Comparative Study of Household Economy and Food Security in Timor-Leste: A Case Study of Acumau and Mertuto Villages

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Abstract

Household economy can be reflected by food security situation of the households. This paper aims to analyze household economy and evaluate food security status at household level between the two villages; Acumau and Mertuto categorized as peri-urban and rural, respectively. All households in Mertuto practice commercial farming whereas 88% of the households in Acumau engage in it. In both of the villages, some of the households do farming together with non-farm activities. Food self-sufficiency (staple food) level of both Acumau and Mertuto are very low. Nevertheless, their land is not suitable for rice cultivation, they prefer to consume rice as their primary staple food. They can't achieve food sufficient situation at household level without cash income from farming and non-farm activities. The households from Acumau attain food sufficiency (staple food) rate of 101% with cash income from farming and non-farm activities composed from selling livestock (12%), solidarity payment (27%) and wage (35%), in contrast to the households from Mertuto who are still under the state of food insufficiency although cash income from coffee (27%), business (14%) and wage (36%) contribute to food sufficiency of the households. Thus, it will be helpful to increase preferred staple, maize production as of the way to achieve food sufficiency in both of the villages. In Acumau, strengthening livestock farming will be a sustainable way for the household food sufficiency with the better access to Dili whereas in Mertuto, coffee production should be increased, considering the contribution of coffee farming to households, and sending migrant will enable them to achieve food security for long run.

1. Introduction

According to FAO, food security is defined as assuring to all human beings the physical and economic access to the basic food they need. It is often associated with poverty. Thus as food security improves, poverty reduces resulting in decline of fertility rate. However, there is still prevalence of food insecurity in developing countries. Timor-Leste (East Timor), which is the second youngest nation in the world, is also not an exception. It is located in Southeast Asia, in the east of the Indonesian archipelago and the north-west of Australia with a size of 15,000 km^2 and a population of 1.07 million people (NSD & UNFPA, 2008). Around 70% of the population live in rural areas, engaging in agriculture that provides employment to around 78% of the population, contributing 30% of the non-oil gross domestic product (GDP) and 90% of non-oil exports whereas 90% of the rural population suffers from poverty.

Staple food is one of the biggest contributers of food security and occupies the major part of our diet and supplies a significant proportion of our energy and nutrient needs (Kilian, 2012). In Timor-Leste, however, nine out of thirteen districts experience high deficit in rice, which is one of the major staple food for Timorese (MAFF, 2015). Similarly, five districts have high deficit in maize regarded as another major staple food (MAFF, 2015). The households that cannot meet their food demand from

own production have to meet the rest from external sources with cash income (GoTL & ILO, 2013). Most households experience food shortage at the beginning of rainy season (UNDP, 2011). Thus, food insecurity associated with high level of poverty has been in Timor-Leste since their independence. It may be related to poor level of nation health, education and living standard. Hence, improving food security situation is one of the challenges for the government of Timor-Leste (GoTL) to stabilize the country and make Timorese economy more viable.

Household is the basic economic unit which can determine the consumption level by an individual. This study considers that household economy can reflect the food security situation of the household members. Hence, this paper intends to analyze household economy and evaluate food security status at household level between the two villages; Acumau and Mertuto, to understand the roots of food insecurity.

2. Food security in context of Timor-Leste

In Timor-Leste, food security is defined in three dimensions: availability (amount of food present in the country), access (household's ability to acquire food) and utilization of food (household's use of food) (FAO, 2006) . In this country, the national food security is measured by annual food surplus/deficit, which is calculated by balancing the difference between cereal production and consumption annually (MAFF, 2012).

Food shortage regularly happens in Timor-Leste particularly in rural areas and is considered to occur in two phases. The first phase is when maize and rice stocks are about to finish but there is reasonable supply of root crops (cassava, sweet potato, taro and arrowroot) to rely on. These root crops are supplemented with pumpkins, beans, peanuts and a wide range of other traditionally grown spicies. During this period known in Tetun as *tempu aihan manus*, the amount of food consumed by household member decreases. Adults access one or two meals a day, whereas children have reasonable assurance of eating two to three times a day. In worst-case scenarios, food shortages enter a second phase when all staple food is in short supply, which is defined as the hunger season known in Tetun as *tempu rai hamlaha* (SoL, 2007; Lopes & Nesbitt, 2012; Da Costa, et al., 2013).

According to SoL (2007) and Lopes and Nesbitt (2012), the hunger season usually occurs when crops are growing but aren't ready for the harvest. Maize is harvested in March or April and the hunger months may extend from September or Octorber. SoL (2007) and Lopes and Nesbitt (2012) tried to increase staple food production at household level through higher yield variety (HYV). However, they didn't consider farmer's income generating activities and consumption behaviour.

During the period of food shortage in the year, households adopt a number of coping mechanisms. There are four such mechanisms; first, reducing the number of meals, the quantity of food cooked per day and substituting the staple food of maize and rice by less preferred food such as vegetables, fruits and coconut (WFP, 2005; UNDP, 2011); second, harvesting wild food; third, relying on social network including neighbors, relatives and member of the working group which the farmer belongs to; and lastly fourth, by selling livestock and other possesions, which is regarded as a last resort to cope with food insecurity (Fang, 2006; UNDP, 2011). Above mentioned coping strategies should also be considered as household economy to assess food security at the household level.

3. Methodology

This study is based on primary data collected through household questionnaire survey and key informant interview. Household survey was administrated with semi-structured questionnaire and was employed to understand food security status at the household level in two villages namely; Mertuto and Acumau from Ermera and Aileu district, respectively. Acumau is categorized as peri-urban, in contrast to Mertuto that is categorized as rural in terms of the distance from Dili. A total of 150 households were selected ramdomly, which constitutes 107 households from Mertuto and 43 households from Acumau. Each household was visited in January, 2015. To understand wider context of food security situation of the villages, two key informants in coffee industry and local Non Government Organization (NGO) were inteviewed for this survey. One is a coffee exporter belonging to Alternative Trade Timor (ATT) which is supported by Japanese non profit organization (NPO), and the other is a program officer working at a local NGO tackling agricultural/rural development issues in the study areas.

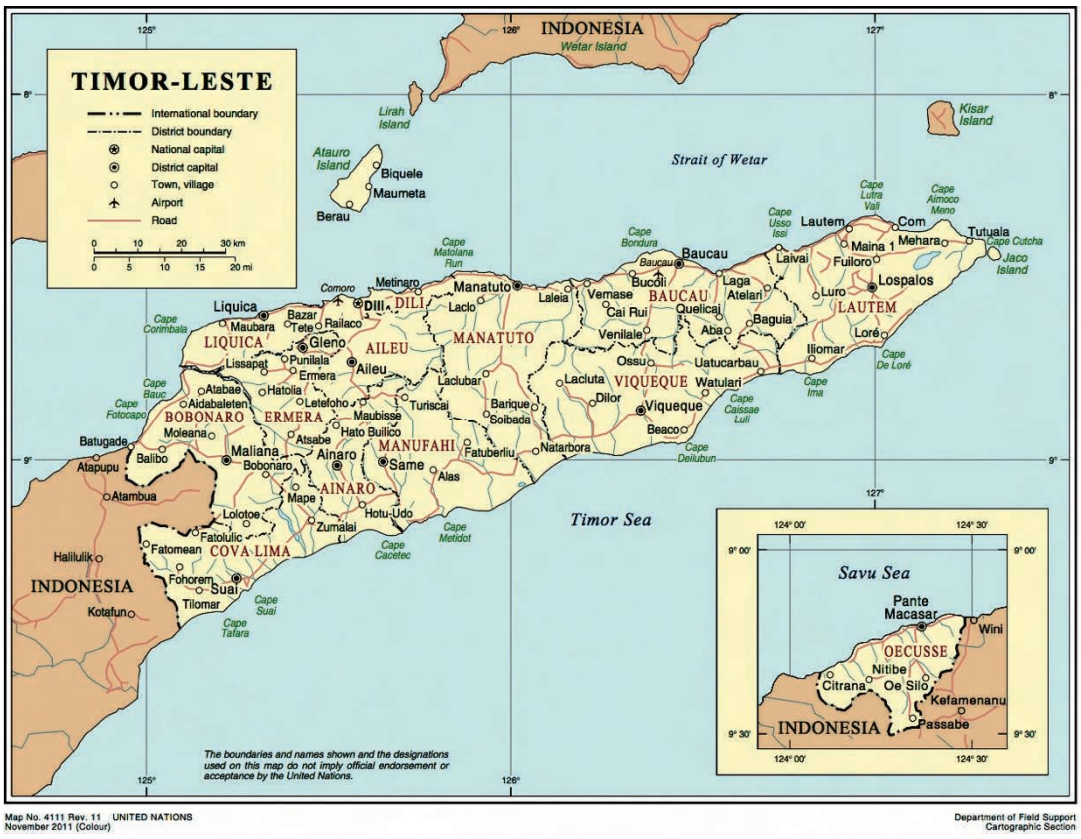

Figure 1. Map of Timor-Leste

Source: United Nations (2011)

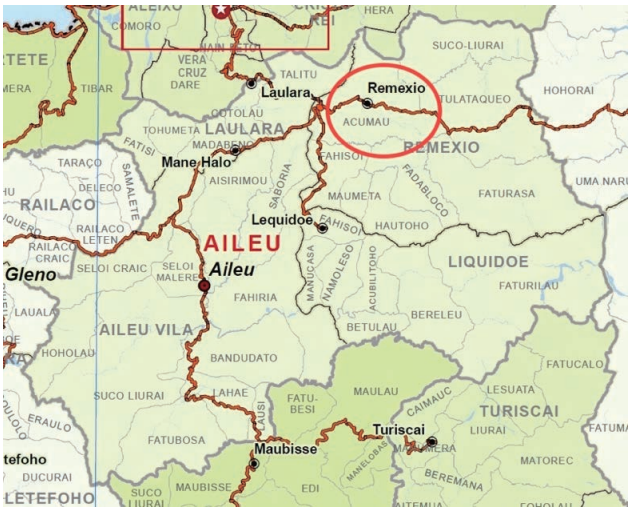

Figure 2. Map of Aileu District

Source: SoL

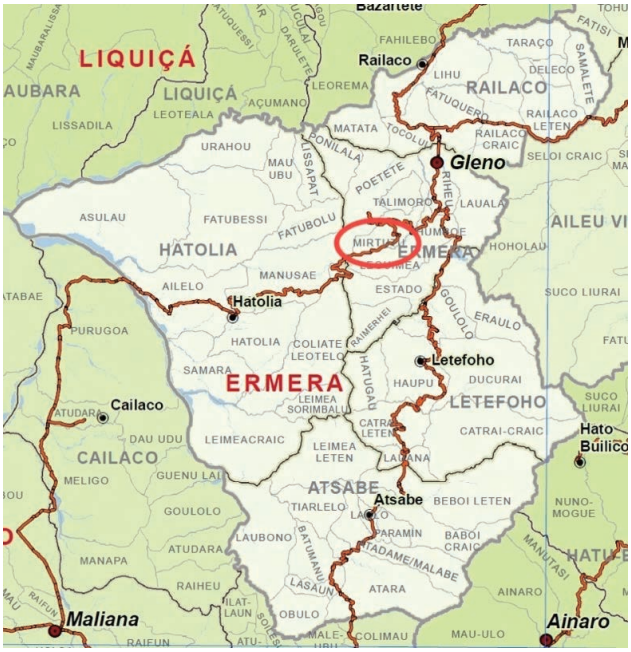

Figure 3. Map of Ermera District

Source: SoL

Primary data has been analyzed by running t-test and chi-square. Further, this study calculates share of food self-sufficiency (staple food) to evaluate food access of the households in both Acumau and Mertuto. The share of food self-suffiency (staple food) was calculated through calorie available for consumption from own crop production and requirement based on consumption unit of respective households for a year. This study regards rice, maize cassava, sweet potato, beans and taro as their staple food because of their significance in household food consumption. Calorie requirement from the major staple food is calculated based on calorie available, requirement and the share of food self-sufficiency (staple food) which are shown below in equation 1, 2 and 3, respectively.

Calorie Available from own production (CA_i) = a_1 maize$_i$ + a_2 cassava$_i$ + a_3 sweet potato$_i$ + a_4 beans$_i$ + a_5 taro$_i$ ..... (1)

Where,

CA_i = Calorie available in ith household

a_1 = Calorie conversion factor of maize$_i$, i.e., 342 kcal per 100gm

a_2 = Calorie conversion factor of cassava$_i$, i.e., 320 kcal per 100gm

a_3 = Calorie conversion factor of sweet potato$_i$, i.e., 110 kcal per 100gm

a_4 = Calorie conversion factor of beans$_i$, i.e., 86 kcal per 100gm

a_5 = Calorie conversion factor of taro$_i$, i.e., 11 kcal per 100gm

maize$_i$, cassava$_i$, sweet potato$_i$, beans$_i$ and taro$_i$ = Food crops produced in ith household

Calorie Requirement (CR_i) = 1696.36 kcal per day per capita ∗ Consumption unit ∗ 365 ..... (2)

Where,

CR_i = Calorie requirement from staple food of ith household per year

1696.36 kcal per day per capita = Carbohydrate from staple food requirement per day per capita

Consumption unit = consumption unit of ith household based on household members

Share of food self-sufficiency (staple food) is simply calculated by dividing calorie available from own production by calorie requirement of the given household.

$$\text{Share of food self} - \text{sufficiency from major staple foods} = \frac{CA_i}{CR_i} * 100 \quad \text{..... (3)}$$

Further, it is necessary to formulate share of food sufficiency for evaluation of food access of the household. Calorie available is from own production and purchase households. Purchased products considered are rice, maize, cassava and beans. Calculation of calorie available from own production and purchase and share of food–sufficiency are based on equation 4 and 5, respectively.

Calorie Available (CA_i')

= a_1 maize$_i$ + a_2 cassava$_i$ + a_3 sweet potato$_i$ + a_4 beans$_i$ + a_5 taro$_i$ + a_6 purchase rice$_i$ + a_7 purchase maize$_i$

+ a_8 purchase cassava$_i$ + a_9 purchase beans$_i$ ..... (4)

Where,

CA_i' = Calorie available from own production and purchase

a_1 = Calorie conversion factor of maize i.e. 342 kcal per 100gm

a_2 = Calorie conversion factor of cassava i.e. 320 kcal per 100gm

a_3 = Calorie conversion factor of sweet potato i.e. 110 kcal per 100gm

a_4 = Calorie conversion factor of beans i.e. 86 kcal per 100gm

a_5 = Calorie conversion factor of taro i.e. 11 kcal per 100gm

a_6 = Calorie conversion factor of purchase rice i.e. 366 kcal per 100gm

a_7 = Calorie conversion factor of purchase maize i.e. 342 kcal per 100gm

a_8 = Calorie conversion factor of purchase cassava i.e. 320 kcal per 100gm

a_9 = Calorie conversion factor of purchase beans i.e. 320 kcal per 100gm

Share of food sufficiency is simply calculated by dividing calorie available from own production and purchase by calorie requirement of the given household.

$$\text{Share of food sufficiency} = \frac{CA_i'}{CR_i} * 100 \quad \text{..... (5)}$$

Household that can meet calorie requirement from major staple food will be considered as food secure. In addition, this study compares food security situation between Acumau and Mertuto based on this share of food sufficiency (staple food).

4. Results and Discussion

Table 1. Household characteristics of the study villages

Variables	Study villages		P-value
	Acumau	Mertuto	
Average household size	7.37	7.30	0.89
Average consumption unit per household[1]	6.29	6.16	0.79
Female headed households (%)	4 (9.3)	10 (9.3)	0.99
Average household head's age (years)	48.95	47.15	0.42
Average household head's education (years)	4.02	3.94	0.92
Average number of migrants per household	0.27	0.42	0.26
Total labor force (person)	82	162	-
Average number of labor force unit per household[2] (person)	1.80	1.60	0.25
Number of households practicing commercial farming	38 (88.4)	107 (100.0)	-
Number of people engaged in business	11	29	-
Number of people engaged in wage income	13	30	-
Number of households receiving solidarity payment	30 (69.8)	26 (24.3)	0.00***
Number of households receiving remittance (%)	9 (20.9)	15 (14.0)	0.29

Source: Field work (2015)

Note: [1]To calculate the consumption unit of a household, child (up to nine years of age) and old (60 years of age and above), members are counted as half of adult members, regardless of sex difference (Maharjan, 1992); [2]Child labor (10 – 14 years of age) and old labor (60 years of age and above) are counted as half of an adult labor (15 – 59 years of age), regardless of sex difference (Maharjan, 1992); *** indicates statistically significant at 1% level.

In both Acumau and Mertuto, there is no significant difference between an average household size and consumption unit (Table 1). They have similarity in terms of household head's age, education and female headed household rate as well. An average household head's age is 48.30 and 47.13 years old, in Acumau and Mertuto, respectively. Similarly, an average household head's education experience is 4.52 years and 3.94 years, respectively. Thus, this study found that the household heads are in their middle age and didn't complete primary school in both Acumau and Mertuto. In terms of labor force, there are no significant difference between Acumau and Mertuto. However, during coffee harvest season, the members that usually don't work also help to harvest coffee since all households from Mertuto engage in commercial farming, particularly coffee farming in contrast to 88% of the households engaging in commercial farming. Some of them do farming together with non-farm activities such as business, wage labor and migration in both Acumau and Mertuto

4.1. Comparison of consumption unit between Acumau and Mertuto

Both Acumau and Mertuto have almost similar size of household and consumption level. The households from Acumau categorized as having < 1.0 ha have the smallest consumption unit of 5.23 and the ones from Acumau categorized as having ≥ 2.0 ha have the largest consumption unit of 7.23. This study finds that the households from Acumau classified as having ≥ 2.0 ha have one adult equivalent more than the ones from Mertuto classified under the same land size.

Table 2. Comparison of household size and consumption unit between Acumau and Mertuto based on land size

Land size	Household size		Consumption unit	
	Acumau	Mertuto	Acumau	Mertuto
Average	7.46	7.24	6.04	5.86
< 1.0 ha	6.18	6.85	5.23	5.73
1 − 2.0 ha	7.37	7.31	6.23	6.16
≥ 2.0 ha	8.38	7.36	7.23	6.18

Source: Field work (2015)

4.2. Comparison of crop production between Acumau and Mertuto

Maize is a main staple crop and highly prioritized to grow in both Acumau and Mertuto. The households from Mertuto categorized as having < 1.0 ha and 1 − 2 ha land produce less maize than the ones from Acumau categorized under the same land size. Households from Mertuto don't own much land to produce maize compared to the ones from Acumau. However, households from Mertuto having ≥ 2.0 ha produce more maize than those categorized under the same land size from Acumau. In this category, the households from Mertuto own larger land to grow any other crops together with coffee.

Table 3. Annual crop production according to household land size (Unit: Kg)

Item	< 1.0 ha		1 − 2.0 ha		≥ 2.0 ha		Average		P-value
	Acumau	Mertuto	Acumau	Mertuto	Acumau	Mertuto	Acumau	Mertuto	
Maize (%)	88.9 (12.5)	57.8 (10.1)	120.8 (17.8)	85.9 (10.8)	97.1 (10.3)	146.0 (12.2)	105.5	89.3	0.30
Cassava (%)	126.8 (17.9)	60.9 (10.6)	155.3 (22.9)	96.7 (10.8)	169.2 (18.0)	112.6 (9.4)	152.2	85.1	0.00 ***
Sweet potato (%)	19.5 (2.8)	24.7 (4.3)	11.8 (1.7)	51.4 (6.4)	30.4 (3.2)	46.9 (3.9)	19.4	38.5	0.00 ***
Beans (%)	11.2 (1.6)	8.4 (1.5)	3.0 (0.4)	11.5 (1.4)	1.3 (0.1)	19.3 (1.6)	4.5	12.2	0.00 ***
Taro (%)	34.7 (4.9)	18.1 (3.1)	29.0 (4.3)	34.5 (4.3)	56.5 (6.0)	34.8 (1.6)	38.8	27.3	0.06 *
Coffee (%)	80.5 (11.3)	171.3 (29.8)	102.8 (15.1)	260.0 (32.6)	303.1 (32.2)	440.4 (36.9)	157.6	268.2	0.02 **
Other crops[3] (%)	347.3 (49.0)	233.3 (40.6)	256.4 (37.8)	257.8 (32.3)	283.6 (30.1)	393.7 (33.0)	287.9	282.7	0.90
Total (%)	708.9 (100.0)	574.7 (100.0)	679.2 (100.0)	797.8 (100.0)	941.2 (100.0)	1193.6 (100.0)	765.0	803.3	0.67

Source: Field work (2015)

Note: [3]other crops include orange, papaya, mango, banana, pineapple, coconut, candle nut, avocado, lemon, jackfruit, canna edulis, mustard, cucumber, pumpkin and guava; ***, ** and * indicates significance at 1%, 5% and 10% level, respectively.

In addition to maize, cassava is also one of the important staple crops because it can be harvested all year around in both Acumau and Mertuto. Cassava production increases according to household land size. However, an average cassava production of the household from Acumau is significantly higher than in Mertuto. Focusing on household land size category of < 1.0 ha, households from Acumau produce roughly twice the amount of cassava as much as the ones from Mertuto. In Mertuto, especially small land holders have to prioritize kinds of crops in the rest of coffee cropping land area and place cassava as staple food only when they lack preferred staple.

Sweet potato and beans are widely grown by the households from Mertuto (83%), where sweet potato production increases according to household land size. Especially beans can be sold at the local market. On the contrary, households from Acumau do not place sweet potato as an important crop. Beans cultivation is also not thriving as much regardless of it being commonly eaten food compared to the other staple food. In contrast to other staple food, taro is the least prioritized among five crops in both of the villages. In Acumau, taro can be regarded as an alternative to maize during the food shortage or for animal feeding and is not considered as a crop to gain cash income. In contrast, it is positioned as an alternative of their staple food while the villagers in Mertuto sell taro to meet their family needs.

Coffee plays a vital role for the households from Mertuto. All of the households are engaged in coffee farming in contrast to only 88% in Acumau. Their coffee farming is not a new start-up but has been inherited from their ancestors since Portuguese and Indonesian occupation. The coffee production increases according to household land size. In all household land size categories, the production of the households from Mertuto is higher than those from Acumau, as Table 3 indicates.

4.3. Crop self-consumption

In both Acumau and Mertuto, maize is the most popular staple food grown in their own land and self-consumed within the households. Thus, maize self-consumption is reflected by their own production. Most of the households don't have surplus maize to sell in both of the study villages due to lack of excess production. However, households from Mertuto categorized as having

≥ 2.0 ha and the ones from Acumau categorized as having 1 − 2.0 ha have comparatively higher maize production and so sell small amount of excess maize in the local market.

Generally, cassava is not preferred as much as maize but is basically self-consumed as breakfast or snack during the shortage of rice and cassava in the households. For this reason it is hardly traded in the local market through a middle man. Assuming cassava is not a crop to gain cash income, 80% to 90% of the production is self-consumed in both Acumau and Mertuto. Households from Acumau categorized as having ≥ 2.0 ha self-consumes 100% of cassava produced because of their similar characteristics of farming to those in Mertuto and prefer self-consuming extra production rather than sell to others.

Table 4. Annual crop self-consumption according to household land size (Unit: Kg)

Items	< 1.0 ha		1 − 2.0 ha		≥ 2.0 ha		Average		P-value
	Acumau	Mertuto	Acumau	Mertuto	Acumau	Mertuto	Acumau	Mertuto	
Maize (%)	88.9 (16.4)	57.8 (17.2)	120.3 (21.5)	82.8 (17.5)	97.1 (16.1)	142.4 (20.7)	105.2	87.4	0.25
Cassava (%)	117.7 (21.7)	53.2 (15.8)	139.0 (24.8)	82.2 (17.4)	169.2 (28.1)	105.4 (15.3)	142.7	75.5	0.00 ***
Sweet potato (%)	19.5 (3.6)	24.1 (7.2)	11.8 (2.1)	46.7 (9.9)	30.4 (5.1)	46.9 (6.8)	19.4	36.8	0.00 ***
Beans (%)	3.9 (0.7)	8.1 (2.4)	3.0 (0.5)	11.5 (2.4)	1.3 (0.2)	17.9 (2.6)	2.7	11.7	0.00 ***
Taro (%)	34.7 (6.4)	8.8 (2.6)	29.0 (5.2)	18.0 (3.8)	48.5 (8.1)	21.6 (3.1)	36.4	14.9	0.00 ***
Coffee (%)	31.8 (5.9)	18.0 (5.4)	54.5 (9.7)	34.7 (7.3)	40.4 (6.7)	46.4 (6.8)	44.4	30.4	0.01 **
Other crops[4] (%)	245.9 (45.3)	166.3 (49.5)	202.7 (36.2)	196.2 (41.6)	214.6 (35.7)	306.3 (44.6)	217.4	211.9	0.86
Total (%)	542.5 (100.0)	336.3 (100.0)	560.3 (100.0)	472.0 (100.0)	601.5 (100.0)	687.0 (100.0)	568.2 (100.0)	468.7	0.04 **

Source: Field work (2015)

Note: [4]other crops include orange, papaya, mango, banana, pineapple, coconut, candle nut, avocado, lemon, jackfruit, canna edulis, mustard, cucumber, pumpkin and guava; *** and ** indicate statistically significance at 1% and 5% level, respectively.

Sweet potato and beans are basically self-consumed in both Acumau and Mertuto. In case they have much enough beans production to meet their family needs, they may choose to sell the extra beans to earn money since beans are traded at around 2 USD/kg in local market and 0.35 USD/kg through middle men. In Mertuto, people with larger land size may choose to cultivate beans to earn more income. On the other hand, people living in Acumau are not as eager to cultivate beans as those from Mertuto. However, around 4 kg (36%) of beans is self-consumed in the households from Acumau categorized as having < 1.0 ha. Few of the households grow beans mainly to sell in Taibesse market, making use of the shorter distance between the village and the market to earn cash income from farming. Taro is not highly prioritized compared to other staple crops in both Acumau and Mertuto. It is not so much preferred by the younger generation in particular and is sold to earn little money or utilize as animal feeding after securing their family needs. This trend is observed especially in the households categorized as having ≥ 2.0 ha.

In both Acumau and Mertuto, coffee is a major cash crop and consumed with their daily breakfast. Particularly in Mertuto, coffee is introduced in their daily meal and consumed when they receive guest in their house. After coffee harvest season, some of the households from Mertuto keep their coffee for self-consumption. The others from Mertuto collect and consume coffee dropped from the tree. On the other hand, the households from Acumau self-consume coffee kept from their coffee production before selling. If they need to consume more than coffee on stock, they purchase instant coffee or tea imported from Indonesia. However, an average coffee self-consumption of the households from Acumau is around 44 kg, which is significantly higher than in Mertuto of around 30 kg (Table 4) because of its importance as cash income source to purchase food in Mertuto.

4.4. Food self-sufficiency (staple food)

In both Acumau and Mertuto, almost all households can't fulfill their family needs without purchasing rice in cash. They heavily depend on food from outside the village, particularly rice. In all household land size categories, households from both

Acumau and Mertuto cannot meet their calorie requirement (Table 5). Hence, both households from Acumau and Mertuto are vulnerable to food availability.

Focusing on each village, food self-sufficiency situation of Acumau was found significantly better than that of Mertuto. Households from Acumau categorized as having < 1.0 ha have the highest food self-sufficiency; first, they have the smallest consumption unit of 5.23, which is equivalent to less than two consumption unit of those from Acumau categorized as having ≥ 2.0 ha; second, in this category, they consume almost same amount of maize and cassava, which are also a major part of their consumption.

Table 5. Food self-sufficiency according to household land size (Unit: percentage)

Land size	Acumau	Mertuto	P-value
< 1.0 ha	33.9	11.7	0.00***
1 − 2.0 ha	25.7	16.6	0.04**
≥ 2.0 ha	17.9	24.6	0.39
Average	26.9	18.8	0.02**

Source: Field work (2015)
Note: *** and ** indicate statistically significance at 1% and 5% level, respectively.

In contrast, in Mertuto food self-sufficiency increases according to household land size. Households from Mertuto categorized as having < 1.0 ha have the smallest food self-sufficiency rate (11%), followed by the ones classified as having 1 − 2.0 ha and ≥ 2.0 ha (Table 5). It is reflected by the amount of crop production from own household land and consumption unit size. In Mertuto, consumption size ranges from 5.73 to 6.18. Thus, the amount of staple food production can influence the food self-sufficiency. Households from Mertuto categorized as having < 1.0 ha and 1 − 2.0 ha produce their staple food, especially maize and cassava as a rotational crop/an inter-crop to their coffee cropping. However, households from Mertuto classified as having ≥ 2.0 ha have the highest food self-sufficiency rate (around 24%) because of their relatively larger land size.

4.5. Cash income from farming

Coffee is a major part of cach income from farming in the study villages, partcularly in Mertuto. Coffee producers gain most of their income during the harvest season by selling their coffee. In Mertuto, most of the farmers sell coffee at 1.65 USD/kg at food/drink stand near their house. Some of them sell coffee at 2.25 USD/kg to ATT, which delivers their quality coffee to Japanese consumers. In contrast, coffee is traded at 0.7 USD/kg to 2.0 USD/kg at food/drink stand near their house and to CCT in case of Acumau. Thus, coffee farmers from Mertuto have relatively better income from coffee trading than those from Acumau. In Acumau, some of the households that have less coffee production do not choose to sell their coffee, but rather self-consume all the production. Table 6 indicates that households from Mertuto are more heavily depend on income from coffee than those from Acumau on average. Households from Mertuto categorized as having < 1.0 ha gain around 208 USD per year from coffee, which is around four times as much as the households from Acumau categorized in the same land holding category. It is a gloomy reality that small landholders don't have any other choice than to sell their coffee to gain income, although they cannot expect more coffee production from their own land in Mertuto compared to Acumau. In household land size category of 1 − 2.0 ha also, similar phenomenon is observed. In both Acumau and Mertuto, coffee is an important cash income source for large landholders as well. However, coffee production in Timor-Leste as a whole is small scale in global context, which makes Timorese farmers vulnerable to the price shock (Panitchpakdi, 2011). Consequently, it signifies that the households who heavily rely on coffee as their primary income source, like those from Mertuto, are more vulnerable to the risk.

It is common that households basically don't sell their staple food in both Acumau and Mertuto. Average cash income from selling staple food is around 3 USD in each village (Table 6). Households from Mertuto categorized as having 1 − 2.0 ha and from Acumau categorized as having < 1.0 ha gain the highest cash income from selling staple crops in each village. This is because those two households based on land size are characterized as the ones that are most eager to practice farming in each village.

Table 6. Share of cash income from farming by household land size

Income source	< 1.0 ha		1 − 2.0 ha		≥ 2.0 ha		Average		P-value
	Acumau	Mertuto	Acumau	Mertuto	Acumau	Mertuto	Acumau	Mertuto	
Coffee	52.68 (11.7)	208.24 (71.2)	49.21 (22.9)	341.80 (83.6)	255.19 (60.1)	609.05 (78.2)	115.05	349.98	0.00 ***
Staple crops	6.36 (1.4)	1.28 (0.4)	3.00 (1.4)	6.09 (1.5)	1.15 (0.3)	3.21 (0.4)	3.30	3.22	0.97
Other crops[5]	22.91 (5.1)	32.70 (11.2)	15.53 (7.2)	24.34 (6.0)	22.31 (5.3)	52.25 (6.7)	19.46	35.31	0.15
Livestock[6]	370 (81.9)	50.21 (17.2	146.84 (68.4)	36.56 (8.9)	146.15 (34.4)	114.11 (14.7)	203.72	62.85	0.02 **
Total	451.95 (100.0)	292.65 (100.0)	214.58 (100.0)	408.80 (100.0)	424.81 (100.0)	778.63 (100.0)	338.86	451.36	0.23

Source: Field work (2015)

Note: [5]other crops includes orange, papaya, mango, banana, pineapple, coconut, candle nut, avocado, lemon, jackfruit, canna edulis, mustard, cucumber, pumpkin and guava; [6]this study considers only income from selling livestock as livestock income; *** and ** indicate significance at 1% and 5% level, respectively.

Selling other crops such as fruits is also cash income sources for the households. In Mertuto, some of the households expect that they can't earn much money from some kind of fruits such as mango and avocado at the local market due to transportation cost to the local market and low market price. The relatively small land holders commonly sell their fruit at a cheaper price through a middleman to earn an even small amount of money.

Acumau is characterized as livestock based farming as ownership livestock ratio in the households from Acumau constituted chickens (78%), pigs (81%), goats (45%) and cow (31%), in contrast to Mertuto where it is composed of chicken (69%), pigs (52%), goats (10%) and cow (15%). In Acumau ownership of more livestock like pigs, goats and cow marked at higher price enable them to sell their livestock. Further the distance from Taibesse market can be another factor resulting in the higher price to sell. For that reason, households from Acumau gain significantly higher cash income from livestock, especially the ones categorized as having < 1.0 ha.

4.6. Non-farm activities

Some households only engage in farming, while others engage in both farming and non farm activitities. Labor force of households in non farm activities are engaged in various type of jobs. Carpentry, which is helping villagers build their house; and making household goods such as *tais,* which is a traditional textile of Timor-Leste are categorized as business income. Other non-farm jobs include running food/drink stall*,* which is also one of the important cash income sources for them and regarded as business income. In addition, some of them gain wage income by working in government or non-government sectors as a regular employment and as a casual employment such as *ajundante* (helper for minibus driver). In addition, solidarity payment is also one of the cash income sources for households for members over 60 years old and vulnerable ones including disabled and female-headed households, who usually receive 180 USD every 6 months. Solidarity payment is also given to veterans (Falintil soldiers who fought for the independence). All these are sources of non-farm income that form a very crucial part of the overall household income in both the study villages.

Some of the households send migrants to the capital of the districts or capital city of Dili to gain cash income to meet family needs such as food and education. Most of the migrants choose to go to Dili as their destination. There is a wide range of job opportunities that the migrants can get as a regular worker such as government officer and NGO officer and as casual employment such as servants, *ajudante,* cleaners and taxi drivers. Some of them remit certain amount of money and bring some imported food such as rice, cooking oil and other amenities from Dili, including clothes and household necessities to their family when returning to their hometown.

In Mertuto, non-farm income is very important for the households categorized as having < 1.0 ha to sustain their family members, compared to the relatively larger landholders. In this category, an average household unit is composed of six to eleven family members. Recognizing they can't make a living only by income from coffee, they need non-farm income source to sustain their livelihood. Some of the household heads who graduated from secondary school level during the Portuguese or the Indonesian occupation work as lecturer in the school. The rest of the time, they engage in farming. Also, the household heads that have completed primary school level during the Indonesian occupation help the villagers build their house as carpenters. When they are

not engaged in carpentry, they practice farming, as teachers do. Further, the relatively younger household heads that didn't complete primary school level, work as *ajudante* to earn around 40 USD per month. Some of the households invest in education for their children, expecting they could get better income job within the country. In contrast non-farm income is not considered as crucial for the households categorized as having 1 − 2.0 ha. In this category, the household engaging in farm activities and non-farm activities consists of five to eight family members. Household head or children are engaged in carpentry in the households categorized as having < 1.0 ha. Household heads or older children are engaged in constructing road to secure livelihood for their family members after harvest. Few of the household heads who have completed secondary school work in government sectors located in Gleno. For households categorized as having ≥ 2.0 ha, non-farm income plays vital role in their livelihood. Those engaging in both farming and non-farming activities are composed of 6 to 13 family members. Among the relatively large sized households, some of the villagers that completed secondary school work as government officers, teachers and security guards; similar to the households in other land size category. These households are expected to give donation for their cultural ceremony. Others that didn't get education earn cash as a handy man as per need.

Table 7. Non-farm income according to household land size (Unit: USD)

Non-income source	< 1.0 ha		1 − 2.0 ha		≥ 2.0 ha		Average		P-value
	Acumau	Mertuto	Acumau	Mertuto	Acumau	Mertuto	Acumau	Mertuto	
Business income	176.36 (20.7)	163.40 (21.3)	86.84 (6.4)	149.69 (25.3)	327.69 (21.8)	253.57 (19.8)	182.55	182.89	0.99
Wage income	327.27 (38.4)	412.60 (53.7)	798.95 (58.9)	331.50 (55.9)	420.92 (28.0)	744.00 (58.0)	564.00	475.06	0.64
Solidarity payment[7]	294.55 (34.5)	86.81 (11.3)	352.37 (26.0)	93.75 (15.8)	678.46 (45.1)	205.71 (16.0)	436.16	120.00	0.00 ***
Remittance	54.54 (6.4)	105.43 (13.7)	117.37 (8.7)	17.81 (3.0)	76.92 (5.1)	78.57 (6.1)	89.07	72.20	0.72
Total	852.72 (100.0)	768.24 (100.0)	1355.53 (100.0)	592.75 (100.0)	1504.99 (100.0)	1281.85 (100.0)	1271.78	850.15	0.06 *

Source: Field work (2015)

Note: [7]solidarity payment is pension for the veterans that contributed during the independence, the elderly and vulnerable households such as disabled or female headed households. *** and * indicate statistically significance at 1 % and 10% level, respectively.

On the other hand, non-farm income is necessary to make a living in the household from Acumau in addition to farming income. Some of the households constituting seven to nine family members place non-farm income as more important than farm income in all household land size categories. In household land size category of < 1.0 ha, the household open food/drink stand along the main road connecting to other district from Dili to gain cash income and are eager to expand their family business rather than farming. In household land size category of 1 − 2.0 ha, non-farm income especially wage income plays an important role to sustain the household other than from farm income. Those households engaging in non-farm activities consist of nine to ten household members. In this category, the household heads or/and the family members that completed secondary school work as government or NGO officers. There are few households having two non-farm income sources and they don't consider farming as vital in their daily life. In Acumau, wage and business income is not necessarily placed as important for larger land holders. Households categorized as having ≥ 2.0 ha consist of 6 to 13 family members. For instance, the household heads usually engage in carpentry and mainly the spouse and other family members practice farming in his absence. This behavior can be observed within households having the heads working as *ajudante*. Few other households have two non-farm income sources like the ones categorized as having 1 − 2.0 ha. The household and his spouse are engaged in farming while their two children work as a businessman and government officer, respectively.

Each chief of the village annually identifies eligible households to receive solidarity payment for the vulnerable, based on the economic situation of the households the year before. Further, the households eligible to receive solidarity payment for veterans are decided by GoTL. On average, the amount of solidarity payment of the households from Mertuto is 120 USD per year, which is significantly lower than from Acumau of around 436 USD per year. The reason is that in Acumau, their maize production was less than usual due to heavy rain the year before data collection. Thus, solidarity payment is not a stable cash income source for the households in both Acumau and Mertuto.

Remittance is almost same and does not contribute much to increase non-farm income of the households in both of the study villages because of high vulnerable employment rate of 42% in urban areas, especially in Dili (ILO & NSD, 2010). There is no

guarantee to find even casual employment for migrants from rural areas. People engaging in casual employment sectors usually earn from around 80 USD to 150 USD. Due to high living cost in Dili, migrants seem to be able to save very little, which is why it is difficult for them to remit as much money for their families in their home town. The exception is the households from Mertuto categorized as having < 1.0 ha and the ones from Acumau categorized as having 1 − 2.0 ha. Some of the households from Mertuto categorized as having < 1.0 ha have to send money to their family members in Dili to meet their family needs and enable younger children to go to school. It is impossible to purchase food to supplement lack of the staple food production without remittance from the migrants. Thus, remittance is also one of the important income sources for them.

4.7. Cash food expenditure

In both Acumau and Mertuto, people basically self-consume their agricultural products. However, if they don't have much enough food left to secure their household need, they purchase food in the local market or food/drink stall near their house. Rice is a widely preferred crop in almost all the households in both Acumau and Mertuto. They usually consume purchased rice all year round, excluding maize harvest season Thus, the households with more cash income prefer rice to other staple food, and rice expenditure in cash depends on household cash income. The exception is the households from Acumau categorized as having < 1.0 ha because of the smallest consumption unit of 5.23.

Table 8. Annual cash food expenditure[8] according to household land size

Crops	< 1.0 ha		1 − 2.0 ha		≥ 2.0 ha		Average		P-value
	Acumau	Mertuto	Acumau	Mertuto	Acumau	Mertuto	Acumau	Mertuto	
Rice (%)	325.64 (36.5)	381.41 (34.3)	389.63 (32.3)	351.88 (41.2)	442.92 (33.2)	452.46 (45.5)	389.37 (30.1)	391.17 (39.0)	0.97
Maize (%)	93.82 (10.5)	51.22 (4.6)	45.47 (3.8)	41.25 (4.8)	96.00 (7.2)	46.00 (4.9)	73.11 (6.3)	47.39 (4.7)	0.14
Cassava (%)	0.00 (0.0)	5.11 (0.5)	0.00 (0.0)	11.25 (1.3)	5.54 (0.4)	1.71 (0.2)	1.67 (0.1)	6.05 (0.6)	0.16
Beans (%)	43.64 (4.9)	45.96 (4.1)	53.05 (4.4)	26.25 (3.1)	46.15 (3.5)	24.00 (2.4)	48.55 (4.2)	34.31 (3.4)	0.15
Sugar (%)	58.91 (6.6)	97.69 (8.8)	84.63 (7.0)	90.75 (10.6)	80.31 (6.0)	118.71 (12.0)	76.74 (6.6)	101.11 (10.1)	0.08 *
Bread/dried noodle (%)	17.75 (2.0)	29.87 (2.7)	75.79 (6.3)	18.75 (2.2)	103.38 (7.7)	11.14 (1.1)	69.20 (5.9)	21.64 (2.2)	0.00 ***
Others[9] (%)	353.89 (39.6)	502.35 (45.1)	556.93 (46.2)	314.10 (36.8)	560.42 (42.0)	332.79 (33.7)	496.01 (43.4)	401.68 (40.0)	0.09 *
Total (%)	893.35 (100.0)	1113.6 (100.0)	1205.51 (100.0)	854.23 (100.0)	1334.73 (100.0)	988.83 (100.0)	1164.72 (100.0)	1003.38 (100.0)	0.14

Source: Field work (2015)

Note: [8]Calculation of annual cash food expenditure is based on weekly cash food expenditure; [9]Others include potato, meats, powder milk, imported fruits, drink, cooking oil, salt, onion/garlic, spice, coffee, tea and biscuit. *** and * indicate statistically significance at 1% and 10% level, respectively.

Subsequent to rice, maize is placed as the second important staple food in both Acumau and Mertuto. An average expenditure for maize by the households from Acumau (73 USD) is comparatively higher than that of the households from Mertuto (47 USD). Two years before the data collection, they experienced hunger season because of heavy rain during maize cropping season and most of the households had to consume the stock for next harvest in Acumau. During the data collection year, they purchased maize for next harvest as well. This is the reason why households from Acumau spent more money for purchasing maize than those from Mertuto, on average. Households categorized as having 1 − 2.0 ha are not eager to farm because of the existence of non-farm income sources.

Compared to rice and maize, cassava is less preferred staple food in both Acumau and Mertuto. The villagers choose to purchase maize or rice rather than cassava with cash. Thus, the households that earn more cash income, spend less for purchasing cassava. Beans is consumed as their staple food and side dish and is one of the preferred crops in both of the study villages. After consuming their own production as their staple food, they purchase beans with rice as per need before rainy season. Hence, the households that produce less beans comparatively purchase more of it.

Generally, people prefer coffee with a lot of sugar in both Acumau and Mertuto. Sugar is one of the necessities and can be purchased at food/drink stall near their house. Sugar expenditure increases according to household land size. It is in relation with coffee production, which increases according to household land size. An average sugar expenditure in Acumau is significantly less than in Mertuto. In Acumau, they consume their own production and instant coffee imported from other countries such as Indonesia, which already contains sugar. In Mertuto, the households consume coffee dropped from tree in addition to their stock. Actual coffee consumption of the households from Mertuto should be higher than that of the households from Acumau.

Dried noodles is one of the alternative choices in daily meals in Mertuto. When they run out of their vegetable stock to eat with rice, they purchase four packs of dried noodles at one USD at food/drink stall near their house. Thus, dried noodles should not necessarily be regarded as a luxury. In Acumau it is recognized as an additional food and not as one of the substitutes. On the other hand, bread is basically eaten as breakfast in both Acumau and Mertuto. Expenditure for bread/dried noodle of the households from Mertuto decreases according to household land size, whereas in Acumau the household expenditure increases according to household land size. This phenomenon is reflected in cash income of the households from Acumau.

4.8. Non-food expenditure

Non-food expenditure is also one of the important components of household economy to be discussed and basically consists of clothes, festival/ceremony, education, home purchase/maintenance and transportation cost. Households expense these cost in cash obtained from farming and non-farm activities. Expenditure for festival/ceremony is one of the important aspects of their social life within the community in both Acumau and Merututo. In Ermera district including Mertuto, *tara bandu* (village norm) strongly functions, compared to the other districts within Timor-Leste. The households are basically equally expected to contribute for this festival/ceremony. The villagers also expect that households that have relatively larger land size to contribute more to these expenses than the others, with the recognition of comparatively larger cash income due to coffee farming. For this reason, households from Mertuto categorized as having ≥ 2.0 ha spend more money for festival/ceremony than others. In contrast, in Acumau people recognize that the households that earn relatively larger cash income through business and wage income can spend more money for these activities than the others.

Table 9. Non-food expenditure according to household land size (Unit: USD)

Non-food expenditure	< 1.0 ha		1 − 2.0 ha		≥ 2.0 ha		Average		P-value
	Acumau	Mertuto	Acumau	Mertuto	Acumau	Mertuto	Acumau	Mertuto	
Clothes (%)	70.00 (33.5)	62.98 (15.4)	73.42 (17.8)	85.63 (28.7)	98.46 (21.2)	108.75 (25.2)	76.70	81.19	0.92
Festival/ Ceremony (%)	23.64 (11.3)	119.60 (29.2)	199.47 (48.4)	111.75 (37.5)	90.00 (19.4)	187.14 (43.4)	110.40	136.87	0.73
Education (%)	29.18 (14.0)	110.13 (26.8)	12.89 (3.1)	24.25 (8.1)	44.77 (9.6)	43.07 (10.0)	22.96	65.66	0.31.
Home purchase/ maintenance (%)	34.18 (16.3)	49.00 (11.9)	28.95 (7.0)	28.91 (9.7)	81.54 (17.5)	49.29 (11.4)	45.72	44.11	0.91
Transportation (%)	52.18 (24.9)	68.53 (16.7)	97.11 (23.6)	47.75 (16.0)	150.08 (32.3)	43.39 (10.1)	97.72	57.00	0.03 **
Total	209.18 (100.0)	410.23 (100.0)	411.84 (100.0)	298.28 (100.0)	464.85 (100.0)	431.64 (100.0)	353.50	386.85	0.09 *

Source: Field work (2015)
Note: * and ** indicate statistically significance at 10% and 5% level, respectively.

In Timor-Leste, pre-school and basic education is free but households still need to purchase school supplies, school uniform, shoes and so on by themselves. Education cost includes these necessities and cost for higher education such as university. In Mertuto, comparatively poorer households also send their children to university in Dili or ETCI in Gleno, hoping they would return and contribute to hometown through better paying jobs. In some of the households under poverty, sharing tuition with the family members and the relatives within the community enables them to invest for higher education even for the households categorized as having < 1.0 ha with the highest expenditure for education than others. On the other hand, in Acumau the households that have financial ability can send their family members to university located in Dili as households classified as having 1 − 2.0 ha have the highest education cost in Acumau.

Transportation cost can be one of the indicators to access the market in both Acumau and Mertuto. Villagers from Mertuto

can access the market located in Ermera Villa on their foots. In order to go to other markets, it cost 2 USD and 10 USD to go to Gleno and Dili for a round trip by *mikrolet,* respectively. It is common that they go to Vila Ermera to sell their agricultural products. In Acumau, most of the villagers go to Dili to get some necessary items like imported rice, cooking oil and other goods that are available at cheaper price, compared to food/drink stall within the village. For this reason, average transportation cost of the households from Acumau (97 USD) is significantly higher than that from Mertuto (57 USD). In Acumau, transportation cost increases according to cash food expenditure, in particular to rice and bread/dried noodle expenditure whereas in Mertuto, households categorized as having < 1.0 ha have the highest transportation cost (68 USD) attributed from sending relatively more migrants to Dili to secure their family members' livelihood requirements.

4.9. Food sufficiency (staple food)

Food sufficiency is an indicator of food security of the households. In case they don't have enough production of their own to secure their family members' food requirement, they have an option to purchase food in cash. This study adopts this food sufficiency to assess food access of the households. In both Acumau and Mertuto, food access plays a significant role to stabilize food security status of the households because of their inability to meet their requirement only with their own production. On average, the households from Acumau achieve food sufficiency of 101% in contrast to the one from Mertuto with 83%.

In Acumau, food sufficiency decreases according to household land size. Households categorized as having < 1.0 ha is positioned as having the highest food sufficiency rate as well as food self-sufficiency. Their income is mainly composed of income from selling livestock (28%), solidarity payment (22%) and wage income (38%). They have the highest cash income from selling livestock (370 USD) in all household land size categories with household economy surplus (202 USD). Further, households classified as having 1 − 2.0 ha are food insufficient despite being the second highest food sufficient in Acumau. In this category, relatively more households are mainly engaged in non-farm activities than others. Their cash income mainly comes from selling livestock (9.4%), solidarity payment (22%) and wage income (50%). contributing to food sufficiency though there is deficit of around 47 USD in their household economy, resulting in not being able to meet food requirement with purchased food. Similarly, households categorized as having ≥ 2.0 ha are food insufficient in this village. Those constitute most of the cash income from selling livestock (7.6%), solidarity payments (35%) and wage income (36%) have household economy surplus of 128 USD. Thus, this study found food sufficiency in the households from Acumau are supported by income from livestock and solidarity payment, which is regarded as unstable income source.

Table 10. Food sufficiency according to household land size (Unit: percentage)

Land size	Acumau	Mertuto	P-value
< 1.0 ha	121.8	83.4	0.04**
1 − 2.0 ha	98.5	79.4	0.13
≥ 2.0 ha	92.1	88.3	0.82
Average	101.1	83.5	0.03**

Source: Field work (2015)
Note: ** indicates statistical significance at 5% level.

In Mertuto, households categorized as having ≥ 2.0 ha is regarded as food insufficient despite the highest food sufficiency (88%) and food self-sufficiency (26%). They have more staple food production than others, in addition to cash income from farming in particular to coffee because of their larger land size with household economy surplus (628 USD). Therefore, their food sufficiency status can be enhanced with their cash income from both farming and non-farm activities. Households categorized as having < 1.0 ha have the second highest food sufficiency in Mertuto despite the lowest food self-sufficiency (11%). In this category, they cannot produce enough staple food because of coffee farming. Cash income is required to fulfill their food requirement and is composed of coffee income (20%), business income (15%) and wage income (38%). Currently, they have deficit of around 463 USD in their household economy. Similarly, households from Mertuto classified as having 1 − 2.0 ha have the lowest food sufficiency in the village despite having the second highest food self-sufficiency rate (16%) due to lack of enough staple food production attributing from coffee farming just like households from Mertuto categorized as having < 1.0 ha. They basically consume purchased food to supplement lack of their food requirement with cash income mainly constituting of coffee income (34%), business income (14%) and wage income (33%). But, they have deficit of 154 USD in their household economy and are still food insufficient.

5. Conclusion

This study indicates that both Acumau and Mertuto cannot fulfill their food requirement without cash income from farming and non-farming activities. They prefer consuming rice to other staple food though their land is not suitable for rice cultivation. In order to stabilize food security situation in both Acumau and Mertuto, increasing maize production is required because of the preferred staple food in their land. Focusing on each village, in Acumau, solidarity payment contributes to food sufficiency of the households together with income from selling livestock. However, solidarity payment is not given to the households every year. Hence, it is not a stable cash income source to achieve food security. Households gain more cash income from selling livestock and having merit of easy access to the market located in Dili. As demand for livestock sector increases, Acumau may have more merit to sell livestock in Dili in the future. Therefore, strengthening livestock farming will be possible way to attain food security of the households in Acumau. On the contrary, in Mertuto, coffee as a main cash income source for covering food expenditure contributes to food sufficiency of the households although they are still food insufficient. It is not a rationale choice to replace coffee farming into staple food farming. Despite the price fluctuation in the international market, increase of coffee production is possible way for achieving food security since their coffee price is marked at relatively higher price than from Acumau by ATT which is supported by Japanese NPO. This study found livelihood strategy of the households from Mertuto classified as having < 1.0 ha be sending several family members to Dili to help them make a living to sustain their households. Further, they send their child to university located in Dili by utilizing the remittance from migrants with the expectation that they will get better paying job in the future. Thus, their education investment will help them improve their food sufficiency in the long run.

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