Urban farming and food security: household’s adaptive strategy to COVID-19 crises

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Abstract. The COVID-19 pandemic has raised concerns regarding the importance of food security and the agricultural sector. Experiencing positive growth in the Gross Domestic Product during pandemic, the agricultural sector is considered to be the most resilient sector. This study examines changes in the household pattern of food consumption and their current position on food security. It also analyses household adaptation to current health crises. We conduct an online survey from September to October 2020. The coverage areas of this survey are concentrated in Java Island and captured 1,499 households. We calculate the food security index to measure the behavioral changes of household on their food consumption pattern. The index indicates that the majority of households are food secure. However, households with food insecurity generally have multidimensional vulnerabilities on the effects of this pandemic. Our survey has indicated several activities of household resilience to cope with the increase of food prices during pandemic. Urban farming is one of the solutions to access food, and their concerns on food safety, food prices and stimulate the local economy are utmost reasons. People utilized their yards by cultivating short-lived vegetables in small pots or hydroponic method. Given these reasons, the yields of their products do not go to the commercial market, although the potential to enter this market is possible. Based on the results of this study, it is suggested that the government can respond to the changes that occur in society as a time to support agricultural sustainability, particularly in expanding urban farming.

1. Introduction

Today, a novel virus COVID-19, was a major concern for people around the world. As we wrote this paper, Indonesia's total number of infections is 1,963,266 people, with death toll to 54,043, and 1,779,127 recoveries patients. It seems that Indonesia has met the second wave of the crises in the last two months [1]. The current health crisis is also different from Indonesia's economic downturn in 1997-1998, but the adverse effect is similar to high uncertainty when this pandemic will end. During the COVID-19 crisis, agriculture has grown significantly by about 2.10% while the other sectors have sluggish average annual growth, such as manufacturing and hospitality services in 2020 [2]. However, the latest report by FAO (Food and Agriculture Organization) stated that COVID-19 is significantly disrupted food availability, prices, and quality as consequences of the lockdown policy [3]. The disruption of the food supply chain led to food insecurity and malnutrition, particularly for vulnerable people in terms of income and food stocks.
Given this fact, at the micro-level of economic agent, a family try to maximize their efforts to cope with the adverse effect of pandemic and lockdown policy. Kind of strategies may different among household but it can be included all their capacities. The downturn of economic implies increasing unemployment, making difficult to get additional income. In addition, during the pandemic a household tend to be cautious and apply a series of consideration to buy high quality of food and building herd immunity. For those reasons, many families are concerned about planting their own food in their home garden, especially for those who live in urban areas. Urban farming emerges as an alternative strategy for household to secure their food at the same level before the COVID-19 pandemic.

Urban farming is defined as all forms of agricultural production (food and non-food) occurring within or around cities [4]. It may comprise ground-based outdoor urban gardens and farms, hydroponic, indoor production through rooftop gardens and farms, landscaping and nursery businesses, and urban livestock [5]. Historically, the victory of home gardening as a survival strategy is nothing new. During the World War II, the surge of urban gardening in the cities across the United States suggests that Americans derive defining moral and political virtues from farming as a way of life [6] In the case of Canada, home gardening usage is associated with self-reported mental and physical wellbeing for people over 70 years old during the economic lock-down [7]. Importantly, it is well documented that in time of hardship particularly in the COVID-19 outbreaks, home gardening for urban communities play important role to in advancing food and nutritional security, strengthening the provision of ecosystem services [8], increase community cohesion and resilience [9], and beyond of those thing, home gardening can promote sustainable natural resources [10] and society [6].

This study aims to explore the effect of COVID-19 outbreaks on the food security status of Indonesian family. It also describes household strategies that further affect food security. In particular, this study emphasizes on the role of urban farming as a means of adaptive capacity. This study is scant in the literature, particularly in discussion on Indonesian household. It is expected that this study could promote urban farming as an alternative food production to ensure food security and avoid the risk of malnutrition.

2. Materials and methods

2.1. Materials

The survey was conducted by using an online questionnaire at the household level in Indonesia. The main reason for using online instead of offline survey was health and safety protocols to avoid or minimize direct contact with people during pandemic COVID-19. An online survey is also considered an effective tool to gather and collect large data in a short period. The survey was voluntary, confidential and anonymous. Participants of the online survey were required to read and accept the letter of consent, which includes the statement of their age that must be above 18 years old before they start to participate in this survey. The data analyses were obtained from 1,499 respondents.

2.2. Methods

The study was conducted by online survey from 15th of September to 5th of October 2020. The online questionnaire launched through ‘SurveyMonkey’ online survey platform, then launched in official website of Economic Research Center, Indonesian Institute of Sciences and distributed among colleagues, friends, and business network through emails and other social media messaging systems (such as Facebook™, and WhatsApp™). The circulation information was applied in snowballing mechanism through social media groups. Data were analyzed using statistical analytical tools (STATA Version 15, Software for Statistics and Data Sciences), and descriptive statistics were used to define the proportion of responses among the respondent. This study relied on self-reported data that considered proxy indicators of reported
expenditures, food consumption, and coping strategy in urban farming activity rather than detailed calculations of these indicators.

Household food security index was adopted from [11] and calculated using the indicators collected from the survey result. Three households food security outcomes were constructed and calculated based on the sum of the 18 household food security items (with children, aged below 18 years) or 10 items (for the household without children) that listed in the questionnaire [11,12]. Urban farming activities were defined from the responses of respondents in urban areas that indicated their food-based coping strategy. To document the reliability of survey data, we calculate Cronbach's alpha statistics among variables used to construct the food security index.

3. Results and discussion

3.1. Reliability and validity tests

The reliability test of variables constructing urban farming and food security index were conducted. By using data responses from approximately 40 questions, the alpha values were in the range of cut of values (from 0.70 to 0.95). The average of alpha value for each item of the food security index is above 0.8. Thus, it is suggested that our data have passed the level of construct validity and reliability instruments.

3.2. Respondent characteristics

The quantitative data are obtained from 1,499 respondents participated in the online survey. Most respondents lived in urban areas (77%), with the ages were in the range from 30 to 50 years old (71%). In addition, the majority of respondents were workers with relatively stable salaries, both in government and private sectors (33% for each sector). On the other hand, 17% of the total respondents had daily or uncertain wages, including those working in the sectors of agriculture (farmers) and transportation (drivers). There were also business owners or entrepreneurs participating in this study (12%). Meanwhile, the monthly expenditure data were used as a proxy for the income. Respondents in general had expenses of IDR 7.21 million per month (26%). However, if we refer to the regional minimum wage (Upah Minimum Regional/UMR) in DKI Jakarta, capital city of Indonesia, (almost IDR 4.3 million per month) [13], the majority of respondents had expenditures below the standard of the minimum wage. There were 34% of the total respondents whose monthly expenses less than IDR 3.1 million.

3.3. Household food security index

The survey results of household food security index during the COVID-19 pandemic in Indonesia in this study (Figure 1a) shows that 60% of the households are categorized as food secure. Meanwhile, there were 23% and 17% of the total households categorized as low food security and very low food security, respectively, both considered to be food insecure (40%). The calculation of household food security index used in this study adopted the latest [11] module and research results from [12]. Previous calculations from [14] were adopting the earlier version of [15] guideline to calculate the household food security index, as seen in Figure 1b. The result shows that both methods have a similar pattern in calculating the household food security, with the majority of the households were estimated as food secure. It is important to note that by adopting the latest module [11,12], there were only slight differences between the food insecurity status, or between the percentage of households with low food security and very low food security. This further reflects the vulnerability of the households to food insecurity problems during the COVID-19 pandemic. The following discussion in this paper refers to the latest estimation of the food security index as stated in Figure 1a.
3.4. Some determining indicators in household food security

Based on the questionnaire referring to [11], we obtained five out of 18 questions as an example to show the severity of food security on the rural and urban communities amid the COVID-19 pandemic. There are five main indicators highlighted as follows (1) did the respondent ever feel hungry but did not eat enough because they did not have enough money?, (2) did the respondent or other adult family members ever eat less than three times a day because they did not have enough money?, (3) the child eats less than three times a day because there is not enough money?, (4) Have the children in your family ever felt hungry but did not have enough money to buy food?, and (5) did the children never eat all day because they did not have enough money?

The result showed that there were 2.64%-17.28% of urban communities and 5.10%-16.84% of rural communities whose food needs were not fulfilled amid the COVID-19 pandemic. They were unable to fulfil their food needs because of the limited money. Urban communities experienced a direct impact on decreasing income because of layoffs in a number of business sectors. Hence, the urban communities are more insecure than rural communities in fulfilling the basic food needs amid the COVID-19 pandemic.

3.5. Food Availability during pandemic COVID-19

Survey result indicates people who buy food directly to markets/stores and buy food at restaurants seem less attractive during the pandemic. Only 5.14% of respondents still go to a restaurant to buy some food and 11.2% of reactions prefer to purchase daily needs to market/store directly. The majority of respondents state that home cooking (67.98%) is more carried out during this pandemic. This result is also in line with the previous study [16] that found health, social, and psychological factors influenced the respondent’s food consumption behavior. There are increasing organic food intentions and self-cooking trends. The urban area dominating this survey shows that participants prefer to buy food on an online platform (27.2%) to reduce interactions and anxiety in a pandemic era. PWC’s report [17] mentioned that Indonesia’s consumers tend to increase costs on some commodities like health products (77%), grocery products (67%), entertainment, and media (54%), food picks up/delivery (47%), and DIY (Do It Yourself)/home improvement/gardening expenses (32%).

Figure 2 also describes people’s consumption preference patterns during a pandemic. It shows respondents tend to increase consumption of fruits, vegetables, and spices (empon-empon) to increase their immunity. In Indonesia, some people consume empon-empon as multivitamins consumption to prevent Coronavirus [18]. Consumption of spices as an immune booster in society incurred higher (13%) in high-expenditure groups. High-expenditure groups prefer to consume healthy drinks that are already available in the market.
### 3.6. Adaptive Strategy during pandemic COVID-19

Identifying shocks by scope, frequency, timing, and intensity is another concern. Current health crises brought domino effects that affected the economic performance of the country. Importantly, families face multiple shocks during the pandemic. Notably, the partial or fully economic lockdown in the global food market leads to price shock. This shock has usually been transmitted to domestic food prices, albeit uniformly, depending on the way the market's function, the degree to which domestic markets are incorporated into the foreign market, and the government's price policies. In the context of broad spatial dispersion in Indonesia, agricultural markets are not completely incorporated into the central market due to limitations in infrastructure, like transportation. In such cases, it is more likely that the effect of pandemic COVID-19 hits severely employment who work in warehouse, transportation, and accommodation job. To this point, the effects of food price volatility on household income and consumption are exposed, to differing extents, to differing risks [19, 20].

According to Kirchberger [21], there are two stages of coping strategies in the lower-income households in response to income fluctuations. In the first stage, households decide how to smooth their income shock by diversifying their work or producing higher than usual output [21]. This mechanism may have been prepared before the shock occurred if the shock is predictable. In the second stage, the households should make decisions after the shock has occurred. To maintain their consumption at least at the same level as before the shock, they can take several actions such as adjusting the composition of their main labor activities, deplete their financial assets, claim formal or informal insurance, or reduce their savings. More specifically, added the possibility of an austerity response (postponing education and health care expenditure), which would allow consumption to fall further to, perhaps, preserve productive assets.

Apparently, the quick response to deal with shock, both respondents in rural and urban households are spending their savings (32.45%) and buying local food (28.03%). Other strategies seem less preferable (<10%), indicating that the crisis affected transitory income. The survey also found that about 26% of urban households and 20% of rural households were not affected by crises which means that the current crisis has no significant effect to change their consumption pattern and family welfare. However, this survey was designed to measure food security of the household in time of crisis. Hence, this study cannot capture the long-term effect of pandemic on household welfare or how long they can maintain their food security status. Further, the partial lockdown applied in Indonesia in 2020 as large-scale social restrictions (pembatasan social berskala besar, PSBB) policy implies that people must stay at home with or without income is a particularly difficult situation for those who earn from casual job. The percentage of unemployment as...
consequences of this pandemic crisis is experienced by 7% of respondents. Given this fact, the opportunity to get a job is hard to obtain, and the contribution of crisis to open unemployment is higher than that of pre-crisis. Subsequently, the crisis is still going on during the survey, and it is found that the crisis has a significant effect on changing the pattern of work from office (WFO) to work from home (WFH) 42.96%.

3.7. Urban farming during pandemic COVID-19

The unprecedented situation due to the outbreaks of novel virus SAR COV-2 had been a concern for the whole entities. Many studies proved the significant effect of current health crisis to household income and welfare at the micro level. At global level, the COVID-19 pandemic has disrupted the food supply chain, it is important to strengthen the local food production by promoting home garden in the urban as well as rural area. Home garden is an alternative solution to supply medicinal herbs, fresh fruits, and vegetables daily [22]. Additionally, it supports mental and physical human health and well-being and improves food security, diversity, nutritious value, and the micro environment around the family home. Regarding the impact of COVID-19 are more affected urban people than rural communities, this study focus on how urban farming as an alternative to supply food for urban families.

Figure 3. Urban farming activities by main occupation of the breadwinner

Figure 3. describes the urban farming activities during the partial economic lockdown. We do cross-tabulation of households in urban areas based on their main occupation, monthly family expenditure and level of their education. We compare the households doing urban farming activities (home garden and livestock) equal to 1 and those who are not doing urban farming activities (equal to zero) during the three first months of pandemic. Of 30% respondents in the urban area have activities for home garden. Their activities on hydroponic production and breeding livestock are about 25% and 9.17% respectively. Accordingly, urban farming is also interesting for non-farm job employee. It is about 20% to 30% of them do farming activities beside their main occupation during the pandemic. Working from home may be why they spend their time on such leisure activities such as gardening.

Figure 4 shows the cross-tabulation results between urban farming respondents and some general characteristics, namely education level, age, expenditure level during March-May 2020, and expenditure level during June-October 2020. Compared with lower attainment, respondents with higher educational attainment were more likely to experience increasing urban farming activities. It is an alternative solution when people should be at home in pandemics and make other valuable creativity. On the other hand, another
respondent may not have the option to survive, so they still work outside and did not have time to implement urban agriculture. Furthermore, respondents more than 60 years old tend to be more engaged in urban farming activities than other age ranges. They are generally already entering retirement, so it is possible to conduct farming activities because they have more free time. Urban farming was also more often carried out by respondents with high expenditure levels during the pandemic period (March-October 2020). They usually have greater access, such as access to land or other resources required for practicing the urban farming.

Numerous studies addressed the importance of home gardens and urban farming to stimulate social change and development [22]. The major contribution of home gardens is expected to improve the quality of food consumption and nutrition of the families [8]. However, if this goal did not realize, the home gardens can be an instrumental approach for women to improve their income, social status, and awareness of evolving food habits in urban areas [8]. Therefore, in the wake of the global food crisis, a home garden has enhanced food security and livelihood and needs initiatives from local government and non-governmental organizations (NGO) to improve productivity and scale up home gardens activities.

4. Conclusions
This study examined the effects of COVID-19 on household food security in Indonesia and their adaptation strategy, especially in relation with urban farming activities. The results show evidence of household food security situation varies from different social-economic backgrounds. This is attributed to the reduction in household income, and limited access to markets due to the application of health protocol restrictions during
COVID-19 outbreaks. The number of respondents with food-insecure outcomes counted by 17% as very low food security and 23% as low food security.

Food security conditions were worse among low-income households and those dependent on labor and daily-based income, as they are less likely to have enough money to purchase food during the partial lockdown. In this situation, respondents were more likely to apply food-based coping strategies such as withdrawing their savings (if any), borrowing food, borrowing money, and selling assets that can be exchanged for food. In such situations, urban farming activities raise a good attention from the community. The result from this study implies the following strategies to overcome the problem in stabilizing household incomes, access to food, and livelihood recovery in post COVID-19 outbreaks. First, although the pandemic scale is far from the ending, the government needs to implement some changes in social security schemes, including a data enhancement in national single identity number that are responsive to fulfill the needs of targeted households during such crises immediately. Second, the government continues to make a national campaign to increase the awareness of household to prepare their self-sufficient food production from their own backyard by implementing home garden. For those living in urban areas with limited backyard space, the importance of urban farming supports the survival of food supply, particularly in making available some short-life plants such as vegetables and horticulture.

Since this study based on rapid survey, a future research involving representative samples can build upon and extend the study for more comprehensive and satisfying result but it depends on pandemic situation.

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