ความรู้เรื่องแมงกะพรุนและการปฐมพยาบาลในเด็กนักเรียนชั้นประถมศึกษาปีที่ 6 และมัธยมต้น บนเกาะหมาก เกาะกูด และเกาะช้าง จังหวัดตราด ประเทศไทย

Jellyfish Sting and First Aid Knowledge among 6th- 9th Grade Students in Koh Mak, Koh Kood, and Koh Chang, Trat Province, Thailand

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บทคัดย่อ

การวิจัยนี้เป็นการศึกษาแบบตัดขวาง มีวัตถุประสงค์เพื่อศึกษาความรู้เรื่องแมงกะพรุนและการปฐมพยาบาลของเด็กนักเรียนชั้นประถมศึกษาปีที่ 6 และมัธยมต้นที่อาศัยอยู่บนเกาะหมาก เกาะกูด และเกาะช้าง ในจังหวัดตราด จำนวน 458 คน เพื่อหาความสัมพันธ์ระหว่างปัจจัยด้านบุคคล ความคุ้นเคยกับชายหาด ประวัติการสัมผัสแมงกะพรุน ประวัติการอบรมด้านการปฐมพยาบาล และความรู้เรื่องแมงกะพรุนและการปฐมพยาบาล รวบรวมข้อมูลโดยใช้แบบสอบถามชนิดตอบด้วยตนเองที่ผู้วิจัยสร้างขึ้นจากการทบทวนวรรณกรรม วิเคราะห์ความสัมพันธ์ระหว่างคะแนนความรู้ทั้งหมดและตัวแปรอิสระโดยใช้สถิติทดสอบฟิชเชอร์เอ็กแซค และการวิเคราะห์การถดถอยพหุโลจิสติก ตัวแปรที่มีการแจกแจงปกติแสดงเป็นค่าเฉลี่ย (ค่าเบี่ยงเบนมาตรฐาน : SD) และค่าที่มีการแจกแจงแบบไม่ปกติแสดงเป็นค่ามัธยฐาน (ช่วงควอไทล์ : IQR) นำเสนอตัวแปรเชิงคุณภาพเป็นร้อยละ

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ผลการวิจัย พบว่า ร้อยละ 62.01 (284 คน) ของนักเรียนมีความรู้ในระดับเพียงพอ เมื่อเปรียบเทียบตามเกาะ พบว่า นักเรียนบนเกาะกูดมีความรู้เพียงพอมากที่สุด เมื่อแบ่งตามชั้นเรียนนักเรียนชั้นมัธยมศึกษาปีที่ 3 มีความรู้เพียงพอมากที่สุด นักเรียนหญิงมีความรู้เพียงพอมากที่สุด เมื่อเปรียบเทียบกับนักเรียนชาย เมื่อใช้การวิเคราะห์ถดถอยพหุโลจิสติกหาความสัมพันธ์ระหว่างลักษณะพื้นฐานของนักเรียนและความรู้ทั้งหมด พบว่า นักเรียนชั้นมัธยมศึกษาปีที่ 3 มีความรู้เป็น 3.22 เท่าเมื่อเทียบกับนักเรียนชั้นประถมศึกษาปีที่ 6 (95% CI 1.64, 6.33) นอกจากนี้นักเรียนหญิงมีความรู้เป็น 1.57 เท่าเมื่อเทียบกับนักเรียนชาย (95% CI 1.00, 2.46)

ข้อเสนอแนะ นักเรียนบนเกาะหมากมีความรู้เรื่องแมงกะพรุนและการปฐมพยาบาลน้อยเมื่อเทียบกับเกาะกูดและเกาะช้าง จึงควรให้ความรู้เรื่องนี้แก่นักเรียนให้มากขึ้น ซึ่งสามารถทำได้โดยการบรรจุหัวข้อนี้ไว้ในหลักสูตรกลุ่มสาระการเรียนรู้วิทยาศาสตร์หรือกิจกรรมนอกหลักสูตร อาจสื่อสารข้อมูลเกี่ยวกับการปฐมพยาบาลที่เหมาะสมของแมงกะพรุนผ่านอินโฟกราฟิกที่เรียบง่ายสำหรับนักเรียน สื่อเหล่านี้ยังสามารถให้กับผู้ใหญ่ที่อาศัยอยู่และผู้ประกอบการรีสอร์ทบนทั้งสามเกาะ เพื่อให้ทุกคนตระหนักถึงความรุนแรงของแมงกะพรุนพิษและดำเนินมาตรการป้องกันที่มีประสิทธิภาพ

คำสำคัญ : แมงกะพรุน พิษจากสัตว์ทะเล ประเทศไทย

Abstract

The aim of this research was to investigate the knowledge of jellyfish stings and first aid management among 458 6th- 9th grade students living in Koh Mak, Koh Kood, and Koh Chang in Trat province. Other objectives were to investigate the relationship between basic demographic features, acquaintance with beaches, and previous experiences with jellyfish stings and first aid training. Data was collected using a questionnaire developed by the investigator based on literature review, and distributed to all 6th- 9th grade students living on these three islands. Variables with normal distribution were presented as mean (standard deviation : SD) and those without a normal distribution were presented as median (interquartile range : IQR). Qualitative variables were presented with counts and percentages. Relationship between total knowledge score and independent variables were assessed by Fisher's exact test and multiple logistic regression.

Results showed that two hundred and eighty-four students (62.01%) had adequate knowledge. Students from Koh Kood had the highest percentage of adequate knowledge. Comparing by class, students from 9th grade had the highest percentage of knowledge. Female students (67.14%) had higher adequate knowledge when compared to males. The relationship between students' baseline characteristics and total knowledge score was assessed by multiple logistic regression. Ninth-grade students had 3.22 times higher

adequate knowledge compared to 6th grade students (95% CI 1.64, 6.33). Female students had 1.57 times higher adequate knowledge compared to male students (95% CI 1.00, 2.46).

Suggestions: Students from Koh Mak had the least adequate knowledge on toxic jellyfish stings and first aid when compared to students from Koh Kood and Koh Chang. We should offer more education on this topic to students by including it into science curricula, health education subjects, or extra-curricular activities. Information on appropriate first aid management of jellyfish stings, via simple infographic material, can be provided to students, residents, and resort operators on these islands. Everyone should be aware of the severity associated with toxic jellyfish stings to create an effective preventive measure.

Keywords : jellyfish, marine stings, Thailand

Introduction

Each year there are over 30 million tourists arriving in Thailand as the country is well-known for its white sand beaches and peaceful mountains. Injuries from jellyfish are becoming an important public issue in Thailand. Most jellyfish stings are minor, but some toxic jellyfish in Thailand are also known to cause severe injuries and possible deaths. Box jellyfish, *Chironex spp.* and *Morbakka spp.* are found in both the Gulf of Thailand and the Andaman Sea coasts.[1] *Chironex spp.* are notoriously known as the most dangerous marine animal in the world.[2] Deaths usually result from inappropriate first aid.[3] Some of the local population used the plant *Ipomoea biloba* (beach morning glory) as a natural remedy, but they are probably not aware that this might not be effective for severe stings from box jellyfish. A minimum of 30-second rinse with vinegar is considered the most appropriate first aid for box jellyfish stings.[4] Vinegar helps to prevent further stinging and prevent further discharge of nematocysts from tentacles that may remain on the skin after envenomation.[5]

Knowledge of jellyfish types present in Thailand, as well as appropriate first aid management is crucial in reducing the morbidity and mortality from severe jellyfish stings. Trat province is the second most common province that severe jellyfish stings have known to occur, after Surat Thani.[6] It consists of three main islands that are very popular among tourists, namely Koh Mak, Koh Kood, and Koh Chang. In Thailand, there are limited studies exploring the knowledge of jellyfish stings among different population groups, therefore, we find that this study will benefit locals and tourists to help reduce the morbidity and mortality associated with toxic jellyfish stings. For this study we have selected children of the 6th- 9th grade age group, since they could have had some past experiences

and education in this topic, and are capable of processing and learning new information well. Children are unique in their capability of learning and remembering, and they can be victims or bystanders in such incidents. Moreover, their correct knowledge may be useful in the future when they grow up and face the situation, as a girl could save her family from the 2004 tsunami in Thailand based on what she learned from school.[7]

Research Objectives

This study aimed to investigate the knowledge of jellyfish stings and first aid management in 6th- 9th grade students on the three islands, namely Koh Mak, Koh Kood, and Koh Chang. Other objectives of this study were to assess 6th- 9th grade students' personal data, including past experience with jellyfish stings, their knowledge on the types of jellyfish present in their area, and knowledge on the first aid management of jellyfish stings, and to examine the relationship between personal data and knowledge of jellyfish stings and first aid management in 6th- 9th grade students on the three islands.

Conceptual Framework

The conceptual framework of this study was developed based on literature review. Basic demographic features, acquaintance with beaches, and students' past experiences were assessed. Basic demographic features included gender and age. Acquaintance with beaches included frequency of visiting beaches and location of home in proximity to beaches. Past experiences included the students being victims themselves, being bystanders in an event of a jellyfish sting, previous knowledge about jellyfish and first aid management, and any formal training about jellyfish and first aid management at school or other similar programs. These would bring about the knowledge of jellyfish stings and first aid management.

Materials and Methods

This study was a cross-sectional study. The study population were all 6th- 9th grade students living on the 3 islands of Trat province. The inclusion criteria were all 6th- 9th grade students, studying in all public primary and secondary schools on the 3 islands of Trat province. Students who were absent from school on the day of data collection were excluded from the study.

Research Instrument

The questionnaire was developed based on related literature review of Thaikruea's guidelines[8] and adapted from Kan' s questionnaire regarding Northeast China naval personnel's knowledge about jellyfish envenomation.[9] Jellyfish in this questionnaire refers to *Chironex*, *Morbakka*, and *Physalia* species. The questionnaire is comprised of 10 questions, and consisted of two parts: the first part included the respondents' data including gender, age,

acquaintance with beaches, including frequency of visiting beaches and location of home in proximity to beaches, past experiences, including the student being a victim themselves, being by standers in an event of a jellyfish sting, previous knowledge about jellyfish and first aid management, and any past formal training about jellyfish and first aid management at school or other similar programs. The second part included general knowledge about jellyfish stings, including jellyfish parts that cause envenomation, symptoms, first aid management, and emergency medical telephone number. This section included 4 multiple-choice questions, 3 true-false items, and 3 questions requiring single or multiple answers. Each of the question is awarded 1 point if answered correctly, and 0 point if answered incorrectly or did not answer. There are two questions that have 4 sub-questions; therefore, the total score for the questionnaire is 16 points. Since this is a non-standardized questionnaire developed by the investigator, the cut off point for high and low knowledge was set at the median of sum of scores (13). Students will be classified as having high (adequate) knowledge if they achieve a score of equal to or more than 13, and low (inadequate) knowledge if they achieve a score of less than 13.

Content Validity and Reliability

The study was conducted using a questionnaire developed by the investigator and evaluated by 3 jellyfish experts for its content validity with an IOC index of 0.67, and yielded an internal consistency reliability of 0.80.

Data Collection

Questionnaires were distributed to the students at each school in the schools' auditorium, which each class' s teacher and the investigator present. Students completed the questionnaires by themselves.

Ethical Consideration

This study abides the ethical principles and guidelines for the protection of human subjects of research, covering respect for persons, beneficence, and justice. After obtaining approval from the Ethics Committee of the Faculty of Medicine, Chulalongkorn University, IRB No. 048/62, and obtaining parents' written consent in asking their children's assent to complete the questionnaire, the study was conducted in the first week of February 2019.

Statistical Analysis

Data analysis was performed using STATA version 14.0 (StataCorp. 2015. Stata Statistical Software: Release 14.1. College Station, TX : StataCorp LLC). Variables with normal distribution were presented as mean (standard deviation : SD) and those without a normal distribution were presented as median (interquartile range : IQR). Qualitative variables were presented with counts and percentages. The relationship between total knowledge score and independent variables were analyzed by multiple logistic regression.

Results

The study population consisted of 582 students, and 458 students were included into the study. There were 248 males and 210 females, the mean age being 13.56 years (SD = 1.42). Three hundred and sixty students lived in Koh Chang, while Koh Mak had only 5 students. Most students (56.96%) visited the beach about 1 - 2 times/ month, and most (73.57%) lived less than 15 minutes away from the beach. Most students had never been stung by jellyfish nor were bystanders in an event of a jellyfish sting. Almost half (48.91%) of students had had previous first aid training. The demographic data of the respondents and past experience with jellyfish stings and first aid training are presented in Table 1 and Table 2, respectively.

Table 1. Respondents' demographic data

Characteristics	n (%)
Gender (n = 458)	
Male	248 (54.15%)
Female	210 (45.85%)
Mean Age (SD)	13.56 (1.42)
Island (n = 458)	
Koh Mak	5 (1.09%)
Koh Kood	93 (20.31%)
Koh Chang	360 (78.60%)
Class (n = 458)	
6^{th} Grade	160 (34.93%)
7^{th} Grade	108 (23.59%)
8^{th} Grade	96 (20.96%)
9^{th} Grade	94 (20.52%)
Frequency in visiting beaches (n = 374)	
Less than once/month	25 (6.68%)
1 - 2 times/month	213 (56.96%)
3 or more times/month	136 (36.36%)
Distance (in minutes) between home and beach (n = 333)	
< 15 minutes	245 (73.57%)
16 - 30 minutes	67 (20.12%)
> 30 minutes	21 (6.31%)

Table 2. Students' past experience with jellyfish sting events and first aid training (n = 458)

Characteristics	n (%)
Stung by jellyfish	
Yes	96 (20.96%)
No	362 (79.04%)
Bystander in a jellyfish sting event	
Yes	106 (23.14%)
No	352 (76.86%)
Previous first aid training	
Yes	224 (48.91%)
No	234 (51.09%)

Next, we demonstrated the responses to the questionnaire as shown in Table 3. Only 173 (37.77%) of the students answered correctly to the question regarding the season which jellyfish was most prominent, while most students (92.58%) knew that tentacle was the part that could cause stings. Most students (72.27%) knew that certain types of jellyfish could cause deaths. As for first aid knowledge, 335 students (73.14%) knew that vinegar was the most appropriate type of first aid management in jellyfish stings. Most students (89.74%) also knew that a victim should be immediately referred to a medical care facility after a jellyfish sting, since some cases, especially in Irukandji or Irukandji-like syndrome, symptoms are often delayed therefore it is advisable to transport the victim to a hospital for advanced and hospital-based management.[10]

Table 3. Number of correct responses regarding general knowledge and first aid knowledge about jellyfish stings (n = 458)

Question	n (%)
What season are jellyfish most prevalent in your area? Summer, ***Rainy***, Winter	173 (37.77%)
From the pictures, which ones are not jellyfish? ***Pictures 2, 3***	268 (58.52%)
From the pictures, which ones are not jellyfish wounds? ***Pictures 2, 4***	294 (64.19%)
Which part of the jellyfish could cause stings? ***Tentacle***	424 (92.58%)

Table 3. Number of correct responses regarding general knowledge and first aid knowledge about jellyfish stings (n = 458) (Cont.)

Question	n (%)
Can certain types of jellyfish cause deaths? ***Yes,*** No, Do not know	331 (72.27%)
Which one of these is the most appropriate first aid management? Freshwater, Seawater, ***Vinegar***, Ipomoea biloba, Sand, Do nothing	335 (73.14%)
Should a victim go to the hospital after a jellyfish sting? ***Yes***, No, Do not know	411 (89.74%)
Jellyfish can cause stings even when they are stranded on a beach or their parts are separated. ***Yes***, No, Do not know	264 (57.64%)
Can tentacles that are stuck on the victim's skin be removed with bare hands? Yes, ***No***, Do not know	291 (63.54%)
What is the medical emergency telephone number? ***1669***	373 (81.44%)

The scores achieved by the students are shown in Table 4. The full score is 16, and a full score of 16 was obtained by 16 students (3.49%); the lowest score was 3, which was obtained by one student (0.22%). The mean score was 12.8 with a standard deviation of 2.00. Adequate knowledge was obtained by calculating the median of sum scores, with 13 being the cutoff point. Two hundred and eighty-four students (62.01%) had adequate knowledge (≥ 13), while 174 students (37.99%) had inadequate knowledge (< 13).

Table 4. Total knowledge score of responses to questions regarding jellyfish sting and first aid (n = 458)

Knowledge score	n (%)
Highest score (16/16)	16 (3.49%)
Lowest score (3/16)	1 (0.22%)
Mean (SD) 12.80 (2.00), min - max (3 - 16)	
Knowledge score (median of sum scores)	
≥ 13 = adequate knowledge	284 (62.01%)
< 13 = inadequate knowledge	174 (37.99%)

Table 5 shows the relationship between different variables and the total knowledge score which is comprised of general knowledge about jellyfish and first aid knowledge. Of the three islands students from Koh Kood had the highest adequate knowledge with 75.27% of the students having adequate knowledge, followed by students from Koh Chang, where 59.44% of students had adequate knowledge. None of the students from Koh Mak had adequate total knowledge. By class, students from the 9th grade had the highest knowledge (74.47%), followed by 8th, 7th, and 6th grade, respectively (63.54%, 62.96%, 53.12%). Female students (67.14%) had a higher total knowledge when compared to males (57.66%). One hundred and fifty-one students (70.89%) who visited the beach 1 - 2 times/month had the highest total knowledge score, followed by those who visited less than once a month (60.00%), and more than twice a month (55.88%), respectively. Those who lived 16 - 30 minutes away from the beach had the highest total score (70.15%), followed by those who lived less than 15 minutes away (64.90%), and more than 30 minutes away (52.38%), but without statistical difference. There were no statistical differences in total knowledge score between groups who had previous stings, or who were bystanders in a jellyfish sting incident, or those who had previous first aid training.

Table 5. Bivariate analysis of total knowledge score and independent variables

Variable	Adequate total knowledge n (%)	Inadequate total knowledge n (%)	p-value†
Island (n = 458)			< 0.001
Koh Mak	0 (0%)	5 (100%)	
Koh Kood	70 (75.27%)	23 (24.73%)	
Koh Chang	214 (59.44%)	146 (40.56%)	
Class (n = 458)			0.008
6th Grade	85 (53.12%)	75 (46.88%)	
7th Grade	68 (62.96%)	40 (37.04%)	
8th Grade	61 (63.54%)	35 (36.46%)	
9th Grade	70 (74.47%)	24 (25.53%)	
Gender (n = 458)			0.043
Male	143 (57.66%)	105 (42.34%)	
Female	141 (67.14%)	69 (32.86%)	
Frequency (n = 374)			0.014
< once/month	15 (60%)	10 (40%)	
1 - 2 times/month	151 (70.89%)	62 (29.11%)	

Table 5. Bivariate analysis of total knowledge score and independent variables (Cont.)

Variable	Adequate total knowledge n (%)	Inadequate total knowledge n (%)	p-value†
> 2 times/month	76 (55.88%)	60 (44.12%)	
Distance (n = 333)			0.332
< 15 minutes	159 (64.90%)	86 (35.10%)	
16 - 30 minutes	47 (70.15%)	20 (29.85%)	
> 30 minutes	11 (52.38%)	10 (47.62%)	
Sting (n = 458)			0.813
Yes	61 (63.54%)	35 (36.46%)	
No	223 (61.60%)	139 (38.40%)	
Bystander (n = 458)			> 0.999
Yes	66 (62.26%)	40 (37.74%)	
No	218 (61.93%)	134 (38.07%)	
Training (n = 458)			0.124
Yes	147 (65.62%)	77 (34.38%)	
No	137 (58.55%)	97 (41.45%)	

†Fisher's exact test

Finally, we assessed the relationship between students' baseline characteristics and total knowledge score by using multiple logistic regression model. From the analysis, it can be seen that 9th grade students have 3.22 times higher knowledge when compared to 6th grade students with statistical significance (95% CI 1.64, 6.33). Additionally, female students had 1.57 times higher knowledge when compared to male students with statistical significance (95% CI 1.00, 2.46). Frequency in visiting beaches did not have a significant association with total knowledge score, as shown in Table 6.

Table 6. Relationship between baseline characteristics and total knowledge score

Variable	Crude OR	95% CI	Adjusted OR	95% CI
Island				
Koh Mak + Koh Kood	1.00	Reference	1.00	Reference
Koh Chang	0.59	0.36, 0.95	0.58	0.32, 1.06
Class				
6th Grade	1.00	Reference	1.00	Reference

Table 6. Relationship between baseline characteristics and total knowledge score (Cont.)

Variable	Crude OR	95% CI	Adjusted OR	95% CI
7th Grade	1.50	0.91, 2.47	1.45	0.81, 2.57
8th Grade	1.54	0.92, 2.58	1.66	0.90, 3.07
9th Grade	2.57	1.47, 4.50	3.22	1.64, 6.33
Gender				
Male	1.00	Reference	1.00	Reference
Female	1.50	1.02, 2.20	1.57	1.00, 2.46
Frequency in visiting beaches				
< once/month	1.00	Reference	1.00	Reference
1 - 2 times/month	1.62	0.69, 3.81	1.47	0.61, 3.54
> 2 times/month	0.84	0.35, 2.01	0.70	0.28, 1.73

Discussion

The purpose of this study was to determine whether the 6th- 9th grade students on the three islands of Trat province had adequate knowledge regarding jellyfish stings and first aid management. When analyzing each answer from the questionnaire, in the part about general jellyfish knowledge, only 37.77% answered correctly that rainy season is the season that jellyfish are most prevalent in their area.[8] This result is different from Suriyan's study of jellyfish sting knowledge among SCUBA divers that 63.45% of divers answered correctly to this question.[11] However, a little over half, 57.64% of the students answered correctly to the question about jellyfish stranded on the beach can still cause stings.[12,13] This is similar to Kan's study in naval personnel in Northeast China.[9] Moreover, 63.54% of students did not know that tentacles should not be removed with bare hands[2], which is also different from Suriyan's study that the respondents knew that the nematocysts should not be removed from the skin with bare hands.[11]

From the study, we could see that two hundred and eighty-four students (62.01%) had adequate knowledge. This is more than half of the sample population which shows that the majority of students are somewhat experienced in jellyfish stings and first aid knowledge. This could be due to the fact that they live and spend time at beaches, and are familiar with their environment. Additionally, almost half (48.91%) of the students have had previous first aid training, which could also explain their adequate knowledge on this topic. However, when analyzing by

each variable, out of the three islands, Koh Mak students appeared to have inadequate knowledge about jellyfish stings. From all the classes, students of the 9th grade had the highest knowledge with statistical significance. Female students had higher adequate knowledge than male students, with statistical significance. Students who visited the beach about 1 - 2 times a month had adequate knowledge when compared to those who visited the beach more than twice a month. Distance from home to the beach did not have a statistical significance to the students' adequate knowledge, neither did past experience. Previous first aid training also did not have a statistical significance in the students' total knowledge on jellyfish stings.

It was rather surprising to see that Koh Mak students had inadequate knowledge in general knowledge about jellyfish stings, and also first aid knowledge. This should be of high concern due to high incidence in the area. From unofficial reports, Koh Mak has the highest incident of toxic jellyfish stings, out of the three islands. It is also the smallest island out of all three, and the highest school education available on this island is only Grade 6. The number of students was only 5, therefore this information might not be a good representative of what the other locals or adults on this island actually knew. However, the number of incidents is still very high on this island, therefore more relevant information should be provided to all residents of this island in order to help reduce the morbidity and mortality associated with toxic jellyfish stings. Awareness of the issue and prevention of envenomation is crucial.[5,10,14] Koh Chang, even though being the largest island, did not have the highest adequate knowledge. This is probably due to the fact that not all the beaches on this island are easily accessed or swimmable, therefore less encounters with jellyfish and less experience.

Grade 9 students had the highest adequate knowledge; this can be related with having had more education in school and science, and being more mature with more experience. Female students had higher adequate knowledge than male students; this is probably due to the higher number of female students in the higher class (but without statistical significance from bivariate analysis). Also, students who visited the beach about 1 - 2 times a month had adequate knowledge when compared to those who visited the beach more than twice a month. The reason for this could be due to those who visited the beach very often are less aware of possible harm around them, since they were used to the environment, while those who visited less would be more alert and aware of possible dangers.

From multiple logistic regression analysis, it can be seen that 9th grade

students have 3.22 times higher knowledge when compared to 6th grade students with statistical significance (95% CI 1.64, 6.33). This is most likely due to higher education and more experience. Additionally, female students had 1.57 times higher knowledge when compared to male students with statistical significance (95% CI 1.00, 2.46). The reason for this is probably due to the higher number of female students in the 9th grade when compared to males in other classes, but without a statistical significance. It is difficult to establish other reasons as to why females would have higher knowledge than males, which can probably be explored and confirmed in future studies.

Limitations of the Study

This is a cross-sectional descriptive study, therefore it is not the most accurate representation of the students' knowledge about jellyfish types and stings and first aid, and also not guaranteed to be a representative of the other population groups. Another limitation was there were quite a high number of students (124 students) who were absent from the school on the day the questionnaire was collected. Moreover, the sample size from Koh Mak is very small, hence there might not be enough statistical power to conclude that this island had the least adequate knowledge.

Recommendations

From the results, we could see that Koh Mak students had the least adequate knowledge on toxic jellyfish stings and first aid. Although the number of sample size in Koh Mak is very small, it could still be implied that there is inadequate information about this subject given to the local population. Therefore, we need to offer more education on this subject to the students. This could be done by including this topic into the science curriculum science curricula, health education subjects, or extra-curricular activities. Moreover, it would be sensible to approach and educate other potential victims or population groups such as resort operators or medical officers working at the health promoting hospital on Koh Mak. Information should also be provided to the residents and resort operators on all three islands on appropriate first aid management of jellyfish stings. Everyone should be made aware of the severity associated with toxic jellyfish stings in order to create an effective preventive measure. Correct and relevant knowledge could be easily and widely distributed via social media. Moreover, from this data, we could provide feedback to the Ministry of Public Health to develop more striking or appropriate signage to warn about jellyfish and provide first aid information, including

other preventive measures on all beaches, especially on Koh Mak.

Future research could explore other population groups or occupations on these islands to be able to capture the whole picture of knowledge on jellyfish and first aid. A similar study design may be done in Surat Thani province to understand the students' knowledge on toxic jellyfish stings there, since it is the province with the highest number of toxic jellyfish sting incidents. Also, a similar study could be done in Thai navy officers to get a better understanding of officials' knowledge regarding this matter.

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