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Mental toughness and empathy as match performance predictors of high-level female basketball players

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Abstract

Study aim: The aim of this study was to explore empathy and mental toughness as predictors of match performance of young basketball players.
Material and methods: The correlation design was used in order to meet the research goals. The research was conducted on a sample of 40 female basketball players, with average age of 16.15 ± 1.02 years, members of the four best teams of the National First Women's Cadet League. Half of the players in the sample were also national team members. The independent variables empathy and mental toughness were assessed with the Interpersonal Reactivity Index and Sports Mental Toughness Questionnaire. The dependent variable match performance was assessed through match performance analysis based on indicators from official league statistics by calculating the performance index rating (PIR).
Results: The results of the hierarchical multiple regression analysis showed that by adding empathy to the model of mental toughness, the percentage of PIR variance explained increased from 21% to 46%.
Conclusion: Adding empathy to the model of mental toughness increased its predictive value. The model of mental toughness and empathy, as predictors of match performance of young basketball players, was found to be very effective. The results are not unambiguous and indicate the need for further research in this area, as it could have a positive impact on the selection system in sport. Also, the research represents a step towards greater integration of sports and collective creativity studies.

Key words: Match performance – Basketball players – Empathy – Mental toughness – SMTQ – Collective creativity

Introduction

Analysing, understanding and predicting match performance is one of the major preconditions for successful management of the training process (i.e., achieving top sports results). This is a complex and multidimensional phenomenon, and not an easy task for coaches and researchers. In basketball, which is a team sport involving open and closed skills, the number of dimensions that determine match performance is larger than in individual basic sports disciplines. In addition to the physical [7, 37, 38] and physiological characteristics of the player [35, 36], as well as the technical and tactical skills level [31, 32, 40], the match performance in basketball can be influenced by numerous other variables. Due to the nature of the game, technical skills are constantly open, and players have to make a decision every second, depending not only on opponents' behaviour, but also on that of teammates, unlike in individual and close skilled sports such as gymnastics. Therefore, it is not surprising that studies reveal a significant percentage of variance in match performance that is not related to the laboratory and field tests' results about functional, metabolic and motor abilities, as well as morphological characteristics of the players [35]. In the context of international sports competitions at the highest level, attended by athletes whose physical abilities and level of technical and tactical skills are equal to or close to the biological and genetic limits of the human body, the predictive value of the model, based solely on physical predictors of performance, is questionable. Taking into account the oscillatory character of the adaptive characteristics of the organism as a reaction to the training process, the applicability of similar models is even more arguable. Hence the conclusion is that top match performance is the

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result of the interaction of numerous factors, not sufficiently explained yet, and not fully and properly described by the physiological and physical properties of athletes [30].

So far, the influence of various psychological variables in sports achievement has been empirically confirmed in several studies [16–18, 28, 39]. Therefore, it is reasonable to assume that the psychological variables should be used to explain the part of the variance in the match performance of basketball players (as well as for other athletes) that cannot be explained by the physical and technical-tactical capabilities of the players. Due to the much more rigid nature of psychological indicators compared to the adaptive characteristics of the organism [10, 28, 30], their predictive power is higher, and predictions are more consistent and more precise when it comes to estimating game performance [16–18, 28, 39].

One of the most influential concepts in sport psychology is mental toughness, constructed with the ambition of a valid representation of a wide range of everyday characteristics and behaviour [10], that has found its domain-specific application in sport. Mental toughness is defined as a personality trait that determines how people respond to challenges, stress and pressure [1], combined with the ability to constantly achieve the best results, according to their maximum capabilities and regardless of the circumstances in which they find themselves [2]. Its high correlation with sports performance is not surprising [11, 12, 20, 28], but it is still arguable whether mental toughness is sufficient to explain all psychological aspects of team contact games, such as basketball [19].

When considering all the previously tested predictors of match performance – the physical and technical-tactical properties of the players on the one hand and the mental toughness on the other – one can notice a common shortcoming, especially relevant for basketball and similar team games; namely, the results are mostly focused on the individual achievement of athletes and overlook the fact that basketball is a collective activity in which the end result is not a simple sum of the contributions and behaviour of individuals, but rather the result of their synchronised interaction based on a mutuality. According to this feature, basketball can be observed as a collaborative creative practice, similar, for example, to a theatre or a philharmonic concert. This observation opens a new space for interdisciplinary research of sports performance, but also collective creative practices, which to date has not been properly fulfilled [25], especially when it comes to top-level professional sport.

The results of collective creativity studies show that in strictly selected and highly creative groups, the quality of a creative product depends on communication and interaction of group members [23]. And the interpersonal reactivity, which refers to different dimensions of empathy, is one of the basic prerequisites for quality communication and interaction in group work [24]. Consequently, it should come as no surprise that empathy has been shown to be a better predictor of group product creativity than assessments of individual creativity of group members involved [22]. This is also the reason why high empathy can be a special asset for young theatre artists during the educational process at the academies. Although high creativity is a prerequisite for success in artistic work, highly developed empathy is necessary for this ability to be actualised in a group setting. An analogy with a team sport such as basketball can be easily made. Although a high level of physical abilities and technical-tactical skills are prerequisites for sports achievements, an optimal level of empathy could be necessary for the abilities and skills to be maximally manifested in the context of team play. The analyses of the extensive empirical material have shown that oxytocin is involved in stimulating bio-psychological processes associated with greater team performance in sports, among which empathy occupies a key role [21]. However, direct empirical confirmation of the correlation between empathy and match performance has been lacking to date, as has the evaluation of predictive power of empathy for match performance [21, 25].

Based on what has been written so far, a question arises: is empathy related to achievement in team sports such as basketball? Moreover, are the correlations strong enough to provide a qualitative prediction of match performance? It is also worth asking whether empathy, as a possible predictor, can explain a particular part of the variance of match performance, or whether it has already been described by other psychological traits such as mental toughness. In this paper, mental toughness serves primarily as a criterion for evaluation of the predictive value of empathy, as the predictive value of mental toughness has already been empirically validated [39]. Young female basketball player cadets (oldest pre-senior competition category, age 16–18, playing in the National Cadet League) are the focus of this research, due to the specifics of basketball described earlier, the greater empathic capacity in females [33], and developmental specifics of cadet age [16]. In addition, for the first time for cadets, a system of league competition analogous to senior age is being introduced, according to the FIBA rules. In this way, moderator variables – gender and age – are under control, while the influence of other variables will be controlled through study design. The first goal of this study is to investigate correlations between mental toughness and empathy with basketball game performance, while the second goal is to evaluate the predictive value of their use for constructing the basketball game performance predictive model. It is assumed that players with more developed empathy and mental toughness will perform better (Hypotheses (H)1a and H1b) and that adding empathy, as a predictor of match performance, to an already validated model of mental

toughness will significantly increase its predictive value (H2). This research is a step towards greater integration of sports and collective creativity studies – the potential of which has not been sufficiently used to date.

Material and methods

Participants

In order to keep the intervening variables (i.e., the level of technical-tactical training and physical ability) under control, the research was conducted on a purposive sample of young female basketball players – members of the four best teams of the National First Women's Cadet League of Serbia – and their shots registered for the 2019/2020 season. For the aforementioned reason, an additional condition for participating in the research was that the players were among the top ten in terms of the number of minutes played during the season (i.e., that they represented the first and second team line up). In this way, the sample (N = 40) of female basketball players was formed (nine point guards, eleven shooting guards, nine small forwards, six power forwards and five centres), with an average age of 16.15 ± 1.02 years, who had played basketball for an average of 5.65 ± 2.13 years. In the 2019/2020 season, they played an average of 12.47 ± 2.96 games (out of a total of 16 games), that is, 235.37 ± 107.59 minutes (on average 18.87 minutes per game). Almost half of the sample (19 players) consisted of members of the female national team. In order to estimate the size and representativeness of the sample, we took into account the fact that a total of 175 basketball players were registered for the National First Women's Cadet League in the 2019/2020 season, which means that the selected sample represents over 20% of the total population in focus. The sample size was determined after applying a power analysis. For the linear multiple regression with a probability of making type I error $\alpha = 0.05$, statistical power $1\text{-}\beta = 0.80$, large effect size ($f2 = 0.19$), and ten predictors, a minimal sample size includes 36 subjects [6]. Power analyses were performed using G-power 3.1.9.6.

All the participants were informed about the study aims and procedures, and provided written consent for their voluntary participation. The study was conducted in accordance with the European Commission's General Data Protection Regulation (GDPR), and the American Psychological Association-prescribed Ethical Principles and Code of Conduct. The study design was approved by the Ethical Board (number 484-2) of the Faculty of Sport and Physical Education, University of Belgrade.

Design and procedure

The correlation design was used to evaluate empathy and mental toughness as predictors of the match performance of young basketball players (i.e., to test the set hypotheses, obtain an answer to the identified problem and meet research goals).

The independent variable mental toughness was measured by the Sports Mental Toughness Questionnaire (SMTQ) [29], which provides a reliable assessment of athletes' mental toughness (SMT) through its three basic dimensions: Confidence (SMTcnf), Constancy (SMTcns), and Control (SMTcnt). The instrument consists of 14 items, and the participants express the degree of agreement with the statements by four-point Likert-type assessment scales. The total score and sub-scale scores vary from a minimum of 1 (poorly developed) to a maximum of 4 (extremely developed). The SMTQ has good psychometric characteristics which are empirically confirmed [13, 28, 29] and has been widely used in the psychological testing of athletes [3, 14, 26, 27, 34].

The independent variable empathy was measured by the Interpersonal Reactivity Index (IRI) [4], which consists of 25 items that are answered using five-point Likert-type assessment scales. The IRI assesses an individual's empathy (IR) through four sub-dimensions: fantasy (IRf), personal distress (IRpd), empathic concern (IRec), and perspective-taking (IRpt). Similar to the SMTQ, the total score and score on the sub-scales vary from a minimum of 1 (poorly developed) to a maximum of 5 (extremely developed). The IRI has been widely used in scientific research and clinical practice [8, 15, 22], due to its good psychometric characteristics [5, 9].

The dependent variable was the match performance of the players and was assessed using match performance analysis (MPA) through indicators from the official statistics of the National First Women's Cadet League in the 2019/2020 season, which calculated the absolute performance index rating (PIR). PIR was calculated according to the following formula: PIR = (number of 3-point shots made × 3 + number of 2-point shots scored × 2 + number of free-throw shots made + number of assists + number of rebounds + number of 'steals' + number of personal fouls made on the player + number of blocks) – (number of 3-point shots missed + number of 2-point shots missed + number of free-throw shots missed + number of personal fouls + number of technical fouls + number of turnovers + number of shots by the player blocked by an opponent) [35].

The research was conducted at the final phase of the competition season of the National First Women's Cadet League for 2019/2020 year. It was organised in groups in the clubs' offices. Each participant was asked to complete the questionnaire that consisted of items related to the socio-demographic status, sports experience, position, membership in the national team, and SMTQ and IRI psychological tests. The order in which the psychological tests were given was randomised. There was no time limitation.

Data collection and analysis

Data collection was performed in two phases. At the end of the season, the official statistics for each player and the team performance data were taken from the website of the National Basketball Association. Based on these data, a sample was formed, and then the players from the sample completed questionnaires within the four sessions on the club's premises. After data collection, in order to perform further analyses, the data were coded and transformed into a numerical matrix. The data from the first part of the questionnaire were transformed into a nominal and ordinal scale according to the participant's answers and their frequency (for example club membership, a place in the team or playing in national selections), while the answers to the statements from the SMTQ and IRI were converted into total scores and sub-scale scores for each participant. MPA data (i.e., PIR results) were added to these data.

First, the data were subjected to descriptive statistical analysis. Then, Pearson's correlation analysis and multiple regression analysis of hierarchical type were performed to determine the degree of correlation between the dependent (PIR) and independent variables (SMTQ and IRI), as well as to evaluate the predictive value of the independent variables. Statistical significance was defined at the level of 95% probability, for the value of $p < 0.05$. All statistical analyses were performed using SPSS 20.

Results

The amount of variance in the match performance of young basketball players that can be explained by assessments of mental toughness and empathy (Table 3) represent the main result of this study. However, if we wish to interpret the data properly (i.e., to answer the problem posed), it is necessary to get acquainted with the broader context of the nature of the assessed variables and their relationship.

Descriptive statistical analysis (Table 1) was performed at the level of the whole sample for the dependent variables and for the independent variables (i.e., for the total scores on SMT and IR as well as the scores on four subscales of each). The analysis showed that the sample was quite heterogeneous according to the match performance assessment. At the same time, assessments were homogeneous on the psychological variables. Descriptive statistics and the Kolmogorov–Smirnov test showed that there were no significant deviations from the normal distribution of any of the variables.

Correlation analysis (Table 2) showed a statistically significant ($p < 0.05$) positive correlation between PIR and the total score of SMT, as well as the sub-scales confidence and control, while a statistically significant ($p < 0.05$)

Table 1. Descriptive statistics of dependent and independent variables for the whole sample (n = 40)

	Min	Max	Mean	Std Dev	Skew	Kurt
PIR	–7.00	273	84.07	70.33	0.87	0.04
SMT	2.21	3.78	3.04	0.42	–0.30	–0.83
SMTcnf	2.17	3.83	2.91	0.51	0.15	–1.04
SMTcns	2.25	4.00	3.55	0.44	–0.98	0.48
SMTcnt	1.50	4.00	2.74	0.63	–0.05	–0.25
IR	2.64	4.07	3.43	0.40	–0.44	–0.67
IRf	1.63	4.13	2.95	0.69	–0.06	–0.88
IRpt	1.25	4.25	3.16	0.56	–1.05	2.63
IRec	1.88	4.25	3.45	0.54	–0.85	0.52
IRpd	1.88	3.38	2.61	0.38	–0.21	–0.67

PIR –performance index rating, SMT – sport mental toughness, SMTcnf – confidence, SMTcns – constancy, SMTcnt – control, IR – interpersonal reactivity, IRf – fantasy, IRpt – perspective-taking, IRec – empathic concern, IRpd – personal distress.

Table 2. Pearson's correlation analysis of dependent and independent variables

		SMT	SMTcnf	SMTcns	SMTcnt	IR	IRf	IRpt	IRec	IRpd
PIR	r	0.33	0.39	–0.03	0.32	–0.41	0.27	0.24	0.09	–0.16
	p	0.04	0.01	0.85	0.04	0.01	0.10	0.14	0.58	0.32

PIR – performance index rating, SMT – sport mental toughness, SMTcnf – confidence, SMTcns – constancy, SMTcnt – control, IR – interpersonal reactivity, IRf – fantasy, IRpt – perspective-taking, IRec – empathic concern, IRpd – personal distress.

Table 3. Hierarchical multiple regression analysis of dependent and independent variables

PIR	Predictor	B	Std. Error	β	p	R^2	F	p
Step 1	SMTcnf	58.71	27.78	0.42	0.04	0.21	3.06	0.03
	SMTcns	–38.52	26.50	–0.24	0.15			
	SMTcnt	13.65	20.34	0.12	0.51			
Step 2	SMTcnf	68.39	27.71	0.49	0.03	0.43	3.40	0.02
	SMTcns	–17.05	26.60	–0.11	0.53			
	SMTcnt	–5.83	23.52	–0.05	0.81			
	IR	–70.77	29.39	–0.41	0.02			
	IRf	–3.70	17.22	–0.04	0.83			
	IRpt	35.91	21.21	0.29	0.10			
	IRec	–0.89	20.61	–0.01	0.97			
	IRpd	–23.53	26.88	–0.13	0.39			

PIR – performance index rating, SMT – sport mental toughness, SMTcnf – confidence, SMTcns – constancy, SMTcnt – control, IR – interpersonal reactivity, IRf – fantasy, IRpt – perspective-taking, IRec – empathic concern, IRpd – personal distress.

negative correlation between PIR and total IR score was also obtained.

The value of empathy as a predictor of the match performance of young basketball players was shown by the results of multiple regression analysis of the hierarchical type (Table 3). Adding empathy to the mental toughness model doubled the percentage variance in PIR that could be explained by scores on psychological tests. The percentage of variance explained increased from 21% to 43% after adding empathy.

Discussion

This study aimed to examine the relationships among mental toughness, empathy, and match performance, as well as to evaluate the value of empathy as a predictor of match performance with young female basketball players. Statistically significant correlations were obtained between mental toughness and empathy on one hand and the indicators of match performance on the other. Furthermore, the independent variables were found to be statistically significant predictors of match performance, but it is important to emphasise that adding empathy to the model of mental toughness increased its predictive value.

The obtained results are not unambiguous when it comes to their interpretation in the light of the first hypothesis that players who have more developed empathy and mental toughness will have better performance (H1a and H1b). When it comes to mental toughness, the point is clear. As shown in previous studies [11, 12, 28, 29, 39], mental toughness is positively correlated with match performance (Table 2). The results of the regression analysis can be interpreted in a similar way (Table 3). In the first step, confidence was the most important and only statistically significant predictor. In the second step, the total IRI score was added to confidence as a statistically significant predictor, this time even stronger than confidence. It seems that increased mental toughness along with reduced interpersonal reactivity is a prerequisite for greater performance in the match. This certainly speaks of mental preparation as a prerequisite for success in the match. However, taking into account the results of correlation and regression analysis (Tables 1 and 2) together, the obtained results can be interpreted more precisely. Although certain dimensions of mental toughness as predictors took a negative sign or were negatively correlated with PIR, this cannot be interpreted as a finding contrary to the hypothesis, due to the lack of statistical significance in these cases. When it comes to empathy, things are a little different. The results of correlation and regression analysis (Tables 2 and 3) confirmed the correlation between match performance of the young basketball players and empathy, but the direction is not positive. However, the negative correlation between match performance and total score of interpersonal reactivity primarily derived from a negative correlation with the sub-score of personal distress. Regression models revealed that when paired with mental toughness fantasy and empathic concern also showed a negative connection with performance, although the influence was weak so the connections cannot be interpreted clearly. The

remaining empathy sub-dimension (i.e., empathic concern) was positively correlated with match performance and demonstrated considerable predictive power in the regression model. It should also be noted that in the sample, the sub-dimensions of fantasy and personal distress were relatively poorly developed, especially compared to the sub-dimensions of empathic concern, as well as mental toughness (Table 1). We can assume that fantasy and personal distress, as two less developed empathic sub-dimensions, are unmatched with the effective perception of reality that is required for top sports results. At the same time, empathic concern and perspective-taking can be crucial in the context of collective actions performed in team sports. Another explanation might be that the correlation between sub-dimensions of empathy and match performance of basketball players is not linear. In a study with young artists, the results revealed that groups of medium-level empathy were more creative than low and high-level groups [22]. It might be a similar situation in the collective action of basketball players. For this hypothesis to be validated, new research with more players from more different teams in the sample is needed. Therefore, due to all the above, the first hypothesis can only be partially accepted.

The obtained results, especially the results of regression analysis (Table 3), supported the hypothesis that adding empathy as a predictor of match performance to an already validated model of mental toughness will significantly increase its predictive value (H2). However, in order to fully meet the research goals (i.e., to evaluate the predictive value of the model), the broader context of research on this topic should be kept in mind.

In previous studies, different features composed the model to predict match performance of young basketball players, including the following: the contractile abilities of basic muscle groups, lower limb strength characteristics, locomotion and agility speed, aerobic and anaerobic endurance, flexibility, as well as functional and metabolic parameters of recovery rate. All of these predictors were derived from 16 laboratory tests which explained 50% of the variance, as well as the model derived from 10 field tests which explained 33% of the variance [35]. In this study, only two questionnaire tests were used. Also, the prediction based on the results of laboratory and field tests referred only to two matches before and two matches after testing, while the proposed model in this study referred to the whole season. This is the reason why previous studies resulted in a considerable homogeneity of the variables of match performance [35], while this is not the case here (Table 1). Due to all the above, the second hypothesis can be fully accepted, while the model of mental toughness and empathy, as predictors of match performance of young basketball players, can be described as very effective.

Of course, although the predictive model was found to have high efficiency, this does not suggest that it should replace already validated models that assess functional, metabolic and motor abilities, as well as morphological characteristics. However, the proposed model should be an important and valuable addition. As explained in the introduction, the physical and physiological characteristics of athletes are prerequisites for top results in professional sports. However, when it comes to team contact games such as basketball, one should keep in mind the important role of empathy that was shown in this research. This finding is important because empathy so far practically has not been taken into account in the selection of athletes. Also, the possibility of systematic work on the development of this trait, specifically the dimensions of empathic concern and perspective-taking, through the training process and psychological preparation of athletes, should be considered.

The obtained findings expand the previous research on the sports performance of young basketball players [35, 39, 40]. They have opened the space for further research on this topic, both among young basketball players and athletes of other sports, gender and age categories. The results can have a positive impact on the selection system in sports, primarily for basketball players, but also for others. In this way, studies of match performance are expanded: in addition to the individual, the collective context is also taken into account, which is already noticed, but its research and practical potential are insufficiently used [21, 25]. The obtained findings also confirm previous studies of collective creativity [22, 24], this time in the specific sport context. Collective creativity studies in this way have been given a new field of research and space for stronger integration of research with sports studies. Finally, the findings of this study represent new insights relevant to social and developmental psychology.

Limitations

A major limitation of this study is the post hoc nature of prediction; namely, the true validity of the model could only be shown after longitudinal monitoring of the players from the sample, which will certainly be the subject of subsequent research, justified by the findings of this exploratory study. Also, the sample selection regarding the age of the participants is disputable. After puberty, we can talk about a certain stabilisation of personal traits, but this process will only end after the age of 20. Therefore, longitudinal research should be a necessary addition. However, since the ambition is to positively influence the selection system of athletes, a sample of basketball players aged 20 and over would be quite inefficient in this sense (i.e., it would not give usable implications for the selection system).

Conclusion

This study unequivocally showed the existence of a correlation between mental toughness, empathy and match performance among high-level young female basketball players. In addition to the well-known relationship between mental toughness and sports success, a correlation between empathy and sports performance, which has been poorly investigated to date, has been observed and described. However, when it comes to the direction of the observed increases, the results are not unambiguous and point to the need for deeper and more detailed research on this topic. These results can help in the selection of top female basketball players, but they also show that mental training aimed at developing mental toughness and empathy can lead to better results in women's basketball.

Conflict of interest: Authors state no conflict of interest.

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