INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH AND ANALYSIS

ISSN(print): 2643-9840, ISSN(online): 2643-9875

Volume 09 Issue 05 May 2026

DOI: 10.47191/ijmra/v9-i5-112, Impact Factor: 8.685

Page No. 3125-3143

The Lived Strain: Exertion, Fatigue, And Well-Being in College Athletes

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ABSTRACT: This study explored the lived experiences of futsal athletes regarding perceived exertion, fatigue, and well-being within the dual context of athletic and academic responsibilities. Anchored in Self-Determination Theory, Cognitive Appraisal Theory, and the Allostatic Load Model, the research examined how exertion and fatigue shaped performance, recovery, motivation, and academic functioning among collegiate athletes at Batangas State University – The National Engineering University.

A qualitative narrative inquiry design was employed. Fifteen officially recognized futsal athletes were purposively selected who participated in in-depth semi-structured interviews. Data were analyzed using thematic analysis following open coding, axial coding, and selective coding procedures. Seventeen initial codes were condensed into six categories and five overarching themes.

Findings revealed that fatigue was experienced as a multidimensional strain encompassing physiological exhaustion (heavy legs, muscle soreness, breathlessness), cognitive impairment (slower reaction time, reduced decision-making accuracy), and emotional fluctuation (frustration, determination). Performance degradation became more evident under accumulated load, particularly during consecutive training sessions and tournaments. Fatigue also spilled over into academic functioning, resulting in reduced concentration, sleep disturbance, and decreased productivity. Despite these challenges, athletes demonstrated adaptive coping through structured physical recovery practices, psychological self-regulation strategies, social support systems, spiritual reliance, and strategic time management. A strong endurance-based student-athlete identity enabled them to sustain commitment despite strain.

Based on these findings, the study proposed an Integrated Fatigue Management and Performance Sustainability Framework that integrates load monitoring and periodization, recovery protocols, psychological conditioning, academic–athletic coordination systems, institutional support reinforcement, and fatigue awareness education. The framework emphasizes proactive monitoring, holistic integration, and shared institutional responsibility to promote sustainable performance and athlete well-being in collegiate futsal contexts.

The study contributes to the limited qualitative literature on futsal athletes in the Philippine setting and underscores the importance of institutionalized fatigue management systems that address both performance demands and holistic athlete care.

KEYWORDS: perceived exertion, fatigue, collegiate athletes, futsal, well-being, dual-career balance, narrative inquiry, athlete performance, recovery strategies, training enhancement framework

INTRODUCTION

Athlete well-being has become a major concern in sports due to increasing physical and mental demands. In futsal, a fast-paced and high-intensity sport, athletes often experience fatigue and high perceived exertion caused by repetitive sprints, quick movements, and limited recovery time. Studies show that both physical and mental fatigue negatively affect performance, endurance, and motivation.

For collegiate athletes, balancing academics and sports creates additional stress, leading to fatigue, poor recovery, and reduced well-being. In the Philippines, many college sports programs lack adequate support systems such as recovery resources, mental health services, and training monitoring, especially in less-funded sports like futsal.

At Batangas State University – The National Engineering University, futsal athletes reportedly struggle with chronic fatigue, academic pressure, and insufficient recovery, affecting their performance and motivation. Coaches also face challenges in managing athlete workload and maintaining motivation with limited resources.

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This study aimed to explore the lived experiences of BatStateU futsal athletes regarding perceived exertion and fatigue and how these affect performance, recovery, motivation, and well-being. Using a qualitative narrative inquiry approach, the study sought to develop a training enhancement framework to improve athlete support systems and promote sustainable performance and well-being.

Research Question

This study sought to examine futsal athletes' lived experiences of perceived exertion and fatigue and how these influenced their performance, recovery, motivation, and well-being while balancing academic responsibilities. The inquiry focused on athletes of Batangas State University – The National Engineering University (BatStateU-TNEU).

Specifically, it aimed to answer the following questions:

1. What are the lived experiences of futsal athletes during training and competition in terms of exertion and fatigue?
2. How do futsal athletes describe their experiences during the games and training sessions in terms of psychological and physical adaptation strategies?
3. How do the futsal athletes describe their experiences in terms of exertion and fatigue while maintaining their overall performance and academic responsibilities?
4. Based on the study's results, what training enhancement framework can be proposed to address issues related to perceived exertion and fatigue among futsal athletes?

SCOPE AND LIMITATION OF THE STUDY

This study focused on exploring the lived experiences of futsal athletes at Batangas State University – The National Engineering University (BatStateU–TNEU) regarding their perceived exertion and fatigue and the subsequent impact on performance, recovery, motivation, and overall athlete well-being. It aimed to capture the athletes' personal accounts during both training sessions and competitive events in order to develop a training enhancement framework that could strengthen athlete health and address potential gaps in support systems.

Specifically, the scope of the study included the profile of futsal athletes in terms of age, sex, year level, course or program, and years of playing experience. It also examined the types of exertion and fatigue—physical, mental, and emotional—experienced during training and competitions, the psychological and physical adaptation strategies used to cope with these demands, and the challenges encountered in balancing competitive readiness with academic responsibilities. In addition, the study explored the perceived influence of exertion and fatigue on performance, recovery, motivation, and academic functioning. The findings served as the basis for the development of a proposed training enhancement framework.

The participants of the study consisted of officially recognized futsal athletes from Batangas State University – The National Engineering University during Academic Year 2025–2026. Participants met the following inclusion criteria: (1) currently enrolled students of the university, (2) with at least one year of active participation in the futsal varsity team, (3) having experienced physical, mental, or emotional strain resulting from training or competition, and (4) willing to participate voluntarily in the interview process.

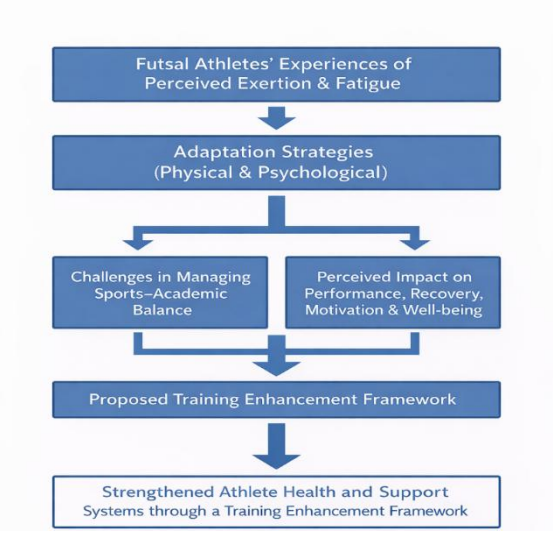
Futsal athletes were selected because the sport involves continuous high-intensity movements, rapid transitions, and short recovery intervals, making it suitable for examining exertion, fatigue, and strain within a collegiate athletic context. Furthermore, their dual role as students and athletes provided valuable insights into the balance between physical demands and academic responsibilities.

This study was delimited to futsal athletes of BatStateU–TNEU and excluded athletes from other varsity sports and institutions. The research employed a qualitative narrative inquiry design using semi-structured interviews and thematic analysis to capture and interpret the lived stories of futsal athletes. Quantitative measures, such as laboratory-based physiological testing or biomarkers including lactate threshold or cortisol levels, were not included in the study. The investigation focused solely on the athletes' self-reported experiences and narratives, and therefore did not include perspectives from coaches, trainers, or sports administrators.

Moreover, the research was geographically limited to Batangas State University – The National Engineering University and did not extend to other campuses, provinces, or institutions. Although the proposed training enhancement framework was primarily intended for the futsal program of BatStateU–TNEU, the findings may provide insights applicable to other sports programs or collegiate institutions. However, generalization beyond the specific research context should be interpreted with caution.

By establishing these parameters, the study ensured that its objectives remained clearly defined and that the findings were focused, relevant, and applicable to improving athlete support systems and performance sustainability within the context of collegiate futsal.

Framework



This study was anchored on the premise that futsal athletes' lived experiences of exertion and fatigue serve as the primary foundation for understanding their performance, recovery, motivation, and overall well-being. The conceptual framework follows a qualitative narrative inquiry progression, beginning with the athletes' personal stories and experiences during training and competition.

From these lived experiences, key themes were generated through thematic analysis, corresponding to the first three statements of the problem: (1) experiences of exertion and fatigue, (2) psychological and physical adaptation strategies, and (3) the challenges of balancing athletic performance and academic responsibilities. These thematic findings represent the core analytical layer of the study.

As illustrated in Figure 1, these themes collectively informed the identification of critical dimensions affecting student-athletes, including performance outcomes, recovery processes, motivational factors, and overall well-being. The interaction of these dimensions highlights the complex and interconnected nature of fatigue in the context of collegiate futsal.

The insights derived from these thematic dimensions served as the basis for the development of the Proposed Training Enhancement Framework. This framework integrates load management, recovery strategies, psychological support, and institutional interventions aimed at promoting sustainable athletic performance and holistic well-being among futsal athletes.

Thus, the conceptual progression of the study moves from lived experiences to thematic analysis, and ultimately to framework development, ensuring that the proposed model is grounded in the authentic narratives of the participants.

Research Design

This study employed a qualitative narrative inquiry design to examine the personal stories of futsal athletes regarding their experiences of exertion, fatigue, and strain, and how these influenced their performance, recovery, motivation, and well-being. Narrative inquiry was appropriate for this study because it focused on how individuals constructed and expressed meaning through their lived experiences. According to Clandinin and Connelly (2000), narrative inquiry seeks to understand human experience through the stories people tell, emphasizing context, temporality, and personal meaning-making. This approach allowed the researcher to explore how futsal athletes interpreted their experiences within the dual contexts of sport and academics, thereby providing a holistic understanding of their challenges and coping mechanisms.

Through in-depth interviews, the study captured the athletes' narratives of exertion and fatigue during training and competition, their adaptation and recovery strategies, and the consequences of these experiences on both athletic and academic performance. Narrative inquiry provided an avenue to understand not only what athletes experienced but also how they made sense of those experiences over time. Each story revealed the dynamic interaction between physical strain, mental resilience, and institutional support, thereby offering insights into the broader realities of collegiate sports participation.

This design aligned with the study's goal of developing a Training Enhancement Framework that was grounded in the authentic narratives of futsal athletes rather than in pre-established theoretical constructs. The narrative approach allowed for rich, contextualized descriptions that illuminated the temporal and relational dimensions of student-athlete life. By giving voice to the athletes' lived stories, this study contributed to a deeper appreciation of how exertion, fatigue, and well-being shaped their academic and athletic journeys at Batangas State University – The National Engineering University.

Data Generation

The data for this study were generated through semi-structured in-depth interviews, which were suitable for capturing the personal narratives and meaning-making processes of student-athletes. This method allowed participants to share their stories and experiences related to exertion, fatigue, strain, performance, recovery, motivation, and academic responsibilities. The semi-structured format provided flexibility for the researcher to probe emerging ideas and clarify meanings while maintaining consistency across interviews. To ensure comprehensive data capture, audio recordings, field notes, and reflective memos were utilized, allowing both verbal expressions and contextual cues to inform the analysis.

The participants of this study consisted of officially recognized futsal athletes from Batangas State University – The National Engineering University (BatStateU–TNEU) during Academic Year 2025–2026. Purposive sampling was used to select athletes who had substantial experience in training and competition, as well as in balancing athletic and academic responsibilities. The inclusion criteria required that participants were (1) currently enrolled students at BatStateU–TNEU, (2) actively engaged in the university's futsal program with at least one year of playing experience, (3) had experienced physical, mental, or emotional strain resulting from participation in training or competition, and (4) were willing to participate voluntarily in an in-depth interview.

A total of 15 athletes were recruited, a number considered sufficient to achieve narrative depth and data saturation in qualitative research. This purposive selection strategy ensured that participants could meaningfully reflect on their experiences, thereby providing rich and authentic narratives. The combination of carefully chosen participants and the use of in-depth interviews aligned with the narrative inquiry design, allowing the researcher to construct a contextualized understanding of futsal athletes' lived stories and to develop a Training Enhancement Framework grounded in their real experiences and expressed needs.

Thematic Reflection

Thematic reflection in this study was employed to ensure that the voices and lived experiences of the futsal athletes were meaningfully captured and systematically interpreted. The analysis followed Braun and Clarke's (2006) six-phase framework of thematic analysis. To facilitate the organization and management of qualitative data, the researcher utilized ATLAS.ti qualitative data analysis software in coding and categorizing the interview transcripts.

The researcher initially immersed in the data by carefully reading and re-reading the interview transcripts to gain familiarity with the participants' narratives. The transcripts were then imported into ATLAS.ti, where open coding was conducted to identify recurring expressions, descriptions, and insights related to exertion, fatigue, adaptation strategies, performance, recovery, motivation, and academic balance. The software enabled the systematic labeling and organization of meaningful data segments, allowing the researcher to generate and manage multiple codes across the interview data.

Following the coding process, related codes were grouped and organized within ATLAS.ti to form categories and candidate themes. For instance, accounts describing physical exhaustion, muscle soreness, and mental strain were clustered under themes related to types of exertion and fatigue, while descriptions of mindfulness practices, sleep routines, and pacing strategies were categorized under adaptation strategies. Additional themes emerged from participants' accounts regarding the impact of fatigue on academic responsibilities, the challenges of balancing athletic and academic roles, and suggested strategies for improvement.

The themes generated through the software-assisted coding process were then reviewed and refined to ensure that they accurately represented the data and remained aligned with the research questions. ATLAS.ti also facilitated the visualization of relationships among codes, categories, and themes, enabling the researcher to develop a coherent thematic structure that reflected the athletes' shared and unique experiences.

The thematic reflection process not only categorized responses but also highlighted the meanings athletes attached to their experiences. This reflexive interpretation allowed the researcher to contextualize the findings within the specific circumstances of Batangas State University – The National Engineering University futsal athletes. Through this process, the study produced a holistic interpretation that acknowledged both the challenges and resilience of the athletes while informing the development of a Training Enhancement Framework.

Finally, the thematic reflection ensured that the proposed framework was grounded in authentic athlete narratives, thereby strengthening its relevance, applicability, and potential contribution to athlete health, performance sustainability, and institutional support systems.

RESULTS

This chapter presents the presentation, analysis, and interpretation of data. The data were presented in tabular form based on the presentation of the statement of the problem. Data were analyzed and interpreted by stating the label or title of the table, mentioning and analyzing the significant data, and making a generalization based on the concepts of the different authors from the gathered literature or study.

1. What are the lived experiences of futsal athletes during training and competition in terms of exertion and fatigue?

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To provide a deeper understanding of the lived experiences of futsal athletes regarding exertion and fatigue, the narratives of the participants are first presented individually. Narrative inquiry emphasizes the importance of highlighting each participant's story in order to capture how individuals interpret their experiences within specific contexts. The following vignettes illustrate how each athlete described the physical, cognitive, and emotional dimensions of fatigue encountered during training sessions and competitive matches. Pseudonyms were assigned to protect the identity of the participants while allowing their experiences to be presented as unique and meaningful accounts.

Narrative of Participant 1 – "The Endurance Fighter"

Participant 1, referred to as The Endurance Fighter, described fatigue as a constant companion during intense training sessions and competitive matches. He explained that futsal requires repeated sprints, quick directional changes, and sustained effort throughout the game, which often results in heavy legs and muscle soreness. During prolonged matches, he noted that breathing becomes more difficult and maintaining the same level of speed becomes increasingly challenging. Despite these physical limitations, he emphasized that determination and discipline enable him to push through fatigue. For him, fatigue is not merely a physical condition but also a test of mental toughness. He explained that even when exhaustion sets in, the responsibility to contribute to the team motivates him to continue performing at his best. His narrative reflects how endurance and resilience are essential traits in sustaining performance under physically demanding conditions.

Narrative of Participant 2 – "The Tactical Thinker"

Participant 2, referred to as The Tactical Thinker, emphasized the cognitive impact of fatigue during gameplay. He explained that when physical exhaustion accumulates, his reaction time slows down and decision-making becomes more difficult. During intense moments in a match, fatigue sometimes causes hesitation when making passes or defensive movements. He shared that in such situations, he tries to compensate by focusing more on positioning and tactical awareness rather than relying purely on speed or strength. According to him, experience in the sport helps him adjust his gameplay when fatigue occurs. He also noted that maintaining concentration becomes one of the biggest challenges when exhaustion sets in. Despite these difficulties, he described fatigue as something that athletes gradually learn to manage through discipline, awareness, and game intelligence.

Narrative of Participant 3 – "The Resilient Competitor"

Participant 3, referred to as The Resilient Competitor, described fatigue as both a physical and emotional challenge. During matches and training sessions, he frequently experiences muscle soreness and exhaustion, particularly after repeated high-intensity movements. However, what stood out in his narrative was the emotional frustration he feels when fatigue prevents him from performing at the level he expects from himself. At times, he admitted feeling irritated or disappointed when mistakes occur because of exhaustion. Nevertheless, he explained that such experiences also strengthen his determination to improve. Instead of allowing fatigue to discourage him, he uses it as motivation to train harder and become mentally stronger. His narrative illustrates how resilience plays an important role in helping athletes cope with the pressures of competitive sports.

Narrative of Participant 4 – "The Breathless Sprinter"

Participant 4, referred to as The Breathless Sprinter, described how the fast pace of futsal quickly leads to breathlessness and physical exhaustion. He explained that during matches, the continuous transitions between offense and defense require repeated bursts of speed that place heavy demands on the cardiovascular system. As the game progresses, he begins to feel shortness of breath and reduced stamina, making it more difficult to sustain the same level of intensity. Despite these physical challenges, he emphasized the importance of pacing and maintaining focus during the game. By adjusting his movements and conserving energy when possible, he is able to continue contributing effectively to the team.

Narrative of Participant 5 – "The Determined Playmaker"

Participant 5, referred to as The Determined Playmaker, described fatigue as an inevitable part of competitive sports. He explained that intense training sessions often leave his body feeling drained and sore, particularly after long hours of practice. However, he emphasized that fatigue becomes more noticeable during matches where the pressure to perform is higher. In those moments, he sometimes struggles to maintain the same level of coordination and speed. Despite this, he explained that his commitment to the team encourages him to continue pushing through exhaustion. For him, teamwork and responsibility serve as powerful motivators that help him overcome physical limitations during demanding situations.

Narrative of Participant 6 – "The Focused Defender"

Participant 6, referred to as The Focused Defender, described fatigue as something that affects both his physical and mental performance. During long matches, he experiences tired legs and slower movements, which can make defensive actions more difficult. He explained that when exhaustion sets in, maintaining concentration becomes more challenging, especially when reacting quickly to opponents' movements. However, he emphasized that mental focus plays an important role in managing

fatigue. By staying alert and communicating with teammates, he is able to compensate for the effects of exhaustion and continue performing his defensive responsibilities effectively.

Narrative of Participant 7 – "The Persistent Runner"

Participant 7, referred to as The Persistent Runner, described how the repetitive movements involved in futsal lead to accumulated fatigue throughout the game. He explained that sprinting, stopping, and changing directions repeatedly places significant strain on the body. As the match progresses, he begins to feel muscle fatigue and reduced stamina. Despite these challenges, he emphasized that persistence and determination allow him to keep moving and supporting his teammates. For him, endurance and commitment are essential qualities that enable athletes to continue performing even when physical exhaustion becomes overwhelming.

Narrative of Participant 8 – "The Strategic Survivor"

Participant 8, referred to as The Strategic Survivor, explained that fatigue forces him to adapt his playing style during matches. When he begins to feel exhausted, he becomes more strategic in his movements and decisions. Instead of relying solely on speed, he focuses on positioning and anticipating opponents' actions. This adjustment allows him to conserve energy while still contributing effectively to the game. He emphasized that learning to manage fatigue through strategic thinking is an important skill that athletes develop through experience.

Narrative of Participant 9 – "The Competitive Spirit"

Participant 9, referred to as The Competitive Spirit, described fatigue as a challenge that tests his dedication to the sport. During intense matches, he experiences muscle soreness and reduced energy levels, particularly when games extend for long periods. Despite these difficulties, he explained that his passion for the sport motivates him to keep pushing forward. According to him, the desire to win and contribute to the team often outweighs the discomfort caused by fatigue. His narrative reflects how strong motivation and competitive drive enable athletes to persevere through physically demanding situations.

Narrative of Participant 10 – "The Mentally Tough Player"

Participant 10, referred to as The Mentally Tough Player, emphasized the importance of mental strength in coping with fatigue. He explained that physical exhaustion is unavoidable in competitive sports, but maintaining a positive mindset helps him overcome its effects. During difficult moments in matches, he reminds himself to stay focused and continue giving his best effort. For him, mental toughness is what allows athletes to remain resilient even when their bodies begin to feel exhausted.

Narrative of Participant 11 – "The Energy Manager"

Participant 11, referred to as The Energy Manager, described how he consciously regulates his energy during games. He explained that because futsal is physically demanding, it is important to conserve energy and avoid unnecessary movements. By managing his pace and staying aware of his physical condition, he is able to maintain performance even when fatigue begins to appear. His narrative highlights the importance of self-awareness and energy management in sustaining athletic performance.

Narrative of Participant 12 – "The Adaptable Athlete"

Participant 12, referred to as The Adaptable Athlete, described fatigue as a signal that requires adjustment in playing style. When exhaustion occurs, he becomes more cautious and focuses on teamwork rather than individual effort. He explained that communicating with teammates and supporting each other helps reduce the impact of fatigue during matches. For him, adaptability and cooperation are essential for maintaining performance under physically demanding conditions.

Narrative of Participant 13 – "The Resilient Performer"

Participant 13, referred to as The Resilient Performer, described fatigue as something that builds up gradually during tournaments or consecutive training sessions. He explained that when multiple games are played within a short period of time, the body becomes increasingly tired. Despite this, he emphasized that resilience and discipline help athletes continue performing despite accumulated exhaustion.

Narrative of Participant 14 – "The Composed Competitor"

Participant 14, referred to as The Composed Competitor, explained that fatigue often challenges an athlete's ability to remain calm during intense situations. During demanding matches, he sometimes feels physical exhaustion and reduced focus. However, he emphasized the importance of staying composed and maintaining emotional control. By keeping a clear mind, he is able to continue making effective decisions even when tired.

Narrative of Participant 15 – "The Dedicated Athlete"

Participant 15, referred to as The Dedicated Athlete, described fatigue as a normal part of being a competitive athlete. He explained that the physical demands of futsal require constant effort and endurance. During training and matches, he often experiences muscle soreness and exhaustion. Despite these challenges, he emphasized that dedication to the sport motivates him to continue training and improving. For him, overcoming fatigue is part of the journey of becoming a stronger and more disciplined athlete.

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Across the narratives of the participants, several common patterns emerged regarding how futsal athletes experience exertion and fatigue during training and competition. These patterns highlight the multidimensional nature of fatigue, which affects physical capacity, cognitive functioning, emotional responses, and overall performance. Through thematic analysis of the participants' accounts, the researcher identified several recurring themes that describe the lived experiences of futsal athletes. These themes are presented in Table 1.

Table 1. Lived Experiences of Futsal Athletes in Terms of Exertion and Fatigue

Major Theme	Category	Codes	Sample Verbatim Responses	Participants	Interpretation
Multidimensional Fatigue Experience	Physiological Manifestations	Heavy legs, Muscle soreness, Shortness of breath, Cramps	"My legs feel heavy and sore." / "Nakakaranas ako ng kakulangan sa paghinga." / "Extreme muscle fatigue in my legs."	P1–P15	Fatigue is primarily experienced as lower limb exhaustion and cardiovascular strain.
	Cognitive Impairment	Slower reaction time, Poor decision-making, Reduced accuracy	"My reaction time slowed down." / "Maling decision dahil sa pagod." / "It was harder to think clearly."	P3–P15	Physical fatigue directly influences cognitive sharpness and tactical performance.
	Emotional Response	Frustration, Irritability, Determination	"I feel frustrated when I cannot perform well." / "Nababawasan ang focus at motibasyon."	P3, P6, P8–P15	Fatigue generates emotional strain but also competitive drive.
Performance Degradation Under Load	Immediate Performance Effects	Slower sprints, Defensive lapses, Missed passes	"My speed decreased." / "Late defensive reaction."	P6, P8–P15	Acute fatigue reduces speed, explosiveness, and precision.
Accumulated Fatigue Strain	Cumulative Effects	Persistent soreness, Energy depletion, Reduced explosiveness	"Fatigue builds up over consecutive games." / "My body feels constantly tired."	P1, P3, P6–P15	Fatigue intensifies across consecutive training days and tournaments.

After presenting the themes in Table 1, the findings are further interpreted through thematic analysis grounded in the narratives of the participants. The individual stories shared by the futsal athletes revealed recurring patterns that describe how exertion and fatigue are experienced during both training sessions and competitive matches. Although each athlete expressed unique personal experiences, common elements emerged across their accounts. These patterns were organized into three major themes: (1) Multidimensional Fatigue Experience, (2) Performance Degradation Under Load, and (3) Accumulated Fatigue Strain. Together, these themes illustrate the complex and interconnected ways in which fatigue influences athletes' physiological functioning, cognitive processes, emotional responses, and overall performance in collegiate futsal.

Theme 1: Multidimensional Fatigue Experience

This theme captures the complex and multifaceted nature of fatigue experienced by futsal athletes during training and competition. The narratives revealed that fatigue was not perceived merely as a physical condition but as an integrated experience affecting the athletes' bodies, thoughts, and emotions simultaneously. Participants consistently described fatigue as emerging first through physical sensations, which later influenced their mental processing and emotional responses during gameplay.

Several athletes described physiological manifestations of fatigue such as heavy legs, muscle soreness, shortness of breath, and occasional muscle cramps. One participant explained, "My legs feel heavy and sore after intense training sessions," while another noted, "Nakakaranas ako ng kakulangan sa paghinga kapag sunod-sunod ang sprint sa laro." These descriptions reflect the physically demanding nature of futsal, a sport characterized by repeated sprinting, abrupt directional changes, and sustained high-intensity movements. Such physical exertion places considerable strain on the lower extremities and cardiovascular system, leading to progressive muscular fatigue as the match or training session continues.

These experiences align with existing sports science literature that explains fatigue as a result of both peripheral and central mechanisms. Peripheral fatigue occurs when neuromuscular disturbances and metabolic by-products accumulate in the working muscles, while central fatigue involves reduced neural drive from the central nervous system, ultimately affecting voluntary muscle activation. Studies on futsal athletes indicate that neuromuscular fatigue may persist for seventy-two to ninety-six hours following competition, emphasizing the physiological demands of the sport (Souglis et al., 2023; Spyrou et al., 2024).

Beyond physical exhaustion, participants also described cognitive fatigue, which manifested as slower reaction time, difficulty concentrating, and reduced decision-making accuracy during matches. One athlete explained, “It was harder to think clearly and make quick decisions when I was already tired.” In a sport like futsal, where rapid situational awareness and quick tactical decisions are essential, this cognitive impairment can significantly affect gameplay. These findings suggest that fatigue not only limits physical performance but also disrupts mental sharpness and strategic thinking during competitive situations.

Emotional responses likewise formed part of the fatigue experience. Several athletes reported feelings of frustration, irritability, and disappointment when exhaustion prevented them from performing at their expected level. However, the narratives also revealed that fatigue sometimes triggered determination and competitive drive, motivating athletes to continue pushing themselves despite physical limitations. This dual emotional response highlights the psychological dimension of fatigue, where exhaustion can simultaneously challenge athletes while reinforcing their commitment to perform.

Overall, this theme demonstrates that fatigue among futsal athletes is a multidimensional phenomenon, affecting physiological capacity, cognitive processing, and emotional regulation simultaneously. The findings support previous research emphasizing the complex interaction between physical exertion and psychological responses in high-intensity team sports, where fatigue emerges as both a physical state and a psychological experience.

Theme 2: Performance Degradation Under Load

The second theme describes how fatigue directly influences athletic performance during both training sessions and competitive matches. Participants consistently reported noticeable declines in speed, responsiveness, and technical execution as fatigue intensified. These changes were particularly evident during the latter stages of games or during periods of sustained high-intensity activity when athletes were required to maintain repeated bursts of acceleration and defensive transitions.

Several athletes explained that fatigue reduced their sprinting speed and slowed their reactions during defensive plays. One participant shared, “My speed decreased when I started feeling exhausted, and sometimes I reacted late during defense.” Others described how exhaustion affected their passing accuracy and coordination, occasionally resulting in missed opportunities or defensive lapses during critical moments of gameplay.

These experiences reflect the physiological consequences of acute fatigue on explosive performance, particularly in sports requiring repeated high-intensity efforts. In intermittent sports such as futsal, rapid bursts of sprinting and abrupt changes in direction can quickly deplete energy reserves and impair neuromuscular coordination. Previous studies have demonstrated that fatigue significantly reduces sprint capacity, agility, and jump performance following simulated or competitive futsal matches (Moreno-Villanueva et al., 2022).

Beyond physical limitations, athletes also described how fatigue disrupted their ability to maintain tactical awareness and synchronize movements with teammates. As exhaustion intensified, players often simplified their movements or adopted more conservative strategies in order to conserve energy. While such adjustments allowed them to remain engaged in the game, they also indicated that fatigue alters the way athletes approach gameplay and decision-making.

These findings suggest that fatigue does not merely create physical discomfort but directly influences the technical and tactical dimensions of performance. Understanding these limitations is essential for coaches and sports practitioners when designing training programs that balance physical exertion with adequate recovery. Without appropriate load management strategies, fatigue may compromise not only individual performance but also overall team effectiveness.

Theme 3: Accumulated Fatigue Strain

The third theme highlights the cumulative nature of fatigue experienced by futsal athletes across consecutive training sessions and competitive tournaments. Participants described fatigue not as an isolated event but as a progressive accumulation of physical and mental exhaustion that intensified over time.

Athletes frequently reported persistent muscle soreness and declining energy levels during periods of heavy training schedules. One participant remarked, “Fatigue builds up when we have consecutive games and training sessions,” while another explained, “My body feels constantly tired when we have tournaments with multiple matches.” These accounts illustrate how repeated exposure to physically demanding activities without adequate recovery can gradually diminish athletes’ readiness to perform.

This pattern reflects what sports scientists refer to as training monotony and cumulative load, conditions in which repeated physical stress without sufficient recovery leads to prolonged fatigue and decreased performance capacity. Research conducted in futsal training environments has shown that congested competition schedules can significantly increase internal training load and negatively affect athlete wellness markers such as fatigue, soreness, and mood (Chen et al., 2022).

Participants also emphasized that accumulated fatigue influenced not only their physical readiness but also their motivation to train and compete. When recovery time was limited, athletes experienced both physical exhaustion and mental

weariness, which sometimes affected their enthusiasm and overall training quality. These experiences highlight the importance of balancing training demands with sufficient recovery opportunities.

The findings therefore suggest that fatigue management is critical in collegiate sports environments where athletes must simultaneously manage academic responsibilities and athletic commitments. Without structured recovery strategies and effective load monitoring systems, accumulated fatigue may lead to chronic exhaustion, decreased motivation, and reduced athletic efficiency.

Overall, the findings reveal that futsal athletes experience fatigue as a multidimensional phenomenon encompassing physiological strain, cognitive disruption, emotional responses, and cumulative performance effects. These interconnected experiences highlight the importance of implementing structured load monitoring, recovery strategies, and psychological support mechanisms to sustain athlete performance and well-being in collegiate sports environments.

2. How do futsal athletes describe their experiences during the games and training sessions in terms of psychological and physical adaptation strategies?

The lived experiences of futsal athletes revealed that adaptation to exertion and fatigue was not passive but strategic and multidimensional. Athletes actively employed structured physical recovery routines, psychological self-regulation techniques, motivational reinforcement mechanisms, and time management strategies to cope with the cumulative demands of training, competition, and academics. Their narratives illustrated that adaptation was both physiological and psychological, grounded in routine, discipline, and identity. Table 2 presents the major themes derived from their accounts.

Table 2. Psychological and Physical Adaptation Strategies of Futsal Athletes

Major Theme	Category	Codes	Sample Verbatim Responses	Participants	Interpretation
Structured Physical Recovery Practices	Post-Training Recovery Methods	Stretching, Cool-down, Ice application, Hydration, Proper sleep	"I stretch properly and hydrate after training." / "Cold showers and enough sleep help me recover." / "Nag-iice bath kami pagkatapos ng game."	P1–P15	Athletes consistently utilize structured physical recovery strategies to reduce muscle soreness and restore energy.
	Active & Passive Recovery	Light jogging, Foam rolling, Rest days	"Proper cool-down helps avoid body ache."	P4, P6, P8–P15	Recovery is seen as essential in preventing injury and sustaining performance.
	Injury Management	Medical checks, Modified training load	"The school allowed me to rest and reduced training load."	P6, P8–P13	Institutional support reinforces physical adaptation.
Psychological Self-Regulation Mechanisms	Cognitive Coping	Positive self-talk, Goal setting, Focus control	"I tell myself I can push through." / "I break the game into small moments."	P6, P8–P15	Athletes actively regulate internal dialogue to sustain focus under fatigue.
	Emotional Regulation	Stress management, Breathing control	"Breathing techniques calm me down."	P8, P12–P15	Emotional control prevents overwhelm during intense matches.
Motivational Anchors and Identity Reinforcement	Intrinsic Motivation	Competitive drive, Personal goals	"Adrenaline pushes me beyond limits."	P6, P8–P15	Competitive identity fuels psychological endurance.
	Social Support	Coach guidance, Team encouragement, Family support	"My coach and teammates motivate me."	P3, P6, P8–P15	External reinforcement strengthens resilience and persistence.
	Spiritual Coping	Prayer, Faith-based reliance	"I pray for guidance before and during games."	P4–P7	Spiritual belief systems provide psychological stability.
Academic–Athletic Balancing Strategy	Time Management	Scheduling, Prioritization	"Time management is a must as a student-athlete."	P1, P4, P6, P8–P15	Athletes reorganize schedules to manage overlapping demands.

Athletes Theme 1: Structured Physical Recovery Practices

This theme highlights the deliberate recovery routines used by futsal athletes to manage the physical demands of training and competition. Participants consistently described recovery as an essential part of maintaining performance and preventing injury. Rather than waiting for fatigue to subside naturally, athletes reported implementing specific recovery practices after training sessions and matches.

Many athletes mentioned post-training recovery routines such as stretching, hydration, cool-down exercises, and adequate sleep. One participant explained, "I stretch properly and hydrate after training," while another stated, "Cold showers and enough sleep help me recover." Some athletes also mentioned the use of ice baths or cold application as part of their recovery

process. These routines were perceived as necessary for relieving muscle soreness and restoring energy following high-intensity activity.

Participants also described engaging in active recovery practices such as light jogging and foam rolling. These activities were viewed as preventive measures that helped reduce muscle stiffness and prepare the body for the next training session. One athlete explained that performing proper cool-down exercises helped minimize body aches after intense games.

In addition to personal recovery practices, some athletes reported receiving institutional support when managing fatigue or minor injuries. Modified training loads and opportunities for rest were sometimes provided when physical strain became excessive. Such accommodations allowed athletes to recover more effectively while maintaining participation in team activities.

Overall, this theme demonstrates that futsal athletes rely on structured physical recovery practices to restore physical readiness and sustain athletic performance during demanding training schedules.

Theme 2: Psychological Self-Regulation Mechanisms

This theme describes the mental strategies used by athletes to maintain focus, composure, and confidence during physically demanding situations. Participants explained that psychological coping mechanisms were essential in helping them continue performing even when fatigue began to affect their physical abilities.

Several athletes described using positive self-talk to encourage themselves during difficult moments in games or training sessions. One participant shared, “I tell myself I can push through,” emphasizing how internal dialogue helped maintain motivation despite exhaustion. Others described breaking the game into smaller tasks or focusing on immediate actions rather than thinking about the overall fatigue they were experiencing.

Breathing techniques and emotional control were also commonly mentioned. Some athletes explained that controlled breathing helped them remain calm and focused during intense phases of the match. One participant stated that breathing exercises helped reduce pressure and allowed them to regain concentration.

These coping strategies demonstrate that athletes actively regulate their thoughts and emotions to sustain performance under fatigue. By managing stress and maintaining focus, they are able to continue making decisions and executing skills effectively even when physically tired.

Overall, the findings suggest that psychological self-regulation plays an important role in enabling athletes to remain mentally resilient during demanding athletic situations.

Theme 3: Motivational Anchors and Identity Reinforcement

This theme reflects the internal and external sources of motivation that sustain athletes during periods of fatigue. Participants frequently described how their commitment to the sport and their identity as athletes encouraged them to persevere even when they felt physically exhausted.

Intrinsic motivation emerged strongly in the athletes’ narratives. Many participants explained that personal goals and competitive drive pushed them to continue performing despite fatigue. One athlete remarked that the excitement and adrenaline experienced during games helped them go beyond their physical limits.

External support from coaches, teammates, and family members also played an important role in maintaining motivation. Athletes described how encouragement from others strengthened their determination to perform well and contribute to the team. One participant stated that their coach and teammates continuously motivated them during difficult training sessions and matches.

Interestingly, several athletes also mentioned spiritual coping practices such as prayer before or during games. For these participants, faith served as a source of emotional reassurance and confidence during challenging moments in competition.

Overall, this theme demonstrates that motivation and personal identity are powerful factors that help athletes endure fatigue and remain committed to their athletic roles.

Theme 4: Academic–Athletic Balancing Strategy

This theme highlights the strategies used by futsal athletes to balance the dual responsibilities of academic work and athletic participation. Participants emphasized that managing both roles required careful organization, discipline, and effective use of time.

Many athletes explained that time management was essential for fulfilling both academic and athletic responsibilities. One participant noted that being a student-athlete required careful scheduling of study time, training sessions, and personal activities. Prioritizing important tasks and maintaining a structured routine allowed them to complete academic requirements while still participating actively in training and competition.

Athletes also described adjusting their schedules during particularly demanding periods such as examination weeks or tournaments. These adjustments allowed them to maintain academic performance while continuing to fulfill their commitments to the team.

The narratives reveal that adaptation to fatigue extends beyond the physical and psychological aspects of sport. Managing academic responsibilities alongside athletic demands requires additional cognitive effort and organizational skills. By developing effective time management strategies, athletes are able to balance these responsibilities and maintain overall well-being.

Overall, futsal athletes demonstrated a proactive and multidimensional adaptation process in response to exertion and fatigue. Physical recovery routines helped restore the body after intense training and competition, while psychological self-regulation strategies enabled athletes to maintain focus and emotional stability. Motivational factors, including personal goals and social support, strengthened their resilience during physically demanding situations. At the same time, effective time management strategies allowed athletes to balance academic responsibilities with athletic commitments.

These findings suggest that adaptation to fatigue among futsal athletes is not merely a spontaneous reaction but a structured process shaped by personal discipline, psychological coping, and supportive social environments. The combination of physical recovery practices, mental coping strategies, motivational reinforcement, and academic balancing mechanisms provides a comprehensive understanding of how athletes sustain performance in demanding collegiate sports contexts.

3. How do the futsal athletes describe their experiences in terms of exertion and fatigue while maintaining their overall performance and academic responsibilities?

The narratives of futsal athletes revealed that balancing exertion, athletic performance, and academic responsibilities required continuous negotiation between physical strain and cognitive demands. Participants described their experiences as a dual-role challenge where fatigue from training and competition extended into academic spaces, affecting concentration, productivity, and emotional stability. Despite these pressures, athletes demonstrated various adaptive behaviors and coping strategies to sustain both academic engagement and athletic performance. Table 3 presents the major themes that emerged from the participants' narratives.

Table 3. Experiences of Futsal Athletes in Balancing Exertion, Performance, and Academic Responsibilities

Major Theme	Category	Codes	Sample Verbatim Responses	Participants	Interpretation
Dual-Role Strain (Athlete–Student Conflict)	Academic Spillover Effects	Sleepiness in class, Reduced concentration, Mental fog	"I feel sleepy during lectures after evening training." / "Fatigue reduces my concentration in class."	P1, P3–P15	Fatigue from training directly interferes with classroom attentiveness and academic functioning.
	Energy Depletion	Low stamina for study, Reduced productivity	"It makes it harder to complete assignments."	P6, P8–P15	Physical exhaustion limits cognitive endurance for academic tasks.
Performance Preservation Under Fatigue	Maintaining Competitive Output	Pushing beyond limits, Playing despite exhaustion	"I kept sprinting even when I was already tired."	P6, P8–P15	Athletes attempt to preserve performance despite physiological strain.
	Tactical Adjustment	Slower pace, Defensive prioritization	"I chose to defend instead of attacking because I lacked energy."	P1, P6, P8–P15	Athletes modify gameplay strategies when fatigue becomes limiting.
Time and Energy Redistribution	Time Management	Scheduling, Prioritization of tasks	"Time management is a must as a student-athlete."	P1, P4, P6, P8–P15	Strategic scheduling is used to reduce academic-performance conflict.
	Academic Planning	Finishing tasks earlier, Adjusting study time	"Heavy training motivates me to finish schoolwork earlier."	P1, P8–P15	Some athletes proactively reorganize academic workload.
Psychological Endurance and Identity	Role Commitment	Determination to fulfill both roles	"Even when tired, I continue because the team depends on me."	P6, P8–P15	Strong athletic identity sustains effort despite fatigue.
	Stress and Pressure	Academic deadlines vs. match schedules	"The biggest challenge is meeting deadlines while training."	P8–P15	Competing demands heighten psychological pressure.

The Lived Strain: Exertion, Fatigue, And Well-Being in College Athletes

Theme 1: Dual-Role Strain (Athlete–Student Conflict)

This theme reflects the tension experienced by futsal athletes as they attempted to balance the physical demands of sport with the cognitive and academic expectations of being a university student. Participants frequently described how fatigue accumulated during training sessions and competitions and subsequently affected their academic functioning.

Several athletes reported experiencing sleepiness, reduced concentration, and mental fatigue during lectures following evening training sessions. One participant shared:

"I feel sleepy during lectures after evening training because my body is still tired." (Participant 03)

Similarly, another athlete noted:

"Fatigue reduces my concentration in class. Sometimes it feels like my mind is slow when I try to follow the discussion." (Participant 07)

These accounts illustrate how physical exhaustion extended beyond the training environment and affected cognitive engagement within academic settings. Participants also described how energy depletion limited their ability to complete academic tasks effectively. One athlete explained:

"After training, I feel too drained to study. It becomes harder to complete assignments or review lessons." (Participant 08)

These narratives highlight the spillover effect of physical fatigue into academic functioning. Previous research supports this observation, noting that insufficient recovery and disrupted sleep patterns among student-athletes can impair attention, memory, and learning performance (Wilson, 2025; Putra et al., 2023). The findings suggest that the demands of collegiate sports create overlapping physical and cognitive pressures that contribute to dual-role strain among student-athletes.

Theme 2: Performance Preservation Under Fatigue

Despite experiencing fatigue, futsal athletes described deliberate efforts to maintain competitive performance during games and training sessions. This theme captures the athletes' persistence in sustaining athletic output despite physiological strain.

Participants frequently described pushing themselves beyond their physical limits during gameplay. One athlete stated:

"I kept sprinting even when I was already tired because the team needed me to keep up the pressure." (Participant 06)

Such statements illustrate how athletes consciously override feelings of exhaustion in order to maintain performance expectations. However, when fatigue intensified, athletes also described modifying their gameplay strategies to conserve energy. For example, one participant explained:

"When I feel very tired, I slow my pace and focus more on defense instead of attacking." (Participant 01)

These tactical adjustments indicate that athletes engage in adaptive decision-making under conditions of fatigue. Sports science literature suggests that athletes often regulate their pacing strategies to manage energy expenditure while sustaining performance during high-intensity sports (Spyrou et al., 2024). The findings therefore demonstrate that performance preservation among futsal athletes involves both physical endurance and strategic gameplay adjustments.

Theme 3: Time and Energy Redistribution

Another theme that emerged from the narratives was the use of time management strategies to cope with overlapping academic and athletic responsibilities. Participants emphasized that careful scheduling and prioritization were essential in managing the demands of training, competitions, and academic tasks.

One participant explained:

"Time management is a must as a student-athlete. If I don't plan my schedule, everything becomes overwhelming." (Participant 04)

Similarly, another athlete shared:

"Because training takes a lot of time, I try to finish my schoolwork earlier before practice." (Participant 08)

These accounts demonstrate how athletes actively reorganized their schedules in order to minimize conflict between academic obligations and sports participation. Research on dual-career athletes indicates that structured time management is a key coping strategy that helps athletes balance competing responsibilities and reduce stress (Gjaka et al., 2024).

Interestingly, some athletes viewed the discipline developed through sports training as beneficial to their academic routines. By applying the same level of discipline used in training to their academic tasks, participants were able to maintain productivity despite demanding schedules.

Theme 4: Psychological Endurance and Athlete Identity

The final theme reflects the psychological commitment and identity that motivated athletes to persist despite fatigue and competing responsibilities. Participants frequently described a strong sense of responsibility to their team and personal determination to fulfill both academic and athletic roles.

One participant stated:

"Even when I'm tired, I continue because the team depends on me." (Participant 09)

Another athlete expressed the pressure of managing both roles:

"The biggest challenge is meeting academic deadlines while also preparing for matches." (Participant 11)

These statements reveal the emotional and psychological pressures associated with being both a student and an athlete. However, they also highlight the role of personal commitment and team identity in sustaining motivation. According to Self-Determination Theory, athletes who experience strong feelings of competence, autonomy, and relatedness are more likely to sustain motivation despite fatigue and stress (Vilks, 2025).

Nevertheless, the coexistence of academic pressure and athletic expectations can heighten psychological strain. Previous research indicates that student-athletes navigating dual-career demands are more vulnerable to burnout when adequate support systems are absent (Lin et al., 2021; Woods, 2025).

Overall, the lived experiences of futsal athletes demonstrate that balancing exertion, athletic performance, and academic responsibilities requires continuous adaptation and resilience. Fatigue often extends beyond the playing field into academic spaces, influencing concentration, productivity, and emotional well-being. At the same time, athletes employ strategies such as tactical adjustment, time management, and psychological commitment to maintain both roles.

These findings highlight the complex interplay between physiological strain, academic expectations, and psychological endurance in collegiate sports. The results underscore the importance of institutional support systems, recovery management strategies, and academic coordination policies to help student-athletes sustain both athletic performance and academic success.

4. Based on the study's results, what training enhancement framework can be proposed to address issues related to perceived exertion and fatigue among futsal athletes?

The findings of the study revealed that perceived exertion and fatigue among futsal athletes are multidimensional experiences that influence physiological performance, cognitive functioning, emotional regulation, and academic engagement. Across SOP 1 to SOP 3, the results consistently demonstrated patterns of cumulative fatigue, reduced explosiveness, cognitive slowing, emotional strain, sleep disturbance, and the dual-role tension associated with balancing athletic and academic responsibilities. Although athletes employed coping mechanisms such as time management, tactical adjustments, and psychological perseverance, their narratives highlighted the absence of a structured and integrated system for fatigue management and long-term performance sustainability.

Grounded in the lived experiences of the participants and supported by contemporary literature on load monitoring, recovery science, and dual-career athlete development, the researcher developed the Integrated Fatigue Management and Performance Sustainability Framework. This framework adopts a holistic approach that integrates physiological monitoring, structured recovery protocols, psychological conditioning, academic–athletic coordination, and institutional support systems to enhance both athletic performance and overall well-being among collegiate futsal athletes.

The conceptual relationship between the study findings and the proposed framework is illustrated in Figure 2, which follows a narrative inquiry progression from lived experiences to thematic findings and ultimately to framework development.

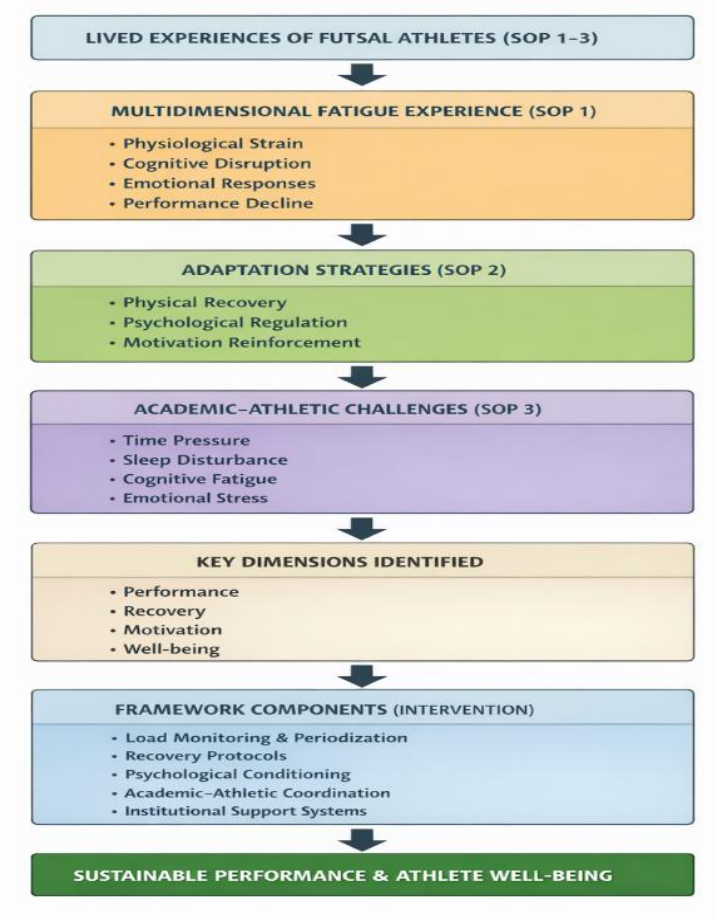


Figure 2. Conceptual Model of Integrated Fatigue Management and Performance Sustainability Framework

The conceptual model presented in Figure 2 illustrates the alignment between the study's findings and the proposed training enhancement framework, following a narrative inquiry progression grounded in the lived experiences of futsal athletes.

The model begins with the lived experiences of futsal athletes (SOP 1–3), which serve as the primary foundation of the inquiry. These experiences reflect the realities of training and competition under sustained physical, cognitive, and emotional demands.

Central to the model is the representation of multidimensional fatigue (SOP 1), which encompasses physiological strain, cognitive disruption, emotional responses, and performance decline. These components emphasize that fatigue is a complex and interconnected phenomenon affecting multiple dimensions of athlete functioning.

Through thematic analysis, these lived experiences were organized into key themes, including multidimensional fatigue experience, adaptation strategies, and academic–athletic challenges. In SOP 2, athletes described adaptation strategies such as physical recovery practices, psychological self-regulation, and motivation reinforcement, which enable them to sustain effort and cope with fatigue. In SOP 3, the findings revealed the challenges of dual-role demands, including time pressure, sleep disturbance, cognitive fatigue, and emotional stress resulting from balancing academic and athletic responsibilities.

From these thematic findings, key dimensions were identified, particularly in relation to performance, recovery, motivation, and overall well-being. These dimensions represent the core domains affected by fatigue and serve as the basis for targeted intervention.

Drawing from these interconnected dimensions, the model advances toward the development of the framework components, which represent the intervention layer of the study. These include load monitoring and periodization, structured recovery protocols, psychological conditioning strategies, academic–athletic coordination, and strengthened institutional support systems.

Finally, the model leads to the outcome of sustainable athletic performance and enhanced athlete well-being, demonstrating that the proposed framework is firmly grounded in the authentic lived experiences and thematic findings of collegiate futsal athletes.

To further operationalize the proposed framework, Table 4 presents the detailed components of the Integrated Fatigue Management and Performance Sustainability Framework. The elements outlined in this table are directly derived from the conceptual progression illustrated in Figure 2. The components outlined in this table are directly derived from the conceptual

progression illustrated in Figure 2. Specifically, the key dimensions identified from the athletes' lived experiences—performance, recovery, motivation, and well-being—served as the foundation for the development of the framework components. These dimensions informed the inclusion of load monitoring and periodization, structured recovery protocols, psychological conditioning, academic–athletic coordination, and institutional support systems. Thus, Table 4 provides the practical translation of the conceptual model into implementable strategies for managing perceived exertion and fatigue among futsal athletes. In this regard, Figure 2 provides the conceptual foundation, while Table 4 translates these insights into structured, implementable interventions.

Table 4. Proposed Training Enhancement Framework for Managing Perceived Exertion and Fatigue

Framework Component	Identified Issue (From Findings)	Proposed Strategy	Specific Interventions	Expected Outcome
1. Load Monitoring and Periodization	Cumulative fatigue, reduced explosiveness, performance decline	Structured monitoring of training intensity and recovery cycles	• Session RPE tracking • Planned rest days • Tournament load adjustment • Substitution planning	Reduced accumulated fatigue and improved performance sustainability
2. Integrated Recovery Protocol	Muscle soreness, heavy legs, sleep disturbance	Standardized recovery system after training and matches	• Mandatory cool-down routines • Stretching protocol • Hydration plan • Sleep hygiene education • Ice and compression therapy	Faster recovery and lower injury risk
3. Cognitive and Psychological Conditioning	Slower reaction time, poor decision-making, emotional frustration	Mental skills training integrated into practice	• Breathing exercises • Positive self-talk workshops • Focus drills • Stress management sessions	Improved cognitive resilience under fatigue
4. Academic–Athletic Coordination System	Academic concentration decline, time conflict	Structured coordination between coaches and academic units	• Flexible training schedules during exam weeks • Academic monitoring support • Time management seminars	Reduced dual-role strain and improved balance
5. Social and Institutional Support Reinforcement	Emotional pressure, minor overuse injuries	Strengthened support ecosystem	• Access to trainer/medical staff • Regular wellness check-ins • Team mentoring system	Enhanced psychological safety and physical protection
6. Fatigue Awareness and Education Program	Normalization of overexertion	Athlete education on fatigue signals and recovery science	• Workshops on recognizing early fatigue signs • Injury prevention education • Self-monitoring logs	Increased athlete self-regulation and injury prevention

The components of the proposed framework were directly derived from the thematic findings presented in SOP 1 to SOP 3. Each intervention area corresponds to a specific pattern of fatigue experience, coping behavior, or dual-role challenge identified in the participants' narratives.

The Load Monitoring and Periodization component addresses the cumulative fatigue and performance decline reported by athletes during consecutive training sessions and tournaments. Participants described persistent soreness and reduced explosiveness, which are consistent with research highlighting the importance of structured internal load monitoring using session Rating of Perceived Exertion (sRPE) and recovery cycles (Inoue et al., 2022; Chen et al., 2022). By implementing systematic load monitoring, institutions can prevent excessive training monotony and physiological strain.

The Integrated Recovery Protocol component responds to the physiological manifestations identified in SOP 1, including muscle soreness, heavy legs, and sleep disturbances. Evidence suggests that structured recovery interventions such as hydration, sleep optimization, stretching routines, and compression therapy can accelerate neuromuscular recovery and reduce injury risk (Souglis et al., 2023; Li et al., 2024; Wilson, 2025).

The Cognitive and Psychological Conditioning component addresses the mental fatigue and emotional frustration experienced by athletes during high-intensity competition. Participants reported slower reaction time and reduced decision-making accuracy under fatigue. Research indicates that breathing regulation, mindfulness-based interventions, and cognitive reframing techniques can enhance psychological resilience and improve performance under pressure (Sun et al., 2024; Cao et al., 2024).

The Academic–Athletic Coordination System component emerged from the findings of SOP 3, where athletes described sleepiness during lectures, difficulty meeting academic deadlines, and time conflicts between training and coursework. Dual-career literature emphasizes the importance of coordinated academic and athletic schedules in preventing burnout and supporting student-athlete well-being (Gjaka et al., 2024; Wilson, 2025).

The Social and Institutional Support Reinforcement component reflects the role of coaches, teammates, and institutional resources in mitigating fatigue-related stress. Previous studies highlight that supportive environments and regular wellness monitoring can reduce psychological pressure and enhance athlete resilience (Vilks, 2025; Woods, 2025).

Finally, the Fatigue Awareness and Education Program addresses the tendency of athletes to normalize overexertion and continue training despite exhaustion. Educational interventions that promote awareness of fatigue signals and recovery science empower athletes to practice self-regulation and injury prevention, aligning with holistic athlete development frameworks (Knight et al., 2022; Gabbett et al., 2023).

Overall, the proposed Training Enhancement Framework integrates the empirical findings of the study with contemporary sports science principles to create a proactive and comprehensive fatigue management system. The framework recognizes that perceived exertion and fatigue are not merely physiological outcomes of training but complex experiences shaped by workload, psychological adaptation, academic responsibilities, and institutional context.

By integrating load monitoring, recovery protocols, psychological conditioning, academic coordination, and institutional support systems, the framework promotes sustainable performance, injury prevention, and holistic athlete development within the collegiate futsal environment. Ultimately, this approach transforms fatigue management from a reactive process into a proactive, integrated, and athlete-centered system designed to support long-term collegiate athlete success.

This chapter presents the summary, conclusions, and recommendations derived from the study on futsal athletes' lived experiences of perceived exertion and fatigue. The findings are organized according to the research questions and highlight fatigue experiences, adaptation strategies, dual-role challenges, and their effects on performance and well-being. Based on these results, recommendations are proposed to strengthen load management, recovery practices, academic–athletic coordination, and institutional support through the Integrated Fatigue Management and Performance Sustainability Framework.

1. The study shows that futsal athletes experienced multidimensional fatigue during training and competition, manifested through physiological strain such as heavy legs, muscle soreness, and shortness of breath, alongside cognitive impairment and emotional responses including slowed reaction time, frustration, and determination.
2. Results reveal that athletes employed both physical and psychological adaptation strategies to manage exertion. These included structured recovery practices such as stretching, hydration, sleep optimization, and load modification, as well as cognitive coping mechanisms such as positive self-talk, breathing control, goal setting, and reliance on social and spiritual support systems.
3. The findings indicate that fatigue extended beyond athletic performance and affected academic functioning. Athletes reported sleepiness in class, reduced concentration, and lower productivity, while simultaneously attempting to preserve performance through tactical adjustments, time management strategies, and strong role commitment as student-athletes.
4. The study further shows the need for a structured and integrated training enhancement framework to address cumulative fatigue, dual-role strain, and performance sustainability. Key components identified include load monitoring and periodization, integrated recovery protocols, psychological conditioning, academic–athletic coordination systems, strengthened institutional support, and fatigue awareness education.

Based on the major findings of the study, the following conclusions were drawn:

1. Futsal athletes experience fatigue as a multidimensional condition that encompasses physiological exhaustion, cognitive disruption, and emotional fluctuation. Exertion in training and competition extends beyond muscular strain and significantly influences mental sharpness, decision-making, and emotional regulation.
2. Athletes actively engage in structured physical and psychological adaptation strategies to manage fatigue. Recovery routines, cognitive coping mechanisms, and social support systems serve as protective factors that sustain performance and resilience under demanding athletic conditions.
3. The dual role of being both athlete and student intensifies the effects of fatigue. Training-related exhaustion spills over into academic responsibilities, affecting concentration and productivity; however, strong role commitment, time management, and tactical adjustments enable athletes to preserve both performance and academic standing.
4. Sustainable athletic performance and well-being require an integrated and institutionally supported approach to fatigue management. The Training Enhancement Framework for Fatigue Management and Performance Sustainability, which integrates load monitoring, recovery science, psychological conditioning, academic–athletic coordination, and institutional support systems, provides a structured and holistic approach to addressing cumulative fatigue and promoting long-term performance sustainability among collegiate futsal athletes.

Based on the conclusions drawn from the study, the following recommendations are proposed to enhance fatigue management, performance sustainability, and overall well-being among collegiate futsal athletes:

1. Coaches and sports program administrators may implement a structured load monitoring and periodization system to regulate training intensity and prevent cumulative fatigue. The use of session Rating of Perceived Exertion (sRPE), planned recovery cycles, and strategic substitution during tournaments can help sustain athlete performance and reduce overtraining risk.
2. The university may institutionalize an integrated recovery protocol that includes mandatory cool-down routines, stretching programs, hydration planning, sleep hygiene education, and access to basic recovery modalities such as ice therapy and compression strategies to accelerate physical restoration and reduce injury incidence.
3. Psychological conditioning programs may be incorporated into regular training sessions to strengthen cognitive resilience and emotional regulation. Workshops on positive self-talk, breathing techniques, stress management, and focus control can help athletes maintain decision-making efficiency under fatigue.

4. Academic and athletic units may strengthen coordination mechanisms to reduce dual-role strain among student-athletes. Flexible scheduling during examination periods, academic monitoring support, and structured time management seminars can assist athletes in balancing performance demands with academic responsibilities.
5. The university may reinforce institutional support systems by ensuring access to medical personnel, regular wellness assessments, and mentorship structures that promote psychological safety and early detection of fatigue-related concerns.
6. A fatigue awareness and education program may be developed to enhance athletes' understanding of recovery science, early signs of overexertion, and self-monitoring practices. Empowering athletes with knowledge promotes self-regulation, injury prevention, and long-term performance sustainability.
7. Future research may explore longitudinal evaluation of the proposed Integrated Fatigue Management and Performance Sustainability Framework to assess its effectiveness in improving athlete well-being, academic performance, and competitive outcomes across collegiate sports contexts.

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