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The Relationship Between Salted Fish Consumption Habits and the Incidence of Hypertension During Pregnancy in the Coastal Areas of Tuban Regency

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ABSTRACT

Hypertension during pregnancy is a significant health issue and one of the leading causes of morbidity and mortality among pregnant women worldwide, with higher prevalence in regions of high sodium intake. In Indonesia, hypertension during pregnancy poses serious challenges, especially in coastal areas where salted fish is a common dietary staple. Salted fish, preserved through processes that increase sodium levels, can raise blood pressure when consumed excessively, elevating the risk of hypertension in pregnant women. This study examines the relationship between salted fish consumption habits and the incidence of hypertension during pregnancy in coastal regions of Tuban. The research employed an analytical observational approach with a cross-sectional design. Data were collected from 99 pregnant women attending antenatal care (ANC) visits at several coastal community health centers, using consecutive sampling conducted from July 29 to August 16, 2024. Information was gathered through questionnaires and medical records. The independent variable in this study was the habit of consuming salted fish, while the dependent variable was the incidence of hypertension during pregnancy. Data were analyzed using Fisher's Exact test with a significance level of α=0.05. The results showed a p-value of 0.000, indicating a statistically significant relationship between salted fish consumption and hypertension in pregnancy. The findings demonstrate that more frequent consumption of salted fish correlates with a higher risk of developing hypertension during pregnancy. These results highlight the need for dietary management, particularly in coastal communities, to reduce sodium intake and lower the risk of hypertension, ultimately improving maternal health outcomes.

Introduction

Hypertension, or elevated arterial tension, constitutes a pathological state wherein an individual endures a protracted escalation in blood pressure, predisposing them to morbidity and mortality. A diagnosis of hypertension is affirmed when systolic pressure exceeds 140 mmHg and diastolic pressure surpasses 90 mmHg (Arikah et al., 2020). This definition is further corroborated by Yulanda & Lisiswanti (2017), who specify that hypertension is diagnosed if these elevated pressures are observed in two separate readings taken five minutes apart while the individual is at rest. Moreover, institutions such as the JNC VII, the World Health Organization and the European Society of Hypertension both define hypertension as a condition characterized by a top blood pressure measurement exceeding than 140 mmHg or a bottom blood pressure reading exceeding 90 mmHg.

Hypertension during pregnancy is one of the most common health issues encountered by expectant mothers and is a primary factor contributing to maternal and newborn health complications and death globally. This condition manifests in various forms, including gestational

hypertension, preeclampsia, and eclampsia, each posing severe risks to both the mother and the unborn child. According to WHO (2019), approximately 10% of pregnancies worldwide are complicated by hypertension, with a disproportionately higher prevalence in developing nations. In Indonesia, the Ministry of Health (2020) identifies hypertension during pregnancy as the foremost cause of maternal mortality, superseded only by hemorrhage and infectious diseases.

The Maternal Mortality Ratio (MMR) serves as a pivotal metric for assessing global maternal health, underscoring its significance within the Sustainable Development Goals (SDGs). One SDG target seeks to ensure universal health and enhancing well-being by reducing the maternal mortality rate (MMR) to 70 out of every 100,000 live births by 2023 (Arikah et al., 2020). Excessive sodium ingestion emerges as a critical factor contributing to hypertensive conditions during pregnancy. Sodium-rich consumables, such as salted fish preserved through salting techniques, exacerbate blood pressure levels when consumed excessively, thereby amplifying the risk of hypertension.Although treatment can normalize blood pressure in individuals diagnosed with hypertension, there is still a significant risk of the condition returning (Anastasya, 2023). The Ministry of Health of Indonesia (2021) identifies both non-modifiable risk factors, such as age, gender, and family history, as well as changeable risk factors such as smoking, poor dietary habits (such as insufficient fruit and vegetable intake), excessive salt consumption, obesity, physical inactivity, high alcohol consumption, dyslipidemia, and stress, which all contribute to hypertension.

The Sustainable Development Goals strive to reduce the Maternal Mortality Ratio (MMR) to 70 deaths per 100,000 live births by the year 2030. However, the current global maternal mortality rate remains distressingly elevated at a rate of 359 deaths per 100,000 live births. In Indonesia, the Ministry of Health (Kemenkes RI) documented 183 maternal fatalities per 100,000 live births in 2022. Within East Java, the Health Department recorded 499 maternal fatalities in the same year. In Tuban Regency, the maternal mortality rate reached 22 deaths in 2020, exceeding the target of fewer than 14 deaths and reflecting an increase compared to 19 maternal deaths reported in 2019 (Dinas Kesehatan Tuban, 2022).

Hypertension-related complications are a leading cause of maternal death, accounting for 33.07% of cases, followed by obstetric hemorrhage at 27.03%, and other causes (Kemenkes RI, 2019). In East Java, Hypertensive conditions during pregnancy contribute to 24.45% of maternal fatalities, with hemorrhage contributing to 21.24% (Dinkes Jawa Timur, 2022). Tuban's maternal mortality rate in 2020 was 136 per 100,000 live births, with hypertension in pregnancy being the leading cause. Globally, hypertension affects about 22% of the population, with the highest prevalence in Africa at 27%. Southeast Asia ranks third, with 25% of the population affected (Kemenkes RI, 2019). Studies show that approximately 18.08 million pregnant women worldwide suffer from hypertensive disorders of pregnancy (HDP), contributing to 27,830 maternal deaths (Wang et al., 2021). In Indonesia, 1,066 maternal deaths occurred due to HDP in 2020, with this number rising to 1,110 deaths in 2021, with the highest rates in West Java (214 deaths) and East Java (147 deaths) (Kemenkes RI, 2021). Data from East Java's Health Profile in 2023 shows an increase in maternal deaths to 499, with hypertensive disorders and obstetric hemorrhage as leading causes (Dinkes Jawa Timur, 2023).

The issue of hypertension is particularly significant in coastal areas like Tuban Regency in East Java, where the diet is high in salt, and salted fish is a common food. Tuban, a coastal region, has an annual fish consumption rate of 37.9 kg per person, higher than the provincial standard of 34 kg per person (Dinas Perikanan dan Peternakan Kabupaten Tuban, 2020). Excessive salt consumption leads to fluid retention and increased vascular resistance, resulting in higher blood pressure (Gupta et al., 2018). A high-sodium diet has been associated with a higher risk of developing preeclampsia in pregnant women (Tanabe et al., 2020). Yulanda and Lisiswanti (2017) found that high salt intake raises the likelihood of hypertension by 1.5 times in pregnant

women in urban areas. However, studies specifically focusing on salted fish consumption and hypertension during pregnancy in coastal regions are scarce. Ramadhan et al. (2021) identified a high-sodium diet, including salted fish, as a major risk factor for hypertension in coastal areas but did not specifically focus on its impact on pregnancy.

This research aims to fill this gap by exploring the relationship between salted fish consumption and hypertension during pregnancy in Tuban Regency. Using an analytical observational cross-sectional design, the study will collect data through questionnaires and medical records from pregnant women attending antenatal care (ANC) at coastal health centers. This research aims to aid in the development of hypertension prevention programs for pregnant women in coastal areas, particularly Tuban Regency, and provide evidence for locally based dietary health policies. The findings are expected to inform better nutritional education and reduce hypertension risks during pregnancy.

Methods

This study is an observational analytical research that employs a quantitative approach to explore the link between the practice of consuming salted fish and the incidence of hypertension. The study design employed is a cross-sectional approach. The independent variable under investigation is the habit of consuming salted fish, while the dependent variable is the prevalence of hypertension among pregnant women. Data collection was conducted through a structured questionnaire assessing salted fish consumption habits, which underwent validity and reliability testing. Additionally, medical records were reviewed to record the respondents' blood pressure measurements. The study's population consists of pregnant women who visit antenatal care clinics at the Palang, Sumurgung, and Jenu Health Centers. The sample size for this research was determined using the Lemeshow formula, which calculated a required number of 96.4 respondents. This number was rounded up to 99 respondents, who were evenly distributed across the three health center locations involved in the study. The inclusion criteria are: Pregnant women who made ANC visits at the Palang, Sumurgung, and Jenu Puskesmas at the time of the study; Pregnant women with or without HDK; Willing to be respondents; The study was completed when the sample needs were met. The exclusion criteria were: Domiciled outside Tuban Regency; Pregnant women with previous hypertension.

The sampling method employed was consecutive sampling, which included pregnant women attending antenatal care visits at several coastal health centers from July to August 2024. The data collection process is carried out when pregnant women have done antenatal care with health workers, then directed to fill out a salted fish consumption habits questionnaire and researchers record the results of blood pressure measurements that have been made during the examination. For data analysis, the study used univariate analysis to describe each individual variable being studied. To investigate the connection between the two variables, bivariate analysis was conducted utilizing Fisher's Exact test, with the significance level set at $\alpha=0.05$. This statistical approach allows for a deeper understanding of how the habit of consuming salted fish may be linked to hypertension in pregnant women.

Results

Table 1 Frequency Distribution of Pregnant Women by Age

Age (Years)	Frequency	Percentage (%)
<20	4	4
20-35	83	83.8
>35	12	12.1
Total	99	100

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According to Table 1, it can be observed that the majority of the 99 pregnant women fall within the age range of 20-35 years (83.8%).

Table 2 Frequency Distribution of Pregnant Women by Gravida

Gravida	Frequency	Percentage (%)
1-3	93	93.9
>3	6	6.1
Total	99	100

According to Table 2, the majority of the pregnant women fall into the gravida ≤3 category (93.9%).

Table 3 Frequency of Salted Fish Consumption Habits Among Pregnan Women in the Coastal Areas of Tuban Regency

Salted Fish Consumption Habits	Frequency	Percentage (%)
No Habit	13	13,1
Low Habit	3	3
Moderate Habit	33	33,3
High Habit	50	50,5
Total	99	100

From the data presented in Table 3, it is evident that most respondents exhibit a high frequency of salted fish consumption, with a total of 50 individuals (50.5%).

Table 4 Frequency of Hypertension Cases During Pregnancy in the Coastal Areas of Tuban Regency

Hypertension Cases	**Frequency**	**Percentage (%)**
No Hypertension	72	72,7
Hypertension	27	27,3
Total	99	100

According to Table 4, the majority of pregnant women did not experience hypertension, with a total of 72 individuals (72.7%) showing no signs of the condition.

Table 5 Relationship Between Salted Fish Consumption Habits and Hypertension During Pregnancy in the Coastal Areas of Tuban Regency

Salted Fish Consumption Habit	**Blood Pressure**				**Total**	
	No Hypertension		**Hypertension**			
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
No Habit	13	13,1	0	0	13	13,1
Low Habit	3	3	0	0	3	3
Moderate Habit	30	30,3	3	3	33	33,3
High Habit	26	26,3	24	24,2	50	50.5
Total	72	72,7	27	27,3	99	100

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According to the data in Table 5, shows that the highest rate of hypertension was observed among pregnant women with high salted fish consumption habits, at 24.2%. This is followed by the occurrence of hypertension among pregnant women with moderate salted fish consumption habits, accounting for 3%.

Table 6 Analysis of the Relationship Between Salted Fish Consumption Habits and Hypertension During Pregnancy in the Coastal Areas of Tuban Regency

Chi-Square Tests

	Value,	dfi	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	22.330[a]	3	.000	.000	
Likelihood Ratio	26.678	3	.000	.000	
Fisher's Exact Test	21.988			.000	
Linear-by-Linear Association	16.573[b]	1	.000	.000	.000
N of Valid Cases	99				

a. 3 cells (37.5%) have an expected count of less than 5, with the minimum expected count being 0.82.

b. The standardized statistic is 4,071.

The results of the Fisher's Exact statistical test indicate a p-value of 0.000, which is below the threshold of 0.05. This finding suggests a statistically significant association between the practice of consuming salted fish and the occurrence of hypertension during pregnancy in the coastal areas of Tuban Regency.

Discussion

Salted Fish Consumption Habits Among Pregnant Women in Coastal Areas of Tuban Regency

The findings of this study suggest that the majority of respondents exhibited a high level of salted fish consumption, with 50 respondents (50.5%) categorized in the high consumption group. These findings are consistent with earlier the study carried out by Sari et al. (2015), which further revealed that the majority of respondents consumed salted fish in large quantities. In that study, 46 individuals (63.01%) reported an average daily intake of 106.78 grams of salted fish, which is 21.78 grams more than the recommended daily consumption. Furthermore, in another study by Yulianda (2021), it was found that most respondents consumed salty foods regularly, with 70 respondents (55.7%) categorizing themselves as frequent consumers of salty foods.

Additionally, another research conducted by Fitriani et al. (2018) found that a number of respondents in Tanjung Gading Village, Riau Province, regularly consumed preserved foods, including various types of salted fish that are high in sodium, canned sardines, and other sea foods such as mackerel, squid, and tuna. This high consumption rate indicates that salted fish has become an integral part of the coastal community's diet, driven by several factors, such as abundant availability, affordable prices, and adaptation to local food culture.

The study also identified several reasons for the respondents' preference for consuming salted fish, which include its affordability, ease of adaptation, lack of alternative menu options, and its use as a primary side dish. Among these reasons, the most significant factor cited by respondents (78.8%) was the availability of salted fish, which is easily accessible in the coastal area. This geographic factor likely contributes to the widespread consumption of salted fish in

these coastal regions, resulting in a higher prevalence of salted fish consumption in these communities. As Efendy et al. (2016) suggest, dietary habits play a vital role in determining public health outcomes, which is particularly relevant when evaluating the influence of dietary choices on health.

Moreover, the affordability of salted fish was another key reason for consumption, with 39 respondents (39.4%) highlighting cost as an important factor. Additionally, 12 respondents (12.1%) reported that there were no other menu options available, and 26 respondents (26.3%) indicated that salted fish was their primary side dish. According to the data gathered from the validated and reliable questionnaire, it is clear that the high consumption of salted fish is not only due to its easy availability but also because many respondents consider it an essential part of their diet, with some making it their main side dish. However, this dietary preference results in a higher intake of sodium, which may have negative long-term effects on health. As noted by Adinda (2019), food consumption patterns are directly related to an individual's nutritional status and are often linked to various health conditions or diseases. Thus, the regular consumption of salted fish, particularly in large quantities, can significantly impact the respondents' health over time.

From a researcher's perspective, it is important to develop intervention approaches that consider the social, cultural and economic factors of coastal communities. Nutrition education that emphasizes low-salt alternatives, the use of fresh fish, or fish processing with techniques that reduce sodium levels could be strategic measures to reduce the adverse health impacts of overconsumption of salted fish. In addition, further research exploring the association of salted fish consumption with other health indicators, such as quality of life or cardiovascular disease risk, is urgently needed to support the formulation of evidence-based health policies in coastal communities.

Incidence of Hypertension in Pregnancy in Coastal Area of Tuban Regency

Based on the conclusions drawn from this research, the prevalence of hypertension among expectant women was categorized into two separate groups: those who were diagnosed with hypertension and those who were not. The results revealed that the majority of pregnant women, comprising 72 respondents (72.7%), did not experience hypertension during their pregnancy. However, a significant portion, more than a quarter of the respondents—27 individuals (27.3%)—were found to be suffering from hypertension. These results underscore the paramount significance of continuous focus and intervention to effectively tackle the occurrence of hypertension during pregnancy, especially among expectant women in coastal regions, as highlighted within the context of this study. Hypertension in pregnancy continues to be a crucial health issue, as it is acknowledged as one of the primary factors contributing to maternal illness and death globally. It is estimated that approximately 10% of all expectant women worldwide are impacted by preeclampsia, a severe form of hypertension that can result in serious complications. This condition is responsible for approximately 76,000 maternal deaths annually (Margarini & Anindhita, 2021).

Hypertension is characterized as a state where blood pressure surpasses normal thresholds, typically exceeding 120/80 mmHg. The WHO and the Joint National Committee define hypertension as present when blood pressure readings are 140/90 mmHg or higher during a resting measurement. Specifically, high blood pressure is indicated by a systolic pressure above 140 mmHg and a diastolic pressure exceeding 90 mmHg. In contrast, an optimal blood pressure range is considered to be ranging from 90-120 mmHg for systolic pressure and 60-80 mmHg for diastolic pressure. Elevated blood pressure often results from various factors, such as increased heart rate, higher peripheral vascular resistance, and improved blood flow (Rahma & Baskari, 2019). According to established guidelines, a person is considered hypertensive when their systolic pressure is ≥140 mmHg and their diastolic pressure is ≥90 mmHg (Yulianda, 2021). This

condition not only poses immediate risks to maternal health but also heightens the chances of complications for both the mother and the fetus, emphasizing the necessity for early detection and management of hypertension during pregnancy.

In this study, it was found that the majority of respondents who experienced hypertension during pregnancy in the coastal area of Tuban Regency were those with high salted fish consumption habits. Specifically, 24 respondents with high salted fish consumption and 3 respondents with moderate consumption levels were identified as hypertensive. These results are consistent with earlier studies, which indicate that hypertension is more prevalent in coastal areas, possibly because of the increased sodium consumption linked to the intake of processed marinated seafood (Rusliafa, 2014). In a related study, Fahlepi (2019) found that among 210 coastal residents in Belawan, 30% were hypertensive, with many exceeding the recommended sodium intake from salt used in side dishes and vegetables.

In addition to the excessive sodium consumption factor, several other variables can contribute to hypertension, as outlined by previous theories and incorporated into this study. These factors were analyzed alongside other demographic and lifestyle data. For example, age was a key factor, with the majority of respondents (83.8%) falling within the 20-35 year age range, amounting to 83 individuals. A family history of hypertension was reported by 68 respondents (68.8%), who did not have a family history of hypertension. Smoking was another factor, with 96 respondents (97%) indicating that they did not smoke. In terms of weight status, the majority of respondents (53.5%) had normal body weight, and with regard to alcohol consumption, most respondents (99%) reported no alcohol consumption habits. These additional factors suggest that while excessive sodium intake is a significant contributor to hypertension in this study population, other lifestyle factors and personal health history also play important roles in the development of hypertension.

Early detection of hypertension and health education among pregnant women in coastal areas should be prioritized. A community-based approach that combines reduced sodium consumption with promotion of healthy lifestyles, such as weight management and regular health monitoring, could have a significant impact on reducing the incidence of hypertension during pregnancy. These results provide a basis for formulating more specific health policies, especially in coastal communities, to reduce the burden of hypertension in pregnant women and its impact on maternal and infant health. Further research focusing on biological mechanisms as well as local culture-based intervention approaches will be needed to support the effectiveness of this health program.

The correlation between salted fish consumption patterns and the prevalence of hypertension during pregnancy in the coastal region of Tuban Regency.

The findings from this study indicated that all respondents diagnosed with hypertension were those who had a habit of consuming salted fish. Among these hypertensive respondents, the majority (24 respondents) had high salted fish consumption habits, while the remaining three hypertensive respondents had moderate salted fish consumption habits.

The statistical analysis conducted through the Chi-Square test yielded a p-value of 0.000, which is significantly lower than the 0.05 threshold. As a result, the alternative hypothesis (Ha) was accepted, and the null hypothesis (H0) was rejected, affirming a significant association between the habit of consuming salted fish and the incidence of hypertension during pregnancy in the coastal regions of Tuban Regency. These results align with prior research, which has also found a connection between seafood intake and hypertension in coastal areas. For instance, Cahyani et al. (2019) reported a p-value of 0.001, and Sari (2015) found a p-value of 0.001, further supporting the conclusion that salted fish consumption is significantly associated with elevated blood pressure. Additional studies, including one by Purwono et al. (2020), revealed that 54.9%

of respondents consumed excessive salt, with 60.8% of them suffering from severe hypertension. This study also found a correlation between salt consumption habits and hypertension, with a p-value of 0.010.

Overconsumption of salted fish results in elevated sodium levels in the bloodstream, which directly contributes to an increase in blood pressure (Sari, 2015). Several Randomized Control Trials (RCTs) have demonstrated that reducing sodium intake can significantly lower blood pressure. High sodium consumption is widely acknowledged as a major risk factor for hypertension. Atun (2014) emphasized that individuals with high sodium intake are six times more likely to develop hypertension than those who consume moderate levels of sodium. When excessive salt is consumed, it causes an increase in the sodium concentration in the extracellular fluid. To restore balance, the body compensates by drawing fluid from the cells into the extracellular space, which raises the amount of extracellular fluid. This rise in fluid volume subsequently elevates blood volume, triggering the onset of hypertension. Therefore, reducing sodium intake is highly recommended as a preventive measure to lower the risk of developing hypertension (Adam, 2019).

The intake of excessive sodium increases sodium concentrations in extracellular fluid, causing the body to normalize this imbalance by drawing fluid from the cells. This process increases blood volume, which further elevates blood pressure and directly contributes to hypertension (Hardiansyah & Supariasa, 2018). This physiological process illustrates how excess sodium consumption affects blood pressure, serving as an important risk factor for hypertension. Moreover, high sodium (salt) intake negatively impacts the blood vessels by narrowing the diameter of the arteries. As the arteries become narrower, the heart is required to work harder to circulate blood throughout the body. The elevated blood volume caused by high sodium levels worsens this situation by reducing the space available for blood to flow. This forces the heart to pump with greater force to push blood through the narrowed arteries, resulting in higher blood pressure. Over time, this persistent strain contributes significantly to the development of hypertension, amplifying the pressure exerted on the heart (Yulianda, 2021).

In conclusion, the findings from this study reinforce the understanding that high salted fish consumption, particularly in coastal communities, is linked to a higher risk of hypertension during pregnancy. Excessive sodium intake is a major contributing factor, and this study's results underscore the importance of addressing dietary habits, particularly the consumption of salted fish, as part of efforts to prevent and manage hypertension in these populations. Reducing sodium intake could play a vital role in lowering the prevalence of hypertension, improving maternal health outcomes, and mitigating the associated risks of pregnancy complications such as preeclampsia and maternal mortality.

Research Limitations

This study only measures some variables, so it is hoped that future researchers can continue research with more complete variables. This study also uses quantitative methods, so that if the next researcher conducts research on the same topic, it can be done with qualitative methods to find out the relationship between salted fish consumption habits and the incidence of hypertension more specifically.

Conclusion

1) Most respondents have salted fish consumption habits with high habit categories, namely as many as 50 respondents (50.5%).
2) Most respondents did not develop hypertension in pregnancy, as many as 72 respondents (72.7%).

3) A significant link was found between the practice of consuming salted fish and the occurrence of Hypertension in Pregnancy (HDK) in the coastal area of Tuban Regency, with a p-value of 0.000, which is below the 0.05 level.

Ethics approval and consent to participate

This study has undergone review and received approval from the Ethics Committee for Health Research at the Faculty of Medicine, Universitas Airlangga. with approval number No. 18./EC/KEPK/FKUA/2024.

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