcaldy, 1982). Another issue regards the operationalization of sports participation; indeed, within the sporting population there may be great variability regarding athletic success and performance that should be taken into account instead of grouping all sport participants in one *sporting* group. These omissions make comparisons among studies difficult and prevent researchers from reaching valid conclusions about the relationship between traits and sports practice. More specifically, this issue is reflected by a lack of effect size synthesis referring to the difference in personality traits (Allen et al., 2013). To manage these issues, it is necessary to i) accumulate a more substantial body of literature reporting effect sizes and ii) precisely define the outcome variables (e.g., sport performance, success, training time) and find an agreement on how to operationalize them. In this direction, a further aspect that deserves consideration is the adoption of statistical methodologies that take into account the latent psychometric constructs and subsequent systematic tests of measurement invariance (Meredith, 1993). Specifically, a comparison between groups as is usually performed (i.e., *t*-test, ANOVA) requires prerequisite assumptions of invariant measurement operations across the groups being compared (Vandenberg & Lance, 2000). If such invariance across sports populations is not achieved, it is not possible to draw scientific conclusions as to how the group differences may be associated with personality dimensions. To test invariance, in recent years, a few studies (Marsh et al., 2010; Marsh, Morin, Parker, & Kaur, 2014) have noted that the classic Confirmatory Factor Analysis (CFA) is inappropriate for testing structure and invariance across groups of Big Five measures. This suggestion is in line with the position argued by Big Five researchers for years (e.g., Church & Burke, 1994; McCrae, Zonderman, Costa, Bond, & Paunonen, 1996) and with previous unsuccessful attempts to test Big Five measure structures through CFA (e.g., Cooper, Smillie, & Corr, 2010; Vassend & Skrondal, 1997). To overcome these limits, recent research has started to apply Exploratory Structure Equation Modeling (ESEM; Asparouhov & Muthén, 2009) to Big Five data (Chiorri, Marsh, Ubbiali, & Donati, 2016; Marsh et al., 2010; Marsh, Nagengast, & Morin, 2013). The advantages of the ESEM approach rely on exploiting the advanced statistical methods typically associated with CFAs and SEMs (e.g., testing for measurement invariance across groups, incorporate latent factors into subsequent analysis) without relying on excessively restrictive CFA constraints (i.e., secondary loadings fixed to zero). For these reasons, the ESEM approach has been proposed to be particularly suitable for testing the dimensionality and measurement invariance for Big Five measures (Marsh et al., 2014).

**Table 1**
Sample size information for each sports group and subgroup.

| | Individual sport ($n$ = 135) | Team sport ($n$ = 620) | |
|---|---|---|---|
| | Track and field ($n$ = 135) | Soccer ($n$ = 230) | Basketball ($n$ = 390) |
| Low-level athletes ($n$ = 558) | 73 | 179 | 306 |
| High-level athletes ($n$ = 197) | 62 | 51 | 84 |

### 1.1. The present study

The purpose of the present study was to explore the relationship among Big Five personality traits and involvement and success in organized sports, a context that has received little attention in the large array of physical activity. The present study aims to overcome most of the limitations of previous research to derive clearer and more valid conclusions on the associations between personality and sports participation. In particular, as claimed by Allen et al. (2013), the present research provides detailed information about the effect size related to population-based differences. Moreover, in line with recent suggestions (Marsh et al., 2010), the ESEM approach has been adopted to test measurement invariance and mean differences across the groups considered.

Based on the most consistent results from available literature, the following hypotheses were developed:

- It was expected that non-athletes would have lower levels of extraversion, conscientiousness, and emotional stability than athletes.
- High-level athletes were expected to be more agreeable, conscientious, and emotionally stable than low-level athletes.
- It was expected that individual-sport athletes would report more conscientiousness, openness, and emotional stability than team-sport athletes.

## 2. Material and methods

### 2.1. Participants

Participants who took part in this study were Italian male athletes ($n$ = 755; mean age = 22.62; $SD$ = 3.56) and non-athletes ($n$ = 126; mean age = 23.78; $SD$ = 2.84) aged between 18 and 30. The athletes (see Table 1) competed in individual (track and field; $n$ = 135; mean age = 22.07; $SD$ = 3.45) or team sports (soccer and basketball; $n$ = 620; mean age = 22.74; $SD$ = 3.58). Athletes competing at regional levels were categorized as low-level athletes (LLA; $n$ = 558; mean age = 22.25; $SD$ = 3.42), while those competing at the national

level were categorized as high-level athletes (HLA; $n = 197$; mean age = 23.68; $SD = 3.77$).[2]

### 2.2. Procedure

#### 2.2.1. Sampling procedures

Athletes were contacted during sporting competitions. They were asked if they would be willing to participate in a study on sports and personality. Participants were also told that all of the questionnaires would be anonymous. Non-athlete sampling was based on the "snowball" method with a ratio of 1:1 (i.e., one participant was asked to find another participant). All participants were provided with an informed consent form and a questionnaire for self-reporting. Both athletes and non-athletes were asked to carefully read and sign the informed consent form, individually complete the measures, and then return them to the researcher responsible for questionnaire administration. The time required for filling the questionnaire was between 3 and 4 min. During the assessment, participants were told that they could ask the researcher regarding any issue, doubt, or incomprehension. Participants received no incentive for their participation.

#### 2.2.2. Measures

Athletes were asked to answer socio-demographic (gender and age) and sports-related (type and category of sport) questions. Non-athletes were asked to report socio-demographic factors (gender and age). Their personality was assessed through a list of 25 adjectives used in a previous study (Barbaranelli, Caprara, Vecchione, & Fraley, 2007). These adjectives (see Appendix) included those most frequently used to describe human personality traits, as well as those most representative of each dimension of the Big Five in the Italian lexicon (Caprara & Perugini, 1994). Furthermore, they overlap considerably with markers used in other languages (Peabody & De Raad, 2002). The list includes five markers for each of the following dimensions: energy, agreeableness, conscientiousness, emotional stability, and openness. Adjectives are rated for how characteristic they are of each target on a 1 (not at all) to 5 (at all) scale. This instrument was chosen because of its brevity, which made it particularly useful when there was only a short time available for questionnaire administration.

#### 2.2.3. Statistical analyses

Analyses were conducted with Mplus 7.3 (Muthén and Muthén, 1998–2012). Preliminary analyses consisted of ESEM on the total group of participants to verify the five-factor structure of the personality measure. A robust maximum likelihood estimator (MLR) and oblique GEOMIN rotation were used.

Measurement invariance over the level of sport success (i.e., non-athletes, LLA, HLA) and type of sport (i.e., individual- and team-sport) was tested adopting the ESEM framework through a 13-nested model taxonomy of invariance tests that integrated factor and measurement invariance traditions (for a more detailed discussion of the invariance models see Marsh et al., 2010; Meredith, 1993). These models vary from the least restrictive model of configural invariance to a model of complete invariance that posits strict invariance, together with the invariance of the latent means and of the factor variance-covariance matrix. In this study, the sequence of measurement invariance was tested comparing the following models from Marsh et al. (2010): model-1 (configural invariance), model-2 (weak measurement invariance), model-5 (strong measurement invariance), model-7 (strict measurement invariance), and model-9 (strict and invariance of the factor variance-covariance matrix). If model-9 invariance is reached, the variances are equal to 1 in all groups, so that the mean differences are expressed in *SD* units as a function of the *SD* of the whole sample.[3] Big Five mean differences are compared by constraining the means of one group at zero and freeing them in the other group(s).

In line with previous studies testing Big Five structure and measurement invariance through ESEM (Chiorri et al., 2016; Marsh et al., 2010; Marsh et al., 2013), the fit indices considered are the root-mean-square error of approximation (RMSEA), Tucker-Lewis index (TLI), and comparative fit index (CFI). For TLI and CFI, values > 0.90 and 0.95 are typically interpreted to reflect acceptable and excellent fit to the data, respectively. For the RMSEA, value of < 0.05 and 0.08 are typically interpreted to reflect a close fit and reasonable fit to the data, respectively (Marsh, Hau, & Wen, 2004). The comparison of fit across the different nested models (i.e., model-1 vs model-2, model-2 vs model-5, model-5 vs model-7, model-7 vs model-9) was based on CFI and TLI comparison. A CFI and TLI diminution of 0.01 or less between a more parsimonious model and the preceding more complex model indicated that the invariance hypothesis should not be rejected (Chen, 2007; Cheung & Rensvold, 2002).

## 3. Results and discussion

### 3.1. Results

#### 3.1.1. Total group analyses to verify the five-factor structure of the personality measure

The fit of the total group ESEM was acceptable ($\chi 2 = 478$, $df = 185$, $p < 0.001$; CFI = 0.95; TLI = 0.92, RMSEA = 0.04), supporting the five-factor structure underlying the list of 25 adjectives. The internal consistency of the five-factor solution was corroborated by the factor scores determinacy coefficients (see Muthén & Muthén, 1998), which provide a measure of internal factor consistency: coefficients of 0.70 or better indicate stable factors (Tabachnick & Fidell, 1989). In the present study, these coefficients were 0.91 for energy, 0.86 for agreeableness, 0.89 for conscientiousness, 0.89 for emotional stability and 0.92 for openness. Cronbach's alpha coefficients were lower, but still adequate, at 0.79 for energy, 0.68 for agreeableness, 0.73 for conscientiousness, 0.73 for emotional stability and 0.81 for openness (see Appendix for factor loadings and sub-groups reliability information).

#### 3.1.2. Measurement invariance over the level of sport success and type of sport

Table 2 reports the results of measurement invariance analysis across the non-athletes, LLA and HLA groups (i.e., level of sport success) and across the team- and individual-sport groups (i.e., type of sport). As shown, the measurement through the different nested models (i.e., from model-1 to model-9) was achieved for both the level of sport success and type of sport. Comparisons of each of these pairs of the models (i.e., model-1 vs model-2, model-2 vs model-5, model-5 vs model-7, model-7 vs model-9) resulted in an equivalent CFI and TLI (i.e., ΔCFI and ΔTLI < 0.01). The most invariant model (i.e., model 9) provided a satisfactory level of approximate fit to the data, with CFI and TLI > 0.90, and RMSEA < 0.05.

#### 3.1.3. Mean differences

*3.1.3.1. Differences in Big Five among non-athletes, LLA, and HLA.* Examining the model in which the means were constrained to 0 in one group (non-athletes) and freely estimated in the other groups (LLA and HLA), it was apparent that LLA displayed significantly higher scores on energy ($d = 1.07$, $p < 0.001$) and agreeableness ($d = 0.36$, $p < 0.01$) than non-athletes, while HLA demonstrated higher levels of energy ($d = 1.17$, $p < 0.001$), agreeableness ($d = 0.58$, $p < 0.001$),

[2] Sports-specific criteria for being included in the high-level group:
Soccer – participation in leagues: Serie A, Serie B, Serie C;
Basketball – participation in leagues: Serie A, Serie A2, Serie B;
Track and Field – meeting the performance requirements for taking part at the Italian Athletics Championship.

[3] The standardized difference between means is a measure of the effect size and is equivalent to Cohen's *d*.

**Table 2**
Summary of the goodness-of-fit statistics for the total group ESEM and measurement invariance over the level of sport success and type of sport.

| | *χ2* | *df* | CFI | ΔCFI | TLI | ΔTLI | RMSEA |
|---|---|---|---|---|---|---|---|
| Total group ESEM | 478 | 185 | 0.951 | | 0.921 | | 0.042 |
| Measurement invariance across level of sport success | | | | | | | |
| Model-1 (configural invariance) | 1028 | 555 | 0.923 | | 0.875 | | 0.054 |
| Model-2 (weak measurement invariance) | 1124 | 755 | 0.923 | 0.000 | 0.909 | 0.034 | 0.046 |
| Model-5 (strong measurement invariance) | 1304 | 795 | 0.917 | − 0.003 | 0.906 | − 0.003 | 0.047 |
| Model-7 (strict measurement invariance) | 1393 | 845 | 0.911 | − 0.006 | 0.905 | − 0.001 | 0.047 |
| Model-9 (strict measurement invariance, factor variance-covariance) | 1453 | 875 | 0.906 | − 0.005 | 0.903 | − 0.002 | 0.047 |
| Measurement invariance across type of sport | | | | | | | |
| Model-1 (configural invariance) | 723 | 370 | 0.934 | | 0.893 | | 0.050 |
| Model-2 (weak measurement invariance) | 849 | 470 | 0.929 | − 0.005 | 0.910 | 0.017 | 0.046 |
| Model-5 (strong measurement invariance) | 903 | 490 | 0.923 | − 0.006 | 0.906 | − 0.004 | 0.047 |
| Model-7 (strict measurement invariance) | 961 | 515 | 0.917 | − 0.006 | 0.903 | − 0.003 | 0.048 |
| Model-9 (strict measurement invariance, factor variance-covariance) | 984 | 530 | 0.915 | − 0.002 | 0.904 | 0.001 | 0.048 |

*Note*: CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root-mean-square error of approximation.

**Table 3**
Mean differences as a measure of the effect size with confidence intervals (CI) among non-athletes, low-level athletes and high-level athletes.

| | Non-athletes ($N$ = 126) | Low-level athletes ($N$ = 558) | | High-level athletes ($N$ = 197) | |
|---|---|---|---|---|---|
| | Constrained mean | Mean | 95% CI | Mean | 95% CI |
| Energy | 0 | 1.07*** | [0.80, 1.33] | 1.17*** | [0.89, 1.46] |
| Agreeableness | 0 | 0.36** | [0.10, 0.62] | 0.58*** | [0.28, 0.87] |
| Conscientiousness | 0 | − 0.13 | [− 0.40, 0.15] | 0.32* | [0.01, 0.62] |
| Emotional stability | 0 | 0.03 | [− 0.23, 0.28] | 0.31* | [0.03, 0.59] |
| Openness | 0 | − 0.06 | [− 0.27, 0.15] | 0.05 | [− 0.19, 0.29] |

| | Non-athletes ($N$ = 126) | | Low-level athletes ($N$ = 558) | High-level athletes ($N$ = 197) | |
|---|---|---|---|---|---|
| | Mean | 95% CI | Constrained mean | Mean | 95% CI |
| Energy | − 1.07*** | [− 1.33, − 0.80] | 0 | 0.11 | [− 0.07, 0.28] |
| Agreeableness | − 0.36** | [− 0.62, − 0.10] | 0 | 0.22* | [0.01, 0.42] |
| Conscientiousness | 0.13 | [− 0.15, 0.40] | 0 | 0.44*** | [0.25, 0.64] |
| Emotional stability | − 0.03 | [− 0.28, 0.23] | 0 | 0.29** | [0.10, 0.48] |
| Openness | 0.06 | [− 0.15, 0.27] | 0 | 0.11 | [− 0.07, 0.29] |

*Note*: Mean differences between non-athletes and low-level athletes and between non-athletes and high-level athletes are expressed as the number of *SD* units (equal to Cohen's *d*) and are analyzed by constraining the means of non-athletes at zero. Mean differences between low-level athletes and high-level athletes are expressed in number of *SD* units (equal to Cohen's *d*) and are analyzed by constraining the means of low-level athletes at zero.
* < 0.05 (two-tailed).
** < 0.01 (two-tailed).
*** < 0.001 (two-tailed).

**Table 4**
Mean differences as a measure of the effect size with confidence intervals (CI) between team- and individual-sport athletes.

| | Team-sport athletes ($N$ = 620) | Individual-sport athletes ($N$ = 135) | |
|---|---|---|---|
| | Constrained mean | Mean | 95% CI |
| Energy | 0 | 0.38** | [0.14, 0.61] |
| Agreeableness | 0 | − 0.08 | [− 0.32, 0.16] |
| Conscientiousness | 0 | 0.21 | [− 0.04, 0.46] |
| Emotional stability | 0 | 0.06 | [− 0.18, 0.30] |
| Openness | 0 | 0.36** | [0.14, 0.58] |

*Note*: Mean differences between team- and individual-sport athletes are expressed as the number of *SD* units (equal to Cohen's *d*) and are analyzed by constraining the means of team-sport athletes at zero.
* < 0.05 (two-tailed).
** < 0.01 (two-tailed).
*** < 0.001 (two-tailed).

emotional stability ($d$ = 0.31, $p < 0.05$), and conscientiousness ($d$ = 0.32, $p < 0.05$) than non-athletes. When the means were constrained to 0 in the LLA group and freely estimated in the other groups, it was possible to examine the differences between LLA and HLA. The results suggested that HLA scored higher in agreeableness ($d$ = 0.22, $p < 0.05$), emotional stability ($d$ = 0.29, $p < 0.01$), and conscientiousness ($d$ = 0.44, $p < 0.001$) than LLA (see Table 3).

*3.1.3.2. Differences in Big Five traits between individual- and team sport athletes*. To analyze the mean differences between individual- and team-sport athletes, the means were constrained to 0 in team-sport group and freely estimated in the individual-sport group. The results suggested that individual-sport athletes are more energetic ($d$ = 0.38, $p < 0.01$) and open-minded ($d$ = 0.36, $p < 0.01$) than team-sport athletes (see Table 4).

### 3.2. Discussion

The present study sought to outline personality differences among various sports populations: non-athletes and athletes, lower success and higher success athletes, and team-sport and individual-sport athletes. The first notable finding was that high-level athletes scored higher than non-athletes in each personality dimension of the Big Five, with the exception of openness, while low-level athletes scored higher than non-athletes only in extraversion and agreeableness. A large to very large effect size indicated that energy is the most important factor differentiating athletes from non-athletes, but not low-level from high-level athletes, suggesting that the level of energy is associated with participation in organized sport activities rather than with sport success, confirming that sports and physical activity are elective contexts of expression and development of energy features. The small to medium effect size in agreeableness was probably because athletes, by taking part in organized sport activities, attend to a social context that typically facilitates relationships with other sport mates. Conversely, conscientiousness and emotional stability differed only between non-athletes and high-level athletes, pointing out that such factors are more associated with athletic success rather than sports participation. According to most of the previous literature, no differences emerged in terms of openness. Taken together, the first results partially confirmed the first hypothesis, and suggested that different findings in the literature (Egan & Stelmack, 2003; Egloff & Gruhn, 1996; Kajtna et al., 2004; Malinauskas et al., 2014; Mckelvie et al., 2003; Paunonen, 2003) may be because comparisons between athletic and non-athletic populations were usually made without controlling for success within the athletic population.

Concerning the association between personality and sports success, the present results confirmed those of the literature (Allen et al., 2011), indicating that more successful athletes are significantly more agreeable, more conscientious, and more emotionally stable than less successful athletes. Such differences may be related to specific characteristics that typically distinguish sports played at a higher level, such as a higher number of sport competitions, more time spent practicing and travelling, and more frequent stressful events (e.g., injuries). Facets of conscientiousness, such as perseverance and diligence, as well as the capacity to manage stress and emotions (emotional stability) and find relational support in case of need (agreeableness), are particularly relevant to managing these high-level sport characteristics. Conversely, these characteristics might provide athletes with frequent occasions to stimulate and improve their trait-related capacities as well as manage emotional disruptive states, foster interpersonal relationships, and pursue tenaciously ambitious goals. Among these personality differences, the largest effect size was related to conscientiousness, suggesting that characteristics such as diligence and responsibility are skills that primarily characterize high-level athletes. This result also confirms the pivotal role of conscientiousness in relation to successful outcomes in various life domains, such as career success and health (Martin & Friedman, 2000).

Finally, regarding the personality differences between individual- and team-sport athletes, the results indicated that the former group scored higher in energy and openness. The observed difference in energy is not in line with the previous literature (Allen et al., 2011; Eagleton et al., 2007). A possible explanation for this divergence might be represented by the different sports considered in the studies. Indeed, the present research focused on three specific sports, while previous studies considered several sports (Allen et al., 2011). As far as openness is concerned, the current result confirmed the result of Allen et al. (2011), supporting the idea that team-sport athletes are less open-minded than individual-sport athletes. A possible explanation may rely on the fact that soccer and basketball are the most popular sports in Italy; thus, the choice to take part in such sports reveals conformity rather than openness to experiment with less common sports.

## 4. Conclusions

Personality differences were observed between male athletes and male non-athletes, between high- and low-level athletes, and between individual- and team-sport athletes. The current findings suggest that the Big Five personality traits can help distinguish various levels of athletic involvement and achievement.

The present study contributed to the accumulation of relevant findings that may be integrated with previous research on personality and sports. One relevant characteristic of the present study was the adoption of a sample size that was much larger than any other study in the previous literature. Second, to the best of our knowledge, the current study is the first in sports and personality research to adopt advances in statistical methodologies to test for measurement invariance and mean differences among groups. More specifically, the ESEM approach was used to verify the dimensionality, measurement invariance and mean differences among groups. Multiple advantages are associated with such methodologies: first, ESEM provides a better fit of Big Five data in comparison with traditional CFA, and second, it provides the opportunity to test mean differences evaluating latent variables' measurement instead of manifest variables' measurement.

Some limitations of the study should also be noted. First, the individual-sport category included one type of sport, whereas the team-sport category included two types of sports. Additionally, because only three sports were considered, the team- and individual-sport variable may be affected by the sport specificity. These issues limit the generalization of the current results to other sport contexts or, at least, offers a caveat. The generalization of the results is also limited by the gender composition of our sample. As we only included male participants we cannot exclude that different findings could arise considering females, also due to gender differences in personality traits (Caprara, Caprara, & Steca, 2003). Moreover, the sampling of athletes during competitions may have led to a considerable amount of state-variance due to the specific context in which the personality assessment occurred. Competitions may play a not negligible role in fostering specific personality facets, especially those related to emotional stability. Finally, the study used a cross-sectional sampling, so it is not possible to infer cause and effect when interpreting these findings, thus restricting any conclusion to an association level.

Further longitudinal research with the adoption of advances in statistics framed into the structure equation modeling approach may help shed light on the association between sports involvement and personality. In this direction, future studies may consider consistently measuring other crucial behavioral outcomes, such as multiple sports performance indicators, amount of time spent on sports activities and past sports practice. Moreover, the adoption of a typological approach aimed at finding prototypical profiles may be useful in testing the replicability of well-known personality typologies (Steca, Alessandri, & Caprara, 2010) in the sporting population.

## Appendix A

Table 1
Big Five observed scores, ESEM factor scores determinacy coefficients, and ESEM standardized factor loadings and factor correlations based on responses to the 25-adjecitves personality measure.

| | E | A | C | ES | O |
|---|---|---|---|---|---|
| Observed scores | | | | | |
| Overall (M, SD) | (3.62, 0.66) | (3.96, 0.55) | (3.64, 0.64) | (3.34, 0.68) | (3.43, 0.69) |
| α | 0.79 | 0.68 | 0.73 | 0.73 | 0.81 |
| Non-athletes (M, SD) | (3.29, 0.74) | (3.83, 0.58) | (3.53, 0.71) | (3.21, 0.73) | (3.33, 0.65) |
| α | 0.82 | 0.71 | 0.76 | 0.76 | 0.73 |
| Lower-level athletes (M, SD) | (3.71, 0.61) | (3.94, 0.56) | (3.59, 0.61) | (3.43, 0.64) | (3.45, 0.70) |
| α | 0.77 | 0.66 | 0.70 | 0.70 | 0.82 |
| Higher-level athletes (M, SD) | (3.82, 0.58) | (4.09, 0.57) | (3.84, 0.64) | (3.60, 0.67) | (3.54, 0.65) |
| α | 0.78 | 0.74 | 0.75 | 0.75 | 0.79 |
| Individual-sport athletes (M, SD) | (3.91, 0.61) | (3.97, 0.56) | (3.74, 0.70) | (3.53, 0.74) | (3.68, 0.70) |
| α | 0.79 | 0.73 | 0.77 | 0.77 | 0.82 |
| Team-sport athletes (M, SD) | (3.70, 0.59) | (3.98, 0.56) | (3.63, 0.61) | (3.47, 0.63) | (3.43, 0.68) |
| α | 0.77 | 0.68 | 0.70 | 0.70 | 0.81 |
| ESEM factor scores determinacy coefficients | | | | | |
| Overall | 0.91 | 0.86 | 0.89 | 0.89 | 0.92 |
| Non-athletes | 0.89 | 0.87 | 0.88 | 0.89 | 0.92 |
| Lower-level athletes | 0.89 | 0.87 | 0.86 | 0.89 | 0.92 |
| Higher-level athletes | 0.89 | 0.87 | 0.88 | 0.89 | 0.92 |
| Individual-sport athletes | 0.89 | 0.88 | 0.88 | 0.89 | 0.93 |
| Team-sport athletes | 0.89 | 0.88 | 0.88 | 0.89 | 0.93 |
| ESEM solution | | | | | |
| Item | | | | | |
| 8. Determined | **0.70** | − 0.03 | 0.19 | − 0.05 | − 0.06 |
| 20. Resolute | **0.64** | 0.01 | 0.21 | 0.04 | − 0.02 |
| 13. Energetic | **0.59** | 0.15 | 0.03 | − 0.13 | 0.04 |
| 16. Dominant | **0.53** | − 0.08 | 0.02 | − 0.08 | 0.16 |
| 15. Entreprising | **0.49** | 0.00 | 0.03 | − 0.02 | 0.29 |
| 21. Friendly | 0.08 | **0.72** | − 0.08 | − 0.02 | 0.01 |
| 18. Cordial | − 0.11 | **0.58** | **0.30** | 0.04 | − 0.01 |
| 10. Affectionate | 0.02 | **0.48** | 0.12 | 0.00 | 0.17 |
| 23. Loyal | − 0.02 | **0.38** | 0.19 | − 0.02 | 0.05 |
| 4. Unselfish | 0.06 | **0.36** | 0.17 | 0.12 | − 0.02 |
| 19. Conscious | − 0.03 | 0.22 | **0.63** | 0.00 | − 0.01 |
| 12. Scrupolous | 0.02 | − 0.05 | **0.62** | − 0.11 | 0.09 |
| 22. Diligent | 0.08 | 0.16 | **0.60** | 0.00 | − 0.05 |
| 7. Responsible | 0.10 | 0.05 | **0.59** | 0.03 | − 0.03 |
| 17. Precise | 0.06 | − 0.05 | **0.59** | − 0.01 | 0.06 |
| 9. Calm | − 0.04 | − 0.05 | 0.25 | **0.75** | 0.01 |
| 1. Relaxed | 0.21 | − 0.03 | − 0.03 | **0.70** | 0.01 |
| 3. Patient | − 0.11 | 0.05 | **0.32** | **0.58** | − 0.01 |
| 25. Serene | **0.41** | 0.15 | − 0.02 | **0.49** | − 0.02 |
| 5. Optimistic | **0.58** | 0.02 | − 0.06 | **0.32** | 0.04 |
| 11. Creative | − 0.01 | 0.00 | 0.04 | 0.02 | **0.84** |
| 2. Immaginative | − 0.08 | 0.07 | − 0.08 | − 0.05 | **0.74** |
| 6. Innovative | 0.23 | − 0.08 | 0.06 | 0.05 | **0.63** |
| 14. Original | 0.20 | 0.04 | − 0.08 | − 0.02 | **0.62** |
| 24. Modern | 0.29 | 0.22 | − 0.04 | 0.06 | 0.23 |
| Correlation with A | 0.18 | | | | |
| Correlation with C | 0.25 | 0.21 | | | |
| Correlation with ES | − 0.14 | 0.28 | 0.05 | | |
| Correlation with O | 0.37 | 0.20 | − 0.05 | − 0.03 | |

Note: ESEM = exploratory structural equation modeling; E = energy; A = agreeableness; C = conscientiousness; ES = emotional stability; O = openness. α = Cronbach's Alpha. Underlined coefficients in the ESEM solution are target loadings while factor loadings higher than 0.30 are in boldface.

Table 2
Mean (M), standard deviation (SD), and correlations among the 25 adjectives.

| | M | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Relaxed | 3.13 | 0.87 | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. Immaginative | 3.40 | 0.95 | 0.04 | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| 3. Patient | 3.37 | 1.07 | 0.34 | − 0.09 | 1 | | | | | | | | | | | | | | | | | | | | | | |
| 4. Unselfish | 3.89 | 0.82 | 0.16 | 0.09 | 0.29 | 1 | | | | | | | | | | | | | | | | | | | | | |
| 5. Optimistic | 3.62 | 0.98 | 0.29 | 0.15 | 0.16 | 0.20 | 1 | | | | | | | | | | | | | | | | | | | | |
| 6. Innovative | 3.27 | 0.88 | 0.08 | 0.49 | − 0.03 | 0.07 | 0.33 | 1 | | | | | | | | | | | | | | | | | | | |
| 7. Responsible | 3.95 | 0.89 | 0.07 | − 0.07 | 0.23 | 0.21 | 0.11 | 0.09 | 1 | | | | | | | | | | | | | | | | | | |
| 8. Determined | 4.07 | 0.83 | 0.03 | 0.08 | − 0.02 | 0.14 | 0.35 | 0.30 | 0.36 | 1 | | | | | | | | | | | | | | | | | |
| 9. Calm | 3.37 | 1.01 | 0.50 | − 0.08 | 0.59 | 0.18 | 0.12 | 0.03 | 0.18 | − 0.04 | 1 | | | | | | | | | | | | | | | | |
| 10. Affectionate | 3.69 | 0.98 | 0.11 | 0.20 | 0.15 | 0.25 | 0.17 | 0.15 | 0.18 | 0.16 | 0.14 | 1 | | | | | | | | | | | | | | | |
| 11. Creative | 3.40 | 0.93 | 0.07 | 0.63 | − 0.03 | 0.04 | 0.20 | 0.56 | 0.02 | 0.17 | − 0.01 | 0.25 | 1 | | | | | | | | | | | | | | |
| 12. Scrupolous | 3.40 | 0.90 | − 0.02 | − 0.01 | 0.10 | 0.15 | 0.06 | 0.11 | 0.31 | 0.23 | 0.03 | 0.14 | 0.07 | 1 | | | | | | | | | | | | | |
| 13. Energetic | 3.83 | 0.86 | 0.01 | 0.18 | − 0.06 | 0.16 | 0.34 | 0.30 | 0.18 | 0.51 | − 0.11 | 0.22 | 0.23 | 0.20 | 1 | | | | | | | | | | | | |
| 14. Original | 3.49 | 0.92 | 0.03 | 0.47 | − 0.07 | 0.04 | 0.22 | 0.54 | 0.00 | 0.21 | − 0.06 | 0.18 | 0.58 | 0.04 | 0.34 | 1 | | | | | | | | | | | |
| 15. Entreprising | 3.53 | 0.83 | 0.03 | 0.30 | − 0.04 | 0.09 | 0.35 | 0.42 | 0.12 | 0.42 | − 0.06 | 0.17 | 0.38 | 0.13 | 0.41 | 0.44 | 1 | | | | | | | | | | |
| 16. Dominant | 3.15 | 0.98 | 0.01 | 0.18 | − 0.17 | 0.02 | 0.28 | 0.32 | 0.06 | 0.39 | − 0.11 | 0.13 | 0.30 | 0.14 | 0.40 | 0.31 | 0.44 | 1 | | | | | | | | | |
| 17. Precise | 3.46 | 1.00 | 0.01 | − 0.05 | 0.17 | 0.13 | 0.07 | 0.09 | 0.36 | 0.22 | 0.14 | 0.13 | 0.06 | 0.45 | 0.19 | 0.05 | 0.13 | 0.19 | 1 | | | | | | | | |
| 18. Cordial | 3.89 | 0.82 | 0.16 | 0.03 | 0.26 | 0.29 | 0.09 | 0.03 | 0.27 | 0.08 | 0.23 | 0.37 | 0.06 | 0.20 | 0.11 | 0.03 | 0.06 | 0.00 | 0.21 | 1 | | | | | | | |
| 19. Conscious | 3.73 | 0.82 | 0.09 | − 0.03 | 0.25 | 0.24 | 0.09 | 0.06 | 0.45 | 0.20 | 0.20 | 0.25 | 0.01 | 0.37 | 0.13 | − 0.02 | 0.09 | 0.10 | 0.34 | 0.43 | 1 | | | | | | |
| 20. Resolute | 3.80 | 0.84 | 0.09 | 0.12 | − 0.01 | 0.12 | 0.36 | 0.27 | 0.28 | 0.58 | 0.08 | 0.14 | 0.19 | 0.23 | 0.44 | 0.23 | 0.38 | 0.42 | 0.28 | 0.13 | 0.28 | 1 | | | | | |
| 21. Friendly | 4.10 | 0.81 | 0.12 | 0.15 | 0.15 | 0.29 | 0.17 | 0.10 | 0.09 | 0.12 | 0.13 | 0.39 | 0.17 | 0.00 | 0.22 | 0.19 | 0.16 | 0.05 | 0.05 | 0.43 | 0.18 | 0.19 | 1 | | | | |
| 22. Diligent | 3.63 | 0.81 | 0.08 | − 0.08 | 0.21 | 0.22 | 0.18 | 0.08 | 0.44 | 0.27 | 0.18 | 0.19 | 0.02 | 0.44 | 0.18 | − 0.01 | 0.17 | 0.09 | 0.36 | 0.31 | 0.49 | 0.27 | 0.21 | 1 | | | |
| 23. Loyal | 4.23 | 0.80 | 0.08 | 0.09 | 0.13 | 0.29 | 0.09 | 0.13 | 0.24 | 0.11 | 0.11 | 0.24 | 0.09 | 0.09 | 0.11 | 0.08 | 0.07 | 0.04 | 0.14 | 0.27 | 0.26 | 0.15 | 0.30 | 0.23 | 1 | | |
| 24. Modern | 3.70 | 0.89 | 0.14 | 0.20 | 0.01 | 0.17 | 0.22 | 0.36 | 0.07 | 0.22 | 0.02 | 0.23 | 0.29 | 0.10 | 0.25 | 0.36 | 0.30 | 0.29 | 0.11 | 0.17 | 0.08 | 0.25 | 0.26 | 0.10 | 0.18 | 1 | |
| 25. Serene | 3.70 | 0.91 | 0.46 | 0.05 | 0.26 | 0.21 | 0.42 | 0.16 | 0.13 | 0.20 | 0.33 | 0.23 | 0.14 | 0.09 | 0.21 | 0.17 | 0.19 | 0.16 | 0.11 | 0.24 | 0.17 | 0.26 | 0.25 | 0.16 | 0.15 | 0.30 | 1 |

## Appendix B

Additional supplemental materials are available at DOI 10.17605/OSF.IO/YMHNC.

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