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URBAN RESILIENCE AND FOOD SECURITY IN THE EARLY COVID-19 PANDEMIC: EMPIRICAL INSIGHTS FROM ONLINE SURVEY*

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ABSTRACT

The COVID-19 pandemic disrupted food supply chains and income sources, threatening household food security worldwide. Using an online survey of 1,495 households across 32 provinces in Indonesia during September–October 2020, this study investigates the determinants of food security and coping strategies among predominantly urban households. Food security was measured using the USDA household food security index, while socio-demographic and economic characteristics were analysed with an ordered probit model. Results show that 36.2% of households experienced food insecurity, with the most vulnerable being those with lower education, informal jobs, and lower expenditures. Urban middle-class households relied on savings, reduced consumption of expensive foods, and shifted to online food purchasing and home cooking as key coping strategies. Social assistance programs were critical in preventing deeper deprivation, but coverage remained limited among informal workers. These findings highlight the importance of strengthening urban resilience through digital food systems, adaptive social protection, and support for vulnerable groups in times of crisis. Beyond the COVID-19 context, the study provides insights for designing more responsive food security and social protection policies in Indonesia and other emerging economies.

Keywords: urban resilience, food security, coping strategies, COVID-19, social protection
JEL Classification: R21, I32, Q18, D81, I18, H53

INTRODUCTION

The COVID-19 pandemic has severely disrupted food systems worldwide, affecting household food access, affordability, and consumption (Laborde et al., 2021; Workie et al., 2020). Restrictions on mobility and economic activity led to reduced incomes, job losses, and limited access to markets, which in turn heightened the risk of food insecurity (Egger et al., 2021; Smith & Glauber, 2020). While food insecurity has long been associated with rural and poor households, recent studies show that urban households, particularly those engaged in informal employment, were also highly vulnerable during the pandemic due to their dependence on food markets and volatile income streams (Akter, 2020; Rasul, 2021).

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In Indonesia, the largest economy in Southeast Asia, the pandemic coincided with large-scale social restrictions (*Pembatasan Sosial Berskala Besar*) that disrupted livelihoods, especially in urban areas. Millions of households experienced sudden income shocks, reduced mobility, and rising food prices, particularly for nutritious items such as animal protein and fresh vegetables (Susilowati & Setiawan, 2021). Social assistance programs were rolled out to mitigate these impacts, yet coverage and targeting remained uneven, leaving many urban informal workers unprotected. Although several studies have examined food insecurity among rural or low-income groups in Indonesia, relatively little is known about how urban and middle-class households coped with the food security challenges posed by the pandemic.

This study addresses the gap by investigating the determinants of food security and coping strategies among predominantly urban households in Indonesia during the early phase of the pandemic. Using data from an online survey of 1,495 households across 32 provinces, we measured household food security with the USDA Household Food Security Index and applied an ordered probit model to identify socio-demographic and economic determinants. In addition, we documented household-level coping strategies, including reliance on savings, reduced food expenditures, dietary adjustments, and increased use of digital platforms for food access.

The contribution of this study is threefold. First, it highlights the experience of urban middle-class households, a group often overlooked in food security research, which typically emphasizes rural or poor populations. Second, it combines an econometric analysis of the determinants of food security with descriptive evidence on coping strategies, offering a comprehensive perspective on household resilience during crises. Third, by situating the Indonesian case in the broader global discourse, this study provides insights for policymakers on strengthening social protection systems, supporting vulnerable urban groups, and enhancing digital food systems to build resilience against future shocks, including pandemics and climate change.

LITERATURE REVIEW

The COVID-19 pandemic impacted people worldwide. The restrictions of activities and closure of most business places, known as lockdowns, disrupted many aspects of life, including the economy, international trade, income distribution, poverty, job opportunities, education, health, and food security (Arndt et al., 2020; Béné, 2020; Laborde et al., 2020; Workie et al., 2020). In Nigeria and India, the COVID-19 restrictions significantly reduced labour market participation due to drastically dropped economic activities (Amare et al., 2021; Mahendra Dev & Sengupta, 2020). The condition implicated to income loss for households in the worldwide, including in Uganda and Ethiopia (K. A. Abay et al., 2023; Mahmud & Riley, 2021). Furthermore, the lockdown not only threatened the household economy to fall below the poverty line but also affected to household food security globally (Chang, Si, Crush, Scott, & Zhong, 2023; Liang & Zhong, 2023; Ojokoh, Makinde, Fayeun, Babalola, Salako, & Adzitey, 2022).

The multi-implications of the economy restrictions during the pandemic significantly challenged food security at the household level. The economic activities restrictions disrupted at least four dimensions of food security—availability, accessibility, utilisation, and stability (Éliás & Jámbor, 2021; FAO, 2020) through food supply and demand, production and distribution, as well as decreased in purchasing power because of job and income loss (Alabi & Ngwenyama, 2023; Amare et al., 2021; Éliás & Jámbor, 2021; Gebeyehu et al., 2022). On the other hand, lockdowns led to more suffer for supply and distribution on food due to shortages in agricultural and manufactured food availability, and border closures infuriated the situation because they reduced food imports (Éliás & Jámbor, 2021; Béné et al., 2021). Moreover, income and asset losses

also impaired food access, forcing many to deplete savings and sell assets to purchase food, particularly affecting vulnerable groups such as the poor, children, elderly, and women (Akinleye et al., 2023; Amare et al., 2021; Chang et al., 2023).

Unprecedentedly, during early stage of the pandemic, the economic disrupted led to food supply chains resilience of households through local adaptations and innovations. The households with adequate resources were adapted by cooking at home and adjusting food expenditures to maintain dietary diversity (Hirvonen et al., 2021). Meanwhile, community-driven innovations played a crucial role in stabilising food access through home gardening and organising food distribution within the neighbourhoods (Nemes et al., 2021; Lal, 2020). The unprecedented situation also changed consumption behaviour, which led to an increase in online shopping and consuming instant food in urban areas (Alaimo et al., 2020). On the other hand, people with lower incomes and those who live in rural areas shifted towards cheaper, local foods and more home cooking for safety and health reasons (Hirvonen et al., 2021).

The COVID-19 pandemic also significantly had a profound impact on Indonesia. The COVID-19 cases were concentrated in Java which is high population density with urbanisation and industrialisation (Widiawaty et al., 2022). However, the Indonesians faced challenges in implementing full lockdowns, as such measures would have significantly harmed the economy (UNICEF et al., 2022). Instead, the Government implemented the Large-Scale Social Restrictions (*Pembatasan Sosial Berskala Besar*/PSBB) policy in the capital city and other big cities with high populations across Indonesia, which limits people's activities and movements (UNICEF et al., 2022; Widiawaty et al., 2022). As a result, the country struggled to develop and implement effective health and economic strategies to address the crisis, including those related to food security.

Prior to the pandemic, Indonesia's food security was rated as moderate, ranking 70th out of 107 countries on the Global Hunger Index 2020 (Grebmer et al., 2021). Despite this moderate ranking, many households retained food security due to accessible food sources (Mouloudj et al., 2020; Widiawaty et al., 2022). The COVID-19 pandemic estimated would increase in the number of food insecure people by their expected changes of income and prices due to restrictions in economic activities including in Indonesia (Bloem & Farris, 2022; Rudin-Rush et al., 2022; Widiawaty et al., 2022). Moreover, Akbar et al. (2023) mentioned that national or regional food security does not always guarantee security at the household level, where food insecurity may still be prevalent especially during the pandemic. Furthermore, The COVID-19 crisis further exacerbated food insecurity not only in Indonesia but also in the worldwide (Éliás & Jámbor, 2021) (Éliás & Jámbor, 2021; Niles et al., 2024; Widiawaty et al., 2022).

RESEARCH METHOD

Due to the pandemic outbreak, on April 10, 2020, the central government applied *PSBB* to the greater Jakarta area and several other areas in Indonesia to contain the spread of infection from human interaction and mobility. The first PSBB took effect April 10–June 4, 2020. Then the government implemented transitional PSBB until September 10, 2020. As an adaptation with the situation, the study was conducted using an electronic survey tool provided by SurveyMonkey.

Data Collection

This research used an online survey to collect data from household respondents in September and October 2020. The questions covered the period of initial shock until the end of the first phase of social restrictions under PSBB implementation. A non-probability snowball sampling technique

was employed for five major islands in Indonesia where the survey link was shared through social media platforms. The respondents were required to be seventeen years and older. Study participation was voluntary and all the participants provided names to indicate signing the informed consent before entering the study, otherwise they were unable to proceed with the questionnaires. Informed consents were obtained from 2,483 participants at the initial responses, yet 62% of the questionnaires were answered in full, resulting in 1,495 respondents. Cleaned data from 1,495 household respondents came from 32 out of 34 provinces in Indonesia and different parts of islands in Indonesia (Table 1). Of 77.19% of the respondents in the cleaned sample were from urban areas, and the rest were from rural areas.

Table 1. Distribution of Respondents by Regions

Regions	Respondents (%)
Sumatra	7.3
Java	74.8
Kalimantan	3.1
Bali and East Nusa Tenggara	6.5
Sulawesi	6.2
Maluku and Papua	2.0

Source: Authors' calculation based on online survey (2020)

Outcome Variables

The variable of interest of this study is food security, which covers various areas. The main metric is the food security index, which was modified from the United States Department of Agriculture (Bickel et al., 2000) (a full set of the questionnaire are available in **Supplement 1**). The household food security assessment four categories: food secure, food insecure without hunger, food insecure with moderate hunger, and food insecure with severe hunger. Furthermore, the food security index was analyzed by socio-demographic characteristics and responses about how the household adapted during the early stage of the pandemic. They included changes in income and job types, spending on cooking and coping strategies to meet daily intake during the early outbreaks of COVID-19. Finally, the study attempted to link the food security index to expenditure to examine whether there was a welfare effect from the changes in food security. Expenditure variable was then set as a binary variable with the cutoff value of IDR 454,652 which was the poverty line based on minimum expenditure per capita according to Indonesia Statistics Agency, (2021). Dummy variable with the value of one is defines as poor households based and the value of zero for those above the IDR 454,652 per month per kapita.

Confounders

We controlled for these household variables: region, job status, educational level, household size, expenditures access to food, types of coping strategies, and region (rural or urban) (see **Table 2**). In addition, there were dummy variables for home gardening, a household ranch (such as poultry), and social program beneficiaries.

Statistical Analysis

This study employs a mixed method using qualitative and quantitative analysis. The former describes various adaptations and responses of the households by their food security index. As for the latter approach to analyse the determinants of household food security during the early phase of the COVID-19 pandemic, we employed an ordered probit regression model. The dependent

variable is the USDA Household Food Security Index (Bickel et al., 2000) , which was categorised into four ordinal levels: (1) very low food security, (2) low food security, (3) marginal food security, and (4) high food security. The ordered probit model is appropriate because the outcome variable is ordinal rather than continuous or nominal, and it allows for estimating the probability of households falling into different categories of food security. The baseline specification of the model is:

$$FSI_{i2020} = \beta_0 + \beta_1 X_i + e_i \quad (1)$$

The explanatory variables include household socio-demographic and economic characteristics (urban residence, education, job status, household size, expenditure level, poor status), as well as contextual and behavioural indicators (food access score, farming, livestock ownership, coping strategy index, and social program beneficiary status). A detailed description of variables is presented in Table 2.

Estimation was conducted using maximum likelihood methods. Standard errors were clustered at the provincial level to account for possible intra-regional correlation. Model fit was assessed with the log-likelihood ratio test and pseudo-R2R^2R2. In addition to coefficient estimates, we computed average marginal effects (AMEs) to facilitate interpretation of the probabilities associated with each category of food security. The AMEs provide a more intuitive measure of how changes in independent variables shift the likelihood of being food insecure or secure.

RESULTS

Table 1 presents the descriptive statistics for the sample. In general, a majority of the respondents exhibited a high level of food security (63.81%), followed by those with marginal food security (23.75%). In both urban and rural settings, individuals experiencing low and the lowest levels of food security constituted 11.3% and 16%, respectively. These patterns are further underscored by demographic and economic characteristics; notably, a substantial portion of respondents held formal employment (76%), with urban areas featuring a higher prevalence of tertiary education and rural areas being characterized by a dominance of high school graduates. On average, households comprised four members, indicating a family structure with two children.

Table 2 presents the household characteristics by their food security status. The majority of respondents fell within the age group of 30-39 years (44.32%), with an average age of 37 years (see Table 2). The respondents were predominantly married (78.99%) and possessed higher education qualifications (84.93%). In contrast, the proportions of respondents with primary and secondary education were minimal, at 0.47% and 14.6%, respectively. Additionally, a significant portion of the respondents served as household breadwinners (52.44%), resided in urban areas (77.19%), and were engaged in formal employment (76.05%) as outlined in Table 1.

Table 2. Characteristics of households, n (%) or mean (standard deviation)

Variables	Definition	n=1,495
Food security index	categorized ordinally from 1 to 4 (food insecure to food secure)	3.49 (0.77)
	1: Very low food security	35 (2.34%)
	2: Low food security	151 (10.10%)

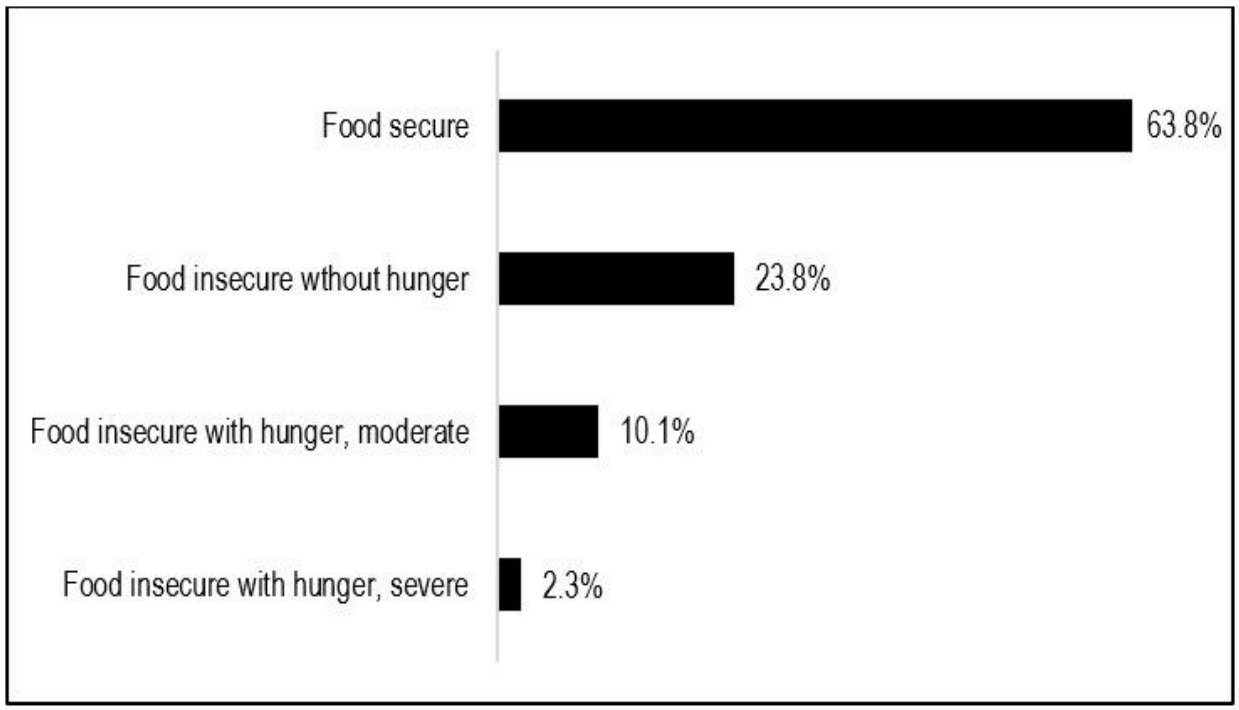
	3: Marginal food security	355 (23.75%)
	4: High food security	954 (63.81%)
Poor status	The poverty line based on minimum expenditure per capita according to the Indonesia Statistics Agency (2021).	
	0: Not poor	193 (12.91%)
	1: Poor	1,302 (87.09%)
Area	0: Rural	341 (22.81%)
	1: Urban	1,154 (77.19%)
Job status	0: Informal job	358 (23.95%)
	1: formal job	1,137 (76.05%)
Education level	0: Lower education (unschooled to secondary school)	225 (15.05%)
	1: Higher education (University)	1,270 (84.95%)
Household size	#	4.12 (1.55)
Household expenditure	0: Monthly household's expenditure <= Rp4,800,000	809 (54.11%)
	1: Monthly household expenditure >Rp4,800,000	686 (45.89%)
Food access	food access score ranged 1 to 4, less number show harder getting access on food	1.94 (0.75)
Household farming	0: if household has no farming	959 (64.15%)
	1: if household has farming	536 (35.85%)
Household ranch	0: if household has no small-scaled ranch	1,244 (83.21%)
	1: if household has small-scales ranch	251 (16.79%)
Consumption strategy	total number of coping mechanisms to fulfil food consumption, from 0 to 10	1.54 (1.39)
Dummy social program recepient	0: if household did not receive program	1,119 (74.85%)
	1: if household receive program	376 (25.15%)

*The detail of questions can be found in appendices

Source: Authors' calculation based on online survey (2020). n= number of observations; M= mean; SD=standard deviation.

Household Characteristics and Food Security Index

Based on the survey results, the majority of respondents experienced food security (63.80%), whereas approximately 36.20% were being food insecurity. Within the food-insecure category, 23.80% reported being food insecure without hunger, 10.10% experienced moderate hunger, and 2.30% faced severe hunger (see Figure 1). These outcomes indicate that during the survey period, a substantial portion of households retained access to food, and the overall food availability remained satisfactory.



Source: Authors' calculation based on online survey (2020)

Figure 1. Food Security Index by Categories

The outcomes of cross tabulating the food security index with household socio demographic characteristics precisely age, educational status, and marital status are presented in **Table 3.** A relationship is observed between socio-demographic factors and the household's food security status. Notably, the highest proportion of food-secure households was found among respondents aged 30–39 years (29.52%), followed by the 40–50 age group (17.42%), while the lowest proportion was recorded for those above 50 years old (6.25%). Conversely, among respondents facing food insecurity, the 30–39 age group showed varied proportions: 9.95% experienced food insecurity without hunger, while 3.97% and 0.87% faced moderate and severe hunger, respectively.

Table 3. Household Socio-Demographic Characteristics by Food Security Index (%)

Socio-demographic characteristic	Food Security Index (%)				Overall
	Food-insecure			Food-secured	
	Very low food security	Low food security	Marginal food security	High food security	
Area					
Rural	34.29	28.48	28.73	19.2	22.81
Urban	65.71	71.52	71.27	80.71	77.19
Age (years)					
< 30	0.34	2.89	4.77	10.76	18.76

30–39	0.87	3. 97	9.95	29.52	44.32
40–50	0.67	2.56	6.52	17.42	27.17
> 50	0.27	0.61	2.62	6.25	9.75
Marital Status					
Married	1.61	7.52	18.05	51.81	78.99
Single	0.54	1.88	3.96	11.14	17.52
Divorced/widowed	0.20	0.67	1.74	0.87	3.49
Educational Status					
Lower education	45.71	30.46	24.23	8.07	15.05
Higher education	54.29	69.54	75.77	91.93	84.95
Job-status					
Informal job	60	49.01	34.37	14.78	23.95
Formal job	40	50.99	65.63	85.22	76.05
Household size (mean)	4.76	4.15	4.27	4.03	4.12
Households expenditure					
<= Rp4,800,000	74.29	81.46	66.2	44.55	54.11
>Rp4,800,000	25.71	18.54	33.8	55.45	45.89
Food access (mean)	1.95	1.58	1.74	2.07	1.94
Household farming					
No farming	65.71	59.6	58.87	66.77	64.15
Has farming	34.29	40.4	41.13	33.23	35.85
Household ranch					
No ranch	77.14	74.17	77.75	86.9	83.21
Has ranch	22.86	25.83	22.25	13.1	16.79
Consumption strategy (mean)	1.8	2.36	2	1.24	1.55
Dummy social program beneficiary					
Receive program	54.29	65.56	63.94	81.13	74.85
Do not receive program	45.71	34.44	36.06	18.87	25.15
Poor status					
Poor	51.43	28.48	21.41	5.87	12.91
Not poor	48.57	71.52	78.59	94.13	87.09

Source: Authors' calculation based on online survey (2020)

There is a positive correlation between the level of education and food security status, indicating that higher educational attainment generally corresponds to better food security. Among respondents classified as food-secure, 58.66% reported that their household head had graduated from tertiary education. Conversely, among groups experiencing food insecurity, those with severe hunger and those without hunger had similar proportions of household heads with primary school education, each accounting for 0.20%. Additionally, married respondents exhibited greater food security (51.81%) compared to their single (11.14%) or divorced/widowed counterparts (0.87%). Given that the majority of respondents were married (78.99%), this marital status heavily

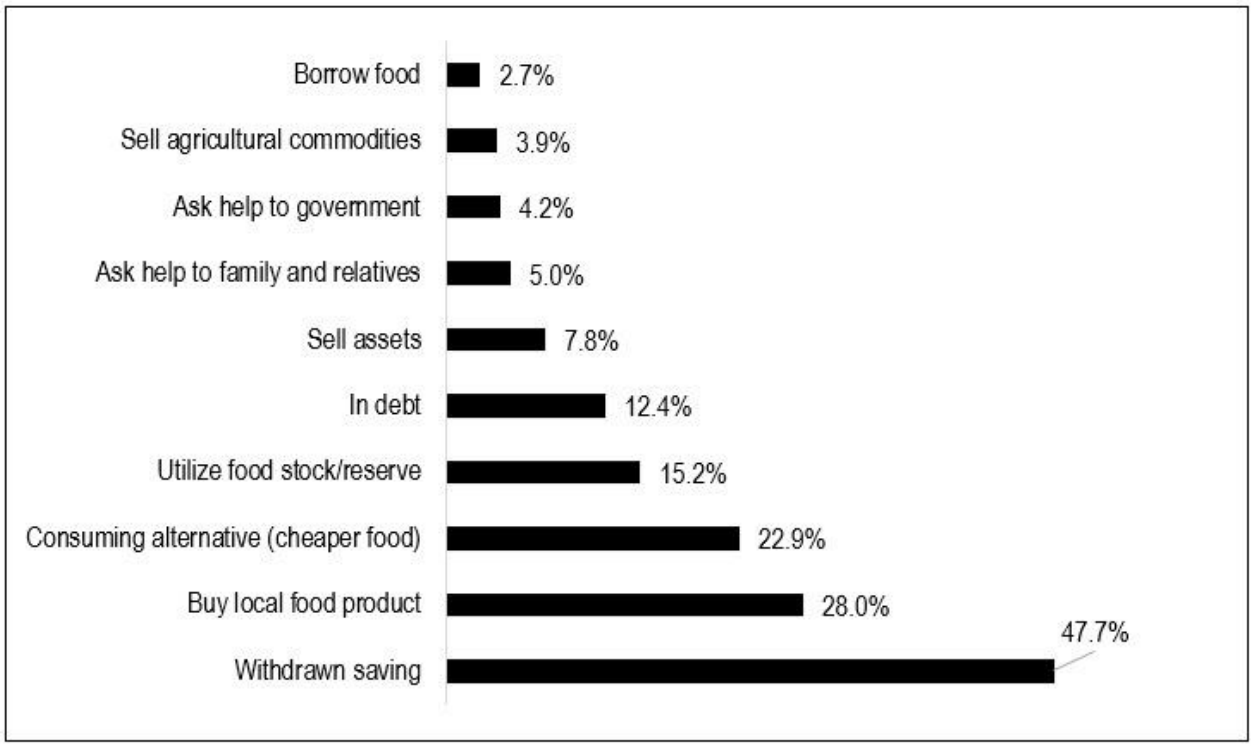
influenced the prevalence of food insecurity within the overall respondent group. Specifically, 18.05% of households were food insecure without hunger, and 7.52% and 1.61% experienced food insecurity with moderate and severe hunger, respectively.

Sources of Household Income (Jobs)

Income sources, determined by job status, were a focal point of the survey. However, one limitation of the online study was its inability to guarantee randomness in participant selection, as it primarily reached individuals with internet access. Notably, 66.56% of respondents were engaged in formal jobs (government and private sectors combined). Approximately one-third of respondents held government jobs (33.65%), followed closely by those in the private sector (32.91%). These figures highlight that individual with secure incomes, particularly those in the government sector (26.02%) and private sector (23.21%), were more likely to be classified as food-secure. On the contrary, respondents engaged in informal jobs, such as entrepreneurs, farmers, public transportation drivers, and the unemployed, with fluctuating incomes tended to face greater food insecurity. This is attributed to the fact that Large-Scale Social Restrictions (PSBB) disproportionately impacted informal jobs. At the same time, individuals in formal employment often had the option to work from home (WFH) during the imposed health protocols.

Coping Strategies

Figure 2 shows that the immediate coping strategy of households to meet their daily needs during the early pandemic was to withdraw from savings to meet their food needs, as stated by 47.7% of respondents. As over 70% of respondents work in government institutions and private firms, their financial conditions are more stable during the early pandemic. Thus, half of the households had contingency cash from savings to address emergencies such as the COVID-19 pandemic. The pandemic also forced people to consume local foods (28%), such as cassava and sweet potato, which were less expensive than their daily food before the pandemic. The survey showed that 22.9% of respondents maintained their daily budget at the lowest expenses. People also tend to optimise the consumption of any available food stock in their homes, as 15.2% of the respondents mentioned that they used their food stock during the pandemic. For those whoare suffering from the COVID-19 pandemic without a good coping strategy, some are forced to incur debt (12.4%), sell assets (7.8%), ask for help from family/relatives or government (9.2%) and borrow food (2.7%).

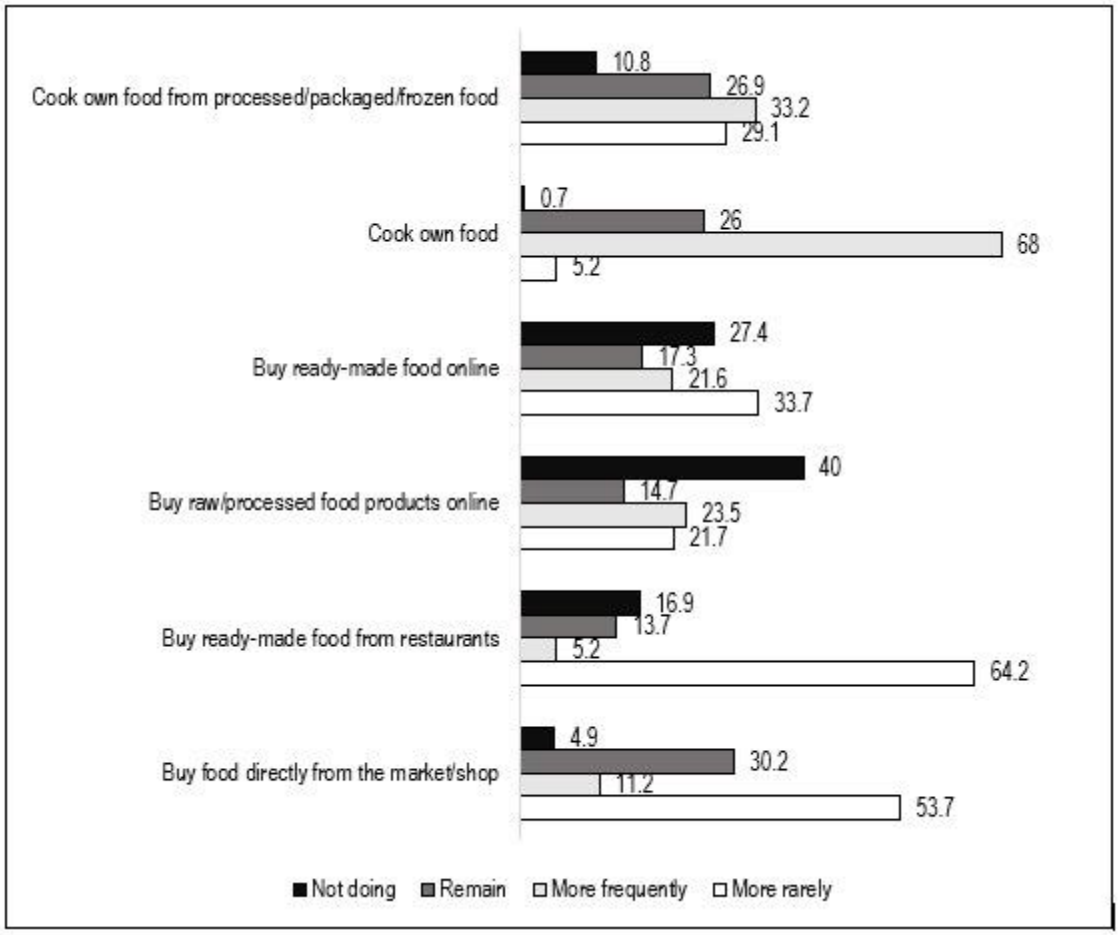


Source: Authors' calculation based on online survey (2020)

Figure 2. Respondent's Coping Strategies During the Pandemic

Food Sources and Consumption Behaviour Changes

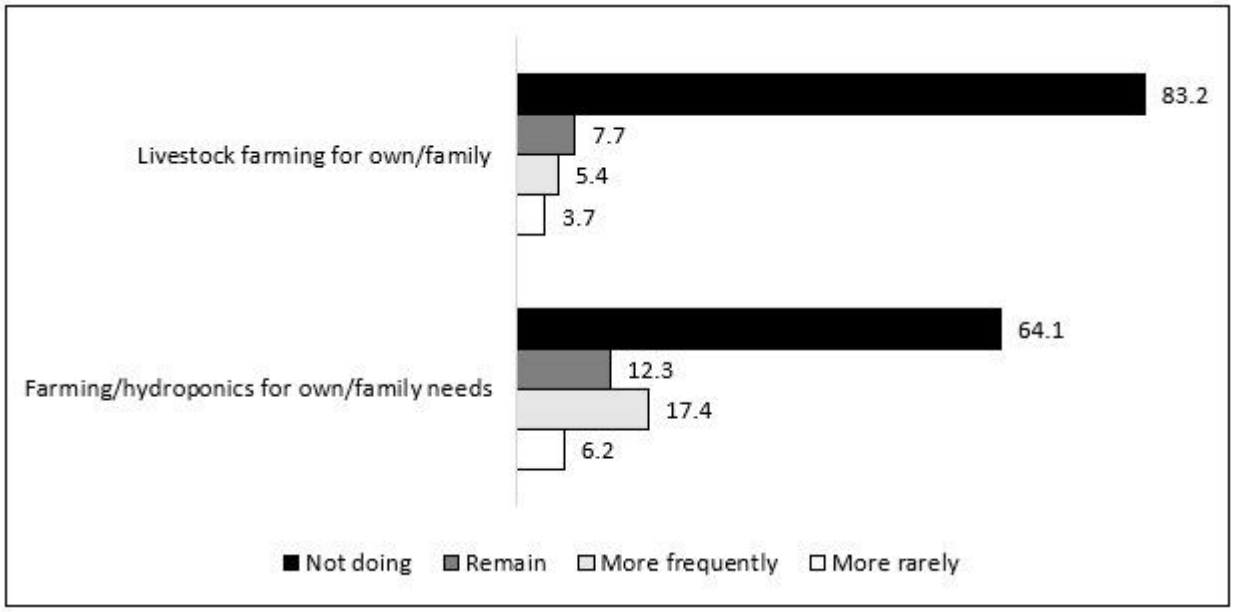
Figure 3 illustrates shifts in households' food purchasing and cooking behaviour during the pandemic. In response to COVID-19, over 70% of households increased their frequency of cooking at home, while about 64% reduced their dining-out activities. Moreover, households exhibited a preference for frozen meals over takeout, opting for cooking from processed/packaged or frozen food and purchasing raw/processed products online, as expressed by approximately 33.2% and 23.5% of respondents, respectively.



Source: Authors' calculation based on online survey (2020)

Figure 3. The Percentages of The Changes of Households' Food Purchasing and Cooking Behaviour During the Pandemic

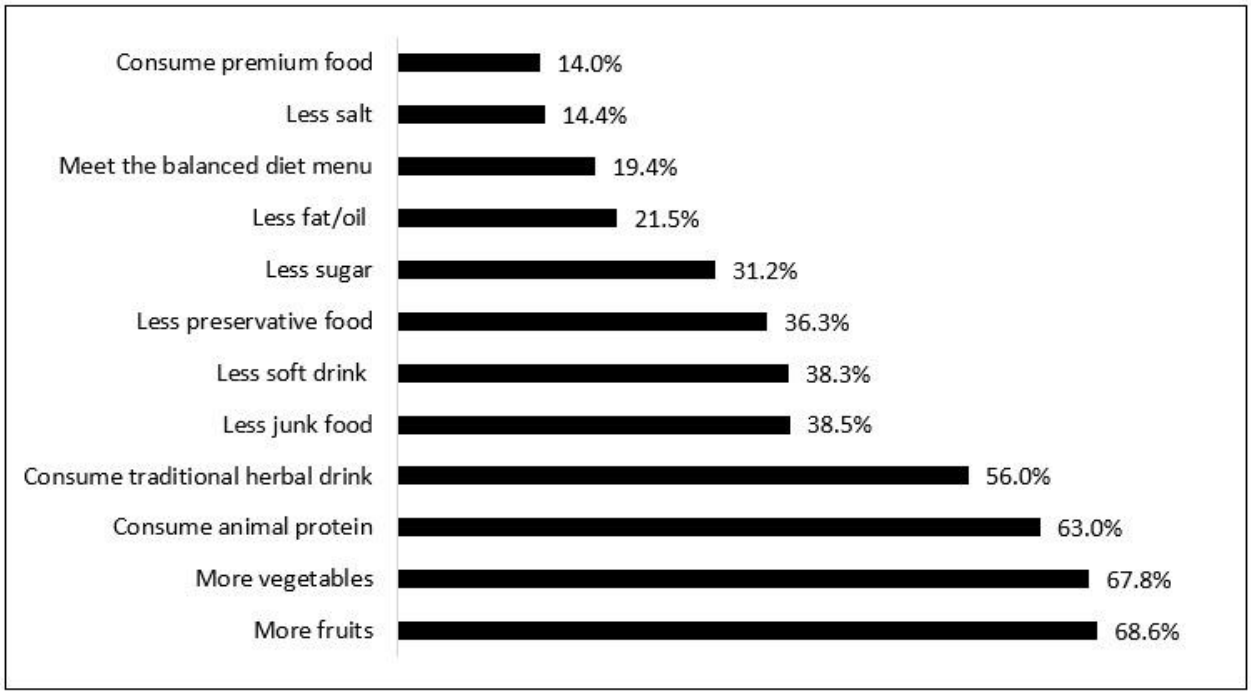
The majority of respondents did not engage in livestock farming or hydroponics during the COVID-19 pandemic, with rates of 83% and 64%, respectively. This is attributed to the predominantly urban residence of most respondents, where limited space impedes such agricultural activities. However, there is a noteworthy increase in urban farming using a hydroponic system, as indicated by 17.4% of respondents. This system is gaining popularity due to its space-efficient nature, making it applicable in smaller areas (see Figure 4).



Source: Authors' calculation based on online survey (2020)

Figure 4. The Percentages of the Changes of Households' Food Self-Sufficiency Activities during The Pandemic

Figure 5 outlines diverse strategies employed by households to safeguard their health during the pandemic. The most prevalent approaches include increased consumption of fruits (68.6%) and vegetables (67.8%). Additionally, a significant portion of households (56%) reported incorporating a traditional herbal drink (known as *empon-empon* in local terms) into their diet. This drink, comprising raw honey and spices such as turmeric, tamarind, ginger, lemongrass, and cinnamon, is believed to offer various health benefits, including immune system enhancement and prevention of coronavirus infection. To mitigate health risks, more than 30% of households adopted strategies such as limiting the intake of junk food, soft drinks, and preservative-laden foods.



Source: Authors' calculation based on online survey (2020)

Figure 5. Consumption Strategies to Keep being Healthy during the Pandemic

The government's promotion of a healthy lifestyle, emphasising the consumption of nutritious food and a balanced diet, has resonated with the community. However, smaller proportions of households prioritise strategies such as maintaining a balanced menu (19.4%), reducing fat/oil intake (21.5%), and lowering salt intake (14.4%). Conversely, the least selected strategy among households is consuming premium food, likely influenced by economic shocks during the pandemic, limiting households' ability to afford such high-priced items.

Factors contributed to households' food security during early COVID-19

The quantitative approach employs ordered-Logit estimations, divided into several regression models for the estimations. They are based on the levels of national, urban, and rural areas. Pada Tingkat nasional, kami membedakan model pada kolom 1 dan 2, dimana model 1 included all the exposures while the second one that took out the household expenditures to avoid potential multicollinearity with status kemiskinan. Maka kami mempertahankan model (2) sebagai acuan.

Table 4 shows the estimation on the factors associated with households' food security based on ordered-logit model. According to the regression, formal jobs, higher education, smaller household size, higher household expenditures, better food access,and less consumption strategies have statistically significant positive effects on food security for all levels. In model two (Table 4**,** columns *2*, *3* and *4*), household respondents with formal jobs are more likely to be food secure at the national and urban levels. Households with less-educated members are more likely to be food insecure at the national level, and they tend to increase in urban and rural areas.

Table 4. Food Security Index Regression by Ordered-LOGIT model

Variables	OLOGIT			
	National		Urban	Rural
	(1)	(2)	(3)	(4)
Dummy urban	-0.0992	-0.0416		
	-0.0849	-0.085		
Formal job status	0.412***	0.446***	0.595***	0.0661
	-0.0813	-0.0811	-0.0948	-0.152
Education level	0.200***	0.230***	0.256***	0.188***
	-0.0355	-0.0351	-0.0434	-0.0598
Household's size	-0.0446*	-0.00347	-0.00669	0.0355
	-0.0234	-0.022	-0.0257	-0.0431
Households' expenditure	0.133***			
	-0.0272			
Food access	0.312***	0.322***	0.340***	0.278***
	-0.0482	-0.048	-0.055	-0.103
Household's farming	-0.00128	-0.0134	-0.115	0.257*
	-0.0821	-0.0816	-0.0957	-0.154
Households' ranch	-0.0888	-0.0934	0.0297	-0.385**
	-0.101	-0.101	-0.132	-0.162
Consumption strategy	-0.229***	-0.240***	-0.287***	-0.128***
	-0.0242	-0.0239	-0.0267	-0.0428
Dummy social program beneficiary	-0.0737	-0.125*	-0.126	-0.068
	-0.0753	-0.0749	-0.0871	-0.149
Poor status	0.111	0.441***	0.354***	0.684***
	-0.123	-0.104	-0.134	-0.172
/cut1	-0.492**	-0.384*	-0.3	-0.26
	-0.233	-0.233	-0.286	-0.411
/cut2	0.485**	0.589**	0.716**	0.667*
	-0.228	-0.229	-0.284	-0.398
/cut3	1.496***	1.584***	1.704***	1.724***
	-0.229	-0.229	-0.284	-0.409
Observations	1,479	1,479	1,144	335

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Source: Authors' calculation based on online survey (2020)

Respondents with informal jobs would likely to be food insecure in aggregate level (Table 4). Households with higher expenditures and better access to food are more likely to be food secure at the national, urban, and rural levels. Households with more members of family are less likely to be food secure. For coping strategies, the more strategies a household use to meet its food needs more likely they are to be food insecure. Efforts to meet domestic intake by practicing home gardening or ranching did not have a statistically significant effect on their food security levels. Social programs were affected significantly only in the second model after taking out the household size and expenditure variables. The households with high food security are less likely to be poor for all levels of regression at the national, urban, and rural area.

Table 5 presents marginal effects for urban respondents. Formal employment, education,

poverty status, and social assistance programs are key factors influencing urban food security. Formal employment significantly increases the probability of high food security by providing stable income, enabling better access to nutritious and diverse foods. Similarly, higher education levels improve food security, likely through enhanced nutritional knowledge and financial management. Conversely, poor status substantially raises the risk of food insecurity, as low income restricts access to quality food. Social programs effectively mitigate this risk, increasing the likelihood of high food security and demonstrating successful support for vulnerable urban households. In contrast, household size, food access, and consumption strategies show no significant effects. Farming and ranching also prove irrelevant or even counterproductive likely due to land constraints and low productivity in urban settings.

Table 5. Average Marginal Effects by Outcome Category for Urban Respondents

Variable (change)	Very Low		Low		Marginal		High	
Formal job	-0.024	***	-0.063	***	-0.086	***	0.173	***
Education	-0.010	***	-0.027	***	-0.037	***	0.074	***
Household's size	0.000		0.001		0.001		-0.002	
Poor status	-0.014	***	-0.036	***	-0.049	***	0.099	***
Food access score	0.005		0.012		0.017		-0.033	
Household's farming	-0.001		-0.003		-0.004		0.009	
Households' ranch	0.012	***	0.030	***	0.041	***	-0.083	***
Consumption strategies index	0.005		0.013		0.018		-0.037	
Dummy social program beneficiary	-0.014	**	-0.037	***	-0.051	***	0.103	***

Rural household food security is influenced by a pattern of factors that show some similarities with urban areas, but with distinct characteristics.

As in urban areas, education remains an important factor that improves food security. Households with higher education levels have a greater chance of achieving high food security categories. However, the effect of education in rural areas is slightly stronger than in urban areas, indicating that improved literacy and nutritional knowledge are key factors in managing rural household consumption.

Formal employment also has a positive impact on food security in rural areas, but its effect is relatively smaller compared to cities. This is likely because many rural households still depend on subsistence agriculture or informal employment with low and unstable incomes. Additionally, poverty status remains a major factor that reduces rural households' chances of achieving high food security. Poor households are more vulnerable to food price fluctuations and limited access to productive resources such as land and capital.

Interestingly, food access in rural areas shows a significant positive influence on improving food security, unlike in urban areas. Higher food access scores, for example through availability of local food materials or adequate market networks, increase households' chances of reaching high food security categories. On the other hand, farm ownership actually reduces the chances of high food security among rural households. This may be due to the dominance of low-productivity traditional farming practices and lack of agricultural diversification. In contrast, livestock ownership provides a slight positive effect, though not consistently significant.

Finally, social assistance programs also play a significantly positive role in rural areas. Beneficiary households have a greater chance of achieving high food security, indicating that

government interventions are effective in reducing food vulnerability in rural areas.

Table 6. Average Marginal Effects by Outcome Category for Rural Respondents

Variable (change)	Very Low		Low		Marginal		High	
Formal job	-0.004		-0.009		-0.009		0.022	
Education	-0.013	**	-0.025	***	-0.026	***	0.064	***
Household's size	-0.002		-0.005		-0.005		0.012	
Poor status	-0.018	**	-0.037	***	-0.039	***	0.095	***
Food access score	-0.017		-0.035	*	-0.036	*	0.088	*
Household's farming	0.026	**	0.052	**	0.054	**	-0.131	**
Households' ranch	0.008	***	0.017	***	0.018	***	-0.043	***
Consumption strategies index	0.005		0.009		0.009		-0.023	
Dummy social program beneficiary	-0.045	***	-0.092	***	-0.095	***	0.233	***

DISCUSSION

This study elaborates figures for household consumption and food security in Indonesia during the first wave of the COVID-19 pandemic. Despite the uncertainty related to major outbreaks of the virus, this study provides an overview of the early phase of the outbreaks. At the early stage of the COVID-19 outbreak in Indonesia, people often receive uncertain information regarding the possibility of lockdown measures in several cities. Since Indonesia applied PSBB to control people's mobilities, markets were not open daily. This sudden change limits the food supply for communities, especially in the traditional market. This condition makes people worry about the availability of food at the market, which might affect their food security status, as has been observed globally (Pakravan-Charvadeh et al., 2021).

As one might predict, in terms of food security, respondents that rely on informal jobs, households with expenditure less than IDR4.8 million, and households with relatively lack of food access and consumption changes strategies tend to bear the heaviest shocks. Education level might influence households' food security as this closely related to the formality of jobs yet, the households' characteristics such as households size cannot be captured (Akbar et al., 2023; Kundu et al., 2021). Abdullah et al. (2019); Maharjan & Joshi (2011); and Omidvar et al. (2013) also claimed that the main factor causing food insecurity is limited access to resources, not only in terms of food quality and quantity, but also due to limited financial resources. Especially amid the pandemic, financial constraints can lead to household food insufficiency and inadequate nutrition that are needed to increase immunity for all family members, including children (Sulaiman et al., 2021). This was corroborated during an in-depth interview with one of the respondents, who noted that the decrease in income during the pandemic led to an inability to afford the necessary and sufficient milk for his children.

The decrease of income during pandemic may also result in changes in the consumption behavior. The respondents, mostly living in urban communities, claim that they shop online, cook food at home, and cook instant food more often. Alaimo et al. (2020) explain that the frequency of online shopping in urban communities is higher because of the internet facilities and social characteristics, such as high level of education and types of work. However, there are challenges in online food purchases especially because buyers cannot directly inspect or select products to ensure desired quality and when certain perishable food items pose storage issues, which is also

dependent on sellers' capacities in handling and shipping the products (Chang et al., 2023). The study of (Hirvonen et al., 2021) in Addis Ababa showed that the pattern of purchasing cheaper foodstuffs is in line with their findings that one common form of adjustment made by the community is to reduce spending by buying local food or cheaper food. This change is accompanied by an increase in the tendency to cook themselves for safety and health reasons. Respondents reported a shift towards buying more affordable food and cooking at home to manage both financial constraints and health risks amidst the pandemic.

The change in food consumption may also be associated with the conditions that various types of vegetables and fruits could be easily found at relatively low prices in Indonesia. This result is in line with studies that found increases consumption of fruits and vegetables during the COVID-19 outbreak (Ben Hassen et al., 2021; Iheme et al., 2020). Similar to our study findings that most households (63%) consider consuming animal protein to be an effective strategy to remain healthy, (Iheme et al., 2020) and Mititelu et al., (2024) (Mititelu et al., 2021) also found that most respondents consumed meat more than twice a week on average during the pandemic. However, (Attwood & Hajat, 2020) point out that some might eat less meat because of worries that the animals could spread the coronavirus or other diseases.

Withdrawing saving as a coping strategy among respondents aligns with the research conducted by Ambel et al., (2021) and Ansah et al. (2020)**,** who explain that the most common coping strategy was to rely on savings. This finding is also consistent with the results of Ajefu et al. (2023) that withdrawing savings was one of the adopted coping strategies of households in Nigeria since the outbreak of the COVID-19 pandemic. While the contingency cash saving showed different results for Indonesia and Nigeria, the coping strategies of borrowing money and selling assets are quite similar in both countries. Further, the quantitative results for household food security in Indonesia are in line with studies in other regions, such as Africa where the impact on food security was not felt during the short research period (Janssens et al., 2021). Households were able to maintain their food spending during the initial weeks after the first measures were implemented. However, as time passed and the pandemic persisted, it became more complex, leading them to start withdrawing their savings to meet their needs over the long term. While Janssens et al. (2021) indicates that households coped with reduced income to fulfil their diet intake through shifting expenditures from schooling and transportation, our study shows that most respondents prefer to maintain the same dietary intake by withdrawing savings.

After all, the social restriction intensified in the broader area households further reduced their expenditure on other essential non-food expenditures as a coping strategy (Nguyen et al., 2021). In addition, in line with Lal (2020) and Suh et al. (2023) some respondents were more likely to switch consumption to local food production and to consume less preferred and less expensive food to adjust the food price fluctuations. Meanwhile, as stated by the SMERU et al. (2021) and Nguyen et al. (2021) that majority of poor households do not have savings; this study also reveals that some other respondents were in debt, sold their assets such as selling jewellery, or asked help from family to cope with the pandemic's shock. Those were also similar with findings from Arif et al. (2020) that people who have limited or no savings tend to be into debt to grocery stores or food sellers during the pandemic.

Even though the respondents are dominated by the secure formal workers, the other disadvantaged groups reflect the extent to which the early pandemic hit them. Job formalities and region may explain the variation of the effect of a pandemic on food security, where informal jobs were more vulnerable to falling into food insecurity due to uncertain income reducing their purchasing power for food items. Several studies also confirm findings that poorest groups are

most vulnerable to food insecurity during the COVID-19 pandemic (Alabi & Ngwenyama, 2023; Kittiprapas, 2022). This is due to reduced personal savings caused by job and income losses (Akinleye et al., 2023). Rural households working in farming experiences food insecurity due to reduced consumption frequency of essential food groups (Suh et al., 2023). Abdullah et al. (2019) and Omidvar et al. (2013) showed that the job types without fixed pay periods or with less stable income, such as in the informal sector, were more closely associated with food insecurity than the formal job types. In other words, households with stable salaries, such as those who work for public or private employers, tend to be more food secure than households with informal jobs.

From a policy perspective, the results confirm the need for more targeted social assistance programs, particularly for households with informal jobs and lower education, who remain the most exposed to food insecurity during urban crises. Moreover, enhancing digital food systems and improving household access to affordable and nutritious food could strengthen urban resilience beyond the COVID-19 context. Another important tool to mitigate poverty during the pandemic is social assistance provided by the government and non-government organisations (K. Abay et al., 2020; Brouwer et al., 2020; Suryahadi et al., 2020).This condition occurs because households with these criteria will experience limitations to food accessibility and uncertainty about food quality and safety due to restrictions in the transportation of farm commodities, shutdowns of food production facilities, restrictions in food trade policies, and delays in transportation of food products.

The importance of social assistance programs emphasises that fiscal stimulus and expansion of social safety nets are crucial as mitigation measures to support the livelihoods of people by providing cash or food assistance programs to meet their basic needs (Laborde et al., 2020; Workie et al., 2020). Moreover, precise targeting of social assistance is essential for reducing the impact of the COVID-19 pandemic for those who are affected. Additionally, efforts to ensure the availability and accessibility of food, particularly for strategic commodities, are maintained through price stabilization measures to uphold domestic food security (World Food Programme, 2020)**.** Initiatives focused on food security, nutrition, and enhancements to social protection schemes aim to secure sufficient food access for impoverished and vulnerable populations.

CONCLUSION

This study examined household food security during the early phase of the COVID-19 pandemic in Indonesia using data from an online survey of 1,495 households across 32 provinces. Applying the USDA Household Food Security Index and an ordered probit model, the analysis revealed that more than one-third of households experienced food insecurity, even among predominantly urban and middle-class groups. Education, employment type, and household expenditure were positively associated with higher food security, while larger household size and poverty status increased the risk of food insecurity. Coping strategies included reliance on savings, reduced consumption of expensive foods, increased home cooking, and the use of digital platforms to access food.

The findings underscore the importance of human capital, stable employment, and financial capacity in protecting households from food insecurity during crises. Urban middle-class households were relatively more resilient due to their savings and access to digital food systems, yet informal workers and poorer households remained highly vulnerable. The negative association between the number of coping strategies and food security further highlights that adopting multiple coping mechanisms often signals distress rather than resilience

From a policy perspective, the results emphasize three key areas. First, strengthening social protection systems is essential to better cover informal urban workers who were disproportionately

affected. Second, promoting digital food systems and e-commerce can enhance food access during mobility restrictions and future shocks. Third, encouraging urban food initiatives, such as small-scale urban farming, can diversify food sources and reduce dependency on disrupted markets.

While this study provides timely evidence, it has some limitations. The use of an online survey may introduce sampling bias toward more digitally connected households, and the data reflect only the early months of the pandemic. Future research should adopt longitudinal and comparative approaches to capture dynamic changes in household food security and resilience across different socio-economic groups and between urban and rural settings.

Overall, this study contributes to the understanding of urban resilience in times of crisis, highlighting the determinants of food security and household coping mechanisms. The insights are relevant not only for Indonesia but also for other emerging economies seeking to design more adaptive food security and social protection policies in the face of future global challenges.

Data Availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable requests.

Ethical Statement

This study received letter of approval from the Deputy of Social Science and Humanities, Indonesian Institute of Sciences, Number 2942/IPSK/HK.01.03/III/2020, date of approval 16 March 2020, who has concerned that our study adheres to all ethical and standard norms of research in social sciences and humanities. The approval ensures the integrity of our work and underscores our commitment to conducting research properly. The consent forms outlined the purpose of the study, assured confidentiality, and clarified the voluntary nature of participation. This process guarantees that the data collected is valid and reliable, and that the rights and well-being of the participants, including their identity, are protected throughout the survey.

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The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Authors contribution

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REFERENCES

Abay, K., Berhane, G., Hoddinott, J., & Tafere, K. (2020). COVID-19 and Food Security in Ethiopia: Do Social Protection Programs Protect? *SSRN Electronic Journal*, *November*. https://doi.org/10.2139/ssrn.3728836

Abdullah, Zhou, D., Shah, T., Ali, S., Ahmad, W., Din, I. U., & Ilyas, A. (2019). Factors affecting household food security in rural northern hinterland of Pakistan. *Journal of the Saudi Society of Agricultural Sciences*, *18*(2), 201–210. https://doi.org/10.1016/j.jssas.2017.05.003

Ajefu, J. B., Demir, A., & Rodrigo, P. (2023). Covid-19-induced Shocks, Access to Basic Needs and Coping Strategies. *European Journal of Development Research*, *35*(6), 1347–1368. https://doi.org/10.1057/s41287-023-00584-y

Akbar, A., Darma, R., Fahmid, I. M., & Irawan, A. (2023). Determinants of Household Food Security during the COVID-19 Pandemic in Indonesia. *Sustainability (Switzerland)*, *15*(5), 1–16. https://doi.org/10.3390/su15054131

Akinleye, S. O., Dauda, R. O. S., Iwegbu, O., & Popogbe, O. O. (2023). Impact of COVID-19 pandemic on financial health and food security in Nigeria: A survey-based analysis. *Journal of Public Affairs*, *23*(2). https://doi.org/10.1002/pa.2859

Akter, S. (2020). The impact of COVID-19 related 'stay-at-home' restrictions on food prices in Europe: findings from a preliminary analysis. *Food Security*, 12(4), 719–725.

Alabi, M. O., & Ngwenyama, O. (2023). Food security and disruptions of the global food supply chains during COVID-19: building smarter food supply chains for post COVID-19 era. *British Food Journal*, *125*(1), 167–185. https://doi.org/10.1108/BFJ-03-2021-0333

Alaimo, L. S., Fiore, M., & Galati, A. (2020). How the COVID-19 pandemic is changing online food shopping human behaviour in Italy. *Sustainability (Switzerland)*, *12*(22). https://doi.org/10.3390/su12229594

Amare, M., Abay, K. A., Tiberti, L., & Chamberlin, J. (2021). COVID-19 and food security: Panel data evidence from Nigeria. *Food Policy*, *101*. https://doi.org/10.1016/j.foodpol.2021.102099

Ambel, A. A., Marcela, L., Sosa, C., Tsegay, A. H., & Wieser, C. (2020). *Monitoring COVID-19 impacts on households in Ethiopia Results from 11 Rounds of High-Frequency Phone Surveys of Households from April 2020 through May 2021*. www.ourworldindata.org

Ansah, I. G. K., Gardebroek, C., & Ihle, R. (2020). Shock interactions, coping strategy choices and household food security. *Climate and Development*, *0*(0), 1–13. https://doi.org/10.1080/17565529.2020.1785832

Arif, S., Isdijoso, W., Fatah, A. R., & Tamyis, A. R. (2020). Tinjauan Strategis Ketahanan Pangan dan Gizi di Indonesia: Informasi Terkini 2019-2020. In *The SMERU Research Institute*.

Arndt, C., Davies, R., Gabriel, S., Harris, L., Makrelov, K., Robinson, S., Levy, S., Simbanegavi, W., van Seventer, D., & Anderson, L. (2020). Covid-19 lockdowns, income distribution, and food security: An analysis for South Africa. *Global Food Security*, *26*.

https://doi.org/10.1016/j.gfs.2020.100410

Attwood, S., & Hajat, C. (2020). How will the COVID-19 pandemic shape the future of meat consumption? *Public Health Nutrition*, *23*(17), 3116–3120. https://doi.org/10.1017/S136898002000316X

Ben Hassen, T., El Bilali, H., & Allahyari, M. S. (2021). Journal of Retailing and Consumer Services Do social media platforms develop consumer panic buying during the fear of Covid-19 pandemic. *Journal of Retailing and Consumer Services*, *9*(17), 1–18. https://doi.org/10.1016/j.jretconser.2020.102226%0Ahttps://en.wikipedia.org/wiki/Panic_buying

Béné, C. (2020). Resilience of local food systems and links to food security – A review of some important concepts in the context of COVID-19 and other shocks. *Food Security*, *12*(4), 805–822. https://doi.org/10.1007/s12571-020-01076-1

Bickel, G., Nord, M., Price, C., Hamilton, W., & Cook, J. (n.d.). *Measuring Food Security in the United States Guide to Measuring Household Food Security Revised 2000*. http://www.fns.usda.gov/oane

BPS. (2021). *Indonesia Statistics Agency*. https://www.bps.go.id/id/pressrelease/2021/02/05/1811/ekonomi-indonesia-2020-turun-sebesar-2-07-persen–c-to-c-.html

Brouwer, I. D., McDermott, J., & Ruben, R. (2020). Food systems everywhere: Improving relevance in practice. *Global Food Security*, *26*(March), 100398. https://doi.org/10.1016/j.gfs.2020.100398

Chang, Y. S., Si, Z., Crush, J., Scott, S., & Zhong, T. (2023). Governing for food security during the COVID-19 pandemic in Wuhan and Nanjing, China. *Urban Governance*, *3*(2), 106–115. https://doi.org/10.1016/j.ugj.2023.03.001

Egger, D., Miguel, E., Warren, S., Shenoy, A., Collins, E., Karlan, D., ... & Mobarak, A. M. (2021). Falling living standards during the COVID-19 crisis: Quantitative evidence from nine developing countries. *Science Advances*, 7(6).

Éliás, B. A., & Jámbor, A. (2021). Food security and covid-19: A systematic review of the first-year experience. *Sustainability (Switzerland)*, *13*(9). https://doi.org/10.3390/su13095294

FAO. (2020). *Coronavirus disease 2019 (COVID-19): addressing the impacts of COVID-19 in food crises*.

Gebeyehu, D. T., East, L., Wark, S., & Islam, M. S. (2022). Impact of COVID-19 on the food security and identifying the compromised food security dimension: A systematic review protocol. In *PLoS ONE* (Vol. 17, Issue 8 August). Public Library of Science. https://doi.org/10.1371/journal.pone.0272859

Grebmer, K. von, Bernstein, J., Wiemers, M., Schiffer, T., Asja, H., Towey, O., Chéilleachair, R. N., Foley, C., Seth, G., Ekstrom, K., & Fritschel, H. (2021). *Global Hunger Index*. *October*.

Hirvonen, K., de Brauw, A., & Abate, G. T. (2021). Food Consumption and Food Security during the COVID-19 Pandemic in Addis Ababa. *American Journal of Agricultural Economics*, *103*(3), 772–789. https://doi.org/10.1111/ajae.12206

Iheme, G. O., Jagun, A. O., Egechizuorom, I. M., Ogbonna, O. C., Edafioghor, L. O., Adeleke, F. A., Asouzu, N. C., Mebude, A. S., Enuka, H. C., Kupoluyi, O. E., Onyekwere, C. C., Okwu, U. P., & Olah, L. E. (2020). Food consumption and coping strategies of urban-households in Nigeria during the COVID-19 pandemic lockdown. *World Nutrition*, *11*(3), 35–50. https://doi.org/10.26596/wn.202011335-50

Janssens, W., Pradhan, M., de Groot, R., Sidze, E., Donfouet, H. P. P., & Abajobir, A. (2021).

The short-term economic effects of COVID-19 on low-income households in rural Kenya: An analysis using weekly financial household data. *World Development*, *138*, 105280. https://doi.org/10.1016/j.worlddev.2020.105280

Kundu, S., Banna, M. H. Al, Sayeed, A., Sultana, M. S., Brazendale, K., Harris, J., Mandal, M., Jahan, I., Abid, M. T., & Khan, M. S. I. (2021). Determinants of household food security and dietary diversity during the COVID-19 pandemic in Bangladesh. *Public Health Nutrition*, *24*(5), 1079–1087. https://doi.org/10.1017/S1368980020005042

Laborde, D., Martin, W., & Vos, R. (2020). Poverty and food insecurity could grow dramatically as COVID-19 spreads. *COVID-19 & Global Food Security*, *July*, 16–20. https://doi.org/10.2499/p15738coll2.133762

Laborde, D., Martin, W., Swinnen, J., & Vos, R. (2021). Impacts of COVID-19 on global poverty, food security, and diets: Insights from global model scenario analysis. *Agricultural Economics*, 52(3), 375–390.

Lal, R. (2020). Home gardening and urban agriculture for advancing food and nutritional security in response to the COVID-19 pandemic. *Food Security*, *12*(4), 871–876. https://doi.org/10.1007/s12571-020-01058-3

Maharjan, K. L., & Joshi, N. P. (2011). Determinants of household food security in Nepal: A binary logistic regression analysis. *Journal of Mountain Science*, *8*(3), 403–413. https://doi.org/10.1007/s11629-011-2001-2

Mahendra Dev, S., & Sengupta, R. (2020). *Impact of Covid-19 on the Indian Economy: An Interim Assessment*. https://time.com/5818819/imf-coronavirus-economic-collapse/

Mahmud, M., & Riley, E. (2021). Household response to an extreme shock: Evidence on the immediate impact of the Covid-19 lockdown on economic outcomes and well-being in rural Uganda. *World Development*, *140*. https://doi.org/10.1016/j.worlddev.2020.105318

Mititelu, M., Stanciu, T. I., Udeanu, D. I., Popa, D. E., Drăgănescu, D., Cobelschi, C., Grigore, N. D., Pop, A. L., & Ghica, M. (2021). The impact of covid-19 lockdown on the lifestyle and dietary patterns among Romanian population. *Farmacia*, *69*(1). https://doi.org/10.31925/farmacia.2021.1.1

Nemes, G., Chiffoleau, Y., Zollet, S., Collison, M., Benedek, Z., Colantuono, F., Dulsrud, A., Fiore, M., Holtkamp, C., Kim, T.-Y., Korzun, M., Mesa-Manzano, R., Reckinger, R., Ruiz-Martínez, I., Smith, K., Tamura, N., Viteri, M. L., & Orbán, É. (2021). The impact of COVID-19 on alternative and local food systems and the potential for the sustainability transition: Insights from 13 countries. *Sustainable Production and Consumption*, *28*, 591–599. https://doi.org/10.1016/j.spc.2021.06.022

Nguyen, P. H., Kachwaha, S., Pant, A., Tran, L. M., Ghosh, S., Sharma, P. K., Shastri, V. D., Escobar-Alegria, J., Avula, R., & Menon, P. (2021). Impact of COVID-19 on household food insecurity and interlinkages with child feeding practices and coping strategies in Uttar Pradesh, India: A longitudinal community-based study. *BMJ Open*, *11*(4). https://doi.org/10.1136/bmjopen-2021-048738

Omidvar, N., Ghazi-Tabatabie, M., Sadeghi, R., Mohammadi, F., & Abbasi-Shavazi, M. J. (2013). Food insecurity and its sociodemographic correlates among Afghan immigrants in Iran. *Journal of Health, Population and Nutrition*, *31*(3), 356–366. https://doi.org/10.3329/jhpn.v31i3.16828

Pakravan-Charvadeh, M. R., Mohammadi-Nasrabadi, F., Gholamrezai, S., Vatanparast, H., Flora, C., & Nabavi-Pelesaraei, A. (2021). The short-term effects of COVID-19 outbreak on dietary diversity and food security status of Iranian households (A case study in Tehran

province). *Journal of Cleaner Production*, *281*. https://doi.org/10.1016/j.jclepro.2020.124537

Rasul, G. (2021). Twin challenges of COVID-19 pandemic and climate change for agriculture and food security in South Asia. *Environmental Challenges*, 2, 100027.

SMERU, PROSPERA, UNDP, & UNICEF. (2021). Ringkasan Eksekutif: Dampak Sosial Ekonomi COVID-19 terhadap Rumah Tangga dan Rekomendasi Kebijakan Strategis untuk Indonesia. *SMERU Research Institute*, 1–7.

Smith, V. H., & Glauber, J. W. (2020). Trade, policy, and food security. *Agricultural Economics*, 51(1), 159–171.

Suh, N. N., Nyiawung, R. A., & Abay, C. F. (2023). Food security and coping strategies for COVID-19 disruptions among farming households in Cameroon. *Food and Humanity*, *1*(December 2022), 614–625. https://doi.org/10.1016/j.foohum.2023.07.001

Sulaiman, N., Yeatman, H., Russell, J., & Law, L. S. (2021). A food insecurity systematic review: Experience from malaysia. In *Nutrients* (Vol. 13, Issue 3, pp. 1–41). MDPI AG. https://doi.org/10.3390/nu13030945

Suryahadi, A., Al Izzati, R., & Suryadarma, D. (2020). The Impact of COVID-19 Outbreak on Poverty: An Estimation for Indonesia (Draft). *SMERU Working Paper*, *April*(April), 1–20. http://smeru.or.id/en/content/impact-covid-19-outbreak-poverty-estimation-indonesia

Susilowati, I., & Setiawan, A. H. (2021). Food security and COVID-19 in Indonesia: Impacts and policy responses. *Journal of Developing Economies*, 9(2), 15–29.

Workie, E., Mackolil, J., Nyika, J., & Ramadas, S. (2020). Deciphering the impact of COVID-19 pandemic on food security, agriculture, and livelihoods: A review of the evidence from developing countries. *Current Research in Environmental Sustainability*, *2*, 100014. https://doi.org/10.1016/j.crsust.2020.100014

World Food Programme. (2020). COVID-19: Economic and Food Security Implications. *Vulnerability Analysis and Mapping (VAM) Unit - Indonesia Country Offi*, 1–38.