

Association between stress level, dietary pattern, and smoking habit with central obesity in PT Raputra Jaya Ferry crews

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Abstract. The ship crew plays a vital role in vessel operations, making it essential to maintain productivity, which can be affected by overweight issues. Central obesity, with a prevalence of 31% among individuals aged ≥ 15 years in 2018, surpasses overall obesity rates. This study examines the relationship between stress, diet, and smoking habits with central obesity in ship crews using a cross-sectional method and 101 respondents selected via stratified random sampling. Chi-square tests revealed significant links between central obesity and the consumption of fatty ($p=0.001$) and sweet foods/beverages ($p=0.001$), but no association with stress ($p=0.170$), salty foods ($p=0.695$), fruits/vegetables ($p=0.458$), or smoking ($p=0.255$). Reducing fatty and sweet food intake is recommended to lower central obesity risk.

1 Introduction

Ferry Transport Ships, as defined by the Regulation of the Minister of Transportation of the Republic of Indonesia Number PM 62 of 2019, are motorized vessels designed to transport passengers and vehicles through ramp doors. These ships feature a double-hull construction and at least two main engines [1]. The crew members are integral to ensuring smooth and safe voyages, making their health and productivity crucial [2].

In 2022, Indonesia operated 433 motorized ferry vessels, comprising 248 privately owned units, 166 units owned by PT ASDP, and 19 units managed by local governments [3]. This extensive network highlights the importance of maintaining the well-being of ferry crews to support efficient operations.

Nutritional status plays a vital role in determining work productivity. Workers with good nutritional status exhibit better agility and efficiency, whereas obesity can hinder performance and productivity [5][6]. Obesity, defined as excessive body weight, poses significant health risks and reduces quality of life [7]. On a global scale, obesity remains a critical public health issue, with over 160 million individuals affected in 2019, a number that continues to grow [8]. Central obesity, characterized by fat accumulation in the abdominal area, is particularly concerning due to its strong link to cardiovascular diseases [9][10].

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In Indonesia, obesity prevalence among adults was reported at 21.8% in 2018, with central obesity affecting 31% of individuals aged 15 years and older [11]. Key contributors include unhealthy dietary habits, such as high-fat and high-calorie diets, insufficient intake of fruits and vegetables, and lifestyle factors like smoking [12][13]. Smoking is associated with elevated cortisol levels, which promote abdominal fat accumulation [14][15]. Stress also exacerbates central obesity by influencing cortisol production and altering fat distribution [16].

The Merak-Bakauheni ferry route, Indonesia's busiest, illustrates the unique stressors and lifestyle challenges faced by ferry crews. Preliminary studies on PT Raputra Jaya's ferry crew revealed that 54% of crew members experienced central obesity. Despite the growing body of research on obesity, limited attention has been given to the specific factors affecting ferry crews. This study aims to explore the relationships between stress levels, dietary patterns, and smoking habits with central obesity among ferry crews. By addressing this gap, the study seeks to provide actionable insights for targeted health interventions.

2 Materials and methods

This study was conducted from February to May 2024 on the motorized ferry vessels of PT Raputra Jaya, operating at Merak Port, Cilegon, Banten. The research is an analytical observational study using the Cross-Sectional method. The sample consisted of 101 respondents selected through a stratified random sampling method. Stratified random sampling is a sampling method that involves dividing the population into groups (*strata*), then randomly selecting samples from each stratum and combining them to estimate the population parameters. This method is used because the research population is divided into four groups consisting of the motorized ferries Raputra Jaya 888, Raputra Jaya 2888, SMS Sagita, and SMS Mulawarman.

The independent variables in this study were stress levels, dietary habits, and smoking behavior. The dependent variable was the incidence of central obesity. A measuring tape was used to measure the respondents' waist circumference to identify whether they experienced central obesity. A respondent is considered to have central obesity if their waist circumference is ≥ 90 cm. A questionnaire, the Perceived Stress Scale (PSS), was used to assess the respondents' stress levels. The PSS consists of 10 questions, and stress levels were measured on a scale ranging from 0 to 40, with higher scores indicating higher stress levels. The Food Frequency Questionnaire (FFQ) was used to assess dietary pattern. This questionnaire described the respondents' dietary patterns based on the frequency of carbohydrate, fruit and vegetable, fat-rich food, and sweet food and drink consumption. The dietary patterns of the respondents were assessed using the Food Frequency Questionnaire (FFQ), which classified risky food consumption, such as the intake of salty foods, fatty foods, fruits and vegetables, and sweet foods and drinks. Respondents were classified as frequent consumers of these food groups if their consumption score was \geq the median, and as infrequent consumers if their score was $<$ the median [18]. Smoking habits were classified according to the number of cigarettes smoked per day. Respondents were classified as light smokers if they smoked ≤ 10 cigarettes per day and heavy smokers if they smoked > 10 cigarettes per day [19].

The collected data were analyzed using the Statistical Package for Social Science (SPSS), comprising univariate and bivariate analyses. The univariate analysis aimed to determine the distribution of characteristics such as age, the incidence of central obesity based on waist circumference, stress levels, risky dietary habits, and smoking behavior among the crew members of PT Raputra Jaya's ferries. The bivariate analysis was conducted using the chi-square test to examine the relationship between the independent and dependent variables, with a 95% confidence level or a p-value of 0.05.

3 Results and discussion

3.1 Respondent characteristics

The respondents were categorized into two age groups: early adulthood (18–40 years) and middle adulthood (41–60 years) [20]. The respondent characteristics are shown in Table 1.

Table 1. Respondent characteristics

Variable	Value	
	n	%
Age		
20-34	57	56.4
35-45	26	25.7
46-60	18	17.8
Incidence of central obesity		
Normal	57	56.4
Central obesity	44	43.6
Stress level		
Low	41	40.6
Moderate	60	59.4
Dietary pattern		
Salty foods consumption		
Infrequent	54	53.5
Frequent	47	46.5
Fatty foods consumption		
Infrequent	60	59.4
Frequent	41	40.6
Fruits and vegetables consumption		
Infrequent	52	51.5
Frequent	49	48.5
Sweet foods and beverages consumption		
Infrequent	59	58.4
Frequent	42	41.6
Smoking habit		
Non smokers	34	33.7
Light smokers	31	30.7
Heavy smokers	36	35.6

Based on the univariate analysis, most respondents (66.3%) were in early adulthood, while 33.7% were in middle adulthood. All respondents were male, reflecting the physically demanding nature of maritime work, which requires endurance for continuous sailing in unpredictable sea conditions and extended working hours [21].

In terms of waist circumference, 43.6% of respondents had central obesity (≥ 90 cm), while 56.4% had a normal waist circumference. A comparable study on seafarers reported 40% overweight prevalence and over 10% obesity prevalence [22].

Stress levels among respondents were predominantly moderate (59.4%), followed by low stress (40.6%). High stress levels were not observed. Contributing factors to stress included high workloads, lack of rest, noisy environments due to ship movements, climate changes, long working hours, and prolonged separation from family [23].

Dietary habits revealed that respondents rarely consumed salty foods (53.5%), fatty foods (59.4%), fruits and vegetables (51.5%), and sweet foods and drinks (58.4%). These findings contrast with a study by Melisa, which reported frequent consumption of high-sugar (71%),

high-fat (82.8%), and high-salt (62.8%) foods among workers [24]. Another study by Jeser and Santoso found that 84% of adults consumed insufficient fruits and vegetables [25].

Smoking was prevalent among respondents, with 36% classified as heavy smokers, 30.7% as light smokers, and 33.7% as non-smokers. Similar findings were reported in a study by Yanti et al., where 70.8% of workers used smoking as a stress-relief mechanism during work breaks [26].

3.2 Association between stress level with central obesity

The relationship between stress levels and central obesity among the ferry crew was examined through bivariate analysis, with the findings presented in the table below.

Table 2. Association between stress level with central obesity

Stress level	Incidence of central obesity				Total		p value	OR (95% CI)
	Normal		Central obesity					
	n	%	n	%	N	%		
Low	27	26.7	14	34.1	41	40.6	0.170	1.929 (0.849 – 4.380)
Moderate	30	29.7	30	50.0	60	59.4		
Total	57	56.4	44	43.6	101	100		

As shown in Table 2, respondents with central obesity were more likely to report experiencing moderate stress. Specifically, 30 individuals (50%) indicated moderate stress levels, compared to just 14 individuals (34.1%) who reported low stress. However, the statistical test yielded a p-value of 0.170, which exceeds the significance threshold of $\alpha = 0.05$. This suggests that there is no significant relationship between stress levels and central obesity among the ferry crew of PT Raputra Jaya.

This finding aligns with the results of a study by Rizkia, conducted on workers at the Provincial Office of Manpower and Transmigration of Banten, which also found no significant association between stress and abdominal fat, with a p-value of 0.137. One possible explanation is that individuals react to stress in various ways, and for some, stress may actually reduce appetite. Therefore, stress may not necessarily be a contributing factor to increased abdominal fat [27].

However, our findings contrast with those of Sitepu, whose study identified a significant association between stress and central obesity. Stress can influence dietary habits and nutritional intake, potentially affecting an individual's nutritional status. In particular, stress may lead to eating disorders, such as increased or decreased appetite [28]. When faced with stress, the hypothalamus triggers the release of cortisol from the pituitary gland, and elevated cortisol levels can stimulate the brain to increase appetite [29].

3.3 Association between dietary pattern with central obesity

The analysis of dietary patterns and their association with central obesity was categorized into four areas: salty food consumption, fruit and vegetable intake, fatty food consumption, and sweet food and drink consumption.

Table 3. Association between salty foods consumption with central obesity

Salty foods consumption	Incidence of central obesity				Total		p-value	OR (95% CI)
	Normal		Central obesity					
	n	%	n	%	N	%		
Infrequent	29	28.7	25	24.8	54	53.5	0.695	1.143 (0.357 – 1.736)
Frequent	28	27.7	19	18.8	47	46.5		
Total	57	56.4	44	43.6	101	100		

As shown in Table 3, the majority of respondents with central obesity reported rarely consuming salty foods, with 25 respondents (34.8%), while 19 respondents (18.8%) consumed salty foods frequently. The chi-square test yielded a p-value of 0.695, which is greater than the significance level of $\alpha = 0.05$, indicating no significant relationship between salty food consumption and central obesity among the ferry crew of PT Raputra Jaya.

This finding aligns with the study by Jeonghwa and Youngran, which found no link between sodium intake and fat accumulation among 80 individuals in South Korea [30]. One possible explanation for this lack of association could be the use of the Food Frequency Questionnaire (FFQ), which may introduce data bias, such as underestimation or overestimation of salty food consumption. In contrast, Mellisa's study of government employees in Bengkulu found a significant association between salt consumption and central obesity (p-value = 0.033) [24]. It suggested that salty foods may be addictive, stimulating appetite and increasing energy intake, which could lead to weight gain. Additionally, high sodium intake can cause water retention, contributing to weight gain [31]. Respondents in this study frequently consumed high-sodium foods like instant noodles, sardines, sauces, and soy sauce.

Table 4. Association between fruits and vegetables consumption with central obesity

Fruits and vegetables consumption	Incidence of central obesity				Total		p-value	OR (95% CI)
	Normal		Central obesity		N	%		
	n	%	n	%				
Infrequent	27	26.7	25	24.8	52	51.5	0.458	0.684 (0.310 – 1.509)
Frequent	30	29.7	19	18.8	49	48.5		
Total	57	56.4	44	43.6	101	100		

Table 4 indicates that respondents with central obesity were more likely to have a low intake of fruits and vegetables, with 25 respondents (24.8%) reporting rarely consuming them, compared to only 19 respondents (18.8%) who consumed fruits and vegetables frequently. The chi-square test yielded a p-value of 0.458, which is greater than $\alpha = 0.05$, suggesting no significant relationship between fruit and vegetable consumption and central obesity among the ferry crew.

This finding mirrors the results of Sucipto and Santoso's study, which also found no significant relationship between fruit and vegetable consumption and central obesity [32]. The study's methodology only measured frequency, without estimating the quantity consumed, which may explain the lack of a significant relationship. Even frequent consumption could involve small amounts of fruits and vegetables. However, adequate intake of fruits and vegetables is known to be a protective factor against central obesity. Fiber-rich, low-energy foods help prevent fat accumulation [33], and high consumption of fruits and vegetables can reduce the risk of central obesity by providing a longer-lasting feeling of fullness, which helps lower overall calorie intake [34]. Commonly consumed vegetables among respondents included spinach, carrots, green beans, and bean sprouts, while fruits such as oranges, bananas, apples, and watermelon were also frequently eaten.

Table 5. Association between fatty foods consumption with central obesity

Fatty foods consumption	Incidence of central obesity				Total		p value	OR (95% CI)
	Normal		central obesity		N	%		
	n	%	n	%				
Infrequent	45	44.6	15	14.9	60	59.4	0.000	7.250 (2.974 – 17.674)
Frequent	12	11.9	29	28.7	41	40.6		
Total	57	56.4	44	43.6	101	100		

According to Table 5, respondents who frequently consumed fatty foods were more likely to experience central obesity. Specifically, 29 respondents (28.7%) with central obesity frequently consumed fatty foods, compared to only 15 respondents (14.9%) who rarely consumed them. The chi-square test yielded a p-value of 0.000, indicating a significant association between fatty food consumption and central obesity among the ferry crew. The odds ratio suggests that respondents who frequently consumed fatty foods were 7.2 times more likely to have central obesity than those who consumed fatty foods rarely.

This result is consistent with Pakaya's study, which found a relationship between fat consumption and central obesity among minibus drivers (p-value = 0.00) [35]. Fatty foods are high in energy, and excessive consumption can lead to a positive energy balance, resulting in weight gain [36]. Most of the fat consumed is stored as triglycerides in adipose tissue, particularly in the abdominal area in men [37]. Respondents in this study frequently consumed high-fat foods such as fried chicken, coconut milk, and fried snacks.

Table 6. Association between sweet foods and beverages consumption with central obesity

Sweet foods and beverages consumption	Incidence of central obesity				Total		P value	OR (95% CI)
	Normal		Central obesity					
	n	%	n	%	N	%		
Infrequent	43	42.6	16	15.8	59	58.4	0,000	5.375 (2.273 – 12.712)
Frequent	14	13.9	28	27.7	42	41.6		
Total	57	56.4	44	43.6	101	100		

Table 6 reveals that the majority of respondents with central obesity frequently consumed sweet foods and drinks, with 28 respondents (27.7%) reporting regular consumption, compared to 16 respondents (15.8%) who rarely consumed them. The statistical test showed a p-value of 0.000, which is less than $\alpha = 0.05$, indicating a significant association between sweet food and drink consumption and central obesity. The odds ratio suggests that respondents who frequently consumed sweet foods and drinks were 5.3 times more likely to experience central obesity compared to those who consumed them rarely.

This finding is supported by Mellisa's study, which found a significant association between sugar consumption and central obesity (p-value = 0.002) [24]. Simple sugars, with their high glycemic index, rapidly stimulate insulin secretion, which contributes to weight gain and abdominal fat accumulation [39]. Excessive sugar intake is largely converted into fat, increasing adipose tissue and promoting obesity [40]. Simple sugars are absorbed quickly, which leads to faster fat accumulation if not immediately utilized [41].

In summary, dietary patterns such as frequent consumption of sweet foods and drinks, fatty foods, and insufficient intake of fruits and vegetables are linked to an increased likelihood of central obesity. These findings highlight the direct impact of unhealthy eating habits on the risk of central obesity, reinforcing the importance of balanced nutrition in preventing this condition [34][35].

3.4 Association between smoking habit with central obesity

The bivariate analysis examining the relationship between smoking habits and central obesity among the ferry crew is presented in Table 7.

Table 7. Association between smoking habit with central obesity

Smoking habit	Incidence of central obesity				Total		P value
	Normal		central obesity		N	%	
	n	%	n	%			
Non smokers	18	17.8	16	15.8	34	33.7	0.255
Light smokers	18	17.8	13	12.9	31	30.7	
Heavy smokers	21	20.8	15	14.9	36	35.6	
Total	57	56.4	44	43.6	101	100	

As shown in the table, respondents with central obesity were more frequently smokers, with 13 light smokers (41.9%) and 15 heavy smokers (41.7%) experiencing central obesity. In comparison, 16 non-smokers (47.1%) were also found to have central obesity. The chi-square test yielded a p-value of 0.255, which exceeds the significance threshold of $\alpha = 0.05$, indicating no significant association between smoking habits and central obesity among the ferry crew of PT Raputra Jaya.

This finding is consistent with Susanto's study, which also found no significant relationship between smoking behavior and central obesity in healthy adults, with a p-value of 0.813 [42]. However, other studies suggest that lifelong smoking habits may contribute to increased abdominal fat. Smoking triggers a rise in cortisol levels, which can impair insulin sensitivity and promote abdominal fat accumulation, causing smokers to accumulate more abdominal fat than non-smokers [43]. Additionally, smoking can suppress appetite. Over time, this may lead to weight loss, as nicotine in cigarettes stimulates the release of serotonin and norepinephrine, both of which reduce hunger [44].

Although this study found no significant association between smoking and central obesity, it is important to note that smoking still poses serious health risks. Smokers are more vulnerable to diseases such as lung cancer and respiratory tract cancers, which can significantly reduce productivity by limiting the ability to work at full capacity [45].

4 Conclusion

This study shows that the majority of respondents were aged between 18 and 40 years (66.3%). A total of 56.4% of respondents had normal waist circumference, while 43.6% suffered from central obesity with a waist circumference of ≥ 90 cm. Most respondents had moderate stress levels (59.4%). Their dietary habits tended to involve infrequent consumption of salty foods (53.5%), fatty foods (59.4%), fruits and vegetables (51.5%), and sweet foods and drinks (58.4%). In terms of smoking habits, 36% of respondents were heavy smokers, 30.7% were light smokers, and 33.7% were non-smokers. Data analysis showed a significant relationship between the consumption of fatty foods and sweet foods and drinks with central obesity ($p=0.000$ and $p=0.000$). These findings emphasize the importance of addressing dietary habits as a key strategy in reducing central obesity within this population. Targeted interventions addressing dietary guidelines tailored for ferry crews, focusing on reducing the intake of high-fat and high-sugar foods are imperative to mitigate central obesity. Further research is needed to explore long-term effects and evaluate intervention effectiveness for sustained health improvements.

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