Research Square

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Association between Well-Being, Total Recovery Quality, and Passing Errors during Official Professional Futsal Matches: A Prospective Observational Study

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Abstract

Background

This study investigated the associations between pre-match well-being, perceived recovery, passing errors and match outcomes in professional futsal players.

Methods

Thirty-three first-division players from three teams were monitored across 315 individual match observations during 15 rounds of first-division competition. On match days, athletes completed a well-being questionnaire and the Total Quality of Recovery (TQR) scale. Passing errors were quantified via video analysis and adjusted for playing time. Linear and generalized linear mixed models with random intercepts for players were applied.

Results

Neither well-being nor TQR was associated with passing error rates during matches (all $p > 0.05$). Pre-match well-being was not significantly different between home and away matches (estimate = − 0.06, 95% CI: −0.14 to 0.02, $p = 0.12$). In contrast, TQR was significantly lower in away matches (estimate = − 0.35, 95% CI: −0.57 to − 0.13, $p = 0.002$). Playing away from home was associated with a higher likelihood of defeat (log-odds = 0.84, OR = 2.33, 95% CI: 1.48–3.69, $p < 0.001$). Although TQR was lower in away matches, it was not associated with defeat risk when included in the model (log-odds = − 0.03, OR = 0.97, 95% CI: 0.82–1.15, $p = 0.77$), and its inclusion did not attenuate the away-match effect.

Conclusions

These findings indicate that short-term variations in self-reported well-being and perceived recovery do not influence passing accuracy and match outcome in professional futsal. Moreover, reduced perceived recovery in away matches does not explain the increased risk of defeat, suggesting that contextual and tactical factors may play a more decisive role in away-match performance.

Background

Futsal is a high-intensity sport characterized by intermittent efforts, rapid transitions, and high technical–tactical demands [1–3]. Precision in technical skills, such as passing, is crucial for maintaining ball possession and collective performance, and errors in this skill can significantly compromise team performance [4]. However, several factors may influence technical performance and may increase risk of passing errors. Aspects related to physical and emotional well-being, as well as athletes´ recovery, have been associated with the risk of different outcomes in technical actions [5–8]. Indicators such as sleep

quality, fatigue, muscle soreness, mood, and stress comprise widely used monitoring tools to assess readiness for training and competition [4, 8, 9]. In parallel, perceived recovery is considered an important marker of an athlete's ability to cope with the physical and cognitive demands imposed by successive competitions [10, 11]. However, the relationship between athletes´ well-being and perceived recovery and failures in technical actions during competitive futsal matches remains unclear.

Successful passes are an essential technical skill for advancing the offensive plays and transitions, maintaining ball possession, and creating numerical superiority in futsal [2, 12]. In soccer, well-being–related factors such as delayed onset muscle soreness and fatigue are negatively correlated with passing errors, while recovery has been positively associated with successful passes [7, 13, 14]. In rugby, associations between well-being and recovery have also been reported in relation to technical passing ability [4, 15, 16]. It is therefore plausible that similar associations may be present in futsal; however, evidence in this context is still limited.

Although well-being and total recovery quality are aspects related to athlete performance in team sports, their relationship with the execution of technical actions in futsal has not yet been established. Therefore, the aim of the present study was to investigate the association between well-being (assessed through sleep, fatigue, muscle soreness, mood, and stress), perceived total recovery quality, and the number of passing errors per minute in first-division futsal players during official matches. The study hypothesized that lower pre-match perceptions of well-being and recovery would be associated with a higher incidence of passing errors during competition and increased risk of defeat.

Materials and Methods

Experimental Design

This observational study examined the influence of well-being and perceived recovery on passing errors during official first-division professional futsal matches. The study design and reporting followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [17]. A total of 33 athletes from three teams were evaluated across 15 rounds of the first phase of the 2025 First Division (Gold Division) of Paraná State Futsal Championship. One team also participated in the National Futsal League, whereas the others competed in the state championship and the State Union Cup. For all teams, the competitive schedule was congested, with an average of two matches per week.

Athletes completed a well-being questionnaire [4] and the Total Quality of Recovery (TQR) scale [18]. The scales were administered individually via a messaging application, between 8:00 and 10:00 a.m. on each training and competition day as part of their team routines. Only values obtained on competition days were included in the study, representing immediate readiness for competition. On match days, athletes performed only short-duration, low-intensity technical–tactical training in the morning. This routine, part of the teams' standard pre-match preparation rather than a research intervention, aimed to make minor

technical and tactical adjustments without inducing additional fatigue, thereby ensuring adequate recovery prior to competition.

Match actions were analyzed by two independent researchers using video footage obtained from official team broadcasts available on YouTube and video material recorded and provided by the teams themselves. Information regarding match location and results was obtained from the official website of the Paraná State Futsal Federation.

Participants

Professional male futsal players aged ≥ 18 years, competing in first-division teams during the 2025 season, were invited. Inclusion criteria required athletes to be in active training, competing either as starters or substitutes. Only plays in which the player was on the court for > 2 minutes and completed at least one pass were included in the analysis [19, 20]. Goalkeepers were excluded due to the low frequency of passing actions.

All participants provided written informed consent. The study was approved by the Research Ethics Committee for Human Subjects of the State University of Londrina (approval no. 86810425.0.0000.5231).

Total Quality of Recovery

Perceived recovery was assessed using the TQR scale [18], ranging from 0 (“very poorly recovered”) to 10 (“very well recovered”). Athletes were familiar with this scale through their regular monitoring routines.

Well-Being

Well-being was assessed using a psychometric scale that evaluates delayed onset muscle soreness (DOMS), fatigue, mood, sleep quality, and stress [4]. The well-being index consisted of a 5-point Likert scale, with scores ranging from 1 (“very poor”) to 5 (“very good”), as perceived by the athlete.

The assessment began with the question, “How do you feel today?”, followed by the well-being domain scales. The mean of the responses was calculated and used as the individual daily well-being score. The scale was originally designed for daily use by teams and athletes to monitor well-being responses to training load and readiness for next effort [4].

Video Analysis

Passing errors were analyzed using video footage available on streaming platforms and YouTube from official and publicly accessible broadcasts of the evaluated teams' matches. Passing errors were identified according to the following criteria:

- Interception by the opponent: when the pass was intercepted by a player from the opposing team before reaching its intended target.
- Out-of-reach pass: when the pass was delivered in such a way that the intended receiver could not reach it, either because it was too far or too high.
- Misplaced pass: when the pass was directed to an area with no teammate present or to the wrong player.
- Technical error: when the pass was poorly executed due to a technical failure, such as insufficient force or lack of accuracy.

To account for differences in playing time exposure, passing errors were normalized by minutes played and expressed as errors per minute [20].

Video analysis was performed by two independent evaluators who were trained and calibrated for action analysis under the supervision of a performance analyst specialized in football and futsal and an experienced futsal coach. For initial calibration, five matches were analyzed, resulting in a Cohen's kappa coefficient of 0.90 between observers. The matches were reanalyzed after 30 days to determine intra-observer reliability, yielding kappa values of 0.99 and 0.95 for each observer, respectively. Researchers responsible for video analysis were blinded to athletes' TQR and well-being scores.

Statistical Analysis

Normality was assessed with the Shapiro–Wilk test. Parametric data are presented as mean ± standard deviation, non-parametric data as median and interquartile range (IQR). Passing errors were modeled using generalized linear mixed models (GLMM) with Poisson distribution, including a random intercept for players and match exposure time as an offset. Age and professional experience were included as fixed effects. A sensitivity analysis excluding pivot players (n = 5) was conducted due to their low representation in the sample, in order to assess the robustness of the findings related to match location and passing errors. Statistical significance was set at $p < 0.05$. All statistical analyses were performed using R software (R Foundation for Statistical Computing, Vienna, Austria), including the packages lme4 for mixed-effects modeling, and GraphPad Prism 8 (GraphPad Software, San Diego, CA, USA) for descriptive statistics and graphical representations.

Results

A total of 42 futsal matches (15 round of competition) were analyzed, involving 33 players with a mean age of 26.3 ± 4.6 years, VO_2max of 56.2 ± 3.7 $mL \cdot kg^{-1} \cdot min^{-1}$, body mass of 72.3 ± 8.6 kg, body fat

percentage of 8.0 ± 4.1%, and mean professional experience of 7.1 ± 4.3 years. The cohort included 10 (30.3%) left wingers, 11 (33.3%) right wingers, 7 (21.2%) defenders, and 5 (15.1%) pivots.

The median passing error rate was 0.13 errors·min⁻¹ (IQR: 0.06–0.24). In the GLMM Poisson model, adjusted for match exposure (offset = log[playing time]) and including random intercepts for players, well-being and TQR were not significantly associated with passing error rates, showing trivial effects (Table 1). Age (β = 0.003, SE = 0.108, p = 0.976) and professional experience (β = 0.005, SE = 0.112, p = 0.966) were also non-significant.

Table 1
Mixed-effects Poisson model for passing errors

Predictor	**β**	**SE**	**z**	**p**	**IRR (95% CI)**
Well-being	0.102	0.094	1.08	0.280	1.11 (0.92–1.33)
TQR	-0.020	0.031	-0.65	0.517	0.98 (0.92–1.05)
Game Outcome Draw x defeat	-0.121	0.086	-1.42	0.155	0.88 (0.75–1.04)
Win x defeat	-0.008	0.084	-0.10	0.921	0.99 (0.84–1.17)
Away match	0.146	0.076	1.91	0.056	1.16 (1.00–1.34)
Player position Left x right winger	-0.069	0.145	-0.48	0.633	0.93 (0.69–1.26)
Defender x right winger	0.062	0.158	0.39	0.696	1.06 (0.78–1.45)
Pivot x right winger	-0.525	0.238	-2.20	0.028	0.59 (0.37–0.93)

Match outcome was not associated with passing errors (Table 1, Fig. 1). Away-home matches showed a trend toward higher passing error rates (Table 1, Fig. 1).

Pre-match well-being scores did not differ according to match location, as the linear mixed-effects model with random intercepts for players showed no significant difference between home and away matches (estimate = − 0.06; 95% CI: −0.14 to 0.02; p = 0.12). In contrast, TQR was significantly lower in away matches (estimate = − 0.35; 95% CI: −0.57 to − 0.13; p = 0.002). Despite this reduction, TQR was not associated with match outcome. In the generalized linear mixed-effects logistic regression, playing away from home was associated with a higher likelihood of defeat (OR = 2.31; p < 0.001), whereas TQR showed no significant association with the risk of defeat (p = 0.77). Furthermore, the inclusion of TQR in the model did not attenuate the effect of match location on defeat risk, suggesting that reduced perceived recovery did not explain the increased likelihood of losing away matches.

Regarding playing position, pivots exhibited a significantly lower rate of passing errors compared with right wingers (Table 1), whereas no significant differences were observed for left wingers or defenders

(Fig. 1). Excluding pivot players (n = 5), the effect of away matches remained consistent (IRR = 1.14; 95% CI: 0.98–1.32).

In the mixed-effects Poisson regression model, adjusted for playing time (offset) and including a random effect for player, none of the well-being subscales were significantly associated with passing errors (Fig. 2). These results indicate that variations in players' self-reported well-being domains on match days did not influence the rate of passing errors in this cohort.

Discussion

This study investigated the relationship between pre-match well-being, perceived recovery, and the incidence of passing errors in professional futsal players. The main findings indicate that neither overall well-being nor perceived recovery (TQR) significantly influenced passing error rates during matches. Similarly, individual well-being subscales - including muscle soreness, fatigue, sleep quality, stress, and mood - were not associated with the rate of passing errors. These results suggest that, in professional futsal players, short-term variations in self-reported well-being may not substantially impact technical performance in terms of passing accuracy. Thus, the initial study hypothesis was not supported.

Well-being scales and TQR has been widely used in team sports to monitor overall recovery for planning training sessions and recovery [14, 21–23]. Despite the common assumption that a better state of well-being is ideal for performance, this concept should be interpreted with caution, particularly due to the multidimensional interaction of physiological and emotional variables assessed by subjective well-being scales. For example, a study conducted in youth basketball players reported that, although athletes presenting better pre-training well-being and recovery status were able to sustain higher internal load intensity and volume during training sessions, the efficiency of technical actions was reduced and was specifically associated with Total Quality of Recovery (TQR) and sleep quality [23]. These findings reinforce the notion that higher perceived readiness does not necessarily translate into greater technical efficiency, highlighting the complex and multidimensional interaction between physiological recovery, cognitive resources, and motor performance.

Delayed-onset muscle soreness and fatigue are also factors associated with detrimental effects on physical performance. However, because the well-being scale operationalizes fatigue as a broad construct reflecting overall readiness, it may lack sensitivity to isolate the specific effects of mental fatigue or insufficient physical recovery. The composite nature of the scale, which integrates multiple subjective dimensions into a single score, may limit its ability to detect specific fatigue-related mechanisms. Among mechanisms accounted for accurate passes that directly influence technical performance, it was cited the decision-making speed, attentional control, or neuromuscular impairments [24]. These performance variables have been associated with central mental fatigue in team sports [25]. But specifically in passing skills, mental fatigue seems not to evoke detrimental effects on the pass freqeuncy and accuracy [26]. On the other hand, studies in soccer players demonstrated a positive impact of TQR on successful passes, but a negative impact of DOMS and fatigue in passing balls [6, 14,

27]. Conversely, a study conducted with futsal professional players under simulated match conditions indicated that game-induced fatigue, despite neuromuscular fatigue, was not associated with a reduction in shooting accuracy at the end of matches [28]. Indeed, neuromuscular fatigue accumulated during a futsal multiday tournament decreased the high intensity running activities, but improved number and accuracy of passes [29]. Therefore, the influence of DOMS, perceived fatigue, and recovery status on passing performance appears to be context-dependent and skill-specific and may not be adequately captured by subjective well-being measures during futsal matches.

Sleep quality is another important component of athletes´ recovery and performance [30, 31]. Although sleep duration and subjective sleep quality have been consistently associated with technical performance and match success in several sports, such associations were not observed for passing errors or match outcomes in futsal players in the present study. In professional athletes, extended sleep duration has been shown to improve aerobic performance and enhance activities that require fine motor skills, thereby supporting greater accuracy in technical–tactical task execution [31, 32]. Regardless of total sleep duration, the subjective perception of sleep quality in basketball players on the night before competition has been associated with technical performance [33]. Other study demonstrated that elite individual and team athletes reporting poor sleep quality in the first day competition exhibited a markedly increased likelihood of poor performance, with an approximately 2.7-fold higher risk compared with those reporting good sleep quality [30]. These discrepancies may be partially explained by differences in sport-specific demands, contextual factors inherent to futsal, and the use of subjective sleep assessments, which may not fully capture subtle variations in sleep-related performance mechanisms.

Sleep quality also have an impact on emotional stress and mood state, changing perception of anger, fatigue, anxiety and vigor in athletes [34, 35]. However, well-being scales address these issues as general stress and mood scores. From a psychometric standpoint, the use of generic stress and mood items in well-being monitoring tools entails important limitations related to construct validity and measurement precision. Distinct emotional states with potentially opposing effects on performance may be aggregated into a single score, reducing sensitivity to detect meaningful associations with technical outcomes. While these scales are designed for practical, time-efficient application in applied sport settings, they provide limited discrimination between different emotional states, their intensity, and their cognitive versus affective components. This trade-off between ecological validity and psychometric specificity may partially explain the absence of significant relationships between stress- and mood-related well-being dimensions and passing errors in the present study, particularly in a sport characterized by high perceptual–cognitive demands and rapid decision-making.

While playing away from home increased the likelihood of defeat, the passing errors and well-being did not statistically differ between home and away matches. Team sports have increased risk of defeat in away-home games which may reflect contextual factors such as absence of team fans [36]. In the present study, neither passing errors nor well-being was significantly different regarding game location, but TQR. Nevertheless, decreased TQR in away-home games did not increase risk of defeat.

Regarding playing position, pivots exhibited significantly lower passing error rates compared with wingers and defenders. This finding may reflect positional differences in tactical responsibilities, spatial constraints, and the nature of passing opportunities. The small number of pivots (n = 5) prompted a sensitivity analysis, which indicated that the observed effect remained directionally consistent, suggesting that results were not solely driven by performance. This hypothesis should be investigated in future studies, since it has been reported that influence of well-being scores on technical-tactical behavior may be position-dependent in team sports [16].

Conclusions

Pre-match wellness and recovery did not significantly impact passing accuracy in professional futsal players. While monitoring well-being and perceived recovery remains important for general athlete management, minor fluctuations in pre-match wellness may not require immediate adjustments to tactical strategies or player selection with respect to passing accuracy. Emphasis should be placed on maintaining consistent recovery routines, individualized preparation protocols, and attention to contextual match factors that may influence performance.

Future research should explore other technical and tactical performance indicators, as well as longitudinal monitoring across congested and non-congested match schedules, to clarify the complex interactions between wellness, recovery, and in-game performance in elite futsal. Additionally, integrating objective physiological measures (e.g., neuromuscular fatigue, heart rate variability) alongside subjective wellness assessments may provide a more comprehensive understanding of performance determinants.

Abbreviations

DOMS
Delayed onset muscle soreness
GLMM
Generalized linear mixed models
IQR
interquartile range
IRR
Incidence Rate Ratio
SE
Standard error
TQR
Total Quality of Recovery

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki and approved by the Research Ethics Committee for Human Subjects of the State University of Londrina (approval no. 86810425.0.0000.5231). All participants were informed about the study procedures and provided written informed consent prior to participation.

Consent for publication

Not applicable, as no identifiable personal data are included in this manuscript.

Availability of data and material

The datasets generated and/or analyzed during the current study will be deposited in the institutional repository of the State University of Londrina (https://sites.uel.br/bibliotecas/repositorio-institucional-da-uel/) and will be publicly available. The data are also available from the corresponding author upon reasonable request**.**

Competing interests

The authors declare no competing interests.

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Authors' contributions

SPR was responsible for supervision, statistical analysis, and writing the manuscript. MAR was responsible for the study methodology and coordinated the collection of video analysis data. LKB contributed to the methodological description and collected contextual competition data. RB contributed to the methodology and performed the analysis of well-being and recovery data. ECFT and VT conducted video analysis. EBC and TS collected well-being and recovery data. All authors contributed to the revision of the manuscript and approved the final version.

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References

1. Amatria M, Álvarez J, Ramírez J, Murillo V. Identification of the Patterns Produced in the Offensive Sequences That End in a Goal in European Futsal. Front Psychol. 2021;12:578332. https://doi.org/10.3389/fpsyg.2021.578332
2. Gómez M-Á, Moral J, Lago-Peñas C. Multivariate analysis of ball possessions effectiveness in elite futsal. J Sports Sci. 2015;33:2173–81. https://doi.org/10.1080/02640414.2015.1075168
3. Spyrou K, Freitas TT, Marín-Cascales E, Alcaraz PE. Physical and Physiological Match-Play Demands and Player Characteristics in Futsal: A Systematic Review. Front Psychol. 2020;11:569897. https://doi.org/10.3389/fpsyg.2020.569897
4. McLean BD, Coutts AJ, Kelly V, McGuigan MR, Cormack SJ. Neuromuscular, endocrine, and perceptual fatigue responses during different length between-match microcycles in professional rugby league players. Int J Sports Physiol Perform. 2010;5:367–83. https://doi.org/10.1123/ijspp.5.3.367
5. Aizava PVS, Codonhato R, Fiorese L. Association of self-efficacy and mental toughness with sport performance in Brazilian futsal athletes. Front Psychol. 2023;14:1195721. https://doi.org/10.3389/fpsyg.2023.1195721
6. Lyons M, Al-Nakeeb Y, Nevill A. Performance of soccer passing skills under moderate and high-intensity localized muscle fatigue. J Strength Cond Res. 2006;20:197–202. https://doi.org/10.1519/R-17114.1
7. Rampinini E, Impellizzeri FM, Castagna C, Azzalin A, Ferrari Bravo D, Wisløff U. Effect of match-related fatigue on short-passing ability in young soccer players. Med Sci Sports Exerc. 2008;40:934–42. https://doi.org/10.1249/MSS.0b013e3181666eb8
8. Rinaldo MA, de Souza EG, da Silva KA, Cardoso PC, Milanez VF, de Paula Ramos S. Contextual situations in competitions that influence well-being and recovery of Futsal athletes before home official matches. Apunts Sports Med. 2022;57:100385. https://doi.org/10.1016/j.apunsm.2022.100385
9. Hooper SL, Mackinnon LT. Monitoring overtraining in athletes. Recommendations. Sports Med Auckl NZ. 1995;20:321–7. https://doi.org/10.2165/00007256-199520050-00003
10. Kellmann M, Bertollo M, Bosquet L, Brink M, Coutts AJ, Duffield R, et al. Recovery and Performance in Sport: Consensus Statement. Int J Sports Physiol Perform. 2018;13:240–5. https://doi.org/10.1123/ijspp.2017-0759
11. Kenttä G, Hassmén P. Overtraining and recovery. A conceptual model. Sports Med Auckl NZ. 1998;26:1–16. https://doi.org/10.2165/00007256-199826010-00001
12. Rinaldo M, Souza EG de, Silva K, Fidelis B, Angelis T de, Cardoso P, et al. Variables Associated with the Effectiveness of Ball Possession in At-Home Futsal Matches. Int J Exerc Sci. 2024;17:916–28.
13. Selmi O, Marzouki H, Ouergui I, BenKhalifa W, Bouassida A. Influence of intense training cycle and psychometric status on technical and physiological aspects performed during the small-sided games in soccer players. Res Sports Med Print. 2018;26:401–12. https://doi.org/10.1080/15438627.2018.1492398

14. Selmi O, Gonçalves B, Ouergui I, Levitt DE, Sampaio J, Bouassida A. Influence of Well-Being Indices and Recovery State on the Technical and Physiological Aspects of Play During Small-Sided Games. J Strength Cond Res. 2021;35:2802–9. https://doi.org/10.1519/JSC.0000000000003228
15. Hills SP, Rogerson DJ. Associatons Between Self-Reported Well-being and Neuromuscular Performance During a Professional Rugby Union Season. J Strength Cond Res. 2018;32:2498–509. https://doi.org/10.1519/JSC.0000000000002531
16. Ramírez-López C, Till K, Weaving D, Boyd A, Peeters A, Beasley G, et al. Does perceived wellness influence technical-tactical match performance? A study in youth international rugby using partial least squares correlation analysis. Eur J Sport Sci. 2022;22:1085–93. https://doi.org/10.1080/17461391.2021.1936195
17. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Lancet Lond Engl. 2007;370:1453–7. https://doi.org/10.1016/S0140-6736(07)61602-X
18. Laurent CM, Green JM, Bishop PA, Sjökvist J, Schumacker RE, Richardson MT, et al. A practical approach to monitoring recovery: development of a perceived recovery status scale. J Strength Cond Res. 2011;25:620–8. https://doi.org/10.1519/JSC.0b013e3181c69ec6
19. Ribeiro JN, Gonçalves B, Coutinho D, Brito J, Sampaio J, Travassos B. Activity Profile and Physical Performance of Match Play in Elite Futsal Players. Front Psychol. 2020;11:1709. https://doi.org/10.3389/fpsyg.2020.01709
20. Spyrou K, Ribeiro JN, Ferraz A, Alcaraz PE, Freitas TT, Travassos B. Interpreting match performance in elite futsal: considerations for normalizing variables using effective time. Front Sports Act Living. 2023;5:1256424. https://doi.org/10.3389/fspor.2023.1256424
21. Clemente FM, Martinho R, Calvete F, Mendes B. Training load and well-being status variations of elite futsal players across a full season: Comparisons between normal and congested weeks. Physiol Behav. 2019;201:123–9. https://doi.org/10.1016/j.physbeh.2019.01.001
22. Rebelo A, Pereira JR, Martinho DV, Amorim G, Lima R, Valente-Dos Santos J. Training Load, Neuromuscular Fatigue, and Well-Being of Elite Male Volleyball Athletes During an In-Season Mesocycle. Int J Sports Physiol Perform. 2023;18:354–62. https://doi.org/10.1123/ijspp.2022-0279
23. Sansone P, Conte D, Li F, Tessitore A. Investigating the effects of athlete-reported pre-training well-being and recovery on subsequent training loads in basketball players. J Sports Med Phys Fitness. 2023;63:957–63. https://doi.org/10.23736/S0022-4707.23.14954-1
24. Natsuhara T, Kato T, Nakayama M, Yoshida T, Sasaki R, Matsutake T, et al. Decision-Making While Passing and Visual Search Strategy During Ball Receiving in Team Sport Play. Percept Mot Skills. 2020;127:468–89. https://doi.org/10.1177/0031512519900057
25. Yuan R, Sun H, Soh KG, Mohammadi A, Toumi Z, Zhang Z. The effects of mental fatigue on sport-specific motor performance among team sport athletes: A systematic scoping review. Front Psychol. 2023;14:1143618. https://doi.org/10.3389/fpsyg.2023.1143618

26. Sun H, Soh KG, Mohammadi A, Wang X, Bin Z, Zhao Z. Effects of mental fatigue on technical performance in soccer players: A systematic review with a meta-analysis. Front Public Health. 2022;10:922630. https://doi.org/10.3389/fpubh.2022.922630
27. McMorris T, Rayment T. Short-duration, high-intensity exercise and performance of a sports-specific skill: a preliminary study. Percept Mot Skills. 2007;105:523–30. https://doi.org/10.2466/pms.105.2.523-530
28. Milioni F, Vieira LHP, Barbieri RA, Zagatto AM, Nordsborg NB, Barbieri FA, et al. Futsal Match-Related Fatigue Affects Running Performance and Neuromuscular Parameters but Not Finishing Kick Speed or Accuracy. Front Physiol. 2016;7:518. https://doi.org/10.3389/fphys.2016.00518
29. Doğramaci S, Watsford M, Murphy A. Changes in futsal activity profiles in a multiday tournament. J Sports Med Phys Fitness. 2015;55:722–9.
30. Brandt R, Bevilacqua GG, Andrade A. Perceived Sleep Quality, Mood States, and Their Relationship With Performance Among Brazilian Elite Athletes During a Competitive Period. J Strength Cond Res. 2017;31:1033–9. https://doi.org/10.1519/JSC.0000000000001551
31. Kirschen GW, Jones JJ, Hale L. The Impact of Sleep Duration on Performance Among Competitive Athletes: A Systematic Literature Review. Clin J Sport Med Off J Can Acad Sport Med. 2020;30:503–12. https://doi.org/10.1097/JSM.0000000000000622
32. Roberts SSH, Teo W-P, Aisbett B, Warmington SA. Extended Sleep Maintains Endurance Performance Better than Normal or Restricted Sleep. Med Sci Sports Exerc. 2019;51:2516–23. https://doi.org/10.1249/MSS.0000000000002071
33. Fox JL, Stanton R, Scanlan AT, Teramoto M, Sargent C. The Association Between Sleep and In-Game Performance in Basketball Players. Int J Sports Physiol Perform. 2021;16:333–41. https://doi.org/10.1123/ijspp.2020-0025
34. Benjamin CL, Curtis RM, Huggins RA, Sekiguchi Y, Jain RK, McFadden BA, et al. Sleep Dysfunction and Mood in Collegiate Soccer Athletes. Sports Health. 2020;12:234–40. https://doi.org/10.1177/1941738120916735
35. Soundara Pandian PR, Balaji Kumar V, Kannan M, Gurusamy G, Lakshmi B. Impact of mental toughness on athlete's performance and interventions to improve. J Basic Clin Physiol Pharmacol. 2023;34:409–18. https://doi.org/10.1515/jbcpp-2022-0129
36. Alonso Pérez-Chao E, Portes R, Ribas C, Lorenzo A, Leicht AS, Gómez MÁ. Impact of Spectators, League and Team Ability on Home Advantage in Professional European Basketball. Percept Mot Skills. 2024;131:177–91. https://doi.org/10.1177/00315125231215710

Figures

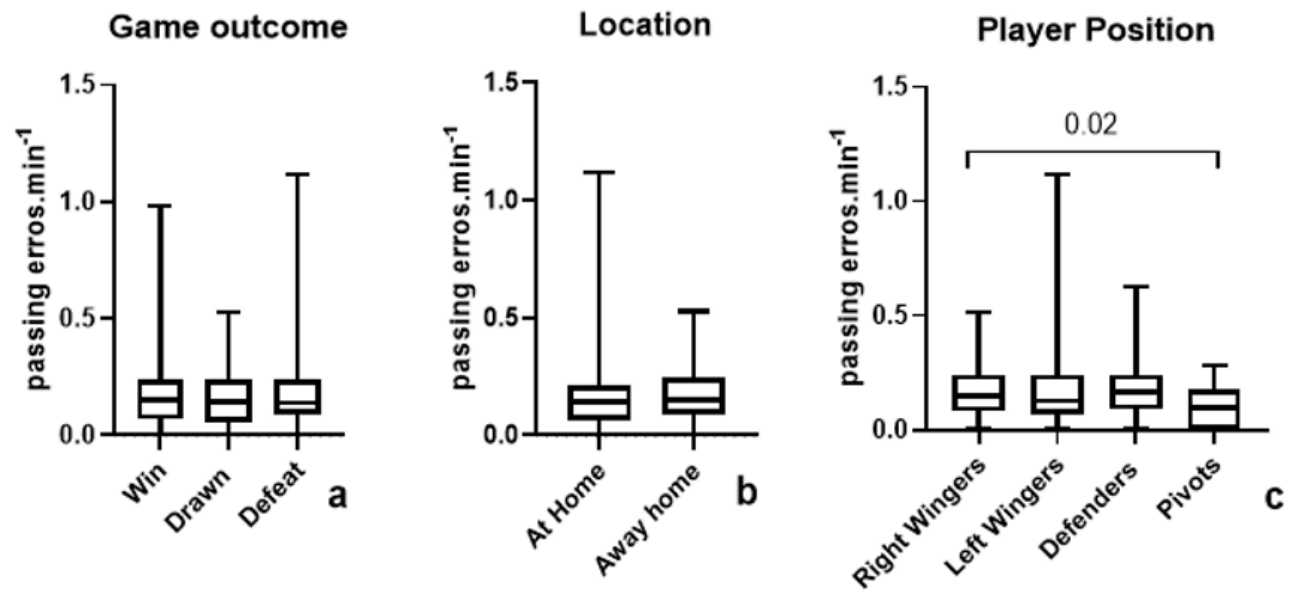


Figure 1

Median passing errors.min^{-1} according to game outcome (a), game location (b) and Player position (c). Data presented as interquartile range. Mixed-effects Poisson model for passing errors.

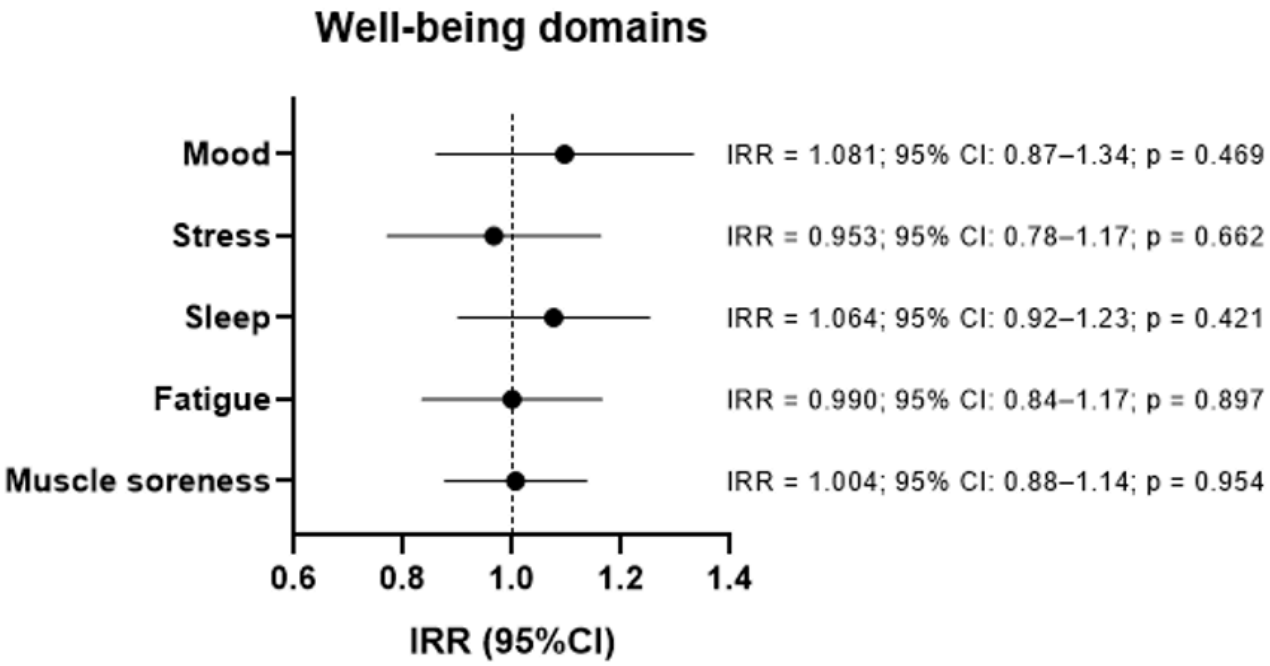


Figure 2

Forest plot showing the incidence rate ratios (IRR) and 95% confidence intervals (CI) for passing errors according to well-being subscales in futsal players. The multivariate generalized linear mixed model (Poisson, log link) was adjusted for playing time (offset) and included a random effect for individual players. Subscales assessed were Muscle soreness, Fatigue, Sleep, Stress, and Mood. Points represent the IRR for each subscale, and horizontal lines indicate the 95% CI. The dashed vertical line at IRR = 1 represents no effect.