

Assessing Household Nutritional Status in High-Density Urban Areas of Bandar Lampung: The Role of Diet Quality and Socioeconomic Determinants

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Abstract

Household nutritional status in densely populated urban areas is influenced by multiple factors, particularly diet quality and socioeconomic conditions. This study aimed to assess household nutritional status in high-density urban areas of Bandar Lampung and to examine the role of diet quality and socioeconomic determinants in shaping nutritional outcomes. A quantitative descriptive approach was employed in three densely populated urban areas, namely Jagabaya II, Kaliawi, and Pengajaran. Data were collected from 285 households selected using simple random sampling and analyzed using descriptive statistics, Pearson product-moment correlation, multiple linear regression, ANOVA, and partial t-tests with SPSS version 28. The findings showed that Jagabaya II had the highest average scores for diet quality (43.45), socioeconomic determinants (31.16), and household nutritional status (39.57), followed by Kaliawi and Pengajaran. Correlation analysis demonstrated positive relationships between diet quality, socioeconomic determinants, and household nutritional status across all study areas, although the strength of association varied by location. Multiple linear regression analysis confirmed that both diet quality and socioeconomic determinants significantly affected household nutritional status in Jagabaya II, Kaliawi, and Pengajaran ($p < 0.05$). The coefficient of determination analysis indicated that the regression models explained 43.2% of the variation in household nutritional status in Jagabaya II, 36.4% in Kaliawi, and 47.3% in Pengajaran. The ANOVA results further showed significant differences in socioeconomic determinants and household nutritional status among the three urban areas, while diet quality did not differ significantly. Overall, the study demonstrates that household nutritional status in densely populated urban communities is shaped not only by diet quality, but also by socioeconomic capacity and local urban conditions. These findings highlight the importance of integrated nutrition interventions that combine healthy dietary promotion, nutrition education, improved food accessibility, and socioeconomic support to improve nutritional outcomes in urban populations.

Keywords: diet quality; socioeconomic determinants; household nutritional status; high-density urban areas; urban nutrition.

INTRODUCTION

Rapid urbanization in developing countries has intensified population density, constrained land availability, and increased living costs, thereby complicating household efforts to achieve adequate nutrition. Urban areas are characterized by large populations, industrial concentration, and rapid socioeconomic development (Nabila et al., 2022). In such settings, households are more likely to depend on processed and fast foods that are relatively low in nutritional value, which can increase the risk of malnutrition, obesity, and other diet-related non-communicable diseases (FAO, 2020). Household dietary patterns are also shaped by socioeconomic conditions, because income, education, and occupation influence food purchasing decisions, food diversity, and nutritional outcomes (Sari, 2017). Food quality, therefore, is not

only a matter of availability, but also of nutritional adequacy, safety, and health relevance (FAO, 2021; WHO, 2022).

In Indonesia, one commonly used indicator of diet quality is the Pola Pangan Harapan (PPH) or Desirable Dietary Pattern, which reflects the balance and diversity of food consumption while considering social, economic, cultural, religious, and taste-related factors. Nationally, the PPH score increased from 92.9 in 2022 to 94.1 in 2023, exceeding the 2023 RPJMN target (Badan Pangan Nasional, 2023). Bandar Lampung also showed a positive trend, with the PPH score rising from 85.4 in 2021 to 93.2 in 2023, suggesting improvement in dietary diversity and consumption quality (Badan Pangan Nasional, 2023). Law No. 11 of 2023 on Food further emphasizes balanced, safe, and nutritious food consumption as a foundation for food security and public health.

Despite these encouraging trends, nutritional vulnerability remains pronounced in high-density urban areas. In Bandar Lampung, the urban districts of Way Halim, Tanjung Karang Pusat, and Teluk Betung Utara have high population density and differing household poverty profiles, making them relevant sites for examining urban nutritional inequality. Within these districts, Jagabaya II, Kaliawi, and Pengajaran represent distinct socioeconomic and demographic settings: Jagabaya II has a relatively high burden of poor households, Kaliawi has the highest population density and a relatively lower socioeconomic profile, and Pengajaran has comparatively fewer poor households and a higher income profile. Such variation supports sub-district-level analysis to identify locally specific nutrition problems and target interventions more precisely.

Previous studies cited in the thesis indicate that urban households, especially low-income groups, tend to consume more processed and ultra-processed foods because these products are inexpensive, convenient, energy-dense, and widely available (Vilar-Compte et al., 2021; Monteiro, 2019). At the same time, access to healthier foods such as fruits, vegetables, legumes, and fresh carbohydrate sources may be constrained by food prices, distribution barriers, and geographic disparities (Horowitz et al., 2004; Vilar-Compte et al., 2021). Vilar-Compte et al. (2021) showed that although urban diets can be more diverse than rural diets due to stronger distribution systems, diversity does not necessarily translate into better nutritional quality. These patterns reflect the nutrition transition associated with urbanization and socioeconomic inequality (Hawkes et al., 2015; Drewnowski & Popkin, 2020).

Socioeconomic determinants remain central to understanding household nutritional status in urban communities. Income influences purchasing power, education shapes nutrition knowledge and food choice, and occupation affects both economic stability and time available for food preparation (Purwati et al., 2023). Inadequate dietary intake may contribute to malnutrition, while poor diet quality is linked to obesity and other health problems (Desmawati, 2023; Hawkes et al., 2015). In densely populated urban settings, households may also face time constraints and practical barriers that encourage reliance on convenient but less nutritious foods (Drewnowski & Popkin, 2020). For this reason, UNICEF and FAO emphasize nutrition education, improved access to healthy foods, and dietary diversification as key strategies to improve urban nutritional outcomes.

In Bandar Lampung, the Food Security and Vulnerability Atlas (FSVA) 2023 highlights persistent food vulnerability in several areas, underscoring the need for nutrition-sensitive interventions at the local level. Understanding household nutritional conditions at the sub-district level is therefore essential for designing interventions that reflect local socioeconomic differences and dietary behavior. Accordingly, this study assesses

household nutritional status in high-density urban areas of Bandar Lampung and examines the role of diet quality and socioeconomic determinants. Specifically, it investigates the influence of diet quality on household nutritional status, the relationship between population density and food consumption quality, the contribution of socioeconomic factors to household nutrition, and the differences in nutritional conditions across Jagabaya II, Kaliawi, and Pengajaran.

MATERIALS AND METHODS

Study Area

This study was conducted in three urban sub-district in Bandar Lampung (Indonesia), namely Jagabaya II, Kaliawi, and Pengajaran, which have been categorized by the Central Bureau of Statistics (BPS) as densely populated urban areas. These locations represent urban communities with high population density and varying socioeconomic characteristics. The study areas are located within three districts: Way Halim, Teluk Betung Utara, and Tanjung Karang Pusat. The population densities of these districts were reported as 6,285 inhabitants/km² in Way Halim, 12,171 inhabitants/km² in Teluk Betung Utara, and 14,379 inhabitants/km² in Tanjung Karang Pusat.

Research Design

This study employed a quantitative descriptive approach to assess household nutritional status in high-density urban areas and to examine the role of diet quality and socioeconomic determinants. In this study, statistical methods were used to analyze numerical data obtained from respondents in order to describe patterns of diet quality, socioeconomic conditions, and household nutritional status in densely populated urban communities.

Sampling and Participants

The study population consisted of households located in Jagabaya II, Kaliawi, and Pengajaran, Bandar Lampung. Household samples were selected using simple random sampling. Sample size was determined using the Slovin formula with a 10% margin of error to obtain representative samples from each study area. Based on the calculation, 97 households were selected from Jagabaya II, 96 households from Kaliawi, and 92 households from Pengajaran.

Data Collection

Data were collected through library research and field surveys. Secondary information was obtained from books, scientific journals, reports, and other relevant references related to urban nutrition and food consumption. Primary data were collected through direct observation and structured questionnaires administered to households in Jagabaya II, Kaliawi, and Pengajaran.

Field observations were conducted through household visits to assist respondents during questionnaire completion, accompanied by local community representatives. Structured questionnaires were administered through household visits, with online responses collected when direct administration was not feasible. Responses were measured using an ordinal scale consisting of three categories: Always (3), Sometimes (2), and Never (1). The questionnaire contained structured statements designed to assess diet quality, socioeconomic determinants, and household nutritional status.

Study Variables

This study involved one dependent variable and two independent variables. Household nutritional status was treated as the dependent variable, while diet quality and socioeconomic determinants were treated as independent variables. The variables were operationalized through structured questionnaire items measured using an ordinal scale. Diet quality (X_1) referred to the extent to which food consumption met standards of nutritional adequacy, food safety, and dietary diversity that support human health. This variable included four dimensions: food safety, nutritional adequacy, dietary diversity, and food affordability/accessibility (Suhaimi, 2019). Socioeconomic determinants (X_2) included household income, education, and occupation, which were considered factors influencing the ability of households to obtain nutritious food and maintain balanced dietary practices. Household nutritional status (Y) referred to the ability of households living in densely populated urban areas to fulfill balanced nutritional needs. This variable included indicators related to food availability, food accessibility, dietary patterns and consumption habits, nutrition education, and food policy, adapted from Nugraha et al. (2022). Overall, the research instrument consisted of 33 questionnaire items measured using an ordinal scale.

Data Analysis

Data analysis was conducted using a quantitative approach supported by SPSS version 28. The analytical procedures included descriptive statistics, data quality testing, classical assumption testing, correlation analysis, multiple linear regression, and hypothesis testing.

Descriptive statistics were used to summarize and describe the characteristics of the collected data, including mean, median, variance, standard deviation, minimum value, and maximum value (Ghozali, 2018). Prior to hypothesis testing, instrument quality was assessed through validity and reliability tests. Validity testing was performed using Pearson correlation to examine the relationship between each questionnaire item and the total score. Reliability testing was conducted using Cronbach's alpha, with a coefficient greater than 0.50 indicating acceptable reliability (Ghozali, 2018). A pilot test involving 30 respondents

with characteristics similar to the study participants was conducted before the main survey.

Classical assumption testing included normality, multicollinearity, and heteroscedasticity tests. Normality was evaluated through residual distribution patterns and histogram plots. Multicollinearity was assessed using tolerance and variance inflation factor (VIF) values, while heteroscedasticity was examined using the Park test. The coefficient of determination (R^2) was used to evaluate the explanatory power of the regression model in explaining variations in household nutritional status.

Pearson product-moment correlation analysis was used to examine the linear relationship between variables, particularly the relationship between diet quality and household nutritional status, as well as between population density and food consumption quality. Correlation coefficients were interpreted based on the strength of association ranging from very weak to very strong (Sugiyono, 2022).

Multiple linear regression analysis was applied to estimate the effects of diet quality and socioeconomic determinants on household nutritional status in densely populated urban areas. The regression model was formulated as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

where Y represents household nutritional status, X_1 represents diet quality, X_2 represents socioeconomic determinants, α is the constant, β represents the regression coefficient, and ε is the error term.

Hypothesis testing included independent-samples t-tests and partial t-tests. Independent-samples t-tests were used to compare differences between groups, while partial t-tests were used to evaluate the individual contribution of each independent variable to household nutritional status. Statistical significance was determined at a significance level of 5% ($p < 0.05$).

RESULTS AND DISCUSSION

Descriptive Characteristics of Diet Quality, Socioeconomic Determinants, and Household Nutritional Status

The results showed that Jagabaya II had the highest average scores for diet quality (43.45), socioeconomic determinants (31.16), and household nutritional status (39.57), compared with Kaliawi and Pengajaran (Table 1). The relatively high diet quality and socioeconomic scores in Jagabaya II indicate that most households were categorized as having relatively adequate access and capacity to fulfill food and nutritional needs. In addition, the moderate standard deviation values for diet quality and socioeconomic variables suggest that household conditions in Jagabaya II were relatively homogeneous, with a more stable distribution of economic welfare across families.

Table 1. Mean scores of diet quality, socioeconomic determinants, and household nutritional status across study areas.

Sub-district	Diet quality	Socioeconomic determinant	Household Nutritional Status
Jagabaya II	43.45	31.16	39.57
Kaliawi	42.96	29.97	36.55
Pengajaran	42.95	29.45	36.60

Despite having the highest mean nutritional fulfillment score, Jagabaya II also exhibited relatively large variation in household nutritional status ($SD = 4.804$). This finding indicates that although average nutritional conditions were generally favorable, some households still experienced lower nutritional fulfillment than others. Such variation may be associated with differences in food preferences, eating behavior, nutrition literacy, and food preparation practices despite relatively sufficient food access and purchasing power. These findings suggest that nutritional outcomes in Jagabaya II were influenced not only by economic access but also by behavioral and educational factors related to food selection and dietary habits.

Kaliawi demonstrated a different pattern. Although the average diet quality score (42.96) was nearly similar to Jagabaya II, the average socioeconomic score was lower (29.97) and showed greater variation ($SD = 4.837$). This pattern reflects greater socioeconomic inequality among households in Kaliawi, where some families had relatively stable economic conditions while others were more vulnerable. Household nutritional status in Kaliawi (36.55) was lower than in Jagabaya II and exhibited high variation ($SD = 6.890$), indicating substantial disparities between households with adequate nutritional conditions and those experiencing nutritional limitations. The broad range of nutritional fulfillment scores further suggests that some households faced serious nutritional constraints while others maintained relatively good nutritional conditions.

These findings indicate that diet quality alone was insufficient to guarantee adequate household nutritional status in Kaliawi. Socioeconomic conditions, particularly household income and access to nutritious food, played an important role in shaping nutritional outcomes. Economically vulnerable households may face difficulties obtaining protein-rich foods, fruits, and vegetables consistently, despite living in urban areas with relatively available food markets.

Pengajaran showed another distinct pattern. Although the average diet quality score (42.95) was comparable to Kaliawi, Pengajaran exhibited the widest range of diet quality values, indicating substantial inequality in food consumption patterns among households. The socioeconomic determinant variable also showed large variation ($SD = 5.405$), reflecting considerable differences between economically stable and vulnerable households. Furthermore, household nutritional status in Pengajaran had the highest standard deviation ($SD =$

7.185) among all study locations, indicating highly heterogeneous nutritional conditions.

Geographically, Pengajaran is located relatively close to food distribution centers, suggesting that physical food access may not be the primary challenge. However, factors such as low nutrition literacy, preference for fast food, and limited time available for food preparation due to occupational mobility likely contributed to poorer dietary behavior among some households. This finding highlights that proximity to food sources does not automatically improve household nutritional status unless accompanied by healthy dietary practices and adequate nutritional knowledge.

Overall, the three sub-districts demonstrated relatively good average diet quality and household nutritional conditions. However, variation in household nutritional status was consistently greater than variation in diet quality and socioeconomic conditions. This pattern suggests that household nutrition in densely populated urban areas is influenced not only by food consumption quality and economic capacity, but also by additional factors such as nutrition literacy, cooking time availability, work burden, and household dietary behavior.

These findings are consistent with previous studies discussing nutritional challenges in urban populations. Harjatmo (2025) reported that limited cooking time and low nutrition literacy strongly affect the effectiveness of food consumption in fulfilling household nutritional needs in densely populated urban settings. Fatmawaty et al. (2025) similarly observed that urban households tend to rely on fast food because of limited time for food preparation, which negatively affects nutritional quality. Aisyah et al. (2023) further emphasized that low household income limits access to nutritious food despite adequate nutrition knowledge. Similar conclusions were reported by Islami & Andrijanto (2024), who identified a significant relationship between household income and nutritional status among school-age children in densely populated settlements.

Additional studies also reinforce the multidimensional nature of household nutrition in urban communities. Aulia et al. (2025) highlighted that the double burden of malnutrition in urban areas is influenced not only by food consumption but also by limited cooking time, media exposure, and parental workload. Somantri et al. (2025) found that low nutrition literacy in densely populated communities contributes to monotonous and nutritionally imbalanced diets. Muslihah et al. (2023) similarly reported that limited

time for preparing healthy meals increases dependence on processed foods high in salt and fat. Agustian et al. (2023) further demonstrated that nutrition education and household time-management interventions significantly improve family nutritional status. These studies collectively support the present findings that improving household nutritional status in densely populated urban areas requires integrated interventions addressing not only food access and income, but also nutrition education and behavioral change.

Instrument Validity and Reliability

Instrument validity testing was conducted to ensure that each questionnaire item accurately measured the intended research variables. Validity was assessed using Pearson correlation analysis, in which each questionnaire item was correlated with the total score of the corresponding variable. Table 2 showed that all questionnaire items met the validity criteria, with

correlation coefficients exceeding the critical value at a significance level of 0.05. These findings indicate that all items were capable of measuring the intended constructs accurately and consistently, demonstrating that the research instrument was appropriate for subsequent statistical analysis. After confirming instrument validity, reliability testing was conducted to evaluate the consistency and stability of respondents' answers using Cronbach's alpha coefficients.

The diet quality variable showed a Cronbach's alpha value of 0.854, while socioeconomic determinants obtained a value of 0.850. Household nutritional status demonstrated the highest reliability value at 0.916. All values exceeded the minimum recommended threshold of 0.50, indicating that the questionnaire possessed strong internal consistency and produced stable responses across respondents. These findings confirm that the research instrument was highly reliable and appropriate for further analysis.

Table 2. Reliability test results.

Variable	Cronbach's Alpha	Interpretation	Reliability level
Diet quality (X_1)	0.854	Reliable	Very strong
Socioeconomic determinants (X_2)	0.850	Reliable	Very strong
Household nutritional status (Y)	0.916	Reliable	Very strong

Classical Assumption Test

Classical assumption testing was conducted to evaluate the suitability of the regression models and to ensure that no violations of regression assumptions were present. The tests included normality, multicollinearity, and heteroscedasticity analyses. Normality testing was performed to determine whether the residual data in the regression models were normally distributed. In this study, the Normal P-P Plot of Regression Standardized

Residual was used to assess normality. The normality test results for Jagabaya II, Kaliawi, and Pengajaran are presented in Figure 1. The results showed that the residual points in all three study areas were distributed around the diagonal line and followed its direction, indicating that the residual data were approximately normally distributed. Therefore, the normality assumption was fulfilled for all regression models used in the study.

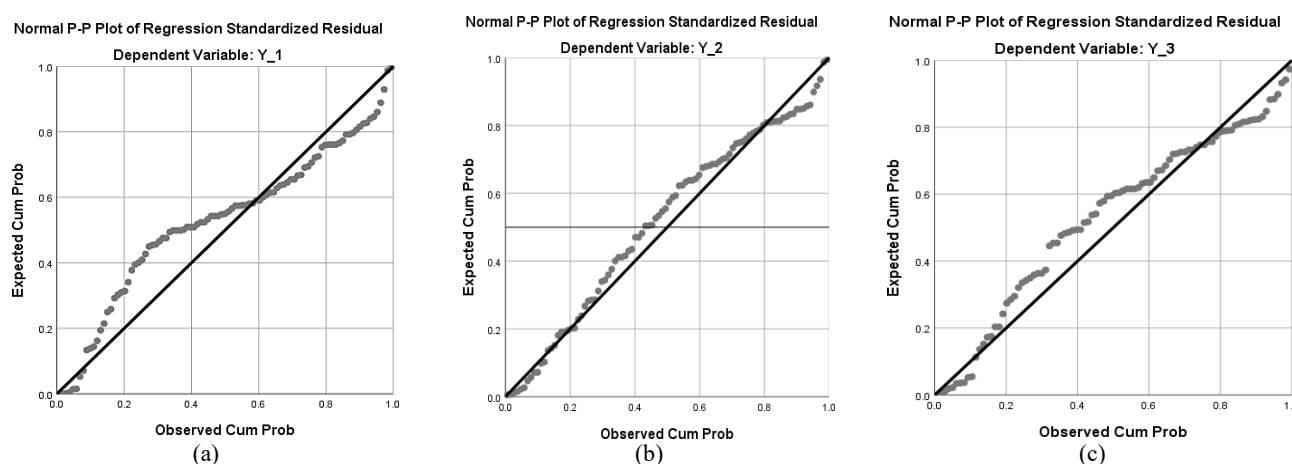


Figure 1. Normality test results of (a) Jagabaya II, (b) Kaliawi, and (c) Pengajaran sub-district.

Multicollinearity testing was conducted to determine whether strong correlations existed among the

independent variables included in the regression model. This test is important because multicollinearity can lead

to unstable regression coefficients and biased interpretations. In this study, multicollinearity was evaluated using tolerance values and variance inflation factor (VIF) values. The multicollinearity test results for Jagabaya II, Kaliawi, and Pengajaran are presented in Table 3. The results showed that all tolerance values

were greater than 0.10 and all VIF values were below 10, indicating the absence of multicollinearity among the independent variables in all study areas. These findings confirm that diet quality and socioeconomic determinants could be included simultaneously in the regression model without causing significant estimation bias.

Table 3. Multicollinearity test results.

Study area	Variable	Tolerance	VIF	Interpretation
Jagabaya II	X ₁	0.770	1.299	No multicollinearity
Jagabaya II	X ₂	0.770	1.299	No multicollinearity
Kaliawi	X ₁	0.963	1.038	No multicollinearity
Kaliawi	X ₂	0.963	1.038	No multicollinearity
Pengajaran	X ₁	0.913	1.095	No multicollinearity
Pengajaran	X ₂	0.913	1.095	No multicollinearity

Heteroscedasticity testing was conducted separately for Jagabaya II, Kaliawi, and Pengajaran using scatterplots between predicted values (ZPRED) and residual values (SRESID). The heteroscedasticity test results are presented in Figure 2. The scatterplots showed random distributions of points without forming systematic patterns such as waves, narrowing, or

widening distributions. In addition, the residual points were distributed evenly above and below the zero axis in all three study areas. These findings indicate that no heteroscedasticity symptoms were detected, suggesting that the regression models fulfilled the assumption of homoscedastic residual variance and were appropriate for further statistical analysis.

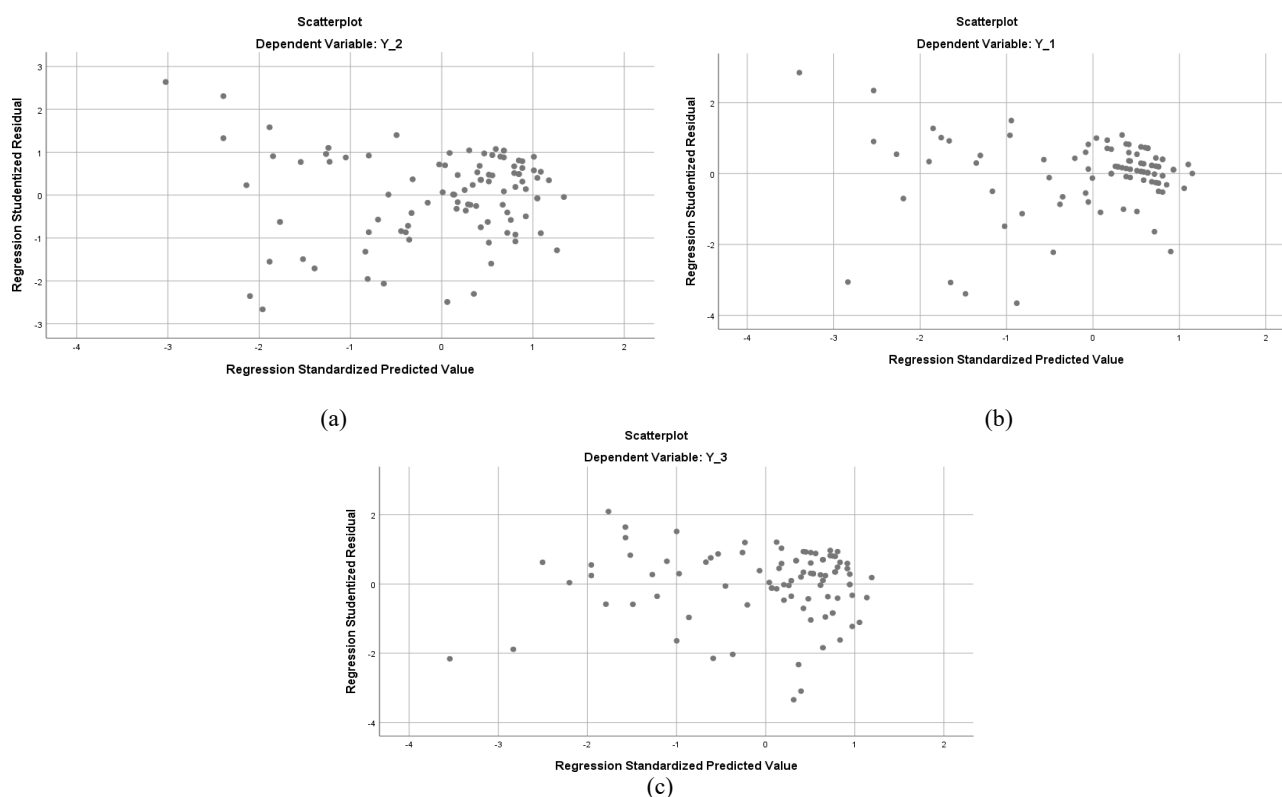


Figure 2. Heteroscedasticity result (a) Jagabaya II, (b) Kaliawi, and (c) Pengajaran sub-district.

Coefficient of Determination (R^2)

The coefficient of determination (R^2) was used to evaluate the extent to which diet quality and socioeconomic determinants explained variations in

household nutritional status. R^2 values range from 0 to 1, with values closer to 1 indicating stronger explanatory power of the regression model. The results of the coefficient of determination analysis are presented in

Table 4. The coefficient of determination results indicate that diet quality (X_1) and socioeconomic determinants (X_2) contributed meaningfully to variations in household nutritional status (Y) across the three densely populated urban areas, although these variables did not fully explain the phenomenon. The R^2 values in all study areas were categorized as moderate, suggesting that household nutritional status is a multidimensional condition

influenced by various interrelated factors. Overall, the highest R^2 value was observed in Pengajaran (47.3%), followed by Jagabaya II (43.2%) and Kaliawi (36.4%). These findings indicate that the combined influence of diet quality and socioeconomic determinants was strongest in Pengajaran, relatively strong in Jagabaya II, and comparatively weaker in Kaliawi.

Table 4. Coefficient of determination (R^2) results.

Study area	R Value	R^2 Value	Percentage of explained variance	Interpretation
Jagabaya II	0.656	0.432	43.2%	Variations in household nutritional status could be explained by diet quality and socioeconomic determinants, while the remaining variation was influenced by other factors outside the model
Kaliawi	0.603	0.364	36.4%	Moderate explanatory power
Pengajaran	0.688	0.473	47.3%	Moderate explanatory power

In Pengajaran, the relatively high R^2 value suggests that diet quality and socioeconomic determinants were more capable of predicting household nutritional status compared with the other study areas. This condition may be associated with the relatively better food access in Pengajaran due to its proximity to food distribution centers, allowing dietary quality and household welfare conditions to relate more directly to nutritional outcomes. Nevertheless, more than 50% of the variation in household nutritional status remained unexplained, indicating the influence of additional factors such as processed food consumption, nutrition literacy, eating habits, and household dietary behavior. In Jagabaya II, the R^2 value indicates that nearly half of the variation in household nutritional status could be explained by diet quality and socioeconomic determinants. This finding suggests that the relatively stable and homogeneous socioeconomic structure in Jagabaya II strengthened the relationship between household income, food consumption patterns, and nutritional fulfillment. However, approximately 56.8% of the variation remained influenced by other factors, including food preferences, cooking practices, nutrition knowledge, and household lifestyle characteristics. Meanwhile, Kaliawi demonstrated the lowest R^2 value, indicating that diet quality and socioeconomic determinants were less capable of comprehensively explaining household nutritional status in this area. Greater socioeconomic inequality and income disparities may have weakened the relationship between economic conditions, food consumption quality, and nutritional outcomes. In Kaliawi, behavioral factors, dietary preferences, and nutrition education appeared to play a more dominant role than the two principal variables included in the regression model. Overall, the findings suggest that household nutritional status in densely populated urban areas is influenced not only by diet quality and socioeconomic determinants, but also by additional

factors such as household income stability, cooking time availability, nutrition literacy, family health conditions, and the surrounding social environment that shapes food choices and dietary behavior.

Multiple Linear Regression Analysis

Multiple linear regression analysis was conducted to examine the influence of diet quality and socioeconomic determinants on household nutritional status across Jagabaya II, Kaliawi, and Pengajaran. The regression analysis results are presented in Table 5. The regression analysis demonstrated consistent relationships between diet quality (X_1), socioeconomic determinants (X_2), and household nutritional status (Y) across the three study areas. In all locations, the calculated t-values exceeded the critical t-table values and all p-values were below 0.05, indicating that both independent variables had significant partial effects on household nutritional status. These findings suggest that despite differences in population density, socioeconomic conditions, and urban environmental characteristics, the fundamental relationship between dietary quality, socioeconomic conditions, and nutritional outcomes remained consistent across the densely populated urban communities. These findings are consistent with previous studies by Islami & Andrijanto (2020) and Andini & Rahmawati (2022), which also reported significant effects of diet quality and socioeconomic conditions on household nutritional status using multiple regression analysis. Nabila et al. (2020) similarly found that the relationships among dietary quality, economic conditions, and nutritional fulfillment remained stable across urban densely populated areas despite environmental differences. Ayuningtyas et al. (2022) further emphasized that although the relative influence of variables may vary by location, the partial effects of diet quality and socioeconomic conditions generally remain statistically significant.

Table 5. Multiple linear regression results.

Variable	Statistical test	t-value	t-table ($\alpha=0.05$)	p-value	Interpretation (Effect to Y_1)
X_1 (Jagabaya II)	Partial t-test	2.081	1.98552	0.400	Significant
X_2 (Jagabaya II)	Partial t-test	2.727	1.98552	0.008	Significant
X_1 (Kaliawi)	Partial t-test	2.855	1.98580	0.005	Significant
X_2 (Kaliawi)	Partial t-test	2.561	1.98580	0.012	Significant

In Jagabaya II, socioeconomic determinants (X_2) showed a stronger influence on household nutritional status than diet quality (X_1). The regression coefficient for socioeconomic determinants (0.362) suggests that improvements in household socioeconomic conditions substantially contributed to better nutritional fulfillment. This pattern may reflect the relatively stable and homogeneous socioeconomic structure in Jagabaya II, where increases in income and education directly improved households' ability to obtain nutritious foods. Although diet quality also significantly influenced nutritional status, its contribution was smaller (0.263), indicating that economic capacity remained the primary determinant of sustainable access to nutritious food. These findings suggest that nutritional improvement programs in Jagabaya II should prioritize strengthening household economic welfare.

Kaliawi demonstrated a different pattern. The regression coefficient for diet quality (0.458) was the highest among all study areas, indicating that diet quality was the most dominant factor influencing household nutritional status in this location. This condition may be associated with the greater socioeconomic diversity observed in Kaliawi, where differences in eating habits, nutrition literacy, food selection, and dietary practices became more important determinants of nutritional outcomes than economic conditions alone. Although socioeconomic determinants remained significant (0.352), their influence was slightly lower than that of diet quality. These findings suggest that nutritional conditions in Kaliawi were more sensitive to daily food consumption behavior, including dietary choices, food preparation methods, and healthy eating practices.

In Pengajaran, both variables also significantly influenced household nutritional status, although diet quality (0.364) showed a greater contribution than socioeconomic determinants (0.291). The stronger effect of diet quality suggests that household food selection and dietary practices were more influential than economic conditions in determining nutritional outcomes. This finding may be associated with the relatively adequate food access in Pengajaran due to its proximity to food distribution centers. Under such conditions, nutritional status depended more heavily on dietary behavior and nutrition knowledge rather than purchasing power alone. Nevertheless, socioeconomic determinants remained important because increases in household income and

education still contributed positively to nutritional fulfillment.

Overall, the regression results demonstrate that both diet quality and socioeconomic determinants significantly influenced household nutritional status in densely populated urban communities, although the dominant contributing factor differed across locations. In Jagabaya II, socioeconomic determinants were more dominant because household economic capacity strongly affected access to nutritious food. In contrast, diet quality was more influential in Kaliawi and Pengajaran, suggesting that food choices, nutrition knowledge, and dietary behavior were more critical than economic conditions alone in determining nutritional outcomes. These findings indicate that nutrition interventions in densely populated urban areas should be tailored to local conditions, emphasizing economic welfare improvement in areas such as Jagabaya II and strengthening nutrition education and healthy dietary behavior in areas such as Kaliawi and Pengajaran. These findings are consistent with studies by Putra et al. (2024) and Dewi et al. (2024), which reported that the dominant determinants of nutritional status vary according to local environmental and socioeconomic characteristics. Zahrah et al. (2019) similarly found that household income played a more dominant role in coastal communities, whereas diet quality and nutrition knowledge were more influential in urban settings. Utami and Andriani (2019) further emphasized that nutrition intervention strategies should be context-specific and adapted to local nutritional challenges rather than implemented uniformly across different regions.

Pearson Product-Moment Correlation Analysis

Pearson product-moment correlation analysis was conducted to examine the relationships between diet quality (X_1), socioeconomic determinants (X_2), and household nutritional status (Y) across Jagabaya II, Kaliawi, and Pengajaran. The correlation analysis across Jagabaya II, Kaliawi, and Pengajaran demonstrated that the relationships between diet quality (X_1), socioeconomic determinants (X_2), and household nutritional status (Y) were not entirely uniform, although all study areas generally exhibited positive associations among the variables. The correlation analysis results are presented in Table 6.

Table 6. Pearson product-moment correlation results in Jagabaya II, Kaliawi, and Pengajaran.

Study area	Variables	Correlation coefficient (r)	p-value	Correlation strength	Significant (p<0.05)
Jagabaya II	X ₁ and Y ₁	0.346	< 0.01	Moderate	Yes
	X ₂ and Y ₁	0.299	< 0.01	Moderate	Yes
	X ₁ and X ₂	0.358	< 0.01	Moderate	Yes
Kaliawi	X ₁ and Y ₂	0.283	< 0.01	Moderate	Yes
	X ₂ and Y ₂	0.252	< 0.05	Weak-moderate	Yes
	X ₁ and X ₂	0.169	0.100	Not significant	No
Pengajaran	X ₁ and Y ₃	0.260	Not fully reported	Weak	Not fully reported

In Jagabaya II, all variables demonstrated positive and statistically significant correlations with moderate strength. The relationship between diet quality and household nutritional status ($r = 0.346$) as well as the relationship between socioeconomic determinants and household nutritional status ($r = 0.299$) both indicated that households with better dietary quality and more stable socioeconomic conditions tended to have better nutritional status. Furthermore, the significant relationship between diet quality and socioeconomic determinants ($r = 0.358$) suggests that dietary behavior and economic capacity developed in parallel and jointly strengthened household nutritional conditions in Jagabaya II.

A different pattern was observed in Kaliawi. Although diet quality and socioeconomic determinants both showed positive relationships with household nutritional status, the relationship between diet quality and socioeconomic determinants themselves was not statistically significant ($r = 0.169$; $p = 0.100$). Diet quality demonstrated a moderate correlation with household nutritional status ($r = 0.283$), whereas socioeconomic determinants showed a weak-to-moderate relationship with nutritional status ($r = 0.252$). These findings suggest that in urban communities with greater socioeconomic inequality, dietary quality and household economic conditions do not necessarily improve simultaneously. Nevertheless, both variables independently contributed to household nutritional outcomes.

In Pengajaran, another distinct dynamic was identified. Socioeconomic determinants (X₂) showed a stronger and statistically significant relationship with household nutritional status ($r = 0.328$; $p < 0.01$) compared with diet quality (X₁), which demonstrated only a weak relationship with household nutritional status ($r = 0.260$). Although food access in Pengajaran was relatively favorable due to its proximity to food distribution centers, household economic capacity appeared to play a more decisive role in determining whether nutritious food could be consistently accessed and utilized. These findings indicate that food availability alone does not necessarily ensure optimal household nutritional status without adequate purchasing power and nutrition-related decision-making capacity.

Overall, the correlation analysis demonstrated that socioeconomic determinants tended to show more stable

relationships with household nutritional status compared with diet quality alone. Meanwhile, diet quality showed stronger associations particularly in areas with relatively homogeneous socioeconomic characteristics, such as Jagabaya II, or in areas where eating behavior became a major determinant of nutritional outcomes, such as Kaliawi. The weak-to-moderate correlation strengths observed across the three study areas further indicate that household nutritional status in densely populated urban communities is influenced not only by diet quality and socioeconomic determinants, but also by additional factors such as nutrition literacy, dietary preferences, fast-food consumption frequency, cooking time availability, and household health conditions.

These findings reinforce the multidimensional nature of household nutrition problems in densely populated urban areas. Therefore, efforts to improve household nutritional status should extend beyond food consumption and economic interventions alone, incorporating nutrition education, behavioral change strategies, and supportive food environments that encourage healthier dietary choices. Such multidimensional approaches are necessary to reduce nutritional disparities among urban households more effectively. The present findings are supported by studies conducted by Dewi and Andriyani (2021) and Putri and Safitri (2022), which reported that nutrition knowledge and dietary behavior often contribute more strongly to household nutritional outcomes than economic factors alone. Wahyuni et al. (2023) similarly confirmed that cooking time availability, access to healthy food, and nutrition education significantly influence nutritional status in urban households. Collectively, these studies support the conclusion that nutritional improvement strategies should be multidimensional and adaptive to local social and behavioral characteristics.

Hypothesis Testing

The hypothesis testing analysis included analysis of variance (ANOVA) and partial t-tests to examine differences and relationships among study variables across the three densely populated urban areas. Analysis of variance (ANOVA) was conducted to determine whether significant differences existed in diet quality, socioeconomic determinants, and household nutritional status across Jagabaya II, Kaliawi, and Pengajaran. The significance value (Sig.) obtained from the ANOVA test

was used as the basis for determining whether differences among the three densely populated urban areas were statistically meaningful. The ANOVA results are presented in Table 7.

Table 7. ANOVA results for diet quality, socioeconomic determinants, and household nutritional status across study areas.

Variable	Source of variation	Sum of squares	Df	Mean square	F	Sig.
Diet quality (X ₁)	Between groups	16.099	2	8.049	0.433	0.649
	Within groups	5240.603	282	18.584		
	Total	5256.702	284			
Socioeconomic determinants (X ₂)	Between groups	147.791	2	73.895	3.316	0.038
	Within groups	6284.995	282	22.287		
	Total	6432.786	284			
Household nutritional status (Y)	Between groups	573.112	2	286.556	7.074	0.001
	Within groups	11423.674	282	40.509		
	Total	11996.786	284			

The ANOVA results showed that diet quality (X₁) did not differ significantly across Jagabaya II, Kaliawi, and Pengajaran ($p = 0.649 > 0.05$). This finding indicates that households across the three densely populated urban communities exhibited relatively similar average dietary quality. In other words, despite differences in local socioeconomic conditions and urban density characteristics, households generally consumed comparable types and quality of food. In contrast, socioeconomic determinants (X₂) showed significant differences among the three study areas ($p = 0.038 < 0.05$). These findings indicate that household socioeconomic conditions (including income, education, occupation, and demographic characteristics), varied substantially across the three sub-districts. Such variation reflects differences in household purchasing power, economic stability, and access to resources that potentially influence nutritional outcomes. Household nutritional status (Y) also differed significantly among Jagabaya II, Kaliawi, and Pengajaran ($p = 0.001 < 0.05$). This finding supports the descriptive analysis showing that Jagabaya II tended to have higher household nutritional status compared with the other study areas.

The observed differences may be associated with variations in household food access, economic capacity, dietary behavior, and nutrition-related decision-making across urban communities. Overall, the ANOVA results demonstrate that although average diet quality was relatively similar across the three densely populated urban areas, socioeconomic determinants and household nutritional outcomes differed significantly. These findings suggest that household nutritional status in urban communities is not determined solely by the quality of food consumed, but also by broader socioeconomic conditions that shape food access, dietary choices, and long-term nutritional well-being.

After examining inter-area differences using ANOVA, partial t-tests were conducted to evaluate the individual effects of diet quality (X₁) and socioeconomic determinants (X₂) on household nutritional status (Y) in Jagabaya II, Kaliawi, and Pengajaran. The analysis used a significance level of 5% ($\alpha = 0.05$). Because the sample size differed slightly among study areas, each sub-district had a slightly different critical t-table value. The partial t-test results are presented in Table 8.

Table 8. Partial t-test results in Jagabaya II, Kaliawi, and Pengajaran.

Study area	Independent variables	t-value	t-table	p-value	Interpretation
Jagabaya II	Diet quality (X ₁)	2.081	1.98552	0.040	Significant
Jagabaya II	Socioeconomic determinants (X ₂)	2.727	1.98552	0.008	Significant
Kaliawi	Diet quality (X ₁)	2.855	1.98580	0.005	Significant
Kaliawi	Socioeconomic determinants (X ₂)	2.561	1.98580	0.012	Significant
Pengajaran	Diet quality (X ₁)	2.336	1.98698	0.022	Significant
Pengajaran	Socioeconomic determinants (X ₂)	2.122	1.98698	0.037	Significant

The partial t-test results demonstrated that both diet quality and socioeconomic determinants had significant effects on household nutritional status across all study areas. In Jagabaya II, diet quality showed a significant positive effect on household nutritional status ($t = 2.081$; $p = 0.040$), while socioeconomic determinants demonstrated an even stronger influence ($t = 2.727$; $p =$

0.008). These findings suggest that in Jagabaya II, improvements in household economic conditions and dietary quality directly contributed to better nutritional outcomes. Given the relatively high poverty burden in this area, even moderate improvements in food quality or household economic conditions may substantially improve nutritional status.

A similar pattern was observed in Kaliawi. Diet quality significantly affected household nutritional status ($t = 2.855$; $p = 0.005$), while socioeconomic determinants also showed significant effects ($t = 2.561$; $p = 0.012$). However, the relatively stronger influence of diet quality suggests that household eating behavior, food selection, and dietary practices played a more dominant role in shaping nutritional outcomes than economic conditions alone. This finding reflects the heterogeneous socioeconomic structure of Kaliawi, where differences in nutrition literacy, food preferences, and consumption behavior may contribute substantially to household nutritional disparities.

In Pengajaran, both diet quality and socioeconomic determinants also significantly influenced household nutritional status. Diet quality demonstrated a significant positive effect ($t = 2.336$; $p = 0.022$), while socioeconomic determinants remained significant ($t = 2.122$; $p = 0.037$). Although the magnitude of influence was slightly lower compared with Kaliawi, these findings indicate that good food access alone is insufficient to ensure optimal household nutrition without adequate dietary behavior and economic support.

Overall, the partial t-test analysis confirmed that household nutritional status in densely populated urban areas was influenced not only by the quality of food consumed, but also by household socioeconomic capacity to access and maintain nutritious diets consistently. These findings reinforce the importance of multidimensional nutrition interventions that integrate healthy dietary promotion, nutrition literacy improvement, and socioeconomic support programs. The present findings are consistent with studies by Annisaulkhairi & Nurdin (2023) and Alim et al. (2023), which reported that both diet quality and socioeconomic determinants significantly affect household nutritional status based on partial regression analysis. Silva et al. (2023) similarly demonstrated that nutrition literacy strengthens the relationship between dietary behavior and nutritional outcomes, emphasizing that effective nutritional interventions should address not only food availability, but also nutrition education and household purchasing power.

CONCLUSIONS

This study demonstrated that diet quality and socioeconomic determinants significantly influenced household nutritional status in high-density urban areas of Bandar Lampung. Better diet quality was consistently associated with improved nutritional status, while socioeconomic factors such as income, education, and occupation affected households' ability to access and maintain nutritious diets. Although average diet quality was relatively similar across Jagabaya II, Kaliawi, and Pengajaran, household nutritional status differed significantly among areas, indicating that socioeconomic

and environmental conditions contributed substantially to urban nutritional disparities. Kaliawi, as the most densely populated area, showed greater challenges related to dietary diversity and nutritional fulfillment, whereas Pengajaran demonstrated relatively better nutritional conditions due to more favorable food access and socioeconomic stability. The findings further revealed that socioeconomic determinants were more dominant in Jagabaya II, while diet quality and dietary behavior exerted stronger influence in Kaliawi and Pengajaran. Overall, the study confirms that improving household nutritional status in densely populated urban communities requires integrated interventions that strengthen diet quality, nutrition literacy, food accessibility, and socioeconomic resilience simultaneously.

Authors' Contributions: Ayu Indah Nathasya, Dwi Eva Nirmagustina, Beni Hidayat designed the study. Ayu Indah Nathasya carried out the field work. Dwi Eva Nirmagustina, Beni Hidayat, and Nurbani Kalsum supervised the study. Ayu Indah Nathasya analyzed the data. Ayu Indah Nathasya wrote the manuscript. All authors read and approved the final version of the manuscript.

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REFERENCES

- Aisyah, I. S., Ginting, R. M. S., Wulansari, A., Fitriani, R. J., Nur, A., Nailufar, F., Mulyani, R. I., Rahmad, A. H., & Utami, K. D. (2023). *Ekonomi pangan dan gizi*. Padang, Indonesia: Get Press Indonesia.
- Agustian, D., Triyanto, S. A., & Apriyani, D. (2023). Strategi pencegahan stunting dalam rumah tangga untuk mendukung pembangunan berkelanjutan di Kota Tasikmalaya. *DEDIKASI: Community Service Reports*, 5(1), 75–90. Retrieved from <https://jurnal.uns.ac.id/dedikasi/article/download/69811/39335>
- Alim, A., Adam, A., & Ashriady. (2023). Food consumption patterns of poor urban families in the maelstrom of nutritional capitalism. *AcTion: Aceh Nutrition Journal*, 8(1), 119–128.
- Andini, R. A., & Rahmawati, Y. (2022). *Analisis faktor penentu gizi keluarga di kecamatan urban: Studi regresi linier*. Universitas Airlangga Repository. Retrieved from <https://repository.unair.ac.id/104786/>
- Annisaulkhairi, & Nurdin, N. M. (2023). Analysis of the food quality and nutritional status of toddler from the family of program beneficiaries of the Indonesian Conditional Cash Transfer Program. *Jurnal Gizi Dietetik*, 2(1), 31–36.
- Aulia, N., Nufus, P. Z., & Prameswari, R. A. (2025). Tinjauan literatur: Faktor penyebab beban gizi ganda pada berbagai kelompok usia di wilayah urbanisasi. *Calvaria Medical Journal*. Retrieved from <http://calvaria.fk.uwks.ac.id/calvaria/article/download/195/49>
- Ayuningtyas, H., Nadhiroh, S. R., Milati, Z. S., & Fadilah, A. L. (2022). Status ekonomi keluarga dan kecukupan gizi dengan

- kejadian stunting pada anak usia 6–24 bulan di Kota Surabaya. *Media Gizi Indonesia*, 17(1SP), 145–152. <https://doi.org/10.20473/mgi.v17i1SP.145-152>
- Badan Pangan Nasional. (2023). *Peta ketahanan dan kerentanan pangan/Food security and vulnerability atlas (FSVA) Kota Bandar Lampung Tahun 2023*. Lampung, Indonesia: Dinas Pangan Kota Bandar Lampung.
- Dewi, L. R., & Andriyani, D. (2021). Faktor-faktor yang memengaruhi status gizi keluarga di wilayah padat penduduk: Studi di Jakarta Selatan. *Jurnal Gizi dan Dietetik Indonesia*, 9(2), 112–120.
- Dewi, N. L. A. N., Witanto, S. W., & Trimono. (2024). Studi pengaruh faktor sosial ekonomi dan sanitasi terhadap prevalensi balita penderita gizi buruk (stunting) di Jawa Timur dengan analisis regresi linier. In *Prosiding Seminar Nasional Sains Data* (Vol. 4, No. 1, pp. 812–822). Universitas Pembangunan Nasional “Veteran” Jawa Timur.
- Drewnowski, A., & Popkin, B. M. (2020). The nutrition transition: New trends in the global diet. *Nutrition Reviews*, 68(3), 1–15.
- FAO. (2020). *The state of world fisheries and aquaculture: Sustainability in action*. Rome, Italy: Food and Agriculture Organization. <https://doi.org/10.4060/ca9229en>
- FAO. (2021). *State of food security and nutrition in the world*. Retrieved from <https://www.fao.org/publications/fao-flagship-publications/the-state-of-food-security-and-nutrition-in-the-world/en>
- Fatmawaty, A. S., Amran, F. D., Sigalingging, C., & Rosada, I. (2025). *Gizi dan ketahanan pangan*. Retrieved from https://karyailmiah.id/wp-content/uploads/publikasi/fanya-bintang-sejahtera/gizi-dan-ketahanan-pangan/1763053139-EBOOK_Gizi-dan-Ketahanan-Pangan.pdf
- Ghozali, I. (2018). *Aplikasi analisis multivariate dengan program IBM SPSS 25* (9th ed.). Semarang, Indonesia: Badan Penerbit Universitas Diponegoro.
- Harjatmo, T. P. (2025). *Pola konsumsi masyarakat perkotaan*. Retrieved from <https://books.google.com/books?hl=en&id=f0WWEQAAQBAJ>
- Hawkes, C., Harris, J., & Gillespie, S. (2015). Changing diets: Urbanization and the nutrition transition. In *Global nutrition report 2015: Actions and accountability to advance nutrition and sustainable development* (pp. 33–42). Washington, DC: International Food Policy Research Institute.
- Horowitz, C. R., Colson, K. A., Hebert, P. L., & Lancaster, K. (2004). Barriers to buying healthy foods for people with diabetes: Evidence of environmental disparities. *American Journal of Public Health*, 94(9), 1549–1554.
- Islami, A. R., & Andrijanto, D. (2020). Hubungan pendapatan orang tua dengan status gizi siswa (studi pada siswa SDN Buncitan). *Jurnal Pendidikan Olahraga dan Kesehatan*, 8(1), 289–293.
- Monteiro, C. A., Cannon, G., Lawrence, M., Costa-Louzada, M. L., & Pereira-Machado, P. (2019). *Ultra-processed foods, diet quality, and health using the NOVA classification system*. Rome, Italy: FAO.
- Muslihah, N., Habibie, I. Y., & Wilujeng, C. S. (2023). *Ekologi dan sosioantropologi gizi*. Retrieved from <https://books.google.com/books?hl=en&id=HqLsEAAAQBAJ>
- Nabila, C. R., Jamal, A., & Mahmud, M. S. (2022). Correlation of population density and health to urban quality of life in Sumatra Island. *Jurnal Ekonomi dan Kebijakan Publik Indonesia*, 9(2), 53–63. <https://doi.org/10.36655/sepren.v4i02.1131>
- Nabila, F. Z., Abidin, Z., & Ramadhaningtyas, K. N. (2020). The effect of family economic status and diet on the incidence of children under the red line (BGM) at Balong Health Center, Ponorogo Regency in 2020. *Jurnal Dunia Kesmas*, 9(4), 463–469.
- Nugraha, A., Heryanto, M. A., Wahyudin, A., Rosmiati, R., & Galtieri, Y. (2022). *Tata kelola pangan dan gizi perkotaan*. Bandung, Indonesia: Dinas Ketahanan Pangan dan Pertanian Kota Bandung & Hivos.
- Putra, M. G. S., Kustiyah, L., & Dwiriani, C. M. (2024). Hubungan antara sosial ekonomi, demografi dan kualitas konsumsi pangan dengan status gizi. *ARTERI: Jurnal Ilmu Kesehatan*, 6(1), 31–40.
- Putri, A. W., & Safitri, R. (2022). Pengaruh status sosial ekonomi terhadap status gizi keluarga di wilayah urban DKI Jakarta dengan pola makan serupa. *Jurnal Gizi Masyarakat dan Kesehatan*, 10(2), 60–70. Retrieved from <https://jurnal.stikesnh.ac.id/index.php/jgm/article/download/150/112>
- Sari, N. A. (2017). Ketahanan pangan tingkat rumah tangga perkotaan dan pedesaan di Kabupaten Kutai Kartanegara. *Journal of Entrepreneurship, Management and Innovation*, 17(1), 8–17.
- Silva, P., Araújo, R., Lopes, F., & Ray, S. (2023). Nutrition and food literacy: Framing the challenges to health communication. *Nutrients*, 15(22), 4708. <https://doi.org/10.3390/nu15224708>
- Somantri, N. U. W., Perdana, F., & S. Gz. (2025). *Gizi & kesehatan masyarakat pesisir dan kepulauan*. Retrieved from https://repository.takaza.id/id/eprint/386/1/E-Book%20Naskah_Gizi_&_Kesehatan.pdf
- Sugiyono. (2022). *Metode penelitian kuantitatif, kualitatif, dan R&D* (18th ed.). Bandung, Indonesia: Alfabeta.
- Suhaimi, A. (2019). *Pangan, gizi, dan kesehatan*. Sleman, Indonesia: Deepublish.
- Utami, Y., & Andriani, S. (2019). *Analisis kebutuhan intervensi gizi berbasis wilayah: Urban, semi-urban, dan rural*. Jakarta, Indonesia: Badan Litbangkes Kemenkes RI.
- Vilar-Compte, M., Burrola-Méndez, S., Lozano-Marrufo, A., Ferré-Eguiluz, I., Flores, D., Gaitán-Rossi, P., Teruel, G., & Pérez-Escamilla, R. (2021). Urban poverty and nutrition challenges associated with accessibility to a healthy diet: A global systematic literature review. *International Journal for Equity in Health*, 20(40), 2–19. <https://doi.org/10.1186/s12939-020-01330-0>
- Wahyuni, F., Prasetya, A., & Lestari, M. (2023). Kajian multidimensi pemenuhan gizi keluarga di daerah urban DKI Jakarta. *Jurnal Gizi Masyarakat dan Kesehatan*, 11(2), 78–90. Retrieved from <https://jurnal.stikesnh.ac.id/index.php/jgm/article/download/150/112>
- Zahrah, N., Handayani, S., & Prasetyo, A. (2019). Perbedaan determinan gizi anak balita antara daerah pesisir dan perkotaan. *Jurnal Gizi dan Pangan*, 14(3), 145–152.