

# Post-earthquake food security analysis in Cugenang Subdistrict, Cianjur District, Indonesia

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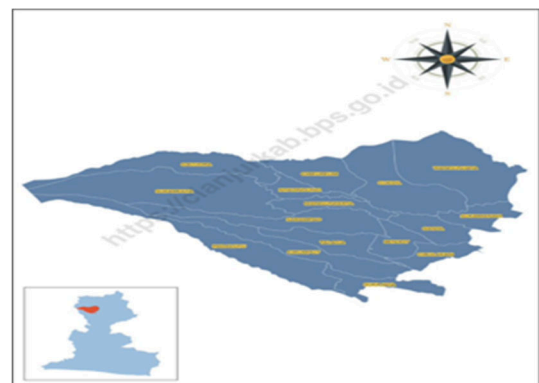
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**Abstract.** Several factors may effect to the fulfillment of food security, i.e., food availability and food consumption, particularly due to the earthquake that occurred in Cugenang Subdistrict. This research aims to identify and determine the condition of food resilience and insecurity after the earthquake disaster in Cugenang Subdistrict. This research uses mixed methods, quantitative and qualitative with 100 respondents. The research stages were divided into three stages, including the baseline desirable dietary pattern score using secondary data, food security using the analysis of food expenditure and energy consumption intake, food insecurity using FIES and qualitative using in depth interviews. The results of the research show that the food security condition of Cianjur District after the earthquake disaster with the desirable dietary pattern using the projected desirable dietary pattern score is in the medium category with the score of 82,72, the status of food security conditions is included in the food less secure category with a percentage of 75% due to low expenditure on food needs and insufficient consumption intake by applying the 24-hour food recall method, and conditions of food insecurity based on FIES are included in the food secure category due to sufficient food quantity and adequate food quality.

## 1 Introduction

Food is an important commodity which is a basic that need to be fulfilled. It needs to be available in sufficient quantities, safe for consumption, easy to obtain, of decent quality and at an affordable price [1]. The food security can be identified by access of households and individuals to healthy living, especially food necessities which depend on food availability (domestic production and import), food accessibility (acquisition resources), food utilization (usage) and food stability (resilience over the period) [2]. Food availability at the macro level does not guarantee food availability at the micro household level [3]. Cugenang Subdistrict is one of the 32 Subdistrict in Cianjur District. Cugenang Subdistrict has 16 villages with an area of 68.08 km<sup>2</sup> and the population is 119,540 people [4].



**Fig. 1.** Map of the Cugenang Subdistrict Area

On November, 21 2022, an earthquake occurred in Cianjur District. Cugenang Subdistrict was most seriously affected by the earthquake that occurred with a magnitude of 5.6 and aftershocks that lasted for 2 months. This earthquake resulted in damage to 23.126 housing units with three categories of damage including light damage, moderate damage and heavy damage. This earthquake disaster had a significant impact on decreasing agricultural land productivity, causing physical damage to the area including the destruction of various residential areas and psychologically affecting the mental condition of the affected people.

All the problems faced by people in Cugenang Subdistrict area will reduced household food

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security significantly that can be identified from household food availability, the aspect of household food accessibility and the aspect of household food consumption in this area. These three aspects are the pillars of national, regional food security and the pillars of household security [5].

Food insecurity can occur repeatedly at a certain time (chronic) and also occur due to emergencies such as natural disasters or social disasters (temporary) [6]. Chronic food insecurity occurs when someone is unable to fulfill the nutritional requirements for activities. Meanwhile, temporary food insecurity occurs when someone loses their ability to be productive and loses access to sufficient and nutritious food. The impacts of climate change such as disasters and disease epidemics, price changes or market shocks and social conflicts [7]. Food insecurity is a multi-dimensional problem resulting from diverse issues of individual, household, social, political, economic and environmental factors [8].

Each individual's food access depend on the availability of food and ability to access continuously. Procurement of sufficient food to fulfill the food need according to nutritional requirements is the biggest problem in human story [9]. The desirable dietary pattern is an arrangement of various food based on the proportion of energy balance from various food groups to meet energy and other nutritional needs both in quantity and quality, taking into account aspects of acceptability, food availability, economics, culture and religion [10]. Apart from that, desirable dietary pattern can be used as a guide in evaluating and planning the provision, production and consumption of foods for the population both in quantity and quality [11]. The desirable dietary pattern score achievement status is categorized into three, namely poor (<80), moderate/medium (>80-<90) and good (>90) [12]. Accordingly, increasing food security does not only apply at the macro level but also at the household level, because food security at the household level is a very close part of food security at the national level. Guaranteed food security in a household will strengthen food security at the national level. Therefore, there is a need for a study that can explain the condition of food security in Cugenang Subdistrict after the occurrence of earthquake disaster.

## 2 Methods

The research method used in the research is mixed method. Mixed methods is a research method that combine quantitative methods and qualitative methods so that data can be more comprehensive, valid, reliable and objective [13].

In this study, researchers used a sequential explanatory design, i.e. the collection of

quantitative and qualitative data carried out sequentially. The first stage was carried out using quantitative then the next stage or second stage was carried out using qualitative [14]. Therefore, this design places more emphasis on quantitative research [15].

Desirable dietary pattern scores used secondary data from Dinas Tanaman Pangan Hortikultura Perkebunan dan Ketahanan Pangan Kabupaten Cianjur, measuring food security used the analysis of food expenditure and energy intake [16] using a 24-hour food recall method. The 24-hour food recall method has advantages and disadvantages. The advantages are that it is easy to implement and does not burden respondents, the cost is relatively cheap because it does not require special equipment and a large space, the implementation is fast so it covers many respondents, it can be used by illiterate respondents and it can provide a real picture that is truly consumed by individuals so that it can calculate daily nutrient intake. However, the method cannot describe daily food intake if it is only done for one day, its accuracy depends on the respondent's memory, and it requires personnel or officers who are trained and skilled in using URT tools [17]. The subjects took and recorded photographs of all foods eaten and provided these during interviews to reduce recall bias [18], measuring food insecurity used the FIES (Food Insecurities Experience Scale) indicator in accordance with WHO guidelines, this scale was formed based on an experience-based assessment tool that can see how a person deals with food insecurity which is calibrated globally in order to ascertain the main indicators of food insecurity [18] and qualitative research used interviews with the Village Head and Head of the Food Security Division as informants regarding the conditions of food security and insecurity before and after the occurrence of earthquake disaster.

Sampling in this study used the proportionate stratified random sampling technique, i.e. technique used if the population has members or elements that are not homogeneous and stratified proportionally [19]. This technique uses grouping villages by the number of damaged houses so that the sample population is grouped or categorized into strata (stratified) with categories of light, moderate and heavy damage. Furthermore, to calculate the sample size of a predetermined population used the Slovin formula [20] :

$$n = N / 1 + N e^2 \quad (1)$$

Notes : n = Sample size

N = Population size

e = Error tolerance (0.1 or 10%)

$$n = 4.249 / 1 + 4.249 (0.1)^2 \quad (2)$$

Based on the calculation results above, the minimum number of samples studied was 98 respondents.

To calculate the proportion of stratified samples, use the proportionate formula :

$$ni = (Ni / N) n \tag{3}$$

- Notes : *ni* = Number of sample members
- Ni = Total population according to stratum
- N = Number of total population members (4.249 damaged housing units)
- n = Number of samples (98 respondents)

**Table 1.** Sample Proportion

Villages	Sample Calculation	Total Sample	Rounded Samples
Galudra	1.033/4.249 × 98	23.82	25
Wangunjaya	1.427/4.249 × 98	32.91	33
Cibulakan	1.799/4.249 × 98	41.49	42

From the results of calculations using slovin formula, the sample size was 100 respondents.

### 3 Results

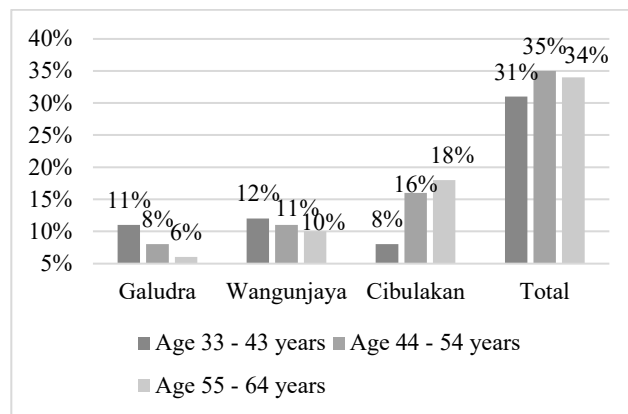
#### 3.1 Food Security based on Desirable Dietary Pattern Score

The desirable dietary pattern score for Cianjur District in 2023 before the earthquake disaster occurred based on 2022 SUSENAS data was 80,5 which was included in the medium category. Regarding the data, consumption patterns in 2022 for the grains and fatty oils food group have reached the ideal desirable dietary pattern score [21].

Meanwhile, the food groups of tubers, animal foods, oily fruit/seeds, nuts, sugar and vegetables and fruit still need to be improved again to achieve the ideal score, these six food groups are included in food insecurity which means the role of consumption of animal-based plant food groups, vegetables and fruit is an important key in increasing the district's desirable dietary pattern score.

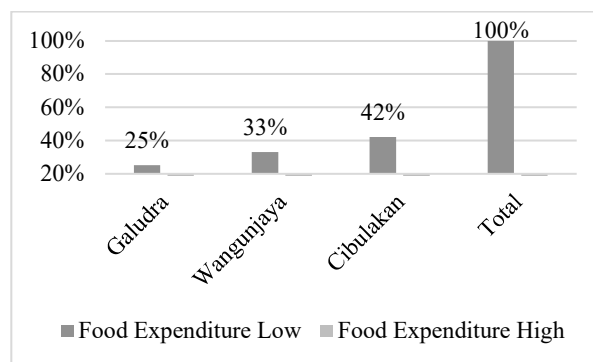
#### 3.2 Food Security

Family level food security can be calculated using food expenditure indicators and energy consumption levels. The following tables are respondents's age, the proportion of food expenditure for each village (Figure 2), average food and non-food expenditure (Figure 3), energy consumption intake (Figure 4) and food security based on proportion of food expenditure and energy consumption levels (Figure 5).



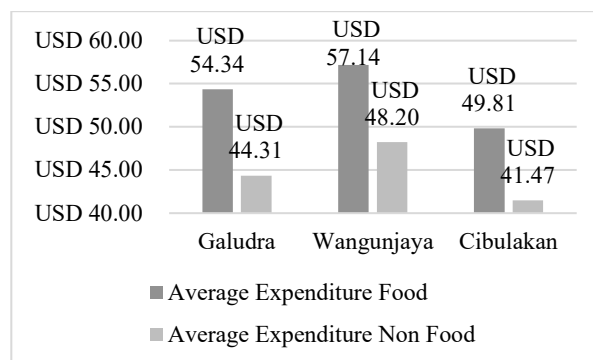
**Fig. 2.** Respondent's Age.

Regarding the respondent's age of the each villages, it shows that respondents aged 33-43 years in the three villages were 31%, aged 44-54 years were 35% and aged 55-65 years were 34%. Consistent with previous finding [21], Age 15-64 years is relatively young and is related to the level of productivity, especially for jobs that require physical strength. As age increases, productivity will decrease, which will result in reduced household income.



**Fig. 3.** Food expenditure with two categories. Low food expenditure and high food expenditure.

Regarding the food expenditure of the each villages, it shows that the three villages Galudra, Wangunjaya and Cibulakan have low food expenditure with a total percentage of 100%.



**Fig. 4.** Average of food expenditure and non-food expenditure.

Regarding the average food and non-food expenditure, it shows that the average food expenditure in the three villages ranges from USD

49.81 to USD 57.14, while non-food expenditure in the three villages ranges from USD 41.47 to USD 48.20.

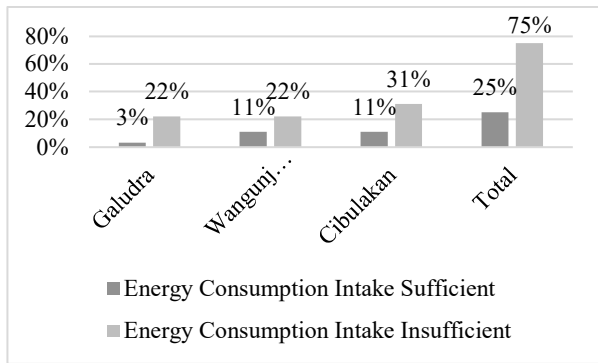


Fig. 5. Energy consumption intake with two categories, insufficient energy consumption level and sufficient energy consumption level.

Regarding the energy consumption intake, it shows that the sufficient energy consumption level (>80%) in the three villages at 25%, while the insufficient energy consumption level (<80%) in the three villages at 75%.

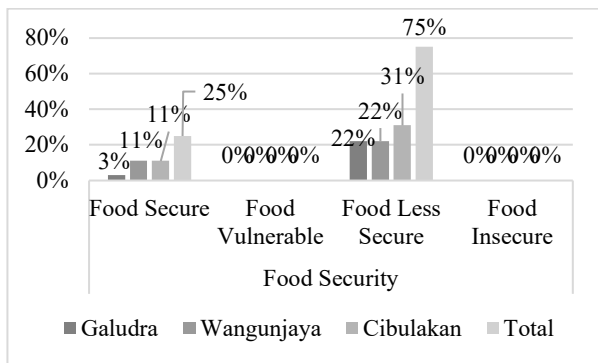


Fig. 6. Food security based on proportion of food expenditure and energy consumption level. For food secure is low food expenditure and sufficient energy consumption, food vulnerable is high food expenditure and sufficient energy consumption, food less secure is low food expenditure and insufficient energy consumption and food insecure is high food expenditure and insufficient energy consumption.

Regarding to food security, proportion of low food expenditure and insufficient energy consumption level of 75% is included in the food less category, while the proportion of low food expenditure and sufficient energy consumption level of 25% is included in the food secure category.

### 3.3 Food Insecurity

Food insecurity is measured using the FIES indicator based on respondents' life experiences regarding food access during the last 12 months. Regarding the results of calculations carried out on food insecurity using FIES (Figure 7).

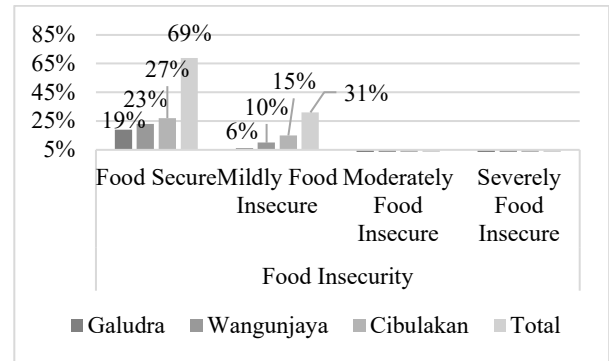


Fig. 7. Food insecurity based FIES indicators with four categories there are food secure, mildly food insecure, moderately food insecure and severely food insecure.

Regarding the food insecurity, it shows that 69% of respondents are food secure category and 31% are mildly food insecure category. If calculated from the 8 questions regarding experiences of food insecurity, 32% of respondents have had concerns about not having enough food to eat, 3% of respondents have never been able to eat healthy and nutritious food, and 3% of respondents have only eaten a few types of food.

### 3.4 Food Security and Insecurity before and after the Earthquake Disaster

Data analysis includes data reduction activities, data presentation and drawing conclusions. Regarding food security and food insecurity before and after the occurrence of the earthquake disaster, there are 6 sub-foci, including:

Sub Focus 1: What was the condition of food security before the earthquake disaster?

Sub Focus 2: What is the impact of the earthquake disaster on the agricultural sector?

Sub Focus 3: What is the availability of food when an earthquake occurs?

Is food access economically and physically sufficient when an earthquake occurs?

Sub Focus 4: What is the condition of food security after the earthquake disaster?

Sub Focus 5: What are the government's efforts when an earth disaster occurs?

If there is aid, from whom and in what form?

Sub Focus 6: What are the government's efforts to maintain food security and insecurity after the earthquake?

Is there a program to anticipate food security and insecurity when natural disasters occur?

If so, by whom is the program carried out and in what form?

## 4 Discussions

### 4.1 Food Security based on Desirable Dietary Pattern Score

The Desirable Dietary Pattern score of Cianjur District in 2022, before the occurrence of the

earthquake disaster, had a score of 80,5, which was included in the medium category, with consumption of food groups that had reached the ideal score, namely the food groups of grains and fatty oils.

Thus, to determine food security after the earthquake disaster based on the baseline desirable dietary pattern score in 2022, a projection was carried out to find out the future desirable dietary pattern score and also the duration needed by the Cianjur District Government to achieve the National desirable dietary pattern score target in accordance with the National Medium Term Development Plan (RPJMN) 2024 of 95,2 point [22].

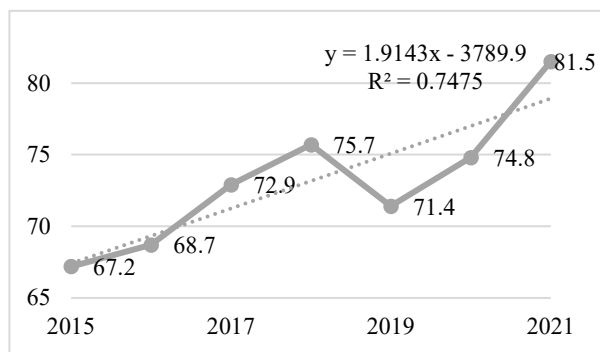


Fig. 8. Desirable Dietary Pattern Score 2015-2021

If calculated based on simple linear regression from the desirable dietary pattern score from 2015 to 2021, a linear regression equation is obtained (Figure 8). Where the equation is

$$y = 1.9143x - 3789.9 \quad (4)$$

Notes :

y = Dependent variable (Desirable Dietary Pattern Score)

x = Independent variable (Year)

$R^2$  = Coefficient of determination. That an  $R^2$  square value of 0.75 is included in the strong category, an  $R^2$  square value of 0.50 is included in the moderate category and an  $R^2$  square value of 0.25 is included in the weak category [23].

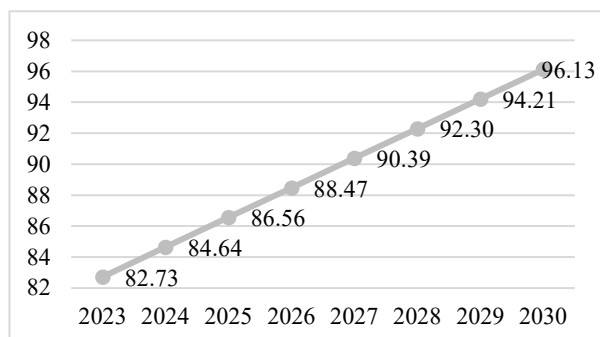


Fig. 8. Desirable Dietary Pattern Score 2023 – 2030

In our study, the 2023 Desirable Dietary Pattern score after the earthquake disaster of 82,72 points is included in the medium category. Meanwhile, in 2030 Cianjur District can achieve the 2024 National desirable dietary pattern target

stated in the 2020-2024 National Medium Term Development Plan (RPJMN).

Therefore, from the desirable dietary pattern score before the 2022 earthquake disaster and to achieve the desirable dietary pattern score after the 2023 earthquake disaster and the National desirable dietary pattern score target for the tuber food groups, animal foods, oily fruit/seeds, nuts, sugar and vegetables and fruit requires more attention in terms of increasing consumption, where this food group is included as a source of protein, vitamins and minerals.

## 4.2 Food Security

In our study, food security is based on the proportion of food expenditure and level of energy consumption in the three villages, around 25% of families are food secure, lower than families food less secure which is 75%. The large percentage of families who are at the food insufficiency level means that food expenditure is low at <60% and the level of energy consumption is less than <80%. This is because the family's energy consumption level is still below 80% of the Energy Adequacy Rate (AKE) and to calculate energy consumption intake only a 24-hour food recall time period is used. Household consumption patterns are dominated by rice, eggs and salted fish. Rice is the staple food menu, eggs are the most affordable and easy food menu while salted fish is the type of fish most often consumed. Thus, respondents did not consume a variety of foods to increase energy within a 24-hour period and respondents only ate at breakfast and lunch or breakfast and dinner. Almost every head of the family consumes cigarettes and coffee so that the energy obtained is very less.

Consistent with previous finding [24], where food security uses the AKE approach and the Food Expenditure Share (PPP) of farmer households affected by the earthquake in Kayangan Subdistrict, North Lombok District is classified as food insecure (40% food insecure, 11.43% food less secure and 14.29% food vulnerable). In this case, the earthquake that occurred last year had a significant impact on the food security of farming households.

## 4.3 Food Insecurity

In our study, the condition of food insecurity based on overall life experience is included in the food secure category with a percentage of 69% and the moderately food insecure category with a percentage of 31% regarding food access. If calculated from the 8 questions regarding food insecurity experiences, 38% of them are mildly food insecure. This is because several respondents have experienced a lack of money or other resources during the last 12 months.

Consistent with previous finding [25], that the proportion of food insecure households during the COVID-19 pandemic using FIES was 29.8% consisting of 19.9% mild food insecurity, 7.4% moderate food insecurity and 2.6% severe food insecurity. This is caused by disrupted economic access to food.

And consistent with previous finding [26], based on FIES scores 77.8% of youth reported mild food insecurity, 11.2% reported moderate food insecurity, and 11.0% reported severe food insecurity. During the three-year period leading up to the Gallup World Poll (GWP) survey year (2015–2017) a total of 828 climate-related disasters occurred within the 142 countries of interest, resulting in 27,508 reported deaths. Of those disasters 47.7% were floods, 33.2% were storms, 6.6% were landslides, 4.5% were wildfires, 4.1% were droughts, and 3.9% were extreme temperatures.

#### 4.4 Food Security and Insecurity before and after the Earthquake Disaster

In our study, for food security conditions before the occurrence of the earthquake disaster were still safe and normal. Judging from the availability aspect with rice production of 617,941 tons, the food access aspect is seen from the average per capita expenditure of the population of IDR. 867,547/month or 54,83 USD and the food consumption figure is 2,085 kcal/day [25], The availability of food during the earthquake disaster was very sufficient because of the assistance. Economic and physical access to food when an earthquake occurs is sufficient, but there are several areas where it is difficult to access food due to damage to infrastructure such as roads and bridges. Food security conditions after the earthquake disaster have begun to improve due to the excess availability of rices. The government's efforts to maintain food security and insecurity are carried out very well through existing programs and also budgeting funds for food security and insecurity.

Consistent with previous finding Setiawan [27], that on average food availability in Serang District in each subdistrict is in a condition where food security is quite adequate and the average access to food in rural areas in the District Serang is in the moderately food secure category.

## 5 Conclusions

The food security condition of Cianjur District after the occurrence of the earthquake disaster 2023 is based on desirable dietary pattern score 2022 with a score 82.72 points in the medium category and to achieve the National desirable dietary pattern target with a score of 95.2 points is predicted will be in 2030. The condition of food

security in Cugenang Subdistrict after the disaster is included in the food less secure category with a percentage of 75% due to insufficient energy consumption levels (<80%) and only using the 24-hour food recall method. The condition of food insecurity in Cugenang Subdistrict after the earthquake disaster is included in the food secure with a percentage of 69% due to sufficient food quantity and adequate food quality (food access).

## References

1. P. Utami, S. Budiningsih, Potential and Availability of Local Food Sources of Non-Rice Carbohydrates in Banyumas District. *Journal of Economic and Business Dynamics*. **12**, 150-158 (2015). <https://doi.org/10.34001/jdeb.v12i2.374>
2. R. Gouvea, D. Kapealianis, S. Li, B. Terra, Innovation, ICT & food security. *Journal Global Food Security*. **35**, 100653 (2022). <https://doi.org/10.1016/j.gfs.2022.100653>
3. Food and Agriculture Organization (FAO), An Introduction to the Basic Concepts of Food Security. (Food and Agriculture Organization, 2008)
4. Cugenang District, Number of House Damages due to the Earthquake in Cugenang Subdistrict, (Cugenang Subdistrict, Cianjur District, 2023)
5. S. Nurjannah, Syarifudin, Study on Food Security of Farm Households Post Earthquake in Kayaangan Subdistrict North Lombok District. *Agrimansions*. **22**, 22-38 (2021). <https://doi.org/10.29303/agrimansion.v22i1.506>
6. K. Nainggolan, General Food Security Policy, (Dewan Ketahanan Pangan, Departemen Pertanian, Departemen Kesehatan dan DPP Pergizi Pangan, Jakarta, 2006)
7. Food and Agriculture Organization (FAO), Methods for Estimating Comparable Rates of Food Insecurity Experienced by Adults throughout the World. (Food and Agriculture Organization, Rome, Italy, 2016)
8. A. Jubayer, S. Islam, A. Nowar, Md. M. Nayan, and Md. H. Islam, Validity of Food insecurity experience scale (FIES) for use in rural Bangladesh and prevalence and determinants of household food insecurity: An Analysis of data from Bangladesh integrated household survey (BIHS) 2018-2019. *Heliyon*. **8** (2023). <https://doi.org/10.1016/j.heliyon.2023.e17378>
9. Fahriyah, C.P. Nugroho, Analysis of Food Material Balance (NBM) and Desirable Dietary Pattern. *Agrise*. **15**, 155 (2016). <https://agrise.ub.ac.id/index.php/agrise/article/view/174>.
10. Badan Ketahanan Pangan, Guide to Calculating Desirable Dietary Pattern, (Badan Ketahanan Pangan, Jakarta, 2015)

11. Hardiansyah, S. Madanijah, and Y. Baliwati, Analysis of Food Ingredients Balance and Desirable Dietary Pattern for Food Availability Planning, (Departemen Pertanian, Bogor, 2002)
12. Badan Ketahanan Pangan, Calculation of Desirable Dietary Pattern, (Badan Ketahanan Pangan, Jakarta, 2022)
13. Sugiyono, Combinations Research Methods, (CV. Alfabeta, Bandung, 2017)
14. W. Wipulanusat, K. Panuwatwanich, R. A. Stewart, and J. Sunkpho, Applying Mixed Methods Sequential Explanatory Design to Innovation Management, in Proceedings of The 10<sup>th</sup> International Conference on Engineering, Project, and Production Management (2020)
15. Sugiyono, Quantitative, Qualitative and R&D Research Methods, (CV. Alfabeta, Bandung, 2017)
16. A. Arida, Sofya, and K. Fadhiela, Analysis of Household Food Security based on the Proportion of Food Expenditures and Energy Consumption (Case Study of Farmer Households Participating in the Food Independent Village Program in Indrapuri Subdistrict, Aceh Besar District). *Agrisep*. **16**, 20 (2015).  
<https://jurnal.usk.ac.id/agrisep/article/view/3028/2890>
17. N. Huzaila, Y. Evawany, Description of Eating Patterns and Work Fatigue among Hired Workers at PT Karya Mandiri Prima Langkat District. *Journal of Health and Medical Science* **1**, 242 (2022)
18. E. K. Kim, J. O. Fenyi, J. H. Kim, M. H. Kim., et al, Comparison of total energy intakes estimated by 24-hour diet recall with total energy expenditure measured by the doubly labeled water method in adults. *Nutrition Research and Practice*, **16**, 646 (2022)  
<https://doi.org/10.4162/nrp.2022.16.5.646>
19. B.B. Balana, A. Ogunniyi, and M. Oyeyemi, COVID-19, food insecurity and dietary diversity of households: Survey evidence from Nigeria, *Food Security*. **15**, 219 (2023).  
<https://doi.org/10.1007/s12571-022-01312-w>
20. Sugiyono, Educational Research Methods Quantitative, Qualitative and R&D approaches, (CV. Alfabeta, Bandung, 2014)
21. H. Umar, Research Methods for Business Theses Second Edition, (Rajagrafindo Persada, Jakarta, 2009)
22. Dinas Tanaman Pangan Hortikultura Perkebunan dan Ketahanan Pangan, Situation Analysis Report and Consumption Patterns in 2023, Cianjur District, (Dinas Tanaman Pangan Hortikultura Perkebunan dan Ketahanan Pangan, Cianjur District, 2023)
23. A. Herdiana, D.H. Darwanto, and J.H Mulyo, Household Food Security in Ciamis District, *SEPA*. **11**, 21 (2014)  
<https://doi.org/10.20961/sepa.v11i1.42247>
24. Peraturan Presiden Republik Indonesia, Attachment to Presidential Regulation of the Republic of Indonesia Number 18 2020 concerning National Medium Term Development Plan 2020-2024, (Peraturan Pemerintah Republik Indonesia, Jakarta, 2020)
25. M. Iqbal, Understanding R Square (Coefficient of Determination in Scientific Research). Available online:  
<https://accounting.binus.ac.id/2021/08/12/memahami-r-square-koefisien-determinasi-dalam-penelitian-ilmiah/>
26. S. Nurjannah, Syarifudin, Study on Food Security of Farm Households Post Earthquake in Kayaangan Subdistrict North Lombok District. *Agrimansions*. **22**, 22 (2021).  
<https://doi.org/10.29303/agrimansion.v22i1.506>
27. D. L. Sufyanm M.N.H. Syah, and Nurbaya, Prevalence and Factors Associated to Household Food Insecurity During COVID-19 Outbreak. *J. Public Health Science*. **12**, 143 (2021)  
<https://doi.org/10.26553/jikm.2021.12.2.143-153>
28. I. Sharpe, C.M. Davison, Investigating the role of climate-related disasters in the relationship between food insecurity and mental health for youth aged 15-24 in 142 countries. *PLOS Glob Public Health*. **2**, 1 (2022).  
<https://doi.org/10.1371/journal.pgph.0000560.s001>
29. Badan Pusat Statistik Kabupaten Cianjur, Cianjur District Regional Statistics for 2023, (Badan Pusat Statistik Kabupaten Cianjur, Cianjur District, 2023)
30. M.A. Setiawan, T.I. Noor, L. Sulistyowati, and L. Trimio, The Impact of Disaster on Food Security in Serang Regency, Banten Province, in Proceedings of the National Seminar on Agribusiness Research Result (2022)