

The analysis of dietary diversity and food insecurity experience of urban farmers' households in Bandung City

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Abstract. More than 96% of Bandung City's food sources came from outside Bandung City and put Bandung as a food insecure city. One of the Bandung City Government's strategies was to increase the availability and access of food through urban farming. This research aimed to examine the household food security of urban farmers' families through the dietary diversity and food insecurity experiences. In this paper, the samples were all 12 P2L (Pekarangan Pangan Lestari/Sustainable Food Garden) groups in Bandung City as well as 13 groups of Buruan SAE located in the same sub-district as the P2L groups. The comparison method was carried out based on HDDS (Household Dietary Diversity Scale) questionnaire and FIES (Food Insecurity Experience Scale) prevalence between the P2L group and the Buruan SAE group. The result showed that both urban farming groups had high HDDS scores (>6 types of food consumed). Based on the prevalence of FIES, there are 38.45% of the Buruan SAE group with mildly food insecure status, higher than the P2L group which is 16.67%. This can be caused by the biodiversity of agricultural land, household income and land ownership status.

1 Introduction

Bandung has 16,729 hectares with 2,5 million people living in the city making it the third largest city in Indonesia [1]. However, 96.24% of Bandung's food sources still come from outside Bandung City, which places it as a city prone to food insecurity. Thus, the Bandung City Government must implement a strategy to prevent a food crisis. The development of urban agriculture is a strategy to increase food availability and access to support food security [2]. There are various kinds of urban agricultural activities that can be carried out, such as production of crops, poultry, livestock, and fisheries [3]. With the low food accessibility index and inflation in Bandung City due to rising food prices, the Bandung City Government through the Department of Food Security and Agriculture (DKPP Kota Bandung) is implementing an urban agriculture program called "Pekarangan Pangan Lestari" (Sustainable Food Garden) and "Buruan SAE". Buruan SAE is a farmer group that receives financial support from the Bandung City Government through DKPP Kota Bandung based on Bandung Mayor Regulation No. 58 of 2022. Meanwhile, the Pekarangan Pangan Lestari (P2L) receives full funding support from the Ministry of

Agriculture based on Minister of Agriculture Regulation No. 8 of 2023.

The P2L activity is carried out through the use of unproductive land, idle land, and empty land as food producers to fulfil household food and nutrition, as well as being market oriented to increase household income, especially for vegetables and fruit commodities [4]. The "Buruan SAE" program comes from the word "buruan" in the meaning in Sundanese means yard, and SAE is an acronym for healthy, natural, and economical (Sehat, Alami, dan Ekonomis). With integrated urban agricultural activities, the Bandung City Government hopes to help ease the burden of demand of the market to maintain price stability and food supply, as well as help affordability of urban food [5]. Even though both Buruan SAE and P2L have some similarities, both still have differences. Buruan SAE is an integrated urban agriculture program with 8 sectors of agricultural activities: produces vegetables, fruit, poultry, fish, composting, medicinal plants, plant nursery, and processing the agricultural products [6]. Meanwhile, the P2L group only depends on the production of vegetables and fruits. Thus, integrated urban agricultural activities in the city of Bandung City are expected to have an impact on food security by facilitating food access and

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improving the quality of food for consumption at the household level.

On the other hand, some studies showed that urban agricultural households are still at the risk of being food insecure. Gardening can provide a sense of security regarding food security, but the diversity score of food consumption for urban farmer households using home gardens remains low [7]. Some of the urban agriculture households still tend to rely on salaries or wages to address the food insecurity and make no difference significantly on the average total income per year among agricultural households in urban areas with the one without urban farming [8]. The case of urban farmers are no more food secure in comparison with urban communities that are not connected to agriculture in any way directly also found in Africa [10].

To evaluate the food security at household level based on a reflection of the nutritional quality of food consumption and the level of diversity of food consumption, the Household Dietary Diversity Scale (HDDS) is used [7]. Also, to evaluate food security in terms of the percentage of individuals/population who have experienced moderate or severe food insecurity in the last 12 months, the Food Insecurity Experience Scale (FIES) indicator can be used [8]. There is also the same phenomenon, namely that the majority urban farming households in Nigeria show food insecurity status [9]. The case of urban farmers are no more food secure in comparison with urban communities that are not connected to agriculture in any way directly also found in Africa [10]. Based on those phenomenons, there is a need to study the food security condition of the families of P2L and Buruan SAE in Bandung.

2 Methods

The research method used is a mixed method. The quantitative method used is measuring the diversity of food consumption of the urban farmers' families using the Household Dietary Diversity Scale (HDDS) instrument to obtain the amount of food variety consumed. The qualitative method used is measurement of the food insecurity experience of urban farmers which is measured using the Food Insecurity Experience Scale (FIES) instrument to obtain data regarding the description of the vulnerable conditions of urban farmer's families through a number of questionnaire questions. The respondents were all P2L urban farmers in Bandung City (12 groups) and Buruan SAE in the same village with P2L (13 groups).

The interview was held face-to-face with a questionnaire that included modules on household characteristics, land assets used for urban farming, total household income and urban farming income, FIES survey module, and

HDDS survey module. In the HDDS survey, a 24-hour food recall method was used. We constructed food insecurity indicators using survey data on the eight-standard experience-based food insecurity experience scale (FIES) questions. Based on the individual's 'yes/no' responses to the eight FIES questions and adapting the FAO's global reference scale of FIES. There are four food insecurity severity scales, that are : (1) food secure; (2) mildly food insecure; (3) moderately food insecure; (4) severely food insecure. The scale defined a household's food insecurity in four ranked categories [11].

- Food secure (= 1): If the household responded 'no' to all the eight questions, i.e., if $Q1 = Q2 = Q3 = Q4 = Q5 = Q6 = Q7 = Q8 = 0$

- Mildly food insecure(= 2): If the household respond 'yes' to at least one of the first three FIES questions (i.e., if $Q1 = 1$ or $Q2 = 1$ or $Q3 = 1$) and zeros to the rest of the FIES questions i.e., $Q4 = Q5 = Q6 = Q7 = Q8 = 0$

- Moderately food insecure (= 3): If the household responded 'yes' to either Q4 or Q5 and zeros to Q6, Q7, and Q8

- Severely food insecure (= 4): If the household responded 'yes' to one or more of the last three FIES questions i.e., $Q6 = 1$ or $Q7 = 1$ or $Q8 = 1$

3 Results

3.1 Social Characteristics of the Subject

The social characteristics of the subjects used in the research were age, gender, profession, land ownership status, education and household income. The subjects used in this research were groups of P2L beneficiaries in the cities of Bandung and Buruan SAE who are located in the same sub-district as P2L and carry out 8 components of the integrated urban farming concept (vegetables, fruit, family medicinal plants (TOGA), nurseries, chicken/poultry, fish, waste processing, and post-harvest processing). The number of subjects used were 12 P2L groups in Bandung City and 13 Buruan SAE groups with these characteristics.

Table 1. Social Characteristics of The Subjects

Variable	P2L	Buruan SAE
Age		
25 - 44	8.33%	0,00%
44 - 60	66.67%	30.77%
60 - 75	25.00%	69.23%
Livelihood		

Variable	P2L	Buruan SAE
Entrepreneur	50.00%	61.50%
Housewife	25.00%	7.70%
Retired	25.00%	23.10%
Freelance	0.00%	7.70%
Education		
High School	41.67%	53.85%
Diploma/Bachelor	58.33%	38.46%
Postgraduate	0.00%	7.69%
Income		
Rp1,500,000 - Rp2,500,000 (Lower)	0.00%	7.69%
Rp2,500,000 - Rp3,500,000 (Middle)	50.00%	69.23%
> Rp3,500,000 (Higher)	50.00%	23.08%
Land Ownership		
Private Property	16.67%	7.69%
Government or Agency Property	75.00%	92.31%
Others	8.33%	0.00%

Based on interview results, the P2L group is dominated by middle-aged people (44 - 60 years). Meanwhile, the Buruan SAE group is dominated by the old age group (60 - 75 years). This is in line with other research that the majority of people are urban farming activists in productive age (<64 years) [12]. Urban agricultural activists in Bandung City are dominated by entrepreneurs and retirees. For retirees, there is more time for urban agricultural activities. However, for the self-employed group, they delegate their agricultural activities to workers, such as mosque caretakers (especially on land close to the mosque area), housewives in the surrounding area, and Gober (village environmental cleaning officer). Meanwhile, 16% of agricultural activists are housewives.

The two urban farming groups are dominated by people with middle income followed by high income. The 2023 Provincial Minimum Wage (UMP) for West Java is IDR 2,057,495 and the Regency/City Minimum Wage (UMK) for 2023

for Bandung City is IDR 4,048,462 [13]. Based on profession, the two urban farming groups are dominated by high school/vocational school graduates and Diploma/Bachelor.

3.2 Dietary Diversity of The Subjects

Food consumption diversity is the amount of food or food groups consumed in a certain time. Food diversity was analysed using HDDS indicators [14].

The diversity of household food consumption of P2L and Buruan SAE subjects all falls into the category of high level of food diversity (≥ 6 food groups). Both the P2L group and the Buruan SAE group have high food diversity (100%). The average food diversity in the P2L group was 9.25. Slightly higher than that of the P2L group, the Buruan SAE is 9. The large variety of commodities produced in urban agriculture is in line with the variety of household food consumption of urban agricultural activists [15]. Increasing the diversity of agricultural production has the potential to intensify the diversity of household food consumption [16].

Other research related to food diversity which stated that subjects with high family income tend to have high food diversity as well [17]. Food diversity is also influenced by external factors, including production, availability and distribution of food ingredients since sufficient food availability results in high food diversity. Thus, urban agriculture, in principle, has a positive impact on the food security of the households involved through the income generated and direct access to the food produced. Households with urban farms may have access to cheaper food, with a wider variety of foods that are nutritious and fresh. The food groups frequently consumed by subjects were cereals, fruit, vegetables, chicken, eggs, beef, green beans, oil, sugar, and herbs and spices.

The average number of food groups consumed by subjects was 8 to 11 food groups. Some of the food groups with the least amount consumed are white tubers such as potatoes, cassava, and others. The preference for carbohydrate sources among urban agricultural farmers still depends on rice. The preference for consuming tubers in Indonesia is higher in Eastern Indonesia, such as East Nusa Tenggara to Papua [18]. In addition, although the respondents also cultivate tubers on their urban agricultural land, urban farming families do not always consume these tubers. The type of protein that is more widely consumed is meat/animal protein such as chicken, beef or offal as well as fish and similar seafood. One reason is that eggs are more widely shared/sold and have higher value compared to vegetable commodities. However, the type of meat/animal protein that is more widely consumed not only comes from urban agriculture, it is mostly obtained from

Table 2. Dietary Diversity of The Subjects

Category	P2L		Buruan SAE	
	n	%	n	%
Low (≤ 3)	0	0.00%	0	0.00%
Middle (4 - 5)	0	0.00%	0	0.00%
High (≥ 6)	25	100.00%	25	100.00%
Min	7	8.33%	6	7.69%
Max	11	25.00%	11	30.77%
Average	9.25		9	

Table 3. Various Commodities Consumed by Subject Families

Category	P2L		Buruan SAE	
	n	%	n	%
Cereal	12	100.00%	13	100.00%
White tubers	3	25.00%	3	23.08%
Vegetables	12	100.00%	13	100.00%
Fruits	10	83.33%	12	92.31%
Meat	11	91.67%	9	69.23%
Egg	6	50.00%	5	38.46%
Fish and Seafood	7	58.33%	6	46.15%
Legumes	12	100.00%	13	100.00%
Milk and derivatives	4	33.33%	6	46.15%
Oil and fat	11	91.67%	11	84.62%
Sweetener	11	91.67%	9	69.23%
Spices and other condiment	11	91.67%	13	100.00%
Eating outside	1	8.33%	4	30.77%

purchases. This shows that with a high level of income, the family's opportunity to be able to choose more nutritious types of food also influences

The commodities consumed by all groups (100%) are cereals, vegetables and nuts. The cereal commodity consumed by all groups is white rice, which is the community's staple food. Meanwhile, vegetables are more widely consumed because in terms of access, vegetables are found in all urban agricultural groups so their availability and affordability is guaranteed. Apart from vegetables, fruit commodities are also widely consumed because both the P2L and Buruan SAE groups grow fruit plants in their yards (bananas, papaya, grapes, tomatoes, etc.).

Most of the legume commodities are tempeh and tofu. Meanwhile, spices and other condiment commodities are also high in both groups. This is because there are medicinal plants (TOGA) in urban agriculture in Bandung City, such as ginger, lemongrass, butterfly pea flowers, and others which are liked to be consumed daily by urban agricultural groups, especially in the 60 - 75 year age group. The high consumption of vegetables, fruit, animal protein and nuts from the P2L and Buruan SAE groups shows the success of these two programs.

Table 4. Various Subjects' Food Crop Commodities

Category	P2L	Buruan SAE
Vegetables	19	12
Fruits	11	6
Tubers	4	2
Medicinal plants	8	5
Total	42	25

In the Table 4, the types of vegetables grown on P2L land are more diverse compared to the SAE Buruan group. This could be caused by the existence of breeding facilities on P2L groups that have been facilitated by the government. By building a seed house, groups have greater potential to carry out plant nursery activities and develop new seeds compared to groups that do not have these facilities. Apart from that, the P2L group receives full assistance from the government starting from seeding facilities, development of demonstration plots, planting, to post-harvest processing which makes the group have greater potential to develop its agricultural productivity

3.3 Food Insecurity Experience

The Food Insecurity Experience Scale (FIES) can measure food insecurity from the perspective of respondents' lived experience of food access [19]. This scale was formed based on an experience-based assessment tool which can see how a person faces food insecurity which is calibrated globally in order to ascertain the main indicators of food insecurity [20].

Table 5. Food Insecurity Experience of the Subjects

Category	P2L	Buruan SAE
Food Secure	83,33%	66,67%
Mildly Food Insecure	16,67%	41,67%
Moderately Food Insecure	0,00%	0,00%
Severely Food Insecure	0,00%	0,00%

From the results of the interviews, it was found that the P2L group had a higher food security status compared to the Buruan SAE group. In addition, the P2L group showed a slightly less food insecurity status than the Buruan SAE group. Several factors such as land ownership status, profession, variety of commodities grown, and income can influence this result.

Table 6. Recapitulation on FIES Questionnaire

FIES Question	P2L	Buruan SAE
1. WORRIED	16.67%	30.77%
2. HEALTHY	0.00%	0.00%
3. FEWFOOD	0.00%	7.69%
4. SKIPPED	0.00%	0.00%
5. ATELESS	0.00%	7.69%
6. RUNOUT	0.00%	0.00%
7. HUNGRY	0.00%	0.00%
8. WHL DAY	0.00%	0.00%

The interview results showed that the P2L group which was categorised as Mildly Food Insecure answered "Yes" to the first question (Q1). Meanwhile, Q1 shows that in the last twelve months, the respondent has experienced worry about experiencing food shortages. This happens because of the emergence of the El Nino phenomenon in 2023 which is said to be one of the world's natural disasters. Since 2023, Meteorology Climatology and Geophysics Council (BMKG) has predicted that Indonesia will face a transition from La Nina to El Nino, where there will be a prolonged drought [21]. Meanwhile, the agricultural sector in tropical countries is very dependent on rainfall for crop production so it is very vulnerable to the negative impacts of the dry season due to El Nino [22]. Thus, during El Nino, respondents previously planted vegetable crops that require a lot of water. These plants include shallots, lettuce, mustard greens, kale, bokchoy, and others. However, when there is a drought, respondents choose to reduce the number of vegetable crops and plant food crops that require less water, such as cucumbers, long beans, peanuts, eggplant, pumpkin, and others.

The answer "Yes" also appears in the third question (Q3). Meanwhile, Q3 shows that respondents in the past year have experienced consuming less variety of food due to lack of resources. This happens to the Buruan SAE group whose livelihood is retired and old age. However, according to respondents, consuming less food was done not only to reduce expenses, but also to try to reduce food portions to feel healthier.

4 Conclusion

Based on the analysis of food consumption diversity, the P2L group and the Buruan SAE group have high food diversity (>6 types of food) as a result of the availability and high diversity of their crops from urban agricultural activities. Based on the analysis of food insecurity experiences, the P2L group had a higher number of food secure groups (83.33%) compared to the Buruan SAE group (66.67%). It can be caused by the differences in food consumption habits, health conditions, and weather conditions..

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