Food Security in Peri-urban Area, San Sai Luang Subdistrict, San Sai District, Chiang Mai Province, Thailand

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Received: 26 May 2023; Revised: 25 September 2023; Accepted: 6 October 2023; Available Online: 15 December 2023

Abstract

Peri-urban areas are locations next to the city that are linked by transportation. Consequently, they are impacted by the city's horizontal expansion. This will ultimately result in a loss of suburban farmland. This article aims to investigate food security in the peri-urban subdistrict in San Sai Luang. 34 food availability questionnaires were distributed to agricultural producers along with surveying, and 134 household respondents were collected in order to study their consumption patterns. For analysis, descriptive statistics were applied. The results illustrate the three fundamental components of food security. The rice fields are unable to produce enough food for the population, so they must import food from nearby regions. Pesticide contamination is a threat to more than fifty percent of rice agriculture. The random sampling of vegetation from five local marketplaces found contamination of lettuce in the three markets in this study. In addition, contamination of kale and long beans was identified in certain markets. Second, food accessibility, the respondents can access food sources due to comprehensive transportation network. The respondents have just enough money to cover their food expenses, but they rarely have savings. This pertains to food insecurity in the event of future pandemics, political upheaval, and natural disasters. In addition, there is food disparity in the community, as individuals with higher earnings have easier access to food than those with lower incomes. Lastly, in regard to their food utilization, respondents have a high level of quantitative utilization, but they still carry the risk of not consuming enough nutrients and calories from their meals to meet the dietary requirement. Therefore, the San Sai Luang subdistrict needs to propose some strategies to minimize sensitivity to these three dimensions of food security and to build sustainable food stability in both family and community levels.

Keywords: Food Access, Food Availability, Food Security, Food Utilization, Peri-urban Area, Thailand

Introduction

Food security is one of the major worldwide concerns that requires considerable coordination between the public and commercial sectors. According to the World Economic Forum, by 2050, the world population of 9 billion would demand 60 percent more food than it does today (Hutt, 2016). Many nations are concentrating on the global challenge of ensuring food security. In addition, eradicating hunger, enhancing food security, improving nutrition, and promoting sustainable agriculture have been designated as one of the United Nations' 17 Sustainable Development Goals that will serve as a global framework for the 2030 Agenda for Sustainable Development (United Nations, 2015). Thailand is membership in the United Nations since 2015 and the results of assessing the status of operations over the past 5 years plan (2016-2020) on the second goal, ending hunger, which indicates agriculture development's annual growth rate is barely 3.17 percent, and the average annual growth rate of sustainable agriculture is only 1.15 million rai, which is less than anticipated (7.5 million rai in 2025 and 10 million rai in 2030).

In the meantime, the pace of the development and urbanization expansion is growing. This change leads to the greater the demand on land and affects the increasing sensitivity to shifting suburban agriculture first and encroaching subsequently on other biodiversity areas (Seto et al., 2013). The most sensitive zone is the peri-urban area (Bryant et al., 1982 as cited in Kanchanaphan, 2000) located between urban and rural settings (Pryor,

1968; Cloke, 1994 as cited in Kanchanaphan, 2000). This area is a relatively high risk of food supply loss on physical, economic, and social dimensions (Webster & Muller, 2002). Peri-urban areas of Oakland, for instance, face with changing land uses from the invasion of housing estates and has an impact on food supply insecurity. Small farms have been changed into homes, commercial space, and industrial facilities, causing Oakland to lose 8.3 percent of its arable land. Agricultural land, particularly in peri-urban areas; therefore, is likely to face provisioning in land and water resources with the expansion of urban areas and industrial production. Moreover, under the umbrella of capitalism, farmers believe that monocultures are more effective than integrated crops. Therefore, the existence of agriculture in peri-urban areas is prone to the risk of being lost leading to further food insecurity (Chen & Popov, 2015).

The peri-urban San Sai Luang Subdistrict in San Sai district, Chiang Mai province, Thailand was selected for the case study. The study region is now dominated by agricultural land, and its location is surrounded by transitional zones, including San Sai Noi Subdistrict, San Pranet Subdistrict, and Nong Jom Subdistrict, which is undergoing a change in land use. This is evident by the growing number of housing developments replacing agricultural land. In this context, the San Sai Luang subdistrict confronts challenges in securing the food supply for local and surrounding populations. To explain the food security situation in the peri-urban areas of San Sai Luang Subdistrict, this article therefore investigates the food security status including food availability, food access, and food utilization of the peri-urban areas of the San Sai Luang Subdistrict to propose guidelines for strengthening the resources and food security at the household and community levels. It is expected that these guidelines will help minimize the vulnerability of the agricultural system, increase the city's food resilience, and promote a local sustainable food system.

Between 1970 and 1979, a time of a global food crisis primarily caused by a lack of grain resources and a concomitant oil price crisis, the idea of food security started to gain prominence (McKeown, 2006 as cited in Prachasan, 2009). The word "food security" was first used in a formal sense during the 1974 World Food Conference, which conceived it as a problem resulting from an "Inadequate supply" of food in a particular country or region (FAO, 2006). According to Prachasan (2009), the idea of food security is dynamic and has evolved to embrace a variety of viewpoints depending on how different societies view the varied functions that food plays in various parts of the world. Nonetheless, the preeminent and widely accepted definition of food security comes from the 1996 World Food Summit in Rome, Italy, as articulated by PrasertSak (2012), which defines food security as "when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 1996). The 1996 World Food Summit defined food security in 4 dimensions (FAO, 2006). 1) Food availability means a sufficiency of local and national food production, food imports, and food aid or donations from various organizations in quality and quantity. It must be adequate to meet the needs of consumers under both normal and unpredictable scenarios, 2) Food access refers to the ability of individuals, communities, and nations to acquire sufficient, nutritious, and safe food. Moreover, food distribution must be unrestricted by legal, economic, social, and political constraints (racism, gender inequality). Access to adequate meals is largely determined by a person's income. Education is another key part of acquiring dietary knowledge (Feinstein et al., 2006; Luo et al., 2012), 3) Food utilization refers to the amount of food a person consumes and his or her ability to absorb sufficient nutrients for both human nourishment needs and the energy intake required for daily activities, and 4) food stability is the capacity to manage food availability, access to food, and utilization of food in a continuous and equitable manner, even under

uncertain circumstances such as epidemics, natural disasters, economic decline, political war, etc. (World Food Program, 2007). Food stability is not a factor for this research because the study areas were not ever encountered uncertain events during the research process. The conceptual framework of the 1996 World Food Summit was applied study as shown in Figure 1.

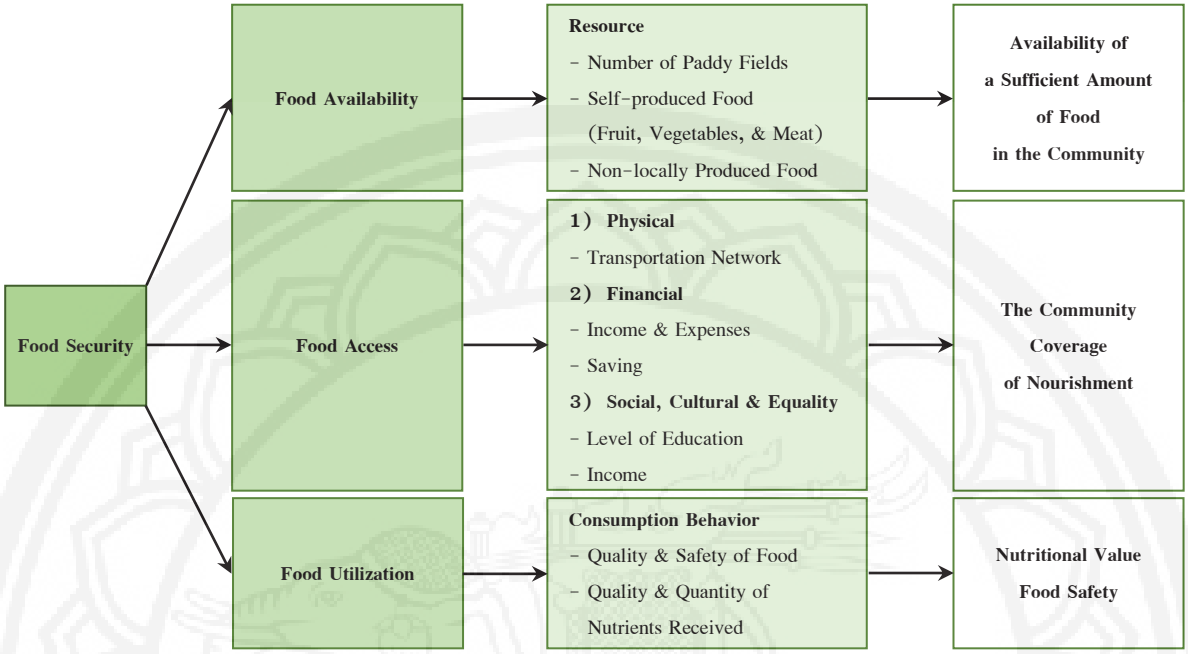

Figure 1 Conceptual Framework.

Methods and Materials

Study Area, Population and Sample

San Sai Luang, a subdistrict in San Sai district, Chiang Mai province, Thailand, was chosen as a case study. The study area is flat and suitable for agricultural areas because the Jo River passes through arable land. It is connected to the city of Chiang Mai by the Chiang Mai-Doi Saket Road, San Sai Road, and the middle and outer ring roads; thus, there is a propensity to convert agricultural land into housing developments. The area is characterized by peri-urban characteristics because some areas have been developed into housing estates, community malls, shops, and restaurants, while some areas still use a traditional lifestyle of agriculture. In 2018, the San Sai Luang Subdistrict consists of nine villages with 3,266 households and 7,112 people. The study employed Yamane (1973) to calculate the sample size for consumer questionnaires to record food consumption behavior. According to the households in 2018, 100 samples were needed for 90% confidence. 134 families were sampled from nine villages. Rice, the most extensively farmed crop in the area, was chosen as the representative plant for food availability. 34 farmer respondents were interviews. In a coordinated effort with community leaders from nine villages, both responder groups were selected using a snowball sampling technique. This collaborative effort sought to locate and appoint community representatives who met the predefined criteria of the target population.

Data Collection

This study was a quantitative and qualitative examination comprising the collection of primary and secondary data regarding consumption behavior of the household respondents and crop yield and production of sampled

farmers. All collected data was examined statistically. The following data are included in household questionnaire, farmer interviews, and field survey:

1. Data on food availability and access included:

- To determine the study area's resource base, a physical survey of the study area's rice fields is conducted, including measurements of their size, number, ownership, and river routes, which the research team did fieldwork within the selected area while working closely with local community leaders to conduct surveys and collect empirical data.

- A structured data recording form was used in conjunction with in-depth interviews with producer groups to assess the three primary factors of food accessibility: 1) A production component that covered communal farming's characteristics, including land ownership, crop type, quantity, quality, price, seed source, monetary gain, and production costs, 2) Consumption culture, which includes the amount and type of food consumed, the amount borrowed or shared food, and way of life related to natural resources, and 3) Marketing, income/expenses, and savings.

2. Data on food utilization includes production and consumption behavior of local people. Data were collected using a questionnaire and a record-keeping form, the household respondents recorded their food acquisition patterns during a seven-day period.

3. The spatial and location of land use change in the study area was assessed via satellite images and geographic information database from the Northern Region Geo-Informatics and Space Technology Center.

Data Analysis

The analysis of data utilized descriptive and inferential statistics, such as frequency and percentage, averaging, distribution measurement (standard deviation), as well as the chi-square test. In addition, Geographic Information System (GIS) was applied to illustrate the spatial distribution of food availability in the research area. Figure 2 depicts the research process.

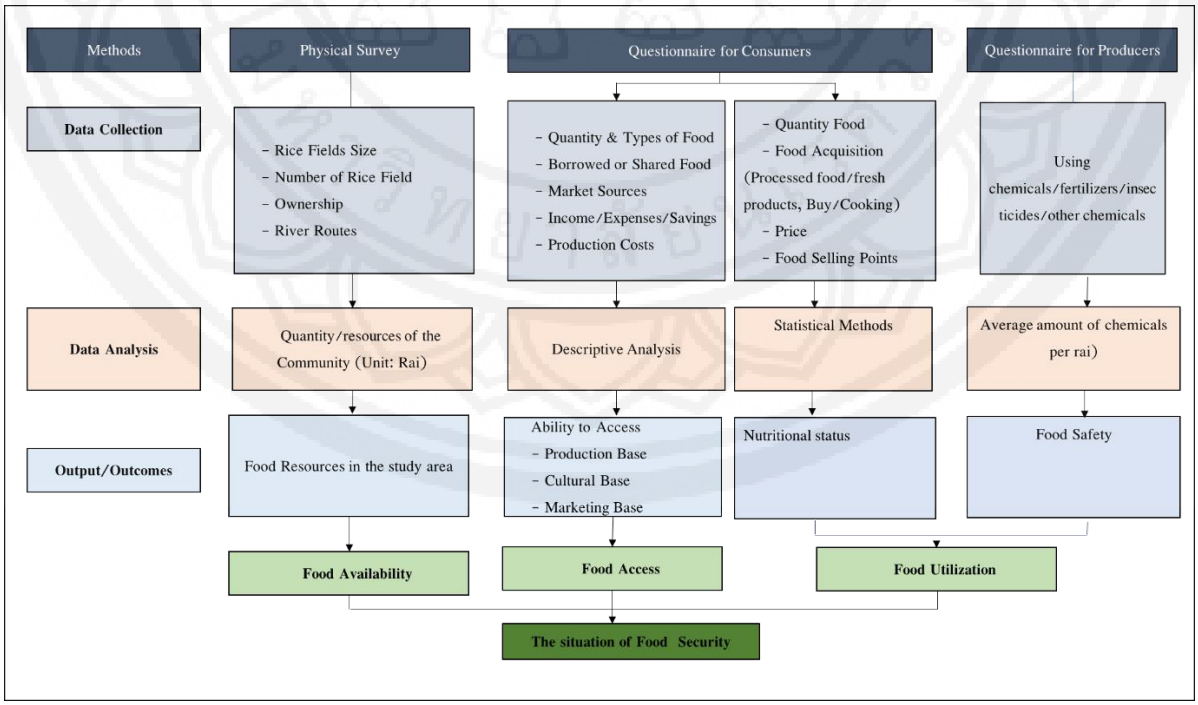

Figure 2 Research Methodology Framework.

Results

Food Availability of San Sai Luang Subdistrict

Food availability refers to food produced and stockpiled in the area, food imported and aid from other regions; that is, the amount of food available to feed a household or community (Evers & Korff, 2000). The availability of food in the study area was determined by analyzing the food sources that farmers may utilize for domestic production and imports.

The agricultural land in the study area is 1,614 rai, or 35.5% of the total area, and there are 145 households whose livelihoods are based on agriculture out of 3,266 total households, or 4.4% of all households. A survey conducted from community leaders showed that of the 145 agricultural households, there were a total of 327 farm lots, of which 80.7% were rented and 19.3% were owned. Rice fields are prevalent in water sources i.e., the Kad, Jo, and Kuang rivers, as well as the irrigation streams.

As for food produced in the area, data obtained from food producers in the study area, 34 farmer households, revealed that they cultivate 20 different types of food crops including vegetation, fruit, and rice. Rice comprises around 33 rai, or 80.48 percent, and vegetable gardens and fruits each comprise 4 rai, or 9.76 percent. Twenty-one households in the neighborhood produced meat-based dishes such as chicken, ducks, geese, fish, and beef. There are 88.24% of farms that use chemicals, whereas just 11.76% are organic.

The San Sai Luang subdistrict can produce food on a proportion of its own territory and import food from other regions. The Pa Muead Market traders purchased from Kad Nong Dok, Kad Mueang Mai, and San Kamphaeng District in Chiang Mai province, as well as from a wholesale market in Lamphun province. The sample of vendors at the San Sai Luang market bought vegetables from the Doi Saket and Kad Muang Mai districts. Whereas sampled merchants of Phu Doi market received goods from the Royal Project vegetables, Kad Mueang Mai in Chiang Mai, their relatives, and their personal farms. The products sold in Mae Gad market were farmed locally and bought from their nearby areas. Figure 3 depicts the distance of the food supply from the San Sai Luang Subdistrict and neighboring communities, as well as other districts and provinces. If food is imported from further away regions, it results in increased fuel usage and atmospheric carbon monoxide emissions (Desrochers & Shimizu, 2008).

The results of the study on food availability in the San Sai Luang Subdistrict indicate that the amount of food that can be produced in the community is insufficient to meet the area's demands. Food must therefore be imported from other regions. The majority of foods were grown using chemicals and pesticides to ensure their quality, which might lead to product contamination. In addition, it was discovered that the producers did not sell their goods locally, but rather to middlemen or in other regions.

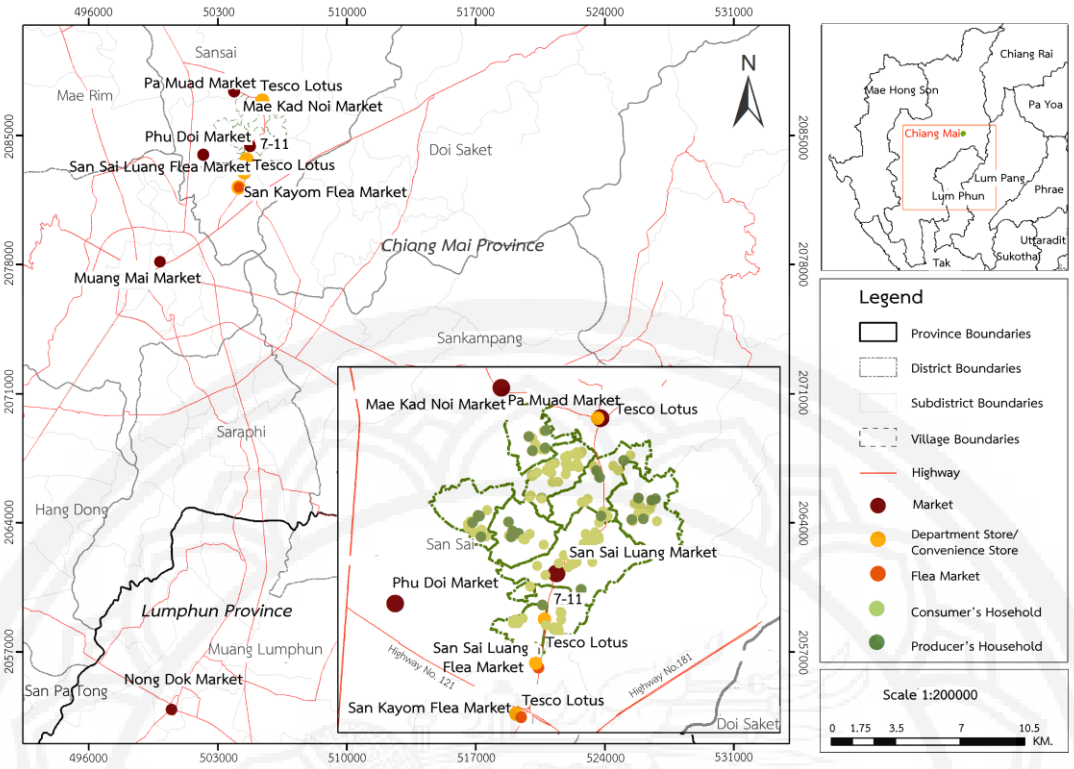

Figure 3 Distribution of Food Sources San Sai Luang Subdistrict.

Food Access

Food access is measured by the potential that households will acquire adequate, nutritious foods (FAO, 2006). Food accessibility can involve physical, monetary, and social factors:

1. Physical accessibility of food refers to the capability of gaining access to food sources or markets via a comprehensive and convenient transportation network. The north-south oriented Highway No. 1367 (Old San Sai Road) runs through the San Sai Luang Subdistrict. The research area has roadways along National Highways No. 121 and No. 118 (Chiang Mai - Doi Saket), incorporating a network of secondary roads across the region. Considering the road network and the location of the sample group, which consists of both consumers and producers, it was determined that the sample group has easy access to transportation routes in the area and a well-distributed food source, such as fresh markets, flea markets, community shops, and various convenience stores.

2. Food access means financial affordability regarding household income and expenses. The study determined that the sample's average household income is 17,809 baht per month, with the lowest median household income being 700 baht per month and the household with the highest average income having an average income of 100,000 baht per month. The deviation standard is 14,159.72. While the sample group's average monthly household expenditure was 11,479.5 baht with a standard deviation of 10,134.3, the lowest monthly household expenditure was 950 baht, and the highest monthly household expenditure was 77,500 baht. Moreover, while analyzing the costs that households incur in various categories, it was determined that the food category had the highest monthly average cost, at 4,411.2 baht. The sample group had higher household incomes than household expenditures. According to the income, expenditure, and savings statistics, 46.3% of the sample group had savings and the remaining half have no savings (53.7%). The sample group still has financial access to food, however, more than half of those who do not save may face food risks during the crisis. The threats from diverse conditions, such as epidemics, political issues, and natural disasters, including the lockdown period during the COVID-19

outbreak disrupt national and international trade and transportation, which leads to a lack of food security and stability (Tortajada & Lim, 2021). Moreover, if the economic crisis is factored in, this results in even less financial accessibility to food.

3. The capability of access to food sources in terms of social and cultural dimensions as well as equality of food access was analyzed in different income groups. The average monthly expenditure on food was 4,412,2 baht. The smallest monthly food expenditure was 300 baht, while the highest was 12,000 baht. 32.8 percent had food expenses between 2,000 and 3,999 baht per month, followed by 24.6 percent of food spending between 4,000 and 5,999 baht per month. Moreover, 29.1 percent of the sample group had household food expenses of more than 6,000 baht per month, and 13.4 percent had food expenses below monthly 2,000 baht. Considering household food expenditures in relation to household income, it was found that 49.2% of the sample group with monthly household incomes of less than 15,000 baht had monthly food expenditures between 2,000 and 3,999 baht. 28.3% of the sample, with a monthly household income between 15,000 and 29,999 baht spent between 4,000 and 5,999 baht on food each month. 54.5 percent with a monthly salary greater than 30,000 baht spend more than 6,000 baht on food each month. Using Chi-square statistics to evaluate the discrepancy between household income and household food spending of the sample group, a correlation was found between total household income and total food expenditure at the significant level of 0.05, with a Pearson Chi-Square value of 41,135. Therefore, it can explain that when the sample group's income increases, so would their food expenses. Alternatively, people with higher earnings have better access to food than those with lower incomes.

Food Utilization

Food utilization is consumption in accordance with the completeness and sufficiency of the nutrients required by the body. In addition, the received meal is clean and sanitary. There is no chemical contamination, and the food consumed is varied (not monotonous). The findings of the examination of data from 134 household surveys regarding weekly food consumption behavior revealed the following:

Food Quality and Safety

If the raw materials for cooking were produced at home, the bulk of them would be chemical-free, resulting in safe food. However, most ingredients for cooking were purchased from markets, or stores, which would be chemical-contaminated raw materials. The research classified food into three types as follows: 1) Fresh food is food ready to eat or to be used as raw materials for cooking, such as vegetables, fruits, pork, poultry, eggs, etc. 2) Food that has been cooked and is ready to eat from stores or markets, such as streamed rice, curry, side dishes, noodles, etc. 3) dry and instant foods, such as canned fish and instant noodles, etc. The following categories classify food sources:

1. Fresh food raw materials were produced in the respondents' households with chemically treated (pesticides, chemical fertilizers, including hormones). The sample group utilized this collection of basic materials to prepare 99 dishes, accounting for 7.2% of their meals, which they are consumed at home, distributed to neighbors, and sold. The majority of these were veggies, including yard-long beans, chili, lemon, eggs, mangoes, and rice etc. There were 1,270 things that account for 92.8% of the total amount of raw materials that are generated naturally and without the use of chemicals.

2. Regarding fresh food ingredients obtained from purchases, it was found that the majority of the sample mostly bought vegetable raw materials, amounting to 3,221 items, representing 57.5 percent, followed by meat, 1,519 items, most of which were bought from various sources, including fresh market, department store

convenience store and community shops. The most popular market to buy fresh food was Pa Muad Market, followed by San Sai Luang Market, Mae Kaet Market, and Muang Mai Market. In addition, some sample groups prefer to buy fresh food ingredients at the market, namely the San Sai Luang Municipal Market. Mae Kuang Market Mae Kaet Market and Sankhayom market, etc. For those who bought food from department stores/convenience stores, it was found that the sample group mostly bought fresh food ingredients in Tesco Lotus, followed by 7-Eleven, Big C, Makro, CP Fresh Mart, and Top market, respectively. The vegetables were tested to verify for cleanliness and safety including water spinach, kale, lettuce, and long beans. These sampled vegetables were from five markets where the respondents prefer to buy fresh food for cooking namely: 1) Pa Muad Market, 2) San Sai Luang Market, 3) Phu Doi Market, 4) Mae Kaet Noi Market, and 5) Tesco Lotus. The selected vegetables were applied to the GPO-TM/2 Kit test kit for organochlorine and pyrethroid chemicals produced by the Government Pharmaceutical Organization. The principle is to separate substances by means of Thin Layer Chromatography (TLC) and examined them by reacting with chemicals and absorbing UV with a wavelength of 254 nm to produce color. If there are organochlorine and pyrethroid insecticides, there will be circles (spots) in gray, dark brown to black on the TLC plate. Table 1 shows the results of the pesticide test. In every market, there was no chemical contamination of Water Spinach, whereas Lettuces were contained contaminated in Pa Muead, San Sai Luang, and Phu Doi markets. Kales was found to be contaminated in three markets (San Sai Luang Market, Phu Doi Market and Tesco Lotus), while Long Beans were contaminated in Pa Muead Market, San Sai Luang Market, Phu Doi Market. Based on the results of the investigation, the use of home-cooked food is safer than purchasing raw materials from the market, where there is a danger of exposure to pesticides from inadequately washed or unclean raw materials.

Table 1 Pesticide Test Results of Selected Vegetables from Different Markets

Source of Raw Materials	Water Spinach	Kale	Lettuce	Long Beans
Pa Muead Market	Negative	Positive	Positive	Negative
San Sai Luang Market	Negative	Negative	Positive	Negative
Phu Doi Market	Negative	Negative	Positive	Negative
Mae Gad Noi Market	Negative	Positive	-	Positive
Tesco Lotus	Negative	Negative	-	Negative

Note: A positive result indicates the presence of organochlorine and pyrethroids in the sample.
A negative result indicates the absence of organochlorine and pyrethroids in the sample.

3. Delicatessen: The sample group in San Sai Luang Subdistrict bought 1,525 items of ready-to-eat food. There were 6 food sources: 1) fresh market, 2) flea market, 3) community shops, 4) department stores/ convenience stores, 5) Sales peddlers, and 6) others (e.g., meetings, merit-making events within the community, etc.). The sample group most frequently purchased streamed rice or cooked noodles from a la carte restaurants in the neighborhood. The intake of delicatessen is considered a risk factor for noncommunicable diseases i.e., heart disease, diabetes, cancer, etc.

Quality and Quantity of Nutrients Received

The majority of samples in the San Sai Luang Subdistrict consumed main dishes 3,503 food items, or 92.0 percent of all food items, according to the observations of their consumption patterns. Followed by sweet foods, which account for 8.0% of all food items (304 items). In the category of sweet foods, there are 73 dessert types, representing 1.9% of the total food items, and 231 fruit items, representing 6.1% of the total food items.

In terms of cooking style, it was determined that of the 3,503 food items, the following was the most prevalent: 1) currying, with 957 items, or 27.3 percent, followed by 2) boiling, with 716 things, or 20.4 percent, 3) stir-frying 583 items, or 16.6% of the total, 4) deep frying 491 items, which corresponds to 14.0%, 5) pounding chili paste 232 items, equivalent to 6.6%, 6) spicy salad 197 ingredients, equivalent to 5.6%, 7) grilling 143 items, or 4.1% of the total, 8) others, 112 items, or 3.2% of the total number of food items, 9) streaming, 72 items, or 2.1% of the total number of food items.

The cooking style indicates that the responder is at risk of food intake because the proportion of foods prepared with oil or coconut milk is greater than the proportion of foods prepared without oil, hence increasing the risk of noncommunicable diseases due to dietary habits. The questionnaire revealed that 69 respondents (51.5%) in the sample group had underlying illnesses and risk factors for non-communicable diseases. Separated by diseases and risk factors, it was found that 53 people had hypertension, representing 76.8 percent of all diseases and risk conditions, followed by 23 people with diabetes, representing 33.3%, 5 people with hyperlipidemia, representing 7.2%, 4 people with asthma, representing 5.8%, and 2 people with both heart disease and cancer. Only one respondent was diagnosed with gout, fatty liver, and thyroid, representing 1.4% of the total number of people with diseases and at-risk situations.

In terms of quantitative adequacy, the samples received adequate nutrients at each meal, indicating that the individuals had sufficient energy to complete daily activities. The amount of energy obtained from the meal was calculated from the energy value of the food referring to the criteria of the Bureau of Nutrition, Department of Health, Ministry of Public Health (2018); Boonvisut (2001) and the Foodieat application developed jointly by the National Science and Technology Development Agency (NSTDA), National Electronics and Computer Technology Center (NECTEC), Thai Health Promotion Foundation (Thai Health), Food and Drug Administration (FDA), and Institute of Nutrition and the Department of Health. The results of the average food energy in each village were shown in Table 2. The respondents in the San Sai Luang Subdistrict received 1660.93 kcal per day, which is less than the recommended daily nutrient intake for adolescents and working men (2,000 kilocalories per day). The findings of the investigation revealed that samples from all villages within the San Sai Luang Subdistrict contained protein levels in excess of the threshold value (recommended value is 50 grams per day). The recommended daily allowance for fats is 65 grams. The results demonstrated that all villages consumed less fat than what is advised. While the recommended daily intake of carbohydrate nutrients is 300 grams each day, the respondents' intake of carbs is below the recommended level.

Table 2 Energy Acquired from Foods by Village in the Subdistrict of San Sai Luang

Village	Energy (kcal)	Protein (grams)	Fat (grams)	Carbohydrate (grams)
1	1,698.80	78.40	49.20	235.20
2	1,716.00	73.60	54.40	234.80
3	1,756.00	76.80	51.20	247.60
4	1,450.40	68.00	43.60	196.40
5	1,585.20	71.60	46.40	221.20
6	1,734.00	79.20	56.40	226.80
7	1,692.40	76.80	49.20	236.80
8	1,684.80	76.40	47.20	239.20

Table 2 (Cont.)

Village	Energy (kcal)	Protein (grams)	Fat (grams)	Carbohydrate (grams)
9	1,630.80	69.60	47.20	232.00
San Sai Luang Subdistrict	**1,660.93**	**74.49**	**49.42**	**230.00**
The daily amount of nutrients that should be consumed	**2,000****	**50**	**65**	**300**

Note: *Information from Prapaisri Sirijakawarn and Umaporn Sudhusworawat's 2012 and Food and Nutrition Policy for Health Promotion's 2020 reports.

**Teenagers and working males should consume 2,000 kilocalories every day to meet their energy needs. Children, working women, and senior should consume 1,600 kilocalories daily.

Conclusion and Recommendation

The study of food security in San Sai Luang subdistrict was examined from three main perspectives: 1) Food availability in peri-urban areas is a crucial resource base since a reduction in agricultural land in the study area brings about to a negative impact on food supply. Specifically, food produced for local use has continually decreased leading to the level of food dependence among local people. Consequently, food needs to be imported from other nearby areas, or other regions, 2) The availability of adequate, nutrient-dense food in sufficient quantity and quality to households is diminished. As the family production base declines, it must rely on external food sources, making it unable to control and manage the quality and amount of food, 3) Insufficient food utilization indicates that the quantity and quality of food consumed are inadequate to fulfill the body's nutritional needs. This may result in an inability to do daily activities due to a lack of sufficient energy.

According to the examination of food availability in the study area, food production is dispersed along water sources, including the Kad, Jo, and Kuang rivers, as well as irrigation streams. 35.5% of the whole area is agricultural land, with 4.4% of households involved in agriculture. The agricultural areas tend to diminish, and the land is repurposed for housing developments due to the urbanization of Chiang Mai city. The area of agricultural land decreased from 2,502 rai in 2013 to 2,124 rai in 2018 (Charoentrakulpeeti & Wattanapinyo, 2020). Furthermore, the growth of population is a major factor of the supply and demand for food that are out of balance (Nigussie et al., 2021; Chen & Popov, 2015). However, locals must import rice from other regions since paddy fields are insufficient for use, the majority of rice produced is sold to middlemen, and only 3 percent of farmers consume their own rice. Regarding food quality, it is discovered that there is a risk of chemical contamination because farmers used chemicals more than fifty percent for rice cultivation. Moreover, the farmer may not profit because of the high production costs i.e. seeds, fertilizers, and pesticides. The results of vegetable contamination tests conduct at five local marketplaces reveals that water spinach is contaminated with pesticides at every selected sites. Additionally, kale and long beans are found to be contaminated in some markets, and nearly 90 percent of the fertilizer used in farming were not organic. Farmers and suppliers lack understanding regarding the effects of chemical use on consumer health, environmental quality, and the ecosystem, as seen from chemicals in local agriculture and the importation of food from regions.

Due to effective communication and network connectivity, the consumer sample group can easily obtain food sources in terms of accessibility. The distribution of products can be found thoroughly i.e. fresh markets, flea markets, community stores, and a variety of convenience stores. Additionally, the sample has financial access to food because of their income sufficiency. However, there are still a significant number of the respondents that do

not have savings, which indicates food insecurity in the event of a variety of crises, such as economic recession, political chaos, and the pandemics etc. These are causing a decrease in food supply and influencing food prices. In term of inequality in access to food, the samples with higher income have better access to food than those with lower income. Low-income households may not be able to afford food of adequate quality, and their inability to procure sufficient food may negatively affect their health (Lugo-Morin, 2020).

For quantitative and qualitative food utilization, the respondents obtain adequate amounts of nutrients from meals. However, utilizing food for quality comes with the possibility of chemical contamination. The danger of food contamination from home is lower than that from commercial ready-made meals. In addition, energy content of the meals is below the nutritional guidelines. This indicates that the respondents have quantitative food consumption but insufficient qualitative food usage. Even though a major producer of agricultural products like wheat, sugarcane, rice, buffalo milk, and meat as Pakistan, a bigger proportion of the population still struggles with malnutrition (Bashir et al., 2010).

Based on the findings of the research, modern consumption behaviors and urbanization in peri-urban areas are the major contributors to Furthermore, limited financial access to food will exacerbate the food security crisis. Therefore, the study proposes the following guidelines to strengthen food security:

1. The study of food availability, access, and utilization enables the community of San Sai Luang to assess food security and the level of community self-sufficiency, which led to the determination of solutions at the household and community levels in consistency with the FAO's strategy that emphasizes on food production from large farms to households (FAO, 2015) and the Sufficiency Economy Philosophy established by King Rama IX focuses on family self-reliance for living, eating, utilizing, and relaxing. The philosophy can enhance livelihoods of the community through the producing of goods, thereby raising their values and insuring the group's sustainability. These require assistance from the local government and the private sector in the form of knowledge, skill, and administration. The development plan and policy of the San Sai Luang Subdistrict Municipality promotes the cultivation of local flora and the value-added processing of their products, such as betel nut trees. Furthermore, developing social networks will aid in the building of an alliance to encourage the development of a food basis and strengthen the family and community.

2. The vulnerability of food availability is a challenge for local communities in terms of development and conservation management because the city desires to expand the area for development into the surrounding area, while the city still requires food sources to feed their citizens and green spaces to create good environmental quality and serve as a source of recreation. The equilibrium between the value of green space to be preserved and the potential value of growth must be evaluated with a focus on the advantages and comprehensive consequences. Land use planning for food security must be considered in order to achieve sustainable development, such as the conservation of high-capacity agricultural lands and highly suited bare lands from further development (Nigussie et al., 2021). In the study areas, the legal mechanism, such as the Town and Country Planning Act, is utilized to designate existing land use zones. In practice, however, it cannot be managed due to the absence of incentives for farmers to maintain green spaces. It is essential to apply an incentive strategy and develop agricultural alternatives (Smith, 2013). The economic measures, specifically the Transfer of Development Rights (TDR), should be implemented because the farmer can sell or transfer development rights from conservation areas to more developed areas, and the conservation area will receive other benefits in exchange, which can be mandated at the local level (Piromreun, 1984 as cited in Bhumisuttikul et al., 2019).

Additionally, social-cultural incentives might assist farmers in preserving their lands. For instance, the Paendin-Thong-Koyruktakwa community in Nong Chok District, Bangkok can maintain its green areas for agriculture and a self-reliant life based on four principles as follows: 1) Religious principles, as it is a Muslim community and religious rites must be held every Friday in the mosque, resulting in sharing and conversation with children joining the community, 2) Under the philosophy of a sufficiency economy and lifestyle, the community has chosen organic agriculture, 3) Self-reliance helps communities handle economic downturns, 4) Community management enable group leaders to visit villages and hold small group meetings. These four rules can help the Paendin-Thong-Koyruktakwa community preserve an agricultural region that produces food and self-sufficiency (Charoentrakulpeeti & Mahawan, 2017). Maintaining suburban agricultural regions as a source of food necessitates an integrated, multifaceted strategy and cooperation from all sectors. In another instance, using Traditional Ecological Knowledge (TEK) to control weather, soil, seeds, plants, and animals to provide food security, Ban Na and Ban Pa located in Dansai district, Loei province, Northeast Region of Thailand, rain-fed rice farms are threatened by significant seasonal variations and uncertainty. Both villages used TEK to control the weather, soil, seeds, plants, and animals. By adopting seasonal and yearly rituals, taboos, and cultural norms, they created ecosystem institutions to strengthen individual-ecological interaction (Phungpracha et al., 2016).

3. Food utilization: According to the results, the sample group in the study area lacked food safety and obtained nutrients below the recommended nutritional levels. It is also the leading cause of non-communicable diseases, such as obesity or being overweight, because inexpensive food is typically low in nutritious value. Therefore, relevant local authorities such as village health volunteers and public health hospitals at the subdistrict and municipal levels should disseminate and create an understanding of the level of nutrition that should be consumed daily in order to promote knowledge of the people's food utilization as well as campaigning for the expansion of sustainable farming areas to provide chemical-free food from both local production and the purchase of raw materials and delicatessen, which contribute to the food security of the community.

4. Agricultural infrastructure is essential for pushing and encouraging farmers to continue their professions in agriculture. Cooperation between farmers, producers, and municipal authorities is essential for a sustainable food supply. Community groups and citizens should increase their collective understanding of the importance of constructing adaptive capacity in order to preserve or expand their production systems. This can aid in reducing food insecurity (Bryant et al., 2010). The provision of locations for selling chemical-free agricultural products requires the collaboration of the relevant sectors to define areas where safe and nutritious products can be conveniently and affordably distributed to consumers. This enables locally produced commodities to enhance the economic conditions of the community, and farmers are no longer forced to compete against international firms and giant retail chains on their own.

Therefore, strengthening self-reliance by implementing the Sufficiency Economy Philosophy Incentives for protecting agricultural land and cooperation amongst diverse local sectors will assist them in maintaining the food supply. Access to nutrient-rich foods will drive the growth and development of the agricultural sector in order to ensure food security and the extension of sustainably farmed land. This would contribute to Sustainable Development Goal No. 2, which is to eradicate hunger.

Acknowledgments

This research was successfully accomplished with the help of many parties. The research team would like to thank the Mayor of San Sai Luang Subdistrict Municipality, community leaders and key informants for their kind assistance and advice. This research can be undertaken with research grants from the Academic Development Fund, fiscal year 2018, Faculty of Social Sciences, Chiang Mai University.

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