

Mental toughness of badminton athletes: the role of coach leadership type and coach-athlete relationship

La fortaleza mental de los deportistas de bádminon: el papel del tipo de liderazgo del entrenador y la relación entrenador-atleta

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Abstract. The coach is someone who must know about all the basic needs for the fulfilment of conditions where athletes have the opportunity to achieve achievement. The relationship between coaches of athletes who are fostered must be a relationship that reflects a common view in realising what is aspired to. This study aims to determine (1) the effect of coach leadership type on the mental toughness of badminton athletes. (2) the influence of the coach-athlete relationship on the mental toughness of badminton athletes. (3) the effect of coach leadership type and coach-athlete relationship on the mental toughness of badminton athletes. This research is quantitative with an ex post facto approach. The subjects in the study were badminton athletes in clubs in Sleman Regency Yogyakarta totalling 73 athletes (male 43, female 30). The measuring instrument with questioner. The statistical analysis technique used the Statistical Package for Social Science (SPSS) version 21 software. The level of statistical significance was set at p-value <0.05. Based on the results of data analysis, it can be concluded that: (1) There is a significant relationship between the coach's leadership type and mental toughness in badminton athletes (t-value 4.453, p-value 0.000<0.05). (2) There is a significant relationship between coach-athlete relationship on mental toughness in badminton athletes, (t-value 2.373, p-value 0.020 <0.05). (3) There is a significant relationship between the coach's leadership type and the coach-athlete relationship on the mental toughness of badminton athletes, (F-value 40.791, p-value 0.00 <0.05) and a contribution of 52.50%. It is recommended for coaches to be able to provide enthusiasm and encouragement for athletes to continue to fight and never give up in facing every match faced in order to achieve maximum achievement and results. Develop leadership as a coach and develop interaction skills in building relationships with athletes.

Keywords: Coach Leadership Type, Coach-Athlete Relationship, Mental Toughness

Resumen. El entrenador es alguien que debe conocer todas las necesidades básicas para que se den las condiciones necesarias para que los deportistas tengan la oportunidad de alcanzar logros. La relación entre los entrenadores de los deportistas que se fomentan debe ser una relación que refleje una visión común en la realización de lo que se aspira. Este estudio pretende determinar (1) el efecto del tipo de liderazgo del entrenador en la fortaleza mental de los atletas de bádminon. (2) la influencia de la relación entrenador-atleta en la fortaleza mental de los deportistas de bádminon. (3) el efecto del tipo de liderazgo del entrenador y de la relación entrenador-atleta sobre la fortaleza mental de los deportistas de bádminon. Esta investigación es cuantitativa con un enfoque ex post facto. Los sujetos del estudio fueron atletas de bádminon de clubes de Sleman Regency Yogyakarta, con un total de 73 atletas (43 hombres y 30 mujeres). El instrumento de medida fue un cuestionario. Para la técnica de análisis estadístico se utilizó el programa Statistical Package for Social Science (SPSS) versión 21. El nivel de significación estadística se fijó en un valor $p < 0,05$. Basándose en los resultados del análisis de datos, se puede concluir que: (1) Existe una relación significativa entre el tipo de liderazgo del entrenador y la fortaleza mental en los deportistas de bádminon (valor t 4,453, valor p 0,000<0,05). (2) Existe una relación significativa entre la relación entrenador-atleta y la fortaleza mental de los atletas de bádminon, (t-valor 2,373, p-valor 0,020 <0,05). (3) Existe una relación significativa entre el tipo de liderazgo del entrenador y la relación entrenador-atleta sobre la fortaleza mental de los deportistas de bádminon, (valor F 40,791, valor p 0,00 <0,05) y una contribución del 52,50%. Se recomienda a los entrenadores que sean capaces de proporcionar entusiasmo y ánimo a los deportistas para que sigan luchando y no se rindan nunca al afrontar cada partido que se les presente, con el fin de conseguir los máximos logros y resultados. Desarrollar el liderazgo como entrenador y desarrollar habilidades de interacción en la construcción de relaciones con los atletas.

Palabras clave: Tipo de liderazgo del entrenador, relación entrenador-deportista, fortaleza mental

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Introduction

Badminton is not only a globally popular sport, but it is also the focus of increasing research in the fields of sport and exercise science (Cabello-Manrique, Lorente, Padial-Ruz, & Puga-González, 2022). Factors that affect the performance of badminton athletes can be divided into several aspects, including physical, technical, tactical, and psychological (Maksum & Indahwati, 2023; Yen, Hooi, & Wah, 2023). One aspect of coaching and developing badminton sporting achievements that cannot be ignored is the existence of psychological factors (Lorca, Baños, Calvo, Romo, & Lorca, 2023). Sport psychology ap-

proaches assist in optimizing athletes' potential by focusing on the mental and emotional aspects of athlete preparation, in addition to intensive physical training (Siekąńska, Bondár, di Fronso, Blecharz, & Bertollo, 2021). Therefore, the sports psychology approach focuses on enhancing athletes' mental resilience and emotional intelligence, with the ultimate goal of improving their physical and mental wellbeing and, consequently, their performance (Akbar et al., 2024; Wandik et al., 2024).

Mental toughness is a collection of values, attitudes, behaviours, and emotions that allow a person to survive and face various obstacles, obstacles, or pressures experienced. However, it still maintains one's

concentration, motivation, and consistency in achieving goals (Gucciardi, 2017). As one of the crucial aspects in supporting athlete performance, mental toughness is developed through structured preparation not through the frequency of competition (Liew, Kuan, Chin, & Hashim, 2019b). The coach in developing the mental toughness of athletes, has a fairly central role (Powell & Myers, 2017). Therefore, the role of the coach is very necessary for the development of talent and mental toughness of athletes because whether or not the results achieved depend on the role of the coach. Gu & Xue (2022) stated that it is necessary to conduct future research that could focus on the coach-athlete relationship in the formation of mental toughness

The coach-athlete relationship was defined as the situation in which the emotions, thoughts and behaviors of the coach and the athlete are mutually and causally interconnected (Vigário, Teixeira, & Mendes, 2020). A coach is required to be able to undergo his profession by not merely capitalising on himself as a former athlete, but must equip himself with a set of important supporting competencies (Gould, Nalepa, & Mignano, 2020). As a central figure in the development of mental toughness, the coach provides guidance, training and activities tailored to the athlete's condition (Soundara Pandian, Balaji Kumar, Kannan, Gurusamy, & Lakshmi, 2023). The coach leadership plays both technical and interpersonal roles in maximizing athletes' performances. As regards technical aspect, the coach has in charge the training and game strategies for the athlete or the team. Concerning the interpersonal role, he has to face motivation, support, strengths, weaknesses, personality of athletes (Fletcher & Roberts, 2013).

Coaches provide athletes with a platform for growth, and encourage them to take on challenges and develop new skills (Light & Harvey, 2017). Insecure coach-athlete attachment may hinder athletes from receiving support from coaches (Peng, Zhang, Zhao, Fang, & Shao, 2020). For example, attachment avoidance may result in decreased likelihood of athletes obtaining social support from coaches, and attachment anxiety may result in decreased subjective perceptions and satisfaction with athletes' support from coaches (Barnum & Perrone-McGovern, 2017). The results of Mandan et al. (2024) that there is no significant effect of the coach-athlete intimacy relationship on achievement performance with p -values of $0.532 > 0.05$.

Another factor that can influence the development of athletes' mental toughness is the relationship between athletes and coaches (Toros et al., 2023). Coach leadership behaviour is a form of leadership behaviour displayed by the coach that consistently appears on and off the field. In sport, leadership research focuses on the coach-athlete relationship (Jowett, 2017). This is based on the idea that a coach in carrying out their duties is required to build positive communication with athletes. The coach-athlete relationship in the training process contributes positively to the successful development of the athlete's potential,

otherwise if ignored it will hinder the success of potential development (Lisinskiene, 2018). The coach-athlete relationship is 'a situation in which the cognitions, feelings and behaviours of coaches and athletes are interrelated and causally interconnected' (Wekesser, Harris, Langdon, & Wilson Jr, 2021). The motivational importance of studying coach-athlete interpersonal dynamics lies in its practical application, providing opportunities for coaches to become more effective when managing their interpersonal exchanges (Jowett & Carpenter, 2015). The coach-athlete relationship is built over time, with prolonged engagement beneficial to a positive relationship (Roux, Martinent, & Trouilloud, 2023). Success in the coach-athlete relationship can be achieved when they work together to achieve a single goal, the 'common goal', which the athletes in this study valued highly in the process of setting common goals (Lisinskiene, May, & Lochbaum, 2019).

In the social life of athletes, the relationship with the coach is an important interpersonal structure, which requires two-way interaction (Fan, Chen, Guo, Ding, & Shi, 2023). On the other hand, attachment to the coach is very important (Kim & Park, 2020). When exploring the relationship between cohesion and athlete engagement, emphasized that coaches, as leaders, are responsible for implementing strategies to improve the team environment (Gu & Xue, 2022). As the most influential figure in a team, the coach's influence on athletes is directly related to their performance and career development (Davis, Jowett, & Tafvelin, 2019; Murray, Dugdale, Habeeb, & Arthur, 2021). These influences mainly include leadership behavior (González-García, Martinent, & Nicolas, 2022; Lopez de Subijana, Martin, Ramos, & Cote, 2021), leadership style (Jin, Kim, & Love, 2022; Keattholetswe & Maletse, 2019), and coach-athlete relationship (Choi, Jeong, & Kim, 2020).

The coach-athlete relationship was defined as the situation in which the emotions, thoughts and behaviors of the coach and the athlete are mutually and causally interconnected (Vigário et al., 2020). Weinberg, Freysinger, and Mellano (2018) explains that to form a comfortable and trusting relationship between coach and athlete is a difficult task. This is because the attitudes, feelings and motivations involved are difficult to control, for example in women's football there is an attraction to coaches of a different gender. The coach-athlete relationship is a situation where coaches and athletes develop interrelated feelings, thoughts and behaviours. There are three dimensions of the coach-athlete relationship, namely, emotional closeness, commitment, and complementary behaviour. The first dimension is emotional closeness, describing affective attachments between athletes and coaches such as mutual respect, trust, and appreciation. The second is commitment, describing the cognitive and long-term orientated attachment to each other. Finally, complementary behaviour, describing behavioural transactions between coach-athletes such as cooperative and contributive behaviours (Jowett, 2017). Previous research suggests sport coaches have the ability to signifi-

cantly influence athletes through their behaviour, communicative actions and the environment they create (Felton & Jowett, 2013). Positive coach-athlete relationships are recognised to increase participation, athlete satisfaction, self-esteem, and improved performance (Peng et al., 2020). Study Foulds et al. (2019) in favour of a dyadic relationship. Athletes preferred coaches who had a positive outlook and an athlete-centred mindset, with active listening and individualised goal setting considered key features in developing positive relationships. Significant correlations were found between two factors including coach-athlete attachment, perceived coach support, self-esteem, and subjective well-being. Subjective well-being is the subjective evaluation of happiness, and consists of life satisfaction, as well as the experience of positive and negative affect (Diener, Oishi, & Tay, 2018; Geng, 2018). On the other hand, attachment to the coach is very important (Kim & Park, 2020).

According to the Multidimensional Model of Leadership, leadership is seen within a relational interaction process, since it is proposed that the leader considers the situational characteristics, the leader's characteristics, and those of the members that make up the group. The team's performance and satisfaction are considered, the result of the leader working harmoniously in relation to these three aspects of leader behavior (required, actual, and preferred) (Caruzzo, Vissoci, Contreira, Caruzzo, & Fiorese, 2021). Still, knowing that mental toughness is, in part, adaptable and develops over time may suggest that coaches are influential in the process of developing this construct through interventions in the context in which the subjects are involved, such as the training environment (Gucciardi, Hanton, Gordon, Mallett, & Temby, 2015). It is pointed out that a positive coach-athlete relationship and constructive coach behavior can support athletes to strengthen their ability to overcome challenges (White & Bennie, 2015). This happens because this influence on the athletes can happen in a more powerful way, when effective bonds are created between the figures involved, since the coach can act as a safe haven and source of comfort, which promotes security in times of need (Davis & Jowett, 2010).

In particular the coach-athlete relationship, an important interpersonal relationship throughout an athlete's career, is an important source of social support for athletes (Woolliams, Spencer, Walters, & Krägeloh, 2021). It reflects the emotional, mental, and behavioral interactions between coaches and athletes. The coach's training, his leadership style and the way he plans the training process are very important and fundamental variables in the coach and sportsperson relationship, and can enhance or limit the continuity of sport participation of these two agents (Domingues et al., 2023). Therefore, to meet the real needs of their athletes, it is important for coaches to adjust their behaviors and strategies. In this context, leadership behaviors are critical to achieving excellence and success in sport. In general, research on this subject concludes that athletes' perceptions of coaches' leadership vary according

to their own individual characteristics, as well as the context in which they find themselves (Pires, Batista, Mesquita, & Ibáñez, 2022).

The above presentation is certainly interesting to study and research more deeply about the role of the coach's leadership type and the coach-athlete relationship on the mental toughness of badminton athletes. We hypothesize that:

H1: the coach's leadership type affects the mental toughness of badminton athletes

H2: the coach-athlete relationship affects the mental toughness of badminton athletes.

H3: the coach's leadership type and coach-athlete relationship affects the mental toughness of badminton athletes.

Materials and Methods

Sample

The subjects in the study were badminton athletes in clubs in Sleman Regency Yogyakarta. The sample criteria are at least having participated in regional / district level matches, the youth category is at least 13 years old, and is willing to be a sample by filling out a screening questionnaire to find out if it has a medical condition that might affect the research. Based on this, the subjects in the study totalled 73 athletes (male 43, female 30). The Research Ethics Committee of Yogyakarta State University approved this study, which was conducted based on the Declaration of Helsinki for human research.

Research Design

This research is quantitative with an correlational. Correlational is a research method that aims to determine the relationship and level of relationship between two or more variables. Correlational research is conducted without trying to influence the variables under study, so the resulting data is valid (Curtis, Comiskey, & Dempsey, 2016). This means that this study aims to statistically determine the effect of coach leadership type and coach-athlete relationship on the mental toughness of badminton athletes.

Instruments

The coach leadership type measuring instrument used by researchers refers to the Leadership Scale for Sports (LSS). The LSS is a 40-item questionnaire to evaluate the five dimensions of leadership behavior in a sporting context (i.e., training and instruction, democratic, autocratic, social support, and positive feedback). For the athlete preference version of the LSS, all items are prefixed with the phrase "I prefer my coach to..." Participants answer each item in terms of frequency on a 5-point Likert scale ranging from 1 to 5; the response options were quantified to increase certainty about the answers: 1 = never; always; 2 = seldom (about 25% of the time); 3 = occasionally (about 50% of the time); 4 =

often (i.e., about 75% of the time); and 5 = always. For the LSS, Cronbach's alpha can be used to estimate the internal consistency of the five leadership dimensions. Moreover, Cronbach's alpha has been used in numerous studies (see e.g. Kao, Chen, Watson, & Halbrook, 2015; Sari & Bayazit, 2017) to determine the reliability of the LSS. In the present study, the Cronbach's alpha values for the five subscales of the LSS were acceptable at 0.970 (training and guidance), 0.889 (autocratic style), 0.939 (democratic style), 0.943 (social support) and 0.905 (positive feedback). This questionnaire allowed participants to rate their perceptions of the relationship on a Likert-type scale, ranging from 1 (Strongly Disagree) to 7 (Strongly Agree).

The Coach–Athlete Relationship Questionnaire (CART-Q) was adopted to assess athletes' perceptions of the athlete–coach relationship (Fouraki, Stavrou, Apostolidis, & Psychountaki, 2020). CART-Q has 11 question items from three dimensions: (i) athletes' closeness (4 items), athletes' commitment (3 items) and athletes' complementarity (4 items) (Gu et al., 2023). This questionnaire used a 7 point Likert scale. The CART-Q used in this research is in the Indonesian version, validity 0.982 and reliability Cronbach's alpha 0.99 (Cahyono et al., 2023).

The instrument that was adapted and validated was The Mental Toughness Index (MTI). MTI has seven dimensions, namely self-belief (I believe in my ability to achieve my goals), attention regulation (I can regulate my focus when performing tasks), emotion regulation (I can use my emotions to perform the way I want to), success mindset (I strive for continued success), context knowledge (I execute my knowledge of what is required to achieve my goals), buoyancy (e.g., I consistently overcome adversity), and optimism (I can find a positive in most situations). These seven dimensions are translated into eight items with alternative answers in the form of a continuum ranging from 1 (False, 100% of the time) to 7 (True, 100% of the time). The original MTI has very good loading factor ($\lambda = 0.56 - 0.80$) and very high composite reliability ($\rho = 0.86$ to 0.89) (Putra, Kurdi, et al., 2024; Putra, Sutoro, et al., 2024).

After we created the instrument items, the next stage was an FGD (discussion group forum) with expert badminton lecturers, sports psychology lecturers, and several badminton coaches with national qualifications.

Statistical Analysis

The statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 21. The level of statistical significance was set at p -value < 0.05 .

Results

The results of descriptive analysis of the variables of coach leadership type, coach-athlete relationship, and

mental toughness in badminton athletes are presented in Table 1.

Table 1.

Descriptive statistics of coach leadership type, coach-athlete relationship, and mental toughness

Variable	N	Mean \pm SD
Coach leadership type	73	168.92 \pm 10.99
Coach-athlete relationship	73	58.77 \pm 3.99
Mental toughness	73	46.78 \pm 3.80

Based on Table 1, obtained data on coach leadership type (168.92 \pm 10.99), coach-athlete relationship (58.77 \pm 3.99), and mental toughness (46.78 \pm 3.80).

Normality Test

The normality test uses the Shapiro-Wilk test, namely by looking at the p -value is above 0.05, it can be said that the data is normally distributed. A summary of the normality test results is presented in Table 2.

Table 2.

Normality test analysis results

Variable	p-value	Description
Coach leadership type	0.484	Normal
Coach-athlete relationship	0.210	Normal
Mental toughness	0.307	Normal

Based on the results in Table 2, it shows that the data of coach leadership type (p -value 0.484 $>$ 0.05), coach-athlete relationship (p -value 0.210 $>$ 0.05), and mental toughness (p -value 0.307 $>$ 0.05), which means the data is normally distributed.

Linearity Test

Linearity testing is done through the F test. The relationship between the independent variable and the dependent variable is declared linear if the p -value $>$ 0.05. The results of the linearity test can be seen in Table 3.

Table 3.

Linearity test analysis results

Variable	p-value	Description
Coach leadership type to Mental toughness	0.186	Linear
Coach-athlete relationship to Mental toughness	0.093	Linear

Based on the results in Table 3 shows that the data of coach leadership type on mental toughness (p -value 0.186 $>$ 0.05), coach-athlete relationship on mental toughness (p -value 0.093 $>$ 0.05). So, it can be concluded that the relationship between the independent variable and the dependent variable is linear.

Multicollinearity Test

The multicollinearity test aims to determine whether there is a correlation between the independent variables in the regression model. To determine the presence or absence of multicollinearity symptoms, it can be seen from the amount of tolerance and VIF values. The cut off value that is commonly used to indicate the presence of multicollinearity is a tolerance value $>$ 0.10 or the same as the VIF value $<$ 10. The results of the multicollinearity calculation can be presented as in Table 4.

Table 4.

Multicollinearity test analysis results

Variable	Tolerance	VIF
Coach leadership	0.496	2.016
Coach-athlete relationship	0.496	2.016

Based on Table 4, it can be seen that the tolerance and VIF of the Coach leadership variable are 0.496 and 2.016, the Coach-athlete relationship Intelligence variable is 0.496 and 2.016. The above results can be concluded that the regression model equation does not contain multicollinearity problems, which means that there is no correlation between the independent variables, so it is suitable for further analysis because the tolerance value is above 0.10 and the VIF value is below 10.

Hypothesis Test Results

Testing the hypothesis of the relationship between coach leadership type and coach-athlete relationship on mental toughness is done with t test analysis (partial) and F test (simultaneous), the results are as follows:

Table 5.

Partial test analysis results (t test)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
	(Constant)	1.462	5.040		
1 Coach leadership type	.178	.040	.514	4.453	.000
Coach-athlete relationship	.261	.110	.274	2.373	.020

Based on the analysis results in Table 5, it can be explained as follows:

The coach's leadership type variable obtained a t-value of 4.453 and a p-value of $0.000 < 0.05$, meaning that the coach's leadership type has a positive and significant effect on mental toughness in badminton athletes. It can be concluded that the coach's leadership type affects the mental toughness of badminton athletes, the better the coach's leadership type perceived by athletes, the higher the mental toughness.

The coach-athlete relationship variable obtained a t-value of 2.373 and a p-value of $0.020 < 0.05$, meaning that the coach-athlete relationship has a positive and significant effect on mental toughness in badminton athletes. It can be concluded that the coach-athlete relationship affects the mental toughness of badminton athletes, the better the coach-athlete relationship, the higher the mental toughness.

The F test is needed to determine the effect of the independent variables on the dependent variable simultaneously and to determine the accuracy of the regression model used. The model accuracy test aims to determine whether the model formulation is appropriate or fit. Based on the analysis results in Table 6.

Based on Table 6, the calculated F-value is 40.791 and the p-value is $0.000 < 0.05$. It can be concluded that the regression model chosen is feasible to test the data and the regression model can be used to predict that the coach's

leadership type and coach-athlete relationship together affect the mental toughness of badminton athletes.

The Coefficient of Determination is essentially used to measure how far the ability of the regression model to explain the variation in the dependent variable. The results of the Coefficient of Determination analysis in Table 7.

Table 6.

F test analysis results (Simultan)

Model	Sum of Squares	df	ANOVA ^b		
			Mean Square	F	Sig.
1 Regression	560.000	2	280.000	40.791	.000 ^a
Residual	480.493	70	6.864		
Total	1040.493	72			

Table 7.

Coefficient of determination

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.734 ^a	.538	.525	2.61996

Based Table 7 shows that Adjusted R Square value of 0.525, which means that the coach's leadership type and coach-athlete relationship together have an influence of 52.50% on mental toughness, the remaining 47.50% is influenced by other factors.

Discussion

Relationship between Coach's Leadership Type and Mental Toughness

Based on the results of the study, it shows that there is a significant relationship between the coach's leadership type and mental toughness in badminton athletes. The correlation coefficient is positive, meaning that if the coach's leadership type is getting better, the mental toughness of badminton athletes will be better. The results of the study are supported by previous research conducted by Diener, Oishi, and Tay (2018) which found that there is a significant relationship between the coach's leadership type and mental toughness in football players. A significant correlation was found between two factors including coach-athlete attachment, perceived coach support, self-esteem, and subjective well-being. Subjective well-being is the subjective evaluation of happiness, and consists of life satisfaction, as well as the experience of positive and negative affect.

In the social life of athletes, the relationship with the coach is an important interpersonal structure, which requires two-way interactions (Fan et al., 2023). On the other side, attachment to the coach is very important (Kim & Park, 2020). Coaches provide athletes with a platform for growth, and encourage them to take on challenges and develop new skills. Insecure coach-athlete attachment may hinder athletes from receiving support from coaches. For example, attachment avoidance may result in decreased likelihood of athletes obtaining coach leadership type from coaches, and attachment anxiety may result in decreased subjective perceptions and satisfaction with athletes' support from coaches (Barnum & Perrone-McGovern, 2017). In a study focusing on National Collegiate Athletics

Association (NCAA) athletes, for example, coaches were reported as having the most influence in developing their mental toughness (Butt, Weinberg, & Culp, 2010). These strategies included creating a tough physical practice environment (e.g., intense competitive practices, tough physical conditioning), a positive mental environment (e.g., confidence building/positive atmosphere, high expectations), and providing awareness/learning opportunities (e.g., observing others being mentally tough). Similarly, in a study involving athletes' mental toughness development across career stages (Connaughton, Wadey, Hanton, & Jones, 2008), coaches were mentioned as being important in the development of mental toughness, specifically referring multiple times to the coaches' leadership styles. In essence, coaches were seen as directly (mentoring, planned teaching) or indirectly (fostering/nurturing/instilling important skills) teaching mental skills. To help create this positive climate, coaches should consider providing reinforcement and feedback, which emphasizes a positive approach to the learning and performance of skills and competition (e.g., provide encouragement, give positive and instructional feedback, set-up practices that are fun and enjoyable, consider individual differences) (Weinberg, 2013).

Leadership is a behavioural process of influencing individuals and groups to achieve predetermined goals. Nugroho et al. (2023) explains that there are five leadership styles of a coach, namely (a) Builder, the coach develops something from nothing in the early stages of club development; (b) Revitalizer, the coach restores lost energy when the club loses momentum; (c) Accelerator, the coach continues and adds momentum to the process of change started by others; (d) Turn-arounder, the coach is involved in a major change in some parts of the club that have suffered setbacks; and (e) Inheritor, the coach inherits success at a club and tries to continue that success in his own style.

As a central figure in the development of mental toughness, the coach provides guidance, training and activities that are tailored to the athlete's condition (Anthony, Gordon, Gucciardi, & Dawson, 2018). Each programme prepared by the coach is expected to provide positive changes to the character, attitude and thinking of athletes (Lisinskiene et al., 2019). A coach needs to be aware of the leadership aspect to be able to direct athletes to achieve goals. A coach's leadership is a behavioural process that influences athletes to have optimal performance (Lopez de Subijana et al., 2021).

Coach-Athlete Relationship on Mental Toughness

Based on the results showed that there is a significant relationship between the coach-athlete relationship on mental toughness in badminton athletes. The correlation coefficient is positive, meaning that if the coach-athlete relationship is getting better, then mental toughness in badminton athletes will get better. A high-quality coach-athlete relationship indicates that coaches and athletes

maintain an efficient interactive mode, in which athletes receive sufficient knowledge, guidance, and coach leadership type, emotional, and information from their coaches. These factors significantly enhance athletes' sense of security, belonging, and encouragement, thereby helping them participate in training and competition with enthusiasm and vitality (Guo, Yang, and Wu 2022).

The results of the study are supported by previous research conducted by Peng et al. (2020) which found that there is a significant relationship between the coach-athlete relationship and mental toughness in football players. Positive coach-athlete relationships are recognised to increase participation, athlete satisfaction, self-esteem, and improved performance. Study Foulds et al. (2019) in favour of a dyadic relationship. Athletes preferred coaches who had a positive outlook and an athlete-centred mindset, with active listening and individualised goal setting considered key features in developing positive relationships.

When exploring the relationship between cohesion and athlete engagement (Song & Li, 2023) emphasises that the coach, as a leader, is responsible for implementing strategies to improve the team environment. As the most influential figure on a team, the coach's influence on athletes is directly related to their performance and career development (Murray et al. 2021). These influences mainly include leadership behaviour (González-García et al., 2022), leadership style (Jin et al., 2022; Keatthoetswe & Malette, 2019), and coach-athlete relationships (Choi et al., 2020). In particular, the coach-athlete relationship, an important interpersonal relationship throughout an athlete's career, is an important source of coach leadership type for athletes (Woolliams et al., 2021). It reflects the emotional, mental and behavioural interactions between coaches and athletes (Nicholls, Morley, & Perry, 2016).

As the direct leader of the sports team, the coach's behaviour is a major external factor that motivates athletes to actively participate in training and competition and improve their competitive ability (Lopez de Subijana et al., 2021). In addition, coaches are an important source of coach leadership type, emotional, and information for athletes, and their influence on athlete engagement cannot be ignored. The coach-athlete relationship is a two-way interactive process (Gu et al., 2023). The quality of interactions between coaches and athletes adjusts their perceptions of the costs and benefits of the relationship. Athlete engagement includes cognitive and emotional components. Of these components, athlete engagement will certainly be influenced by the quality of the coach-athlete relationship (Gu et al., 2023).

A coach will always interact with his athletes in training or competition. The interaction that takes place is part of the coach's efforts in carrying out the task (Kegelaers & Wylleman, 2019) explaining the coach's tasks that include technical, tactical and strategic preparation, as well as the tasks of organising, evaluating and directing athletes will depend heavily on the coach-

athlete relationship defines the coach-athlete relationship as a situation of interconnected emotions, thoughts and behaviours between coaches and athletes. When coaches and athletes are in harmony, it leads to great achievements for the team (Wachsmuth, Jowett, & Harwood, 2018).

The coach-athlete relationship is not always successful and effective. The negative approach taken when coaching also affects the development of the coach-athlete relationship. The negative approach in the form of hard, rule-filled and militaristic training is the coach's attempt to achieve personal ambitions through the athletes he/she trains without considering the condition of injury, fatigue or depression that athletes may experience. The negative approach taken by the coach is negative coaching behaviour. Negative coaching behaviour is a form of neglect and betrayal of the trust that is part of the coach-athlete relationship. Neglect of the coach-athlete relationship can affect circumstances outside of sport (Jowett, 2017).

The Relationship of Coach Leadership Type and Coach-Athlete Relationship to Mental Toughness

Based on the results of the study, it shows that there is a significant relationship between the coach's leadership type and the coach-athlete relationship on the mental toughness of badminton athletes with a contribution of 52.50%. Mental toughness is a psychological factor that athletes must have to be able to give a good performance so that they can win a match (Weinberg et al., 2018). Reactions that arise over a variety of stressful situations tend to be positive such as having a higher level of motivation due to the increasing tension of the match, remaining able to focus even though behind points during the match still trying to do the best results. Mental toughness is a collection of values, attitudes, behaviours and emotions that make athletes able to survive and go through various obstacles, difficulties, or pressures experienced (Liew, Kuan, Chin, & Hashim, 2019a). Athletes are also able to maintain concentration and motivation during normal situations. As one of the crucial aspects in supporting athlete performance, mental toughness is developed through structured preparation not through the frequency of competition (Liew et al., 2019a). Coach leadership behaviour is a form of leadership behaviour displayed by the coach that consistently appears on and off the field. In sport, leadership research focuses on the coach-athlete relationship (Jowett, 2017).

Conclusions

Based on the results of data analysis, description, testing of research results, and discussion, it can be concluded that: (1) There is a significant relationship between the coach's leadership type and mental toughness in badminton athletes (t-value 4.453, p-value $0.000 < 0.05$). (2) There is a significant relationship between coach-athlete relationship on mental toughness in

badminton athletes, (t-value 2.373, p-value $0.020 < 0.05$). (3) There is a significant relationship between the coach's leadership type and the coach-athlete relationship on the mental toughness of badminton athletes, (F-value 40.791, p-value $0.00 < 0.05$) and a contribution of 52.50%. Coach leadership behavior should be used in every practice and match to form high athlete mental toughness. Coach-athlete interaction must be well established in every practice and match in order to form good communication on the field and off the field. Thus, the psychological skills of athletes and the role that coaches may play in developing and nurturing these skills at various stages of development may be an important avenue for future research. Finally, empirical intervention research is warranted to investigate the effectiveness of mental toughness interventions.

Our findings contribute to coaches, sport psychologists, and other professionals involved with the sport of badminton regarding their understanding of the importance of social relationships to motivate and provide mental toughness to young athletes; in addition, it is important to promote closeness, mutual commitment with training and instruction. It is important for coaches to include psychological aspects and social relationships in their training and competition atmosphere to overcome mere technical and tactical aspects. In this sense, it is important for athletes to feel motivated to persist in their sport so that they also feel close to their coach in an affective relationship involving respect and trust. Coaches need to understand the characteristics of athletes through communication to determine the athlete's mental health (Deborah, Larissa, & Fabrício, 2023).

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Conflict of interest

We are not aware of any conflict of interest related to this publication. Also no financial aspects were included in this study which might have affected the results. On behalf of the corresponding author I approve the manuscript for reading and submission by all named authors.

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