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A REVIEW ON SLEEP AND TRAVEL FATIGUE ON MATCH PERFORMANCE IN FOOTBALL: IMPACT OF CIRCADIAN RHYTHM DISRUPTION AND JET LAG

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ABSTRACT
The present study investigates the effects of sleep and travel fatigue on football match performance, with a focus on the disruptions caused by circadian rhythm misalignment and jet lag. Football teams regularly travel across time zones for international competitions, exposing athletes to circadian rhythm disruptions that can impair their performance. A systematic review of 20 studies published between 2000 and 2017 was conducted, examining the relationship between sleep quality, travel-induced fatigue, and football performance outcomes. The results indicate that poor sleep quality and the associated fatigue due to long-distance travel significantly affect match performance, with athletes experiencing reduced reaction times, decreased endurance, and impaired decision-making abilities. Furthermore, jet lag and circadian rhythm disruption were found to negatively influence physiological markers such as heart rate variability and muscle recovery. These findings underscore the importance of managing sleep and recovery protocols for football players, particularly during international travel, to optimize performance.

KEYWORDS*: Sleep, Travel Fatigue, Jet Lag, Circadian Rhythm Disruption, Football Performance, Athlete Recovery, Sports Physiology*

INTRODUCTION

Football is one of the most physically demanding sports, with athletes often required to compete under varying environmental conditions. One of the less understood aspects of athletic performance is the impact of travel fatigue, particularly related to sleep disturbances and circadian rhythm disruptions, such as those caused by jet lag. Football players, especially those competing internationally, frequently travel across multiple time zones, leading to misalignments in their internal body clock (circadian rhythm). This misalignment can have detrimental effects on various physiological and cognitive processes that are critical for match performance. (Noakes et al. 2012) fatigue develops faster than the actual physical workload, acting as a protective mechanism to prevent bodily harm, a role that would be compromised in the absence of sufficient sensitivity. The muscular fatigue reflects a deeper depletion of the nervous system. Today, it is widely recognized that fatigue is largely an emotional experience, forming part of a sophisticated system designed to safeguard the body. Barte (2017) Fatigue is likely to occur during a soccer match due to the sport's demanding combination of aerobic and anaerobic activity. Nevertheless, the extent of fatigue that players experience throughout a match is not frequently documented.

Sleep plays a central role in recovery, cognitive function, and physical performance, and disruptions due to travel or poor sleep quality can exacerbate fatigue and impair decision-making, reaction time, and endurance (Fullagar et al. 2014). (Daurat et al., 2000) The concept of jet lag, characterized by the mismatch between the body's internal time and the external time zone, has been well-documented in aviation, but its implications for sports performance have not been comprehensively explored. Choy & Salbu (2011) The severity of symptoms experienced by travelers following air travel is influenced by various factors, including the number of time zones crossed, the direction of travel, and the timing of flights. Additionally, individual variability significantly affects both the capacity to adapt to a new time zone and the duration of symptom manifestation. Symptoms commonly arise after traversing at least two time zones and may include sleep disturbances, daytime fatigue, diminished cognitive and physical performance, reduced alertness, and headaches. Although sleep-related issues generally resolve within a few days, they may persist for up to a week when the time zone shift exceeds eight hours, Melool (2016). This study seeks to systematically review existing research on the impacts of sleep deprivation and circadian rhythm disruption on football performance, highlighting practical solutions for mitigating the effects of travel-induced fatigue.

MATERIALS AND METHODS

Literature Search and Selection

A comprehensive systematic review was conducted using databases such as PubMed, Scopus, Web of Science, and Google Scholar. The search was limited to articles published between January 2000 and January 2017. Keywords included: "sleep," "travel fatigue," "jet lag," "circadian rhythm disruption," "football," "match performance," and "athlete recovery." A total of 20 studies were selected that met the following inclusion criteria:

Studies examining football athletes or similar team sports
Research focusing on the effects of travel fatigue, sleep quality, or circadian rhythm disruption on performance
Studies that reported on physiological and performance outcomes
Peer-reviewed articles published in English

Inclusion and Exclusion Criteria

Inclusion Criteria:

Studies involving professional or semi-professional football players
Research focusing on sleep disturbances, circadian rhythm misalignment, and jet lag
Studies reporting on performance outcomes such as reaction time, endurance, strength, or decision-making
Full-text, peer-reviewed articles published in high-impact journals

Exclusion Criteria:

Non-football athletes or sports unrelated to football
Articles published before 2000
Non-peer-reviewed publications

Data Extraction and Quality Assessment

Two independent reviewers conducted data extraction, focusing on study design, sample size, participant demographics, outcome measures (e.g., performance tests, physiological markers), and key findings. The quality of the studies was assessed using the Newcastle-Ottawa Scale for non-randomized studies, which evaluates the selection, comparability, and outcome of each study.

Table 1: Selection using Newcastle-Ottawa Scale

Study (Author, Year)	Selection (0–4)	Comparability (0–2)	Outcome (0–3)	Total Score (0–9)	Quality Rating
Brownstein et al. (2017)	4	1	3	8	High
Fullagar et al. (2016)	3	1	3	7	High
Fullagar et al. (2014)	3	1	3	7	High
Jäger et al. (2017)	4	1	3	8	High
Reilly et al. (2007)	3	2	3	8	High
Richmond et al. (2007)	4	2	3	9	High
Souissi et al. (2013)	4	1	2	7	High
Smith et al. (2015)	4	2	3	9	High
Fowler et al. (2017)	3	1	3	7	High
Drust et al. (2005)	3	2	2	7	High
Barger et al. (2004)	3	2	2	7	High
Baehr et al. (2000)	3	2	2	7	High
Melool, S. (2016).	2	1	2	5	Moderate
Choy & Salbu (2011)	2	2	2	6	Moderate
Arendt (2009)	2	1	2	5	Moderate
Goel et al. (2013)	2	1	2	5	Moderate
Smith et al. (2013)	2	2	2	6	Moderate

(Source: Author Compilation)

To evaluate the methodological quality of the studies included in this systematic review, the Newcastle-Ottawa Scale (NOS) was utilized. The NOS is a validated tool designed to assess the quality of non-randomized studies, particularly in the domains of Selection (maximum 4 points), Comparability (maximum 2 points), and Outcome (maximum 3 points), for a total possible score of 9 points. Each study was independently reviewed and scored by two researchers. Discrepancies in scoring were resolved through discussion and consensus. Based on the total NOS score, studies were categorized as high quality (7–9 points), moderate quality (5–6 points), or low quality (below 5 points). Out of the 17 representative studies presented in Table 1, 12 were rated as high quality, 5 as moderate quality. Common strengths among high-quality studies included robust participant selection processes, clear outcome measures, and appropriate control for confounding variables. In contrast, lower-scoring studies often lacks detailed reporting on participant selection or comparability between groups.

RESULTS AND DISCUSSION

Impact of Sleep and Travel Fatigue on Football Performance

Several studies have demonstrated that sleep plays a crucial role in recovery and performance Shona et.al. (2017); Geol et al. (2013). Fatigue induced by sleep deprivation, especially following long-distance travel across multiple time zones, can result in significant declines in athletic performance. The most common effects reported were reduced endurance, impaired cognitive function, slower reaction times, and decreased accuracy in decision-making.

Flower et al. (2003) Long haul travel fatigue results from prolonged immobility, disrupted sleep, dehydration, cabin pressure, and circadian rhythm misalignment. Unlike jet lag, which primarily affects the body's internal clock, travel fatigue encompasses general tiredness, irritability, reduced concentration, and muscle stiffness. Athletes and frequent flyers may experience impaired physical and cognitive performance. Recovery varies by individual but typically requires rest, hydration, light exercise, and time to readjust to the local schedule. Managing travel fatigue is crucial for maintaining health and performance, particularly in competitive sports. Lee et al. (2012) football players who underwent a long-haul flight (more than 6 hours) and experienced significant sleep disruption were found to have a 15-20% decrease in endurance performance during matches. The study also reported that players showed signs of cognitive impairment, as evidenced by slower reaction times and poor decision-making under pressure. Similarly, research by Souissi et al. (2008) confirmed that the impact of jet lag, combined with inadequate sleep, can lead to decreases in muscle strength and stamina, which are critical to football performance.

Notable Findings on Sleep and Performance

- Players experiencing sleep disruption had a slower recovery rate post-match, with decreased muscle repair and elevated levels of cortisol.

• Reaction times in football players traveling across time zones were slower by up to 30% when sleep was impaired. (Jäger at al. 2017)
• Performance in tactical decision-making (e.g., positioning, passing decisions) was notably poorer in fatigued players.

Circadian Rhythm Disruption and Jet Lag

Circadian rhythm disruption is a critical factor influencing travel fatigue, as the body's internal clock is misaligned with the external environment during long-distance travel. In the context of football, this misalignment can result in disturbances in sleep patterns, leading to reduced recovery time and fatigue during competition (Drust et al. 2005; Barger et al. 2004; Baehr et. al. 2000). Jet lag symptoms, such as disrupted sleep-wake cycles, fatigue, and mood disturbances, are commonly reported by athletes, with varying severity depending on the number of time zones crossed.

Studies suggest that the severity of jet lag and its impact on performance is related to the direction of travel. Eastward travel (e.g., from Europe to Asia) typically leads to more significant disruption, as the body has to advance its circadian rhythm, which is harder than delaying it (westward travel). Richmond et al. (2007) highlighted that football teams traveling eastward showed a decrease in sprint performance and a reduction in passing accuracy on the first day after arrival. This was especially evident in players who did not undergo a proper acclimatization period or had insufficient sleep post-travel.

Findings on Jet Lag and Circadian Disruption

• Eastward travel leads to greater circadian disruption and more pronounced jet lag symptoms.
• Players who failed to adjust their sleep schedules before traveling exhibited poorer performance outcomes, including slower sprints and more errors in passing and positioning.
• The effects of jet lag lasted up to 48 hours post-arrival, with performance deficits more severe in the initial 24 hours after arrival.

Interventions to Mitigate the Effects of Sleep and Travel Fatigue

Given the significant impact of sleep and travel-induced fatigue on football performance, several interventions have been proposed to mitigate these effects. These include:

1. **Pre-Travel Sleep Adjustment**: Gradually adjusting the sleep-wake cycle before travel to better align with the destination's time zone has been shown to reduce jet lag symptoms and improve performance.
2. **Light Exposure**: Controlled exposure to bright light during the day upon arrival in a new time zone helps reset the circadian rhythm and reduces jet lag symptoms.
3. **Recovery Protocols**: Enhanced recovery strategies, including hydration, nutrition, and active recovery exercises, are crucial for maintaining performance levels.
4. **Napping**: Short naps (20-30 minutes) during the day can reduce fatigue and enhance alertness, without disrupting the natural sleep-wake cycle.
5. **Sleep Hygiene Practices**: Optimizing sleep quality through environmental factors (e.g., darkness, cool temperatures) and behavioral strategies (e.g., avoiding caffeine and screens before bedtime) can aid in improving recovery and performance.

CONCLUSION

This study emphasises the significant effects of sleep disturbances and travel fatigue on football performance, particularly in relation to circadian rhythm disruption and jet lag. Sleep deprivation, coupled with long-haul travel across time zones, impairs key performance indicators such as endurance, reaction times, decision-making, and tactical execution. These findings highlight the necessity for football teams and athletes to incorporate strategic sleep management and recovery protocols, particularly during international travel. Future research should focus on longitudinal studies to better understand the long-term impacts of travel fatigue on performance and the effectiveness of different interventions in mitigating these effects.

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