The Effect of the Seafood Safety, Consumption Promotion Program among Pregnant Women in Pollution Control Area in Rayong Province

Nipa Maharachpong PhD*, Nantaporn Phatrabuddha PhD**,
Praparsiri Barnette PhD***,****, Chaweewun Intarakul PhD*****

** Department of Health Education, Faculty of Public Health, Burapha University, Chonburi, Thailand*
*** Department of Industrial Hygiene and Safety, Faculty of Public Health, Burapha University, Chonburi, Thailand*
**** Department of Aquatic Science, Faculty of Science, Burapha University, Chonburi , Thailand*
***** The Center of Excellence on Environmental Health and Technology, Bangkok, Thailand*
****** Department of Environmental Health, Faculty of Public Health, Burapha University, Chonburi, Thailand*

The objective of this quasi-experimental study was to investigate the effect of the seafood safety consumption promotion program among pregnant women in pollution control area in Rayong. The sample group was pregnant women who had registered at the hospital during September 2014. Ninety-three informants were willing to participate in this study. Pregnant women were given information on the knowledge of safe seafood and the information on perceived benefits, perceived barriers, and self-efficacy of seafood consumption. The participants were educated by lectures, video, pamphlets, short messages. The data collection was conducted both before and after intervention using questionnaire. Data were consequently analyzed by the descriptive statistics, and paired sample t-test.

The results of the study has shown that perceived benefits and perceived self-efficacy in seafood safety consumption of pregnant women after the intervention were higher than before the intervention with the statistical significance of $p<0.05$. In terms of perceived barriers in seafood safety consumption, it was found that pregnant women had significantly lower perceived barriers in seafood consumption after the intervention ($p<0.01$). Regarding the food consumption behaviors, it was found that pregnant women have shown safer behaviors in food consumption which indicated the statistical significance of $p = 0.02$.

From this study, it revealed that the safe seafood consumption promotion program has facilitated pregnant women to recognize safer behavior in seafood consumption. Therefore, this study could be used as a guideline in health education for pregnant women who receive services from the clinics in the area in order to reduce the risks from seafood consumption.

Keywords: *Seafood safety, Pregnant women, Health promotion, Pollution control area*

J Med Assoc Thai 2016; 99 (Suppl. 9): S40-S46
Full text. e-Journal: *http://www.jmatonline.com*

Seafood contains substantial amount of essential protein and important components for healthy diets[1], especially fish protein. Fish consumption offers advantages to pregnant women because it contains relatively high concentration of proteins that are necessary for fetal brain development and protein hardy found in other foods[2].

However, if the seafood is contaminated with polluted substances, it could be harmful to both marine animals and consumers. Sources of marine pollution normally come from resident areas, communities, agricultural practices and industrial factories, particularly along the shore of the Map Ta Phut. This area is recognized as the industrial area because there is natural gas production and natural gas-related production in the area. Due to its long-lasting contaminated pollution issues, which have been reported in surrounding areas, this area was, therefore, classified as the pollution control area since 2009. Even if Map Ta Phut shore is the pollution control area, there are still fishery activities along the Map Ta Phut coastline. There is cultivation of mussels and marine animals which are continuously caught. As a result, consumers have a high risk to acquire heavy metals and polycyclic aromatic hydrocarbons from the seafood they have consumed[3].

Correspondence to:
Maharachpong N, Faculty of Public Health, Burapha University, Chonburi 20131, Thailand.
Phone: +66-38-202738
E-mail: mnipa@yahoo.com

Heavy metals and polycyclic aromatic hydrocarbons compounds can be accumulated in marine animals' bodies. These heavy metals and hydrocarbons compounds are found in water and sediments before penetrating into animals' tissues through their food chain because they have limited ability to eliminate those contaminants. According to the previous study, heavy metals accumulation was found in marine animals such as fish, shrimp, mantis shrimp, squid, and shellfish; whereas the highest amount of lead was found in shellfish and fish. However, the level detected is still safe for consumption[4]. From the health risk assessment of heavy metals to Thai people through consumption of seafood from the eastern coastal of Thailand, it reveals that 21.2% of the sample contains heavy metals exceeding the standard. Moreover, the trend shows that there are higher risks for health in consuming seafood which is originated from Rayong Province compared with seafood from other provinces, especially marine benthos such as shellfish, mud crab and shrimp. These animals have higher risks than fish[5]. Pregnant women who ingest heavy metals during their first 3 weeks of their gestation will pass on the substances into their fetus. The complication includes impaired neurological function, spontaneous abortion preterm delivery, low birth weight, and neonatal death. There are studies showing that the acquisition of high level of heavy metals will affect infants born from mothers who have previously acquired these substances in terms of brain and nerve development[6].

From literature review regarding knowledge and perception of the risk caused by seafood consumption, it is found that only 19% of the fishermen believed that seafood is unsafe and contaminated. Despite warnings from officers, the fishermen are still consuming unsafe seafood[7]. According to the previous study conducted on knowledge and attitudes on benefits and risks in seafood consumption of the health care providers, it appears that the average score of the officers' knowledge is 56% from the total score. There are only 13% of the officers with a good level of knowledge[8]. In Thailand, Kachanopas-Barnette et al[9] had conducted the study on knowledge and awareness of the risk of seafood contamination and seafood consumption among pregnant women along the Map Ta Phut industrial coastline, Rayong Province. The study has shown that pregnant women have low awareness on the risks on contamination of heavy metals in seafood. For this reason, this study will be relevant as there are reports regarding heavy metals contamination in seafood along the eastern coastline. There are also accidents from the oil vessels which continuously cause pollution in this area. Pregnant women are considered vulnerable group to be effected by chemical contamination. The results of the seafood safety consumption promotion program among pregnant women could be used as the guideline for health promotion among pregnant women or those who prepare to get pregnant so that they can adapt their behavior to choosing seafood safety, which will lead to the future well-being and development of babies.

Material and Method

This study was a quasi-experimental study. It was a One Group Pretest-Posttest Design Research model aimed to study the results of the seafood safety consumption promotion program among pregnant women in Map Ta Phut sub-district, Muang district, Rayong Province. This study was a part of the research project on the effects of heavy metals and polycyclic aromatic hydrocarbons assessment on the sea along Map Ta Phut industrial coastline, Rayong Province.

The research population of the study was the pregnant women who resided in Muang District, Rayong Province. The pregnant women who were selected in the study also registered at Map Ta Phut Hospital, Muang District, Rayong Province. The size of the sample was calculated by the formula developed by Lemeshow[10]. The number of informants was 73 people. The researcher conducted the study by using the cluster sampling method. The participating pregnant women were those who had registered with the ANC unit in Map Ta Phut Hospital for 1 month during September 2014. The number of the participants of the sample group before the intervention was 103 people; 93 people remained until the end of the study; whereas 10 informants had to leave the study because they changed their hospital. The ethical approval for the study was obtained from Burapha University ethics committee while verbal consent was obtained from the women after the objectives of the study had been explained to them.

This seafood safety consumption promotion program was applied from the health promotion concept initiated by Pender (1987) in terms of perceived benefits of action, perceived barriers to action, and perceived self-efficacy. There were 3 activities in this health promotion program, as followed. First, providing knowledge on seafood safety by lectures and leaflets of which the contents which were given focused on chemical contamination, type of chemicals which can

be found in seafood, effects of contaminated chemicals on mother and child's health. Second, providing the perceived benefits of action and perceived barriers to action by using lectures, videos, and case study on different situations on nutrition topics for pregnant women in the selection of seafood purchase, as well as seafood safety consumption. Thirdly, promoting the perceived self-efficacy among pregnant women in seafood safety consumption by discussion, persuasion and stimulating messages.

Data collection used in this study was the questionnaire which comprised of 3 parts. The first part was demographic information such as age, occupation, educational background, income, pregnancy information. The second part included perceived benefits of action, and perceived barriers of action in seafood consumption, perceived self-efficacy to consume safe seafood and seafood consumption behavior among pregnant women. The aspects of the opinion questions were divided into 4 Likert scale points with responses of: strongly agree = 1, agree, disagree, and strongly disagree (with assigned numeric values 1 to 4, respectively). The total number of the questions was 20 items. The third part was seafood consumption behavior which included frequency of consumption form indicating 4 different levels: never, seldom, often and always.

Assessment of the research tools consisted of 2 parts. The first part was content validity. First of all, the program videos and questionnaires were sent to 3 experts in nutrition and environmental toxicology to validate its contents. The contents were later adjusted according to the experts' recommendations. The contents were calculated by the Item objective congruence index (IOC) which indicated more than 0.6. The reliability assessment was conducted by giving 29 questionnaires to pregnant women and subsequently tested by the Cronbach's alpha coefficient. It was found that the information on the perceived benefits, barriers, self-efficacy of pregnant women on seafood consumption in the second part showed a reliability score of 0.80.

Regarding data analysis, this study analyzed the data by using descriptive statistics to calculate the frequency, percentage, mean, standard deviation, the max score and the minimum score. The study also included comparison of seafood consumption behavior before and after program using the Paired sample t-test of health education program.

With regard to informants' right protection, the researcher clarified the objectives and procedure of the study as well as the data collection process before the informants decided to participate the study voluntarily. In case of informant ages were younger than 20 years-old, the objectives and procedure were given to the legal guardian of the informants prior their participation. During the intervention, the informants could leave the study anytime they wished without having any effect on the services provided by the hospital. For academic benefits, the information collected was used in the larger overall scale only. The data collection was started after receiving permission from all informants.

Results

The average age of pregnant women who resided in Map Ta Phut was 26 years-old. Sixty percent of the informants' ages range from 20-29 years-old. Most of the informants (74%) had completed secondary education. The majority of the informants were laborers and housewife. Forty percent of the informants were pregnant for the first time, and 70% of the informants had registered their pregnancy during their first 12 weeks gestation as shown in Table 1.

The results of the study (Table 2) showed that more than 50% of pregnant women had consumed seafood at least 3 times a week, and more than 60% cooked the food at home. The majority of the informants (92.5%) purchased the seafood from the nearby markets. More than eighty percent of the subjects (83.9%) cooked food at home. The majority of pregnant woman (59.1%) consumed only meat and roe, viscera, and fish head (20.1%, 16.1% and 10.8%, respectively).

Table 3 shows the results of the program, it appeared that pregnant women were increasingly aware of the benefits of seafood safety consumption. After the intervention, the statistical significance was at $p<0.01$. After the intervention, the average score was at 14.44; whereas the average score before the invention was at 11.88. Pregnant women were more aware of the seafood safety consumption in the topic of cooked seafood which reduced the chance of getting parasitic worms. They were also aware that shellfish contained more chemicals than fish, and fish meat contained less chemicals than their eggs or their entrails. Pregnant women should refrain from seafood consumption when there is evidence of oil/chemical leakage into the sea as there might be contamination in the seafood.

Regarding perceived barriers in seafood safety consumption, it was found that after receiving the health education, pregnant women acquired better perceived barriers in seafood safety consumption than

before the intervention. There were statistically significant differences between average scores before the intervention (13.33) and the average score after the intervention was 11.86. The topic of pregnant women having better knowledge was the selection of seafood purchase. They knew that they had to avoid purchasing seafood when there was an oil/chemical spill in the sea. They would dispose of the eggs and fish's viscera even though their taste is nicer. They were aware that the seafood has to be cooked.

Regarding results of change in self-efficacy in seafood safety consumption among pregnant women before and after receiving health education program, it was found that after the intervention, pregnant women had perceived self-efficacy in seafood consumption, more than before the intervention, the statistical significance was at $p = 0.003$. After the intervention, the average score was at 15.31; whereas before intervention, the average score was at 14.02. Pregnant women also had more perceived self-efficacy in terms of confidence to avoid undercooked seafood. They would consume more meat than eggs or entrails and consume more fish than shellfish. However, they were unsure that they can reduce the consumption of seafood if there is an oil/chemical leak in the ocean within one month.

Table 1. Number and percentage of pregnant women classified by socio-economic information

Social and demographic aspects	Number (percentage)
Total	93 (100)
Age (year)	
<20	12 (12.9)
20-24	37 (39.8)
25-29	19 (20.4)
30-34	14 (15.1)
≥35	11 (11.8)
Mean ± SD	26.18±7.15
Min-max	18-50
Educational background	
Primary education	22 (23.7)
Lower secondary education	41 (44.1)
Upper secondary education	28 (30.1)
Higher education	2 (2.2)
Occupation	
Laborer	41 (44.1)
Housewife	39 (41.9)
Others (commerce, agriculture)	13 (14.0)
Average monthly income (baht)	
Less than 5,000	7 (7.5)
5,001-10,000	24 (25.8)
10,001-15,000	26 (28.0)
15,001-20,000	10 (10.8)
More than 20,000	13 (14.0)
Prefer not to reveal the income	13 (14.0)
Period of gestation	
1 month	5 (5.4)
2 month	36 (38.7)
3 month	24 (25.8)
4 month	15 (16.1)
At least 5 month	13 (14.0)

Discussion

From the results of the study, it was found that after the experiment, the pregnant women have acquired more perceived benefits of action, perceived barriers of actions and perceived self-efficacy, which has contributed to safer seafood consumption behavior in terms of statistical significance.

Regarding perceived benefits of action after the intervention, it was found that pregnant women acquired higher perceived benefits of actions in terms of the knowing that cooked food reduces parasite in

Table 2. Number and percentage of pregnant women classified by seafood consumption behaviors

Seafood consumption behaviors	Number (percentage)
Frequency in seafood consumption	
Less than 1 time/week	10 (10.8)
1-2 times/week	31 (33.3)
3-5 times/week	40 (43.0)
6-7 times/week	12 (12.9)
Homemade cooking	
Less than 1 time/week	5 (5.4)
1-2 time/week	31 (33.3)
3-5 time/week	27 (29.0)
6-7 time/week	30 (32.3)
Fish organs that were eaten (more than possible 1 answer)	
Not eating fish	9 (9.7)
Head	10 (10.8)
Viscera	15 (16.1)
Fish's roe	20 (21.5)
Fish meat	55 (59.1)
The location of seafood purchase prior to	
Cooking at home	86 (92.5)
Fish market	5 (5.4)
Shopping mall	2 (2.1)
Type of cooking	
Undercooked	15 (16.1)
Cooked	78 (83.9)

Table 3. Comparison of the seafood safety consumption promotion among pregnant women before and after intervention

Variables	$\overline{X}$	SD	$\overline{d}$	$SD_{\overline{d}}$	t	*p*-value
Perceived benefits of action						
Before intervention	11.88	2.38	2.56	3.04	8.12	<0.01
After intervention	14.44	2.50				
Perceived barriers to action						
Before intervention	13.33	2.67	1.47	3.36	4.22	<0.01
After intervention	11.86	2.56				
Perceived self-efficacy						
Before intervention	14.02	3.24	1.29	4.07	3.06	0.003
After intervention	15.31	3.14				
Seafood consumption behavior						
Before intervention	20.44	3.65	1.54	4.56	3.25	0.02
After intervention	21.97	3.40				

the food. Their perception was higher because there was misconception that parasite can be found only in animals in the fresh water and there are very few parasites in seafood[12]. Pregnant women also learned that they have to avoid consuming the seafood during a period when there is an oil/chemical spill in the sea. Some misconceptions among pregnant women have been corrected such as "chemicals will not contaminate marine animals"[12]. The pregnant women are aware that they have to avoid shellfish consumption during their pregnancy as shellfish is an animal which filters the suspended solid in the water. The shellfish also has low level of movement. As a result, toxic matter can accumulate in their tissues more than other types of animals[13]. The seafood safety and consumption promotion program for pregnant women includes giving lectures, visualized aids, and post-training clarifications or giving accurate information to pregnant women. In terms of statistics, these activities enable pregnant women to reach higher perceived benefits of action in seafood safety consumption significantly.

Regarding perceived barriers of actions in seafood safety consumption, it was found that after the consumption promotion program was given, the level of perceived barriers among pregnant women had decreased. They did not regret to dispose of fish roe, fish viscera. They also paid attention to how the seafood was cooked rather than the taste. The brainstorming session during the sanitation training facilitated pregnant women to share their opinions that enabled them to develop a guideline in reducing perceived barriers[14].

Regarding perceived self-efficacy, it is found that after the consumption promotion program was given, pregnant women were more confident in avoiding undercooked food. They have also avoided roe and viscera. In addition, they are more determined in reducing the shellfish consumption. The consumption promotion program was conducted by sending memorable messages, and persuasive dialogue to stimulate pregnant women to form more perceived self-efficacy. However, pregnant women still have low perceived self-efficacy. Regarding seafood consumption, after 1 month of oil/chemical leaking into the sea, the majority of pregnant women thought that it was difficult to avoid seafood as it is the main source of protein available in their area.

According to the results of the study, it was found that the safe seafood consumption promotion program facilitates pregnant women to have safer seafood consumption behavior. Therefore, this study can be used as a guideline in providing health education for pregnant women who have registered at the healthcare service providers in the area. Moreover, pregnant women can reduce the risks of acquiring toxic matter into their bodies as there are constant reports on the heavy metal contamination along the eastern shores region as well as the accidents in the ocean causing the leaking of chemicals into the sea, which causes the long-lasting pollution effects. These preventive measurements will ensure good health and the well-being of the newborn babies.

What is already known on this topic?

Most health promotion studies in pregnant women focused on the effects of the intervention studies related to nutrition and nutritional health behaviors. A few studies have been promoting food

safety for pregnant women.

What this study adds?

This study explore the effect of the intervention study on seafood safety and consumption in areas high susceptible to the environmental contamination.

Acknowledgements

This research work was supported by the National Research Council of Thailand (in the title of Assessments of heavy metals and organic hydrocarbons exposure in selected marine animals from coastal industrial area at Map Ta Phut, Rayong Province) during 2012 and 2014.

The authors express their sincere gratitude to all participants for taking part in the program and the staffs of ANC unit in Map Ta Phut Hospital for their support.

Potential conflicts of interest

None.

References

1. McManus A, Newton W. Seafood, nutrition and human health: A synopsis of the nutritional benefits of consuming seafood. Perth, Western Australia: Centre of Excellence Science, Seafood & Health, Curtin Health Innovation Research Institute, Curtin University of Technology; 2011.
2. Hibbeln JR, Davis JM, Steer C, Emmett P, Rogers I, Williams C, et al. Maternal seafood consumption in pregnancy and neurodevelopmental outcomes in childhood (ALSPAC study): an observational cohort study. Lancet 2007; 369: 578-85.
3. Nadal M, Ferr□-Huguet N, Marti-Cid R, Schuhmacher M, Domingo JL. Exposure to metals through the consumption of fish and seafood by the population living near the Ebro River in Catalonia, Spain: health risks. Hum Ecol Risk Assess 2008; 14: 780-95.
4. Thongra-ar W, Musika C, Wongsudawan W, Munhapol A. Heavy metals contamination in sediments along the Eastern Coast of the Gulf of Thailand. EnviromentAsia 2008; 1: 37-45.
5. Thongra-ar W, Musika C, Wongsudawan W, Munhapol A. Health risk assessment of heavy metals in seafood from industrial areas of the Eastern Coast of Thailand. Chonburi: The Institute of Marine Science, Burapha University; 2009.
6. Caserta D, Graziano A, Monte GL, Bordi G, Moscarini M. Heavy metals and placental fetal-maternal barrier: a mini-review on the major concerns. Eur Rev Med Pharmacol Sci 2013; 17: 2198-206.
7. Burger J, Pflugh KK, Lurig L, Hagen LA, Hagen S. Fishing in urban New Jersey: ethnicity affects information sources, perception, and compliance. Risk Anal 1999; 19: 217-29.
8. Hicks DT, Pivarnik LF, Richard NL, Gable RK, Morrissey MT. Assessing knowledge and attitudes of U.S. Healthcare Providers about benefits and risks of consuming seafood. JFSE 2013; 12: 75-80.
9. Kachanopas-Barnette P, Panutrakul S, Nanthanawat P, Pattarabuddha N, Maharachpong N, Mokkongpai P, et al. Assessments of heavy metals and organic hydrocarbons exposure in selected marine animals from coastal industrial area at Map Ta Phut, Rayong Province. Chonburi: Burapha University; 2013.
10. Lemeshow S, Hosmer DW Jr, Klar J, Lwanga SK. Adequacy of sample sizein health studies. Geneva: World Health Organization; 1990.
11. Pender NJ. Health promotion in nursing practice. 3rd ed. Stamford, CT: Appleton & Lange; 1996.
12. Kachanopas-Barnette P, Panutrakul S, Nanthanawat P, Pattarabuddha N, Maharachpong N, Mokkongpai P, et al. Assessments of heavy metals and organic hydrocarbons exposure in selected marine animals from coastal industrial area at Map Ta Phut, Rayong Province. Chonburi: Burapha University; 2012.
13. Montes MO, Hanna SK, Lenihan HS, Keller AA. Uptake, accumulation, and biotransformation of metal oxide nanoparticles by a marine suspension-feeder. J Hazard Mater 2012; 225-226: 139-45.
14. Evenson KR, Moos MK, Carrier K, Siega-Riz AM. Perceived barriers to physical activity among pregnant women. Matern Child Health J 2009; 13: 364-75.

ผลของโปรแกรมการส่งเสริมการบริโภคอาหารทะเลปลอดภัยในหญิงตั้งครรภ์ ที่อาศัยในเขตพื้นที่ควบคุมมลพิษ จังหวัดระยอง

นิภา มหารัชพงศ์, นันทพร ภัทรพุทธ, ปภาศิริ บารเนท, ฉวีวรรณ อินทรกุล

การศึกษากึ่งทดลองนี้มีวัตถุประสงค์เพื่อศึกษาผลของการส่งเสริมการบริโภคอาหารทะเลปลอดภัยในหญิงตั้งครรภ์ ที่อาศัยในเขตพื้นที่ควบคุมมลพิษ จังหวัดระยอง สุ่มกลุ่มตัวอย่างเป็นหญิงตั้งครรภ์ที่เข้ารับการฝากครรภ์ในโรงพยาบาล ช่วงเดือนกันยายน พ.ศ. 2557 ได้กลุ่มตัวอย่างที่ยินยอมเข้าร่วมการศึกษาจำนวน 93 คน หญิงตั้งครรภ์จะได้รับการให้สุขศึกษาด้วยการให้ความรู้เกี่ยวกับอาหารทะเลปลอดภัย การส่งเสริมการรับรู้ประโยชน์อุปสรรคของการบริโภคอาหารทะเลและการรับรู้ความสามารถตนเอง โดยการบรรยายประกอบวีดิทัศน์ การแจกคู่มือและการส่งข้อความสั้น ทำการเก็บรวบรวมข้อมูลก่อนและหลังด้วยการตอบแบบสอบถาม การวิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนาและ Paired samples t-test

ผลการศึกษาพบว่าหลังการทดลองหญิงตั้งครรภ์ มีการรับรู้ประโยชน์จากการบริโภคอาหารทะเลปลอดภัยและมีการรับรู้ความสามารถตนเองมากกว่าก่อนการให้ความรู้อย่างมีนัยสำคัญ p<0.01 ด้านการรับรู้อุปสรรคต่อการบริโภคอาหารทะเลปลอดภัย พบว่าภายหลังการให้สุขศึกษาหญิงตั้งครรภ์มีการรับรู้อุปสรรคจากการบริโภคอาหารทะเลลดลงจากก่อนทดลองอย่างมีนัยสำคัญ p<0.01 ด้านพฤติกรรมการบริโภคอาหารพบว่าหญิงตั้งครรภ์ มีพฤติกรรมการบริโภคอาหารปลอดภัยเพิ่มมากขึ้นอย่างมีนัยสำคัญ p = 0.02

จากผลการศึกษาทราบได้ว่าการส่งเสริมการบริโภคอาหารทะเลปลอดภัย ทำให้หญิงตั้งครรภ์มีพฤติกรรมการบริโภคอาหารทะเลปลอดภัยเพิ่มมากขึ้น ดังนั้นการศึกษานี้จึงสามารถใช้เป็นแนวทางในการให้สุขศึกษาแก่หญิงตั้งครรภ์ที่เข้ารับบริการในคลินิกฝากครรภ์ในพื้นที่เพื่อลดความเสี่ยงจากการบริโภคอาหารทะเลได้