Impact of personality on postural control in football players – a pilot study

Wpływ osobowości na kontrolę posturalną piłkarzy – badanie pilotażowe

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Wprowadzenie. W porównaniu do innych sportowców, piłkarze są w grupie dyscyplin sportowych o podwyższonym ryzyku kontuzji związanych z utratą równowagi ciała. Jedno z największych wyzwań współczesnego sportu stanowi znalezienie wszystkich czynników, które mogą wpływać na system utrzymywania równowagi ciała zawodników. Rozwój badań nad przewidywaniem i zapobieganiem urazom sportowym powinien być zorientowany na perspektywę biopsychospołeczną.

Cel. Eksplorowanie związków między kontrolą równowagi ciała a cechami osobowości Wielkiej Piątki w grupie piłkarzy.

Materiały i metody. W badaniu wzięło udział 27 piłkarzy (średnia wieku 35,4±16,9 lat). Do oceny równowagi postawy zastosowano platformę Kistlera. Uczestnicy stali na platformie sił Kistlera przez 20 s z oczami otwartymi i zamkniętymi podczas każdego testu. Sygnał przemieszczania się punktu przyłożenia wypadkowej siły nacisku stóp na podłoże (centre of pressure – COP) mierzono w płaszczyznach przednio-tylnej i środkowo-bocznej. Ponadto do pomiaru osobowości zastosowano samoopisowy kwestionariusz NEO-FFI. Przeprowadzono jednoczynnikową analizę wariancji (ANOVA) i HSD post-hoc Tuckeya dla próbek nierównolicznych.

Wyniki. Badanie ujawniło związek między równowagą ciała a sumiennością. Zmienność COP była znacząco wyższa w płaszczyźnie przednio-tylnej z zamkniętymi oczami u wysoko sumiennych piłkarzy, podczas gdy mniej sumienni sportowcy wykazywali wyższe wartości zmienności wychylenia postawy ciała w płaszczyźnie przednio-tylnej podczas stania z otwartymi oczami.

Wnioski. Psychologowie sportu i trenerzy mogą wykorzystać wyniki niniejszego badania do optymalizacji procesu treningowego. Trening równowagi z wyłączoną lub ograniczoną kontrolą wzroku powinien być zindywidualizowany i stosowany w większym stopniu u osób o skrajnie wysokiej i niskiej sumienności.

Słowa kluczowe: *równowaga ciała, kontrola posturalna, piłka nożna, cechy osobowości, kwestionariusz NEO-FFI*

Introduction. In comparison to other athletes, the football players are in the group of sports with an increased risk of injury due to loss of body balance. One of the most important sports challenges is to determine all the factors that can affect the player's body balance system. The development of research on sports injury prediction and prevention should be oriented towards biopsychosocial perspectives.

Aim. To explore the relationships between the body balance control and the Big Five personality traits in the sample of football players.

Material & method. A sample of 27 football players (mean age 35.4±16.9 years) participated in the study. The Kistler force platform was used to assess the posture balance. The participants stood on the Kistler force platform for 20 s with eyes opened and eyes closed during each test. The center of pressure (COP) was measured in the anterior-posterior and medial-lateral planes. In addition, the self-report NEO-FFI questionnaire was used for personality assessment. The one-way analysis of variance (ANOVA) and the post-hoc Tuckey's HSD for non-equal samples were conducted.

Results. The study revealed the relationship between body balance and conscientiousness. The COP variability was significantly greater for highly conscientious football players in the anterior-posterior direction with eyes closed, whereas less conscientious athletes showed greater postural sway in the anterior-posterior plane during the eyes open condition.

Conclusion. Sport psychologists and trainers might use the results of this study to optimize the training process. The balance training with excluded or limited sight control should be individualized and applied to a higher extent in individuals with extremely high and low conscientiousness.

Key words: *body balance, postural control, football, personality traits, NEO-FFI questionnaire*

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Introduction

Football is a very dynamic team game that sets high requirements regarding players' motor coordination. Balance control is one of the crucial elements of coordination abilities [1]. Body balance control both determines the effectiveness of motor function in the stable position of the body and allows us to perform dynamic tasks [2]. Numerous studies indicated that balance exercises can improve adaptive postural control [2-4]. Between 15 and 60 years of age, the smallest scatter of the size of parameters characterizing body stability is noticed, and its changes are small. There may be inter-individual differences, which will depend mainly on health and physical activity, but not on age [5].

Athletes are exposed to a relatively high injury risk [6, 7]. Although injuries occur most frequently during participation in team sports, football seems to exhibit the highest risk ratios [7, 8]. The review study by Emery found evidence that most important risk factors for injury in childhood and adolescent sport are poor endurance, lack of pre-season training and some psychosocial factors [6]. In the past decades, Williams and Andersen's stress-injury model has been frequently investigated among athletes of various disciplines [9]. However, Johnson et al. suggested in their critical review that future study should be oriented towards biopsychosocial perspectives, for the development of research on sports injury prediction and prevention [10].

To our knowledge, little is known about the impact of personality on body balance. It has been confirmed in numerous studies that athletes differ from non-athletes in the Big-Five personality traits [11, 12]. Although Big-Five personality traits seem not to determine sports-related injury directly, most likely there is an indirect association between these variables, with a moderating role of body balance [13]. The relationship between postural balance and personality traits could explain the mechanisms of some aspects of internal factors determining sports-related injury in athletes. We believe that this study results may be helpful in the preparation of appropriate injury prevention strategies during training, which may differ depending on the personality traits of footballers.

Aim

The aim of this study is to explore the relationships between postural balance and the Five Factor Model of personality, which seems the most popular and commonly used personality model in the academic literature [11]. We ask the question whether personality traits can determine body balance control in the sample of football players. One may suppose that better body balance performance is related to a more successful personality pattern, which is reflected in higher extraversion and conscientiousness and lower neuroticism [12].

Material and method

Twenty-seven adults involved in football at a regional level (age 35.4±16.9 years) participated in the pilot study. The participants were engaged in recreational football, practicing regularly for a few years, 3-4 times a week, at least for 1.5 hours per day. The participants stood on a Kistler force platform for 20 s with their eyes open (EO), and later stood for 20 s with their eyes closed (EC). On the basis of the recorded signal of the changes in the foot pressure center on the surface (with a sampling frequency of 100 Hz), average values for the amplitudinal parameters of the stabilogram in the anterior-posterior (AP) and medial-lateral (ML) planes of movement were calculated. It is assumed that an increase in the amplitude values indicates less stability, while lower stabilographic values indicate more efficient control of the upright position.

Personality traits were assessed using standard 'paper and pencil' questionnaires. According to the Big-Five model of personality [10], the Neuroticism Extraversion Openness Five-Factor Inventory (NEO-FFI) consists of 60 items, 12 for each of the five dimensions of adult personality answered on a 5-point Likert scale (from 1 – 'strongly disagree', to 5 – 'strongly agree'). The reliabilities indicated an acceptable internal consistency (Cronbach's alpha) for the Polish version of NEO-FFI [13] for the following scales: Neuroticism (α=0.80), Extraversion (α=0.77), Openness (α=0.68), Agreeableness (α=0.68) and Conscientiousness (α=0.82). The scores of five scales of the NEO-FFI questionnaire, were transposed to a binomial scale on the basis of the mean.

Because the COP variability fulfills the criteria of normal distribution in the samples that represented low and high outcomes in all five scales of personality, parametric analysis was performed to test the relationships between the variables. In this study, the one-way analysis of variance (ANOVA) for repeated measures (ML and AP planes, EO, EC) and the post-hoc Tuckey's HSD for nonequal samples were used. In this analysis, the COP variability was the dependent variable and five personality traits of the NEO-FFI were the independent variable. The results were statistically analyzed using the Statistica 10 computer program. Local ethical permission was given and the study was conducted according to the Helsinki Declaration.

Results

The mean Sten scores of Big Five personality traits in the sample of football players do not differ from the average outcomes of the general population (M_N=5.04±1.95; M_E=5.92±1.94; M_O=5.48±2.19; M_U=5.66±2.09; M_S=6.41±2.08). Table I shows descriptive statistics for the center-of-pressure (COP) variability (mm) of stabilogram curve deflections in the medial-lateral and anterior-posterior planes while standing with eyes open and closed in groups of individuals scoring higher or lower in personality traits. The results of statistical analysis, 2 x 4 (Personality Trait [low, high] x COP Variability [M-L plane, A-P plane, eyes open, eyes closed]) ANOVAs for repeated measures showed no statistically significant main effects of Personality for the following traits: neuroticism [$F(1, 25)=0.04$; $p=0.85$], extraversion [$F(1, 25)=0.05$; $p=0.82$], openness [$F(1, 25)=0.03$; $p=0.87$], agreeableness [$F(1, 25)=0.14$; $p=0.71$], or conscientiousness [$F(1, 25)=0.99$, $p=0.33$]. The significant main effects of COP Variability were found for the following variables: neuroticism [$F(3, 75)=19.60$; $p<0.0001$; $\eta_p^2=0.44$], extraversion [$F(3, 75)=15.65$; $p<0.0001$; $\eta_p^2=0.39$], openness [$F(3, 75)=18.72$; $p<0.0001$; $\eta_p^2=0.43$], agreeableness [$F(3, 75)=19.91$; $p<0.0001$; $\eta_p^2=0.44$], and conscientiousness [$F(3, 75)=17.51$, $p<0.0001$; $\eta_p^2=0.41$]. In general, the COP variability was significantly higher in the A-P plane (when compared with the M-L plane) and also in the condition of eyes closed (in comparison to eyes open).

There was no interaction effect between postural balance (COP variability) and the following personality traits: neuroticism [$F(3, 75)=1.53$; $p=0.21$], extraversion [$F(3, 75)=1.09$; $p=0.36$], openness [$F(3, 75)=0.18$; $p=0.90$], and agreeableness [$F(3, 75)=0.96$; $p=0.42$]. Although highly conscientious participants did not differ significantly from those who scored low in conscientiousness, in terms of the mean variability of sway, the analysis of variance showed an interaction between conscientiousness and postural balance assessed by using four indicators (ML and AP planes, EO, EC), $F(3, 75)=3.88$; $p=0.012$; $\eta_p^2=0.14$; Wilks' $\lambda=0.62$. While standing on a stabilograph with eyes open, less conscientious participants revealed more unstable body balance in the AP plane as compared to the highly conscientious ones. Conversely, highly conscientious individuals showed greater postural sway in the AP direction during quiet standing in the platform with eyes closed than the low conscientious group (tab. I).

Discussion

Postural sway in both directions (AP and ML) represents the effectiveness of the postural control system in maintaining a stable posture. The control of human upright posture stability is commonly viewed as a continuous process of the stabilization of a multilink inverted pendulum. For the simplicity of the model, it is commonly accepted that the pendulum of the human body is controlled mostly in the ankle joints in the AP direction [15, 16]. The ML control of postural stability during quiet stance is qualitatively different and mainly relies on a hip (load/unload) mechanism [15].

In this study, the instability of balance control increased significantly among footballers while standing with eyes closed, which was consistent with other studies [17]. A more difficult task might force the regulatory mechanism to rely only on information from the internal senses (interoceptive sensors) which confirms the strong dependence of balance control on sight [18]. Higher values of the body sway variability may be the result of various mechanisms of body balance that produce random movements to maintain it. A study reported by Yamada, et al. showed that instability in the frontal plane in football players increased after the first half of the match [19]. Other studies have suggested that more intensive training decreases the variability of body sway of footballers [20].

Among Big-Five personality traits, only conscientiousness revealed a significant association with postural balance in footballers. Conscientiousness reflects the degree to which football players prefer systematic and focused tasks and clearly defined rules and regulations. Conscientiousness has showed positive significant correlation with success in sport performance in previous studies [12]. Highly consci-

Table I. Descriptive statistics for Big-Five personality traits and COP variability in medial-lateral (ML) and anterior-posterior (AP) planes
Tabela I. Statystyki opisowe dla cech osobowości Wielkiej Piątki oraz zmienności COP w płaszczyznach przyśrodkowo-bocznej (ML) i przednio-tylnej (AP)

Personality traits /Cechy osobowości		n	COP Variability /COP Zmienność (mm)			
			eyes open/ otwarte oczy		eyes closed /zamknięte oczy	
			ML M±SD	AP M±SD	ML M±SD	AP M±SD
neuroticism /neurotyczność	high /wysoka	12	2.01±0.45	3.22±1.45	2.94±0.81	3.98±1.10
	low /niska	15	2.02±0.46	2.73±1.03	2.51±0.97	4.66±2.32
extraversion /ekstrawersja	high /wysoka	18	1.92±0.48	2.94±1.39	2.52±0.95	4.55±2.16
	low /niska	9	2.20±0.33	2.97±0.91	3.08±0.73	3.97±1.13
openness /otwartość	high /wysoka	11	2.14±0.54	3.07±1.18	2.59±0.81	4.35±1.22
	low /niska	16	1.93±0.36	2.87±1.30	2.78±0.99	4.37±2.26
agreeableness /ugodowość	high /wysoka	14	1.95±0.49	3.08±1.48	2.54±0.82	4.66±2.36
	low /niska	13	2.08±0.41	2.81±0.95	2.88±1.00	4.03±1.18
conscientiousness /sumienność	high /wysoka	18	1.96±0.46	2.48±0.88	2.58±0.98	4.59±2.10
	low /niska	9	2.11±0.44	3.89±1.35	2.94±0.75	3.89±1.32

entious individuals are characterized as being reliable, hard-working, and self-disciplined [11]. They also show more intrinsic regulation of behavior, higher need for competence in physical exercise and greater wherewithal to advance along the continuum of behavioral regulation [21]. It seems likely that highly conscientious football players felt unsteady with the eyes closed because of loss of visual control. There is evidence that perceived control in the sports context directly contributes to perceived risk of injury in athletes [22].

On the other hand, less conscientious football players showed more unstable postural balance in the eyes open condition. Sport fight and the state of fatigue as well as strong pressure for the best results in persons inclined to take high risks to achieve the best score may result in contusions and traumas [23]. Emotions and personality may play an important role in creating risky behaviors in football players [24]. There is evidence that conscientiousness-related traits are negatively associated with all risky health-related behaviors [25]. Merritt and Tharp found that greater reckless risk-taking behaviors in parkour (free-running) practitioners were associated with high neuroticism and low conscientiousness [26].

Psychological factors may play a dominant role in determining injuries in sports and physical activities. The research has consistently demonstrated a relationship between stress and athletic injury risk [8-10]. Williams and Andersen divided risk factors into three main categories: personality, history of stressors, and coping resources [9]. Personality can affect which situations an athlete apprehends as stressful. According to Johnson and Ivarsson's model, selected personality factors (i.e., trait anxiety, mistrust, stress susceptibility and trait irritability), life event stress, and ineffective coping can influence injury risk among football players [8, 10]. Stephan, et al. found that that previous experiences with injury, neuroticism, and obsessive passion were significant positive predictors of perceived susceptibility to sport-related injury among competitive runners [27].

However, there is no 'injury-prone' personality type, as suggested by the Team Physician Consensus Statement [28]. As such, personality factors (e.g., extraversion, self-esteem, perfectionism) and other psychological factors (e.g. a supportive social network, coping resources, high achievement motivation) cannot reliably predict athletic injury risk. This study seems to support these statements, since we do not find a direct influence of the Big Five personality traits (neuroticism, extraversion, openness, agreeableness, conscientiousness) on postural balance among football players. The integrated model of psychological response to sport injury encompasses personal and situational moderating factors, as well as cognitive, emotional, and behavioral responses of athletes to sport injury [29, 30]. Most likely, there is so large a number of factors affecting the occurrence of injuries that interaction between these factors may be a better predictor of injury than any single factor. Further research should address a wide range of psychosocial factors related to both sports injury and postural balance among athletes. Scientific studies regarding body movement and balance should be also related to psychological dimensions and examined by interdisciplinary teams [31]. Future studies on this issue should include such factors as fatigue, emotions and attention in various experimental conditions (hampered tasks, e.g. dynamic conditions and limited sight control) in a larger sample size of football players.

Conclusion

This study confirms that postural stability is highly related to sight control. However, these results should be treated with caution due to the small sample size. Among the personality traits manifested in behavior characteristics, conscientiousness seems to only affect static balance in football players. Balance training with excluded or limited sight control should be individualized and applied to a higher extent in individuals with extremely high and extremely low conscientiousness.

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