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Predicting Badminton Performance Using Binomial Logistic Regression Based on Psychological Factors: Goal Setting, Relaxation, and Imagery

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ABSTRACT

Background: *Psychological skills are increasingly recognized as essential contributors to athletic performance, particularly in sports such as badminton that require rapid decision-making, technical precision, and emotional control. This study aimed to examine whether goal setting, imagery, and relaxation could predict badminton performance among young badminton players.* ***Methods:*** *An ex post facto research design was employed. A total of 50 young male and female badminton players (mean age = 13.08 ± 1.29 years; playing experience = 5.04 ± 1.65 years) participated in the study. Psychological factors were assessed using the Test of Performance Strategies (TOPS) questionnaire, while badminton performance levels were classified into high- and low-performance groups using* ***Hierarchical Agglomerative Cluster Analysis (HACA) based on technical performance indicators.*** *Descriptive statistics were used to summarize the data, followed by binomial logistic regression analysis to determine the predictive contribution of psychological factors to badminton performance classification.* ***Results:*** *The logistic regression model was statistically significant, indicating that the selected psychological factors collectively contributed to the prediction of badminton performance. Among the predictors, imagery emerged as the strongest and only significant predictor of performance classification, whereas goal setting and relaxation did not demonstrate significant independent effects. These findings suggest that athletes with stronger imagery skills were more likely to be classified in the high-performance group.* ***Conclusion:*** *The findings suggest that imagery is a key psychological predictor of badminton performance among young athletes. Integrating imagery training into coaching programs may enhance competitive performance, while binomial logistic regression offers an effective approach for identifying psychological predictors. Future studies should include larger samples and additional performance-related variables to improve predictive accuracy.*

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Introduction

Badminton is one of the fastest racket sports in the world, requiring players to perform repeated high-intensity movements, rapid changes in direction, explosive power, tactical decision-making, and sustained psychological control throughout competition. Unlike many sports where physical attributes dominate performance outcomes, badminton success depends on the interaction of physiological, technical, tactical, and psychological factors (Phomsoupha, M., & Laffaye, 2015;Lees, 2003). During competition, athletes are frequently exposed to pressure situations that demand concentration, confidence, emotional regulation, and effective mental preparation. Consequently, psychological skills have become increasingly recognized as essential determinants of athletic success, particularly in sports characterized by rapid decision-making and precision, such as badminton.

In competitive sports, psychological factors are widely recognized as critical variables associated with athletes' performance and developmental trajectories (Reinebo et al., 2024;Tossici et al., 2024). Among these factors, character traits relatively stable yet moderately malleable components of psychological functioning have attracted increasing attention in recent years for their role in predicting athletic performance (Lochbaum et al., 2022). Although previous research has examined the potential predictive value of character traits for athletes' competitive levels (Garrido-Muñoz et al., 2024). the underlying mechanisms and modeling pathways remain insufficiently explored (Shuai et al., 2023;Allen & Laborde, 2014). Therefore, identifying key character variables and developing theoretically grounded, mechanism-based models for predicting athletes' competitive levels has become an urgent task in sport psychology (Wang et al., 2025).

Sports psychology emphasizes that athletes with superior mental skills are more likely to maintain consistent performance under competitive pressure. Psychological skills training (PST) has therefore become an integral component of elite athlete development programs worldwide. Among the various psychological strategies, goal setting, relaxation, and imagery have consistently demonstrated positive effects on athletic performance by improving motivation, concentration, emotional control, and confidence (Weinberg & Gould, 2019). These psychological constructs not only influence athletes' preparation before competition but also determine their ability to respond effectively during critical moments of play. According to trait activation theory, the behavioral expression of a trait depends on the activation of relevant situational cues (Tett et al., 2021). In badminton, high-pressure, fast-paced, and dynamic competitive environments provide precisely these cues for activating resilience, flexibility, and emotionality. Meanwhile, self-regulation theory emphasizes that athletes striving toward long-term competitive goals must regulate emotions, sustain motivation, and monitor behaviors to maintain performance consistency and psychological equilibrium (Tamminen et al., 2024). Athletes with high resilience are more likely to sustain training engagement and stable performance following injury or defeat; those with high emotional stability are better able to maintain composure during critical points; and those with high flexibility can rapidly adjust tactical responses to opponents' changing strategies (Fletcher & Sarkar, 2012).

Method

Study design and ethical statement

This study employed an ex post facto research design to investigate the predictive relationship between psychological factors (goal setting, relaxation, and imagery) and badminton performance using binomial logistic regression. Prior to participation, all athletes were informed about the purpose of the study, the data collection procedures, potential risks, expected benefits, and their right to withdraw from the study at any time without penalty. Written informed consent was obtained from all participants aged 18 years and above. For participants younger than 18 years, written informed consent was obtained from their parents or legal guardians, and assent was obtained from the participants themselves before data collection commenced. A total of 50 young male and female badminton players were recruited with the (mean ± SD age: 13.08±1.29 years, experience: 5.04±1.65years). The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki for research involving human participants. Ethical approval for the study was obtained from the Universiti Sultan Zainal Abidin Human Research Ethics Committee (UHREC**)**, Malaysia (Approval No.: UniSZA.800-1/1/4 Jld.4 (10). All participant information was treated with strict confidentiality, and the collected data were anonymized and used solely for research purposes.

Assessments of performance

The players' performances were assessed based on key technical indicators, including clear shot, drop shot, drive shot, net shot, service, smash, and backhand drive. These actions were systematically recorded and coded as either successful (winner) or unsuccessful (loser) outcomes. Data were collected using the Statmine mobile application, which was installed on a mobile phone and utilized as a performance analysis tool. The recorded information was analyzed by the designated controller before being shared with the coach during the half-time interval of each match. Performance data were collected over two consecutive days of competition to ensure reliability and comprehensive evaluation.

Instruments

The questionnaire used for data collection was the Test of Performance Strategies (TOPS) developed by (Thomas et al., 1999). This instrument is designed to measure psychological performance strategies during training and after competition. It assesses key psychological skills such as goal setting, relaxation and imagery. Responses are recorded using a five-point Likert scale ranging from 1 (Never) to 5 (Always), with higher scores indicating more frequent use of the respective psychological strategy.

Data analysis procedure

Descriptive statistics (mean ± standard deviation) were first computed for the players' psychological and performance factors to provide an overview of the dataset and identify potential outliers or distributional patterns. Subsequently, a cluster analysis was performed to group players based on shared characteristics. Inferential analyses included binomial logistic regression, which was used to examine the association between cluster membership and relevant predictor variables. All collected data were analyzed using Jamovi Statistical Software version

2.4 for Windows. Detailed procedures for each analytical step are presented in the subsequent sub-sections.

Clustering

K-means clustering is an unsupervised learning algorithm employed to partition datasets into k-distinct clusters. It begins by selecting *k* centroids or centres for these clusters and proceeds by iteratively assigning each data point to the closest centroid (Eswaramoorthi et al., 2018; Taha et al., 2009). The centroid is then updated to represent the average of the points assigned to it, and this process continues until the centroid no longer undergoes significant movement. The primary objective is to minimise the total distance between the data points and assigned centroids. In the context of this study, k-means clustering was utilized to segment a set of data into subgroups, creating *k* non overlapping clusters, with each data point associated with a single cluster. The primary aim is to enhance the similarity of the data points within each cluster while preserving the distinctions between data points belonging to different clusters. This clustering method relies on the Euclidean distance metric to determine the formation of clusters.

Binomial logistics Regression Model Development

A binomial logistic regression (BLR) model was developed to examine the association between psychological factors and badminton performance and to classify players into two performance groups, namely High Performance (HP) and Low Performance (LP). The dependent variable was binary, with performance group coded as high performance and low performance. Binomial logistic regression was selected because it is an appropriate statistical technique for modeling a dichotomous outcome and estimating the probability of group membership based on multiple predictor variables. The predictor variables included goal setting, imagery, relaxation, and self-talk. Before model estimation, all continuous predictor variables were standardized using z-score normalization, whereby each variable was transformed to have a mean of zero and a standard deviation of one. Standardization was performed to ensure that variables measured on different scales contributed equally to the model and to improve the stability and interpretability of the regression coefficients. The overall fit of the binomial logistic regression model was assessed using the likelihood ratio chi-square test, deviance, Akaike Information Criterion (AIC), and McFadden's pseudo-R^2 (R^2McF). The statistical significance of individual predictors was evaluated using the Wald Z statistic, with corresponding regression coefficients (β), standard errors (SE), and p-values. Statistical significance was established at $p < 0.05$. All statistical analyses were conducted using Jamovi (Version 2.6). The binomial logistic regression model was used to identify the psychological factors that significantly predicted badminton performance and to estimate the likelihood of players belonging to the high- or low-performance group.

Model Evaluation

The performance of the binomial logistic regression (BLR) model was evaluated using several established model fit statistics. The overall significance of the model was assessed using the likelihood ratio chi-square (χ^2) test, which compares the fitted model with the null model containing only the intercept. A statistically significant chi-square value indicates that the inclusion of the predictor variables significantly improves the model's ability to distinguish between high- and low-performance badminton players (Hosmer, Jr., Lemeshow, et al., 2013).

Model fit was further evaluated using the deviance (-2 log-likelihood) and the Akaike Information Criterion (AIC). Lower values of deviance and AIC indicate a better balance between model fit and model complexity, making these statistics useful for assessing the adequacy of competing logistic regression models (Akaike, 1974; Burnham & Anderson, 2002). The explanatory power of the model was assessed using McFadden's pseudo coefficient of determination (McFadden's R^2), which provides an indication of the proportion of variation in the outcome explained by the predictor variables. Although pseudo-R^2 values are generally lower than the R^2 values obtained in linear regression, values between 0.20 and 0.40 are typically considered indicative of excellent model fit (McFadden, 1974). The statistical significance of each predictor variable was evaluated using the Wald Z statistic, together with the corresponding regression coefficient (β), standard error (SE), and p-value. Predictor variables with $p < 0.05$ were considered statistically significant contributors to badminton performance. Positive regression coefficients indicate increased odds of belonging to the reference outcome category, whereas negative coefficients indicate decreased odds after controlling for the remaining variables in the model (Hosmer & Lemeshow, et al., 2013).

Results

Table 1 summarizes the descriptive statistics of the psychological factors and badminton technical performance variables assessed in this study. The results indicate that the participants exhibited generally favorable levels of the psychological factors, namely goal setting, imagery, and relaxation, reflecting the regular application of these mental skills during training and competitive play. The relatively low dispersion observed among these variables suggests that the participants demonstrated a comparable level of psychological preparedness. Regarding badminton technical performance, the descriptive statistics reveal variation across the different skills evaluated, including the clear shot, drop shot, drive shot, net shot, service, smash, and backhand drive. These findings suggest that the participants' technical proficiency differed according to the specific skill assessed. Some technical skills displayed greater consistency among players, whereas others showed greater variability, indicating differences in skill execution and performance levels within the sample.

Table 1. Descriptive Statistics of Psychological Factors and Badminton Performance Variables

Variables	Mean	Standard Deviation
Goal Setting	3.13	0.534
Imagery	3.11	0.633
Relaxation	3.29	0.680
Clear Shot	6.22	2.51
Drop Shot	5.12	1.51
Drive Shot	5.16	1.27
Net Shot	5.58	2.05
Service	12.70	3.04
Smash	8.08	11.40
Backhand Drive	5.64	1.38

Table 2 presents the comparison of psychological factors between the high-performance and low-performance badminton players. The results indicate that the two performance groups exhibited different psychological profiles across the measured variables. High-performance players demonstrated relatively stronger imagery skills, suggesting a greater tendency to use mental visualization strategies during training and competition. In contrast, low-performance players showed comparatively higher levels of goal setting, relaxation, and self-talk. The observed differences between the two groups suggest that the utilization of psychological skills varies according to performance level. While high-performance players appeared to rely more on imagery, low-performance players reported relatively greater use of goal setting, relaxation, and self-talk strategies. These findings highlight those psychological characteristics differ between performance groups and may contribute to variations in badminton performance.

Table 2 group compression across measured variable

Performance group

Variables	High Performance (n =30)	Low Performance (n =20)
Goal Setting	3.08 ± 0.532	3.19 ± 0.557
Imagery	3.21 ± 0.698	2.97 ± 0.503
Relaxation	3.18 ± 0.700	3.45 ± 0.631
Self-Talk	2.98 ± 0.635	3.16 ± 0.527

Figure 1 presents the distribution of imagery scores for high- and low-performance badminton players. The high-performance group exhibited generally higher imagery scores than the low-performance group, indicating that better-performing players tended to have stronger imagery abilities. Although there was some overlap between the groups, the overall distribution shows that high-performance players consistently scored higher on imagery. These findings suggest that imagery is positively associated with badminton performance and may be an important psychological factor contributing to competitive success.

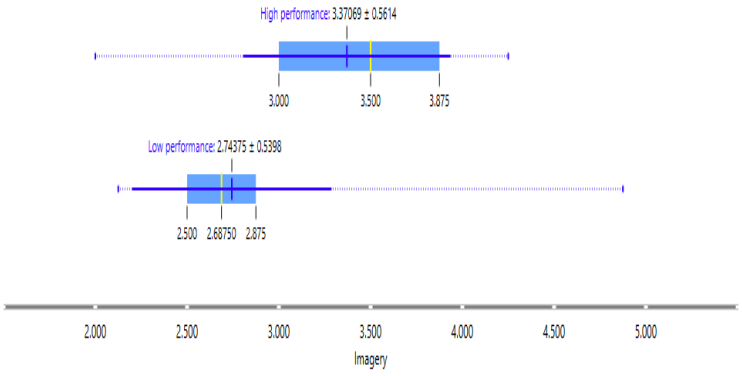


Figure 1. Comparison of Imagery Scores Between High- and Low-Performance Badminton Players

The logistic regression model demonstrated (table 3) a statistically significant overall fit to the data, $\chi^2(4) = 10.9$, $p = 0.028$, indicating that the set of psychological variables significantly improved the prediction of badminton performance compared with the null model. The model had a deviance of 54.6 and an Akaike Information Criterion (AIC) of 64.6, suggesting an acceptable balance between model fit and complexity. Furthermore, the McFadden's R^2 ($R^2McF = 0.166$) indicates that the model explained approximately 16.6% of the variation in players' performance classification. Although this represents a modest explanatory power, it suggests that the included psychological factors contribute meaningfully to distinguishing between high- and low-performance badminton players. The model was estimated using a sample of 50 participants.

Table 3. Binomial logistic regression analysis of psychological predictors of performance classification (High Performance = reference group)

				Overall Model Test		
Model	Deviance	AIC	R^2_{McF}	χ^2	df	p
1	54.6	64.6	0.166	10.9	4	0.028

Table 4 presents the logistic regression coefficients for the psychological factors predicting badminton performance. Among the four predictors, imagery was the only variable that significantly predicted performance ($\beta = -2.055$, SE = 0.761, $Z = -2.701$, $p = 0.007$). The negative regression coefficient indicates that higher imagery scores were associated with lower odds of being classified as a low-performance player, suggesting that athletes with stronger imagery skills were more likely to belong to the high-performance group.In contrast, goal setting ($\beta = 0.642$, $p = 0.448$), relaxation ($\beta = 1.213$, $p = 0.107$), and self-talk ($\beta = 0.595$, $p = 0.415$) were not statistically significant predictors of performance, as their p-values exceeded the 0.05 significance level. Although relaxation showed a positive coefficient, its effect did not reach statistical significance.

Table 4. Model Coefficients for performance classifications

Predictor	**Estimate**	**SE**	**Z**	**p**
Intercept	-1.955	2.306	-0.848	0.396
Goal setting	0.642	0.846	0.759	0.448
Imagery	-2.055	0.761	-2.701	0.007
Relaxation	1.213	0.752	1.614	0.107
Self-talk	0.595	0.730	0.814	0.415

Note. *p<0.05; SE=Standard Error; OR = Odd Ratio, LP =Low Performance; = HP = High Performance

Discussion

The present study examined the predictive role of psychological factors in badminton performance using a binomial logistic regression model. The findings suggest that psychological skills contribute differently to performance classification, indicating that mental characteristics are important components of competitive success in badminton. These results reinforce the

growing recognition that psychological preparedness complements technical and physical abilities in determining athletic performance.

Among the psychological variables, imagery emerged as the most influential predictor of badminton performance. This finding is consistent with previous research demonstrating that imagery enhances motor skill acquisition, decision-making, confidence, and tactical awareness by allowing athletes to mentally rehearse successful performance before and during competition (Guillot & Collet, 2008). In badminton, where players must react rapidly to changing game situations, imagery may facilitate anticipation, shot selection, and execution under pressure, thereby contributing to superior competitive performance.

Although goal setting and relaxation were included in the prediction model, their contributions were comparatively smaller. This may indicate that while these psychological skills remain important for maintaining motivation and emotional control, they may not independently distinguish between high- and low-performing badminton players within the present sample. Goal-setting strategies are generally associated with sustained motivation and self-regulated learning rather than immediate competitive outcomes (Zimmerman, 2008). Similarly, relaxation techniques primarily assist athletes in managing competitive anxiety and maintaining optimal arousal levels, but their effectiveness may depend on consistent psychological skills training and individual differences in coping strategies (Craft et al., 2003).

The findings also suggest that psychological skills should not be considered in isolation but rather as complementary components of an athlete's overall performance profile. Competitive badminton requires athletes to integrate technical proficiency, tactical decision-making, physical fitness, and psychological readiness simultaneously. Consequently, incorporating structured psychological skills training into regular coaching programs may enhance athletes' ability to perform consistently during competition. From a practical perspective, the predictive model developed in this study provides useful information for coaches and sport psychologists. Early identification of athletes with weaker psychological profiles may enable the implementation of targeted interventions focusing on imagery practice, goal-setting strategies, and emotional regulation. Such individualized mental skills training may improve competitive readiness and contribute to long-term athlete development. Despite these contributions, several limitations should be acknowledged. The relatively small sample size and cross-sectional nature of the study limit the generalizability of the findings and prevent causal inferences. In addition, only selected psychological factors were included in the prediction model, whereas other important variables such as self-confidence, resilience, motivation, attentional control, and competitive anxiety may also influence badminton performance. Future studies should employ larger and more diverse samples, adopt longitudinal research designs, and integrate psychological, physiological, technical, and biomechanical variables to develop more comprehensive predictive models of badminton performance.

Conclusion

The present study explored the extent to which selected psychological factors can predict badminton performance through the application of a binomial logistic regression model. The results indicate that psychological characteristics are associated with variations in players' performance levels, emphasizing that mental skills are an important component of athletic success in addition to technical proficiency and physical fitness. Among the variables examined,

imagery was identified as the most influential predictor of performance, suggesting that athletes who frequently engage in mental rehearsal are more likely to demonstrate superior competitive outcomes. Conversely, goal setting and relaxation exhibited comparatively lower predictive contributions within the proposed model. These findings highlight the importance of incorporating psychological evaluation into athlete development and performance monitoring programs. Coaches and sport psychologists are encouraged to integrate structured mental skills training, with particular emphasis on imagery techniques, into routine practice sessions. Strengthening athletes' psychological readiness alongside their physical and technical preparation may enhance confidence, concentration, decision-making, and consistency during competition. The use of binomial logistic regression also proved to be an effective and interpretable analytical approach for identifying psychological factors associated with badminton performance. The predictive model developed in this study may assist coaches and practitioners in recognizing athletes who could benefit from targeted psychological interventions, thereby supporting evidence-based talent development and coaching strategies. Several limitations should be considered when interpreting the findings. The relatively small sample and cross-sectional nature of the study may limit the wider applicability of the results. Future investigations should involve larger and more diverse participant groups, adopt longitudinal research designs, and incorporate additional psychological, physiological, technical, and tactical variables to improve the predictive accuracy and generalizability of performance models. Overall, the findings demonstrate that psychological skills, particularly imagery, have an important role in distinguishing badminton performance levels. Incorporating these mental skills into regular training programs may contribute to improved competitive performance and support a more comprehensive approach to athlete development. The present study also adds to the growing evidence supporting the use of predictive statistical models in sports science to better understand the factors associated with athletic performance.

Conflict interest

The authors have no conflict of interest to declare.

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References

1. Akaike, H. (1974). A new look at the statistical model identification. *IEEE Transactions on Automatic Control*, *19*(6), 716–723.https://doi.org/https://doi.org/10.1109/TAC.1974.1100705
2. Allen, M. S., & Laborde, S. (2014). The role of personality in sport and physical activity. *Curr. Dir. Psychol. Sci*, *23*, 460–465. https://doi.org/10.1177/0963721414550705
3. Burnham, K. P., Anderson, D. R. (2002). *Model selection and multimodel inference: A practical information-theoretic approach* ((2nd ed.)). Springer.
4. Craft, L. L., Magyar, T. M., Becker, B. J., & Feltz, D. L. (2003). The relationship between the Competitive State Anxiety Inventory-2 and sport performance: A meta-

analysis. *Journal of Sport and Exercise Psychology*, *25*(1), 44–65. https://doi.org/https://doi.org/10.1123/jsep.25.1.44

5. Eswaramoorthi V, A. M., RM, M., ABHM, M., NA, K., & NB, R. (2018). A multivariate analysis of cardiopulmonary parameters in archery performance. *Human Movement*, *19*, 35–41. https://doi.org/https://doi.org/10.5114/hm.2018.77322
6. Fletcher, D., & Sarkar, M. (2012). A grounded theory of psychological resilience in olympic champions. Psychol. *Sport Exerc*, *13*, 669–678. https://doi.org/10.1016/j. psychsport.2012.04.007
7. Garrido-Muñoz, M., Blanco-García, C., Diez-Vega, I., García-Merino, S., & Acebes-Sánchez, J., Rodríguez-Romo, G. (2024). Psychological resilience, athletic experience, and competitive level of judokas. A transversal study. *Psychol*, *15:1440412*. https://doi.org/10.3389/fpsyg.2024.1440412
8. Guillot, A., & Collet, C. (2008). Construction of the motor imagery integrative model in sport: A review and theoretical investigation of motor imagery use. *International Review of Sport and Exercise Psychology*, *1*(1), 31–44. https://doi.org/https://doi.org/10.1080/17509840701823139
9. Hosmer, D. W., Jr., Lemeshow, S., & Sturdivant, R. X. (2013). *Applied logistic regression (3rd ed.)*.
10. Hosmer, D. W., Jr.Lemeshow, S., & Sturdivant, R. X. (2013). *Applied logistic regression* ((3rd ed.)).
11. Lees, A. (2003). Science and the major racket sports: A review. *Journal of Sports Sciences*, *21*(9), 707–732.
12. Lochbaum, M., Stoner, E., Hefner, T., Cooper, S., Lane, A. M., & Terry, P. C. (2022). Sport psychology and performance meta-analyses: a systematic review of the literature. *PLoS One*, *17:e026340*. https://doi.org/10.1371/journal.pone.0263408
13. Phomsoupha, M., & Laffaye, G. (2015). The science of badminton: Game characteristics, anthropometry, physiology, visual fitness and biomechanics. *Sports Medicine*, *45*(4), 473–495. https://doi.org/https://doi.org/10.1007/s40279-014-0287-2
14. Reinebo, G., Alfonsson, S., Jansson-Fröjmark, M., Rozental, A., & Lundgren, T. (2024). Effects of psychological interventions to enhance athletic performance: a systematic review and meta-analysis. *Sports Med*, *54*, 347–373. https://doi.org/10.1007/ s40279-023-01931-z
15. Shuai, Y., Wang, S., Liu, X., Kueh, Y. C., & Kuan, G. (2023). The influence of the five-factor model of personality on performance in competitive sports: a review. *Front. Psychol*, *14:1284378*. https://doi.org/10.3389/fpsyg.2023.1284378
16. Taha, M, H., RM, M., MR, A., & Maliki A, A. N. (2009). Intelligent prediction of suitable physical characteristics toward archery performance using multivariate techniques. *J Glob Pharma Technol*, *6*(9), 44–52.
17. Tamminen, K., Wolf, S. A., Dunn, R., & Bissett, J. E. (2024). A review of the interpersonal experience, expression, and regulation of emotions in sport. *Int. Rev. Sport Exerc. Psychol*, *17*, 1132–1169. https://doi.org/10.1080/1750984X.2022.2132526
18. Tett, R. P., Toich, M. J., & Ozkum, S. B. (2021). Trait activation theory: a review of the literature and applications to five lines of personality dynamics research. *Annu. Rev. Organ. Psych. Organ. Behav*, 199–233. https://doi.org/10.1146/annurev-orgpsych-012420-062228

19. Thomas, P. R., Murphy, S. M., & Hardy, L. (1999). Test of Performance Strategies: Development and preliminary validation of a comprehensive measure of athletes' psychological skills. *Ournal of Sports Sciences*, *17*(9), 697–711. https://doi.org/https://doi.org/10.1080/026404199365560
20. Tossici, G., Zurloni, V., & Nitri, A. (2024). Stress and sport performance: a pnei multidisciplinary approach. *Front. Psychol*, *15:1358771*. https://doi.org/10.3389/fpsyg.2024.1358771
21. Wang, Z., Wang, J., Ma, J., Chen, T., Yang, H., & Liu, J. (2025). Psychological mechanism of character strengths and psychological stress affecting the athletic performance in swimmers. *Sci. Rep*, *15*, 26548. https://doi.org/10.1038/s41598-025-11936-5
22. Weinberg, R. S., & Gould, D. (2019). Foundations of sport and exercise psychology (7th ed.). *Human Kinetics*.
23. Zimmerman, B. J. (2008). Investigating self-regulation and motivation: Historical background, methodological developments, and future prospects. *American Educational Research Journal*, *45*(1), 166–183. https://doi.org/https://doi.org/10.3102/00028312073129