International Journal of Public Health Asia Pacific
Open Access: e-Journal
ISSN: 2822-0587(Online)

Effects of health education program through TikTok application to prevent *Opisthorchis viverrini* and Cholangiocarcinoma of primary school students in Amnat Charoen, Thailand

Thanu Seangsawang[1], Nopparat Songserm[2]*, Wilawun Chada[3], Comsun Thongchai[1]

[1]Department of Public Health, Faculty of Public Health, Ubon Ratchathani Rajabhat University, Thailand
[2]Department of Health Sciences, Faculty of Public Health, Ubon Ratchathani Rajabhat University, Thailand
[3]Department of Community Health, Faculty of Public Health, Ubon Ratchathani Rajabhat University, Thailand

*****Corresponding author: Nopparat Songserm, nopparat.s@ubru.ac.th

ABSTRACT

Background: *Opisthorchis viverrini* (OV) is Thailand's most important cause of Cholangiocarcinoma (CCA). The prevention of such diseases must begin in childhood. They use smartphones or social networking services in multiple applications. TikTok is one of the applications to watch entertainment, news, and information to provide health knowledge.

Objectives: This quasi-experimental study aimed to investigate the effects of a health education program through the TikTok application to prevent OV and CCA among primary school students in Amnat Charoen, Thailand.

Methods: The knowledge tests and data collection were administered before and after the experiment. In the experimental group, 70 students from grade 6 received a health education program through the TikTok application. In the comparison group, 70 students received a health education program through brochures. Two types of research tools were employed: (1) the experimental tool, which was a health education program through the TikTok application, and (2) the data collection tool, which was a questionnaire consisting of 4 parts with Cronbach's alpha values of 0.72 and 0.75, respectively. The Kuder-Richardson 20 (KR-20) of the knowledge questionnaire was 0.78. The outcome variables were knowledge, health beliefs, and prevention behaviour. Data were analyzed using descriptive statistics, including frequency, percentage, mean, and standard deviation, as well as inferential statistics, including paired t-tests and independent t-tests.

Results: The findings revealed that after the experiment, the experimental group's mean scores of knowledges (Mean Difference=4.50; 95%CI:3.82-5.17), health beliefs (6.23; 95%CI: 5.08-7.38), and prevention behaviour (4.63; 95%CI: 3.52-5.74) of OV and CCA were significantly higher than those before the experiment ($p<0.001$). Also, they were considerably higher than those in the comparison group ($p<0.001$).

Conclusion: The health education program through the TikTok application can increase knowledge, health beliefs, and prevention behaviour of OV and CCA among primary school students. Therefore, applying it to other populations and diseases will be helpful.

Keywords: Cholangiocarcinoma, Health education, Opisthorchiasis, Primary school students, TikTok

1. Introduction

Opisthorchis viverrini (OV) is a fluke flat, leaf-shaped parasite that can be found in countries in Southeast Asia, especially in the northeastern and northern regions of Thailand and Laos in the Mekong River Basin [1, 2]. In the early stages, there are usually no symptoms. When there is a significant accumulation of parasites over a long period, it can cause symptoms such as bloating, abdominal distension, pain in the right rib cage, and stomach heat, which may turn into Cholangiocarcinoma (CCA) that may be deadly [3, 4]. OV is Thailand's most important cause of CCA [5]. In 2016-2020, OV infection rates were 16.3%, 11.7%, 5.7, 4.7% and 4.3% respectively. Moreover, the Northeastern region had the highest prevalence rate at the village level. More than 20 million people in the northeast region were infected with OV, or more than 6 million people had been infected with OV, considered as one-third of the country's population [6]. In 2016-2018, the National Cancer Institute reported the cancer registry data of the incidence of Hepatocellular Carcinoma (HCC) and CCA in Thailand, which found the age-standardized incidence rate (ASR) of 33.2 in males and 12.2 in females per 100,000 population, respectively [7]. Although this trend is becoming less common, it is still a significant problem because most patients in the early stages usually have no symptoms or specific symptoms [8]. Based on data from a nationwide survey about the current status of helminthiases in Thailand in 2019, the geographical distribution at the provincial level of OV showed that Amnat Charoen has a 0.01-5.00% prevalence [9].

Amnat Charoen is a province that has a significant problem with CCA. According to the data for 2016-2019, it was the number one cause of death, with death rates of 65.33, 69.00, and 61.11 per 100,000 population, respectively [10]. The important thing in reducing the prevalence or incidence of these diseases is to teach disease prevention knowledge from childhood. Providing knowledge through health education is recommended [11, 12]. This will protect individuals and enable them to disseminate the knowledge gained to other people in the future.

Since Grade 6, students are the oldest in primary school, they will effectively receive information, remember the data's details, and apply and transfer the obtained knowledge to other people better than students in other primary grades. They also live close to their

parents to talk and exchange stories with each other [13]. In addition, these students also use smartphones, allowing them to freely use various applications, such as searching for information on the internet or using social networking services in multiple applications like Facebook, LINE, TikTok, or Instagram. TikTok is a prevalent application nowadays. Its feature is creating and sharing short videos with others globally. Most users, therefore, use it to watch entertainment, news, and information or even provide health knowledge [14-17]. However, there have been limited studies on OV and CCA. This study aimed to study the effects of health education programs through the TikTok application in preventing OV and CCA of primary school students in Amnat Charoen, Thailand. The outcomes of this study will also result in the transfer of the knowledge gained to parents and family members and the use of it as a guideline for preventing OV and CCA in the community.

2. Methods

2.1 Study Area

This study was conducted in Amnat Charoen Province, Thailand.

2.2 Study Design

This study was a two-group pre-test-post-test quasi-experimental design. The study population was divided into the experimental group and the comparison group. We administered the knowledge tests and collected data before and after the experiment (Educational Intervention). As determined by the researchers, the experimental group received a health education program for OV and CCA prevention through the TikTok application for 12 weeks. In contrast, the comparison group received a health education program for OV and CCA prevention through brochures for 12 weeks.

2.3 Population and Sample

2.3.1 Sample Size Calculation

As of 21 August 2022, the population included 20,490 primary school students in Amnat Charoen Province [18]. The sample consisted of Grade 6 students studying in schools in Amnat Charoen Province. The sample size was calculated using the sample size formula to compare means in two independent populations.

$$n = \frac{2(Z_a Z_\beta)^2 \sigma^2}{(\mu^1 - \mu^2)^2}$$

We specify that the mean scores for knowledge of OV (μ^1) in the experimental

group were 19.42 (S.D.=0.61), and the mean scores for knowledge of OV (μ^2) in the comparison group were 15.79 (S.D.=1.72) [19], α = 0.05, Z_α = 1.64, and Z_B = 1.28. As a result, the sample size was 66.50 persons per group. To prevent the problem of sample loss, the sample size in this study was increased by 2%. Therefore, the appropriate sample size for this study was 69.8 (≈ 70) people.

2.3.2 Random sampling methods and sample acquisition

A multiple-stage sampling method was employed with the following steps.

Step 1: A stratified random sampling method was employed for site selection based on the size of primary schools in Amnat Charoen Province, Thailand. As of 21 August 2022, there were 252 schools: 179 small schools, 69 medium-sized schools, 3 large schools, and 1 extra-large school [18]. Drawing lots were performed to select schools. As a result, a large school group was selected.

Step 2: Simple random sampling was used to select the schools. Two schools were chosen from 3 large schools and divided into an experimental group and a comparison group. A school was randomly selected as the experimental group in the first randomization. In the second randomization, a school was assigned to the comparison group. As a result, Muang Amnat Charoen School, with more than 100 Grade 6 students, was randomly assigned to the experimental group, and Anuban Pathumratchawongsa School, with more than 100 Grade 6 students, was randomly assigned to the comparison group.

Step 3: Simple random sampling method was employed to select the samples used in the experiment. Two classrooms from all Grade 6 classrooms of the experimental group and two classrooms from all Grade 6 classrooms of the comparison group were selected. As a result, a sample size of 70 students per group was obtained. 6/3 and 6/4 classes of Muang Amnat Charoen School were randomly assigned to the experimental group, and 6/2 and 6/3 classes of Anuban Pathumratchawongsa School were randomly assigned to the comparison group.

2.4 Data Collection

2.4.1 The Experimental Plan

In the experimental group, we organized the health education program activities through the TikTok application, which affected behaviour modification for OV and CCA prevention among primary school students in

Amnat Charoen Province, Thailand. In the comparison group, health education on the same topics was provided as the experimental group using printed media (brochures). Data were collected before and after the experiment. After the research was completed, the comparison group would receive the health education program through the TikTok application on OV and CCA, the same as the experimental group (Table 1).

Table 1: The health education program through the TikTok application for OV and CCA prevention among primary school students in Amnat Charoen Province, Thailand.

Week	Activities
0	Meetings with relevant people, visiting the area, and preparing activities, locations, and sample groups.
1	Preparing the target group and clarifying the objectives of the activities Collecting data before the experiment using a questionnaire
2	Creating TikTok accounts for those who do not have an account Demonstrating essential use of the TikTok application and asking the target group to follow and add friends with the researcher's account Guiding the topics of video clips that would be uploaded through the TikTok application and specifying the period for presenting each topic
3-4	Uploading a video clip on the topic of "*OV: a deadly liver fluke*" to provide knowledge about the background and origin of OV
5-7	Uploading a video clip on the topic of "*Causes of OV infection*" to provide knowledge about the causes of OV infection, carriers, and channels to get parasites into the body
8	Uploading a video clip on "*Symptoms of OV*" to provide knowledge about symptoms that appear after a person is infected with OV
9-10	Uploading a video clip on the topic of "*Causes and symptoms of CCA*" to provide knowledge about the illness with CCA, which OV causes
11	Uploading a video clip on the topic of "*Prevention of OV and CCA*" to provide knowledge about practices and behaviour modification to avoid the risk of OV and CCA
12	Summarizing the lessons learned after acquiring all knowledge
13	Collecting data after the experiment (30 minutes) using a questionnaire

2.4.2 Research tools and quality validation

The following two types of research tools were used in this study.

The experimental tool was a health education program through the TikTok application constructed by the researchers based on the concept of a health belief model for OV and CCA prevention among primary school

students in Amnat Charoen. The researcher applied for the TikTok to upload 3-minute educational video clips. It was a 12-week activity period and used only with the experimental group. During the experimental period, to prevent contamination between the experimental group and the comparison group, we used the friend-adding-following section. The researcher's account was set as a private account, and follow-up invitations were sent to the accounts in the experimental group to access educational video clips. However, at the end of the experimental period, the researcher's account was changed to public, so other accounts and those of the comparison group were allowed to view educational video clips.

The data collection tool was a questionnaire on knowledge, health beliefs, and prevention behaviour of OV and CCA, divided into four parts: Part 1: Personal information, Part 2: Knowledge about OV and CCA: It consisted 15 questions with the answers of 2 options: Yes = 1 and No = 0 points. Part 3: Health beliefs regarding OV and CCA consisted 12 questions, with responses on a 4-point ordinal scale: Strongly Agree = 4, Agree = 3, Disagree = 2, and Strongly Disagree = 1, and Part 4: Prevention behaviour of OV and CCA. There were ten questions. The answers were on the ordinal scale, which had four levels of measurement: Always= 4, Often = 3, Sometimes= 2, and Never= 1. The Cronbach's alpha values of the questionnaires on health beliefs and prevention behaviour were 0.72 and 0.75, respectively. The Kuder-Richardson 20 (KR-20) of the knowledge questionnaire was 0.78.

2.5 Data Analysis

The data acquired by the questionnaire were analysed using the following statistical package: 1) The general data of the samples were analysed by descriptive statistics, including mean, percentage, standard deviation, and minimum and maximum values. 2) The difference in mean scores before and after the experiment within the experimental group was compared by paired t-test. 3) The comparison of the difference in mean scores before and after the experiment between the experimental group and the comparison group was analysed by independent sample t-test.

2.6 Ethical Clearance

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. HE662020).

3. Results

Most of the participants in experimental group were 12 years old (81.43%) and were female (62.86%) with no history of eating raw or semi-cooked freshwater fish (51.43%). However, their family members had a history of eating raw or semi-cooked freshwater fish (77.14%). Although, their family members did not have a history of OV and CCA (95.71%). Most of them had a smartphone or tablet (95.71%) and used Facebook, LINE, Instagram, or TikTok (97.14%). As for the comparison group, they were mostly 12 years old (91.43%), female (54.29%) with no history of eating raw or semi-cooked freshwater fish (51.43%). However, their family members had a history of eating raw or semi-cooked freshwater fish (58.57%). Similarly, their family members did not have a history of OV and CCA (97.14%). Furthermore, most of them had a smartphone or tablet (98.57%) and used Facebook LINE or Instagram or TikTok (97.14%). Notably, the baseline characteristics of both groups were not significantly different, especially gender and age (Table 2).

Table 2: Baseline characteristics of the respondents of Experimental and Control groups

General Information	Experimental group		Comparison group		p-value
	Number	%	Number	%	
Gender					
Male	26	37.14	32	45.71	0.196
Female	44	62.86	38	54.29	
Age (years)					
11	13	18.57	6	8.57	0.377
12	57	81.43	64	91.43	
History of eating raw or semi-cooked freshwater fish					
Yes	34	48.57	34	48.57	0.567
No	36	51.43	36	51.43	
History of eating raw or semi-cooked freshwater fish of family members					
Yes	54	77.14	41	58.57	<0.001
No	16	22.86	29	41.43	
History of having OV and CCA of family members					
Yes	3	4.29	2	2.86	0.500
No	67	95.71	68	97.14	
Having a smartphone or tablet					
Yes	67	95.71	69	98.57	0.310
No	3	4.29	1	1.43	
Using Facebook or LINE or Instagram or TikTok					
Yes	68	97.14	68	97.14	0.690
No	2	2.86	2	2.86	

The mean scores of knowledges, health beliefs, and prevention behaviour of OV and CCA of the experimental group after the experiment were 14.44, 42.97, and 26.94, respectively. The differences in the mean scores within the experimental group were 4.50, 6.23, and 4.63, respectively. It was also revealed that the mean scores of knowledges, health beliefs, and prevention behaviour of OV and CCA of the comparison group after the experiment were significantly higher than those before the experiment (p<0.001) (Table 3).

Table 3: Results of comparing the means scores of knowledges, health beliefs, and prevention behaviour of OV and CCA before and after the experiment within the experimental and comparison groups.

Factors	Before the experiment Mean (S.D.)	After the experiment Mean (S.D.)	Mean Diff.	95% CI	p-value
Experimental group					
Knowledges	9.94 (2.86)	14.44 (0.65)	4.50	3.82, 5.17	<0.001
Health beliefs	36.73 (4.91)	42.97 (2.83)	6.23	5.08, 7.38	<0.001
Prevention behaviour	22.31 (4.31)	26.94 (1.80)	4.63	3.52, 5.74	<0.001
Comparison group					
Knowledges	9.84 (1.65)	10.47 (1.70)	0.62	0.45, 0.80	<0.001
Health beliefs	35.57 (2.63)	36.84 (2.61)	1.27	1.01, 1.53	<0.001
Prevention behaviour	22.44 (3.05)	23.34 (3.13)	0.90	0.57, 1.23	<0.001

The mean scores of knowledges, health beliefs, and prevention behaviour of OV and CCA of the experimental group after the experiment were significantly higher than those of the comparison group (p<0.001) (Table 4).

Table 4: Results of comparing the means scores of knowledges, health beliefs, and prevention behaviour of OV and CCA before and after the experiment between the experimental and the comparison groups.

Factors	Intervention	Experimental group Mean (S.D.)	Comparison group Mean (S.D.)	t	p-value
Knowledges	Before	9.94 (2.86)	9.84 (1.65)	0.22	0.829
	After	14.44 (0.65)	10.47 (1.70)	18.25	<0.001
Health beliefs	Before	36.73 (4.91)	35.57 (2.63)	1.76	0.081
	After	42.97 (2.83)	36.84 (2.61)	13.28	<0.001
Prevention behaviour	Before	22.31 (4.31)	22.44 (3.05)	-0.20	0.839
	After	26.94 (1.84)	23.34 (3.13)	8.29	<0.001

4. Discussion

The study's results on the health education program through the TikTok application for OV and CCA prevention among primary school students in Amnat Charoen Province, Thailand, showed that the mean scores of the

experimental group were higher than those before the experiment and the comparison group. After receiving the program, the experimental group had more knowledge, health beliefs, and awareness about the diseases that significantly impact life, resulting in behaviour modification in disease prevention. This corresponds to a study on the effects of a health education program with a short video on behaviour modification for liver fluke prevention among risk groups aged 40-59 years in Selaphum District, Roi-Et Province, Thailand [20]. It was found that after experiment, the mean scores of the experimental group on knowledge, perceived susceptibility, perceived severity of OV, perceived benefits and perceived barriers to OV prevention, and practice of OV prevention were significantly higher than those of before the experiment and the comparison group ($p<0.05$).

Knowledge about OV and CCA: The experimental group's knowledge was high. The mean knowledge score was significantly higher than score before the experiment, and the comparison group. This is consistent with a study of the effects of the TikTok application on the English-speaking skills development of English as a Foreign Language (EFL) in high school students amidst the COVID-19 pandemic [21]. It was found that Grade 11 students' speaking skills were significantly higher than before utilizing the TikTok application and the control group ($p<0.001$). It also aligns with a study on the effects of health education programs with a short video on behaviour modification for OV prevention among risk groups [20]. The findings revealed that the experimental group's mean score on the knowledge about OV was significantly higher than before the experiment and the comparison group ($p<0.05$). It is also consistent with a study of the effects of health education group programs with electronic media (Facebook) on skill development for adolescent pregnancy prevention among grade 7 students in Buriram Province [22]. The participant's scores on the knowledge of teenage pregnancy prevention were significantly higher than those before participating in the program.

Health beliefs regarding OV and CCA: The experimental group's mean score was significantly higher than before the experiment, and the comparison group. (1) Perceived risk of disease was at the highest level. People may follow health recommendations when in normal and sick conditions. Each person has different health

belief levels. Therefore, they avoid diseases by following different measures to prevent them and maintaining their health [23]. (2) Perceived disease severity was at the highest level. This may be due to the perceived severity of disease, health problems, or effects of disease, causing disability or death. Severity assessment depends on the individual's level of arousal of the illness. (3) Perceived disease treatment and prevention benefits were at the highest level. This may be because when people search for a method for curing or preventing the disease, they must believe that it is a reasonable, beneficial, and appropriate action to cure or prevent it. (4) Perceived barriers were at the highest level. It is because perceived barriers to practice refer to people's anticipation of engaging in behaviours related to their health in a negative way, such as expenses. All of the information above is consistent with investigating the effects of health education programs with short videos on behaviour modification for OV prevention among risk groups aged 40-59 years [20]. The results revealed that the perceived benefits and barriers to practicing OV prevention were more significant than before the experiment and the comparison group ($p<0.05$). It is also in line with a study on the effect of health education programs on health belief model application with social support for behavioural change to prevent OV and CCA of people aged 40 years and over in Muangmai Subdistrict, Sriboonruang District, Nongbua Lamphu Province [24]. It was found that after the experiment, the experimental group's knowledge, perceived risk, perceived severity, perceived benefits, obstacles to preventing the diseases, and proper behaviours to avoid the diseases were significantly higher than before the experiment ($p<0.01$).

Prevention behaviour of OV and CCA: The experimental group's mean score of prevention behaviour of OV and CCA was significantly higher than before the experiment and the comparison group ($p<0.01$). This aligns with a study on prevention behaviours among people screened for OV in Bansonghong, Rongkham Sub-District, Rongkham District, Kalasin Province [25]. It was found that the prevention behaviour of the people screened for OV was at a high level. It is also consistent with a study of the effects of health education programs with short videos on behaviour modification for OV prevention among risk groups [20]. It revealed that the experimental group had a significantly higher mean score of OV prevention behaviour than

those before the experiment and the comparison group at the 0.05 level. This is also in line with a study on the development of health literacy tools for the behaviour of OV prevention among people under the responsibility of the Office of DPC 7 Khon Kaen. The findings indicated that the target group had good OV prevention behaviour with statistical significance at the 0.05 level [26].

An important reason the experimental group received the health education program through TikTok is that their knowledge, health beliefs, and prevention behaviour increased after the experiment. The content conveyed through the application was concise, exciting, and aroused curiosity, which was in consistent with all other research studies mentioned above [20-26]. However, the comparison group's knowledge, health beliefs, and prevention behaviour also increased slightly after the experiment. This is familiar, as this group continues to receive the same knowledge through printed media (brochures). Another thing to consider is that nowadays, there are many platforms, mainly social media, where all age groups can access knowledge, academic content, or entertainment. This allows people to quickly and easily learn and share experiences about health problems. This is considered a good opportunity for proactive public health work to provide health education to citizens now and in the future.

The advantage of this study is that the intervention with health education through social media (TikTok) is appropriate for children, including all age groups. It is easily accessible, and the content is concise and exciting. Moreover, there is no time wasted, and it is not dull waiting for details because the culmination of the various topics is presented according to the specified time. A limitation of this study is that the health education program needs to be further developed to cover content, reach target groups, and be as relevant as possible.

5. Conclusion

The findings revealed that after the experiment, the experimental group’s mean scores of knowledges, health beliefs, and prevention behaviour of OV and CCA were significantly higher than those of before the experiment and the comparison group at the 0.05 level. The health education program through the TikTok application can increase knowledge, health beliefs, and prevention behaviour of OV and CCA among primary school students. Therefore, applying it to

other populations and diseases will be helpful.

Acknowledgement

We would like to express our sincere gratitude to the school administrators, teachers, all students, and research assistants who cooperated in the study. Faculty of Public Health, Ubon Ratchathani Rajabhat University, Thailand, partially funded to carry out this article.

References

[1] Sripa B, Suwannatrai AT, Sayasone S, Do DT, Khieu V, Yang Y. Current status of human liver fluke infections in the Greater Mekong Subregion. Acta tropica. 2021;224:106133.
[2] Zheng J-X, Zhu H-H, Xia S, Qian MB, Nguyen HM, Sripa B, et al. Natural variables separate the endemic areas of Clonorchis sinensis and Opisthorchis viverrini along a continuous, straight zone in Southeast Asia. Infectious diseases of poverty. 2024;13(1):24.
[3] Khuntikeo N, Padthaisong S, Loilome W, Klanrit P, Ratchatapusit S, Techasen A, et al. Mismatch Repair Deficiency Is a Prognostic Factor Predicting Good Survival of Opisthorchis viverrini-Associated Cholangiocarcinoma at Early Cancer Stage. Cancers. 2023;15(19).
[4] Qian MB, Keiser J, Utzinger J, Zhou XN. Clonorchiasis and opisthorchiasis: epidemiology, transmission, clinical features, morbidity, diagnosis, treatment, and control. Clinical microbiology reviews. 2024;37(1):e0000923.
[5] Wiwanitkit V. Expected rate of liver fluke-related cholangiocarcinoma in endemic area of liver fluke with antiparasitic drug distribution program for disease control in Thailand. Journal of cancer research and therapeutics. 2022;18(4):927-30.
[6] Sripa B, Leonardo L, Hong SJ, Ito A, Brattig NW. Status and perspective of asian neglected tropical diseases. Acta tropica. 2022;225:106212.
[7] Rojanamatin J, Ukranun W, Supaattagorn P, Chiawiriyabunya I, Wongsena M CAea. Cancer in Thailand Vol.X, 2016-2018. In: Medical Record and Databased Cancer Unit MDD, editor. Bangkok: National Cancer Institute; 2021.
[8] Gao F, Xu X, Sun Y. Clinical characteristics and prognosis of early-onset cholangiocarcinoma: a population-based study. Scandinavian journal of gastroenterology. 2024;59(2):183-91.
[9] Wattanawong O, Iamsirithaworn S, Kophachon T, Nak-Ai W, Wisetmora A, Wongsaroj T, et al. Current status of helminthiases in Thailand: A cross-sectional, nationwide survey, 2019. Acta tropica. 2021;223:106082.
[10] Amnat Charoen Provincial Public Health Office. Situation of opisthorchiasis and cholangiocarcinoma in Amnat Charoen Province. Amnat Charoen Amnat Charoen Provincial Public Health Office; 2017.
[11] Karsaesen B, Sota C. The development of opisthorchiasis prevention model in Chanuman Subdistrict, Chanuman District, Amnat Charoen Province. KKU J Public Health Res. 2019;3(21):777-82.
[12] Songserm N, Woradet S, Sripa B, Ali A. Sustainable Prevention of Cholangiocarcinoma Through Community Participation in a High-incidence Area in Thailand. Asian Pacific journal of cancer prevention : APJCP. 2020;21(3):777-82.
[13] Gillis RL, Nilsen ES. Children's use of information quality to establish speaker preferences. Developmental Psychology. 2013;49(3):480-90.
[14] Lukić S, Petrović J. The quality of information provided by the most popular dementia videos on TikTok. Frontiers in public health. 2023;11:1266415.
[15] Nicolla S, Lazard AJ, Austin LL, Freelon D, Reyes HLM, Moracco KE. TikToks Lead to Higher Knowledge and Perceived Severity of Sexual Violence among Adolescent Men. Journal of youth and adolescence. 2023;52(12):2449-63.
[16] Salka Bassel AM, Almsaddi Firas, Kaakarli Hamza, Nesi Lauren, Lim Kenneth. TikTok as an Educational Tool for Kidney Stone Prevention. J Cureus. 2023;15.

[17] Tian Y, Liu S, Zhang D. Clearness qualitative comparative analysis of the spread of TikTok health science knowledge popularization accounts. Digital Health. 2023;9:20552076231219116.
[18] Amnat Charoen Educational Service Area Office. Government information service system. Amnat Charoen: Amnat Charoen Educational Service Area Office; 2022.
[19] Panithanang B, Srithongklang W, Kompor P, Pengsaa P, Kaewpitoon N, Wakkhuwattapong P, et al. The Effect of Health Behavior Modification Program for Liver Fluke Prevention among the Risk Group in Rural Communities, Thailand. Asian Pac Cancer Prev. 2018;19(9):2673-80.
[20] Langstan P, Duangsong R. Effects of health education program with short video on behavior modification for liver fluke prevention among risk groups aged 40-59 years in Selaphum District, Roi-Et Province. J Health Educ. 2017;2(43):64-74.
[21] Laksanasut S. Effects of utilizing TikTok Application on English speaking skills development of English as a foreign language (EFL) high school students amidst the Covid-19 pandemic situation. J Learning Innovation Technology. 2022;1(2):61-71.
[22] Wisoram N, Somjai K, Maneepan N. The effects of health education group program with electronic media (Facebook) on skill development for adolescent pregnancy prevention among grade 7 students at Buriram Province. Burirum: Buriram Rajabhat University; 2021.
[23] Songserm N, Korsura P, Woradet S, Ali A. Risk Communication Through Health Beliefs for Preventing Opisthorchiasis-Linked Cholangiocarcinoma: A Community- Based Intervention in Multicultural Areas of Thailand. Asian Pac Cancer Prev. 2021;22(10):3181-7.
[24] Chayngam T, Ruangjarat L, Dechan S. Effect of health education program on health belief model application with social support for behavioral change to prevent opisthorchiasis and cholangiocarcinoma of people aged 40 years over in Muangmai Sub-district, Sriboonruang District, Nongbua Lamphu Province. J Council Community Public Health. 2020;2(3):1-15.
[25] Deeprom C, Sirisuwan P. Prevention behaviors of the liver fluke among screened people for liver fluke in Bansonghong, Rongkham Sub-District, Rongkham District, Kalasin Province. KKU J Public Health Res. 2018;2(11):1-15.
[26] Koonjaetong R, Chantaluk S, Treedech S, Phantupo S. Health Literacy for the Opisthorchiasis Prevention behavior among population In the 7 Region Health Center. Disease Control Journal. 2021;47(Suppl 2):1191-202.