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Factors associated with fruit and vegetable consumption among people in the highest risk area for Cholangiocarcinoma in Thailand

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ABSTRACT

Background: Over the past 30 years, the incidence of cholangiocarcinoma (CCA) in the Northeast of Thailand has been high and has tended to increase. Fruits and vegetables (FV) were accepted as protective factors against CCA. The prevalence of FV consumption among Northeast people is lower than recommended, which is a significant health problem that must be urgently solved.

Objectives: This study investigated the factors associated with FV consumption among people in Ubon Ratchathani, one of the high-risk areas of Thailand.

Methods: A multi-stage sampling method was used to select the population aged 40 years and over. Data were analyzed using descriptive and inferential statistics. A logistic regression analysis was performed to identify the factors associated with FV consumption.

Results: Out of the total 744 respondents, only 11.83% consumed FV according to the standard of <400 grams/day. The bio-social factor regarding an average family income of more than 15,000 Baht had a 10.54 times greater effect on FV consumption (AOR=10.54, 95% CI: 7.59-20.57). Purchasing FVs from mobile sales trucks (AOR=4.11, 95% CI: 1.69-9.97) and receiving information from radio (AOR=1.97, 95% CI: 1.14-3.39) were associated with standard FV consumption. However, a good level of attitude had decreased the risk of FV consumption (AOR=0.30, 95% CI: 0.18-0.49).

Conclusion: The prevalence of FV consumption among the study population is considerably low. Family income, purchasing from mobile sales trucks, receiving information from radio, and having a positive attitude were associated with standard FV consumption among people in Thailand's highest-risk area for CCA. Relevant organizations should organize activities to provide people of every economic status with knowledge and attitude on FV consumption via radio or social media and support access to quality and safe mobile sales trucks to meet consumption standards and prevent as well as reduce the risk of CCA.

Keywords: Cholangiocarcinoma, Fruit and vegetable consumption, Income, Multimedia, Attitude

1. Introduction

In Thailand, both the public and private sectors have given priority to preventing and controlling cholangiocarcinoma (CCA) [1]. In the year 1984, the Ministry of Public Health established a policy to prevent and control CCA in the Northeast, called "Isan people do not eat raw food" [2]. Campaigns were organized through various media channels, resulting in the deduction in the prevalence of *Opisthorchis viverrini* (OV) and CCA. However, the operations were not comprehensive and lacked continuity; therefore, the goals could not be achieved. Moreover, there was not much participation from the public sector, so the spread of OV in Northeast Thailand still existed. In 2012, a strategy called "Reduce OV, eliminate CCA, Isan people's agenda" was established as an influential agenda [3], in which the Ministry of Public Health was the leader in disease promotion and prevention. The public and private sectors and people in all sectors have been asked to join and continuously drive the policy. Over the past 30 years, the prevalence of CCA in the Northeast has been high and has tended to rise [4-6]. It is a significant health problem that must be urgently solved. The focus must be on making people aware of the importance of health by reducing the risk of CCA [7] and changing consumption values [8]. Previous studies revealed that drinking alcoholic beverages, OV infection, using praziquantel, and consumption of raw fish and fermented food containing nitrosamines were significant risk factors for CCA [9-11]. However, encouraging people to consume more fruits and vegetables should help reduce the incidence of CCA. An important reason is that fruits and vegetables were academically accepted as protective factors against CCA [9, 11-13].

In addition, many factors, including geographic factors[14], knowledge, attitude, behaviour, and bio-social factors are related to people's fruit and vegetable consumption [15]. Fruit and vegetable consumption are another important factor that promotes cancer prevention [12, 13]. However, the incidence of CCA in Northeast Thailand is high and tends to increase. The proportion of fruit and vegetable consumption among people in the Northeast is lower than the recommended level and the incorrect consumption behaviour may contribute to the development of CCA among the public. Therefore, more research is needed to investigate the factors associated with fruit and vegetable consumption, especially in areas with a high incidence of CCA.

Hence, the research team has recognized the importance of nutrition, which is an essential factor in reducing the risk of cancer, especially fruit and vegetable consumption behaviour of people in the areas with a high incidence of CCA in Thailand. So, this research was conducted to investigate the factors associated with fruit and vegetable consumption among people in high-risk areas of CCA in Ubon Ratchathani, the province with the highest incidence of CCA in Thailand [16] and to obtain empirical data on knowledge, attitude, and behaviour regarding fruit and vegetable consumption as well as the factors causing people in high-risk areas of CCA to consume fruits and vegetables. The obtained information can be used to plan policies to promote people with knowledge and attitudes toward good nutrition and behaviour to prevent CCA.

2. Methods

2.1 Study design and study participants

This study was an analytical cross-sectional study. The sample size was calculated using the finite population formula.

$$n = \frac{Np(1-p)z^2_{1-\frac{\alpha}{2}}}{d^2(N-1)+p(1-p)z^2_{1-\frac{\alpha}{2}}}$$

We specified that N = 778,633, people aged 40 and over who live in Ubon Ratchathani [17]; p = 41.70%, fruit and vegetable consumption in Northeast Thailand [18]; d = 0.05, and $\alpha = 0.01$. As a result, 645 was the sample size. After that, we added 10% of the sample size to prevent incomplete responses to the questionnaire, resulting to the sample size of 709. Therefore, we expected to receive no less than 709 questionnaires returned. However, by calculating the sample size based on the population proportion of each district, we obtained a sample of 744 people. A multi-stage random sampling method was employed for sample selection. Firstly, Northeast was selected from 6 regions of Thailand, after that Ubon Ratchathani Province was selected randomly. At the provincial level, 25 districts were selected, and one sub-district per district was selected. The number of samples obtained from random sampling was proportional to each district's population and age group. The inclusion criteria for the enrolment in the study included people who had lived in Ubon Ratchathani province for more than one year, could read and write Thai, and voluntarily participated in the research project. However, respondents who withdrew from the research during the research process and had a severe illness were excluded.

2.2 Research tool and validation

The data collection tool was a questionnaire consisting of three parts as follows:

Part 1: Sociodemographic information; sex, age, education level, occupation, and average monthly family income.

Part 2: Fruit and vegetables consumption behaviour: 1) amount of fruit and vegetable consumption per day (a fill-in-the-blank question); 2) frequency of fruit and vegetables consumption (responding on a 4-point rating scale: Not eating; 1-3 days a week; 4-6 days a week, and every day); 3) sources for purchasing fruit and vegetables (a closed-ended question with three options: Yes, No, and Don't know) and 4) sources of information about fruit and vegetables (a multiple choice question allowing the respondents to choose more than one answer).

Part 3: Knowledge and attitude towards fruit and vegetable consumption: 1) knowledge about fruit and vegetable (a closed-ended question with three options: True, False, and Don't know); 2) attitude towards fruit and vegetable consumption (responding on a 4-point rating scale: Strongly disagree, Disagree, Agree, and Strongly agree).

Five experts examined the content validity of the research tool. The Index of Item Objective Congruence (IOC) was more than 0.5, which is considered valid. Kuder-Richardson 20 (KR-20) checked the reliability of the knowledge questionnaire, resulting in value of 0.74. Cronbach's coefficient alpha examined the reliability of the attitude questionnaire (0.80).

2.3 Data collection

The data collection process was as follows: 1) The letter was submitted to request permission to collect data in the randomly selected sub-districts in 25 districts. 2) Coordination with the persons responsible in all 25 districts was carried out to clarify the research objectives and other research details and to make appointments for data collection. 3) The researcher collected data with one research assistant per district. The meeting was held to explain the steps and details of data collection to the research assistants before collecting data. 4) The data completeness was checked, and the data were coded to prepare for data analysis.

2.4 Ethical considerations

This research was approved by the Ubon Ratchathani Rajabhat University Ethics Committee for Human Research: UBRUEC (Ref. No. HE642017).

2.5 Statistical analysis

The statistical package SPSS was employed for data analysis. Descriptive statistics, including mean, percentage, and standard deviation (S.D.), were used to analyse the sociodemographic information of the participants. The inferential statistics: the binary and multivariate logistic regression analysis were performed to identify the factors associated with fruit and vegetable consumption among people in Ubon Ratchathani, Thailand's highest-risk area of CCA. Additionally, the adjusted odds ratio (AOR) and the 95% confidence interval (CI) value at the significance level of 0.05 were used to explain the results.

3. Results

Among the total 744 respondents, 365 were males (49.10%) and 379 were females (50.90%) with an average age of 53.72 years (S.D.±9.99). Most of the respondents had graduated from primary education (80.38%) and worked in agriculture (78.76%). In addition, most of the study population had an average monthly family income of less than 15,000 Baht (79.03%) (Table 1).

Table 1: The sociodemographic information of the participant (n=744)

Characterics	Number (n)	Percentage (%)
Sex		
Male	365	49.10
Female	379	50.90
Age (years)		
40-49	293	39.38
50-59	219	29.44
60-69	133	17.87
70+	99	13.31
Average age = 53.72 (S.D.= 9.99)		
Education level		
Primary school	598	80.38
Secondary school or higher	146	19.62
Occupation		
Agriculturist	586	78.76
Others	158	21.24
Average monthly family income (Baht)		
<15 000,	588	79.03
≥15,000	156	20.97

Out of total 744 participants only 11.83% had the standard fruit and vegetable consumption; which is at least 400 grams of fruit and vegetable consumption per day. The factors associated with fruit and vegetable consumption in high-risk areas for CCA in Ubon Ratchathani Province were; monthly family income of more than 15,000 Baht (AOR=10.54, 95% CI: 7.59-20.57), purchasing fruits and vegetables from mobile

sales trucks (AOR=4.11, 95% CI: 1.69-9.97) and receiving information from the radio (AOR=1.97, 95% CI: 1.14-3.39). Also, good level of attitude played protective role on consumption of fruit and vegetable (AOR=0.30, 95% CI: 0.18-0.49) (Table 2).

Table 2: Factors associated with fruit and vegetable consumption in high-risk areas for CCA in Ubon Ratchathani Province, Thailand (n=744)

Factors	Consuming fruits and vegetables According to standards (≥400 grams/day) n (%)	Crude OR	AOR	95 %CI	p-value
Overall	88 (11.83)	N/A	N/A	N/A	N/A
Average monthly family income (Baht)					
<15,000	28 (4.76)	1.00	1.00		
≥15,000	60 (38.46)	12.50	10.54	7.59 - 20.57	<0.001
Sources for purchasing fruits and vegetables					
Local or fresh markets	67 (10.84)	1.00	1.00		
Convenient stores	11 (11.46)	0.32	1.06	0.54 - 2.09	0.857
Mobile trucks	8 (33.33)	3.95	4.11	1.69 -9.97	0.002
Online	2 (33.33)	1.28	4.11	0.73 - 22.87	0.106
Sources of information					
Television	21 (8.05)	1.00	1.00		
Radio	47 (14.73)	1.26	1.97	1.14 - 3.39	0.014
Print media / online	20 (12.20)	2.94	1.58	0.83 - 3.02	0.161
Attitude (scores)					
Moderate (21-30)	61(18.60)	1.00	1.00		
Good (31-40)	27 (6.49)	0.32	0.30	0.18 - 0.49	<0.001
Knowledge (scores)					
Low (0-8)	23(15.23)	1.00	1.00		
Moderate (9-11)	14(10.22)	0.82	0.62	0.44 - 1.50	0.199
High (12-15)	51 (11.16)	0.84	0.69	0.54 - 1.33	0.177

*n= Frequency, AOR=Adjusted Odds Ratio, 95% CI=95% Confidence Interval

4. Discussion

The present study revealed that the monthly family income of more than 15,000 Baht had a 10.54 times greater effect on fruit and vegetable consumption than an average monthly family income of less than 15,000 Baht ($p<0.05$). This indicates that having an appropriate average family income makes it possible to have more access to purchasing raw materials for consumption and choose a wider variety of raw materials than those with low income. It is consistent with a study on fruit and vegetable consumption by sociodemographic and behavioural factors among adults in China by Li et al. (2022), which found that people with higher income had higher fruit and vegetable consumption than those with low income [19]. A study by Valmórbida and Vitolo (2014) also revealed that family income was related to fruit and vegetable consumption [20].

In terms of sources for purchasing fruits and vegetables, it was revealed that buying them from mobile sales trucks had a 4.11 times greater effect on consumption which points out that having mobile trucks or products reaching the community or home makes it more convenient and easily accessible than buying products from other sources. This aligns with a study by Myo et al. (2023) on the factors associated with fruit and vegetable consumption among Burmese refugees, which found that having a food store within walking distance of the house can promote fruit and vegetable consumption [21]. It also aligns with a study of the objective and self-reported factors associated with food-environment perceptions and fruit-and-vegetable consumption by Lucan et al. (2014), which revealed that accessing services in nearby areas was related to fruit and vegetable consumption [22].

In addition, receiving information from radio had a 1.97 times greater effect on the consumption than receiving information from television ($p<0.05$). This shows that in rural communities or areas, communication through radio can reach more people than any other communication source. It is consistent with a study by Nithitantiwat and Udomsapaya (2017) on food consumption behaviour among Thai adolescents, impacts, and solutions; which found that the media influencing food consumption behaviour included personal media, and advertising media from radio, television, newspapers, magazines, and the Internet [23]. A study by Vassanadumrongdee et al. (2020) on the perception of news and attitudes affecting plastic bag use of Thai youths also pointed out that the perception of news significantly affected behaviour change at the 0.05 level [24].

Moreover, a good level of attitude had a 70% greater effect on fruit and vegetable consumption than a moderate level ($p<0.05$). This shows that attitude is one-factor affecting decisions and behaviour. A good attitude affects purchasing choices, such as buying quality products or products necessary for life. This is consistent with a study by Suriyut et al. (2023) on developing a fruit and vegetable consumption promotion model in a high-risk population for CCA in Thailand, stating that attitude affected fruit and vegetable consumption among populations at high risk for CCA [25]. Moreover, a study by Klinkulab et al. (2014) on the factors predicting fruit and vegetable

consumption among Grade 6 primary school students in Pa Mok District, Ang Thong Province in Thailand, also found that attitude was associated with fruit and vegetable consumption [26]. The fact that people have a good attitude towards the consumption of fruits and vegetables leads to being good role models for individuals and communities that can be self-reliant by producing products that are used to prevent CCA in the community and selling them in other areas. It is beneficial in increasing the income and the quality of life of people in the community [27].

The acquisition of sample groups is strength of this study. The sample was selected from 25 districts of Ubon Ratchathani, randomly one sub-district per one district. The method used the distribution of questionnaires according to age and sex in proportion to the population of each district, which resulted in comprehensive data. However, the study design has limitations. It is well known that cross-sectional studies usually analyse data from a population. This may result in only information on fruit and vegetable consumption at single point during the time of collection.

5. Conclusion

The factors associated with fruit and vegetable consumption among people in Thailand's highest-risk area for CCA were family income, purchasing from mobile sales trucks, receiving information from the radio, and a good attitude. Promotion in various regions should be carried out to encourage people of all ages to be aware of fruit and vegetable consumption. Relevant government and private organizations should support and promote activities to encourage people of all ages to consume more fruits and vegetables that meet the standard of maintaining good health and preventing non-communicable diseases. Public health officials and village health volunteers should advise people on fruit and vegetable consumption by adding various online communication channels to make it more interesting.

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