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The Implementation and Effectiveness of Recovery Methods in a cohort of South African semi-professional Football Players during pre-season Training: A Case Study

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Abstract

This case study aimed to assess the efficacy of various training methods during the pre-season training of semi-professional football players. The demanding nature of football training places significant strain on players' psychophysiological practices, leading to fatigue. To mitigate fatigue and prevent overtraining, monitoring tools for training loads and recovery interventions are essential. A descriptive cohort case study design, using questionnaires for data collection, applied to 23 football players. The players were observed and evaluated to determine the most preferred recovery methods and monitor psychophysiological fatigue using the well-being questionnaire and Borg's category ratio scale (CR-10) during pre-season training. Recovery interventions tested included active recovery, cold water immersion, and stretching. Analysis revealed that players' well-being consistently fell below baseline levels ($p<0.05$) according to the well-being questionnaire. Additionally, the CR-10 indicated high perceived training loads among players, with no significant difference observed between the highest and lowest perceived loads ($p>0.05$). The effectiveness of the recovery interventions appeared limited, as baseline wellness scores were not achieved. Nonetheless, the high acute training loads experienced during pre-season training may serve as a stimulus for adaptations. Semi-professional players may benefit from tailored combinations of recovery methods following training sessions or games.

Keywords: Soccer, Pre-Season Training, Recovery Methods, Fatigue.

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A. Background of Study

Methods of recovery encompass a spectrum of approaches aimed at restoring the human body to its typical psychological and physiological equilibrium, referred to as homeostasis, within a specific timeframe after training sessions (Kellmann et al., 2018). These techniques have demonstrated effectiveness in alleviating both psychological and physiological fatigue (Hausswirth & Mujika, 2013), a crucial concern in modern sports where athletes frequently endure intense training regimens that can impact their ability to sustain peak performance during competition (Knicker et al., 2012). Insufficient recovery between strenuous activities may result in overtraining or injury, underscoring the significance of efficient recovery methods for athletes, as optimal muscle function amidst fatigue often distinguishes winners from losers (Dakić et al., 2023).

Fatigue indicates the decline in muscle force production and cognitive performance stemming from both acute and chronic training loads (Taylor et al., 2012; Bourdon et al., 2017). Acute loads involve daily high-intensity sessions, while chronic loads reflect the cumulative impact of these sessions over time (Kellmann et al., 2018; McLean et al., 2010; Bourdon et al., 2017). In semi-professional football leagues, which span from 5 to 8 months with weekly matches, striking a balance between appropriate training loads and recovery methods to prevent overtraining poses a challenge (Thorpe et al., 2015). Timely detection of overtraining symptoms is vital, and self-perceived monitoring tools may aid in tracking fatigue levels in team sports (McLean et al., 2010).

Ensuring the correct application of recovery methods is paramount in season planning, as players who recover effectively and swiftly attain homeostasis are more likely to deliver exceptional performances throughout the season (Dal Monte et al., 2002; Knicker et al., 2012). Thus, efficient recovery methods expedite the process of achieving homeostasis and staving off fatigue in athletes (Kellmann et al., 2018; Knicker et al., 2012). However, the challenge lies in selecting suitable and effective methods for each player, considering numerous variables such as individual preferences and the nature of training sessions, which may influence efficacy (Weiss et al., 2017).

To attain adequate homeostasis, employing multiple recovery methods may be necessary. Venter, (2012) advocate for a variety of recovery modalities in team sports environments to address individual differences comprehensively, encompassing various physiological and psychological aspects. These methods may

include hydrotherapy, passive and active recovery, physical manipulation techniques (such as sports massage and foam rolling), stretching, nutrition, imagery, compression garments, sleep, and electrostimulation.

Hydrotherapy, also known as aquatic therapy or water therapy, utilizes water for rehabilitative purposes. Methods like hot (HWI) or cold-water immersion (CWI) are commonly employed (Kurniawan & Sifaq, 2018). CWI, in particular, is considered more effective, alongside aquatic exercises and water massage (Kurniawan & Sifaq, 2018). Sports massage, involving passive manipulation to prevent or reduce sports injuries, has shown effectiveness in minimizing muscle fatigue (Fitrah Mubarak et al., 2023). Adequate sleep, crucial for both psychological and physiological recovery, plays a fundamental role. Sleep deprivation can impede processes like muscle glycogen repletion, muscle damage repair, cognitive function, and increase mental fatigue (Nédélec et al., 2015).

This study aimed to evaluate the efficacy of recovery strategies employed among a cohort of semi-professional football players during periods of intensified training. Findings revealed gaps in the implemented strategies, potentially impacting performance capabilities in subsequent seasons. Assessing the quality of recovery experienced by players is essential, as it allows coaching staff to refine strategies and enhance player recovery during pre-season training and throughout the competitive season.

B. Research Methodology

Participants

A group of 23 players, with 87% being within their initial five years of playing semi-professional football. Informed consent was obtained from all participants. The inclusion criteria specified that participants must be active, registered, and competing football club members who were free from injuries and utilized at least one of the selected post-training recovery methods.

The research protocol was approved by the Institutions Research Ethics Committee (REC-01-114-2017), and the study adhered to the ethical principles outlined in the Declaration of Helsinki.

Procedures

The study utilized a descriptive cohort case study design to examine a group of 28 football players. Quantitative methods were employed, and data collection primarily relied on various questionnaires, including a demographic and well-being questionnaire.

Data collection instruments comprised the WB-Q, CR-10 scale, and demographic questionnaires for both participant groups.

The WB-Q assessed players' perceived well-being before each training session, while the CR-10 gauged perceived workloads during sessions. Demographic questionnaires captured age, playing positions, and recovery preferences. Administered at study onset, demographic questionnaires were completed one-time, while the CR-10 was completed post-training and the WB-Q pre-training sessions. This process spanned over one week, including four training sessions.

Data Analysis

The data underwent statistical analysis utilizing the Statistical Package for Social Sciences (SPSS-PC) software (version 25.0). Descriptive statistical methods, employing frequency tables, were utilized to determine the duration of players' involvement in professional football, their positions, and their preferred and non-preferred recovery methods. The Friedman Test was employed to compare WB-Q and CR-10 baseline scores with pre- and post-training session scores provided by participants. Additionally, a one-way ANOVA test was conducted to compare each category with their respective baseline scores. A confidence level of 95% was applied, with statistical significance defined as a p-value < 0.05.

C. Result and Discussion

Demographic Information of Players

A total of n=23 players completed the questionnaire. The majority (n=18) had less than five years of experience in professional football, with only three players having over five years of experience. The most prevalent positions within the team were attacking (n=3) and defending (n=2) midfielders, followed by defenders, including goalkeepers, with only two players being strikers. Among the players, the most favoured recovery method was sleep (n=17), followed by CWI (n=14) and passive stretching or sports massage (n=3). The least preferred methods were HWI (n=3) and active recovery (n=2).

Well-being Questionnaire (WB-Q) Scores

These scores reflect the subjective impact and efficacy of the recovery methods chosen by players during the study. The baseline score, recorded on the first day of pre-season, had a mean of 20 (±2.28). Subsequently, all post-training scores demonstrated a decline in wellness scores, with values of 18.8 (±2.53) ($p<0.05$) on three different preseason training days, labelled as WB-Q (1), WB-Q (2), and WB-Q (3) respectively. Specifically, the scores were 19.5 (±2.92) ($p<0.05$) for WB-Q (1), 19.4 (±2.81) ($p<0.05$) for WB-Q (2), and 19.4 (±2.81) ($p<0.05$) for WB-Q (3). WB-

Q (1) deviated the furthest from the baseline, indicating the perceived ineffectiveness of the recovery methods. Figure 1 illustrates the individual categories and their contributions to the overall well-being scores. These findings demonstrate the subjective efficacy of the applied recovery methods on fatigue markers, including perceived fatigue, sleep quality, DOMS, stress levels, and overall mood.

Internal load (CR-10) scores.

The mean scores reflected the internal load perceived by players during various preseason training sessions in the study. Borg's Category Ratio Scale, also referred to as the CR-10 Scale, is a subjective rating system used to gauge perceived exertion or subjective intensity levels during physical activity. It comprises numerical ratings from 0 to 10, where 0 signifies no exertion and 10 indicates maximum exertion. Participants select a number on the scale corresponding to how hard they feel they are working during the activity.

In the initial preseason training session, denoted as CR-10 (1), 34.8% of participants rated the session as a seven on the CR-10 scale, categorizing it as somewhat "hard." One team member perceived it as "very hard," while 30% found it "moderate." The rest of the players viewed it as "somewhat hard" (17.4%), with a few considering it "very-very easy" (8.7%).

During CR-10 (2) in the subsequent training session, two players found the session "hard," while several others perceived it as "somewhat hard." The majority (56.5%) regarded it as "moderate," followed by "easy" (13%), "very-very easy" (4.3%), and one player felt no effort was required, choosing "nothing at all."

In the third session, denoted CR-10 (3), 52% of players viewed it as "moderate," with five finding it "easy," three selecting "very-very easy," and only two suggesting no effort was necessary.

The Friedman test compared rank scores, indicating subjective training load and volume across the three preseason days. CR-10 (1) had the highest perceived training load (2.46), significantly more than CR-10 (3) (1.54) ($p>0.05$). There was a notable difference in subjective training volume between CR-10 (1) and CR-10 (2), with scores of 2.37 and 1.78, respectively ($p<0.05$).

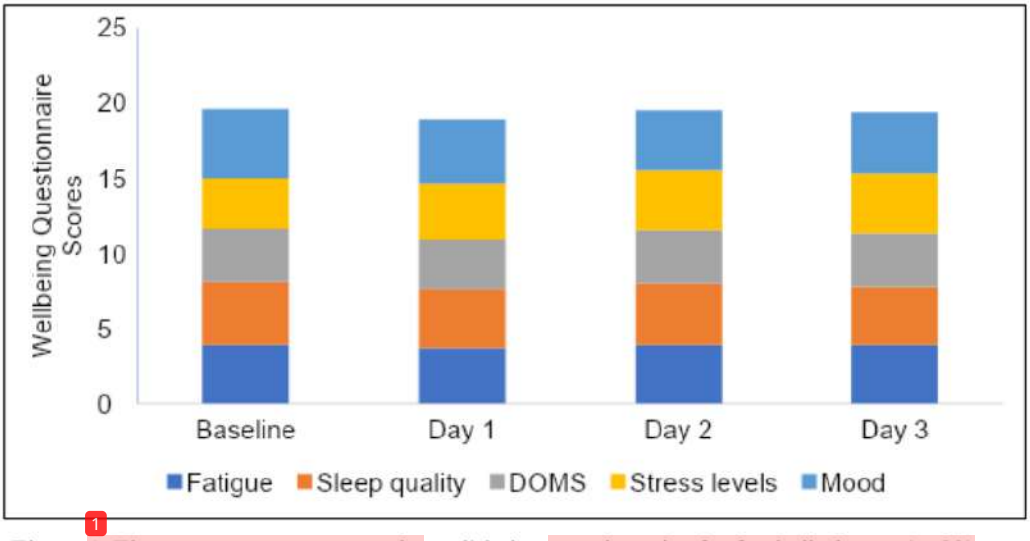

Figure 1. The category responses to the well-being questionnaire for football players (n=23) during a three-day pre-season training load

D. Discussion

The importance of recovery in sports cannot be overstated, as it facilitates training adaptation and supercompensation, leading to enhanced performance while preventing fatigue and overtraining-related issues. This study aimed to evaluate various recovery methods in football players using two questionnaires (WB-Q and CR-10). Results showed that sleep and cold-water immersion (CWI) were the most favoured methods, while active recovery and imagery were the least preferred. Despite some methods not meeting expectations according to the WB-Q, certain scores did reach or exceed baseline levels. The study also suggested that training load and volume might have influenced players' perceptions of recovery efficacy. Inconsistent application of recovery protocols by both players and coaching staff, along with a lack of understanding and guidance, could have affected results. Specific protocols for methods like CWI and nutrition were not consistently followed, which could have impacted their effectiveness. Coaching staff preferences leaned towards CWI and nutrition, while compression garments and passive recovery were least favoured.

Player Demographics

The study analysed demographic factors that could affect football players' perceived recovery efficacy. Most players were within their first five professional years, suggesting youth, which typically correlates with faster recovery. However, older players might have been more knowledgeable about recovery methods,

impacting their perceptions. Due to a small sample size, players weren't divided by position, resulting in uniform training despite varied positional demands. Player preferences leaned towards sleep and cold-water immersion (CWI) for recovery, likely influenced by effectiveness and media portrayal. Less favoured methods included active recovery, imagery, compression garments, and electromyostimulation, possibly due to lack of awareness or exposure. Coaches were responsible for implementing recovery strategies, evaluated using monitoring tools like the WB-Q. This study highlights the importance of aligning recovery methods with player preferences and coaching strategies for optimal effectiveness.

Well-being Questionnaires

The WB-Q, a self-assessment tool, was employed to evaluate recovery methods among football players, measuring parameters like fatigue, sleep quality, muscle soreness, stress, and mood. Initially, players exhibited good health and preparedness for pre-season. However, as training progressed, well-being declined, indicating ineffective recovery methods. Despite this, the study suggests that individualized or additional recovery methods might be necessary, considering factors like player preference and resource limitations. Time constraints during data collection were noted, but the WB-Q facilitated efficient monitoring. Comparisons with scientific tests bolstered the tool's credibility. Thus, the WB-Q could aid coaching staff in maintaining player performance throughout the season.

Players' perceived exertions – Borg Scale Scores

The CR-10 monitoring tool was utilized to assess the acute training load in pre-season, offering insight into players' perceived effort during training sessions. It allowed players to subjectively reflect on their psychophysiological experiences, encompassing factors like mental fatigue, stress, and motivation (Coyne et al., 2018). Findings revealed varying perceptions among players within the same session, highlighting individual differences in response to training stimuli (Kellmann et al., 2018).

These differences could stem from various factors, including varying fitness levels post off-season, differing motivation levels, and positional specificity within the team. Additionally, the CR-10 was used to gauge the impact of training load on recovery strategies, indicating a potential link between subjective training load and player well-being (McLean et al., 2010; Bahnert, Norton, & Lock, 2013; Buckner et

al., 2017). The data suggested that tailoring recovery methods to match training intensity could be crucial for effective recovery. Days with higher training intensity and volume correlated with decreased well-being, indicating potential shortcomings in recovery strategies (McLean et al., 2010; Bahnert, Norton, & Lock, 2013; Buckner et al., 2017)

Implementing more recovery strategies and self-monitoring tools could aid in optimizing recovery processes and mitigating risks of overtraining, ultimately safeguarding player welfare and performance.

Limitations

A significant limitation is that this investigation, in the form of a case study, was performed at a single club and used a single team of 23 players. As a result, no inferences can be made across the sport or recovery modalities. Additionally, data collection during the pre-season may not allow nuances from in-season demands to be quantified. Finally, the internal load measure (CR-10) may not have been sensitive to account for factors, such as mental fatigue, mood, stress, and general muscle soreness, which may have influenced the study. Although the WB-Q addressed these factors, the inclusion of more sensitive tools such as biomarkers of muscle damage (cortisol and testosterone) and physical performances (force plate jumps) may be necessary for a more holistic view of the athlete's state of recovery.

E. Conclusions

Choosing appropriate recovery strategies to enhance performance and prevent overtraining among football players is a multifaceted endeavour. It involves considering factors such as individual preferences for recovery methods and finding the right balance between training intensity and recovery efforts to yield optimal results.

Research by Crowther et al. (2017) indicates that players are keenly attuned to how they feel following the implementation of various recovery techniques, often selecting methods based on their perceived effectiveness. This underscores the players' awareness of the impact that chosen recovery strategies can have on their performance levels.

Furthermore, the study highlights that high subjective training loads can adversely affect perceived recovery levels, suggesting a need for further investigation into the interplay between acute training loads and the effectiveness of recovery interventions. This could provide valuable insights for both players and coaches in devising tailored recovery strategies for footballers,

ultimately maximizing their performance potential.

Practical implications

The recommendations from this study were drawn from the application of incorrect protocols within the observed player cohort. None of the recovery method recommendations were adhered to, potentially serving as a significant factor influencing the study's outcomes. Specifically, it is crucial for Cold Water Immersion (CWI) to be conducted under controlled water temperature conditions and for a specific duration to achieve effectiveness. However, during the study, CWI was administered without temperature regulation or measurement by the coaching staff, and players did not adhere to the recommended duration in the bath.

Moving forward, researchers and trainers should meticulously consider the impact of acute training loads on recovery and performance, particularly in the context of short to medium duration competitions. The potential for overtraining should be carefully assessed, especially in team sports, where it can significantly impact performance and player well-being. In addition to implementing recommended recovery protocols, ongoing monitoring and adjustment of training regimes may be necessary to optimize player recovery and overall team performance.

F. Acknowledgments

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G. Conflict of Interest

The authors declare no conflict of interest.

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