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The Relationship between Socioeconomic and Food Source Factors and Caloric Energy Acquired of the Coastal Artisanal Fishing Households in Trang Province, Southern Thailand

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Abstract This research aimed to examine the relationship between socioeconomic and food source factors and the caloric energy acquired of the coastal artisanal fishing households in Trang province, southern Thailand. The sample for the study consisted of 240 the coastal artisanal fishing households. The instrument used in the research was a structured interview schedule. The data were analyzed using the Spearman rank correlation coefficient. The results of the study reveal the following: For the socioeconomic factor, the number of members in the household shows a negatively 'very low' correlation with an average caloric energy of the coastal artisanal fishing households (r = -.169), while the amount of food consumed per week show a positively 'very low' correlation with an average caloric energy of the coastal artisanal fishing households (r = .153). Cash income earned from crops and livestock show a 'very high' correlation with an average caloric energy of the coastal artisanal fishing household (r = -.808, r = -.882 respectively); whereas educational level of the household head and cash income earned from fish caught from the sea show no correlation with an average caloric energy of the coastal artisanal fishing households.

For the food source factors, the ratio of food from crop cultivation and livestock raising shows a negatively 'very low' correlation with an average caloric energy of the coastal artisanal fishing households (r = -.168); whereas the yield of livestock shows a negatively 'high' correlation with an average caloric energy of the coastal artisanal fishing households (r = -.776). As for other factors, the proportion of food from nature, market, shop, goods exchange, total production of marine animals, plants, vegetable, including types of aquatic animals, plants, vegetable and livestock show no correlation with an average caloric energy of the coastal artisanal fishing households in Trang province.

Keywords: caloric energy acquired, the coastal artisanal fishing households, Southern Thailand, coastal resources

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Introduction

Food is an essential factor in human life from birth to death; for survival, man must consume adequate food, both in quality and quantity, needed by the body (Patipimpakhom, 2000). However, a factor that influences human consumption is the family factor (Fleck, 1981), because the family is a unit of society that shapes eating habits among family members in selecting the food that is beneficial and nutritious (Sotdee and Chimplee, 2007). These characteristics include access to food in response to the energy needs of the body in order to provide enthusiasm and well being in life (Barrett, 2010; Prachasan, 2009), thus assuring food security to household. However, part of food crisis in the family arises from the inequalities in the utilization of production resources for agriculture, fisheries, livestock, natural disasters and environmental degradation, affecting 860 million people worldwide to be in a state of chronic hunger; among the affected, 815 million people, or 94.77 percent, live in developing countries (FAO, 2005).

The food insecurity problem in Thailand has been increasingly in a deteriorating state. Approximately 10.7 million people are malnourished despite adequate domestic food production (Supawatthanakul, 2012). One of the major food sources comes from the artisanal fishery. However, this food source has been adversely affected by environmental deterioration: waste discharge from factories, communities and shrimp farms, destruction of mangroves and devastation of breeding grounds for aquatic animals, resulting in a decreased amount of marine lives and in turn reducing an income of the artisanal fishermen (Organization of Cooperation for Rehabilitation of the Andaman Natural Resources, 2011). It has been reported that in the year 2011, such a condition caused the people engaged in the artisanal fishing, mangrove forestry and agricultural service to become the largest number among the impoverished people (39.68%) (Office of National Economic and Social Development Board, 2014). Among the total of 57,801 fishing households country-wide (National Statistical Office, 2009), 70% are those of the artisanal fishing households (Phutemkiat, 2012), mainly residing in descending order in the southern, eastern, central and western regions of the country, respectively (Department of Fisheries, 2009). Surprisingly, Trang, a province in coastal southern Thailand has a largest number of fishing boats with no engine, with up to 563 boats (Department of Fisheries, 2009). Fishery resources are considered to be important for local people because the resources provide fishing-related industries and businesses. However, at present fishing sources have become deteriorated due to over-exploitation of marine resources beyond capacity

(Trang Provincial Office, 2012), thus having affects of the food supply for the household.

The significance of the problems mentioned above has inspired the researchers to conduct a study on the relationship between socioeconomic and food source factors and caloric energy acquired of the coastal artisanal fishing households in Trang province. The study aimed at identifying the factors related positively or negatively to caloric energy acquired of the coastal artisanal fishing households: education, number of household members, revenues from food sources - both cash income and non-cash income, proportion of food from each food source, quantity and types of crops, livestock and aquatic animals caught by the households of the artisanal fishermen in the coastal province. The findings can be used to develop guidelines for food security in the artisanal fishing households.

Study Objectives

To study the socioeconomic aspects related to source of caloric energy acquired of the coastal artisanal fishing households in Trang province.

To study the relationship between socioeconomic factors and caloric energy acquired of the coastal artisanal fishing households in Trang province.

Materials and methods

This research is a quantitative study, details of which are given below.

Population and Sample. The population used in this study is the coastal artisanal fishing households in Trang province residing in the four districts of Palian, Sikao, Kantang and Hat Samran, totaling 1,923 households (Trang Provincial Fishery Office, 2012). The sample was selected using a probability sampling and the multi-stage sampling process (Wanitbancha, 2006) as follows.

Step one: Select all districts in the province where people are engaged in the coastal artisanal fishing covering the four districts of Palian, Sikao, Kantang and Hat Samran.

Step two: Select two Tambon (sub-district) where there is a largest number of fishing households.

Step three: From each selected Tambon (subdistrict), select a village that has the largest number of fishing households. Altogether, a total of over 569 households were selected and the sample size was determined using the Yamane's technique. A sample of 240 households were selected using a non-probability sampling from each village through a quota sampling and a total of

30 villages were selected and from each village. In this way, the households selected evenly cover all artisanal fishing households in the coastal province of Trang. Finally, the convenience sampling was utilized in selecting each household (Wanitbancha, 2006).

Research Instruments consisted of a three-part structured interview schedule with open ended questions.

The first part dealt with socioeconomic data of the coastal artisanal fishing households in Trang province, which include level of education of household heads, number of household members, revenues from food sources (crops, vegetable, aquatic animals, livestock) - both cash income and non-cash income. Cash income refers amount of money derived from natural resources, crops, vegetable, aquatic animals, and livestock multiplied by selling prices of the yields in the local community. Non-cash income is the revenue earned not in the form of cash due to the products being distributed to, or received from relatives and neighbors, or the products being exchanged on cultural basis, including the amount of household food items consumed within one week.

Food Sources of the coastal artisanal fishing households include proportions of food from all four food sources: cultivation of crops, from nature, markets and or shops and exchange of food based on cultural basis, including the amount and type of crops, livestock, aquatic animals, produced or caught by the coastal artisanal fishing households in Trang province.

The caloric energy acquired the coastal artisanal fishing households in Trang province includes the total caloric energy acquired by all household members in a day. The acquired energy is calculated by type and quantity of each food intake per day of individual members of the household. The amount of calories of each food type is based on the nutritional value of food obtained from the table showing the nutritional value of Thai food (Department of Health, 2001).

For example, a breakfast for a household with three members consists of the following: the first and the second member take a glass of hot coffee each, two pieces of *Pathonggo* (deep-fried doughstick), sweet sticky rice, whereas the third member takes chicken *Biryani* rice and a glass of iced tea. For lunch, they all eat rice with boiled mackerels (consisting of 1 kg. of sardines, 50 grams of turmeric, 50 grams of garlic, 200 grams of lemon grass, and 100 grams of fresh tamarind), 1 kg of steamed *Poo Ma* (blue crabs), 5 tablespoons of chili paste, 300 grams of fresh vegetable and cucumber, 300 grams of eggplant and 300 grams of lentils. For dinner, the members take fried mackerels (600 grams of mackerels, 100 grams each), beef *Kua Kling* spicy curry (400 grams of beef), boiled mackerel leftover from lunch, fresh – 2

bananas for each member. For rice as main staple, the first and the third member take 6 ladles each meal, while the second member takes 4 ladles of rice. Each member of the household takes an equal proportion of the dishes and fruit. The amount of caloric energy acquired for the household can be calculated as shown in Table 1.

Table 1. Summary of caloric energy from daily food intake of the household.

Meal	Caloric energy of household members (kcal)		
	First member	**Second member**	**Third member**
Breakfast	965.0	965.0	653.0
Lunch	1,222.7	1,062.7	1,222.7
Dinner	1,729.2	1,569.2	1,729.2
Total	**3,916.9**	**3,596.9**	**3,604.9**
Average		**3,706.2**	

Minimum requirements for nutrition of Thai children aged 6-13 years, adults and elderly people can be classified into e levels of energy requirements (Department of Health, 2008) as follows:

1. 1,600 kcal for children aged 6-13 years, working women aged 25-60 years and elderly people aged 60 years and over.

2. 2,000 kcal for male and female adolescents aged 14-25 years and working people aged 25-60 years.

3. 2,400 kcal for men and women who use a lot of energy, such as farmers, workers, athletes.

Jitsuchon and Plaengprapan (2004) have mentioned about children's nutritional requirements as the following. 800 kcal is the nutritional needs for children from birth to 1 year old, 1,000 kcal for children 1-3 years old, 1,300 kcal for 4-5 years old, and 1,400 kcal for 6-8 years old.

Verification of Research Instruments: The instruments have been verified in the following manners. 1) Three experts in the field have examined the questionnaire for coherence with the research objectives. The results showed the content validity of 0.67 to 1.00. An improvement has been made to the questionnaire items as recommended by the experts. 2) Consequently, the improved questionnaire was then tried out with 3 non sample members of the artisanal fishing households. The purpose was to check their understanding of question items in the interview schedule, accuracy of the text used and appropriate time spent in the interview. Afterwards, improvement has been made to the items in question for clarity and consistence with the contexts of the artisanal fishing households. The interview schedule was then used as a

pilot survey. The overall results revealed that respondents understood the questions clearly; however, the time spent for the interview session was longer than expected because the respondents had to think about the kinds and quantities of food they normally consumed in their households, approximately 30-45 minutes depending on the number of members in the households.

Data Analysis: The relationship between socioeconomic and food source factors and the caloric energy of food of the coastal artisanal fishing households in Trang province was analyzed using the Spearman rank correlation coefficient, where the correlation criteria were applied (Hinkle, DE, William, W. And Stephen GJ, 1998) as follows:

Correlation values (R_{xy})

0.90 to 1.00	=	very high correlation
0.70 to 0.90	=	high correlation
0.50 to 0.70	=	moderate correlation
0.30 to 0.50	=	low correlation
0.00 to 0.30	=	very low correlation

Results

The findings of the relationship between socioeconomic and food source factors and caloric energy of food of the coastal artisanal fishing households in Trang province can be summarized as the following.

Socioeconomic characteristics, food sources and caloric energy of food of the coastal artisanal fishing households in Trang province

Education, **Number of members in a household, and Food intake items:** Most of the heads of the coastal artisanal fishing households in Trang province completed the elementary education (75.8%), mostly living in a single family with 3-6 members, and with food intake of 15-24 food items per week (see Table 2).

Table 2. Social conditions of the coastal artisanal fishing households in Trang province.

n=240

Particulars	Number	Percentage
Level of education		
Non-schooling	7	2.9
Elementary	182	75.8
Lower secondary	32	13.3
Upper secondary	16	6.7
Higher than upper secondary	3	1.3
Number of members in a household		
1-2 members	35	14.6
3-4 members	127	52.9
5-6 members	64	26.7
7-8 members	8	3.3
9-10 members	6	2.5
Average (min-max)	4 members (1-10 members)	
Food intake per week		
10-14 items	39	16.3
15-19 items	96	40.0
20-24 items	83	34.6
25 items and over	22	9.2
Average (min-max)	19 items (10-35 items)	

Sources of income and amount of cash income: Most of the coastal artisanal fishing households in Trang province (63.4%) earn the cash income from catching aquatic animals in natural habitat, equivalent to or less than 342,000 baht/year; only 7.1 percent of the households earn money revenue from natural aquatic animals valuing more than 684,000 baht/year, while only 4.6 percent of the households earn the cash income from the crops, mostly less than 5,000 baht/year. The household's cash income from livestock (poultry, cattle) accounts for only 2.9 percent of all the households, among these households, most earn the income less than 15,000 baht/year (Table 3).

Table 3. Cash income of the coastal artisanal fishing households in Trang province, classified by food sources.

Income	Number of households	Percentage
Catches from natural habitat (n = 240, 100.0% of the sampled households)		
Less than or equivalent to 171,000 Baht/year	76	31.7
171,001-342,000 Baht/year	76	31.7
342,001-489,000 Baht/year	45	18.8
489,001-636,000 Baht/year	26	10.8
More than 684,000 Baht/year	17	7.1
Average (min-max): Baht/year	351,299.2 (24,696.0-4,497,700.0)	
Crops (n = 11, 4.6% of the sampled households)		
Less than 5,000 Baht/year	6	54.5
More than 5,000 Baht/year	5	45.5
Average (min-max): Baht/year	40,830.2 (140.0-264,000.0)	
Livestock (poultry, cattle) (n = 7, 2.9% of the sampled households)		
Less than 15,000 Baht/year	5	71.4
More than 15,000 Baht/year	2	28.6
Average (min-max): Baht/year	10,485.7 (720.0-38,840)	

Sources of income and amount of non-cash income: 36.7 percent of the artisanal fishing households in the coastal province of Trang earn the non-cash income from aquatic animals in nature accounting for less than or equal to 19,680 baht/year; only 7.9 percent of the households earn the non-cash income from aquatic animals in natural habitat at the amount more than 78,720 baht/year, while only 10.4 percent have a household non-cash income of crop, mostly in the range of 1,000-3,500 baht/year. Most of the households which earn the non-cash income from livestock (poultry, cattle) account for only 2.9 percent with an earning less than or equivalent to 2,000 baht/year (Table 4).

Table 4. Non-cash income of the coastal artisanal fishing households in Trang province, classified by food sources.

Income	Number of households	Percentage
Catches from natural habitat (n = 196, 81.7% of the sampled households)		
Less than or equivalent to 19,680 Baht/year	88	36.7
19,681-39,360 Baht/year	50	20.8
39,361-59,040 Baht/year	26	10.8
59,041-78,720 Baht/year	13	5.4
More than 78,720 Baht/year	19	7.9
Average (min-max): Baht/year	36,244.8 (320.0-309,600.0)	
Crops (n = 25, 10.4% of the sampled households)		
Less than 1,000 Baht/year	8	32.0
1,000-3,500 Baht/year	10	40.0
More than 3,500 Baht/year	7	28.0
Average (min-max): Baht/year	3,275.7 (125.0-17,420)	
Livestock (poultry, cattle) (n = 7 2.9% of the sampled household)		
Less than or equivalent to 2,000 Baht/year	5	71.4
More than 2,000 Baht/year	2	28.6
Average (min-max): Baht/year	1,430.0 (120.0-4,320.0)	

Ratio of food from food sources: 50.0 percent of the artisanal fishing households in the coastal province of Trang acquire food from crops in the range of 1-20 percent, while 69.1 percent of all households acquire food from aquatic animals caught from nature in the range of 21-60 percent. 50.0 percent of the households acquire the food bought from the market and shops in the range of 1-20 percent. Similarly, 57.1 percent of the households acquire the food through exchange of food in the range of 1-20 percent (Table 5).

Table 5. Proportions of food acquired from each food source of the coastal artisanal fishing households in Trang province.

n=240

Ratio (%)	Food Sources			
	Crop, livestock, aquaculture	**Catches from nature**	**Market/shop**	**Exchange**
1-20	120 (50.0)	8 (3.3)	120 (50.0)	137 (57.1)
21-40	28 (11.7)	80 (33.3)	76 (31.7)	18 (7.5)
41-60	2 (0.8)	86 (35.8)	29 (12.1)	1 (0.4)
61-80	1 (0.4)	55 (22.9)	9 (3.8)	-
81-100	-	5 (2.1)	4 (1.7)	-
Total	151 (62.9)	234 (97.5)	238 (99.2)	156 (65.0)
Average food ratio	17.1	52.2	29.1	14.4

Note: Numbers in parentheses are percentage of all sampled households.

Quantify of aquatic animals acquired by the artisanal fishing households: 92.5 percent of the amount of fish caught by the fishing households per year is less than or equal to 16,160 kg per year, while 55.6 percent of all households acquire the yield from crop cultivation such as morning glory, papaya, cabbage, lemon grass, basil, peppers, etc., less than 50 kg per year, and 55.6 percent of the households acquire the food from livestock at the amount of 30 kg or over per year (Table 6).

Table 6. Quantity of aquatic animals caught, crops and livestock produced by the coastal artisanal fishing households in Trang province.

Quantity of food acquired	Number of households	Percentage
Food from natural habitat (n = 240, 100.0% of all sampled households)		
Less than or equivalent to16,160 kg/year	222	92.5
16,161-32,120 kg/year	6	2.5
32,121-48,080 kg/year	2	0.8
More than 48,080 kg/year	10	4.2
Average (min-max): kg/year	11,903 (234.0-1,051,050.0)	

Table 6. (Continue)

Quantity of food acquired	Number of households	Percentage
Crops		
(n = 27, 11.3% of all sampled households)		
Less than 50 kg/year	15	55.6
50-150 kg/year	6	22.2
More than 150 kg/year	6	22.2
Average (min-max): kg/year	3,959.4 (1.5-91,200.0)	
Livestock (poultry, cattle)		
(n = 9, 3.8% of all sampled households		
Less than 30 kg/year	4	44.4
30 kg/year and over	5	55.6
Average (min-max): kg/year	88.7 (2.0-500.0)	

The number of types of aquatic animals caught, crops cultivated and livestock produced: Most the coastal artisanal fishing households (63.3%) catch 3-6 species of aquatic animals. Similarly, most of the households (88.8%) grow a total of 1-4 percent of crops and most of them (77.8%) raise only 1 species of livestock (Table 7).

Table 7. The number of types of aquatic animals caught, crops cultivated and livestock produced.

Types	Number of household	Percentage
Aquatic animals acquired from nature		
(n = 240)		
1-2 types	60	25.0
3-4 types	80	33.3
5-6 types	72	30.0
7-8 types	21	8.8
More than 8 types	7	2.9
Average (min-max)	4 types (1-14 types)	

Table 7. (Continue)

Types	Number of household	Percentage
Crop (n = 27, 11.3% of all sample households)		
1-2 types	12	44.4
3-4 types	12	44.4
More than 4 types	3	11.2
Average (min-max)	3 types (1-9 types)	
Livestock (poultry , cattle) (n = 9, 3.8% of all sampled household)		
1 types	7	77.8
2 types	2	22.2
Average (min-max)	1 types (1-2 types)	

Caloric energy acquired: 80.8 percent of the coastal artisanal fishing households in Trang province acquire the caloric energy more than 2,000 kilocalories per person per day, followed by 12.9 percent which acquire 1,600-2,000 kcal per person per day, whereas those in the range of 5.0 percent and 1.3 percent acquire the caloric energy of 1,401-1,599 and 1,000-1,400 kcal per person per day, respectively (Table 8).

Table 8. Caloric energy acquired of the coastal artisanal fishing households in Trang province.

Average caloric energy[1] (Kcal/person/day)	Number of households	Percentage
1,000-1,400	3	1.3
1,401-1,599	12	5.0
1,600-2,000	31	12.9
More than 2,000	194	80.8
Average (min-max)	**2,488.2 (1,015.4-4,804.0)**	

Note: [1] The levels of caloric energy were modified from Department of Health, 2008; Somchai Jitsuchon and Jiraporn Plaengprapan, 2004.

The relationship between socioeconomic and food source factors and caloric energy acquired

The relationship between the socioeconomic factors and caloric energy acquired: the study reveals such socioeconomic factors as

educational level and non-cash income from aquatic animals caught from natural habitat show no correlation with the caloric energy acquired of the coastal artisanal fishing households in Trang province, whereas the number of household members is negatively correlated with the average caloric energy acquired by fishing households at a 'very low' level. That is to say that if the number of household members increases, an average caloric energy acquired by the fishing households decreases. Similarly, the amount of food consumed per week show a positive correlation with an average caloric energy acquired at a 'very low' level; that is to say if the amount of food consumed per week increases, the average caloric acquired by the artisanal fishing households also increases. Cash income earned from crop and livestock negatively correlated with an average caloric energy acquired by the coastal artisanal fishing households in Trang province at a 'high' level; that is to say that if the cash income from crop and livestock increases, an average caloric energy acquired by the artisanal fishing households decreases (Table 9).

Table 9. Relationship between socioeconomic factors and caloric energy acquired from food of the coastal artisanal fishing households in Trang province.

Socioeconomic factors	Average caloric energy (Kcal/day)		
	r	P-value	Level of relationship
Educational level	-.031^{ns}	.636	No relationship
Number of members in a household	-.169**	.009	'Very low' level
Amount of food consumed per week	.153*	.018	'Very low' level
Cash income			
Acquired from nature (aquatic animals)	.039^{ns}	.551	No relationship
Crop	-.808**	.003	'High' level
Livestock	-.882**	.009	'High' level
Non-cash income			
Acquired from nature (aquatic animals)	-.048^{ns}	.500	No relationship
Crops	-.061^{ns}	.771	No relationship
Livestock	-.331^{ns}	.468	No relationship

Notes: * a statistically significant relationship;
** a statistically significant relationship at 05 levels;
*** a statistically significant relationship at 01 level;
ns no statistically significant relationship

The relationship between food source factors and caloric energy acquired: It is found that the proportion of food acquired from crops, aquaculture and livestock is negatively correlated with an average caloric energy acquired of the artisanal fishing households at a 'very low' level; that is to say that if the proportion of food acquired from crop cultivation, aquaculture and livestock increases, the caloric energy acquired from food of the artisanal fishing households decreases. On the contrary, the quantity of live stock produced is negatively correlated with the average caloric energy acquired of the fishing households at a 'very high' level; that is to say that the proportion of food from livestock increases, an average caloric energy acquired of the fishing households decreases. Other food sources such as food from natural habitat, market and or shops, food exchange, and amount of food acquired from aquatic animals, plants, vegetable and livestock are not correlated with an average caloric energy acquired of the coastal artisanal fishing households in Trang province (Table 10).

Table 10. The relationship between food source factors and caloric energy acquired of the coastal artisanal fishing households in Trang province.

Food sources factors	Average caloric energy (Kcal/day)		
	r	**P-value**	**Level of relationship**
Food proportion (%)			
Crops, aquaculture, livestock	-.168*	.039	'Very low' level
Acquired from natural habitat	.063 ns	.334	No relationship
Market and or shops	.102 ns	.118	No relationship
Food exchange	-.038 ns	.640	No relationship
Quantify produced (kg. per year)			
Aquatic animals	.029 ns	.657	No relationship
Plants, vegetable	-.198 ns	.322	No relationship
Livestock	-.776*	.014	'High' level
Types of products			
Aquatic animals	.115 ns	.076	No relationship
Plants, vegetable	.135 ns	.502	No relationship
Livestock	-.436 ns	.240	No relationship

Notes: * a statistically significant relationship;
** a statistically significant relationship at 05 levels;
*** a statistically significant relationship at 01 level;
ns no statistically significant relationship

Discussion

Socioeconomic characteristics, food sources and caloric energy acquired of the coastal artisanal fishing households in Trang province

Most of the heads of the artisanal fishing households completed the primary education (75.8%). This is due to the fact that the wisdom and experience accumulated from generation to generation have taught the heads of the fishing households to realize that learning in the school system is not necessary for the engagement in occupation; though not completing a high level of education, people can earn income from the fishery. While some household heads demand their children to complete a certain level of education in order for them to engage in other careers that provide job security, such as government officials; however, part of the graduates who finish high school still return to fishery. This is because children of the fishing households have the skills and preference in this profession, the fact which is in consistent with a study by Sooknual (2007), stated that children in the mangrove area, a fishing community of Pak Panang Basin in Southern Thailand, learn to make a livelihood out of fishing since the age of 10 by accompanying their fathers in the boats during the holidays. Occasionally, sometimes they go out fishing with their families on weekdays, resulting in cases of dropout from Ban Kongkang School, at least 10 cases per years. Most of them leave the school at grade 4-5.

Food sources: Almost all of the coastal artisanal fishing households in Trang province acquire food from 2 major sources. Aquatic animals caught from natural habitat account for 52.2 percent and food acquired from markets and shops accounts for 29.1 percent. This is due to the fact that most fishing households keep use part of their catches for household consumption, mostly aquatic animals that have been damaged by fishing gears, such as headless and tailless shrimp or fish, which do not fetch a good price. However, the fish caught are mainly sold for income and the money earned is used for household expenses. A portion of the income is used for buying food such as rice, condiments, cooking oils, etc., thus making the proportion of food acquired from in the form of aquatic animals is greater than that that acquired from the market and shops. This shows that the artisanal fishing households in the coastal province Trang rely on the natural resources to create food security in the form of food and income for the households. The other two sources of food sources such as crop production, livestock rearing, aquaculture and food exchanges have the average proportion of 17.1 percent and 14.4 percent, respectively. This fact is consistent with the study by Yaimueang (2012) stated that the food security of the artisanal fishing communities depends on an great quantity of

food from the sea; the fishermen rely on natural resources from the sea and near the coast as economic resources. Food security comes from the selling of the products in order to earn an income and to spend for the cost of food.

Caloric energy acquired: 80.8 percent of the coastal artisanal fishing households in Trang province acquire sufficient caloric energy for bodily needs, i.e. more than 2,000 kcal per person per day. However, 6.3 percent of the fishing households acquire the caloric energy lower than the nutritional need criteria set by the Department of Health, i.e. in the range of 1,000-1,599 kcal per person per day. This is due to the fact that most households acquire energy from protein, such as from fish, crabs, shrimp and shellfish caught from nature and carbohydrates mainly from rice, thus gaining sufficient energy for bodily needs. At the same time, a few households acquire insufficient energy needs of the body since the number of household members is large and the amount of food evenly distributed among household members is limited. The other case is concerned with a member who is 70 years or older who naturally eats less, thus lowering an average energy received from food below the nutritional threshold. This case is in line with the study by Nantachai et al (2000) which notes that under-nutrition is a direct result of consumption behavior, such as eating less due to a limited amount and type of food available because of poverty or poor economic status, dietary habits, including poor nutrition. The biological environment factors such as age, gender and age are factors that affect nutritional condition.

The relationship between socioeconomic and food source factors and the caloric energy of the coastal artisanal fishing households in Trang province

The number of household members is negatively correlated with the average caloric energy of the artisanal fishing households at a 'very low' level ($r = -.169$); that is to say that if the number of household members increases, an average caloric energy acquired of the artisanal fishing households decreases. This is due to the fact that when there is an increase in the number of household members, the amount of food consumed in the household must be distributed among the members, focusing on filling the stomach of the members rather than the dietary diversity. In this typical household, members normally consume rice or carbohydrates in greater quantities. A source of protein mostly from the fish obtained from nature is partly used for household consumption, with vegetables or fruit reduced in amount. This finding is in line with the result in the work of Nantachai et al (2000) which found that the average family size or number of household members affects the quantity and quality of food consumed. The cost of food for a large family with many family members is

normally high but if cost of food per persona is taken into account, the cost of food is low. Therefore, in a large family or the family with a large number of family members, the quantity and quality of food consumed decrease. An interesting observation is that most of the artisanal fishing households under study are mainly of Islamic faith, where birth control is contrary to the practices in the religion. Therefore, more knowledge and understanding should be provided to the fishing households because in a larger number of household members, there is a tendency for the member to contract diseases arising from malnutrition (obesity, diabetes, hypertension) nutrition deficiency or underweight of the child. The Office of the National Economic and Social Development Board (2014) found that a large household with 7 members are twice as much to become a poor families as compared to a small family with three members, measured in terms of income and opportunities, access to basic services of the state.

Food intake items in one week: There exists a positive correlation between amount of food intake items in one week and an average caloric energy acquired of the artisanal fishing households in a 'very low' level ($r = .153$); that is to say that if the amount of food intake items in one week increases, the average caloric energy of the artisanal fishing households also increases. This is probably due to the fact that a household which consumed a variety of food or more than 24 food items in one week prefer to grow vegetables or herbs around the house or raising animals for household consumption. These extra materials can be added to the food items for the household. Or in the case where a household with a rather high income from the artisanal fishing, part of the income is kept for the purchase of raw materials to cook a variety of dishes. According to the research by Nantachai et al (2000), families can afford to buy food in the market for consumption at a larger or less quantity depending on family's affordability dictated by the income.

Cash income from crops and livestock: Cash income from crops and from livestock is negatively correlated with an average caloric energy acquired of the artisanal fishing households at a 'high' level ($r = -.808$, $r = -.882$, respectively); that is to say that if the cash income from farming and from livestock increases, the average caloric energy acquired from crops and livestock decreases. This is due to the fact that the coastal artisanal fishing households in Trang province derive an increasing income from the crops and livestock by doubling the revenue growing crops and raising livestock for commercial purpose rather than for household consumption. This practice causes the decline of household reserved caloric energy (kcal) from crops and livestock because the energy is changed into income. A similar instance has been echoed in the research by Unjan and Nissapa (2015) which found that farmers who grow oil palm as the main occupation choose to grow rice and

supply its yield to the factory manufacturing flour; they do not grow rice for household consumption, thus making rice reserve of households in the form of calorie to be lower than the rice and rubber farming households. As a result, an incidence of food insecurity among households that cultivate oil palm as the main occupation is the highest among this type of farming households, accounting for 53.1 percent.

Proportions of crop cultivation, aquaculture and livestock raising: Proportions of crop cultivation, aquaculture and livestock raising are negatively related to an average caloric energy acquired of the artisanal fishing households at a 'very low' level (r = -.168); that is to say that if the proportion of food from crop cultivation, aquaculture and livestock raising increases, an average caloric energy acquired of the fishing households decreases. This is due to the fact that the artisanal fishing households which cultivate crops, aquaculture and raise livestock for household consumption will have a higher food intake of proteins, fruits and vegetables than the fishing families which do not engage in crop cultivation, aquaculture and livestock raising, where protein foods, fruits and vegetables provide less caloric energy than carbohydrates. The table showing nutritional value of food in Thailand indicates that the caloric energy from the food intake of 100 grams, carbohydrates or grains such as rice provide a caloric energy of 231 kcal and Jasmine rice provide a caloric energy of 356 kcal. Protein such as eggs provides a caloric energy of 160 kcal; mullet provides a caloric energy of 98 kcal; tiger prawns with head provide a caloric energy of 120 kcal; chicken provides a caloric energy of 165 kcal. For vegetable group, morning glory provides a caloric energy of 24 kcal; *Phakkood* (fern) provides a caloric energy of 25 kcal; cucumbers provide a caloric energy of 15 kcal. For fruit group, watermelon provides a caloric energy of 8 kcal; guava provides a caloric energy of 43 kcal, etc. (Department of Health, 2001). The findings in this study reveal that approximately half of the artisanal fishing households in the province of Trang lack the land area for planting or raising animals. Therefore, the proper management approach for the artisanal fishing households to acquire sufficient caloric energy may be achieved by modifying the way how food crops are grown. Instead of spending a high investment on buying land for crop cultivation, the artisanal fishing households are encouraged to grow crops in containers and place them around the house for household consumption, the approach which requires minimum investment amount and it provides the households with a wide range of food for consumption, additional proportions of food from crops and more nutritional valued foods. Household members are able to acquire appropriate caloric energy from the food intake as required by bodily needs; at the same time, food security can be assured for the artisanal fishing households.

Livestock product: Livestock product is negatively correlated with an average caloric acquired of the fishing households at a 'high' level (r = -.776); that is to say that if there is an increase in livestock production, an average caloric energy acquired by the artisanal fishing households decreases. This is due to the fact that an increased livestock production results from the main aim of raising livestock of the fishing family, for commercial aspiration rather than for household consumption. This practice is in contrast with the sustainable farming principle and economic sustainability advocating that the net income per unit area is indeed an incentive for farmers to adopt technology. Sustainable agriculture can improve farmers' self-reliance, both in terms of the means of production and subsistence by utilizing the resources sparingly, reducing the volatility of output and income, increasing revenues by reducing expenditures, and encouraging production, partly to satisfy their own needs (Jitsanguan, 2007). Therefore, if the coastal artisanal fishing households in Trang province turned to livestock production for household consumption, they may be able to acquire an increased amount of caloric energy required.

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