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Research article

The ability of dryland farmer households in achieving food security in food-insecure area of East Nusa Tenggara, Indonesia

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Abstract: Dryland farmer households in food-insecure areas are faced with an unfavorable situation infertile agricultural land, low rainfall, lack of production activity and very limited infrastructure. On the other hand, their needs for food consumption must be fulfilled for a healthy, productive and sustainable life. The purpose of this study is to determine the ability of farmer households to achieve food security in food-insecure areas. This study uses primary data obtained from dryland farmer households by snowball sampling. The ability of dryland farmer households in terms of food availability, access to food, food utilization, energy adequacy rate, protein adequacy rate, the ratio of food expenditure and total expenditure. The households commonly consume local food with the amount of energy and protein sufficiency less than the recommended amount. The food consumption adaptation strategy is applied during the off-season and/or when food stock is running low.

Keywords: food consumption; food insecure area; local food; food availability; access to food; food utilization

1. Introduction

Global hotspots of food insecurity are South Asia and Sub-Saharan Africa [1] and one of the areas in Indonesia [2]. Food insecurity is still a major issue in Indonesia, particularly in East Nusa Tenggara (ENT) Province [3]. Based on data from Dewan Ketahanan Pangan [4] and Badan Pusat Statistik (BPS) [5], ENT is one of the provinces with relatively high poverty and food insecurity. One of the factors contributing to poverty and food insecurity is the condition of natural resources

and dry climate [6,7]. More than 50% of the population work in the agricultural sector, but 37% of the total sub-districts in ENT belong to food-insecure areas. Approximately 83.13% of the areas in ENT are dryland and the rest are rice fields [8].

Sustainable food production in the 21st century is the major challenge in the era of global environmental problems which include climate change, population increase and degradation of natural resources, comprising land degradation and loss of biodiversity [9]. Both climate variability and climate change will exacerbate food insecurity and malnutrition in areas that suffer most from poverty and hunger and are also most vulnerable to extreme weather at this time [10].

The productivity of dryland farming is influenced by soil fertility, land conservation, vegetation, technology, institution and socio-economic condition of the community [11]. Various models of farming systems are adopted by farmers allocated from the limited resources they have or face such as land, labor and capital to maximize their income [12]. Food-crop productivity in food-insecure areas in ENT is lower than the national food-crop productivity [5,13].

The province has a very high level of risk associated with the repetitive drought that will have an impact on the productivity of food crops and other agricultural products. Effective management of dryland farming has a distinct relevance where agriculture plays a key role in meeting the supply of food and raw materials [14]. The majority of farmers indicated that prolonged wet, hot, and dry weather conditions affect the efficient use of their resources and investment decisions. Some specific impacts of these conditions such as crop damage, death of livestock, soil erosion, bush fires, pests, lower incomes [15].

Dryland farming is under great pressure from the social, economic and ecological environment, which later creates new obstacles in the production and management systems of farmers to modify agricultural practices with all the limitations [16]. According Tjoe's [17] research results in West Timor (Nusa Tenggara) show that the main determinants of life vulnerability include agricultural income and subsistence food reserves. The capacity of farmer households to achieve food security in food-insecure areas is important to be examined. This is worthy of note in terms of food availability, access to food, food utilization, energy sufficiency rate, protein adequacy rates and farmer household income. On the other hands, farm households apply strategies to adapt to the conditions of the food crisis, especially when food shortage occurs to avoid starving. This research is expected to provide solution of food crops that can be developed more intensively in the research areas to deal with with food insecurity. Food security is a fundamental element of community health [18].

2. Materials and methods

2.1. Research location

The research location of ENT Province was selected purposively with the consideration that this is a province with relatively high poverty and food insecurity level [19]. The food-insecure area as one aspect of the study is the area with the population experiencing food shortages. The districts observed were selected by considering three large islands. One regency from each island was selected as a sample, by considering that the area was vulnerable to food shortage. Further, two sub-districts in each regency were taken as samples.

Timor Island: Timor Tengah Selatan Regency (Batu Putih and Kota Soe Sub-districts).

Sumba Island: East Sumba Regency (Ngaha Ori Angu and Kambata Mapambuhang Sub-districts).

Flores Island: East Manggarai Regency (Borong and Kota Komba Sub-districts).

From each sub-district, a village with food-insecurity and a village with food-security were taken.

2.2. Sample design and data collection

The population of this research are farmers who cultivate seasonal crops on dryland farming. The farmer sampling method was done using a purposive sampling technique. The participating farmers were those with the ability to communicate and respond to the questions provided by the researchers. Samples of farmers were taken by snowball sampling by considering ease of access to location and communication. The samples in each regency were 80 respondents. The number of samples in the village of food insecurity and food security villages was 40 farmers each. The total farmers participating in this research were 240 people [20]. The data collection methods in this study included survey, interview and observation in 2019. The data on the costs, production and income from agricultural products of households were calculated for one year in 2018. The data on the consumption costs and other household expenditure costs were calculated for one year in 2018 while the data on the household consumption of farmers were the 24-hour consumption recall data. The survey method was carried out by visiting the respondents to obtain the required information.

2.3. Data analysis

Food security is usually examined through three dimensions are availability, access, and utilization of food [21]. Food security beyond the quantity of food available to encompass the needs of communities, households, individuals, offering a more transformative and progressive role for local systems, not with standing the significance of asymmetrical power relations [22]. The condition of food security of farm households was also viewed from the share of food expenditure and the adequacy of energy (kcal) and protein (gram) consumption. The collected data were then tabulated, analyzed descriptively and presented in tables.

The adequacy of energy and protein consumption was measured by comparing the amount of energy and protein consumed with the recommended Energy and Protein Adequacy Rate of 2150 kcal/person/day for energy and 57 grams/person/day for protein (Food Security Agency, 2015). The adequacy of energy and protein consumption was expressed in percentage.

The followings are the categories of food security of farmer households adopted from Maxwell [23].

Food secure: >80% of energy and protein adequacy, share of food expenditure <60% of total expenditure.

Food-vulnerable: >80% of energy and protein adequacy, share of food expenditure ≥60% of total expenditure.

Lack of food: ≤80% of energy and protein adequacy, share of food expenditure <60% of total expenditure.

Food-insecure: ≤80% of energy and protein adequacy, share of food expenditure ≥60% of total expenditure.

The ability of farmer households in achieving food security is seen from the aforementioned indicators.

3. Results and discussion

3.1. The general condition of agriculture in food-insecure areas in ENT

ENT belongs to an area with a semiarid climate, rain periods of 3–4 months and dry periods of 8–9 months. Such conditions contribute to small hydrological potential, especially surface water, and have an impact on the limitations of plant growth and food security.

Agriculture production in developing countries must be increased to meet food demand for a growing population [24]. Plants that are tolerant to drought are cassava and corn [25]. These food crops are cultivated in the research areas and become the staple food, besides rice planted in dryland. Corn, rice and cassava are the main commodities in the studied area [3].

Cultivated and wild biodiversity, where it is part of traditional agricultural and food systems, can be best conserved and enhanced through rational use. On-farm conservation of intraspecific diversity, as well as neglected and underutilized species, are the priority for increased agricultural investment in biodiversity management. Home gardens and urban agriculture offer contexts where functional diversity can be usefully promoted [26]. Home gardens serve as important complementary resources for diet and medicine [27].

The crops cultivated in East Manggarai, East Sumba and Timor Tengah Selatan Regency have similarities and differences. Farmers grow staple foods are rice, corn, peanut and cassava to meet their basic needs of food. These production results are similar to those of farmers' in the Sudan and Guinea Savanna zones, focusing on the production of cereals and legumes as these crops and will give the farmers a competitive advantage [25]. However, farmer households in East Manggarai grow coffee, cocoa and candlenut, while few farmer households in East Sumba grow vegetables. Farmer households in Timor Tengah Selatan grow vegetables and carry out agroforestry such as mahogany and teak. Agroforestry has real potential to contribute to food security and climate change mitigation and adaptation [28].

3.2. The ability of farmer households in achieving food security in food-insecure areas

3.2.1. Food Availability

The interrelationship between water and food security is that water and food security will face major challenges under conditions of climate change [29]. Recent droughts reduced dryland farming production and the volume of water allocated to irrigated agriculture [30] and damage to crops [31]. Due to short rainy period, there are difficulties in seeking water storage to support plants in the dry period. Government and community make some efforts such as building reservoirs, but these can merely support water needs in the beginning of planting in the subsequent period. Climate change, indicated by an increase in average air temperature per year, contributes to the shift in the beginning of the rainy season and the dry season, as well as more extreme rainy and dry seasons. Thus, climate change increases the risk of crop failure. These cause the productivity of food crops in food-insecure areas in ENT to be lower than the national food crop productivity [13]. This is noticeable on the map of the distribution of food commodity productivity in all regencies in ENT published in the Badan Pusat Statistik [13] as presented in Table 1.

Table 1. Productivity of staple food crops in ENT (ton/ha).

Regency	Corn	Dryland paddy	Cassava	Sweet potato
West Sumba	2.54	2.04	19.03	7.05
East Sumba	3.54	3.87	10.25	7.33
Kupang	2.53	2.00	8.43	5.61
South Central Timor	2.53	1.06	5.58	7.66
North Central Timor	2.09	1.34	10.37	8.16
Belu	3.34	2.80	14.24	8.54
Alor	1.92	1.70	13.66	4.75
Lembata	2.10	1.61	15.37	4.00
East Flores	1.66	2.03	9.92	7.51
Sikka	2.08	1.62	7.52	55.67
Ende	2.35	1.66	16.89	12.99
Ngada	2.81	3.37	14.21	8.31
Manggarai	2.64	4.09	9.73	6.24
Rote Ndao	2.91	1.94	11.37	8.64
West Manggarai	2.98	1.89	15.01	6.32
Central Sumba	3.37	3.07	10.21	7.65
Southwest Sumba	2.46	2.23	12.74	7.44
Nagekeo	2.45	2.79	10.41	4.07
East Manggarai	2.65	2.79	6.46	8.39
Sabu Raijua	2.50	2.64	9.26	7.58
Malaka	2.74	1.66	15.26	7.54
Kupang	1.80	2.07	10.34	8.07
Provincial average productivity (ton/ha)	2.51	2.17	10.52	6.98
National average productivity (ton/ha)	5.18	5.34	22.96	16.13

Regional food production is closely linked to food productivity and availability of the farmer's households. Staple foods consumed by the community in the studied area include corn, rice, cassava, yams, taro, pumpkin, and beans. The availability of staple food for farmers' households is largely supported by production domestic agricultural products, purchases, transfers from public programs or other households [32] in Table 2.

Staple foods are mostly resulted from farmers' production. Donation/transfer of rice is a government program aimed at helping poor society. Rice is provided by the government to deal with the food crisis [33] under the "Raskin program", which is 'rice for the poor' [34]. The raskin program is intended for every poor household, in which each household receives 10 kg of rice per month. The average raskin contribution to household rice consumption in Indonesia is about 35% [35], whereas the contribution to households in the study area is approximately 16.3%. This is so for the amount of rice consumption is the studied area is higher.

The ability of farmers to provide food in Table 2, varies depending on the multiple socio-economic and bio-physical factors affecting food systems and hence food security, the capacity to adapt food systems to reduce their vulnerability to climate change, is not uniform [36]. Rice and corn are more available than other products because they are staple food for farmers in East Nusa Tenggara [37]. Farmers in that area consume both types of food by mixing them with vegetables while cooking. The food is so-called '*katemak*', while corn mixed with beans is called '*bose* corn'.

Nuts are added to the mixture as a source of vegetable protein. During the dry season, tubers such as taro and elephant's foot (*Amorphophallus muelleri blume*) are very important for households who have limited stocks of rice and corn which are insufficient for daily needs [38].

Table 2. The average staple food availability of the farmer households in dryland vulnerable to food shortage per year.

Type of food crop	Description						
	Production	Purchase	Donation/ Transfer	Sold	Seed	Given to other farmers	Availability
	(1)	(2)	(3)	(4)	(5)	(6)	(1) + (2) + (3) − (4) − (5) − (6)
Corn (kg)	352.45	43.36	8.12	173.63	12.88	30.31	187.11
Rice (kg)	387.80	245.92	95.17	110.77	15.40	18.84	583.88
Cassava (kg)	111.90	0	1.76	54.14	0	7.08	52.44
Sweet potato (kg)	77.21	0	0	18.14	0	6.03	53.04
Taro (item)	48.11	0.5	0	0	0	2.31	46.30
Pumpkin (item)	43.52	0.4	0	16.11	1.83	1.28	24.70
Peanut (kg)	29.88	0.25	0.12	7.64	2.19	0.85	19.57

Staple food production of corn, rice, pumpkin and peanut can be stored for approximately 5–10 months. Corn and rice are harvested from March-April to be consumed and stored until the next harvest season. Crop storage plays an integral part in ensuring domestic food supply. Effective storage plays an important role in stabilizing food supply at the household level by smoothing seasonal food production. Improved maize storage is urgently required to improve food security and provide potential storage for increased maize production. Besides, progressive production technologies should be investigated to improve yields and minimize production constraints [39]. Cassava, sweet potato, taro and pumpkin are harvested only when the crops will be consumed so that they function as stalls of life. This is so for these crops cannot be stored for a long time, except pumpkin. A timeline with the conservation period for the different harvested crops is as follows.

Table 3. Harvest period of staple food in a year.

Crop	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Corn	*–	*–	+–	+–	*	*	*	*	*	*	*–	*–
Dryland paddy	*–	*–	+–	+–	*	*	*	*	*	*	*–	*–
Cassava	–	–	–	–	–	–	–	+	+	+	+	+
Sweet potato	*–	–	–	–	–	–	–	+	+	+	+	+
Taro	*–	*–	–	–	–	–	–	+	+	+	+	+
Pumpkin	*–	*–	–	–	–	–	+	+	+	*	*–	*–
Peanut	*–	–	+	+	*	*	*	*	*	*	*–	*–

Note: +: Harvested; *: Stored; −: Production period.

Field rice, corn, pumpkin and beans have similar beginning of planting time while cassava, sweet potato and taro are planted after the previous planted crops have already grown. In one area,

there are 3–5 main crops which are intercropped to anticipate crop failure. Therefore, the prioritized crops for development and increased for production are plants that have been produced in this area due to similar agro-climatological conditions. The crops include dryland paddy, corn, cassava, sweet potato, taro, pumpkin and peanut. To develop and increase productivity, it is necessary to introduce and apply Good Agriculture Practices (GAPs) in the management of dry land farming [40].

3.2.2. Food access

Food accessibility includes physical, economic and stability aspects [41]. Farmer households have food growing, by providing convenient access to diverse varieties of affordable and nutritious produce and providing important support for community food security. In this exploratory assessment, home food gardening contributes to community food security. The sustainability of household food sourcing and gardeners' overall health and well-being are also increased with food production. Secure access to suitable land to grow food and gardening skills are the most significant barriers found to residential food production [18].

Farmers' households rarely consume food with imported raw materials. They are accustomed to consuming both self-produced food and local production of basic food, vegetables, side dishes and fruit [22]. Providing a wholesome and adequate food supply is the most basic tenet of agricultural sustainability. The term 'local food' is a food product that is produced and consumed by farmers such as field rice, corn, cassava and vegetables grown around the house. Local food is very important to anticipate off season and rising prices of staples [42], as well as suffer from food poverty [43]. Moreover, local food is the output of the agricultural production adaptation system.

Access to food can also be seen from the ownership of farmland of farmer households. The broader the ownership of agricultural land, the easier access to food is because food is available and easily obtained [44]. However, agricultural land in ENT is relatively far and the access is merely a path from community settlements. Various cropping patterns applied by farm households to meet their food needs are presented in Table 4.

All farmer households prioritize the fulfillment of food from their production [32]. If there are extra yields, they will sell them to meet non-food needs [43]. The purchasing power of farmer households is also seen from the amount of income obtained from various sources namely agriculture and non-agriculture [43], remittances from family members and government programs. Income from food crops is mainly in the form of self-consumed crops [45].

Viewed from the amount of income in Table 5, it is known that farmer households have an average income of IDR 1,251,205.95. With the average household sizes of five persons per household, per capita income per year is IDR 250,241.19. The average per capita income per month is below the provincial poverty line of IDR 322,947 [5]. Income is the most important determinant of household food security [45]. The amount of household income of dryland farmers decreases their purchasing power in accessing food.

The low food coverage is due to the limited road conditions and transportation facilities so that food trade from the area is relatively limited. On the other hand, people's low purchasing power cause them to consume local food. To adapt to urgent food needs during the dry/off season, households implement strategies by selling chickens/goats/pigs, borrowing rice/corn from relatives/neighbors who have excess yields [45,46]. This is the same as that done by households in Burkina Faso [47]. The strategies to increase food coverage in the future include: 1) increasing

productivity to upsurge farmers' incomes, which in turns ultimately escalates their purchasing power; 2) improving transportation facilities and infrastructure to enable easier access for trading and relatively affordable food prices [48]; and 3) multiplying the variety of local food production for more varied sources of nutrition.

Table 4. The average farmland ownership of dryland farmer households in the food-insecure area.

Type of land ownership	Average land square area (Ha)	The farming pattern in a year
Home garden/yard	0.06	Cassava, pumpkin, papaya, spinach, cassava, coconut tree, betel, areca nut Coffee, cocoa, hazelnut, taro, banana Corn, pumpkin, cassava, sweet potato, rice beans/beans Chili, tomato, spinach—gamalia
Tegalan (dry field)	0.97	*Gogo*/upland rice, corn, pumpkin, peanut/bean, sweet potato, mahogany, teak, gamalia, palm *Gogo*/upland rice, corn, pumpkin, peanut/bean- coconut, gamalia, palm, bamboo Spinach, spinach mustard, swamp cabbage, chilies, tomatoes, cabbage, cauliflower—gamalia Beans and long beans—gamalia Coffee, cocoa, hazelnut, coconut, vanilla, betel, areca nut, banana, taro
Ladang (garden/bare land/shifting land)	0.22	*Gogo*/upland rice, corn, peanut/beans, cassava, sweet potato
Total	1.25	

Data source: Primary data analysis 2019.

Table 5. The average income of dryland farmer households in food-insecure areas.

Source of income	Amount of income (IDR/month)	Percentage (%)
Agriculture		
a. Staple food crops	165,704.68	13.25
b. Vegetables	71,203.36	5.70
c. Plantation crops	218,784.38	17.49
d. Animal husbandry	231,013.54	18.47
Non-agriculture	275,052.08	21.99
Remittances from family members	77,739.58	6.22
Raskin program	39,583.33	3.17
Kesejahteraan Harapan Program	172,125.00	13.71
Total	1,251,205.95	100

3.2.3. Food utilization

For people and households with marginal incomes, as prices rise, difficult decisions arise regarding essential expenditure [49]. There may be a reduction in food diversity as more expensive fish, meat, milk and dairy products, nuts, fruits, and vegetables are sacrificed; grains, which may be refined rather than whole-grain are the fall-back food [50].

Nutrition offers a nexus for the changes in individual behavior and motivation essential for fundamental shifts in production and consumption patterns. Biodiversity, where it is part of traditional agricultural and food systems, can be best conserved and enhanced through rational use within a broad-based developmental focus on small-scale and low-input production. The fact that traditional systems, once lost, are hard to recreate underlines the imperative for timely documentation, compilation, and dissemination of eroding knowledge of biodiversity and the use of food culture for promoting positive behavior [26].

The dryland farmer households have very limited variations of food sources. They are accustomed to consuming both staple food and vegetable harvested from their land where the vegetables are grown have few variations [45]. Plants are the sources of carbohydrates, while leaves and tubers can be used as vegetables, such as cassava, sweet potato and pumpkin leaves, as well as taro tubers. Variations of side dishes are more limited due to limited income.

3.2.4. Food consumption share on the total consumption

Jonsson and Toole's research (1991) as quoted and adopted by Maxwell [23], uses indicators of household income and nutritional consumption to measure the degree of household food security. In the 1943 working paper cited by Pakpahan [51], the share of food expenditure has a negative relationship with household expenditure, while food security has a negative relationship with the share of food expenditure.

The highest food consumption is for grain and a small proportion of consumption is for meat, eggs, milk and alcoholic drink. Alcoholic drink or ‘sopi’ is made from palm fruit which is produced by farmer households. Most of the food consumption presented in Table 6 is local food and is produced by dry land farmers. The results of this study are the same as those of [45].

Tobacco and betel are consumed by every family member from children to grandparents because consuming those products is a tradition inherited. The habit of chewing betel and areca nut is the same as that of South and Southeast Asian immigrants, as well as Indian society [52]. According to the farmers, consuming betel and areca nut makes them eager to work, work longer, not easily sick and able to withstand hunger [53]. Whereas research on the effects of betel has proven that chewing betel can cause oral cancer [52,54].

Most of the non-food expenditure of dryland farmer households is for goods, services and houses, respectively. Expenditures on various goods and services are used to purchase clothes/shoes for school children and transportation to buy goods for daily needs in a month. While housing expenditure is mostly used to buy kerosene/diesel oil for lighting at night.

Table 6. The average food consumption of dryland farmer households in food-insecure areas.

Type of food	Amount of consumption	
	IDR/month	Percentage (%)
Grains	462,130.94	46.86
Tubers	61,107.35	6.20
Fish	35,541.67	3.60
Meat	9,367.08	0.95
Egg and meat	10,927.08	1.11
Vegetable	110,477.29	11.20
Beans	20,103.60	2.04
Fruits	30,302.45	3.07
Oil and fat	25,028.55	2.54
Beverage	63,924.79	6.48
Spices	36,590.29	3.71
Other consumption	12,529.29	1.27
Fast food and beverage	14,245.83	1.44
Liquor (alcoholic drinks)	12,126.04	1.23
Tobacco and betel	81,818.90	8.30
Total	986,221.15	100

Table 7. The average non-food expenditure of dryland farmer households in food-insecure areas.

Type of non-food consumption	Amount of consumption	
	IDR/month	Percentage (%)
Housing	70,262.96	20.32
Various goods and services	121,713.82	35.20
Education expenses	82,401.70	23.83
Medical expenses	1,788.19	0.51
Clothes	39,598.26	11.45
Durable goods	3,447.91	0.99
Tax and insurance	24.30	0.04
Social needs	26,508.54	7.66
Total	345,745.68	100

The food consumption of dryland farmer households in food-insecure areas is 74% of the total expenditure. This is in line with secondary data from BPS [55] that the expenditure of rural population and urban population in East Nusa Tenggara in 2012–2016 for food as approximately 60% and 45% of total income, respectively. The highest value of average expenditure per capita in ENT is for food [56].

3.2.5. Energy Consumption Adequacy

The calculation of the Energy and Protein Adequacy Rate is based on the recall of the previous day's consumption of each member of dryland farmer households in food-insecure areas. The conversion of calorie and protein calculation is adjusted to the calorie and protein requirements

depending on the age of each family member. Variation in daily food consumption is limited which results in the low contribution of food types to the amount of energy and protein adequacy.

Table 8. The average energy and protein consumption of dryland farmer household per day.

Type of food	Amount	
	Calorie (kcal/person/day)	Protein (gram/person/day)
Grains	993.01	15.29
Tubers	49.52	0.64
Fish	31.39	2.04
Meat	367.61	1.54
Eggs and milk	15.01	3.15
Vegetable	28.70	1.92
Beans	80.86	4.39
Fruits	67.54	0.80
Oil and fat	0.22	0.01
Beverages	52.23	0.36
Other types of consumption	2.66	0.08
Fast food and beverage	3.69	0.08
Total	1,692.44	30.29
The amount of recommended nutrition adequacy	2,150	57
Level of nutrition adequacy (%)	78.71	53.15

Table 8 shows that the adequacy of energy and protein consumption is less than the recommendation. The amount of income earned by dryland farmer households affects the ability of farmer households to determine the amount and type of food they consume. Also, it is attributable to the less varied food consumption patterns applied by the people in the region. This influences the achievement of nutrition adequacy. In the long run, lack of energy and protein will reduce public health.

3.2.6. Food-security status seen from food consumption on the total consumption and adequacy of energy consumption

The results reveal that most of the population in ENT are dryland farmer households is food-insecure. This finding is not in line with the result of research by Rachman [57] investigating the distribution of provinces based on the degree of households' food security, with data from Susenas in 1999 and the same indicators. The result uncovers that the proportion of households in ENT is food-vulnerable (48.48%), food-insecure (39.65%), food-secure (6.62%) and lack of food (5.25%). This condition is because the studied areas belong to a food-insecure category. In food-insecure areas, farmer households have difficulties dealing with access to capital, agricultural product marketing, technological innovations in agriculture, transportation, education, clean water and electricity. These aspects cause most of the farmer households to belong to the food-insecure category.

Table 9. The categories of food security based on food expenditure and energy consumption.

Category of household	Number of households	Percentage (%)
Food-secure	5	2.10
Food-vulnerable	22	9.20
Lack of food	17	7.10
Food-insecure	196	81.60

Data source: Primary data analysis 2019.

The results of the studies in Tables 8 and 9, in line with the results of the study carried out by Ariani and Rachman [58], indicate that the type of food consumed by food-insecure household groups is mostly derived from food sources of energy and is dominated by carbohydrates which is less varied, resulting in low quality (less nutritious) food. For respondents, their consumption priority is eating and avoiding starving, without considering the nutritional status.

3.3. Farmer households' adaptability in consuming food

The total expenditure of dryland farmer households is greater than their monthly income (see Tables 5, 6 and 7). Therefore, adaptability is needed to minimize food expenditure. Housewife, as a determinant of food consumption patterns, must be clever to maintain a balance between the needs and availability of food. The combination of food consumption patterns is very important because they merely rely on yield from one harvest period for consumption during a year the next year until the next harvest.

The adaptability in consuming food during the off-season can be a barometer of the farmer household's success in setting free from hunger and realizing their food security. Several efforts that farm households can do in adapting to food consumption are: 1) looking for work outside the area, even though only working as manual workers/labor, so that they have purchasing power over food; 2) looking for food sources in the forest; 3) selling livestock such as horses, cows, goats, pigs or chickens; 4) managing agricultural land by combining various food crops in one planting area [59]; 5) mixing various staple food with dynamic proportion to adjust their availability; and 6) reducing the amount of staple food consumption. Most dryland farmer households combine 2–4 food consumption adaptation strategies during the dry season, making them surviving from hunger.

Diverse daily food consumption needs to be improved so that the quality of food increases. Identifying and trialing to plant vegetables and fruits rich in protein, fat, vitamins and minerals that are tolerant to drought. The introduction of sustainable dryland agricultural technology followed by agricultural assistance will achieve food security in food-insecure areas.

3.4. Policy implications

Agricultural revitalization is very important to be carried out on dry land farming in food insecure areas to increase food availability. The focus on increasing productivity is the main target of the agricultural revitalization program by integrating with livestock. Building water reservoirs and conserving water sources to meet water needs in the second planting season can reduce the risk of crop failure in the second planting season. Location-specific cultivation technology innovations that are in line with local wisdom are disseminated to farmer groups. Agricultural revitalization will

succeed if there have cooperation between the central government, regional governments, farmers, farmer groups, extension workers and stakeholders.

The role of field extension workers in assisting and empowering farmer groups are enhanced. Field extension workers as agents of change play an important role in the diffusion and adoption process of dry land agricultural technology innovation. Success in this process has an impact on increasing productivity and production so that food security at both the household and regional levels will increase.

4. Conclusions

Dryland farmer households rely on sources of income from farming to attain food security. On the other hand, dryland farming is at high risk of drought and crop failure due to pests and diseases. Yields affect the availability of food, access to food, food utilization and food consumption. The dryland farmer households obtain food from yards, dry fields and garden/bare land that are inadequate in terms of energy adequacy. More than 70% of farmer households' expenditure is used to meet food needs which are local food. The farmer households commonly belong to the food-insecure category. The ability to adapt to food consumption is applied by farm households so that they do not starve and can achieve household food security.

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Conflict of interest

The authors declare no conflict of interest.

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