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Is food insecurity higher among pregnant women in rural areas of Indonesia?

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ABSTRACT

Aims: This study aimed to provide valuable insights to inform targeted interventions to alleviate food insecurity and improve maternal and fetal health outcomes, particularly in Indonesia.

Methods: This cross-sectional study was conducted in rural West Sumatra, Indonesia, and investigated food security among 103 randomly selected pregnant women from Pesisir Selatan District. Participants were selected based on residency and consent, while those with severe illness or communication limitations were excluded. Data were collected using the validated Household Food Insecurity Access Scale. Statistical analysis, including Chi-square tests and logistic regression, was used to explore associations.

Results: The study included 103 pregnant women, with a mean age of 25.22±3.35 years, ranging from 19 to 40 years. Results indicated a high prevalence of food insecurity (62.1%) among participants. Initial bivariate analysis showed a significant association between food insecurity and low maternal nutrition knowledge [odds ratio (OR): 6.378; 95% confidence interval (CI): 2.638-15.418; p≤0.001]. In the multivariate analysis, adjusted for maternal occupation and socioeconomic status, the association remained significant with p-values of 0.014 and <0.001, respectively. Multiple logistic regression revealed significant associations between food insecurity and maternal unemployment (OR: 9.147; 95% CI: 1.559-53.665; p=0.014) and low socioeconomic status (OR: 29.603; 95% CI: 8.800-99.584; p<0.001).

Conclusions: These findings highlight the strong impact of unemployment and low socioeconomic status on food insecurity among pregnant women in rural West Sumatra. While maternal nutrition knowledge initially showed a significant relationship, its influence diminished in the context of other factors.

Introduction

Food security, defined as universal access to sufficient, nutritious meals for a healthy lifestyle, is imperative to combating undernutrition (1). Recent global trends have shown a concerning rise in moderate to severe food insecurity, with prevalence reaching 29.6% and persisting at this elevated level from 2019 to 2020. Despite a slight decrease in severe food insecurity from 11.7% to 11.3% between 2021 and 2022, the overall figures remain higher than pre-pandemic levels, which were below 11.7% (2). While Indonesia showed signs of improvement in food security according to the 2022 Global Food Security Index, the country still grapples with persistently low levels compared to previous years (3).

Pregnant women are especially susceptible to the effects of not having enough nutritious food. The Food and Agriculture Organization and various studies consistently highlight that women, especially in lower-income countries and rural areas, face a higher risk of food insecurity compared to men (1,4-6). Inadequate food intake during pregnancy can exacerbate complications such as maternal morbidity, mental health issues, and fetal problems like intrauterine growth retardation and low birth weight (7-12). Previous research identified various factors contributing to household food insecurity, encompassing health risks, food accessibility, and socioeconomic factors (13). Studies have extensively explored determinants of food security across different populations and regions in Indonesia, examining factors like age, gender, education, and socioeconomic status (14). These studies reveal a complex array of determinants influencing food security. Building on this knowledge, the current study sought to explore the specific determinants of food security among pregnant women in rural areas of Western Indonesia. The aim was to provide insights that could inform targeted interventions to alleviate food insecurity and improve maternal and fetal health outcomes in Indonesia.

Methods

Research design and respondents

This cross-sectional study focused on pregnant women living in rural Pesisir Selatan District, West Sumatra, Indonesia, particularly in the Basa Ampek Balai Subdistrict under the Tapan Public Health Center's jurisdiction.

A sample size of pregnant women was determined using the Lemeshow formulation for observational research on two population proportions, where Z=1.96 and d=0.05 (15). This formula was chosen to ensure a desired level of precision in estimating the proportions of interest within the population. The value of Z=1.96 corresponds to a 95% confidence level, indicating confidence that the actual population parameter lies within the computed interval. The margin of error (d=0.05) signified the desired precision level, indicating the maximum allowable deviation from the true proportion. By using these parameters, the study aimed to achieve reliable estimates of population proportions while maintaining statistical confidence in the findings.

$$n = \frac{Z_{1-\alpha/2^2} P(1-P)N}{d^2(N-1) + Z^2 P(1-P)}$$

$$n = \frac{1.96^2 \times 0.577\ (1-0.577) \times 141}{0.05^2(141-1) + 1.96^2\ \times\ 0.577\ (1-0.577)}$$

$$n = 103$$

The sample obtained using this formula consisted of 103 pregnant women who were selected through random sampling. Participants who consented to the study after receiving thorough explanations and signing informed consent forms were included. Exclusion criteria included individuals who were sick, making it difficult to communicate, those who needed more rest, and respondents who refused to be interviewed or were not at the location. Exclusion criteria in this study applied to those suffering from serious illness and being unable to communicate effectively. Illness status was assessed through initial observations by enumerators and self-reported symptoms from respondents. Evaluating participants' communication abilities involved direct observations by enumerators to gauge their comprehension and responses to basic instructions or study-related questions. The study also excluded respondents who refused to be interviewed or were not present at the location.

Data collection

Enumerators received training on how to interview participants and complete research questionnaires. Trained enumerators, under the direct supervision of two researchers, collected both secondary and primary data for this study. Secondary data were obtained from agency reports, including the prevalence of nutritional problems in pregnant women and the population of pregnant women in the research location. Primary data were obtained from a validated and standardized questionnaire, namely the Household Food Insecurity Access Scale (HFIAS) from the Food and Nutrition Technical Assistance (16). The validation test was carried out using the gamma correlation test by examining the p-value and correlation coefficient (r) obtained. The higher the correlation value obtained (the closer it was to 1), the better the validity of the measuring instrument.

The assessment of food security in this study was conducted using a questionnaire tool called the HFIAS. It consisted of nine questions aimed at gauging the frequency and severity of food insecurity experienced by families over the past four weeks. Respondents indicated whether certain conditions had occurred during this period with a "yes" or "no" response. To further assess the severity of food insecurity, Likert scale questions were used with response options of never (0), rarely (1 or 2 times), sometimes (3-10 times), and often (>10 times). Scores were then calculated based on these responses, ranging from 0 to 27, to determine the level of food insecurity. Based on the total scores, households were categorized into four levels: food secure (0 scores), mildly food insecure (1-5 scores), moderately food insecure (6-13 scores), and severely food insecure (14-27 scores). For analytical purposes, food security status was dichotomized into "secure" (no occurrence of any conditions) and "not secure" (at least one positive response to the nine items), facilitating the identification of predictors of food security (16-18).

Pregnant women's characteristics, encompassing age, gestational age, nutrition knowledge, education level,

maternal employment status, and socioeconomic status, were systematically collected using a structured, standardized, and validated questionnaire. Education level was classified as “low” (completion of junior high school or below) or “high” (completion of senior high school or above) (19). Maternal employment status was dichotomized into “unemployment”, for those who did not work or solely engaged in household duties, and “employment” for those with an occupation (20,21).

Socioeconomic status was determined using a structured socioeconomic assessment tool. The cut-off categorization, which used about 80% of the total scores, was modified from previous studies. This tool categorized socioeconomic status into “low” (total score <19) and “high” (total score ≥19) based on various indicators, including educational level (1 = less than middle school, 2 = less than high school, 3 = graduated with a diploma or a degree), income (1 = less than Rp. 600.000, 2 = Rp. 600.000-1.200.000, 3 = more than Rp. 1.200.000), occupation (1 = not working, 2 = trader, 3 = civil servant or private employee), housing quality (1 = not permanent, 2 = semi-permanent, 3 = permanent), ownership status (1 = renting, 2 = contract/rent, 3 = own), number of children (1 = more than 4 people, 2 = 2-3 people, 3 = 1 person), wealth items such as gold, television, and refrigerator (1 = 1 type, 2 = 2 types, 3 = 3 types or more), and sources of drinking water (1 = well water, 2 = well water and tap water, 3 = tap water) (22,23).

In terms of nutrition knowledge, participants were assessed through a series of 16 questions covering topics such as nutritious foods, their importance for bodily health, the consequences of inadequate nutrition, and strategies for preventing undernutrition during pregnancy. Respondents were allowed to select multiple answers for each question. The total score, based on correct responses, was 50 points. Nutrition knowledge status was categorized as “low” (scores <70%) or “high” (scores ≥70%) (24,25).

Before data collection, participants had been briefed on the study’s objectives and potential risks, after which they provided consent by signing an informed consent form. Additionally, approval was secured from the school principal. The procedures of the study were approved by the Ethics Committee of the Faculty of Public Health of Universitas Andalas (decision number: 10/UN16.12/KEP-FKM/2023, date: 30.05.2023).

In addition, permission letters to conduct research in the Tapan Community Health Center area were obtained from the relevant health agencies and local government authorities. These permission letters explicitly provided access to the support necessary for the smooth implementation of the research. This support included coordination with local health staff, access to necessary health records, and the use of health center facilities for data collection activities. Such comprehensive permits ensured that the research was compliant with local regulations and with the necessary institutional support.

Statistical Analysis

Data analysis was performed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA). The analysis included univariate, bivariate, and multivariate techniques. Chi-square tests were used to examine the relationships between independent and dependent variables. Simple and multiple logistic regression models were used to determine the key factors influencing food security among pregnant women. Variables with a p-value of less than 0.5 in the bivariate analysis were included in the multivariable analysis. Independent predictors of anemia were identified using odds ratios (OR) greater than 1 with 95% confidence intervals (CI).

Results

The study included 103 pregnant women with a mean age of 25.22±3.35 years; they had a gestational age of 5.49±1.82 months, or second trimester. In general, respondents had an educational background above junior high school (95.1%), were housewives (85.4%), and had low socioeconomic status (55.3%) (Table 1).

The analysis of data from a cohort of pregnant women residing in rural areas of Western Sumatra indicated a notable prevalence of food insecurity, with 62.1% of participants affected. Using the HFIAS, researchers observed that the majority of respondents (93.2%) reported minimal concerns regarding household food sufficiency (Table 2).

Regarding demographic variables, a significant proportion (66.7%) of pregnant women aged 19 to 29 years experienced food insecurity, although the statistical association between age and food security status was not significant (OR: 1.778; 95% CI: 0.768-4.114; p=0.177). Additionally, a substantial segment

Table 1. Demographic characteristics

Demographic characteristics	**Mean±SD**
Pregnant women’s age (years)	25.22±3.35
Gestational age (months)	5.49±1.82
Variable	**n (%)**
Nutrition knowledge	
Low	64 (62.1)
High	39 (37.9)
Education level	
Low	5 (4.9)
High	98 (95.1)
Maternal employment status	
Unemployment	88 (85.4)
Employment	15 (14.6)
Socio-economic status	
Low	57 (55.3)
High	46 (44.7)

SD: Standard deviation

(78.1%) exhibited low levels of nutrition knowledge, with a statistically significant correlation observed between low levels of nutrition knowledge and food insecurity (OR: 6.378; 95% CI: 2.638-15.418; p<0.001).

While educational attainment did not exhibit a statistically significant association with food insecurity, mothers who were unemployed or homemakers were more predisposed to household food insecurity (69.3%) compared to their employed counterparts. Notably, a significant association was identified between maternal employment and food insecurity among pregnant women (OR: 9.037; 95% CI: 2.357-34.645; p<0.001). Furthermore, lower socioeconomic status was strongly correlated with heightened rates of food insecurity (91.2%) compared to those with higher socioeconomic standing, a relationship deemed statistically significant (OR: 29.467; 95% CI: 9.526-91.153; p<0.001) (Table 3).

Subsequent multiple logistic regression analysis revealed (Table 4) that both maternal unemployment status (OR: 9.147; 95% CI: 1.559-53.665; p=0.014) and low socioeconomic status (OR: 29.603; 95% CI: 8.800-99.584; p<0.001) emerged as risk factors against food insecurity among pregnant women.

Table 2. Prevalence and indicators of food insecurity of pregnant women in rural areas of Western Sumatera

Food security category	**n**	**%**
Food secure	39	37.9
Food insecure	64	62.1
Household hunger scale indicators in the past 4 weeks	**Yes n (%)**	**No n (%)**
Worry about household would not have enough food	7 (6.8)	96 (93.2)
Pregnant woman or household member was unable to eat the foods you preferred because of a lack of resources	30 (29.1)	73 (70.9)
Pregnant woman or household member had to eat a limited variety of foods due to a lack of resources	36 (35.0)	67 (65.0)
Pregnant woman or household member had to eat foods they did not want because they couldn't obtain other types of food	47 (45.6)	56 (54.4)
Pregnant woman or household member had to eat smaller meals than needed due to a shortage of food	103 (100.0)	0 (0.0)
A pregnant woman or other household member had to reduce daily meals because of insufficient food	103 (100.0)	0 (0.0)
There were times when the household had no food due to a lack of resources	103 (100.0)	0 (0.0)
Pregnant woman or household member slept hungry at night because there was not enough food	103 (100.0)	0 (0.0)
Did you or any household member go all day and night without eating anything due to a lack of food?	103 (100.0)	0 (0.0)

Table 3. Characteristics and other factors of pregnant women with food security

Independent variables	**Food security status**		**p-value**
	Insecure n (%)	**Secure n (%)**	
Pregnant woman's age			
19-29 years	46 (66.7)	23 (33.3)	0.177
30-40 years	18 (52.9)	16 (47.1)	
Nutrition knowledge			
Low	50 (78.1)	14 (21.9)	**<0.001**
High	14 (35.9)	25 (64.1)	
Education level			
Low	5 (100.0)	0 (0.0)	-
High	59 (60.2)	39 (39.8)	
Maternal employment status			
Unemployment	61 (69.3)	27 (30.7)	**<0.001**
Employment	3 (20.0)	12 (80.0)	
Socio-economic status			
Low	52 (91.2)	5 (8.8)	**<0.001**
High	12 (26.1)	34 (73.9)	

*Statistical test: Chi-square test

Table 4. Determinants of food insecurity of pregnant women in rural areas of Western Indonesia

Variables	Simple logistic regression		Multiple logistic regression	
	OR (95%CI)	p-value	OR (95%CI)	p-value
Pregnant woman's age	1.601 (0.180-14.234)	0.673	-	-
Nutrition knowledge	2.227 (0.700-7.081)	0.175	-	-
Education level	88651145.28 (0.000-)	0.999	-	-
Maternal employment status	6.693 (1.112-40.270)	**0.038**	9.147 (1.559-53.665)	**0.014**
Socio-economic status	22.063 (6.367-76.450)	**<0.001**	29.603 (8.800-99.584)	**<0.001**

*Statistical test: Simple logistic regression and multiple logistic regression, OR: Odds ratio, CI: Confidence interval

Discussion

The findings of this study corroborated earlier research, indicating a high incidence of food insecurity among pregnant women in rural areas. A significant relationship was also observed between maternal nutrition knowledge and food security, with well-informed mothers tending to provide better nutrition for their families. Comparable studies conducted in Semarang District, Indonesia, and rural Bangladesh reported similarly elevated rates of household food insecurity, indicating a consistent regional trend (26,27). Conversely, a lower prevalence was noted in Iran, albeit within an urban context. Significantly, the coronavirus disease of 2019 pandemic worsened global food insecurity, as evidenced by a meta-analysis showing a high prevalence of food insecurity (28,29). A study referenced in this research underscored the detrimental effects of food insecurity on the quality of life of pregnant women (30).

The observed disparities in food insecurity percentages could be attributed to variances in geographical location, methodologies, sample sizes, and measurements employed across studies. Nonetheless, common determinants emerged, including socioeconomic factors such as low income, unemployment, and limited access to food markets and transportation (31,32).

Dietary patterns also played a role, with food-secure pregnant women displaying higher consumption of animal proteins, while their food-insecure counterparts relied more heavily on vegetables (33). A wealth of research demonstrated a robust link between food insecurity and malnutrition among women of reproductive age, including pregnant women (34,35). A study conducted in Central Tapanuli Regency, Indonesia, identified a significant connection between household food security and energy and protein intake during pregnancy, which affected maternal weight gain and birth outcomes (36,37).

Furthermore, economic constraints often led to restrictive feeding practices, limiting dietary variety and nutritional adequacy (38,39). In line with earlier studies, maternal education level was identified as a critical factor, with lower educational attainment being associated with a higher risk of food insecurity among pregnant women (40,41). Additionally, maternal employment and household socioeconomic status were recognized as key risk factors, supporting existing literature, which indicated that socioeconomic and environmental factors influenced food insecurity (42-44). According to the findings of this study, increasing income levels were essential for attaining household food security.

The research results indicated that the level of nutritional knowledge acted as a mediating factor in the relationship between maternal employment and socioeconomic status, and food insecurity. Mothers who had good nutritional knowledge prepared more balanced food and were able to understand the nutritional adequacy of pregnancy as recommended (45). Even if a mother had a high socioeconomic background, having low levels of nutritional knowledge made it difficult for her to provide nutritious food for her family. This was supported by the current study, which showed that more than half of the mothers had low levels of nutritional knowledge. Research conducted by Mousa TY and Dardas LA in 2023 found that nutritional knowledge was linked to food security ($p<0.05$). This was because individuals who possessed good nutritional knowledge were motivated to apply the acquired information by providing a healthy food supply, engaging in better food shopping practices, and improving health and nutrition-related behavior (46-48).

Despite these insights, the cross-sectional nature of the study limited its ability to establish causal relationships between predictors and food insecurity. Additionally, the generalizability of the findings was confined to pregnant women with similar rural characteristics, but the study did not specifically address other health conditions of pregnant women in rural areas. Furthermore, the study did not distinguish the effect of financial resources on food insecurity apart from employment status. Future research endeavors are warranted to explore and compare determinants

of food security across urban and rural settings and informing targeted interventions to alleviate malnutrition among pregnant women and children.

Conclusion

The study findings highlighted the crucial influence of maternal unemployment and low socioeconomic status as primary determinants of food insecurity among pregnant women in rural areas of West Sumatra Province. Notably, nutrition knowledge emerged as a mediating factor in the relationship between maternal employment, socioeconomic status, and food security. Consequently, integrating nutrition education initiatives into health center activities holds promise for enhancing maternal knowledge and fostering improved nutrition practices within households. Moving forward, there is a pressing need for further research employing robust study designs to elucidate causal associations and guide targeted interventions aimed at tackling food insecurity within this vulnerable population.

Ethics

Ethics Committee Approval: The procedures of the study were approved by the Ethics Committee of the Faculty of Public Health of Universitas Andalas (decision number: 10/UN16.12/KEP-FKM/2023, date: 30.05.2023).

Informed Consent: Consent form was filled out by all participants.

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Footnotes

Authorship Contributions

Surgical and Medical Practices: A.A., R.R., G.F.I., U.U.F., A.D.A., Concept: A.A., Design: A.A., G.F.I., Data Collection or Processing: G.F.I., Analysis or Interpretation: A.A., Literature Search: A.A., R.R., U.U.F., Writing: A.A., R.R., U.U.F., A.D.A.

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