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Comprehensive and Understanding of PM2.5 among Thai High School Students

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ABSTRACT: The majority of Thai people prefer to spend their time participating in outdoor activities. However, Thailand is considered a polluted country, and Bangkok is ranked as the most polluted city in the country. Younger generations faced an issue of lacking awareness about PM2.5. As a consequence of encountering particulate fine particles, individuals may be at high risk of developing respiratory and cardiovascular diseases. In addition, none of the researchers have ever conducted a survey researching the comprehensiveness and understanding of high school students in Thailand about PM2.5. Hence, this research aims to analyze and determine understanding among Thai high school students in Thailand. The research was conducted through an online survey consisting of 21-multiple choice questions. With 133 individuals participating in the survey, the mean score was rounded up to 13.65, illustrating the comprehension level of high school students to be on an average scale. From analyzing the correlation between the two variables, the F value was 0.27. According to mean value, the most prominent fundamental reasons for having average knowledge on fine particles may be a consequence of not including the topic into school's syllabus and low promotion in the media, such as newspapers and social media. Thus, this research aims to raise awareness, concern, and comprehension among high school students about the effects of PM2.5.

KEYWORDS: Awareness, High school student, Knowledge, PM2.5.

1. INTRODUCTION

In the present world, living with small dust particles is one of the major problems faced by younger people. Individuals in Thailand used to assume these fine particles were fog. However, after various studies and experiments, scientists can conclude that it was PM (particulate matter). The most significant kinds of PM introduced to society were PM10 and PM2.5. Particles with a diameter of less than or equal to 10 microns (PM10) are inhalable and capable of traveling through the lungs. Moreover, fine particulate matter refers to particles with a diameter less than or equal to 2.5 microns. The two categories of particles differ in terms of emission sources. Car exhaust, chemicals from mass production in industries, and burning fuel emit PM2.5, while on the other hand, PM10 comes from construction, wildfires, and agriculture [1, 3, 4]. Particulate matter was first introduced to the world through the use of microscopy in the early 18th century. The majority of studies of PM2.5 measurements were conducted by developing countries and are related to health effects.Moreover, China has more access to evidence about fine dust particles since they took part in identifying the new PM2.5 ambient air quality standards [2]. According to the rise in population and vehicle owners, the amount of air pollutants emitted is undoubtedly increasing, assembling gasses in the atmosphere especially sulfur dioxide (SO2) and nitrogen oxides (NOx), and also accumulation of PM2.5.

Individuals who are exposed to fine particulate matter for a short period of time (not more than 24 hours duration) have been reported to have a higher number of cases in the hospital for respiratory and cardiovascular diseases. Older adults, infants, and individuals with preexisting heart or lung diseases are at higher risk of being seriously affected by fine particle dust. The California Air Resources Board (CARB) utilized the US Environmental Protection Agency's (EPA) risk assessment approach to quantify the premature fatalities linked with PM2.5 exposure. An update to this analysis using ambient air quality data from 2014 to 2016 found that PM2.5 exposure contributes to 5,400 (uncertainty range of 4,200 - 6,700) premature deaths attributable to cardiopulmonary causes in California each year [1]. Furthermore, each year in California, PM2.5 causes approximately 2,800 admissions for cardiovascular and respiratory illnesses (uncertainty range 350 - 5,100) [1]. It has been reported that fine particles affect one's health

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by infiltrating through the lungs in order to enter the circulatory system. To elaborate, encountering PM2.5 influences the initiation of respiratory and cardiovascular diseases such as breathing difficulties and lung cancer [5]. Another interesting fact is that air pollutants negatively correlate with individuals' cognitive systems. A study shows that in Brazil between 2000 and 2020, test scores of students who were exposed to low air quality for years dropped, varying from 0.13% to 5.39% [6].

The ambient air quality standards for PM2.5 indicate the appropriate amount of pollutants measured in $\mu g/m3$ present in the atmosphere that tend not to be harmful to humans. For fine particulate matter (PM2.5), 12 $\mu g/m3$ is an annual average amount. Additionally, 35 $\mu g/m3$ is the 24-hour average amount of particles present in the air [1]. Additionally, it has been reported that the amount of PM2.5 in Thailand during 1-30 April 2023, varied from 19.9 $\mu g/m3$ to 75.5 $\mu g/m3$ [7]. According to the US Air Quality Index, a number from 12.1 $\mu g/m3$ to 35.4 $\mu g/m3$ PM2.5 is considered as "moderate" and a number between 35.5 $\mu g/m3$ to 55.4 $\mu g/m3$ is considered as "unhealthy for sensitive groups" [7]. Bangkok was ranked the 48th most polluted city in Thailand, out of 68 cities included in the database [7]. However, even though PM2.5 dramatically alters one's health, high school students in Thailand have poor awareness of this subject. Thus, this study aims to improve common knowledge about PM2.5, including general information, sources, measurement, and a solution to a problem. The data from this survey will help assess the understanding of high school students in Thailand about fine particulate matter.

2. METHODOLOGY

The survey research was conducted to test the knowledge of PM2.5 among high school students in Thailand. The questionnaire consists of 28 questions, which are divided into three sections: (1) General information; (2) General knowledge about PM2.5; and (3) Additional knowledge about PM2.5. The responses were collected mainly using multiple choice questions as an option in the questionnaire questions. If the answer was correct, the scores increased by one. If it was incorrect then the score did not increase. The questions were reviewed by three specialists and had an Item Objective Congruence (IOC) score higher than 0.5. The item difficulty (P) of the questionnaire needs to be between 0.2 and 0.8. Since we had 25 questions that did not pass the item difficulty (P), we changed some of the multiple choices to make the values fall in the Item difficulty standard (P). A total of 20 Thai high school students were chosen to complete the survey as a pilot group. At first, we had 24 questions but 3 questions were deleted since the reliability score was 0.66 and it did not pass the reliability standard. Therefore, we were left with 21 questions excluding the general information part, and the score was 0.74, which is considered reliable and acceptable for practical uses. For the statistical analyses, we used Statistical Product and Service Solutions version 26.0 (SPSS) to analyze the significant value among different academic levels on understanding about PM2.5 by using One-way ANOVA (F test). To be considered as significant, the F value must be lower than 0.05 and a F value that is higher than 0.05 will be considered as not significant.

3. INSTRUMENTS

General Information

1. Gender
2. Type of school
3. Academic level

General information about PM2.5

1. Scale your knowledge about PM2.5
2. What does PM stand for?
3. What does AQI stand for?
4. What kind of dust is PM2.5?
5. What color represents the best criterion of the air quality index (AQI)?
6. Which masks are the most effective at dustproofing?
7. How many percent can N95 masks prevent PM2.5?
8. Which number of AQI affects human health?
9. Which program gives information about PM2.5?

Additional information about PM2.5

1. What is Thailand's 24-hour standard average of PM2.5?

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2. Which of the following effects is unrelated to PM2.5 dust?
3. Which region in Thailand has the lowest level of PM2.5?
4. What is the primary cause of PM2.5
5. Which one is the unit of PM2.5
6. Which institution is in charge of reporting PM2.5 level?
7. Who is the most vulnerable to the effects of PM2.5?
8. What impact does PM2.5 have on the environment?
9. What is the primary component of PM 2.5 dust?
10. Which event will have the greatest impact on the distribution of PM2.5 dust?
11. Where does PM2.5 in Chiang Rai originate most frequently?
12. What are the effects of PM2.5 on pregnant women?
13. Which of the following is the most effective management strategy for PM2.5 pollution?

4. RESULTS

Table 1: General information of participants

Information	Frequency	Percentage
Gender		
Female	95	71.4
Male	25	21.8
Other	9	6.8
Type of school		
Public school	68	51.1
Private school	50	37.6
International school	15	11.3
Academic level		
Grade 10	57	42.9
Grade 11	50	37.6
Grade 12	26	19.5

According to Table 1, the result illustrates that the majority of the participants are studying in Grade 10, consisting of 42.9%. Those studying in Grade 11 and Grade 12 are 37.6% and 19.5%, respectively. In addition, the percentage of high school students in public school students comprise 51.1 of the total. Consecutively, those studying in private school and international school account for 37.6%, and 11.3%. Lastly, 71.4% of our samples were female and 21.8% are male while 6.8% were others.

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Table 2: Descriptive Statistics (Mean and Standard Deviation).

	Mean	**Std. Deviation**	**N**
Score on the online survey (out of 21)	13.65	0.14	133

According to Table 2, the result illustrates the mean and the standard deviation from 133 participants. The mean of the score was 13.65, while its standard deviation was rounded up to 0.14. The highest score was 21 out of 21 points; however, the lowest was 4 out of 21 points.

Table 3: One-Way Anova table: academic level and understanding

	SS	**MS**	**df**	**F**
Between group	0.05	0.27	2	1.34
Within group	2.58	0.02	127	
Total	2.63		129	

According to Table 3, the table shows the result from One-way ANOVA obtaining the mean square value of 0.27 and the F value of 1.34. Since the F value exceeded 0.05, this indicates that there is no significant difference among different academic levels on the comprehension of PM2.5.

5. DISCUSSION

Due to the current situation of air pollution, PM2.5 levels are on the rise, which increases the impact on our everyday lives and health. Thus, understanding about PM2.5 is critical. As a result, we decided to conduct this study to assess PM2.5 knowledge among Thai high school students. From a total of 133 participants, we obtained a mean score of 13.65 out of 21, which is considered to be on average knowledge (Table 2). In order to be determined as having above average knowledge and understanding, individuals must score more than or equal to 16 out of 21 marks. However, there are only 30 percent of all the participants who are determined as above average. This is in line with the study from Environmental Analysis Health and Toxicology (EAHT), the study about public awareness and practices towards health impacts of PM2.5 in the Kingdom of Bahrain: identifying areas for intervention, where they found that most of the people in the population were unaware of PM2.5 and it's important to raise awareness of the public [8]. Our findings from the student F-test also revealed that education level may have no effect on PM2.5 knowledge in Thai high school students; as the mean score of each academic level student is very close together (Table 3). In addition, the result in Table 3 also demonstrates that there is no significant difference in perception of PM2.5 across education levels. The computed p-value for the One-Way ANOVA approach is higher than 0.05, indicating that there is no statistical difference between education level and awareness of PM2.5 ($F = 1.34$, $p = 0.27$). This could be owing to the fact that PM2.5 concentrations in Thailand's air were four times higher than the World Health Organization's (WHO) annual air quality guideline value [9], which may have urged Thai people's attention to this critical issue.

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6. CONCLUSION

In conclusion, we performed a survey to groups of Thai high school students to complete a questionnaire, regarding their knowledge about PM2.5. According to the results, there was no correlation between academic levels and the knowledge of PM2.5. This suggests that academic level may have no effect on our online survey score. However, we believe that this study could be beneficial to educate people and raise students' awareness about PM2.5. As a result, we cannot truly assert that academic level is unrelated to understanding of PM2.5. In the future, we could expand our research to a wider scale and wish to use the findings to educate the public.

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