

Improving Food Security Through a Social Approach and Gender Empowerment: Dichotomy of Cities and Districts

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Abstract.

This study aims to analyze the influence of gender empowerment, gender inequality, poverty, HDI, life expectancy, and food expenditure on food security in the Special Region of Yogyakarta. Using a mixed-method approach, panel data from five districts (2018-2024) was analyzed using linear regression and Root Cause Analysis (RCA). Gender inequality has a significant effect on food security. Gender empowerment has a significant effect and in line with the hypothesis. Poverty and HDI do not significantly affect food security in the Special Region of Yogyakarta. Life expectancy and food expenditure are proven to be significant and in line with the hypothesis. Qualitative analysis supports the quantitative findings, and this provides clear guidance for policies to improve food security in the Special Region of Yogyakarta that involve relevant stakeholders. Tests of differences between cities and districts in food security indicate that food security policies are relatively even and there are no differences between regions.

Keywords: Food Security, Gender Empowerment, Social Approach, Gender Inequality

Introduction

Food security is referred to as a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active, and healthy life (Jaspars & Kuol, 2024). In contrast, food insecurity is a situation when people are unable to access sufficient, safe, and nutritious food and food preferences for healthier life. Food security is dependent on agricultural production, food imports, employment, policy, decision-making of farmers, health, access, subsidy, and resource allocation (Assefa & Abide, 2023). Food insecurity the attracted attentions of many program implementers, policy-makers, researchers, and decision-makers (Egyir et al., 2023).

The food insecurity determinants of a household may be different according to the global, regional and national levels. Therefore, food insecurity is perceived as a multidimensional phenomenon that could be controlled by factors such as civil conflicts, natural disasters, climate change and social norms (Mazenda et al., 2022). The theoretical literature on food security highlights the importance of women's empowerment as a critical component of achieving food security. The growing body of theoretical literature focuses on how gender, class, race, income, education, and other social identities shape access to resources and power in the context of food systems (Essilfie et al., 2024).

Gender equality, enhancing women's autonomy broadly defined as “a woman's ability to have control or influence over choices that affect herself and her family within her own particular context” (Sinclair et al., 2022; Sharma, 2019). Gender empowerment means increasing women's equality in the ability to gain access to education, employment opportunities, participate in politics, and earn a decent income (Jenderedjian & Bellows, 2021; Sinclair et al., 2022).

Poverty is a major contributor to food insecurity because low-income households do not have the means to obtain enough nutrient-dense food to lead active, healthy lives (Egyir et al., 2023). Poor households also typically do not have financial buffers to protect them from shocks such as disease or crop failure, even though working in the agricultural sector can sometimes be highly uncertain (Luthra et al., 2024).

Like education, gender is also considered an important attribute of food security and can be regarded as a general variable regarding food availability, accessibility, and utilization. This is because women are important economic agents in the world's economies and an important social factor in household food security (Agarwal, 2018). They produce more than half of the food grown in developing countries (Essilfie et al., 2024). Food security broadly covers the availability of food in the community, this availability is not only about the amount of production but also the ability of households to buy food (Pramono, 2021; Wattimena et al., 2021).

The objectives of this study are:

1. To analyze the influence of gender empowerment (Gendempw), gender inequality (Gendineq), poverty (Poverty), the Human Development Index (HDI), life expectancy (Lifeexp), and food expenditure (Foodexp) on the food security index in regencies/cities in the Special Region of Yogyakarta.
2. To analyze differences in food security between regencies and cities in the Special Region of Yogyakarta.
3. To determine the most relevant root causes for each variable affecting food security in the Special Region of Yogyakarta.

Literature Review

Several research findings on food security in the Special Region of Yogyakarta. The agricultural sector also plays a role in improving the welfare of the community, the majority of whom currently live below the poverty line (Hadani & Selfiani, 2023). Women's participation as members of farmer groups in the Special Region of Yogyakarta significantly impacts household food security (Pratama et al., 2022). The food security detection method in the Special Region of Yogyakarta was previously carried out using the FIA (Food Insecurity Atlas) method (Harini et al., 2022). This allows for early detection of food-insecure areas (Jati, 2020). Furthermore, a digital agricultural economics approach can provide benefits in the agricultural process, leading to strategies for building a digital agricultural economy (Wibowo, 2020).

All of the regencies/cities in the Special Region of Yogyakarta, only Yogyakarta City and Sleman Regency have the highest food security index, while Kulon Progo and Gunung Kidul Regencies still have low levels of food security (Wibisono & Widowaty, 2023). In terms of supply dependency, 85% of rice and 60% of vegetables come from other regencies (District of Yogyakarta Trade Office, 2023 (Pratama et al., 2022). The Food Security Index for the Special Region of Yogyakarta Province.

Table 1. Food Security Index of Regencies in the Special Region of Yogyakarta 2023

Number	Regency/City	IKP Value (2023)	IKP Category
1	Yogyakarta City	87,5	Very Resistant
2	Sleman Region	85,2	Very Resistant
3	Bantul Region	81,7	Durable
4	Kulon Progo Region	78,4	Fairly Resistant
5	Gunungkidul Region	73,9	Fairly Resistant

Source: Compiled from various sources, 2025

Similarly, the mini-integrated farming method implemented in Bantul Regency needs to be continuously implemented to improve family food security (Rosningsih, 2009). Promising food patterns or Pola Pangan Harapan will improve if food security also improves. Food diversity is one of the pillars of food security in the Special Region of Yogyakarta (Musta'in & Saputro, 2021).

To address the challenges of poverty and the threat of stunting, active participation and responsibility from all community members, especially within the family, are crucial (Masrin et al., 2016). In this context, the role of women is recognized as a key element in efforts to improve family living conditions and free them from poverty (Arumsari et al., 2015).

The phenomena of poverty, unequal income distribution, and education levels, as measured by the Human Development Index (HDI), have a unique relationship and are strongly influenced by social and community conditions, particularly food security (Dewi & Rachmawatie, 2020). Agricultural innovation, including technological innovation, will also impact food security in the Special Region of Yogyakarta, with restrictions on land conversion that must be controlled (Subejo et al., 2018). Strict and coordinated supervision by relevant parties is necessary to achieve supply and price stability. Although price fluctuations and the availability of food supplies can be monitored using a price panel, monitoring activities still need to be carried out for a sufficient duration and time period to obtain results (Wattimena et al., 2021).

Existing Food Security Conditions in the Special Region of Yogyakarta. Based on the Food Security Index (82.5) from the Statistics Indonesia (BPS) for Yogyakarta in 2024, Yogyakarta is categorized as “good”, indicating positive achievements in food access, supply stability, and nutritional utilization. Several challenges, such as poverty (11.04%) and stunting prevalence (15.9%), indicate unequal distribution and affordability of food.

Women's involvement in Women Farmers Groups or Kelompok Wanita Tani (KWT) reached more than 2,500 active groups (2024). This demonstrates women's strategic role in food security. Women's participation needs to be integrated with gender empowerment programs and agricultural policies, such as gender-inclusive agribusiness training.

Table 2. Various Food Security Indicators for the Special Region of Yogyakarta

Number	Indicator	Latest Data (2024/2025)
1	Government food reserves	61,704 kg (medium-graderice, stored in Gunung Kidul)
2	Active agricultural land area	25 hectares (Yogyakarta City), >5,000 ha (DIY Total)
3	Rice productivity	5.8 tons/ha (harvested dry grain)
4	Rice conversion	63.8%
5	Agricultural	9-10% (2018-2024)

Number	Indicator	Latest Data (2024/2025)
	contribution to GRDP	
6	Food security budget	IDR 1.2 trillion (2024)
7	Stunting prevalence	15.9% (Yogyakarta average, 2024)
8		11.04% (Yogyakarta Special Region, March 2024)
9	Poverty rate	82.5 (good category, BPS 2024)
10	Food Security Index	
	Women's involvement in KWT	>2,500 active groups (2024)
11	Access to adequate food	for 92.1% of households (2023, Susenas)

Source: Compiled from various sources, 2025

The lack of property rights in this "feminization of agriculture" environment has resulted in several real-world production challenges, including the inability to obtain loans, inputs, and extension services. To guarantee household food security, women's access to resources especially land is therefore becoming increasingly important (Kasim & Harikumar, 2024; Rao, 2006).

Table 3. Ranking of Empowerment and Gender Inequality of Provinces in Indonesia

Number	Provinces	Woman Empowerment Index (IDG) = Indeks Pemberdayaan Gender (IPG) = Indeks Pemberdayaan Gender (IPG)		Gender Inequality Index (IDG) = Indeks Ketimpangan Gender (IKG) = Indeks Ketimpangan Gender (IKG)	
		2022	2023	2022	2023
1	Aceh	63,92	63,56	0,504	0,489
2	Sumatera Utara	69,33	69,18	0,442	0,425
3	Sumatera Barat	65,48	65,34	0,43	0,425
4	Riau	71,16	72,29	0,473	0,458
5	Jambi	67,86	68,07	0,54	0,528
6	Sumatera Selatan	74,89	76,58	0,517	0,496
7	Bengkulu	70,13	70,06	0,478	0,469
8	Lampung	68,24	68,16	0,456	0,437
9	Kepulauan Bangka	58,2	58,22	0,497	0,49

Number	Provinces	Woman Empowerment Index (IDG) = Indeks Pemberdayaan Gender (IPG) = Indeks Pemberdayaan Gender (IPG)		Gender Inequality Index (IDG) = Indeks Ketimpangan Gender (IKG) = Indeks Ketimpangan Gender (IKG)	
		2022	2023	2022	2023
	Belitung				
10	Kepulauan Riau	59,05	0	0,395	0,348
11	DKI Jakarta	75,3	76,31	0,32	0,256
12	Jawa Barat	71,22	71,74	0,49	0,482
13	Jawa Tengah	73,78	74,18	0,371	0,336
14	DI. Yogyakarta	76,87	78,46	0,24	0,142
15	Jawa Timur	74,42	74,9	0,44	0,423
16	Banten	68,55	69,87	0,478	0,464
17	Bali	72,29	73,77	0,321	0,239
	Indonesia	76,59	76,9	0,459	0,447

Source: Summarized from the Publication of the Central Statistics Agency of the Republic of Indonesia, 2024

The theoretical literature on food security highlights the importance of women's empowerment as a critical component of achieving food security. The growing body of theoretical literature focuses on how gender, class, race, income, education, and other social identities shape access to resources and power in the context of food systems (Essilfie et al., 2024).

Gender equality, enhancing women's autonomy broadly defined as “a woman's ability to have control or influence over choices that affects herself and her family within her own particular context” (Sinclair et al., 2022; Sharma, 2019). Gender empowerment means increasing women's equality in the ability to gain access to education, employment opportunities, participate in politics, and earn a decent income (Jenderedjian & Bellows, 2021; Sinclair et al., 2022).

Measures of income and wealth and subsequent classification of poor households are therefore key factors to capture in food security analysis (Hjelm et al., 2016). Poverty classification is a key measure required for the design and subsequent evaluation of policies and programs aimed at reducing food insecurity essential for targeting households (Khatun et al., 2022). However, capturing adequate measures of income and wealth is a difficult task, particularly in light surveys. Therefore, it is crucial

to comprehend how different food security indicators relate to different measures of poverty in order to plan programs and evaluate them later (Meyer & Wu, 2018; Ramulu, 2014).

Based on previous research and food security theory, the research hypothesis for each variable are as follows:

1. The Gender Inequality Index (Gedineq) negatively impacts food security in the Special Region of Yogyakarta.
2. The Gender Empowerment Index (Gedempw) positively impacts food security in the Special Region of Yogyakarta.
3. Poverty Level in the Yogyakarta Special Region (Poverty) positively impacts food security in the Special Region of Yogyakarta.
4. The Human Development Index in the Yogyakarta Special Region (HDI) positively impacts food security in the Special Region of Yogyakarta.
5. Life Expectancy in the Yogyakarta Special Region (LifeExp) positively impacts food security in the Special Region of Yogyakarta.
6. Food Expenditure in the Yogyakarta Special Region (FoodExp) positively impacts food security in the Special Region of Yogyakarta.

Research Methods

Type of Research

This study uses a mix of quantitative and qualitative approaches, or mixed-method research. The quantitative approach was used to analyze the influence of independent variables on food security in the Special Region of Yogyakarta and to identify differences between cities and regencies (objectives 1 and 2). Qualitative analysis was used to examine the aspects influencing each variable that are at the root of the problem (objective 3) and strategies for improving food security in the Special Region of Yogyakarta (objective 4). With these two approaches, it is hoped that the analysis in this study will be more comprehensive and can be implemented by relevant stakeholders.

Analysis Tools and Data Used

Referring to the objectives of this study, the analysis tools used in this study are as follows: multiple linear regression using SPSS and Eviews, analysis of differences between cities and regencies using dummy variables, qualitative analysis using RCA, NVivo, and Artificial Intelligence (AI), and SWOT analysis. The use of each analysis tool is explained in detail at each research stage in the discussion below. The data used in this study is panel data. The data series covers the years 2018 to 2024, and the regions used are five regencies and cities in the Special Region of Yogyakarta: Yogyakarta City, Bantul Regency, Gunung Kidul Regency, Sleman Regency, and Kulon Progo Regency.

Research Stages

The stages in this research answer the four research objectives above. First stage is collecting cross-sectional data. Data consists of Food Security Index, gender empowerment index, gender inequality index, poverty rate, Human Development Index, Food Expenditure, and Life Expectancy from official government publications at the district/city level for 2018-2024. The quantitative analysis tools used in this first stage are Eviews and SPSS. Second stage is quantitative data processing. The data collected in the first stage will be processed to answer (1) the influence of gender empowerment (Gendempw), gender inequality (Gedineq), poverty (Poverty), the Human Development Index (HDI), life expectancy (Lifeexp), and food expenditure (Foodexp) on the food security index in districts/cities in the Special Region of Yogyakarta. (2) analyzing the differences in the influence of the food security index between districts and cities in the Special Region of Yogyakarta. The models used are:

To determine the most appropriate panel data estimation technique among the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM), this study conducted the Chow test to select between CEM and FEM, the Hausman test to select between FEM and REM, and the Lagrange Multiplier (LM) test to select between CEM and REM (Baltagi, 2021; Gujarati & Porter, 2011). Based on these tests, the Fixed Effect Model was selected as the most appropriate estimator for the panel data used in this study.

$$\text{Foodsec} = \alpha + \beta_1 \text{Gedineq}_{it} + \beta_2 \text{Gendempw}_{it} + \beta_3 \text{Poverty}_{it} + \beta_4 \text{HDI}_{it} + \beta_5 \text{LifeExp}_{it} + \beta_6 \text{FoodExp}_{it} + \epsilon_{it}$$

Foodsec = Food Security Index of Yogyakarta Special Region

Gedineq = Gender Inequality Index

Gedempw = Gender Empowerment Index

Poverty = Poverty Level in Yogyakarta Special Region

HDI = Human Development Index in Yogyakarta Special Region

LifeExp = Life Expectancy in Yogyakarta Special Region

FoodExp = Food Expenditure in Yogyakarta Special Region

ϵ = Error Term

Stage three is conducting a root cause analysis. This third stage is conducted to answer the third objective: to determine the most relevant root causes for each variable affecting food security in the Special Region of Yogyakarta. This qualitative analysis was conducted using NVivo and RCA (Root Causes Analysis) tools. This stage will identify the root causes of each variable used, making it easier to determine problem-solving strategies for each variable. In addition to NVivo and RCA, artificial intelligence (AI) was also utilized to determine the root causes of each research variable. Stage four is designing strategies and policies. The analysis of the third stage identified the main root causes of each research variable related to food security in the Special Region of Yogyakarta. Each of these root causes will be clustered into key

issues that will be used in determining policies to improve food security in each district/city within the Special Region of Yogyakarta. The analytical tool used was the SWOT Matrix Analysis.

Results and Discussion

The data used in this study is panel data for four districts and one city in the Special Region of Yogyakarta from 2019 to 2024. The variable selection used to predict food security in DIY yielded an unadjusted R^2 of 0.569. This model explains 56.9% of the variation in the Food Security Index (Foodsec) in DIY. This is explained by the six independent variables selected in this study. The remaining 43.1% is influenced by other factors not included in the model. Although the selected variables are quite representative in their influence on food security in DIY, there are still other variables that need to be included in the model. As described above and from previous research, possible influencing variables include the production and distribution of staple foods, purchasing power as measured by income level, climate change and conditions, and other variables that require further investigation. The overall significance test from the F-test of 7.373 indicates that the model is valid and suitable for analysis. Summary of data processing results for food security in DI. Yogyakarta is as follows:

Based on the Chow, Hausman, and Lagrange Multiplier tests, the Fixed Effect Model (FEM) was identified as the most appropriate estimator for this panel dataset, and all reported coefficients in Table 5 are derived from this FEM specification (Baltagi, 2021). The dichotomy between districts and cities in Objective 2 was examined by including a City/Regency dummy variable (coded 1 for the city and 0 for regencies) in the estimated panel regression model, so that its coefficient captures the difference in the effect of the food security determinants between the two types of administrative regions (Gujarati & Porter, 2011).

Table 5. Results of Food Security Data Processing in the Special Region of Yogyakarta

Variable	Coefficient	t-Statistic	Conclusion	Adjusted-R ²	F-Test
Foodsec	-.026	-2.014	Significant	0,569	7,373
Gendineq	-.201	2.878	Significant		
Gendempw	.065	3.191	Significant		
Poverty	-.005	-1.054	Not Significant		
HDI	-.045	-.072	Not Significant		
Lifeexp	-.050	-4.157	Significant		
FoodEfp	-.026	-2.014	Significant		
City/Reg	-.28	.068	Not Significant		

Source: Compiled from various sources, 2025

Gender inequality worsens food security. For every 1-point increase in the gender inequality index, Foodsec decreases by 0.201 points. For example, women's limited access to land/credit reduces household food security. This result contradicts the hypothesis developed, which states that gender inequality should negatively impact food security in the Special Region of Yogyakarta. Higher gender inequality, reflected by the lagging role of women in development, including agricultural development, will weaken food security in the Special Region of Yogyakarta.

Gender empowerment improves food security with a coefficient of 0.065, indicating that increasing gender empowerment, as measured by access to education, income, and access to politics, significantly improves food security in the Special Region of Yogyakarta. As an educational city with one hundred universities, it contributes to strengthening the food security index in the Special Region of Yogyakarta. This result aligns with the previously developed hypothesis.

The result that does not align with the hypothesis developed based on theory and previous research is the poverty rate. Although this result aligns with the initial hypothesis, this variable indicates that poverty does not significantly impact food security in the Special Region of Yogyakarta. Yogyakarta has the highest poverty rate in Java, namely 11.04%.

The Human Development Index (HDI) is hypothetically consistent and proven, but it does not significantly impact the food security index in the Special Region of Yogyakarta. This is likely due to Yogyakarta's high Human Development Index (HDI) (80.6), resulting in a small variation in the impact. Theoretically, and based on previous research, improving the quality of human resources should lead to increased income, which ultimately impacts the ability to meet basic food needs.

Life expectancy is negatively and significantly related to the food security index in the Special Region of Yogyakarta. Indeed, life expectancy is rarely included in the food security index; if any, it differs from previous research results. The results of the hypothesis test are indeed consistent and proven. Life expectancy in Yogyakarta is the highest in Indonesia, reaching 76 years. This figure indicates good health and attention to the elderly in the Special Region of Yogyakarta. The latest data from the Central Statistics Agency (BPS) of the Special Region of Yogyakarta shows that the average life expectancy in the Special Region of Yogyakarta is 75.53 years. More specifically, life expectancy in Yogyakarta City is 75.43.

Increasing food expenditures significantly reduce the food security index in the Special Region of Yogyakarta. Households that spend >60% of their income on food (28% of cases in the Special Region of Yogyakarta) are more vulnerable to price shocks. Although inflation is well-controlled in the Special Region of Yogyakarta, at less than 3 percent on average, food inflation often contributes to inflation, impacting vulnerable groups.

The test results for differences in food security between cities and regencies showed no significant differences. This means that food security and the influencing

variables in the Special Region of Yogyakarta show no differences between cities and regencies. This result demonstrates that the variables of gender empowerment (Gendempw), gender inequality (Gendineq), poverty (Poverty), the Human Development Index (HDI), life expectancy (Lifeexp), and food expenditure (Foodexp) are not different. The Special Region of Yogyakarta government has succeeded in establishing a relatively equitable distribution between regencies and cities. In other words, there is no inequality in food security. This indicates that all regencies and cities in the Special Region of Yogyakarta are categorized as having good food security, although they are not vulnerable to food security.

The results of the qualitative analysis, using NVivo and root cause analysis, showed that each root cause within the six research variables had a relatively equal contribution and dominated the primary variable. This indicates that the root causes of each variable contribute equally to the problems that need to be addressed.

Likewise, by combining the results of the root cause approach, the dominant factors influencing each variable studied were obtained, with the following results.

Dominant Root of the Problem: Gender Inequality

1. Minimal Political Representation
2. Limited Access to Education
3. Limited Access to Credit
4. Lack of Technical Training

Dominant Root of the Problem: Low Gender Empowerment

1. Low financial literacy
2. Dependence on husbands
3. Technological limitations
4. Cultural discrimination

Dominant Root of the Problem: High Poverty Rates

1. Low farm labor wages
2. Limited market access
3. Traditional equipment
4. Massive land conversion

Dominant Root of the Problem: Low IPM

1. Low education
2. Poor nutrition
3. Educated unemployment
4. Illiteracy rate
5. Talent migration

Dominant Root of the Problem: Low Food Expenditure

1. Volatile food prices
2. Low resilience
3. Minimal nutrition
4. Cheap instant food

Dominant Root of the Problem: district and city gaps

1. Budget Concentration
2. Unequal Infrastructure
3. Minimal Processing Industry
4. Unequal Human Resources

Dominant Root of the Problem: Food Security

1. Agricultural Land Conversion
2. Aging Farmers
3. Low Agricultural Productivity
4. Low Technology Adoption

Conclusion

Gender empowerment, improved welfare, and quality education have been statistically and empirically proven to improve food security in the Special Region of Yogyakarta. Investment in these areas must continue to be increased, especially in food-insecure areas and vulnerable groups, to promote inclusive and sustainable economic growth. Gender inequality has a significant effect on food security, but not in line with the hypothesis. Gender empowerment has a significant effect and is in line with the hypothesis. Poverty levels do not significantly affect food security in the Special Region of Yogyakarta. Similarly, the human development index does not significantly affect food security. Life expectancy and food expenditure are proven to be significant and in line with the hypothesis. Qualitative analysis supports the quantitative findings, and this provides clear guidance for policies to improve food security in the Special Region of Yogyakarta that involve relevant stakeholders. Tests of differences between cities and districts in food security indicate that food security policies in the Special Region of Yogyakarta are relatively even and there are no differences between regions.

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