



The Relationship between Macronutrient Intake and Nutritional Status with Employees Fatigue Levels in Hospital Catering Industry

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Abstract. A common issue in the workplace is fatigue. One of the causes is inadequate nutritional intake. This study examined the relationship between macronutrient intake and nutritional status, as well as work fatigue, in industry catering in a hospital. The study was conducted with a sample of 63 employees using a cross-sectional design. Data were collected through a 2x24-hour food recall questionnaire, weight and height measurements, and a fatigue scale (JIFRC). The results showed that 60.3% of employees experienced mild fatigue, and 42.9% had normal nutritional status. From the results of the correlation test, it was found that there was no significant relationship between nutritional status and energy, protein, and carbohydrate intake with fatigue, but there was a significant relationship between carbohydrate intake and fatigue levels. Marked by a value of $p = 0.201$ for nutritional status and fatigue, and $p = 0.107$ macronutrient intake related to fatigue (energy), $p = 0.149$ (protein), $p = 0.342$ (fat), and $p = 0.017$ (carbohydrate). Thus, maintaining adequate and quality carbohydrate intake can help reduce the risk of fatigue during work. It is recommended to choose complex carbohydrate sources such as brown rice, oatmeal, fruits or vegetables, which provide more stable and long-lasting energy than simple carbohydrates.

Keywords: Macronutrient intake, Nutritional status, Work fatigue.

1 Introduction

Work fatigue is a state of feeling tired, exhausted, or sleepy resulting from prolonged mental, physical, and anxious work, exposure to a harsh environment, or lack of sleep [1]. Employee fatigue leads to poorer outcomes, poorer performance, and increased risk of injury [2]. Taken data from the Indonesian Ministry of Manpower (KEMNAKER) during January-August 2024, there were 279,000 cases of work accidents [3]. Factors contributing to work fatigue are very complex and diverse, including individual characteristics of workers and external factors originating from the work environment itself [4]. Several studies have identified a correlation between individual characteristics such as nutritional status and nutritional intake with the level of fatigue experienced by workers [5, 6]. In addition, external factors such as workload, length of work, and sleep

quality also play an important role in influencing the level of work fatigue [4]. "Based on preliminary observations of catering employees in two hospital locations in this study, only 40% of the 10 selected employees had normal nutritional status. Some employees complained of fatigue while working (often yawning, body and leg aches), and some worked more than 8 hours a day due to overtime. This has an impact on the decline in the quality of work, such as substandard cooking and errors in providing patient diets. Findings from the observation indicate that symptoms of fatigue are felt among employees, especially during peak working hours. Unfortunately, quantitative data that objectively examines the relationship between nutritional factors and fatigue is still lacking. Therefore, this study aims to provide scientific evidence regarding the relationship between adequate macronutrient intake, nutritional status, and levels of work fatigue in hospital catering employees in two different places.

2 Methods

This study was an analytical observational study with a cross-sectional design. Data collection was carried out by measuring height and weight to calculate Body Mass Index (BMI). Furthermore, 2x24-hour food recall method was applied on weekdays and holidays to collect information on the adequacy of nutrient intake. In addition, the level of work fatigue was measured by asking respondents to fill out a questionnaire developed by the Japanese Industrial Fatigue Research Committee (JIFRC) [7, 8]. Questionnaire consists of 30 questions covering physical, mental, and motivational fatigue symptoms. Based on the total score obtained, the level of fatigue can be classified into three categories: mild fatigue (score 30-52), moderate fatigue (score 53-75), and severe fatigue (76-98). This questionnaire was chosen because it has been proven to have validity and reliability in assessing fatigue caused by work in industrial environments. This instrument is considered very appropriate to the characteristics of work at PT Paradise Seera Abadi, because it includes questions about physical, mental, and motivational fatigue, so it is suitable to describe the overall fatigue condition. This research was conducted from August to September 2024 in the hospital catering work environment in two different places. The sample in this study was taken using the total sampling method, involving all hospital catering employees who work in both installations, with a total of 63 people. Descriptive statistics were used to summarize participant characteristics, nutritional intake, nutritional status, and fatigue levels. Statistical analysis was then performed using the Spearman rank correlation test to examine the relationship between nutritional adequacy, BMI, and work fatigue levels. A p value <0.05 was considered statistically significant. All analyses were performed using Jamovi version 2.3.28. This study has obtained permission and ethical approval from the Health Research Ethics Committee of Binawan University, with approval number: 192/KEPK-UBN/IX/2024.

3 Result

3.1 Descriptive exploration

The results of this descriptive exploration are in the form of levels of work fatigue, nutritional status, and adequacy of energy, protein, fat, and carbohydrate intake.

Table 1. Descriptive exploration.

Variable	N	%
Work fatigue level		
Mild Fatigue	38	60.3
Moderate Fatigue	23	36.5
Severe Fatigue	2	3.2
Nutritional Status		
Underweight	14	22.2
Normal	27	42.9
Overweight	9	14.3
Obesity	9	14.3
Obesity II	4	6.3
Energy Intake		
Normal	13	20.6
Mild Deficit	34	54.0
Moderate Deficit	14	22.2
Heavy Deficit	2	3.2
Protein Intake		
Normal	52	82.5
Mild Deficit	8	12.7
Moderate Deficit	1	1.6
Heavy Deficit	2	3.2
Fat Intake		
Normal	41	65.1
Mild Deficit	13	20.6
Moderate Deficit	6	9.5
Heavy Deficit	3	4.8
Carbohydrate Intake		
Normal	6	9.5
Mild Deficit	6	9.5
Moderate Deficit	37	58.7
Heavy Deficit	14	22.2

This study analyzed 63 eligible participants (aged 19-58 years, comprising both genders). The majority of 63 respondents reported mild work fatigue, while 42.9% maintained normal nutritional status. Dietary assessment revealed that more than half of participants (54.0%) had mild energy deficits, though protein intake was generally adequate (82.5%). Interestingly, while fat intake was normal for 65.1% of respondents, most workers (58.7%) showed moderate carbohydrate deficits. These findings suggest that despite sufficient protein and fat consumption, the prevalent carbohydrate deficiency and energy deficits may contribute to the reported fatigue levels among employees.

3.2 Bivariate analysis

Bivariate analysis was conducted to determine the relationship between independent variables and dependent variables. This relationship includes the relationship between nutritional status, adequacy of energy intake, protein, fat, carbohydrates and the level of work fatigue.

Relationship between adequate energy, protein, fat and carbohydrate intake and work fatigue levels

Table 2. Relationship between adequate energy, protein, fat and carbohydrate intake and work fatigue levels.

Research variable	Work fatigue level	
	<i>P-value</i>	rHo
Energy Intake	0.107	-0.159
Protein Intake	0.149	-0.133
Fat Intake	0.342	0.052
Carbohydrate Intake	0.017	-0.268

The results of the analysis showed that there was no significant relationship between energy intake ($p=0.107$, $r=-0.159$) and protein intake ($p=0.149$, $r=-0.133$) with the level of work fatigue in hospital catering industry employees. Similarly, fat intake showed no significant correlation with fatigue ($p=0.342$, $r=0.052$), although a weak positive trend was observed.

However, carbohydrate intake demonstrated a statistically significant inverse relationship with work fatigue ($p=0.017$, $r=-0.268$), indicating that higher carbohydrate consumption was associated with lower fatigue levels. While this correlation was moderate in strength, it was the only nutritional factor that significantly influenced fatigue in this study.

Relationship between nutritional status and work fatigue levels

Table 3. Relationship between nutritional status and work fatigue levels.

Research variable	Work fatigue level	
	<i>P-value</i>	rHo
Nutritional status	0.201	-0.108

The results of the relationship between nutritional status variables and the level of work fatigue of hospital catering industry employees can be seen in table 2 with the Spearman correlation statistical test, obtaining a p value of 0.201 ($p>0.05$) and rHo - 0.108.

4 Discussion

4.1 Relationship between adequate energy, protein, fat and carbohydrate intake and work fatigue levels

According to the study, only carbohydrate consumption had a statistically significant negative correlation with work fatigue ($p=0.017$, $r=-0.268$), whereas energy, protein, and fat intake showed no significant relationship. This indicates that out of the nutritional factors analyzed, carbohydrates most prominently impact fatigue levels in this population of workers. The strong relationship between carbohydrate deficiency and work fatigue for catering staff ($p=0.017$) suggests that sufficient carbohydrate consumption leads to reduced fatigue, emphasizing the importance of carbohydrates in energy metabolism by stress fatigue. Foods that are high in calories benefit workers since such foods enable them to sustain their energy and endurance while working for around 8 hours [9]. Moreover, supplying carbohydrates helps to increase muscle as well as liver glycogen stores prior to competition, therefore delaying fatigue onset and maintaining work levels [10]. This is opposite to studies that have found no association between carbohydrates and fatigue [11, 12] a paradox which could be due to a combination of occupational requirements, physical activities, workload intensity, and shift hours.

Research	Statistical Methods	Results	Conclusions
This research	<i>Spearman rank correlation</i>	- $P\text{-value} = 0.017$ ($p<0.05$), rHo - 0.268	The direction of the correlation is negative with sufficient correlation strength and there is a significant relationship.

Farihatin A. and Subandriani D.N. 2023	<i>Spearman rank correlation</i>	- P-value = 0,601 (p >0,05), rHo = - 0,125	The direction of the correlation is negative with a weak correlation strength and no significant relationship.
Okta Sari et al., 2023	<i>Spearman rank correlation</i>	- P-value = 0,701 (p >0,05), rHo = 0.049	Positive correlation direction with weak correlation strength and no significant relationship.
Arsanti et al., 2023	<i>Chi square</i>	- P-value = 0.400 (p >0,05)	No significant relationship.

Table 4. Comparative reference of the relationship between carbohydrate intake and fatigue.

The results of this study indicate that there is no significant relationship between the adequacy of energy, protein, and fat intake with the level of work fatigue of hospital catering industry employees. These results are in line with the research of Farihatin A. and Subandriani D.N., which also reported no correlation between energy, protein and fat intake with the level of fatigue in production employees [11]. Similar to research conducted on health workers in Jakarta. This is likely due to the adequacy of protein intake in most respondents 82.5% [13], so that when protein intake has met basic needs, the effect in reducing fatigue may not be significantly reduced. One cause of fatigue is a lack of consumption or excess activity when compared to macronutrient intake [14]. However, it is different from the results of Dengo study which found a significant relationship between energy intake and fatigue [15]. In another study, it was explained that respondents who had sufficient and excess protein intake in a balanced amount tended to have a good proportion of food intake, thus contributing to reducing the risk of work fatigue. Protein plays an important role in the process of energy metabolism and repair of body tissues, including the recovery of tired muscles due to physical activity or work [16] And, Sari et al. did not find a similar relationship [12], because here respondents who had normal fat intake also showed fatigue, but in lower total amounts and there was still variation from mild to high.

Table 5. Comparative reference for the relationship between energy, protein and fat intake with fatigue.

Research	Statistical Methods	Results	Conclusions
This research	<i>Spearman rank correlation</i>	- P-value = 0.107 (p >0.05), rHo -0.159 (Energy intake) - P-value = 0.149 (p >0.05), rHo -0.133 (Protein intake)	Negative correlation direction with very weak correlation strength and no significant relationship

		- P-value = 0.342 (p>0.05), rHo = 0.052 (Fat intake)	Negative correlation direction with very weak correlation strength and no significant relationship Positive correlation direction with very weak correlation strength and no significant relationship
Farihatin A. and Subandriani D.N. 2023	<i>Spearman rank correlation</i>	- P-value = 0,300 (p >0,05), rHo = - 0,244 (Energy intake)	The direction of the correlation is negative with a very weak correlation strength and no significant relationship.
		- p-value = 0,077 (p >0,05), rHo = - 0,405 (Protein intake) - p-value = 0,199 (p >0,05), rHo = - 0,300 (Fat intake)	Negative correlation direction with moderate correlation strength and no significant relationship. Negative correlation direction with moderate correlation strength and no significant relationship.
Wardani, et al., 2024	<i>Pearson rank correlation</i>	- p-value = 0,084 (p >0,05) (Protein intake)	No significant relationship.
Arsanti et al., 2023	<i>Chi square</i>	- p-value = 0.821 (p >0,05) (Protein intake)	No significant relationship.
Dengo, M.R. and M, Hafid, 2023	<i>Spearman rank correlation</i>	- p-value = 0.001 (p <0,05), rHo = - 0.282 (Energy intake)	The direction of the correlation is negative with sufficient correlation strength and there is a significant relationship.
Hasanah et al., 2024	<i>Chi square</i>	- p-value = 0,013 (p <0,05) (Protein intake)	There is a significant relationship.
Okta Sari et al., 2023	<i>Spearman rank correlation</i>	- p-value = 0,005 (p >0,05), rHo = 0.343 (Fat intake)	The direction of the correlation is positive with moderate correlation strength

and there is a significant relationship.

It is possible that other elements, such as workload, duration of rest, stress, and other health issues, may have a greater impact on fatigue than the intake of macronutrients [17]. Although observing macronutrient consumption patterns does not provide significant statistical benefit, it is still useful as part of a broader strategy to mitigate work fatigue. The differences in results across various studies highlight that there is no universal method to work nutrition management; it must be adjusted to fit the particular job and setting.

4.2 Relationship between nutritional status and work fatigue levels

It is known that there is no significant relationship between nutritional status and the level of work fatigue of hospital catering industry employees. This is thought to be because most respondents have normal nutritional status, considering that workers in the kitchen have easy access to food, so their nutritional intake is sufficient [18]. Research conducted by Kowaas et al. also showed that there was no relationship between nutritional status and work fatigue in local fishermen who had a good and sufficient diet, and did not experience difficulty in obtaining food sources [19]. This shows that if an individual's nutritional intake is well met and their nutritional status is in the normal category, then this factor does not directly affect the level of work fatigue.

Nutritional status reflects the balance between nutrient intake and body needs over a certain period of time, and changes in nutritional status do not occur instantly unless it takes time [20]. Mustofani explains that work fatigue is more influenced by the balance between energy intake and energy expenditure during work [21]. Work fatigue is also influenced by workload, duration of the work, the working environment, and patterns of rest making it a multifaceted phenomenon. Regardless, even with adequate nutrition, other aspects of a worker's nutritional intake impact the degree of work fatigue [13]. When a person is sufficiently nourished and efficiently utilized, optimal nutritional status can be attained which enables physical growth, brain development, functionality, and general health [22].

Research	Statistical Methods	Results	Conclusions
This research	<i>Pearson rank correlation</i>	- P-value = 0.201 (p >0.05), rHo -0.108	Negative correlation direction with very weak correlation strength and no significant relationship.

Kowaas et al. 2019	<i>Spearman rank correlation</i>	- P-value = 0,294 (p >0.05), rHo = 0,132	Positive correlation direc- tion with very weak corre- lation strength and no sig- nificant relationship.
Dengo, M.R. and M, Hafid, 2023	<i>Spearman rank correlation</i>	- P-value = 0.001 (p <0.05), rHo = 0,270	The direction of the corre- lation is positive with suffi- cient correlation strength, and there is a significant relationship.

Table 6. Comparative reference of the relationship between nutritional status and fatigue.

5 **Conclusions**

The analyses conducted did not demonstrate significant correlation between work fatigue and nutritional status including energy adequacy, protein, and fat intake. Nevertheless, adequate intake of carbohydrates was significant in relation to work fatigue demonstrating that lack of carbohydrates contributes to higher levels of fatigue among workers.

To reduce fatigue levels, employees are advised to pay more attention to the balance of their nutritional intake, especially the adequacy of complex carbohydrates. Adequate carbohydrate consumption can help maintain energy levels during work and reduce fatigue. In addition, employees are expected to maintain a healthy lifestyle by taking regular breaks and getting enough sleep to support physical and mental recovery. Setting regular breaks and doing light stretching during work hours can also help reduce muscle tension and physical fatigue.

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