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Factors Affecting Household Food Security of Rice Farmers (Case Study on Rice Farmers' Households in Banjar Regency after the Flood Disaster)

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Abstract:
Background: *. South Kalimantan has a wide potential of agricultural land which is dominated by swamp land with a recorded area of 4,969,824 ha, consisting of tidal swampland, peatland, and lowland swamp which have the potential for regional-based integrated agriculture development. This great potential is part of the food security system that must be considered to maintain the availability and adequacy of food in South Kalimantan Province. This great potential is not necessarily safe without threats and disasters, with flat area conditions and low elevations and empties into the sea making several districts and cities in South Kalimantan prone to flood disasters, one of which is in the research location of Banjar Regency which will certainly have an impact on Damage to agricultural land and its subsequent consequences affect the income of farmers and affect the pattern and level of food consumption, which in turn is used as an indicator of the farmer's household in terms of food security status. This study was conducted to analyze the food security of rice farmers' household in Banjar Regency after the flood and to analyze the factors that influence the food security of rice farmers' households after the flood in Banjar Regency, South Kalimantan.*
Material and methods: *The research area selection method in this study uses a purposive approach. 1) The first stage: selecting 5 sub-districts (Sub-districts of Sungai Tabuk, West Martapura, East Martapura, Astambul and Karang Intan) from 9 sub-districts in Banjar Regency which indicated food insecurity due to severe flooding with high Water (TDC) 20 to 100 cm. 2) Second stage: selecting two villages in each sub-district based on the flood-affected areas. 3) The third stage of each village is determined by the number of samples to represent the population by proportionate random sampling with the number of samples taken is 100 farmers. In this study, to answer the first objective is to analyze the resilience of rice farming households in Banjar Regency after the flood in early 2021 using a simple tabulation analysis method (univariate analysis) where the analysis of food security is distinguished in the form of percentages, then to answer the second objective, analyzing the factors that influence the food security of rice farmers' households after the flood in Banjar Regency, South Kalimantan Province was carried out using a multiple logistic regression analysis models* using SPSS 25.
Results: *The results showed that the average energy consumption of rice farmers after the flood in Banjar Regency was 1,784 cal/cap/day, meaning that there was still a shortage of 316 cal based on the recommendation of the National Food and Nutrition Widyakarya (WNPG) XI in 2018 that the Energy Adequacy Level (TKE) 2100 kcal/capita/day. While the average protein consumption of rice farmers after the flood in Banjar Regency was 64 g/cap/day, this indicates that there is no protein deficiency based on the recommendation of the National Food and Nutrition Association (WNPG) XI of 2018 that the Protein Adequacy Level (TKP) 57gram/capita/day, or a protein surplus of 7.1 grams/capita/day. The number of farmers classified as food insecure dominates, which is as much as 70%. Meanwhile, 30% of farmers are classified as food insecure. Based on the binary logistic regression model, it shows that the variables that affect the food security of rice farmers' households in Banjar Regency after the flood in early 2021 are income, education of the head of the household, number of household members, the share of food expenditure and categories of small or non-small farmers. For every one hundred thousand rupiah increase in farmer household income, the household's chances of becoming food insecure will increase by 1,377 times. Every one year increase in farmer education will increase the chances of households becoming food insecure by 1,327 times. Each additional 1 member of the household will reduce the chance of the household becoming food insecure by 0.468 times. Every one percent increase in the share of food expenditure will reduce the chances of households becoming food insecure by 0.956 times. Every farmer who is categorized as non-farm will have the opportunity to become a food-insecure household 8,769 times that of a household in the low-income category..*

Keyword*: Food Security, Post Flood, Food Consumption*

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I. Introduction

Indonesia is known as an agricultural country because most of Indonesia's population has a livelihood as farmers or farming, so the role of the agricultural sector is expected to improve the economy and meet food needs. According to Law no. 18 of 2012, everyone has the right to get proper food and according to their needs. Food Security is a human right.

The province of South Kalimantan has a wide potential of agricultural land which is dominated by swampland with an area of 4,969,824 ha which is a potential for the creation of food security. However, this potential is not immediately safe without threats from disasters, such as floods that hit in early 2021 because the condition of the flat area and low elevation and empties into the sea made several regencies and cities in South Kalimantan affected by flooding, which of course will have an impact on potential land damage agriculture.

Banjar Regency is one of the rice granaries in South Kalimantan known as "Kindai Limpuar, spread over 20 sub-districts with a total of 51,873 farmers. Data from the Department of Food Crops and Horticulture of Banjar Regency, there are 1,339 farmer groups with 178,622 kg of rice seedlings affected by the flood and an area of 3,219.70 Ha of rice plants affected by the flood. Puso seedlings are 45,177 kg and the plant area is 1,292 ha. If the estimated productivity is the same as the first subroud in 2020 (January – April) of 3.65 tons/ha, then the estimated production loss due to puso plants is 4,267 tons. This causes farm incomes to have the potential to decrease, the further consequence is that it affects the pattern and level of food and non-food consumption, which in the end will determine the level of resilience of the farmer's household. Therefore, research on the food security of farmer households and other factors that are thought to be related to food security needs to be carried out on rice farming households in Banjar Regency after the flood.

II. Material and Methods

This research was conducted in five sub-districts in Banjar Regency, South Kalimantan Province. The selected agricultural area is an agricultural area that produces lowland rice and in January 2021 it was flooded. The research was conducted from March to November 2021 which includes preparation, implementation, data processing, and report generation.

Data Sources The data sources of this research are primary data and secondary data. Primary data were obtained directly from respondents based on a questionnaire. Primary data sources were obtained through questionnaires given to rice farmers affected by floods. The data of this study include farmer household income, education level of the head of household, number of household members, household expenditure of rice farmers, availability of rice/grain stock that was lost/damaged by flooding, data on the area of land arable for farming to determine the classification of smallholders and non-farm, and food consumption data for the heads of farmer households in Banjar Regency affected by the flood. Secondary data obtained from other parties are needed to support the analysis and discussion, secondary data can be in the form of written evidence, journals reports from researchers, and related institutions in this study. In this case, the support for researchers is from books, research journals, the Central Statistics Agency for Banjar Regency and the Central Statistics Agency for South Kalimantan Province.

The research area selection method in this study uses a purposive approach , namely the research area is selected based on certain considerations. The sampling process was carried out through stages, namely: 1) The first stage: selecting 5 sub-districts (Sub-districts of Sungai Tabuk, West Martapura, East Martapura, Astambul and Karang Intan) from 9 sub-districts in Banjar Regency which indicated food insecurity due to severe flooding with high Water (TDC) 20 to 100 cm. 2) Second stage: selecting two villages in each sub-district based on the flood-affected areas. 3) The third stage of each village is determined by the number of samples to represent the population by proportionate random sampling with the number of samples taken is 100 farmers.

To answer the first objective is to analyze the resilience of rice farming households in Banjar Regency after the flood in early 2021 using a simple tabulation analysis method (univariate analysis) where the analysis of food security is distinguished in the form of percentages. To determine the level of household energy and protein adequacy, it is based on the recommendations of the National Food and Nutrition Association (WNPG) XI of 2018, namely the energy adequacy level (EAL = 2100 kcal/capita/day) and the protein adequacy level (PAL = 57gram/capita/day), is calculated using the following formula:

EAL= Total Household Energy Consumption x 100% / Recommended Nutritional Adequate Energy

PAL= Total Household Protein Consumption x 100% / Recommended Nutritional Adequate Protein

In this study, to calculate energy and protein consumption per capita using the food recall method 1x24 hours, namely asking the food/drink consumed by respondents in this case are farmers yesterday. Food recall was taken twice for each respondent, then data from food consumption was processed using the Nutri2008 application and the result was the amount of energy and protein intake consumed by the respondents. The criteria for determining household food security are based on Table 1. below:

Table 1. Criteria for determining household food security

Energy Adequacy Level	Protein Adequacy Level		
	≤ 75	75 – 100	100
≤ 75	Food insecure	Food insecure	Food insecure
75 - 100	Food insecure	Food Resistant	Food Resistant
≥100	Food insecure	Food Resistant	Food Resistant

Source: Sukandar, et al, 2001

Meanwhile, to answer the second objective, analyzing the factors that influence the food security of rice farmers' households after the flood in Banjar Regency, South Kalimantan Province was carried out using a multiple logistic regression analysis models, because the dependent variable (food security) is categorical data. In this study, households categorized as food insecure = 0, while households not food insecure = 1.

Mathematically determining the probability (opportunity) of food security in rice farmers' households after the flood in the logistic model can be calculated through the estimation of Odds Ratio (OR) which is an exponential calculation of the multiple logistic regression line equation with the following formula:

Odds Ratio (OR) = e z = e

Furthermore, if these odds are logged, a log-odds or multiple logistic regression model will be obtained for the food security of rice farmers' households after the flood in Banjar Regency as follows:

$$Ln\frac{P}{1-P} = Z = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6$$

Description :

Z = Probability of household food security rice farmer's ladder after the flood

A = intercept

B = logistic coefficient (from 1,2,...,6)

X1 = Income per capita (Rp/capita/month)

X2= Head of household education (years)

X3 = Number of household members (person)

X4 = Food Expenditure Share (%)

X5 = Amount of rice/grain availability lost (kg)

X6 = Small and non-smallholder farmers (dummy), smallholders = 0, non-small farmers = 1

To determine whether the model formed is correct or not, namely the Hosmer and Lemeshow Test or also called the Googness of fit test (GoF). To see the suitability of the Logit model, a partial parameter test (Wald test) was carried out with the SPSS 25 application.

III. Result

Household Income. Farmer household income in this study is spread over various sources of income from various forms of work or business. Most of the farmers in the research area do not only rely on income from farming, but there are other jobs as a sideline. The distribution of farmers' income by occupation can be seen in Table 2. below:

Table 2. Average household income of farmers by type of work

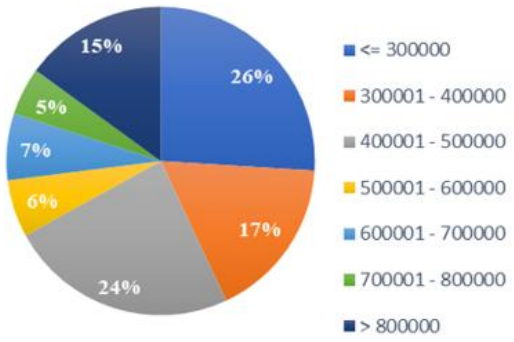
No.	Category	Type of work	Income (Rp/month)
1	*On Farm*	Rice Farming	1.102.133
		Horti Farming	1.004.500
		Cattle	1.037.037
		Plantation	1.429.696
2	*Off Farm*	Farmworkers	576.815
		Fisherman	401.309
3	*Non Farm*	Trade	1.492.982
		Builder	472.222
		Others	1.203.750

Based on the data presented in Table 2. shows that income from non-farm businesses as traders provide the largest contribution from other types of work, this is because several sub-districts in the research location, such as Sungai Tabuk District, Martapura Barat District, and Martapura District East, some respondents live on the side of the road that runs parallel to the Martapura river which is the main road between sub-districts and is an alternative road from downtown Banjar Regency to Banjarmasin City, making the causeway busy and very strategic for trade activities. Some respondents traded in grocery stores, traded vegetables and fruits in between their farming activities.

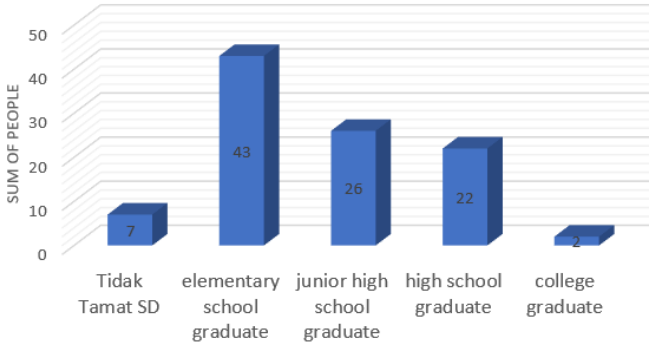
Farm laborers and river fishermen are jobs carried out by respondents to help increase income which are carried out on the sidelines of rice farming activities. When farmers have finished doing farming on their own land, they can help other farmers do farming as laborers. Some farmers also catch fish in rivers which are then sold in the form of dried fish and sold along the Martapura causeway to Banjarmasin City.

Another job that has a fairly large contribution to income is the rubber plantation sector which is carried out by several farmers in Karang Intan District. Geographically, the Karang Intan sub-district has a diverse topography, so that several types of plantation land and food crops are found in Karang Intan District. Some farmers there do rice farming and plantations, they do this because of the characteristics of the land that supports it, so that it has the potential to increase income.

The condition of income/capita/month of rice farmer households in Banjar Regency after the flood in early 2021 can be seen in figure below:

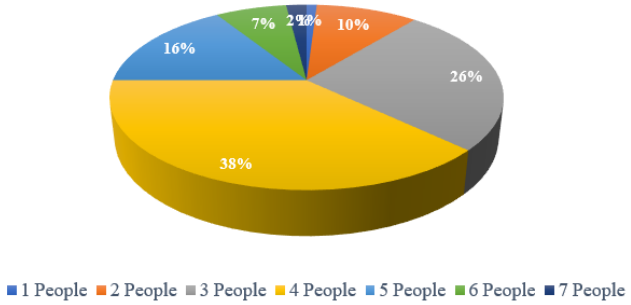


Based on the data presented in figure above, it can be seen that the number of farmers with the lowest income, namely income IDR 300,000/capita/month, dominates the distribution of farmer household income by 26%. Meanwhile, the number of farmers with relatively high income, namely income Rp.800,000/capita/month is only 15%.



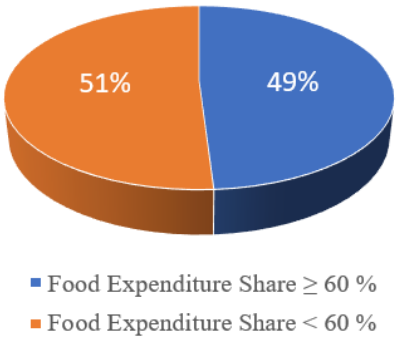
Head of Household Education Level. The head of the household Education level can be used as a reflection of the socio-economic conditions in the community. Based on the data presented in Figure 2 shows that the household education level is dominated by elementary school graduates, namely 43 people (43%), while the education of the head of the household with a college degree is only 2%. If you look at the graph in figure below. it can be seen that the number of elementary school graduates up to a higher level of education has decreased, meaning that there are fewer farmers with higher levels.

Number of Family Members. The number of family members of rice farming households in Banjar Regency varies, but is dominated by households with 4 or 3 family members. Look at the graph in figure below:



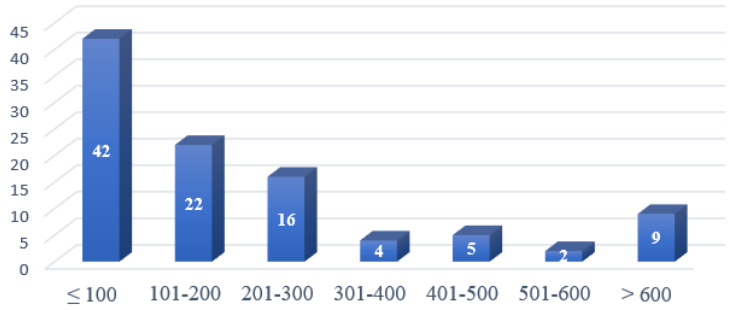
In this study, children who are married and have their own household are no longer counted as family members whose daily life is no longer borne by their parents, but still counts people who are included in the family's dependents, such as parents in our care.

Food Expenditure Share. The share of food expenditure is one indicator of food security, the larger the share of expenditure on food means that food security is decreasing. The higher the welfare of the people of a region, the share of food expenditure of the population is getting smaller, and vice versa. A farm household is said to be food insecure if the PPP value is less than 60%. On the other hand, if the PPP value is more than or equal to 60%, the farm household is classified as not yet food secure. (Sinaga and Nyak Ilham, 2007).



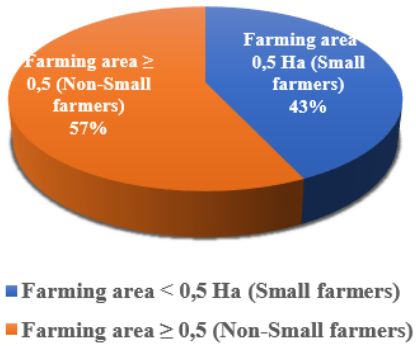
This study shows that 51% of respondents from farmer households have a share of food expenditure <60% and 49% have a share of food 60%. This means that when measured based on the share of food expenditure, 51% of respondents are considered food insecure and 49% of respondents are not food insecure.

Amount of Lost/Damaged Grain Due to Flood. The availability of rice and unhulled rice stored by farmer households is a reserve of staple food that can be consumed at any time when needed or sold to obtain other goods or services in fulfilling the farmer's household life.



In picture above, it can be seen that not many farmers have lost large amounts of grain. On average, farmers lose 29 grains of grain or about 290 kg. This is because before the flood occurred, farmers had harvested and most of them had been sold, so that economically it did not have much impact on the family economy because only a little grain was lost or damaged. A total of 42 farmers who lost less than 100 kg of grain, lost 101-200 kg as many as 22 farmers and lost more than 600 kg as many as 9 farmers.

Small and non-small farmers. The availability of rice and unhulled rice stored by farmer households is a reserve of staple food that can be consumed at any time when needed or sold to obtain other goods or services in fulfilling the farmer's household life. This study shows that the average area of land controlled by rice farmers for farming is 0.775 ha. If it is categorized as landless or non-low-income, then the average rice farmer in Banjar Regency that is affected by the floods is in the non-small land category, meaning that many farmers whose farming area is more than 0.5 ha. The following is the area of rice farming land cultivated by respondents in this study, which has been categorized into small and non-small farmers. Farmers with the least farming area are 0.114 ha, while the largest farming area is 3.60 ha.

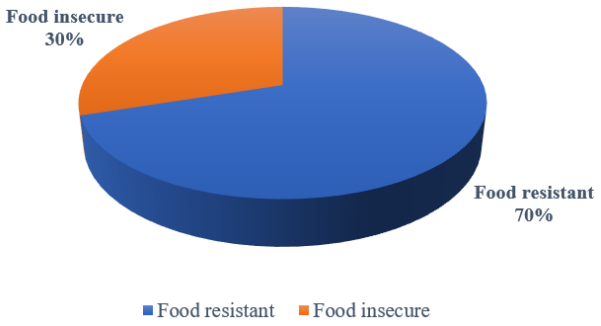


Farmers' Household Food Security. Household food security is determined based on the level of energy and protein consumption which is measured based on the nutritional adequacy that should be met. Households are food insecure if the level of adequacy of energy and protein per capita is > 75%, while households that are not food insecure are those whose level of adequacy of energy and/or protein per capita is 75%. The following Table 3. illustrates the condition of food security of rice farmers' households in Banjar Regency after the flood:

Table 3. Energy and protein consumption of rice farmers in Banjar Regency after the flood

No	Energy (kal/kap/day)	Total (people)	Protein (gr/kap/day)	Total (people)
1	≤ 1.400	10	≤ 50	17
2	1.401 - 1.500	6	50,1 - 55	5
3	1.501 - 1.600	9	55,1 - 60	10
4	1.601 - 1.700	7	60,1 - 65	10

5	1.701 - 1.800	14	65,1 - 70	18
6	1.801 - 1.900	17	70,1 - 75	16
7	1.901 - 2.000	16	75,1 - 80	15
8	2.001 - 2.100	8	80,1 - 85	4
9	> 2.100	13	> 65	5
	Total	**100**		**100**



Based on the data presented in figure above, shows that the number of farmers classified as food insecure dominates, which is as much as 70%. Meanwhile, 30% of farmers are classified as food insecure. In comparison between groups of farmers who are food insecure and those who are not food secure in Banjar Regency after the flood, there are still more who are food insecure, meaning that the impact of flooding in this case does not significantly affect the condition of farmers' food security. Several things might be the reason why the food security condition of rice farmers in Banjar Regency is not too bad after the flood, namely the amount of aid that flows to farmers affected by the flood, even in some places there may be excess aid due to uneven distribution, then many of them the farmers at the time of the flood had finished harvesting, meaning that the sales from farming were still safely stored and utilized for daily needs, besides that what made the farmers still survive in conditions of food security was the abundance of natural resources in the form of rivers and swamps that were abundant. produce high protein from abundant fish.

Multivariate Analysis With Logistic Regression Model

Simultaneous Test , The results of the analysis of the Omnibus Tests of Model Coefficient show that the model produced by Fit based on its sig value (0.000) is smaller with a confidence level of = 5% (sig value 0.000 <0.05), and the Chi Square value count > value Chi table with df = 6 (47,575 > 12,591). This means that there is a simultaneous significant influence of per capita income factors, education of the head of the family, number of family members, share of food expenditure, loss of grain/rice, and category of farmers (small/non-smallholder) on food security of farmer households.

The ability of the independent variable in explaining the dependent variable, the values of Cox & Snell R Square and Nagelkerke R Square are used . These values are also called Pseudo R-Square or if in linear regression (OLS) it is better known as R-Square . Value of Nagelkerker R Square is 0.726 or 72.6% and there are 100%-72.6% = 27.4% other factors outside model that explains the dependent variable.

Hosmer and Lemeshow Test is a Goodness of fit test (GoF) , which is a test to determine whether the model formed is correct or not. It is said to be appropriate if there is no significant difference between the model and the observed value. The value of Chi Square Hosmer and Lemeshow count shows a value of 12,995 while the value of Chi Square table df 8 shows a value of 15.50731. Because the value of Chi Square Hosmer count 12,995 < Chi Square table 15.50731 and the significance value is 0.122 > =5% (0.05). So that the decision taken that the model in this study can be accepted because there is no significant difference between the model and the observed value, then further hypothesis testing can be carried out.

Table 4. The results of the multivariate analysis test between socio-economic variables and household food security of rice farmers in Banjar Regency after the flood

No	Socio-Economic Variables	Koefisien (B)	Wald	Sig.	Exp(B)
1	Income per capita	0,320	4,042	0,044	1,377
2	Head of Household Education Level	0,283	6,162	0,013	1,327
3	Number of Family Members	-0,758	7,165	0,007	0,468
4	Food Expenditure Share	-0,045	4,605	0,032	0,956
5	Amount of Lost/Damaged Grain Due to Flood	0,000	0,001	0,979	1,000
6	Small and non-small farmers	2,171	9,632	0,002	8,769

Source: primary data processing 2021 using SPSS 25 application.

Based on the Logistics Regression test, the following binary logistic regression equation was obtained

$$Logit[P] = \ln\left[\frac{P}{1-P}\right] = 2{,}077 + 0{,}320X_1 + 0{,}283X_2 - 0{,}758X_3 - 0{,}045X_4 + 2{,}171X_6$$

Based on the data presented in Table 3. shows that 5 of the 6 socio-economic variables analyzed have a significant influence. One variable that shows no insignificant effect is the variable amount of grain/rice lost due to flooding, it can be seen from the sig value of 0.979 which is greater than the 5% confidence level (α). The absence of a significant effect between grain loss on food security is related to the small average loss of farmers' grain, because at the time of the flood most of the farmers had already harvested and most had been sold. So that the average loss during the flood is only 29.24 blek or if it is in rupiah, assuming the price of grain is Rp. 50.000,- per batch, the farmer's loss for lost/damaged grain is Rp. 1.462.000,- on average. , the value of the loss can be covered with other income and assistance after the flood.

The household income of rice farmers in Banjar Regency after the flood which is calculated per capita per month has a significant influence on the food security of farmer households, this can be seen from the Sig value of 0.044 which means it is smaller than the confidence level (α) of 5%. In addition, the value of the Odds Ratio on the variable of farmer household income is 1.377. This means that for every one hundred thousand rupiah increase in farmer household income, the household's chances of becoming food security will increase by 1.377 times.

The education of the head of the rice farmer household in the Regency has a significant influence on the food security of the farmer's household, this can be seen from the Sig value of 0.013 which means it is smaller than the confidence level (α) of 5%. In addition, the value of the Odds Ratio on the education variable of the head of the farmer's household is 1.327. This means that for every one year increase in farmer education, the household's chances of becoming food insecure will increase by 1.327 times.

The variable number of family members of rice farmer households in Banjar Regency after the flood has a probability value or sig of 0.007 which is smaller than the confidence level (α) of 5%, which means it has a significant influence on food security of farmer households. The Odds Ratio value for the variable number of household members is 0.468 and looking at the B value or the coefficient of the binary logistic model which is negative, it means that every increase in 1 household member will reduce the chance of the household becoming food insecure by 0.468 times.

The share of food expenditure, which is the percentage of household food expenditure to total household expenditure, has a significant influence on the food security of farmer households, this can be seen from the Sig value of 0.032 which means it is smaller than the confidence level (α) of 5% and the value of Odds Ratio - equal to 0.956. This means that every one percent increase in the share of food expenditure will reduce the chances of households becoming food insecure by 0.956 times.

The category of smallholders or non-smallholders also has a significant influence on the food security of rice farmers' households in Banjar Regency after the flood, this can be seen from the sig value of 0.002 which is smaller than the confidence level (α) of 5%. While the value of the Odds Ratio of 8.769 in the category variables of small and non-small farmers means that every farmer who is in the non-farm category will have a greater chance of becoming a food insecure household by 8.769 times than farmers who are classified as smallholders.

IV. Conclusion

Based on the results of the discussion, it can be concluded:

1. The average energy consumption of rice farmers after the flood in Banjar Regency is 1,784 cal/cap/day, meaning that there is still a shortage of 316 cal based on the recommendation of the National Food and Nutrition Widyakarya (WNPG) XI 2018 that the Energy Adequacy Level (TKE) is 2100 kcal /capita/day. While the average protein consumption of rice farmers after the flood in Banjar Regency was 64 g/cap/day, this indicates that there is no protein deficiency based on the recommendation of the National Food and Nutrition Association (WNPG) XI of 2018 that the Protein Adequacy Level (TKP) 57gram/capita/day, or a protein surplus of 7.1 grams/capita/day.
2. The number of farmers classified as food insecure dominates, which is as much as 70%. Meanwhile, farmers who are classified as food insecure as much as 30%.
3. Based on the binary logistic regression model, it shows that the variables that affect the food security of rice farmers' households in Banjar Regency after the flood in early 2021 are per capita income, education of the head of the household, number of household members, share of food expenditure and the category of small or non-small farmers. gloomy. The effect of each variable shows as follows:

a) Every one hundred thousand rupiah increase in farmer household income, will increase the household's chances of becoming food insecure by 1.377 times.
b) Every one year increase in farmer education will increase the chances of households becoming food insecure by 1.327 times.
c) Each additional one member of the household will reduce the chance of the household becoming food insecure by 0.468 times.
d) Every one percent increase in the share of food expenditure, will reduce the chances of households becoming food insecure by 0.956 times.
e) Every farmer in the non-farm category will have the opportunity to become a food insecure household 8,769 times that of a non-farm household.

V. Suggestion

Based on the results of this study, some suggestions can be given as follows:

1. Increase farmers' income by encouraging efforts to diversify, accelerate, modernize, produce quality and competitiveness by supporting their readiness in agribusiness which includes personal readiness, management, production readiness, marketing, networking and optimal use of technology through technical and practical training.
2. Encouraging the regeneration of farmers with a higher level of education by opening the widest possible information and education opportunities at vocational schools and colleges of agriculture and jointly building the image of conventional agriculture into modern agriculture as an attraction, the end of which is to create farmers young farmers who are more productive and efficient in farming.
3. Encouraging farmers to increase their business scale (small to non-smallholder) through extensification efforts accompanied by various infrastructure supports, access to capital and adequate assistance as an effort to increase production and income.

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