

RESEARCH ARTICLE

Editorial Process: Submission:11/20/2022 Acceptance:02/18/2023

Capacity Building of a Self-Reliant Model Community for Cholangiocarcinoma Prevention by Producing Fruit and Vegetable Juice Products in a High-Risk Area of Thailand

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Abstract

Objective: This participatory action research aims to develop healthy fruit and vegetable juice products (FVPs) to enhance people's income and quality of life (QOL) in a community with the highest prevalence of cholangiocarcinoma (CCA) in Thailand. **Methods:** We randomly sampled study areas from 25 homes in a Thai community to solve poverty and improve QOL. Descriptive and inferential statistics were employed for data analysis. Moreover, qualitative data were analyzed by content analysis. **Results:** The community management system relies on local resources under religious inspiration. Academics also keep developing FVPs from local raw materials planted by organic farming under "Nong Lak Rak Sukapab." The product's nutritional value was measured by In-House and Nutrition Labeling Methods from National Food Institute Laboratory (IEC/ISO17025). According to the Bureau of Nutrition, a 230 ml bottle of each wheatgrass and corn juice contains nutrients beneficial to health and necessary for the body. In addition, the community has participated in production planning, marketing, distribution, and household accounting. As a result, average monthly household income and QOL increased with statistical significance after the project implementation. **Conclusions:** These findings demonstrated that improving communities' capacity to be health leaders by producing FVPs to prevent CCA in high-risk areas is critical to early disease prevention and community health care. These issues can also be applied to public policy implications for other regions and diseases in order to emphasize community health care and long-term community development.

Keywords: Income enhancement- quality of life- local development- Sustainable Development Goals

Asian Pac J Cancer Prev, 24 (2), 725-731

Introduction

Thailand is currently implementing the 20-Year National Strategy and the 12th National Economic and Social Development Plan, aiming at Sustainable Development Goals (SDGs). It focuses on two goals of SDGs: Goal 1 – End poverty in all its forms everywhere by raising people's incomes per day, and Goal 3 – Ensure healthy lives and promote well-being for all at all ages by preventing financial risks. Indeed, poverty is still prevalent in northeast Thailand, where incomes between the rich and the poor remain primarily different (Office of the National Economic and Social Development Board, 2016).

According to the situation review, the problems can be divided into three areas: 1) Health dimension: Ubon Ratchathani is the highest prevalence of Opisthorchis

viverrini (OV) and cholangiocarcinoma (CCA) in Thailand. The evidence was obtained from (i) report on the prevalence of OV, which was 28.7% (Sithithaworn et al., 2012), (ii) research assessing behavioral risk factors and risk areas, which was found to be 1.61 times riskier than the reference area (Songserm et al., 2020a), and (iii) cancer registry database which found that the age-standardized incidence rate (ASR) of men was 57.1 and that of women was 29.3 (Imsamran et al., 2018). 2) Economic dimension: The area of 5,549,799 rai in Ubon Ratchathani is suitable for agriculture, but chemicals are mainly used in production. Only 22,805 rai (0.4%) are organic farming areas. Therefore, it aimed to increase organic farming areas to 1% in 2021 (Ubon Ratchathani Provincial Health Assembly, 2017). It pushes for non-toxic agricultural products as food safety

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which can create value, solve poverty problems and enhance well-being (Office of Agricultural Research and Development Region 4 Ubon Ratchathani, 2021). Quality of life (QOL) issue: Employment and income were related to the QOL in urban poor in northeast Thailand (Surit et al., 2008). According to the employment and income, the savings of people in Ubon Ratchathani is only 1.3%, which does not meet the average household income per year compared to expenditure per person per year for the past three years (Community Development Office of Ubon Ratchathani, 2019). In addition, QOL affects the family earner and the survival of CCA patients, especially if the family has a patient in care at that time (Chanchai et al., 2019).

Muang Sam Sip is one of the districts of Ubon Ratchathani with low household income (Ubon Ratchathani Provincial Statistical Office, 2017). Also, the level of people's QOL is at 8.6 out of 10, ranked 12th out of 25 districts (Community Development Office of Ubon Ratchathani, 2019). For this reason, the administrators have realized the problems and planned to increase organic farming areas to drive the agricultural economy according to the concept of self-reliance community with organic agriculture. Accompanying the Faculty of Public Health, Ubon Ratchathani Rajabhat University has provided cooperation in academic support in developing health products, especially products that are antioxidants and can prevent CCA (Songserm et al., 2016). More importantly, these products are produced from local raw materials. People in the community are growers, manufacturers, suppliers, and beneficiaries. It is expected to create a career, generate income, enhance good health, prevent CCA and increase the QOL for people in the community. Therefore, this research aimed to develop healthy fruit and vegetable juice products (FVPs) from local wisdom with community participation for income and QOL enhancement of people in a rural community at-risk of CCA in Ubon Ratchathani, the highest prevalence of OV and CCA in Thailand.

Materials and Methods

Study design

This study is participatory action research (PAR) intending to develop FVPs from local wisdom by community participation for income and QOL enhancement of people in Ubon Ratchathani, located in northeast Thailand. Included in the study were as follows: 1) both men and women representing households living in the University's Flagship project area; and 2) people who were able to communicate in and understand Thai. Participants who were not willing to voluntarily participate in the study were excluded from the study. Finally, all the volunteers gave their consent to participate in the project by signing the consent form.

Study participants

The population was organic farmers from all 25 districts of Ubon Ratchathani, Thailand. First, study areas were drawn from 6 out of 25 districts with low household income and increased risk of CCA. So, Muang Sam Sip

District was drawn. Then, 25 households in Nong Lak Sub-district willing to participate in the local development project to alleviate poverty and improve QOL, known as the Flagship Project (Figure 1), were randomized.

Research tools

The research tools used in the exploration needs stage were the seven community tools, developed from anthropologists' devices used for in-depth community study, namely 1) geo-social mapping, 2) genogram, 3) community organization, 4) local health systems, 5) community calendar, 6) local history and 7) life history of interesting people (Chuengsatiansup, 2002).

The household income and expenditure record form developed by the researchers was used to collect the household income data, consisting of 3 parts as follows: 1) Part 1: Household information (12 items) used to determine the life identification of the poor households; 2) Part 2: The target households' income collection form, divided into three aspects: (a) agricultural income (plants, animals, fishery, product processing); (b) other annual income; (c) community/government/private support or assistance and 3) Part 3: Daily household income-expense record.

We applied the tool used to measure the QOL of the people in this study from 26 indicators of QOL of the World Health Organization (WHOQOL-BREF-THAI) (Dajpratham et al., 2011). Responses used a five-point Likert scale (from 1 = not at all means you do not have that feeling to 5 = incredibly means you always have that feeling)-the scores from 26 to 130 points, with higher scores indicating higher QOL. The Cronbach's alpha coefficient in this study was 0.87.

Data collection

The data collection process consisted of five steps (Figure 2).

Step 1 Exploration needs

The seven community tools were used to assess 1) the need for additional income, 2) the need to create added value of agricultural products, 3) the need for product processing, 4) the need for using local resources, 5) the need for community products, 6) the need for community pearls of wisdom, and 7) the need for community integration. We also collected data on household income and QOL before the implementation.

Step 2 Planning

It consisted of 1) coordinating with community leaders and relevant agencies to clarify research objectives, 2) Requesting permission to enter the area for a community survey, 3) organizing a meeting to prepare basic information and community needs, and 4) assigning products according to the agreements and developing prototypes.

Step 3 Implementation

It consisted of 1) workshop on the production of FVPs from organic materials, 2) workshop on product development according to the pasteurization system,

3) workshop on building a community product brand, 4) workshop on community marketing planning in the digital age, 5) workshop on creating safety in the use of vegetable and fruit juice production equipment, 6) workshop on finding factors related to accidents in the production process, 7) workshop on setting food and drug standards in the community and 8) workshop on household accounting.

Step 4 Monitoring

It consisted of 1) monitoring of production standards, 2) monitoring of production quality, 3) monitoring of building structures for production, and 4) monitoring of household accounting.

Step 5 Evaluation

It consisted of 1) evaluation of production standards, 2) evaluation of product quality, 3) evaluation of nutritional value, 4) evaluation of household income after the implementation, and 5) QOL measurement after the implementation.

Data analysis

Both quantitative and qualitative data were obtained from data collection. The accuracy of the collected data was verified and analyzed. The quantitative data were analyzed by a statistical package. The reliability of the statistical test was determined at the significance level of 0.05. Descriptive statistics, including mean, percentage, and standard deviation (S.D.), min, and max, were used

to analyze the demographic characteristics of the samples. The inferential statistics, including paired t-test, were used to compare the average monthly income and the average QOL scores of the participants before and after the implementation of the project. In addition, the qualitative data were analyzed by content analysis.

Results

The community has a long history and is located in a geographical area suitable for agriculture. The community management system relies on local resources under religious inspiration. The government, households, temples, and schools support the community health system. Academics also keep developing FVPs from two local raw materials planted by organic farming under “Nong Lak Rak Sukapab.” The community plays a role in all product development steps, namely exploration needs, planning, implementation, monitoring, and evaluation, as presented in Figure 3.

The product’s nutritional value was measured by the In-House Method and Methods of Analysis for Nutrition Labeling of the National Food Institute Laboratory (IEC/ISO17025). It was also found that a 230 ml bottle of corn juice contains 2% of fat, 4% of protein, 5% of carbohydrates, 4% of dietary fiber, 15% of sugar, 4% of sodium, 10% of vitamin B1, 2% of vitamin B2, 2% of selenium and provides 90 Kcal of energy. In addition, a 230 ml bottle of wheatgrass juice contains 2% of sodium, 8% of vitamin B1, and 2% of vitamin B2 (Table 1).

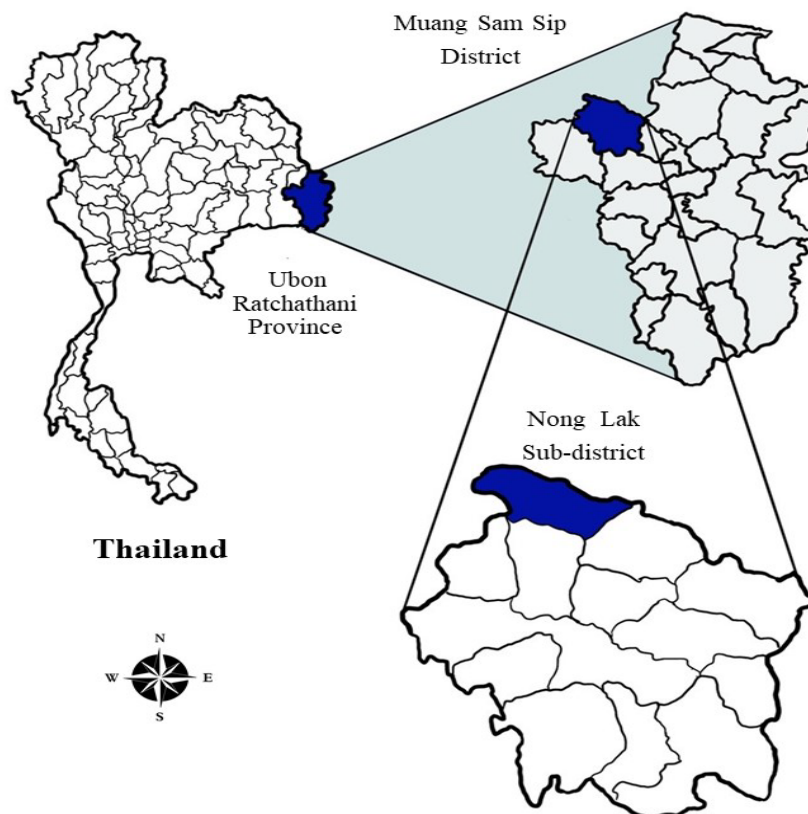


Figure 1. The study Areas

Table 1. The Nutritional Value of Healthy Fruit and Vegetable Juice Products: Corn Juice and Wheatgrass Juice

Test items	Test method analytical tools **	Analysis results: 230 ml.				The number of nutrients the body needs mg/day ***
		Corn juice		Wheatgrass juice		
		g/100 g	%/230 ml	g/100 g	%/230 ml	
Fat	In-House method T966 based on AOAC (2019)	1.5	2	0	0	45-78 g
Protein	In-House method T927 based on AOAC (2019)	3	4	0	0	75-100 g
Carbohydrate	Methods of Analysis for Nutrition Labeling 1993	16	5	0	0	225-235 g
Dietary fiber	In-House method T995 based on AOAC (2019)	1	4	0	0	25 g
Sugar	In-House method T997 based on AOAC (2019)	10	15	0	0	65 g
Sodium	In-House method T9152 based on AOAC (2019)	0.8	4	0.4	2	1.5 mg
Vitamin B1	In-House method T995 based on AOAC (2019)	-	10	-	8	0.2-1.2 mg
Vitamin B2	In-House method T997 based on AOAC (2019)	-	2	-	2	0.2-1.3 mg
Selenium	In-House method T9154 based on AOAC (2019)	-	2	-	0	15-55 mg
Energy	Methods of Analysis for Nutrition Labeling 1993	90 Kcal		N.A.		2,000 Kcal

** , Food Institute Laboratory (IEC/ISO17025), accredited by the Department of Medical Sciences (DMSc); ***, Dietary reference intake for Thais 2020, Bureau of Nutrition, Department of Health

The comparison of the average monthly income from household accounts revealed that after the implementation of the project, the average monthly household income increased with statistical significance at the level of 0.05 (Table 2).

Table 3 shows the results of comparing the average QOL scores before and after implementing the project. Again, the samples had better QOL than before participating in the project, with a statistical significance

Table 2. Comparison of the Average Monthly Income from Household Accounts before and after the Implementation of the Project

Samples	Average monthly income (Baht)	S.D.	t	p-value
Before (N=25)	4,758.00	0.2	-3.2	0.004
After (N=25)	6,909.90	0.5		

of 0.05.

Discussion

This research used the PAR process to solve poverty by increasing income and QOL for people in a high-risk area of CCA. The community was involved in every step from planning, implementing, and receiving benefits. It started by developing FVPs meeting the needs of the community

Table 3. Comparison of the Average QOL Scores before and after the Implementation of the Project.

Samples	Average QOL scores	S.D.	t	p-value
Before (N=25)	92.5	0.5	27.5	<0.001
After (N=25)	115.7	0.6		

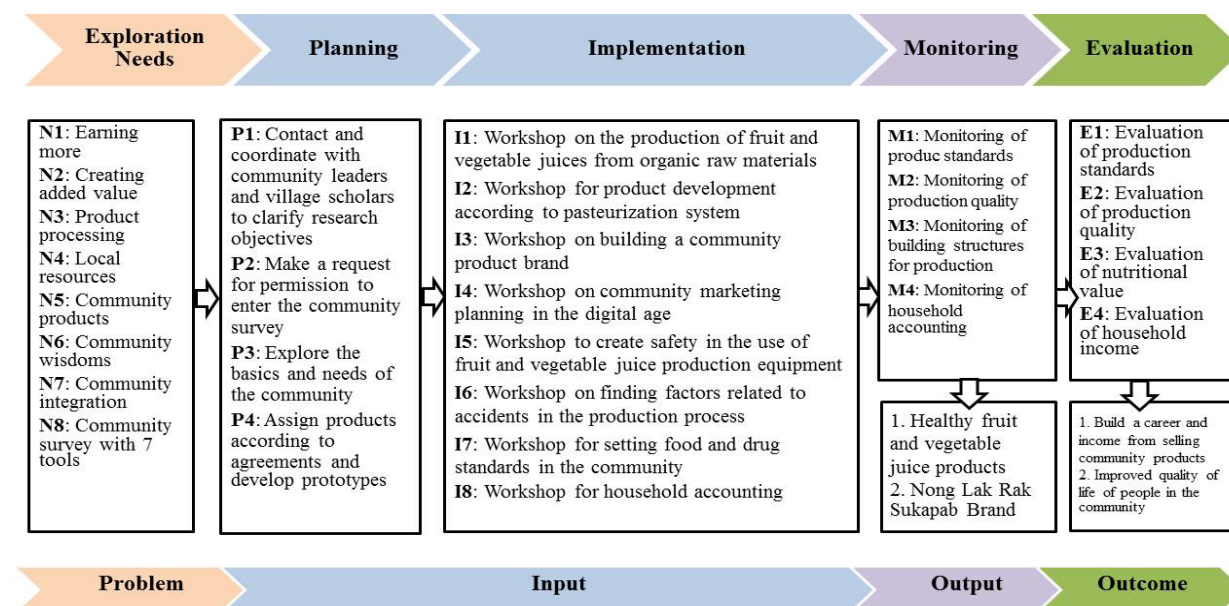


Figure 2. Data Collection Process

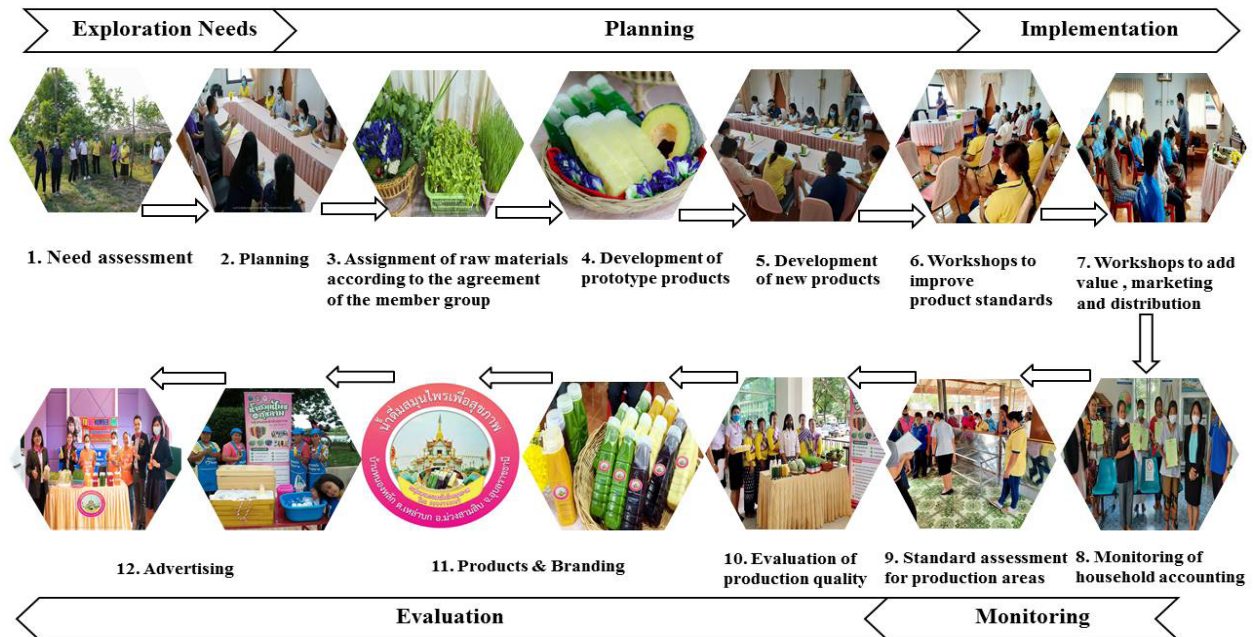


Figure 3. Development of Healthy Fruit and Vegetable Juice Products from Local Wisdom with Community Participation

and consumers. It can be seen that the household income of the community increased with statistical significance after participating in the project. This is probably because the community has developed a body of knowledge in producing and processing products that can reduce costs, resulting in higher profit margins and monthly income. This is consistent with the study by Saokham et al., (2018), developing the local product for hotel marketing business in Chiang Rai, Thailand, which was found the potential of the community in producing products that match the needs of hotel customers can increase sales and revenue.

The QOL of people in the community also increased with statistical significance after participating in the project. It is probably because the community has strong leaders who can gather community members together. People's free time has been reduced, but their working time has been increased. People in the community also get new knowledge all the time. There is a systematic management of household accounts. The community has self-worth. This makes it possible to use the ability to develop products for sale and generate income. The production is also balanced with natural resources in the community. Therefore, people have better QOL according to the community's way of life. This is consistent with a previous study, developing the product to enhance the competitiveness of community enterprises in Maha Sarakham, Thailand (Singmat, 2016). It was found that creating and developing a body of knowledge for manufacturers and creating a balance of production with natural resources can increase the competitiveness of community enterprises (Singmat, 2016). It is also consistent with a study by Suriyasarn et al., (2021), improving the life quality of farmer groups with organic agricultural innovations in Lampang, which found that creating community innovation as a model for organic agriculture begins with strong community leaders.

These FVPs are developed from organic ingredients rich in nutrients the body needs and antioxidants that help prevent various cancers, including CCA (Songserm et al., 2016). Corn has been reported to have active compounds and antitumor actions on lung cancer (Jayaram et al., 2015) and colorectal cancer cells (Ramos-Bueno et al., 2016). Wheatgrass (*Triticum aestivum*) extracts have high chlorophyll and essential vitamins, minerals, vital enzymes, amino acids, and dietary fibers (Khan et al., 2015). More importantly, it also has antioxidant, anti-aging, and anti-inflammatory effects that can inhibit ovarian cancer (Ben-Arye et al., 2017) and oral squamous cell carcinoma (Gore et al., 2017), hypoxia-inducible factor (HIF)-1-related diseases (Do et al., 2017). It also increased the immunity of colon cancer patients receiving chemotherapy (Avisar et al., 2020a; Avisar et al., 2020b). This indicates that FVPs, especially corn juice and wheatgrass juice, developed as the first products of the community, are of great importance in terms of benefits to consumers. They are safe for health and help prevent various cancers, especially in areas with a high incidence of CCA. This concept is one of the most sustainable models for CCA prevention with community participation (Songserm et al., 2020b).

Developing FVPs from local wisdom with community participation and academic support makes the community have health-consciousness. Still, it can also create a career and increase the income and QOL of rural people. It is also a starting point for being a model for community development under the concept of the SDGs in the social dimension. It is to end poverty, ensure healthy lives, promote well-being based on community resources, and create value for promoting new products in the community (Stolzenbach et al., 2013) to generate income and enhance QOL for a sustainable household economy. In terms of the potential of the community, it can be seen that this

community has food security as food can be grown, produced, and sold to consumers sufficiently. However, the researchers and the community continue to increase productivity or add new products to suit consumers and markets.

The present study has four potential limitations. First, there was a shortage of some raw materials outside the growing season. As a result, the products cannot be produced and sold. Most importantly, raw materials from other areas cannot be substituted because only organic materials are needed. Second, there was a restriction on the shelf life of products because they did not contain preservatives. Third, there was a lack of quality control over the raw material production process and the cultivation system meeting the food and drug standards. Finally, there were limitations on sales and marketing due to the Covid-19 outbreak situation, so their sales dropped.

In conclusion, To the best of our knowledge, we found that FVPs development from local wisdom with community participation and academic support makes the community care about health, generate income, and increase QOL in rural communities at-risk of CCA. Improving the capacity of communities to become health leaders through the production of FVPs to prevent CCA in high-risk areas is a key to early disease prevention and community health care. In addition, these issues can be applied to public policy implications for other regions and diseases to emphasize community health care and sustainable community development.

Author Contribution Statement

CY and NS conceived and designed the research. ST, CT, and OS were responsible for connecting and coordinating the fieldwork. CY, CT, YP, and JD collected the data. CY and NS carried out the analyses. CY and NS reviewed drafts of the paper. All authors contributed to the writing and revisions of the manuscript and approved the final version.

Acknowledgements

We would like to express our sincere gratitude to the community leaders and volunteers who cooperated in the research.

Funding statement

Ubon Ratchathani Rajabhat University granted this research to develop the community for the Flagship Project to Solve Poverty and Improve Quality of Life, which was a part of the Rajabhat University Strategic Fund for Sustainable Local Development. Faculty of Public Health, Ubon Ratchathani Rajabhat University, Thailand, partially funded this article.

Ethical approval

This study was approved by the Human Research Ethics Committee of Ubon Ratchathani Rajabhat University based on the Declaration of Helsinki and the ICH-GCP Guidelines (Ref. No. HE642027).

Availability of data (if apply to your research)

Data will be available upon request to the corresponding author.

Conflict of interest

The authors declare no competing interests.

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