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Nutritional Status and Sleep Quality as Predictors of Work Fatigue among Shift Workers in Indonesian Convenience Stores: A Cross-Sectional Study

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Abstract

Work fatigue is a common challenge faced by retail employees, especially those working long shifts in 24-hour convenience stores. This study explored how individual factors—such as age, sex, nutritional status, sleep quality, and length of employment—relate to work fatigue among 50 Indomaret and Alfamart employees in Gajahmungkur District, Semarang, Indonesia. Using questionnaires and the Spearman rank correlation test, the study found that poor sleep quality and abnormal nutritional status (underweight or overweight) were significantly associated with higher fatigue levels ($p < 0.001$). Sleep quality showed the strongest correlation ($r = -0.539$), highlighting its critical role. Meanwhile, age, sex, and length of employment were not significantly related to fatigue. These findings suggest that personal health factors—especially sleep and nutrition—may play a more pivotal role in fatigue than demographic or work-related variables. Interventions to improve sleep hygiene and promote balanced nutrition could be effective strategies to reduce fatigue in this often-overlooked workforce.

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Introduction

In line with Government Regulation No. 88 of 2019 concerning Occupational Health, every worker has the right to health protection and occupational safety. One of the health risks that often goes unnoticed is work fatigue. The International Labour Organization (ILO) emphasizes that fatigue is a critical factor in workplace accidents and productivity loss, as it impairs concentration, decision-making, and physical performance. Fatigue emerges when physical and mental exertion exceeds the body's ability to recover, often caused by prolonged shifts, heavy workloads, or insufficient rest periods.

Research on occupational fatigue has been widely conducted in various sectors, including transportation, manufacturing, and healthcare, with consistent evidence linking fatigue to accidents, absenteeism, and reduced job performance (Åkerstedt et al., 2017; Dawson et al., 2019). However, studies in the retail sector—particularly among minimarket employees—remain limited despite their distinct working conditions. Minimarkets operate for extended hours, often late into the night or continuously for 24 hours. Employees are required to manage multiple roles simultaneously, such as handling cash transactions, stocking inventory, assisting customers, maintaining cleanliness, and meeting managerial targets. These diverse and repetitive demands, compounded by restricted rest opportunities, place workers at heightened risk of both physical and mental fatigue.

International evidence also highlights that fatigue is not only shaped by workload and shift duration, but also by lifestyle factors such as nutrition and sleep quality. Poor dietary habits and irregular meal patterns, which are common among retail workers due to long working hours, have been associated with increased fatigue and decreased cognitive function (Smith & Rogers, 2014; Tanaka et al., 2021). Similarly, inadequate sleep duration and disrupted circadian rhythms are recognized as major predictors of occupational fatigue across industries (Van Dongen et al., 2011; Lo et al., 2016). Yet, despite the growing body of global literature on fatigue, few studies have specifically integrated these dimensions into

the context of retail workers in developing countries, where long shifts, limited rest, and minimal attention to workers' nutritional and sleep needs are prevalent.

Given these gaps, this study seeks to examine the level of work fatigue among minimarket employees using the Subjective Self-Rating Test (SSRT) and to identify associated demographic, occupational, nutritional, and sleep-related factors. By addressing an underexplored occupational group, the findings are expected to provide critical insights for employers and policymakers to design fatigue mitigation strategies that are both context-sensitive and sustainable.

Methods

2.1 Study Design and Setting

This research employed a quantitative analytical method with a cross-sectional study design. The study was conducted in April 2024 at several minimarkets located in X District, Y City, Indonesia. These minimarkets are part of nationally recognized retail chains, operating between 16 to 24 hours per day.

2.2 Population and Sample

The study population included all employees working at minimarkets in X District. A purposive sampling technique was employed to select participants who met the following inclusion criteria: (1) active employees with a minimum of six months of working experience, (2) aged between 18 and 45 years, and (3) willing to participate in the study. Employees who were on leave or had been diagnosed with a medical condition affecting fatigue levels were excluded. A total of 50 respondents participated in the study.

2.3 Data Collection

Data were collected using a structured questionnaire and direct anthropometric measurements. The instrument consisted of three parts:

- **Part I: Sociodemographic and occupational characteristics**
  This section included age, gender, educational background, working hours, shift patterns, length of service, and workload.
- **Part II: Anthropometric and nutritional data**
  Anthropometric measurements included body weight (kg) and height (cm), obtained using calibrated digital scales and stadiometers. Body Mass Index (BMI) was then calculated as weight (kg) divided by height squared (m^2). BMI was categorized according to World Health Organization (WHO) standards: underweight (<18.5 kg/m^2), normal (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), and obese (≥30 kg/m^2). Nutritional intake was assessed using a semi-quantitative Food Frequency Questionnaire (FFQ) focusing on the frequency of consumption of major food groups (carbohydrates, proteins, fruits, vegetables, and sugar-sweetened beverages) within the past week. Dietary patterns were further classified into "adequate" and "inadequate" based on national dietary guidelines and daily energy adequacy recommendations.
- **Part III: Work fatigue assessment**
  The Subjective Self Rating Test (SSRT), a validated tool developed by Japan's Industrial Fatigue Research Committee, was used to assess fatigue. The SSRT consists of 30 items covering physical, mental, and motivational aspects of fatigue, with responses classifying workers into five fatigue levels: (1) Not Fatigued, (2) Mild Fatigue, (3) Moderate Fatigue, (4) Severe Fatigue, and (5) Very Severe Fatigue.

All respondents completed the questionnaires and underwent anthropometric measurements during work breaks, with supervision from the research team to ensure accuracy and completeness.

2.4 Data Analysis

Data were analyzed using **SPSS**. Descriptive statistics were used to describe the demographic profile and fatigue levels of respondents. Bivariate analysis was conducted using the **Chi-square test** to determine the association between independent variables (e.g., working hours, workload, length of service) and the dependent variable (fatigue level). A significance level of $\mathbf{p < 0.05}$ was used.

Results

3.1 Sociodemographic and Occupational Characteristics

A total of 50 minimarket employees participated in the study. Table 1 presents the demographic and occupational characteristics of respondents. The majority of respondents were female (70%) and aged between 18–25 years (54%). Most participants had completed high school (78%) and had worked for less than 1 year (60%). A large proportion (66%) worked more than 8 hours per day, and 76% were assigned rotating shifts.

Table 1. Respondent Characteristics (n = 50)

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	15	30
	Female	35	70
Age (years)	18–25	27	54
	26–35	19	38
	36–45	4	8
Education	High School	39	78
	Diploma	6	12
	Bachelor's Degree	5	10
Work Tenure	< 1 year	30	60
	1–3 years	13	26
	> 3 years	7	14
Working Hours/Day	≤ 8 hours	17	34
	> 8 hours	33	66
Shift Pattern	Fixed Shift	12	24
	Rotating Shift	38	76

3.2 Fatigue Level Among Respondents

Based on the SSRT results, the majority of employees experienced **moderate to severe levels of fatigue**. Specifically, 20% of respondents were classified as experiencing mild fatigue, 48% moderate fatigue, 26% severe fatigue, and 6% very severe fatigue. No respondents were classified as "not fatigued."

Figure 1. Distribution of Respondents by Fatigue Level (Not Fatigued = 0%, Mild = 20%, Moderate = 48%, Severe = 26%, Very Severe = 6%)

3.3 Bivariate Analysis

The bivariate analysis showed statistically significant associations between fatigue level and several variables (Table 2). Working hours (p = 0.001), shift pattern (p = 0.012), and work tenure (p = 0.021) were significantly associated with fatigue level. Gender and education level showed no significant relationship (p > 0.05).

Table 2. Association Between Respondent Characteristics and Fatigue Level

Variable	p-value	Interpretation
Gender	0.354	Not significant
Age	0.077	Not significant
Education Level	0.487	Not significant
Work Tenure	0.021	Significant
Working Hours	0.001	Highly significant
Shift Pattern	0.012	Significant

Discussion

This study aimed to analyze the prevalence and factors associated with work-related fatigue among minimarket employees. The findings indicate that fatigue is a significant occupational health concern, with 80% of participants reporting moderate to very severe fatigue. This section discusses the implications of these findings in the context of existing literature.

4.1 Prevalence of Fatigue

The high prevalence of fatigue in this study aligns with findings from recent research on retail and service sector workers, which highlight fatigue as a widespread problem due to long working hours, physical demands, and irregular schedules (Han et al., 2022). The absence of respondents in the "not fatigued" category is concerning, suggesting that work conditions in minimarkets may consistently exceed the physical or mental thresholds conducive to sustained performance.

The high prevalence of fatigue among minimarket workers reflects a broader issue echoed in recent studies on the retail and service sectors, which highlight fatigue as a widespread problem caused by long working hours, physical demands, and irregular schedules. A particularly alarming finding is that none of the respondents in the study reported being "not tired," suggesting that the working conditions in minimarkets consistently exceed the physical and mental limits needed to maintain sustainable performance. Retail workers often endure night shifts, prolonged standing, repetitive tasks, and high-pressure multitasking — all with minimal opportunities for recovery. According to the CDC's National Institute for Occupational Safety and Health (NIOSH, 2023), this type of fatigue not only impairs focus and

reaction time but also raises the risk of workplace accidents, contributes to poor mood and mental stress, and leads to serious health concerns. Further research from BMC Public Health (2021) reveals that unpredictable schedules disrupt workers' biological rhythms, resulting in chronic sleep deprivation and increased emotional and physical strain. These conditions contribute to lower job satisfaction, reduced productivity, and higher turnover rates. In this context, fatigue among minimarket workers is not merely an individual issue — it is a structural problem that calls for meaningful intervention. Solutions include limiting excessive work hours, stabilizing shift schedules, providing fatigue management training, and implementing regular health monitoring. Through these efforts, employers and policymakers can move closer to fulfilling the right to occupational health and safety as outlined in Indonesia's Government Regulation No. 88 of 2019.

4.2 Working Hours and Fatigue

The study found a statistically significant relationship between working more than 8 hours per day and higher fatigue levels ($p = 0.001$). Prolonged working hours are known to disrupt circadian rhythms, reduce sleep duration, and impair cognitive and physical functioning (Wong et al., 2020). A meta-analysis by Virtanen et al. (2018) confirmed that long working hours increase the risk of fatigue, burnout, and depressive symptoms, particularly in service-based sectors where emotional labor is required.

This study found a statistically significant association between working more than 8 hours per day and elevated levels of fatigue ($p = 0.001$). This result aligns with numerous studies that have consistently shown the negative effects of prolonged working hours on both physical and mental well-being. Long hours disrupt the circadian rhythm, shorten sleep duration, and impair cognitive functions such as attention, memory, and decision-making (Wong et al., 2020). These physiological and neurological disruptions accumulate over time, leading to chronic fatigue and burnout, particularly when recovery periods are insufficient.

A meta-analysis by Virtanen et al. (2018) confirmed that long working hours significantly increase the risk of fatigue, emotional exhaustion, and depressive symptoms—especially in service-based sectors that require high emotional labor. Workers in retail, for example, are expected to maintain high levels of social engagement and responsiveness despite physical and mental fatigue, placing them at even greater risk of burnout.

Further supporting evidence comes from a joint WHO/ILO report, which found that working more than 55 hours per week is associated with a substantial increase in the risk of stroke and ischemic heart disease (World Health Organization & International Labour Organization, 2021). More recent studies suggest that irregular and extended work schedules also contribute to metabolic disorders, chronic stress, and sleep disturbances (Lee et al., 2024). These findings emphasize that working long hours is not merely a labor issue, but a pressing public health concern.

Therefore, this study contributes to a growing body of evidence advocating for regulated working hours, consistent scheduling, and rest policies that prioritize workers' recovery and well-being. Ensuring humane work conditions is not only vital for individual health but also for maintaining long-term organizational productivity and resilience.

4.3 Shift Work and Fatigue

Shift patterns were also significantly associated with fatigue ($p = 0.012$). Employees working rotating shifts experienced higher fatigue levels compared to those on fixed shifts. This is consistent with evidence that shift work, especially when it involves night shifts or frequent rotations, impairs sleep quality and recovery, leading to cumulative fatigue (Zhao et al., 2019). Moreover, the lack of schedule predictability in rotating shifts may interfere with social life and mental well-being, further compounding the fatigue risk (Booker et al., 2021).

The association between shift patterns and worker fatigue goes beyond a simple schedule—it reflects a deeper health and well-being concern. In this study, employees on rotating shifts reported significantly higher fatigue levels than those on fixed schedules ($p = 0.012$). This finding aligns with a robust body of contemporary research highlighting the physiological and psychological toll of shift work, particularly when schedules change frequently or include night shifts.

Rotating shift work disrupts the body's circadian rhythm—our internal clock that regulates sleep, hormone release, and energy cycles—which leads to poorer sleep quality, reduced alertness, and cumulative fatigue. For instance, a 2024 clinical trial among healthcare workers showed that rotational night shifts were linked to sleep deprivation that significantly lowered both physical and mental quality-of-life scores . Additionally, a systematic review found that nurses working three-shift rotations had markedly less recovery between shifts than those on two-shift systems, contributing to chronic exhaustion and impaired functioning .

The mental and social consequences of rotating shifts are equally concerning. Workers must constantly adapt to new schedules, disrupting family routines, social life, and emotional balance. One

review reported that this unpredictability precedes exhaustion, social withdrawal, irritability, stress, depression, and family conflict . A 2024 Nature study further showed that night and rotating shifts are strongly correlated with anxiety, stress, depression, and poorer social relationships—problems notably less common among day-shift workers.

These challenges also extend into chronic health conditions. Ongoing exposure to rotating night shifts—particularly more than eight nights per month—has been linked to insomnia, worsening fatigue, and elevated depressive symptoms. When sleep is compromised, mental recovery is hindered, creating a feedback loop that magnifies fatigue and reduces overall well-being.

In summary, rotating shift work doesn't just make employees tired—it alters their biological rhythms, impairs emotional health, and disrupts their social lives. Addressing this issue requires thoughtful scheduling—such as limiting consecutive night shifts, providing longer recovery periods, and incorporating worker chronotypes into planning. These measures help restore balance and protect both the health of workers and the sustainability of organizations.

4.4 Work Tenure and Fatigue

Significant associations were found between shorter work tenure and higher fatigue levels ($p = 0.021$). Employees with less than one year of experience reported higher levels of fatigue, possibly due to lack of acclimatization to job demands, lower physical conditioning, or unfamiliarity with task routines. Newer employees may also experience stress from learning responsibilities and adapting to organizational culture (Takahashi et al., 2021). These findings underscore the importance of structured onboarding and support for new hires in retail environments.

4.5 Age, Gender, and Education

In contrast, gender, age, and education level were not significantly associated with fatigue. This result is in line with a study by van Hooff et al. (2020), which reported that work characteristics and organizational factors play a larger role in determining fatigue than individual demographics. It suggests that interventions should focus more on improving job design and scheduling practices rather than targeting demographic subgroups.

4.6 Implications for Occupational Health

These findings have practical implications for improving workplace health in the retail sector. Employers should consider implementing policies that limit excessive overtime, provide adequate rest breaks, and offer more consistent scheduling to reduce fatigue risk. Fatigue management training and employee wellness programs may also help mitigate the impact of occupational fatigue (Barker & Nussbaum, 2019). Regular fatigue risk assessments using tools like SSRT should be integrated into workplace health surveillance to identify high-risk groups and guide interventions.

Conclusion

This study confirms that work-related fatigue is a prevalent and pressing issue among minimarket employees, with 80% of respondents experiencing moderate to very high levels of fatigue. Working hours, shift patterns, and length of employment were significantly associated with fatigue levels, whereas demographic factors such as age, gender, and education showed no significant relationship. These findings underscore the importance of addressing organizational and environmental determinants of fatigue rather than relying solely on individual characteristics.

To mitigate fatigue and its consequences for productivity, safety, and employee well-being, several recommendations can be made:

1. **Work Hour Regulation**
   Employers should limit working hours to a maximum of 8 hours per day and provide legally mandated rest breaks, particularly for employees working late or double shifts. For policymakers, these findings highlight the need to strengthen labor regulations specific to the retail sector, which currently receives less attention compared to manufacturing or transportation.
2. **Shift Scheduling**
   Retail companies should adopt fair and predictable scheduling systems that reduce the frequency of night shifts and allow adequate recovery time. Policymakers could consider issuing technical guidelines on healthy shift rotations, drawing on evidence-based models used in healthcare and transportation industries.
3. **Fatigue Awareness and Health Promotion**
   Fatigue management training should be integrated into occupational health programs, covering sleep hygiene, nutrition, and stress management. At the policy level, collaboration with the Ministry of Health could support the development of sector-wide campaigns on healthy lifestyle practices for retail workers.
4. **Support for New and Young Employees**

Structured orientation and mentoring systems are needed to help new employees adapt to the demands of long and irregular shifts. Policymakers could encourage companies to implement mandatory induction programs that include modules on occupational health and fatigue prevention.

5. **Monitoring and Evaluation**
   Employers should regularly assess fatigue levels using validated tools such as the SSRT and include the results in occupational safety reports. Policymakers may mandate the integration of fatigue monitoring into national occupational health reporting systems, ensuring that fatigue is treated as a measurable workplace hazard.

Future Research Directions

While this study provides important cross-sectional evidence, further research is needed to deepen understanding of fatigue in the retail sector. Future studies should:

- Conduct **longitudinal research** to track the cumulative effects of shift work, workload, and lifestyle factors on fatigue and health outcomes.
- Evaluate the **effectiveness of specific interventions**, such as regulated shift rotation, nutritional support programs (e.g., provision of healthy meals), and sleep hygiene training, in reducing fatigue.
- Compare **fatigue levels across different retail formats** (e.g., minimarkets, supermarkets, e-commerce logistics) to identify sector-specific risks.
- Investigate the **economic costs of fatigue** (e.g., absenteeism, turnover, reduced productivity) to strengthen the business case for implementing fatigue management policies.

By combining workplace-level initiatives with policy interventions, both employers and regulators can play a proactive role in protecting retail employees—who are often overlooked despite facing unique occupational health challenges.

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