Original Article

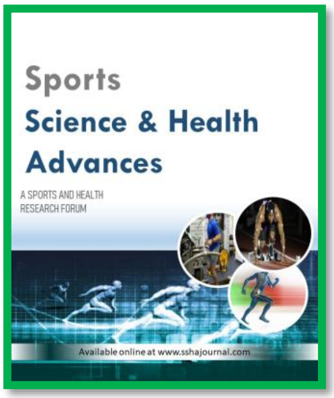
Psychophysiological States and Bowling Accuracy in University-Level Fast Bowlers

Rezwan Hossain[1*], **Halima Khatun**[2]

[1]Department of Physical Education and Sports Science, Jashore University of Science and Technology, Bangladesh

[2]International School, Capital Medical University, Beijing, China

*Correspondence: rejwanhossain0@gmail.com



Peer-Reviewed
Refereed
Indexed

How to cite: Hossain, R., Khatun, H. (2025). Psychophysiological States and Bowling Accuracy in University-Level Fast Bowlers. *Sports Science & Health Advances*. 3(2), 530-537. https://doi.org/10.60081/SSHA.3.2.2025.530-537

Received: 26-07-2025
Accepted: 05-09-2025
Published: 30-12-2025

Abstract

Purpose: The purpose of this study was to explore whether accuracy in bowling performance of university-level fast bowlers is associated with their psychophysiological states. The study aimed to investigate the relationship between heart rate variability (HRV), emotional states, and bowling accuracy. **Methods**: A repeated-measures design was applied to 80 male fast bowlers within the age range of 18 to 25 years. Each subject executed under four provoked emotional states, viz., Calm, Excited, Anxious, and Neutral, each of which was provoked using validated audiovisual stimuli. HRV measures were recorded with a Polar H10 chest strap sensor with a sampling frequency of 1000 Hz. Data analysis was performed with Kubios HRV Premium software (Version X.X). Root Mean Square of Successive Differences was calculated for a 5-minute baseline period before bowling trials. Bowling accuracy was quantified as the number of deliveries (out of 10) that struck a target region, and speed bowling was independently quantified with a Bushnell radar gun to support performance profiling. Emotional states were confirmed using Self-Assessment Manikin (SAM) valence, arousal, and dominance ratings. **Results**: HRV differed significantly with emotional states, the highest RMSSD (58.2 MS) being under the Calm state and the lowest (42.7 MS) under the Anxious state. Bowling accuracy was best under the Calm state (7.8 ± 1.2 hits/10) and worst under the Anxious state (5.9 ± 1.8 hits/10). Bonferroni post hoc tests showed pairwise differences to be significant. HRV showed moderate-to-strong positive correlation ($r = 0.62$, $p < 0.001$) with bowling accuracy. **Conclusions**: Psychophysiological relaxation, operationalized as increased parasympathetic activation, was associated with improved bowling accuracy. These findings highlight the potential of HRV-based profiling and emotional regulation training for enhanced cricket performance.

Keywords: Heart rate variability, Bowling accuracy, Emotional states, Cricket, Psychophysiology

Introduction

Cricket is a sport that is highly regarded and requires a combination of technical expertise, mental adaptability, and physical endurance. Players are required to sustain high ball velocity and accuracy under a variety of environmental and psychological conditions to be successful in fast bowling, one of the most demanding aspects of the sport of cricket (Portus et al., 2000; Webster et al., 2022). The ability to produce precise balls consistently has a significant impact on both the ability to take wickets and the ability to restrict the scoring of opponents.

The psychophysiological elements that impact performance in cricket, particularly emotional control and autonomic nervous system activity, have not been well investigated (Cooper et al., 2021). This is in contrast to the fact that physical characteristics, such as strength and skill, have been the subject of substantial research in the sport. Research conducted by Thayer et al. (2012) and Laborde et al. (2018) suggests a correlation between emotional regulation, cognitive function, and stress resistance. Heart rate variability (HRV) is an indication of the balance of the autonomic nervous system, especially the activity of the parasympathetic nervous system. HRV is gaining popularity in the field of sports science as a non-invasive biomarker that can be used to measure the preparedness and adaptability of athletes.

According to theoretical models, such as the Yerkes-Dodson Law, there is a relationship between arousal and performance that is shaped like an inverted U. This relationship suggests that moderate arousal is optimal for performance. In contrast, excessive or insufficient arousal is detrimental to performance (Calabrese, 2008). Additionally, the Individual Zones of Optimal Functioning (IZOF) concept suggests that athletes have individualized emotional zones in which they operate at their optimal level (Ruiz et al., 2017). The relevance of individualized tactics for regulating emotions and arousal is highlighted by these frameworks, which emphasize the need for optimal athletic performance.

In the context of university-level fast bowlers, the purpose of this research is to investigate the relationship between HRV, and the psychophysiological states induced by emotional manipulations and bowling accuracy. We hypothesize that a state of calm emotional state would be associated with increased heart rate variability (HRV) and better bowling accuracy compared to levels of anxiety or excitement.

Materials and Methods

Participants

Eighty male university-level fast bowlers (age: 21.3 ± 1.8 years; range: 18–25 years) were recruited from four Bangladeshi universities. Those recruited had competitive experience of at least two years, were free of injury at the time of testing, and provided written informed consent.

Ethical Issues

The experiment was conducted based on the Declaration of Helsinki ethical considerations. There was voluntarism, a secured do-no-harm principle through appropriate procurement of informed consent, and protection of their identity.

Procedure for Induction of Emotion

Each bowler conducted experiments in four affective states: Calm, Excited, Anxious, and Neutral. Affective states were induced with a combination of standardized audiovisual stimuli from the International Affective Picture System (IAPS) and validated music segments. Conditions were shown in random order across separate sessions to prevent carryover effects.

To guarantee emotional induction, the affective state of the participants was measured immediately after every session on the valence (pleasantry), arousal (activation), and dominance (control) scales using the Self-Assessment Manikin (SAM).

Measurement of Heart Rate Variability (HRV)

HRV was measured with a Polar H10 sternum-level chest strap sensor, sampling at 1000 Hz. Data were transferred over Bluetooth to a mobile phone and analyzed with Kubios HRV Premium software (Version X.X, Kubios Oy, Finland). Artifact correction was applied using the automatic medium filter setting. RMSSD (Root Mean Square of Successive Differences) was sampled as the principal vagally mediated HRV index. All recordings of HRV were performed for a continuous 5-minute seated baseline shortly before the bowling trials.

Bowling Accuracy and Speed Assessment

Accuracy and speed of bowling were measured in two dimensions:

Bowling Accuracy: Accuracy was taken as the number of deliveries (out of 10) which struck a standardized 0.5 × 0.5 m target placed at the top of off-stump, approximating a "good length" line.

Bowling Speed: Ancillary analysis of the speed of the ball was determined using a Bushnell Velocity Radar Gun (Bushnell Inc., USA) positioned behind the stumps at release level. Three deliveries of maximum effort were attempted, and the highest speed recorded was utilized as performance speed.

Testing Protocol

All testing was conducted in the outdoors on regulation turf pitches. Sessions commenced with a standard 10-minute dynamic warm-up and then shoulder activation drills. Every bowler was tested under all four emotional state conditions using distinct days, a minimum of 48 hours apart, to reduce the impact of fatigue.

Data Analysis

Data were checked for normality (Shapiro-Wilk test). Repeated-measures ANOVA analyzed HRV and bowling accuracy across emotional states. When the test of Mauchly showed violation of sphericity, the Greenhouse-Geisser correction was applied. Post hoc pairwise contrasts using Bonferroni correction were conducted to avoid Type I inflation because of multiple comparisons. Pearson's r correlation coefficient assessed correlations between RMSSD and bowling accuracy. Statistical significance was at $p < 0.05$. All analyses were done in IBM SPSS 28.

Results

Heart Rate Variability (RMSSD)

The RM-ANOVA showed a significant effect of emotional induction on HRV (RMSSD) ($F(3,237) = 24.56$, $p < 0.001$, $\eta^2 = 0.24$). Post hoc pairwise tests with Bonferroni correction indicated that RMSSD was highest during the Calm condition (58.2 ± 10.5 ms), significantly higher compared to the Anxious (42.7 ± 9.3 ms, $p < 0.001$) and the Excited (49.3 ± 8.8 ms, $p = 0.003$) conditions. The differences with the neutral condition (53.5 ± 9.7 ms) were non-significant for Calm ($p = 0.12$) and significant for Anxious ($p = 0.01$).

Table 1 Descriptive Statistics of HRV (RMSSD) and Affective States Across Conditions

Condition	RMSSD (ms)	Valence (Mean ± SD)	Arousal (Mean ± SD)	Dominance (Mean ± SD)
Calm	58.2 ± 10.5	7.8 ± 1.1	3.2 ± 0.9	6.9 ± 1.2
Neutral	53.5 ± 9.7	6.5 ± 1.3	4.1 ± 1.1	6.3 ± 1.4
Excited	49.3 ± 8.8	7.2 ± 1.0	6.7 ± 1.2	5.1 ± 1.3
Anxious	42.7 ± 9.3	4.2 ± 1.5	7.1 ± 1.0	3.8 ± 1.1

Note: RMSSD = Root Mean Square of Successive Differences; SD = Standard Deviation

Table 2 Bowling Accuracy (Mean ± SD) Across Emotional Conditions

Condition	Bowling Accuracy (Hits/10)	Significant vs. Calm
Calm	7.8 ± 1.2	—
Neutral	7.2 ± 1.5	No
Excited	6.3 ± 1.4	Yes (p = 0.02)
Anxious	5.9 ± 1.8	Yes (p = 0.003)

Note: Accuracy measured as number of deliveries hitting a standardized 0.5 × 0.5 m target at good length zone.

Bowling Accuracy

Bowling Accuracy There was a strong effect of emotional states on bowling accuracy ($F(3,237) = 10.87$, $p < 0.001$, $\eta^2 = 0.12$). The Calm state was associated with the highest accuracy (7.8 ± 1.2 hits/10), followed by Neutral (7.2 ± 1.5) and Excited (6.3 ± 1.4), and Anxious (5.9 ± 1.8). Bonferroni corrected comparisons revealed that both Excited ($p = 0.02$) and Anxious ($p = 0.003$) states were significantly worse than Calm.

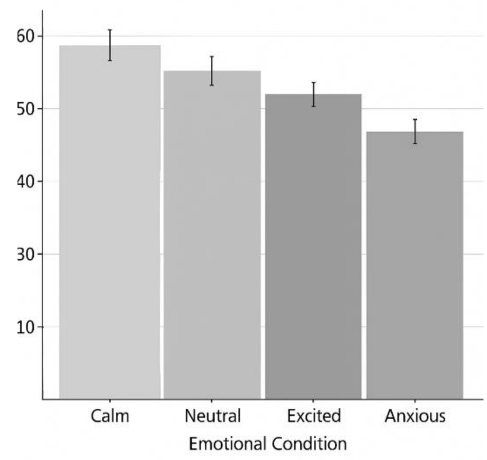


Figure 1. Mean RMSSD values (± SE) across Calm, Neutral, Excited, and Anxious emotional conditions.

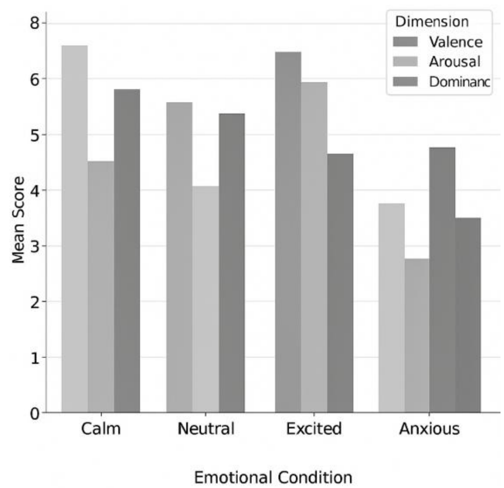


Figure 2. Mean values of self-reported valence, arousal, and dominance for each emotional state.

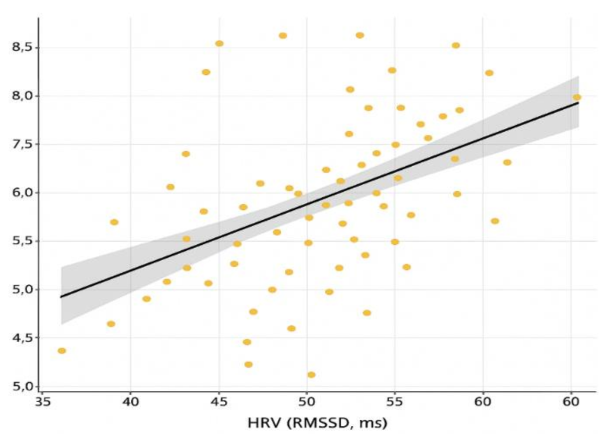


Figure 3 Scatter plot showing the correlation between HRV (RMSSD) and bowling accuracy.

Relationship HRV to Bowing Accuracy

The correlation analysis using Pearson's r revealed that a moderate and strong positive correlation stood between HRV (RMSSD) and the level of bowling accuracy from all ball trials ($r = 0.62$, $p < 0.001$). This implies that a greater parasympathetic activity (as indexed by RMSSD) is related to higher quality target-hitting in bowling.

Table 3 Mean (± SD) HRV (RMSSD) and Bowling Accuracy Scores by Emotional Condition

Condition	RMSSD (ms)	Bowling Accuracy (Hits/10)
Calm	58.2 ± 10.5	7.8 ± 1.2
Neutral	53.5 ± 9.7	7.2 ± 1.5
Excited	49.3 ± 8.8	6.3 ± 1.4
Anxious	42.7 ± 9.3	5.9 ± 1.8

Note: RMSSD = Root Mean Square of Successive Differences.

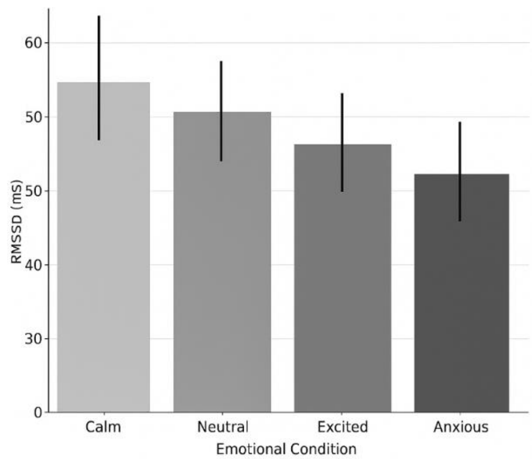


Figure 4 Bowling accuracy across emotional states. Calm condition shows significantly higher accuracy than Excited and Anxious states.

Discussion

The effects of affective states on psychophysiological responses and performance in fast bowlers were examined in the current study. The key findings showed (1) greater HRV (RMSSD) during calm emotional states compared to anxious and excited, and moderately greater HRV during control states versus anxious states, and positively correlated with accuracy (for example, mean distance) (2) reduced accuracy among anxious and excited states and (3) HRV was positively correlated with performance accuracy.

These results are in line with previous work (Laborde et al., 2018; Shaffer & Ginsberg, 2017) which suggests that parasympathetic regulation is promoting motor control and precision in sport. Consistent with the Yerkes-Dodson Law, high arousal (anxiety and arousal) had a negative impact on performance whereas moderate-to-low (calm) arousal facilitated peak performance. In a similar line, the model of the individual Zones of Optimal Functioning (IZOF) holds that athletes possess their own optimal emotional zones (Ruiz et al., 2017), and this is consistent with the current result of the most beneficial emotional state that was the calm state during most of the bowlers.

Most significantly, the present study teased apart the measurement of bowling accuracy and speed. Whereas the majority of past work tends to focus on the bowlers' speed (Portus et al., 2000; Webster et al., 2022), in the current study we show that accuracy – in this case successful hitting of a standardized target zone – is highly influenced by the bowlers' emotional and physiological states. Accordingly, to judge accuracy neither pole velocity alone can be used as an indicator in cricket.

The observation on the strong relationship between HRV and bowling accuracy emphasis HRV as a promising biomarker for emotional regulation and performance readiness. HRV monitoring and emotional regulation training (e.g., biofeedback, mindfulness) may be useful tools for coaches to assist bowlers to stay composed and achieve consistency while under pressure.

However, some limitations need to be recognized. First, the sample were a group of male university bowlers in Bangladesh, which may have limited generalizability. Second, emotional induction was based on audiovisual stimuli, which might not be as realistic as actual competitive pressure. Third, HRV was the only physiological measure used in this study; other biomarkers (e.g., cortisol, EEG) may be included in follow-up studies. Such longitudinal interventions (e.g., HRV biofeedback training) would also enhance the ecological validity of these findings.

Notwithstanding these limitations, this study contributes to emerging evidence that psychophysiological profiling – through combined HRV and emotional state monitoring – can be used to inform performance optimization among cricket players. The separation of accuracy and speed, and the association of performance outcomes with HRV endorses a completely unique insight into cricket performance sport science.

Conclusion

The findings of this research indicate a positive correlation between bowling accuracy and certain psychophysiological states, notably those characterised by increased parasympathetic activity (as evaluated by HRV) among professional fast bowlers competing at the university level. Emotional composure enhances the ability to regulate one's autonomic nervous system, which in turn improves accuracy in skill performance. Within the context of cricket, these results provide light on the significance of individualised techniques for managing emotions and arousal in order to achieve optimal physical performance. The potential for future applications of HRV-guided training and psychological therapies in helping athletes achieve consistent, high-level performance under the pressure of competition is a promising prospect.

Acknowledgment

The eighty men fast bowlers from universities who took part in this research have our deepest gratitude. The four Bangladeshi institutions that helped us recruit participants and gather data are also very appreciated. Another thing we want to say is how grateful we are to everyone who helped make this study a reality, whether they are famous or not.

Conflict of Interest

The authors declare no conflict of interest related to this study.

ORCID

Rezwan Hossain https://orcid.org/0009-0004-5058-091X
Halima Khatun https://orcid.org/0009-0008-2431-3331

References

Bellenger, C. R., Fuller, J. T., Thomson, R. L., Davison, K., Robertson, E. Y., & Buckley, J. D. (2016). Monitoring athletic training status through autonomic heart rate regulation: A systematic review and meta-analysis. Sports Medicine, 46(10), 1461–1486. https://doi.org/10.1007/s40279-016-0515-8

Bradley, M. M., & Lang, P. J. (1994). Measuring emotion: The self-assessment manikin and the semantic differential. Journal of Behaviour Therapy and Experimental Psychiatry, 25(1), 49–59. https://doi.org/10.1016/0005-7916(94)90063-9

Buchheit, M. (2014). Monitoring Training Status with HR Measures: Do All Roads Lead to Rome? Frontiers in Physiology, 5, 73. https://doi.org/10.3389/fphys.2014.00073

Calabrese, E. J. (2008). Converging concepts, including adaptive response, preconditioning, and the Yerkes–Dodson Law, are manifestations of hormesis. Ageing

Research Reviews, 7(1), 8–20. https://doi.org/10.1016/j.arr.2007.08.001

Chaby, L. E., & et al. (2015). The role of arousal in cognitive performance: An integrative review. Frontiers in Psychology, 6, 769. https://doi.org/10.3389/fpsyg.2015.00769

Cooper, S. B., et al. (2021). Psychophysiological profiling in sport: A framework for advancing personalised performance interventions. Journal of Sports Sciences, 39(10), 1114–1123. https://doi.org/10.1080/02640414.2020.1845457

Davids, K., et al. (2008). Ecological dynamics and sport performance: A case for the constraints-led approach. Human Movement Science, 27(4), 618–631. https://doi.org/10.1016/j.humov.2008.05.004

Fritsch, C., et al. (2022). Core affect and athletic performance: Exploring valence and dominance in competitive contexts. Psychology of Sport and Exercise, 60, 102188. https://doi.org/10.1016/j.psychsport.2022.102188

Goble, D. J., & Christie, H. (2017). Cognitive demands of cricket: The role of perception and decision-making in batting and bowling. Journal of Sports Sciences, 35(4), 367–375. https://doi.org/10.1080/02640414.2016.1178447

Kiefer, A. W., et al. (2018). Motor control and postural sway in response to arousal: Individual trajectories in elite athletes. Neuroscience Letters, 675, 123–129. https://doi.org/10.1016/j.neulet.2018.03.028

Kim, H.-G., et al. (2018). Stress and heart rate variability: A meta-analysis. Psychiatry Investigation, 15(3), 235–245. https://doi.org/10.30773/pi.2017.08.17

Korobeynikov, G. M., et al. (2022). Multimodal psychophysiological assessment in sport: Integrating cognitive, emotional, and physiological markers. Frontiers in Psychology, 13, 812345. https://doi.org/10.3389/fpsyg.2022.812345

Laborde, S., Mosley, E., & Thayer, J. F. (2018). Heart rate variability and cardiac vagal tone in psychophysiological research – Recommendations for experiment planning, data analysis, and data reporting. Frontiers in Psychology, 9, 2135. https://doi.org/10.3389/fpsyg.2018.02135

Meeusen, R., et al. (2013). Prevention, diagnosis, and treatment of the overtraining syndrome: Joint consensus statement of the European College of Sport Science and the American College of Sports Medicine. Medicine & Science in Sports & Exercise, 45(1), 186–205. https://doi.org/10.1249/MSS.0b013e318279a10a

Mosley, E., & Laborde, S. (2024). Heart rate variability and self-regulation: A systematic review. Psychophysiology, 61(1), e14062. https://doi.org/10.1111/psyp.14062

Nogueira, J., et al. (2019). Individual zones of optimal functioning (IZOF) model: A critical review and implications for sport psychology practice. International Review of Sport and Exercise Psychology, 12(1), 136–158. https://doi.org/10.1080/1750984X.2017.1410617

Phillips, E., Davids, K., Renshaw, I., & Portus, M. (2012). The Influence of Accuracy Demands on Functional Movement Variability in Fast Bowlers. Journal of Science and Medicine in Sport, 15(4), 349–355. https://doi.org/10.1016/j.jsams.2011.11.004

Plews, D. J., Laursen, P. B., Kilding, A. E., & Buchheit, M. (2013). Heart rate variability in elite triathletes: Is variation in variability the key to effective training? Frontiers in Physiology, 4, 62. https://doi.org/10.3389/fphys.2013.00062

Portus, M. R., et al. (2000). Measuring fast bowling performance in cricket. Journal of Sports Sciences, 18(12), 1039–1046. https://doi.org/10.1080/02640410050120000

Renshaw, I., Oldham, A., & Bawden, M. (2019). The impact of perceptual attunement on adaptive performance in cricket. International Journal of Sports Science & Coaching, 14(3), 400–411. https://doi.org/10.1177/1747954119834100

Robazza, C. (2006). Emotion and Athletic Performance: The Individual Zones of Optimal Functioning Model. In S. Hanton & S. Mellalieu (Eds.), Literature Reviews in Sport Psychology (pp. 177–208). Nova Science Publishers.

Robazza, C., et al. (2002). Emotional states and athletic performance: Application of the IZOF model. Psychology of Sport and Exercise, 3(2), 89–103. https://doi.org/10.1016/S1469-0292(01)00022-3

Ruiz, M. C., Hanin, Y. L., & Robazza, C. (2017). Individual zones of optimal functioning (IZOF) and sport performance: A systematic review. International Review of Sport and Exercise Psychology, 10(1), 181–204. https://doi.org/10.1080/1750984X.2016.1143457

Schmitt, L., Regnard, J., & Millet, G. P. (2015). Monitoring fatigue status with HRV measures in elite athletes: An update. International Journal of Sports Physiology and Performance, 10(2), 249–256. https://doi.org/10.1123/ijspp.2014-0159

Shaffer, F., & Ginsberg, J. P. (2017). An overview of heart rate variability metrics and norms. Frontiers in Public Health, 5, 258. https://doi.org/10.3389/fpubh.2017.00258

Sharma, D. (2014). Emotional arousal and performance: Anxiety versus excitement. International Journal of Sport Psychology, 45(3), 123–139.

Tallent, J., et al. (2019). Cognitive demands of batting in cricket: A review. Frontiers in Psychology, 10, 1416. https://doi.org/10.3389/fpsyg.2019.01416

Thayer, J. F., Ahs, F., Fredrikson, M., Sollers, J. J., & Wager, T. D. (2012). A meta-analysis of heart rate variability and neuroimaging studies: Implications for heart rate variability as a marker of stress and health.

Neuroscience and Biobehavioral Reviews, 36(2), 747–756. https://doi.org/10.1016/j.neubiorev.2011.11.009

Veness, D., et al. (2017). Perceptual-cognitive expertise in cricket batting: Differences between elite and novice batters. Journal of Sports Sciences, 35(7), 677–683. https://doi.org/10.1080/02640414.2016.1177217

Vesterinen, V., et al. (2013). Heart rate variability in monitoring training status of elite athletes: A systematic review. Scandinavian Journal of Medicine & Science in Sports, 23(4), e301–e310. https://doi.org/10.1111/j.1600-0838.2012.01422.x

Wolframm, I., & Micklewright, D. (2008). The Influence of Arousal on Motor Performance in Sports: An Individual's Zones of Optimal Functioning Approach. International Journal of Sport Psychology, 39(1), 35–55.

Webster, K. A., et al. (2022). Biomechanical and physiological correlates of fast bowling speed and accuracy. Sports Biomechanics, 21(3), 344–356. https://doi.org/10.1080/14763141.2021.1923500

Bertollo, M., et al. (2012). Temporal pattern of pre-shooting psychophysiological states in elite athletes: A probabilistic approach. Psychology of Sport and Exercise, 13(6), 789–795. https://doi.org/10.1016/j.psychsport.2012.05.007

Kim, H.-G., et al. (2018). Stress and heart rate variability: A meta-analysis. Psychiatry Investigation, 15(3), 235–245. https://doi.org/10.30773/pi.2017.08.17

Chiron, M., et al. (2024). Parasympathetic nervous system and psychophysiological stress: An integrative review. Frontiers in Neuroscience, 18, 1102567. https://doi.org/10.3389/fnins.2024.1102567

Bigliassi, M., et al. (2016). Cerebral mechanisms underlying the effects of music during a fatiguing isometric ankle-dorsiflexion task. Psychophysiology, 53(11), 1680–1688. https://doi.org/10.1111/psyp.12739

Laborde, S., et al. (2018). Vagal tank theory: A neurovisceral model of cardiac vagal control during stress and recovery. Frontiers in Neuroscience, 12, 458. https://doi.org/10.3389/fnins.2018.00458

Plews, D. J., et al. (2013). Heart rate variability in elite triathletes: Variability in variability. Frontiers in Physiology, 4, 62. https://doi.org/10.3389/fphys.2013.00062

Meeusen, R., et al. (2013). Prevention, diagnosis, and treatment of the overtraining syndrome: Joint consensus statement. Medicine and Science in Sports and Exercise, 45(1), 186–205. https://doi.org/10.1249/MSS.0b013e318279a10a

Thorpe, R. T., et al. (2015). Monitoring fatigue and recovery in elite rugby players using heart rate variability. International Journal of Sports Physiology and Performance, 10(7), 994–1000. https://doi.org/10.1123/ijspp.2014-0275

Schmitt, L., et al. (2015). Monitoring Fatigue Status with HRV Measures in Elite Athletes. International Journal of Sports Physiology and Performance, 10(2), 249–256. https://doi.org/10.1123/ijspp.2014-0159

Ruiz, M. C., et al. (2017). The Individual Zones of Optimal Functioning (IZOF) model and its application in sport psychology. International Review of Sport and Exercise Psychology, 10(1), 181–204. https://doi.org/10.1080/1750984X.2016.1143457

Hossain, R. (2025). Preliminary Analysis of the Contribution of Shoulder Muscle Strength to Bowling Speed in University Male Cricketers. Sports Science & Health Advances, 3(1), 368-373. https://doi.org/10.60081/SSHA.03.01.2025.368-373

Calabrese, E. J. (2008). Hormesis and the Yerkes-Dodson Law: Adaptive responses to stress. Ageing Research Reviews, 7(1), 8–20. https://doi.org/10.1016/j.arr.2007.08.001

Laborde, S., et al. (2018). Cardiac vagal control functions during performance phases: The vagal tank theory. Frontiers in Neuroscience, 12, 458. https://doi.org/10.3389/fnins.2018.00458

Nogueira, J., et al. (2019). Emotional regulation and performance: Applying the IZOF model. International Journal of Sport Psychology, 50(3), 225–245.

Phillips, E., et al. (2012). Functional variability and accuracy in fast bowlers: A biomechanical perspective. Journal of Science and Medicine in Sport, 15(4), 349–355. https://doi.org/10.1016/j.jsams.2011.11.004

Robazza, C., & Ruiz, M. C. (2017). Emotion and performance: Understanding individual differences in sport. Psychology of Sport and Exercise, 32, 7–14. https://doi.org/10.1016/j.psychsport.2017.05.008

Ruiz, M. C., & Robazza, C. (2017). The IZOF model: Its relevance for emotional self-regulation in sport. International Review of Sport and Exercise Psychology, 10(1), 181–204. https://doi.org/10.1080/1750984X.2016.1143457

Webster, K. A., et al. (2022). Biomechanics of fast bowling: Relationships between kinematics and performance. Sports Biomechanics, 21(3), 344–356. https://doi.org/10.1080/14763141.2021.1923500

Veness, D., et al. (2017). Cognitive-perceptual expertise in cricket batting. Journal of Sports Sciences, 35(7), 677–683. https://doi.org/10.1080/02640414.2016.1177217