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Personality profile of team handball referees at expert level

Referees play a vital role in competitive sports. They ensure that games can be played and are conducted according to current regulations. Along with players and coaches, referees are described as the essential third dimension of sport, whose role is to maintain game control (Clegg & Thompson, 1993; Purdy & Snyder, 1987). However, different demands characterise this task depending on the sport. Plessner and MacMahon (2013) developed a model that classifies referees along two continuums representing the amount of interactions and movements as well as the number of cues and athletes monitored. Compared to other sports, where referees act as monitors (e.g., gymnastics referees) or as reactors (e.g., line judges in tennis), handball referees can be assigned to the type of interactors. In multidirectional team sports such as handball, referees must handle a high amount of interactions and movements and a high number of athletes and cues.

During the game, handball referees are permanently in the thick of the action and directly at eye level with players and coaches. Especially in critical situations, they have to cope with multiple sources of stress (Anshel & Weinberg, 1995; Rainey, 1995; Tsobatzoudis, Kaisidis-Rodafinos, Partemian, & Grouios, 2005), remain calm, and sell their decision credibly (Mellick, Fleming, Bull, & Laugharne, 2005). This requires empathy, effective communication, and game management. The ability and willingness to interact and build relationships with players and coaches to effectively manage a game are considered crucial in terms of

creating flow and exerting control (Slack, Maynard, Butt, & Olusoga, 2013). These characteristics, however, presuppose certain behavioural stability, which can be founded in stable dispositions towards an action, belief, and attitude formation (Asendorpf, 2015). Between-individual differences with regard to these dispositions can in turn be captured by personality traits that are specific to each individual. This approach is a powerful descriptive and predictive tool widely used both in clinical, social, and educational research, but also in sport science research.

According to the Cornerstones Performance Model of Refereeing (Mascarenhas, Collins, & Mortimer, 2005), personality, among other areas, is anchored as a key component of successful refereeing. This applies especially to interactors and opens up an interesting field of research for sport psychology in terms of understanding, explaining, and predicting the degree of involvement and success in sport (Newcombe & Boyle, 1995).

The most widely used and empirically supported model of personality is the five-factor model, also known as “The Big Five” (John, Naumann, & Soto, 2008; McCrae & Costa, 2008). Studies have already used the five-factor model (McCrae & John, 1992) to investigate sport-related performance (e.g., Allen, Greenlees, & Jones, 2011; Steca, Baretta, Greco, D’Addario, & Monzani, 2018). Since handball referees also behave similarly over time, it seems meaningful to apply this model to describe the very personality traits that influence referees’ behaviour.

State of research

Despite the importance of the referee and the generally known challenges in recruitment and retention of referees, refereeing, unfortunately, has received little attention in the scientific debate (Diotaiuti, Falese, Mancone, & Purromuto, 2017; Guillén & Feltz, 2011; Placortés, Gomà-i-Freixanet, & Avilés-Antón, 2015). So far, there is only limited evidence on the psychological characteristics required from handball referees. This is particularly surprising because Weinberg and Richardson (1990) pointed out that the success of experienced referees was influenced by psychological skills by as much as 70%.

The first studies in this area (Alker, Straub, & Leary, 1973; Dale, 1976; Ittenbach & Eller, 1988; Quain & Purdy, 1988; Sinclair, 1975;) analysed differences in the personality of referees in different sports using the California Psychological Inventory (Gough, 1957). The studies concluded that referees scored significantly higher than the respective reference group in terms of dominance, self-acceptance, communality, and achievement via conformance.

More recently, a study by Balch and Scott (2007) investigated personality characteristics of volleyball, hockey, and wrestling officials using the NEO Five-Factor Inventory (Costa & McCrae, 1992). The results showed that—except for higher values in extraversion—there were no significant differences between the personality domains of the respective referee groups and the normative sample. The authors, therefore, concluded

Table 1 Description of the Big Five facets. Adapted from Soto and John (2017)

Domain	Facet	Description
Open-Mindedness	Aesthetic Sensitivity	Interest in art, music, or literature
	Intellectual Curiosity	Interest in abstract ideas, enjoyment of thinking
	Creative Imagination	Creative and original thinking
Conscientiousness	Organization	Being systematic, organized, and orderly
	Productiveness	Efficient and persistent behaviour
	Responsibility	Being reliable and steady
Extraversion	Sociability	Outgoing behaviour, enjoyment of interaction
	Assertiveness	Dominant and assertive tendencies
	Energy Level	Enthusiastic and excited feelings
Agreeableness	Compassion	Helpful and unselfish behaviour
	Respectfulness	Being polite, respectful, and conflict avoidant
	Trust	A forgiving nature, belief in sincerity and good intentions
Negative Emotionality	Anxiety	Feeling easily stressed, anxious, and worried
	Depression	Feeling sad and blue
	Emotional Volatility	Moody or temperamental tendencies

that officials were neither different from regular people, nor possessed any outstanding characteristics that would have made their job easier (Balch & Scott, 2007). Another recent study by Pla-Cortés et al. (2015) examined the personality profile of Spanish basketball referees. Using the NEO PI-R (Costa & McCrae, 1999), they found that the referee group had a differential personality profile compared to the general population. The tested referees achieved higher scores in neuroticism and lower scores in openness, agreeableness, and conscientiousness. In extraversion, no difference was found in this study.

The studies presented reveal a mixed picture of referees' personalities. This could be because of the different sports and thus different classification of referees into monitors, reactors, and interactors (Plessner & MacMahon, 2013). However, personality is considered an integral part of, for example, models describing elite refereeing performance (Mascarenhas et al., 2005) or effective communication and player management (Cunningham, Simmons, Mascarenhas, & Redhead, 2014). Thus, this study aims at extending the previous findings with a focus on handball referees at expert level in order to close the knowledge gap in this specific context. This seems important for us to provide initial results for further research in the sport of handball, e.g., on the issue of stress (Tsorbatzoudis

et al., 2005) or improving the decision-making process (Schweizer, Plessner, & Brand, 2013).

Theoretical framework and the present study

There are diverse theoretical approaches to personality research. A model widely used in science is the five-factor model (John et al., 2008; McCrae & Costa, 2008). The model captures the Big Five personality traits open-mindedness, conscientiousness, extraversion, agreeableness, and negative emotionality with three facets each (Table 1).

The five-factor model subsumes the vast majority of competing personality models and is therefore often referred to as the "universal" personality model (John et al., 2008; McCrae & Costa, 2008). Several studies have proven the accuracy of this model in different countries and cultural backgrounds (cf. Ostendorf & Angleitner, 1992). In sports, it has often been investigated whether the dimensions of this model are related to the performance of athletes (Allen, Greenlees, & Jones, 2013). Yet, this model has never been applied in the context of assessing the personality of handball referees at expert level before. However, because of the high suitability in the context of sports, especially in team sports, the user-friendliness, and not least also from an economic point of view, we con-

sider this model to be highly adequate for our study.

Based on the limited literature on the psychological parameters of handball referees at expert level, assumptions about the personality of this group of referees are presented in the following section.

Open-Mindedness. Open-Mindedness indicates a dimension that distinguishes creative and imaginative individuals from conventional and more practical ones (Costa & McCrae, 1992). With regard to referees at expert level, the domain of open-mindedness is difficult to predict. On the one hand, one could assume that referees tend to reach average or even higher values because they gain new experiences and adapt to different settings and people every match day. Furthermore, their job can be considered intellectually demanding. On the other hand, it could be argued that every match day is subject to a certain routine and that match actions must be evaluated consistently and according to recurring decision patterns. Such automatisms require little creativity and might, therefore, correspond with the findings of Balch and Scott (2007) and Pla-Cortés et al. (2015) that referees score low in this domain.

Conscientiousness. The personality trait of conscientiousness refers to an individual's level of being organised, productive, and responsible (Costa & McCrae, 1992) and is suggested as being a predictor for athletic performance (Allen et al., 2011; Piedmont, Hill, & Blanco, 1999). The unpredictability of the course of a game and the complex game actions at the highest level confront the referees with new challenges in every game. They must be ambitious, focused, well-organised, and reliable to meet the demands of the highest leagues. Ultimately, they are role models in terms of impartiality, sportsmanship, and conveying the spirit of the game which also requires adequate organisation and preparation. Therefore, it is assumed that these considerations are reflected in this domain and referees score a high value. This would then contradict the findings of Pla-Cortés et al.

(2015), who found a low value for basketball referees in this domain.

Extraversion. The dimension of extraversion reflects a self-confident, dominant, active, and excitement-seeking tendency. Individuals who, in their lives, prefer being with other people and connecting to the outside world and are more outgoing are defined as extravert people (Costa & McCrae, 1992). Previous studies have shown that, in comparison with selected reference groups, extraversion scores higher in officials from a variety of sports (e.g., wrestling, hockey, and volleyball, Balch & Scott, 2007; basketball, Fratzke, 1975; football, Ittenbach & Eller, 1988; volleyball, Sinclair, 1975). In contrast, Pla-Cortés et al. (2015) found no evidence for this in their study with expert basketball referees. For handball referees at expert level, however, a high value in extraversion is assumed. They act in an exciting environment with several hundred spectators, constantly interact with players and coaches, and are exposed to permanent decision-making situations which is probably not compatible with an introverted nature.

Agreeableness. Agreeableness reflects the tendency to be kind, empathetic, trusting, cooperative, and sympathetic and indicates how well an individual harmonizes with society (Costa & McCrae, 1992). It is assumed that referees at expert level score an average to a high value in the domain of agreeableness. On the one hand, referees must enforce their decisions and ensure that players and coaches accept their interpretation of the rules. On the other hand, good game management implies a cooperative and communicative interaction with the involved parties which does not aim to take on a superior role (MacMahon et al., 2015). Furthermore, in professional handball, two referees with equal authority are in charge of each game (International Handball Federation, 2016) who must be well attuned to each other. It is therefore presumed that referees oscillate back and forth between sustainable pursuit of their own concerns and adapted behaviour conducive to the game, depending on the respective situ-

ation and the course of the game. This would then again contradict the findings of Pla-Cortés et al. (2015) who found a low agreeableness value for basketball referees.

Negative emotionality. The last domain is the only one with a negative connotation. Negative emotionality describes the tendency to experience negative and stressful emotions and to exhibit behaviour that signifies a lack of emotional stability (Costa & McCrae, 1992). The job of the referees—especially in the top leagues—requires a high level of stress resistance and impulse control (Macra-Oşorhean, Lupu, & Bud, 2012). Due to the pressure which the referees are subjected to on match days, it is assumed that they probably have a more emotionally stable and resilient disposition and, therefore, score a low value in this domain.

In summary, we note that it is not possible to make precise predictions about the personality traits of handball referees due to a limited theoretical fundament. Therefore, this study is based on an exploratory approach. However, the state of research to date allows us to make certain assumptions as described above. Based on these considerations, we believe that handball referees at expert level score medium values in open-mindedness and agreeableness, high values in conscientiousness and extraversion, and a low value in negative emotionality.

Method

In order to examine the assumptions made above, a cross-sectional study was conducted with handball referees from the squads of the German Handball Federation. This includes all referees who are active in the 1st to 3rd division and in the perspective squads.

The aim of the present study is to outline the personality dimensions of open-mindedness, conscientiousness, extraversion, agreeableness, and negative emotionality of handball referees at expert level and to put the characteristics in relation to values of the general population.

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Personality profile of team handball referees at expert level

Abstract

Referees play a central role in every sport. Particularly at national level, referees must meet ever higher demands due to increasing professionalisation. While cognitive and conditional aspects have already been investigated intensively, personality traits of handball referees have so far only received little attention. In addition to a profound understanding of the game and knowledge of the rules, however, it is precisely the demands on referees' personalities that are becoming increasingly important. Individual differences in personality are related to job performance in sports, especially with regard to coping with pressure and stress. Thus, personality is considered an essential component of the performance profile of referees and is required in the context of efficient game management. In this study, the personality profiles of male handball referees at expert level ($N = 163$) were examined for the first time, using the German version of the Big Five Inventory 2 (BFI-2). Standard values of the German general population from a population survey were used for comparison. Referees scored higher values in extraversion, agreeableness, and conscientiousness and a lower value in negative emotionality. The results of this cross-sectional study provide initial insights into the personality of this group of referees and thus lay the foundation for further research. A study with referees from different performance levels or cultural backgrounds could provide information on whether the results of this study only apply to German handball referees at expert level or are valid for all handball referees.

Keywords

Sports psychology · Big Five Inventory 2 · Team sports · Officiating · Interactors

To carry out this study, we obtained the approval of the local Ethics Committee (ethics application no. 082/2020) and the German Handball Federation. The study has also been conducted following the guidelines of the Declaration of Helsinki (World Medical Association, 2013).

Participants

For this study, 181 handball referees from leagues under the authority of the German Handball Federation (18 women, 163 men) were interviewed. In the course of the evaluation of the data, it became apparent that the gender imbalance could lead to biases in terms of intergender differences. For this reason, the study focused only on the personality profile of male referees.

The male referees ($M_{\text{age}} = 29.0$ years, $SD = 7.2$ years, age range 19–48 years) belonged to squads of the first and second league (26% of referees), as well as the third league (42% of referees) and perspective squads (32% of referees). They had a wide range of officiating experience ($M = 13.1$ years, $SD = 7.2$ years, range 4–36 years) and a high educational level (79.8% stated that they have a university entrance qualification). Furthermore, 62.0% of the sample reported being the eldest child in their family and 31.9% the second eldest.

Materials

The online survey consisted of the German-language scale of the Big Five Inventory 2 (BFI-2). The German translation of the BFI-2 (Danner et al., 2019) is an adaptation of the original English version by Soto and John (2017), which in turn is based on the Big Five Model of personality (Costa & McCrae, 1992). The instrument consists of 60 items and captures the Big Five personality traits open-mindedness, conscientiousness, extraversion, agreeableness, and negative emotionality with three facets each. The participants had the opportunity to indicate the extent to which they agree or disagree with the statements on a 5-point Likert-scale from 1 (strongly disagree) to 5 (strongly agree).

The reliability estimates of the BFI-2 are in a good to very good range. In the present study, Cronbach's alpha (α) for the domain values was between 0.73 and 0.86 (mean 0.83) and between 0.50 and 0.87 (mean 0.71) for the facet values. Danner et al. (2019) reported similar reliability estimates with Cronbach's α between 0.80 and 0.87 (mean 0.85)

for the domain values and Cronbach's α between 0.56 and 0.84 (mean 0.73) for the facet values. The domain and facet values were predominantly not normally distributed, as assessed by the Shapiro–Wilk test, $p > 0.05$. The survey was programmed in such a way that no nonresponses were possible. All items were created as mandatory items, which means that only fully completed data records were transferred to the analysis. Therefore, a complete data set without missing values could be evaluated.

Procedure

An online survey was created for this study. The link to the survey was sent to all referees of the German Handball Federation via an internal mailing list. The survey included informed consent, which ensured that all participants agreed to the anonymous processing of data. The online survey was completed in full by all participants, with a response rate of 59.5%.

Analysis

The SPSS 25 software was used for data analysis. To compare the expressions of the referees' personality dimensions, standard values from a nationally representative sample of the German general population (Danner et al., 2019)¹ were used. The use of these values is possible because the data was collected with the same instrument. Despite the violation of the normality assumption but because of the sufficiently large sample, differences between the referee sample and the reference sample were calculated with one-sample t -tests (Wilcox, 2012). Cohen's d_s values were calculated as indicators of the effect size (Cohen, 1988; Lakens, 2013).

¹ $N = 1224$ (611 women, 613 men) aged between 18 and 65 years ($M = 43.3$; $SD = 13.9$). 36% of the respondents completed secondary modern school, 33% completed comprehensive school, 16% had a higher education entrance qualification, and 15% had a university degree. As the referee sample consisted only of male referees, only the male respondents were used for the comparison.

Results

In this section, the results of the BFI-2 are presented. Detailed information on descriptive and inferential statistics can be found in [Table 2](#) and reliability coefficients and intercorrelations in [Table 3](#) in the appendix. [Figure 1](#) shows the mean values of the dimensions and facets.

The assumption that referees at expert level ($M = 3.16$, $SD = 0.62$, 95% CI [3.07, 3.26]) would score an average value in the domain of open-mindedness can be confirmed compared to the general population ($M = 3.28$, $SD = 0.63$; Danner et al., 2019). The difference in the mean values is descriptively visible, but cannot be verified statistically, $t(162) = -2.38$, $p = 0.02$, $d = -0.18$. It should be noted that referees ($M = 2.39$, $SD = 0.97$, CI [2.24, 2.55]) differ significantly from the general population ($M = 2.89$, $SD = 0.96$; Danner et al., 2019) only in the facet of aesthetic sensitivity. This finding can also be confirmed statistically, $t(162) = -6.46$, $p < 0.001$, $d = -0.51$.

On average, referees at expert level ($M = 3.72$, $SD = 0.57$, CI [3.63, 3.81]) were found to be more conscientious than the general population ($M = 3.57$, $SD = 0.59$; Danner et al., 2019). The prediction that conscientiousness is a pronounced characteristic of these referees is also supported by the data, $t(162) = 3.34$, $p = 0.001$, $d = 0.26$. However, the result of this domain is in no small extent due to the strong expression of the facet of responsibility in the referee sample ($M = 3.98$, $SD = 0.52$, CI [3.90, 4.06]). The general population displays a significantly lower value in this facet ($M = 3.66$, $SD = 0.57$; Danner et al., 2019) which can also be confirmed statistically, $t(162) = 7.80$, $p < 0.001$, $d = 0.57$.

For the domain of extraversion, the assumption that referees at expert level ($M = 3.67$, $SD = 0.56$, CI [3.59, 3.76]) would score a high value was descriptively confirmed compared to the general population ($M = 3.13$, $SD = 0.61$; Danner et al., 2019). The prediction that extraversion is more pronounced in top-class referees is also verified statistically, $t(162) = 12.32$, $p < 0.001$, $d = 0.90$. Particularly striking is the high value of the referees ($M = 3.78$, $SD = 0.59$, CI

Fig. 1 Mean values of the Big Five Inventory 2 (BFI-2) domains and facets expressed by referees at expert level and the general population. Error bars show standard deviations

[3.69, 3.88]) in the facet of assertiveness compared to the general population ($M=3.21$, $SD=0.73$; Danner et al., 2019). The comparison of the assertiveness values also indicates a higher expression among referees at expert level, $t(162)=12.33$, $p<0.001$, $d=0.82$.

For the domain agreeableness, the assumption that an average value would be characteristic for referees at expert level ($M=3.86$, $SD=0.41$, CI [3.80, 3.93]) was descriptively not confirmed compared to the general population ($M=3.64$, $SD=0.51$; Danner et al., 2019). The referee sample indicated significantly higher agreeableness values than the reference group, $t(162)=6.96$, $p<0.001$, $d=0.45$. At the level of the associated facets, the statistical analysis revealed comparable values.

Finally, referees at expert level ($M=2.16$, $SD=0.51$, CI [2.08, 2.24]) scored a lower value in negative emotionality than the general population ($M=2.66$, $SD=0.68$; Danner et al., 2019). Thus, the assumption regarding this dimension could be confirmed statistically, $t(162)=-12.37$, $p<0.001$, $d=-0.77$. Lower referee values and statistically significant differences to the general population were also found in all related facets.

In addition to the results on male referees, an analysis between male and female referees showed no significant dif-

ferences (all $ps>0.05$; all $ds<0.48$). The only exception were the facets of energy level, $t(179)=-2.72$, $p=0.007$, $d=-0.68$ and emotional volatility, $t(179)=-2.58$, $p=0.011$, $d=-0.64$.

Discussion

The present study examines for the first time the personality profile of handball referees at expert level in comparison to mean values of the general population. As a result, it can be stated that the referee sample showed partly conspicuous values in the BFI-2 domains and facets.

The finding that referees at expert level achieve an average score in open-mindedness and do not differ from the general population is consistent with the results of other studies (referees, Balch & Scott, 2007; athletes, Steca et al., 2018). In contrast, Pla-Cortés et al. (2015) reported a significantly lower value in their sample of basketball referees. The results of this study indicate that handball referees have little interest in aesthetic aspects and are stable in their intellectual and creative concerns. These personality traits could explain the great persistence with which referees carry out their tasks despite the difficulties involved (Sinclair, 1975).

In the domain of conscientiousness, referees achieved a high value and differed significantly from the general population. This conscientious attitude forms

part of the referees' personality and describes them as productive workers who prefer order and structure and tend to follow rules and norms (Soto, Kronauer, & Liang, 2016). Similar results were also found for athletes at higher performance levels (e.g., Allen, et al., 2011; Piedmont et al., 1999). However, the strong expression of this domain is mainly due to the high value in the facet of responsibility. This supports a finding by Steca et al. (2018), who stated that responsibility is a skill that primarily characterises high-level athletes. This also applies to referees, as being in charge of a game, especially in the higher leagues, is connected with enormous reliability and sense of duty, which requires the referees to meet all sporting expectations addressed to them. This apparently essential trait should, therefore, either be present from the beginning or be developed over time. Surprisingly, Pla-Cortés et al. (2015) did not suggest that conscientiousness is particularly pronounced among basketball referees. Furthermore, one might have expected that handball referees in higher leagues would be more orderly and productive. After all, it is their job to maintain order on the playing court during the matches, including preparation and follow-up, which requires a lot of effort and diligence. According to Rullang, Emrich, and Pierdzioch (2017), a high level

of conscientiousness also increases the duration of a referee career, which coincides with a pivotal characteristic of this dimension of completing tasks and working towards long-term goals (Soto et al., 2016) and provides an explanation as to why these particular referees have made it to this level of professionalism.

The finding that handball referees at expert level are more extravert than the general population can be well reconciled with findings of previous studies in which referees demonstrated a higher level of extraversion (e.g., Balch & Scott, 2007; Valdevit, Ilić, Vesković, & Suzović, 2011), dominance (e.g., Sinclair, 1975), and well-developed qualities of leadership (e.g., Alker et al., 1973; Fratzke, 1975; Ittenbach & Eller, 1988). On the level of facets, referees appear as talkative and outgoing individuals, and their assertiveness is particularly pronounced. The high relevance of assertiveness for the referees' job has already been pointed out by McCarrick, Wolfson, and Neave (2019). Furthermore, Taylor, Daniel, Leith, and Burke (1990) suggested that assertiveness in experienced referees is associated with the development of coping strategies that protect them from stress and burnout. A high level of extraversion, therefore, seems to be a fundamental characteristic for the successful execution of the job as a referee. Referees must always stand behind their sometimes unpopular and critical decisions and, if necessary, emphasise them by a dominant appearance to maintain match control and credibility. This includes appropriate and situation-specific communication with players and coaches to increase acceptance of the decisions made. The manifestation of this domain and facets could explain why referees at expert level endure stress in an otherwise often hostile and highly volatile environment and are even motivated to expose themselves to such situations repeatedly. The need for excitement but also for reward and positive feelings also comply with extravert personalities. It is therefore surprising that other studies (Pla-Cortés et al., 2015) did not find higher scores for extraversion.

Referees, in contrast to the general population, scored high both on agreeableness and in the related facets, which

may indicate personality traits important for refereeing. According to studies with athletes (e.g., Allen et al., 2011; Steca et al., 2018), sporting success is positively related to agreeableness, which is expressed in cooperative, prosocial behaviour (team player) and general trust in other people. Transferred to referees, this attitude could be related to the high level of commitment and dedication described by Purdy and Snyder (1985) and Furst (1989, 1991) that referees put into their sport in the course of their sporting affiliation. The social cohesion among referees on the one hand and the mostly sportsmanlike behaviour between referees, players, and coaches on the other hand contribute to creating a respectful and trusting environment.

In the last domain, negative emotionality, referees at expert level scored a notably low value which also applies to the related facets. Studies have shown that emotional instability leads to a greater probability of dropout, loss of attention, low performance, and low satisfaction (Anshel & Weinberg, 1995; Guillén & Feltz, 2011; Rainey, 1995; Taylor et al., 1990; Weinberg & Richardson, 1990). In return, emotional stability is directly linked to sporting success (e.g., Allen et al., 2011; Piedmont et al., 1999; Steca et al., 2018). From the referees' perspective, a high degree of emotional stability is required to be able to think calmly and clearly even in difficult situations in order to make the right decisions. Furthermore, referees can only perform at this high level if they are not afraid of the consequences of their decisions and can handle frustrating moments and criticism with confidence. Surprisingly, previous studies have found no differences (Balch & Scott, 2007) or even higher values (Pla-Cortés et al., 2015) for referees in their samples, which should encourage future studies to dedicate more attention to this domain.

In summary, the present study provides a first personality profile of handball referees at expert level. Referees achieved remarkable values in the BFI-2 such as low aesthetic sensitivity, high conscientiousness with the facet responsibility, high extraversion with the facets sociability, assertiveness, and energy level, high

agreeableness with the facets compassion and respectfulness, and low negative emotionality with the facets anxiety, depression, and emotional volatility. However, the causality of these attributes is difficult to interpret. On the one hand, it could be argued that personality traits are stable over time and have led these individuals to take up the job as a referee and experience a successful career. On the other hand, these referees have already had a long career and have been promoted to the national level. In this context, the regular training and education sessions as well as frequent interaction with other referees and the exchange of experience may have contributed to the development of these characteristics.

For a more global integration of these findings, the two-factor model of personality (Bakan, 1966) provides indications as to why typical patterns often emerge in the Big Five. Within the agency-communion framework, there are clear links between the Big Two and more specific factors. Abele et al. (2016) suggested that agency is closely related to emotional stability (negative correlation with neuroticism), extraversion, and conscientiousness. They also found that assertiveness was most strongly associated with emotional stability and appeared to be the core component of agency. Applying this to the results of this study, referees at expert level can be assigned to the agentic type, which is characterised by qualities relevant for goal-attainment, such as being ambitious or capable. According to Hogan (1982), they can thus be better described with the attribute "getting ahead" than with "getting along".

It could also be discovered that handball and basketball referees, although both belong to the group of interactors, do not necessarily have to share the same personality traits. This could be because of the sport-specific task demands including, e.g. selling decisions or communication, and underlines the necessity of a differentiated consideration.

The strengths of this study are a broad sample (return rate: 59.5%) and a high level of expertise. In addition, the results suggest that differences in personality profiles can also occur between referees from similar sports. However, despite

the gain in knowledge about the personality of handball referees at expert level and indications of potentially conductive characteristics for high level refereeing, this study has some limitations. First, the overall sample included only a small proportion of female referees (10.0%), which is why we decided to study the personality profile of male handball referees only. As the number of female referees in higher leagues has steadily increased in recent years, a much larger sample with more meaningful results could be studied in the future. Moreover, we acknowledge that this study uses a cross-sectional sampling and, therefore, cannot make any statements as to whether the identified personality traits of the referees are attributable to selection effects or socialisation effects. Future research might, for example, examine socialisation effects of handball referees using longitudinal studies, i.e., whether or not promoted referees from lower leagues become more similar to their colleagues at the professional level.

An investigation of, for example, amateur referees using the same instruments—which we are currently conducting—would allow a much closer study of the within-person personality. Finally, we would like to point out that this study only examines referees from one country, which might be addressed with a cross-country or cross-cultural investigation.

Although the results of this study are not yet sufficient to derive conclusions for specific training measures, the potential of these new findings is nevertheless clearly visible. In order to meet the handball-specific requirements, handball referees need to possess particular personality traits. This insight could provide food for thought for recruiting or talent development. Furthermore, previous studies have provided evidence that important aspects of refereeing can be developed and trained (e.g., decision-making skills, Schweizer, Plessner, Kahlert, & Brand, 2011; coping strategies, Blumenstein & Orbach, 2014). The knowledge gained about the personality of handball referees could therefore be valuable in order to develop requirement-related training programmes.

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Declarations

Conflict of interest. M. Dodt, F. Fasold and D. Memmert declare that they have no competing interests.

All procedures performed in studies involving human participants or on human tissue were in accordance with the ethical standards of the institutional (local Ethics Committee; ethics application no. 082/2020) and/or national research committee and with the 1975 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

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Appendix

Table 2 Descriptive and inferential statistics of the Big Five Inventory 2 (BFI-2)

	Male referees at expert level (N = 163)			General population (N = 613)		Df	t	p	d
	M	SD	95% CI	M	SD				
Open-Mindedness	3.16	0.62	[3.07, 3.26]	3.28	0.63	162	-2.38	0.02	-0.18
Aesthetic Sensitivity	2.39	0.97	[2.24, 2.55]	2.89	0.96	162	-6.46	< 0.001	-0.51
Intellectual Curiosity	3.60	0.70	[3.49, 3.71]	3.46	0.71	162	2.49	0.01	0.19
Creative Imagination	3.49	0.74	[3.38, 3.61]	3.50	0.76	162	-0.08	0.94	-0.01
Conscientiousness	3.72	0.57	[3.63, 3.81]	3.57	0.59	162	3.34	0.001	0.26
Organization	3.68	0.83	[3.56, 3.81]	3.60	0.85	162	1.31	0.19	0.10
Productiveness	3.49	0.68	[3.39, 3.60]	3.44	0.70	162	1.06	0.29	0.08
Responsibility	3.98	0.52	[3.90, 4.06]	3.66	0.57	162	7.80	< 0.001	0.57
Extraversion	3.67	0.56	[3.59, 3.76]	3.13	0.61	162	12.32	< 0.001	0.90
Sociability	3.62	0.81	[3.50, 3.76]	3.05	0.78	162	9.07	< 0.001	0.73
Assertiveness	3.78	0.59	[3.69, 3.88]	3.21	0.73	162	12.33	< 0.001	0.82
Energy Level	3.60	0.60	[3.51, 3.70]	3.11	0.68	162	10.47	< 0.001	0.74
Agreeableness	3.86	0.41	[3.80, 3.93]	3.64	0.51	162	6.96	< 0.001	0.45
Compassion	4.00	0.57	[3.91, 4.09]	3.78	0.66	162	4.93	< 0.001	0.34
Respectfulness	4.22	0.49	[4.15, 4.30]	4.00	0.60	162	5.89	< 0.001	0.39
Trust	3.35	0.55	[3.27, 3.45]	3.15	0.64	162	4.78	< 0.001	0.33
Negative Emotionality	2.16	0.51	[2.08, 2.24]	2.66	0.68	162	-12.37	< 0.001	-0.77
Anxiety	2.34	0.60	[2.25, 2.44]	2.84	0.71	162	-10.37	< 0.001	-0.71
Depression	1.92	0.56	[1.83, 2.00]	2.56	0.83	162	-14.56	< 0.001	-0.82
Emotional Volatility	2.22	0.68	[2.12, 2.33]	2.56	0.79	162	-6.36	< 0.001	-0.44

Effect sizes > 0.50 are in boldface
CI confidence interval

Table 3 Reliability coefficients and intercorrelations of the Big Five Inventory 2 (BFI-2) facets

	Open-Mindedness				Conscientiousness				Extraversion			Agreeableness			Negative Emotionality		
	Aes	Int	Cre	Org	Pro	Respo	Soc	Ass	Ene	Com	Respe	Tru	Anx	Dep			
Aesthetic Sensitivity	0.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Intellectual Curiosity	0.69	0.53**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Creative Imagination	0.82	0.28**	0.37**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Organization	0.85	-0.08	0.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Productiveness	0.72	0.12	0.13	0.63**	-	-	-	-	-	-	-	-	-	-	-	-	-
Responsibility	0.59	0.04	0.10	0.49**	0.60**	-	-	-	-	-	-	-	-	-	-	-	-
Sociability	0.82	0.19*	0.33**	0.23**	0.25**	0.13	-	-	-	-	-	-	-	-	-	-	-
Assertiveness	0.77	0.26**	0.27**	0.24**	0.31**	0.22**	0.54**	-	-	-	-	-	-	-	-	-	-
Energy Level	0.63	0.15	0.29**	0.18*	0.33**	0.17*	0.66**	0.41**	-	-	-	-	-	-	-	-	-
Compassion	0.67	0.20**	0.17*	0.01	0.05	0.19*	0.12	-0.07	0.20**	-	-	-	-	-	-	-	-
Respectfulness	0.58	0.03	0.08	0.09	0.17*	0.34**	0.07	-0.07	0.07	0.41**	-	-	-	-	-	-	-
Trust	0.51	0.09	0.07	0.10	-0.08	-0.03	0.15	-0.10	0.15	0.38**	0.31**	-	-	-	-	-	-
Anxiety	0.65	-0.23**	-0.28**	0.00	-0.21**	-0.18*	-0.17*	-0.33**	-0.14	0.11	-0.26**	-0.12	-	-	-	-	-
Depression	0.73	0.04	-0.14	-0.20*	-0.42**	-0.34**	-0.34**	-0.35**	-0.33**	-0.02	-0.24**	-0.19*	0.62**	-	-	-	-
Emotional Volatility	0.77	-0.12	-0.17*	0.07	-0.12	-0.13	0.01	0.00	0.03	-0.12	-0.50**	-0.23**	0.61**	0.39**	-	-	-
Mean	0.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

N = 163

* $p < 0.05$, ** $p < 0.01$

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