Food Security and Coping Mechanisms During the COVID-19 Pandemic: Evidence from Indonesia

Ira Eka Pratiwi

Graduate School of Pan-Pacific, International Development and Cooperation, Kyung Hee University, Seoul, South Korea

Keywords

Abstract

This study provides empirical evidence regarding whether coping mechanisms adopted by households in Indonesia during the COVID-19 pandemic significantly influenced food security. The data used were from the fourth round of high-frequency monitoring data on the impact of COVID-19 on households, collected by the World Bank through a phone-based survey conducted over November 3-15, 2020. By employing a logit regression model and controlling for household characteristics such as gender, age, and education level, this study confirms that reducing non-food consumption effectively lowered the probability of food insecurity across various indicators, including 'being hungry' (by 3.3 percentage points), 'going without eating' (by 2.0 percentage points), 'being unable to eat nutritious food' (by 6.6 percentage points), 'experiencing food shortage' (by 9.6 percentage points), and 'eating less' (by 5.6 percentage points). Additionally, Households which relied on savings had a lower probability (13.7 percentage points) of being unable to eat nutritious food, while households that received assistance from the government had a lower chance (by 2.4 percentage points) of experiencing hunger during the pandemic. This study emphasizes that temporary strategies or short-term coping mechanisms, such as relying on support from relatives, taking loans, and engaging in additional income-generating activities, as well as reducing food consumption, may not effectively contribute to food security; rather, these types of coping mechanisms may exacerbate food insecurity. The findings of this study offer several implications for enhancing the capacity of households to cope with difficulties during crises, as well as policy implications for designing effective interventions to deal with future shocks.

1. Introduction

As the country with the largest Muslim population in the world (12.7% of the world's Muslims) and categorized as lower middle-income country, Indonesia has made a substantial progress in terms of economic growth, reducing poverty, and enhancing food security and nutrition. For instance, the poverty rate has declined from 13.3% in 2010 to 9.8% in 2020, and there has been impressive progress in reducing the rate of undernourishment, from 13% of the population in 2010 to 7% in 2020. In addition, the under-five stunting rate – an indicator of impaired growth measured by height relative to age – dropped from over 40% in 2000 to under 30% in 2022 (ADB, 2021). However, the COVID-19 pandemic, which emerged in Indonesia in early 2020, may reverse these years of progress in reducing poverty and food insecurity. According to The Economist Impact (2022), Indonesia's food security index sat at 61.4 in 2020 and declined by 2.2 points to 59.2 in 2021. This indicates that the COVID-19 COVID-19 may have had a negative effect on the affordability, availability, quality, and safety of food in Indonesia. Previous studies have also revealed this negative impact of COVID-19 on food security, including Bukari *et al.*, 2022, Habtewold, 2021, and Inegbedion, 2021. Furthermore, according to *Anderson et al.* (2013), while Indonesia's self-sufficiency score was 0.95 in 2004, it is projected to decrease to 0.83 by 2030. Indonesia typically struggles to meet its self-sufficiency needs and is facing even greater challenges as a result of COVID-19. Therefore, despite programs developed by the government to support the households to fulfil their basic needs during the pandemic, households also needed to implement an array of coping strategies to survive, particularly in terms of food security.

To make important contributions to the literature, this study attempts to provide specific answers regarding the extent to which coping mechanisms implemented by Indonesian households during COVID-19 effectively contributed to food security. To the extent of our knowledge, this is the first study to analyze household coping mechanisms in Indonesia by employing national representative data sets, focusing on how households met their daily needs during the COVID-19 pandemic and how important these strategies were to food security. Previous studies, such as Samputra and Antriyandarti (2024), suggested several factors which contribute to the occurrence of food insecurity, including underuse of household gardens for cultivation, lack of agricultural income, and limited value of household assets. Samputra and Antriyandarti (2024) also concluded that, to mitigate food insecurity, families should prioritize food spending, live frugally, cultivate garden

crops, engage in full-time farming, and reduce reliance on government aid. However, this study focused on estimating food insecurity on female farmers in Indonesia. Hangoma *et al.* (2024) also estimated the impact of COVID-19 on food insecurity by using panel data from nine low- and middle-income countries. The study concluded that household coping strategies may not be sufficient to stop worsening food insecurity, but cash transfers could help minimize its severity. Additionally, Dauda Goni *et al.* (2024) focused their study on evaluating household food insecurity in Malaysia during the early stages of the COVID-19-era movement control order, but this study has some limitations related to not examining various aspects of food insecurity comprehensively, including coping strategies.

Therefore, the main contribution of this study is to provide the empirical evidence regarding the micro-level impact of lockdowns during the early phase of the COVID-19 pandemic on employment and food security in Indonesia. Furthermore, the evidence from this study can contribute to the development of more effective preparedness and coping strategies of Indonesian households to face the future potential shocks.

This study utilizes high-frequency monitoring data of the COVID-19 impact on households from the World Bank (2020). The data was obtained between 1 May 2020 and 20 April 2022 and consisted of seven rounds of phone-based surveys. For the purpose of this study, results from the fourth round of surveys (November 3-15, 2020) is employed, which covered questions relating to household coping mechanisms and food security. Several findings are worth mentioning. First, despite the comparatively small proportion of households experiencing food insecurity during COVID-19 pandemic, as evidenced by the relatively low mean values for all five dependent variables (were hungry, went without eating, unable to eat nutritious food, experiencing food shortage, eating less), the impact of the pandemic on food insecurity cannot be overlooked, particularly in vulnerable populations in Indonesia. Second, this study reveals that households applied various coping mechanisms in order to cope with the difficulties face and to meet their daily needs during the pandemic. The most common coping mechanisms adopted by households included engaging in additional income generating activities (mean score of 0.297), reducing food consumption (mean score of 0.210), and reducing non-food consumption (mean score of 0.19). Meanwhile, other coping mechanisms were less common, such as selling harvests in advance, delaying payment obligations, selling assets (agricultural and non-agricultural), accessing credit, taking loans from financial institutions, and relying on savings. Third, this study confirms that only 'reducing non-food consumption' was found

to be effective in lowering the probability of experiencing food insecurity, as the effect was observed in all indicators of food insecurity. In detail, reduced non-food consumption is substantially associated with a 3.3 percentage point reduction in the probability of 'being hungry', a 2.0 percentage point reduction in the probability of 'going without eating', a 6.6 percentage point reduction in the probability of being 'unable to eat nutritious food', a 9.6 percentage point reduction in the probability of experiencing a 'food shortage', and a 5.6 percentage point reduction in the probability of 'eating less'. Additionally, households who 'relied on savings' had a lower probability of not being able to eat nutritious food (by 13.7 percentage points), while households who 'received assistance from government' were less likely to experience hunger during the pandemic (by 2.4 percentage points). Fourth, this study emphasizes that temporary strategies or short-term coping mechanisms such as relying on the support from relatives, taking loans, and engaging in additional income generating activities may not effectively contribute to food security, but may instead exacerbate food insecurity. Further, this study also confirms that the gender and education level of household heads may influence the likelihood of experiencing food insecurity. Therefore, the gender and education level of household heads were considered as critical in mitigating food insecurity at the household level.

The rest of the paper is organized as follows: section two focuses on the literature review of previous research related to this study. Section three is methodology, which presents the data, variables, and analysis methods used in the study. Section four represents the results and discussion of the study, while the last section provides the conclusion and notes the limitations of the study, as well as providing recommendations and policy implication.

2. Literature Review

Food security is a major concern worldwide, including in many Muslim and Muslim majority countries, where food insecurity is a pervasive issue due to factors such as poverty, climate change, and conflict. According to the World Food Programme (WFP), more than 820 million people do not have enough food and nearly 43.3 million people across 51 countries, most of which are Muslim majority countries, such as Yemen and South Sudan, are at serious risk of famine (WFP Executive Board, 2023). Furthermore, it is projected that the COVID-19 pandemic is adding an additional 130 million people to the number of people who at serious risk of famine. According to Food Association Organization (FAO, 2006), food security can be defined as the state where every individual has both the physical

and financial ability to obtain adequate, safe, and nourishing food that satisfies their dietary requirements and personal food choices, enabling them to lead a healthy and active life. As such, various interventions and strategies are needed in order to increase the resilience of households and communities in terms of food security.

Coping strategies have been widely studied in the literature to understand how households and communities cope with food insecurity. Coping is a term used to describe the conscious and voluntary thoughts and behaviors employed to manage internal and external stressful situations. Coping styles are relatively stable traits that determine an individual's behavior in response to stress. Coping mechanisms are categorized into four major categories: problem-focused, emotion-focused, meaning-focused, and social coping, all of which have been proven to be useful in certain situations (Algorani & Gupta, 2022), such as during the outbreak of the COVID-19 pandemic.

There is abundant existing literature concerning food security and its relationship with the COVID-19 pandemic. According to Kim and Murphy (2024), food insecurity and economic hardship worsened across the world during the pandemic, and notable differences were visible in the nature of economic hardship before and during the pandemic. Economic hardship emerged as a significant factor explaining food insecurity, and the pandemic amplified this association, suggesting that the pandemic had a particularly pronounced impact on exacerbating economic challenges and subsequently increasing food insecurity. In Indonesia, Amrullah *et al.* (2023) suggest that the prevalence of mild, moderate, and severe food insecurity increased between 2020 and 2021, coinciding with the period of the COVID-19 pandemic. Moreover, the study showed that urban households, potentially facing income and food access constraints, were more affected by the pandemic than rural households. Similarly, households with heads who were economically vulnerable, less educated, or unemployed were also more greatly impacted. In addition, Akbar *et al.* (2023) found that household characteristics (such as gender, age, family size, education, occupation, income, and expenditure on food) had a significant impact on their food security status during the pandemic, while according to Antriyandarti *et al.* (2024), the key determinants of economic resilience included household income, assets, and market product availability.

On the other hand, a study conducted by Bahiru *et al.* (2023) concluded that households in Humbo district, southern Ethiopia, who experience food insecurity were more familiar with coping strategies compared to households who were food secure. In regard to the determinants of food security, the study suggested that

several socio-demographic factors were associated with food insecurity, such as the household head's gender and education level, and household size, income, and use of credit. Further, this study found that households generally used a combination of different coping strategies to deal with food shortages. Key coping strategies included purchasing preferred crops, reducing meal size and frequency, selling firewood and charcoal, engaging in manual labor, and borrowing crops or money from relatives. As the severity of food shortages deepen, households resorted to more drastic measures such as selling livestock, renting out land, and even migrating. Similarly, a study by Olaimat *et al.* (2022) in Jordan found that food-based coping strategies were more likely to be implemented during COVID-19 pandemic by participants experiencing severe food insecurity, who chose to eat cheaper food, borrow food, and eat smaller amounts of food. Deschak *et al.* (2022) identified coping strategies among international migrants transiting through Mexico and stated that chosen strategies differed geographically, with food insecurity coping strategies classified as follows. First, there was the use of social resources, such as obtaining food through social gatherings or organizations. Second, there were food-based coping strategies involved altering the quality of food, such as gathering wild foods or preferring high-calorie-density options and adjusting the quantity of food by reducing meal frequency or skipping meals. Third, the use of financial resources such as borrowing money and limiting expenditure. Meanwhile, in conflict-affected situations, Swesi *et al.* (2020) found that food insecurity coping mechanisms adopted by households in conflict-affected Libya were identical with those in non-conflict areas, such as asset compromising, changing income-generation activities, budgeting and borrowing, relying on food aid, using local norms of cooperation (social capital), and migration.

Tabe-Ojong *et al.* (2022) attempted to assess five coping strategies (reducing food intake, increasing food searches, eating less nutritious/desirable food, receiving support from the government, and receiving support from friends and family) in three rural areas in Africa (Kenya, Namibia, Tanzania) during the COVID-19 pandemic. This study revealed that reducing food intake was the most frequently-used strategy in Kenya and Tanzania, while in Namibia, participants relied on government support to cope with food insecurity. Nevertheless, this study also confirmed that households applied various coping mechanisms by modifying rationing strategies and relying on formal and informal support. Finally, a study conducted by Dasgupta & Robinson (2022) examining the evolution of food insecurity in lower-income countries during the COVID-19 pandemic revealed that, in terms of gender, female-headed households were more likely to suffer from

food insecurity compared to male-headed households, while in terms of education level, households with higher-educated heads were less likely to experience food insecurity. This study also confirmed that households who relied on savings had a lower probability of experiencing food insecurity compared to households who borrowed money. In other words, savings effectively helped households to cope with food insecurity during the COVID-19 pandemic. Consequently, by rooting its hypothesis in the existing empirical evidence, this study hypothesizes that coping mechanisms adopted by households during the COVID-19 pandemic may have substantially protected households from food insecurity, particularly in the case of Indonesia, the world's largest Muslim-majority nation.

This means that utilizing multiple waves of High Frequency Phone Surveys (HFPS) conducted with households since the beginning of the pandemic, and connecting them with ongoing panel micro studies, the researchers conducted the first comprehensive analysis across multiple countries and time periods to examine how food insecurity evolved in lower-income countries during the COVID-19 pandemic.

3. Data and Methodology

3.1. Data

This study uses data from the World Bank Microdata Library. Specifically, it uses data from high-frequency monitoring survey on the impact of the COVID-19 pandemic on households, which was conducted between 1 May 2020 and 20 April 2022 and consisted of seven rounds of phone-based surveys. For the purpose of this study – that is, to identify the determinants of food insecurity and the subsequent coping mechanisms implemented by households in Indonesia during the COVID-19 pandemic – data from the fourth round of the survey (conducted on November 3-15th, 2020) is employed, as this data covers household characteristics, coping mechanisms, and food security. Specific household characteristics identified are gender, age, and education level.

For the indicators of household coping mechanisms and food (in)security, this study utilizes the following indicators from the survey questionnaire (https://microdata.worldbank.org/index.php/catalog/3938/related-materials):

3.1.1. Food Insecurity

1. In the last month, did you or any other adult in your household experience hunger because there was insufficient money or resources to purchase food?
2. Within the past month, have you or any adult member of your household gone

an entire day without eating due to a lack of funds or resources?

3. Have you or any adult member of your household been unable to consume nutritious or healthy meals in the past month due to financial constraints or other resource limitations?

4. Has your household experienced food shortages in the past week because of a lack of funds or resources?

5. In the past week, have you or any household members eaten less than you normally would due to financial constraints or other resource limitations?

3.1.2. Coping Mechanisms

1. How has your household been coping with difficulties in fulfilling daily necessities since the onset of the COVID-19 outbreak?

It is worth noting that for coping mechanisms, respondent answers were spontaneous, as the aim was to capture a genuine and natural response from participants. In total, 12 coping mechanisms were identified and analyzed in the study. Table 1 presents a summary of the coping mechanisms employed by the households in order to cope with difficulties in meeting basic needs during the COVID-19 pandemic.

Table 1. List of Coping Mechanisms

No	Answers
1.	Sale of assets (agriculture and non-agriculture)
2.	Engaged in additional income generating activities
3.	Received support from family and friends
4.	Borrowed money from family and friends
5.	Took a loan from a financial institution
6.	Made purchases on credit
7.	Delayed payment obligations
8.	Sold harvest in advance
9.	Reduced food consumption
10.	Reduced non-food consumption
11.	Relied on savings
12.	Received assistance from government

Table 2. List of Variables

Dependent Variable	
Food Insecurity	**Definition**
Were hungry	Dummy variable that takes value 1 if the household was hungry but could not eat because there was not enough money or other resources for food during the past month (in the time of COVID-19 pandemic), and 0 if otherwise.
Went without eating	Dummy variable that takes value 1 if the household went without eating for a whole day because of a lack of money or other resources during the past month (in the time of COVID-19 pandemic), and 0 if otherwise.
Unable to eat nutritious food	Dummy variable that takes value 1 if the household was unable to eat nutritious/healthy food because of a lack of money or other resources during the past week (in the time of COVID-19 pandemic), and 0 if otherwise.
Experienced food shortage	Dummy variable that takes value 1 if the household experienced a food shortage because of a lack of money or other resources during the past week (in the time of COVID-19 pandemic), and 0 if otherwise.
Ate less	Dummy variable that takes value 1 if the household ate less than they should because of a lack of money or other resources during the past week (in the time of COVID-19 pandemic), and 0 if otherwise.
Independent Variable	
Coping Mechanisms	**Definition**
Sale of assets (agriculture and non-agriculture)	Dummy variable that takes value 1 if the household coped with difficulties in meeting daily needs due to COVID-19 outbreak by selling assets (agriculture and non-agriculture), and 0 if otherwise.
Engaged in additional income generating activities	Dummy variable that takes value 1 if the household coped with difficulties in meeting daily needs due to COVID-19 outbreak by engaging in additional income generating activities and 0 if otherwise.
Received support from family and friends	Dummy variable that takes value 1 if the household coped with difficulties in meeting daily needs due to COVID-19 outbreak by receiving support from family and friends, and 0 if otherwise.
Borrowed money from family and friends	Dummy variable that takes value 1 if the household coped with difficulties in meeting daily needs due to COVID-19 outbreak by borrowing money from family and friends, and 0 if otherwise.
Took a loan from a financial institution	Dummy variable that takes value 1 if the household coped with difficulties in meeting daily needs due to COVID-19 outbreak by taking a loan from financial institutions, and 0 if otherwise.
Purchased on credit	Dummy variable that takes value 1 if the household coped with difficulties in meeting daily needs due to COVID-19 outbreak by purchasing on credit, and 0 if otherwise.
Delayed payment obligations	Dummy variable that takes value 1 if the household coped with difficulties in meeting daily needs due to COVID-19 outbreak by delaying payment obligations, and 0 if otherwise.
Sold harvest in advance	Dummy variable that takes value 1 if the household coped with difficulties in meeting daily needs due to COVID-19 outbreak by selling harvest in advance, and 0 if otherwise.
Reduced food consumption	Dummy variable that takes value 1 if the household coped with difficulties in meeting daily needs due to COVID-19 outbreak by reducing food consumption, and 0 if otherwise.

Reduced non-food consumption	Dummy variable that takes value 1 if the household coped with difficulties in meeting daily needs due to COVID-19 outbreak by reducing non-food consumption, and 0 if otherwise.
Relied on savings	Dummy variable that takes value 1 if the household coped with difficulties in meeting daily needs due to COVID-19 outbreak either by relying on savings, and 0 if otherwise.
Received assistance from government	Dummy variable that takes value 1 if the household coped with difficulties in meeting daily needs due to COVID-19 outbreak receiving assistance from government, and 0 if otherwise.
Household Characteristics	**Definition**
Gender	Dummy variable that takes value 1 if the head of household is female and 0 if otherwise.
Age	Numerical or continuous variable that indicates the head of household's age.
Education level	Categorical variable that indicates the education level of head of household, 0 =not in school, 1=primary school, 2 = junior high school, 3= senior high school, 4=university degree.

3.2. Method of Analysis

To assess the impact of coping mechanisms on household food insecurity during the COVID-19 pandemic in Indonesia, logistic regression is employed in this study. Alongside a binary dependent variable, the logit model is utilized to predict the probability of household food insecurity, considering their coping mechanisms. The estimation model is presented below:

$$Y_i = \alpha_0 + \delta C_i + \gamma X_i + \alpha_i + \varepsilon_i$$

where;

δC_i = represents a vector of coping mechanisms implemented by household i to deal with the challenges of meeting daily needs during the COVID-19 pandemic. These mechanisms include: Sale of assets (agricultural and non-agricultural), Engaging in additional income generating activities, Receiving support from family and friends, Borrowing from family and friends, Taking loans from financial institutions, Purchasing on credit, Delaying payment of obligations, Selling harvest in advance, Reducing food consumption, Reducing non-food consumption, Relying on savings, Receiving government assistance.

γX_i = represents a vector controlling for household characteristics of gender, age, and education level.

Y_i = is the dependent variable representing each indicator of food insecurity for household i.

4. Results and Discussion

4.1 Descriptive Statistics of Variable Used

Table 3. Summary of Demography Characteristics

Variable	Mean	SD	Min	Max	Obs.
Dependent Variable (Food insecurity)					
Were hungry	0.056	0.229	0	1	3889
Went without eating	0.054	0.227	0	1	3889
Unable to eat nutritious food	0.264	0.441	0	1	3889
Experienced food shortage	0.245	0.430	0	1	3889
Ate less	0.297	0.457	0	1	3889
Independent Variable					
Coping mechanism					
Sale of assets (agriculture and non-agriculture)	0.010	0.103	0	1	3889
Engaged in additional income generating activities	0.297	0.457	0	1	3889
Received support from family and friends	0.027	0.164	0	1	3889
Borrowed from family and friends	0.039	0.196	0	1	3889
Took a loan from financial institution	0.010	0.103	0	1	3889
Purchased on credit	0.011	0.103	0	1	3.889
Delayed payment obligations	0.001	0.032	0	1	3889
Sold harvest in advance	0.006	0.079	0	1	3889
Reduced food consumption	0.210	0.407	0	1	3889
Reduced non-food consumption	0.195	0.395	0	1	3889
Relied on savings	0.011	0.107	0	1	3889
Received assistance from government	0.041	0.198			3889
Household characteristics					
Gender	0.876	0.331	0	1	3889
Age	46.767	11.056	16	94	3889
Education level	3.369	1.081	1	5	3885

Source: Author's calculation

This section provides a descriptive statistic of the data used in this study, with the summary is presented in Table 3. The dependent variables used in this study represent the type of food insecurity experienced by the households during the pandemic. There are five dependent variables, including: were hungry, went without eating, unable to eat nutritious food, experienced food shortage, and ate less. The results of descriptive statistic analysis indicate that an insignificant proportion of households experienced food insecurity in Indonesia during the COVID-19 pandemic, as evidenced by the relatively low mean values for all five dependent variables. The highest mean value is observed for the variable 'ate less', with a mean score of 0.297, followed by 'unable to eat nutritious food' and 'experienced

food shortage' with mean scores of 0.264 and 0.245, respectively. Meanwhile the variable 'were hungry' and 'went without eating' have very low mean values (0.056 and 0.054), indicating that only a very small proportion of households were hungry or went without eating for a whole day because of a lack of money or other resources during the pandemic. Further results can be seen in Figure 1, which presents the percentage of households that experienced each level of food insecurity. Still, it is important to note that while the overall proportion of the households experiencing food insecurity during the pandemic may appear low based on the mean scores, it is nevertheless a substantial issue that needs to be addressed.

Table 3 also depicts the descriptive statistics analysis of 12 independent variables of coping mechanisms and three control variables of demographic characteristics. The results show that while households used various coping mechanisms to meet their basic needs during the COVID-19 pandemic, the most common mechanisms were engaging in additional income generating activities (mean score of 0.297), reducing food consumption (mean score of 0.210), and reducing non-food consumption (mean score of 0.19), indicating that households resorted to various strategies to cope with the impact of the pandemic. Meanwhile, other coping mechanisms such as selling harvest in advance, delaying payment obligations, selling assets (agricultural and non-agricultural), purchasing on credit, taking a loan from a financial institution, and relying of savings have relatively low mean scores. Furthermore, the results indicate that most households were headed by men, aged 46 years old on average and who had finished junior and senior high school. Figure 2 depicts the percentage of coping mechanisms implemented by households.
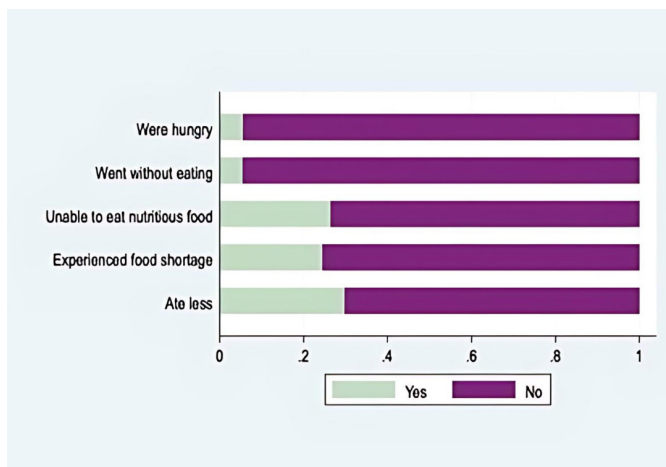

Figure 1. Five Indicators of Food Insecurity Experienced by Households During Pandemic of COVID-19
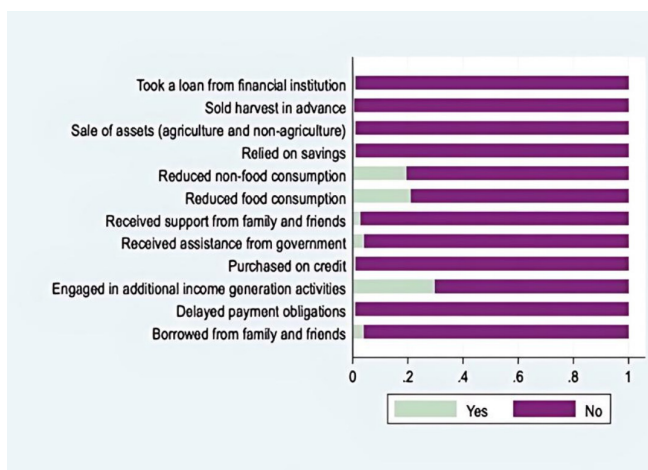Source: Author's calculation

Figure 2. Descriptive Statistics of Coping Mechanism Adopted by Households During COVID-19 Pandemic
Source: Author's calculation

4.2. Coping Mechanisms and Experiences of Food Insecurity

This section examines the relationship between household coping mechanisms and experiences of food insecurity during the COVID-19 pandemic in Indonesia. In order to do so, logistic regression analysis was conducted to provide insights into which coping mechanisms were substantially important in mitigating food insecurity and how different levels of food insecurity were associated with different coping mechanisms. The result of the logistic regressions analysis is presented in Table 5. Overall, the econometrics results are considerably consistent across the five indicators of food insecurity as shown in columns (1) to (5).

Table 5. Logistic Regression Results

	Food Insecurity				
	Were hungry	Went without eating	Unable to eat nutritious food	Experienced food shortage	Ate less
	(1)	(2)	(3)	(4)	(5)
Sale of assets (agricultural and non-agricultural)	-0.001***	-0.023***	-0.002***	0.122***	0.077***
	(0.033)	(0.025)	(0.071)	(0.077)	(0.078)
Engaged in additional income generating activities	0.024***	0.044***	0.088***	0.092***	0.166***
	(0.009)	(0.009)	(0.017)	(0.017)	(0.018)
Received support from family and friends	0.042***	0.058***	0.019***	0.210***	0.107***
	(0.028)	(0.031)	(0.044)	(0.050)	(0.050)
Borrowed from family and friends	0.041***	0.019***	0.057***	0.212***	0.259***
	(0.023)	(0.022)	(0.040)	(0.043)	(0.043)
Took a loan from financial institution	-0.008***	0.004***	0.168***	-0.042***	0.032***
	(0.029)	(0.036)	(0.079)	(0.060)	(0.075)

Purchased on credit	0.057***	0.001***	0.025***	0.062***	0.106***
	(0.047)	(0.034)	(0.071)	(0.072)	(0.079)
Delayed payment obligations			0.241***	0.279***	
			(0.250)	(0.251)	
Sold harvest in advance	-0.015***	0.016***	0.035***	0.069***	0.269***
	(0.034)	(0.049)	(0.090)	(0.092)	(0.102)
Reduced food consumption	0.043***	0.028***	0.113***	0.157***	0.217***
	(0.013)	(0.012)	(0.022)	(0.022)	(0.023)
Reduced non-food consumption	-0.033***	-0.020***	-0.066***	-0.096***	-0.056***
	(0.007)	(0.008)	(0.019)	(0.017)	(0.020)
Relied on savings	-0.004***	-0.002***	-0.137***	-0.010***	0.000***
	(0.032)	(0.032)	(0.052)	(0.067)	(0.072)
Received assistance from government	-0.024***	-0.018***	-0.005***	-0.026***	-0.040***
	(0.012)	(0.013)	(0.035)	(0.032)	(0.035)
Gender	-0.020***	-0.018***	-0.019***	-0.042***	-0.049***
	(0.011)	(0.011)	(0.021)	(0.021)	(0.023)
Age	-0.001***	-0.001***	0.001***	0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education level	-0.005****	-0.006***	-0.020***	-0.027***	-0.027***
	(0.003)	(0.003)	(0.007)	(0.006)	(0.007)
Obs.	3,881	3,881	3,885	3,885	3,881
LR chi2(11)	50.60	53.96	84.81	167.75	220.93
Pseudo R-Square	0.0306	0.0329	0.0189	0.0388	0.0468

Source: Author's calculation. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$

The results show that the variable of 'engaged in additional income generating activities' generally had a positive and significant impact on food security, as observed in all indicators. These results indicate that households which engaged in additional income generating activities were more likely to have faced severe food insecurity, compared to households who did engage in additional income generation. Specifically, households who engaged in additional income generating activities were 2.4 percentage points more likely to be hungry, 4.4 percentage points more likely to go without eating, 8.8 percentage points more likely to be unable to eat nutritious food, 9.2 percentage points more likely to experience a food shortage, and 16.6 percentage points more likely to eat less during the pandemic. This may be because households' incomes were insufficient to meet their basic needs, including food. Regardless of the fact that these households had begun to generate more income, particularly when facing limited financial resources, households also had a number of basic needs that may have had to be prioritized over food, such as housing, education, and health. Moreover, households may be involved in seasonal work, such as in the agriculture sector, or in temporary work,

leading to unpredictable and inconsistent income. This may also have contributed to the inability of households to consistently purchase enough food. Owusu *et al.* (2011) confirmed that non-farm work has a positive and significant effect on household income and food security. Rahman & Mishra (2020) found in their study that non-farm income and remittance income have a positive impacts on various food security indicators. This is because non-farm opportunities allow households to allocate more funds towards higher-quality food, leading to diversified diets. Additionally, the increased use of remittances as a source of household income has contributed to the maintenance of household food security.

The results also reveal that households who 'received support from family and friends' and 'borrowed from family and friends' had a higher probability of experiencing food insecurity, suggesting that these types of coping mechanism may not have been effective in dealing with difficulties in meeting daily needs, particularly food needs. The results (summarized in Table 5) show that these types of coping mechanism have positive and significant effect on food insecurity. To elaborate further, the effect of 'receiving support from family and friends' was significantly related to a 5.8 percentage point increase in the probability 'going without eating', a 21.0 percentage point increase in the probability of 'experiencing food shortage', and a 10.7 percentage point increase in the probability of 'eating less'. Meanwhile, the impact of 'borrowing from family and friends' was significantly associated with a 4.1 percentage point increase in the probability of 'being hungry', a 21.2 percentage point increase in the probability of 'experiencing food shortage', and a 25.9 percentage point increase in the probability of 'eating less'. In respect to these empirical findings, several factors may have influenced the results, such as household income level, or that the amount of support provided or lent by family and friends may have been insufficient to meet households needs (especially food needs), or was too little in comparison to the size of the household and the cost of food in the household's particular area. In addition, households who relied on the support of family and friends, or borrowing money from relatives, likely faced other financial challenges that must also be fulfilled. Therefore, it was difficult for households to adequately distribute the resources available to them between getting enough food and fulfilling other needs. Therefore, receiving support or borrowing from family and friends may have been a temporary solution that failed to address the underlying causes of the food insecurity being experienced. In some cases, households may have needed more sustained support, such as access to education or job training programs, in order to achieve greater economic stability and food security. This result is similar to the findings of a study conducted by

Dasgupta & Robinson (2022), which identified that households which had to borrow rather than rely on savings had a higher probability of experiencing food insecurity, indicating inequality and distributional impacts of the pandemic, as relatively higher income households were more likely to have sufficient savings while poorer households were more likely to borrow to meet basic needs.

In terms of reduction of household consumption, the findings reveal a contrasting result between reductions made on food and those made on non-food items. While decreased food consumption is positively associated with food insecurity, reduced non-food consumption shows a negative effect on food insecurity. These results indicates that households who reduced their food consumption during the COVID-19 pandemic had a higher probability of experiencing food insecurity, while households who reduced their non-food consumption as their way of coping with difficulties in meeting daily needs were more likely to be food secure. Specifically, reduced food consumption was related to a 4.5 percentage point increase in the likelihood of experiencing 'hunger', a 2.8 percentage point increase in the likelihood of 'going without eating', a 11.3 percentage point increase in the likelihood to being 'unable to eat nutritious food', a 15.7 percentage point increase in the likelihood to 'experiencing food shortage"', and a 21.7 percentage point increase in the likelihood of 'eating less' during the pandemic. Meanwhile, reduced non-food consumption is was associated with a 3.3 percentage points in the reduction in the probability of 'being hungry', a 2.0 percentage point reduction in the probability of 'going without eating', a 6.6 percentage point reduction in the probability of being 'unable to eat nutritious food', a 9.6 percentage point reduction in the probability of 'experiencing food shortage', and a 5.6 percentage point reduction in the probability of 'eating less'. It is rational that a reduction in food consumption could lead to food insecurity, due to insufficient quantity and nutritional quality of food. As discussed earlier, a reduction in food consumption may also have been the result of households having limited financial resources due to job losses or reductions in income, resulting in decreased food consumption in order to meet other basic needs, such as health, education, and housing. In the long-term, however, reducing food consumption may lead to undernourishment, which can exacerbate the burden of malnutrition and related disease (Tsegaye et al., 2018). On the other hand, a reduction in non-food consumption indicates that households prioritized food over other expenses such as clothing and entertainment in order to maintain their food security during the pandemic, despite facing financial challenges. Similarly, in a study undertaken by Hirvonen *et al.* (2021), households were able to maintain food consumption

levels by reducing non-food consumption, whether intentional or as a result of pandemic-related lockdowns or restrictions.

Meanwhile, it is evident that households which borrowed from financial institutions exhibited a positive correlation with food insecurity. Such households had a 16.8 percentage point higher likelihood of being unable to afford nutritious food. Similarly, households which sold their harvest in advance also showed positive correlation with food insecurity; they were 26.9 percentage point more likely to reduce their food intake during the pandemic. This may be related to job losses or other declines in income, forcing households to take loans from financial institution or sell harvests in advance in order to cope with the difficulties in generating income. However, this may not have been enough to cover all the household's basic needs, including nutritious food.

Interestingly, a reliance on savings was found to significantly increase food security. Households which relied on savings had a lower probability (13.7 percentage points) of being unable to eat nutritious food. This result indicates that the households had financial stability, which allowed them to adjust their budgets to prioritize the consumption of nutritious food, even if they had a decline in income during the pandemic. This research is in line with studies conducted by Kansiime *et al.* (2021) and Dinegde *et al.* (2022), which found that households' participation in saving money increased their abilities to meet dietary energy requirements and consume diverse foods, as well as a lower likelihood of having to reduce food consumption. Similarly, households which 'received assistance from government' showed a negative correlation with food insecurity. This result suggests that households who received assistance from government had were less likely (2.4 percentage points) of experiencing hunger during pandemic. However, it is important to note that findings regarding borrowing from financial institutions, selling harvests in advance, relying on savings, and receiving government assistance were found to be significant only for one indicator of food insecurity, suggesting inconsistent results. Additionally, other coping mechanisms such as selling assets (agricultural and non-agricultural) and purchasing on credit did not show any significant impact on food insecurity. One possible explanation is that the assets owned by households were already limited prior to the pandemic. Therefore, household with limited assets may have chosen not to liquidate their assets, instead utilizing other coping mechanisms to maintain levels of food consumption. Other possible explanations may be related to sample variability. Further research is needed to comprehensively understand the impact of coping mechanisms on food security during pandemics.

In terms of respondent characteristics, such as gender, age, and education level, this study found that households headed by men generally had a lower percentage of food insecurity. In particular, this was observed in the effect of the household head's male gender on the household being 'hungry', 'experiencing food shortage', and 'eating less'. Male-headed households were 2.0 percentage points less likely to experience hunger and 4.2 and 4.9 percentage points, respectively, less likely to experience food shortages and eating less food during the pandemic. Furthermore, these findings suggest that households with relatively higher-educated heads were less likely to experience food insecurity, as this was evident for all indicators of food insecurity. These results corroborate previous findings, such as Broussard (2019), Yohannes *et al.* (2023), and Grimaccia & Naccarato, (2022) which found that women were more vulnerable to food insecurity compared to men and that education can be a driver to mitigate this issue, as both men and women with university degrees have lower probability of experiencing food insecurity. Therefore, gender and education household heads are both critical in mitigating food insecurity among households.

5. Conclusion

In order to provide specific analysis on the effectiveness of coping mechanisms adopted by Indonesian households during the COVID-19 pandemic to combat food insecurity, this study utilizes high-frequency monitoring data from the World Bank. Conducted between 1 May 2020 and 20 April 2022, the survey consisted of seven rounds of phone-based surveys. For this study, the survey from the fourth round (November 3 – 15, 2020) is employed, covered questions related to coping mechanisms and food security. The descriptive statistical analysis shows that an insignificant proportion of households experienced food insecurity in Indonesia during the pandemic, as evidenced by the relatively low mean values for all five dependent variables. Still, it is important to note that although the overall proportion of the households experiencing food insecurity during the pandemic may appear low based on the mean scores, it is a substantial issue that must be addressed, particularly with regards to the impact on vulnerable households. In terms of coping mechanisms, the result shows that while households used various coping mechanisms to meet their basic needs during the pandemic, the most common coping mechanisms were engaging in additional income generating activities, reducing food consumption, and reducing non-food consumption, indicating that households resorted to a variety of strategies to cope with the impact of the pandemic. Meanwhile, other coping mechanisms such as selling

harvests in advance, delaying payment obligations, selling assets (agricultural and non-agricultural), purchasing on credit, taking loans from financial institutions, and relying on savings were adopted less freuqently by the households.

Further analysis using a logit regression model showed that the impact of different coping mechanisms varied in respect to the five indicators of food insecurity. This study confirms that only 'reducing non-food consumption' was found to be effective in lowering the probability of experiencing food insecurity, as a significant effect was observed against all indicators of food insecurity. Specifically, reduced non-food consumption was associated with a 3.3 percentage points reduction in the likelihood of 'being hungry', a 2.0 percentage point reduction in the likelihood of "going without eating", a 6.6 percentage point reduction in the likelihood of being "unable to eat nutritious food", a 9.6 percentage point reduction in the likelihood of having "food shortage", and a 5.6 percentage point reduction in the likelihood of 'eating less'. Additionally, households who 'relied on savings' were less likely (by 13.7 percentage points) to be unable to eat nutritious food, while households who 'received assistance from government' were less likely (by 2.4 percentage points) to experience hunger during the pandemic. This study also found that the gender and education level of the household head may influence a household's likeliness of experiencing food insecurity, and that temporary strategies – such as relying on support from relatives, taking out loans, and engaging in additional income generating activities – may not effectively improve food security. Rather, such short-term coping mechanisms may exacerbate food insecurity. At the same time, choosing to reduce food consumption was found to worsen household food insecurity; it increased the likelihood of being hungry by 4.3 percentage points, of going without eating by 2.8 percentage points, of being unable to eat nutritious food by 11.3 percentage points, of experiencing food shortage by15.7 percentage points, and of eating less food by 21.7 percentage points. This issue warrants attention, because the long-term effect of reducing food consumption may lead to undernourishment, which can exacerbate the burden of malnutrition and related diseases.

This research supports the need for appropriate and effective coping mechanisms to be taken into account in order to diminish food insecurity, particularly in time of shocks, such as natural disasters, economic crisis, or pandemics. Furthermore, households should adopt financial behavior that improves and diversifies their sources of income (including saving and investing) in order to cope with difficulties in future disruptions. It is important to note that since this study used cross-section data, which only captures the information at a single period, it did not

allow for the analysis of trends over time. Therefore, future research is required to confirm the effectiveness of coping mechanisms on improving food security at different times, such as by employing other rounds of the World Bank survey used here. In addition, the five indicators of food insecurity used in this study are simply quantified by using binary variable. Further research needs to develop this proxy by calculating the index of food insecurity of each household in order to fully capture the state of food insecurity, which can vary widely between households. As this study provides several implications for enhancing capacity of households to cope with the difficulties during crises as well as policy implications to design effective interventions in dealing with future shocks, prospective studies are still needed to fully understand the relationship between food insecurity and coping mechanisms in the broader context.

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