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ASSOCIATION OF FLUORIDE IN DRINKING WATER WITH URINARY FLUORIDE OF SCHOOL CHILDREN AT SMK SERI SERDANG, SELANGOR

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BY

NURUL SHAFINA BINTI MOHAMED SHARIF

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Thesis submitted in fulfilment of the requirement for the degree of Bachelor Science (Environmental and Occupational Health) from the Faculty of Medicine and Health Sciences, University Putra Malaysia

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ABSTRACT

ASSOCIATION OF FLUORIDE IN DRINKING WATER WITH URINARY FLUORIDE OF SCHOOL CHILDREN AT SMK SERI SERDANG, SELANGOR

NURUL SHAFINA BINTI MOHAMED SHARIF

Introduction: Fluoride has been described as an essential element required for normal development and growth of animals and very useful for human beings. Fluoride is abundant in the surroundings and the core source of fluoride to humans is drinking water. The Malaysian Government approved the fluoridation of drinking water in 1972 as an effort to reduce dental caries. However, too much fluoride can cause dental fluorosis which in severe form, leads to brownish mottling of teeth. Study showed that fluoride levels in a few Malaysian states were above the recommended levels and this may be a factor contributing to the higher prevalence of dental fluorosis among the population.The fluoride level in Seri Serdang area (0.68-0.89 mg/L) slightly higher the recommended level which range between 0.4-0.6 mg/L. **Objective:** This study was conducted to determine fluoride in drinking water and urine of school children**. Method**: A cross sectional study was conducted at Seri Serdang, Selangor, involved 71 respondent aged 15-17 years old. Samples of drinking water and urine that taken were analysed by using direct reading spectrophotometer model DR 1900 HACH Brand. **Result**: The mean concentration of fluoride in drinking water was 0.4899 (±sd 0.1201) mg/L while the mean concentration of urinary fluoride was 1.2865 (±sd 0.3958) mg/L. There was no significant difference of mean urinary fluoride level between male and female ($p=0.06$). There was no significant relationship between urinary fluoride level and fluoride in drinking water ($p=0.177$). Drinking water was not the main contributor to the urinary fluoride ($p=0.148$). **Conclusion**: Finding shows that, there was no significant relationship between fluoride in drinking water and urinary fluoride. However, other exposure and source of fluoride that maybe contributes to urinary fluoride level were not taking into consideration and not measured in this study.

Keywords: Fluoride, Drinking water, Urinary Fluoride, School Children

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ABSTRAK

HUBUNGAN ANTARA FLUORIDA DALAM AIR MINUMAN DAN FLUORIDA DALAM AIR KENCING KANAK-KANAK DI SMK SERI SERDANG, SELANGOR

NURUL SHAFINA BINTI MOHAMED SHARIF

Pengenalan: Fluorida merupakan salah satu elemen penting yang diperlukan untuk tumbesaran haiwan dan sangat berguna kepada manusia. Fluorida boleh didapati di persekitaran dan sumber utama fluorida kepada manusia adalah air minuman. Kerajaan Malaysia telah meluluskan pemfluoridaan air pada tahun 1972 untuk mengurangkan flurosis gigi. Penggunaan fluorida yang berlebihan boleh menyebabkan fluorosis gigi yang membawa kepada tompok coklat pada gigi. Kajian menunjukkan bahawa tahap kandungan fluorida di beberapa negeri di Malaysia melebihi tahap yang disyorkan dan ini boleh menjadi faktor yang menyumbang kepada peningkatan fluorosis gigi di kalangan penduduk Tahap kandungan fluorida di kawasan Seri Serdang (0.68 -0,89 mg / L) melebihi tahap yang disyorkan (0.4-0.6 mg / L). **Objektif**: Kajian ini bertujuan untuk menentukan tahap fluorida dalam air minuman dan air kencing di kalangan pelajar sekolah. **Kaedah**: Kajian keratan rentas yang telah dijalankan di Seri Serdang ini telah melibatkan seramai 71 org responden berumur 15-17 tahun. Sampel air minuman dan air kencing diambil dan telah dianalisis menggunakan bacaan terus spectrophotometer model DR1900 HACH Brand. **Keputusan:** Nilai min bagi fluorida dalam air minum adalah 0.4899 (±0.1201) mg/L manakala nilai min bagi fluorida dalam air kencing adalah 1.2865 (±0.3958) mg/L. Tiada perbezaan yang signifikan antara min tahap fluorida dalam air kencing pelajar lelaki dan perempuan ($p = 0.06$). Tiada hubungan yang signifikan antara tahap fluorida dalam air kencing dan fluorida dalam air minuman ($p = 0.177$). Air minuman bukan penyumbang utama kepada fluorida dalam air kencing ($p = 0.148$). **Kesimpulan**: Dapatan kajian menunjukkan, tiada hubungan yang signifikan antara fluorida dalam air minuman dan fluorida dalam air kencing. Walau bagaimanapun, pendedahan dan sumber fluorida lain yang mungkin menyumbang kepada tahap fluorida air kencing tidak diambil kira dan tidak diukur dalam kajian ini.

Kata kunci: Fluorida, Air Minuman, Fluorida dalam Air Kencing, Pelajar Sekolah

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LIST OF ABBREVIATIONS

ATSDR	Agency for toxic substance & Disease Registry
mg/L	Miligram per liter
mg/kg	Milligram per kilogram

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CHAPTER 1

INTRODUCTION

1.1 Research Background

Fluoride has been described as an essential element required for normal development and growth of animals and very useful for human beings. Fluoride is abundant in the surroundings and the core source of fluoride to humans is drinking water. Most of countries have added fluoride in water to reduce the health problem especially dental effect. Figure 1 show those communities in Asia with optimally fluoridated water. It has been proved to be beneficial in recommended doses, and at the same time its toxicity at higher levels has also been well recognized. Fluoride gets accumulated in hard tissues of the body and has been known to play a significant role in mineralization of bone and teeth. More than 90% of ingested or inhaled fluoride is excreted in urine (Czarnowski & Krechniak, 2002).

Malaysian government had approved fluoridation of water in 1972 in an effort to reduce dental caries. Reportedly, 75.5% of the country's population (around 20.7 million people) receives fluoridated water. Johor is the first state that receives the water fluoridation system (Malaysian Dental Association, 2010). Figure 2 shows that fluoride is added in water during water treatment process before it being pump to the balancing reservoir and next to the consumer.

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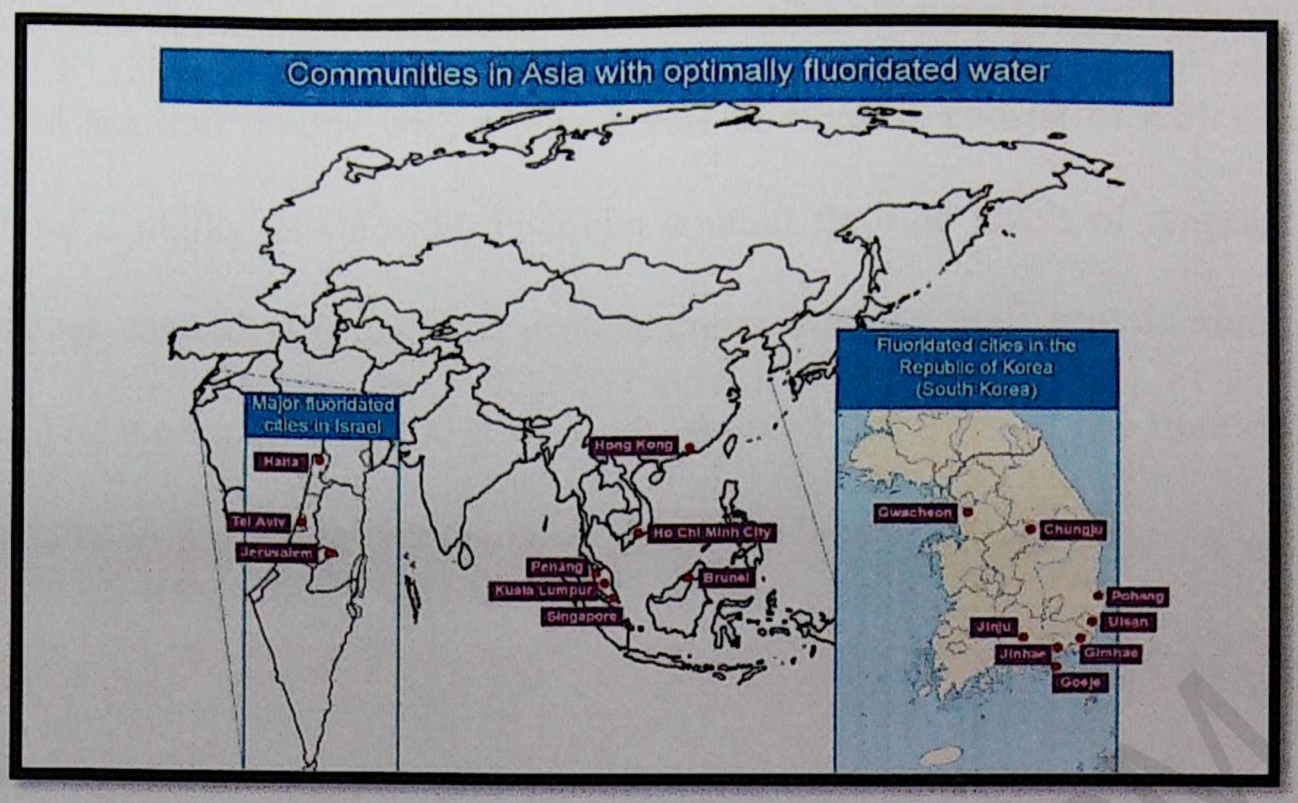

Figure 1: Communities in Asia with optimally fluoridated water (British Fluoridation Society, 2015)

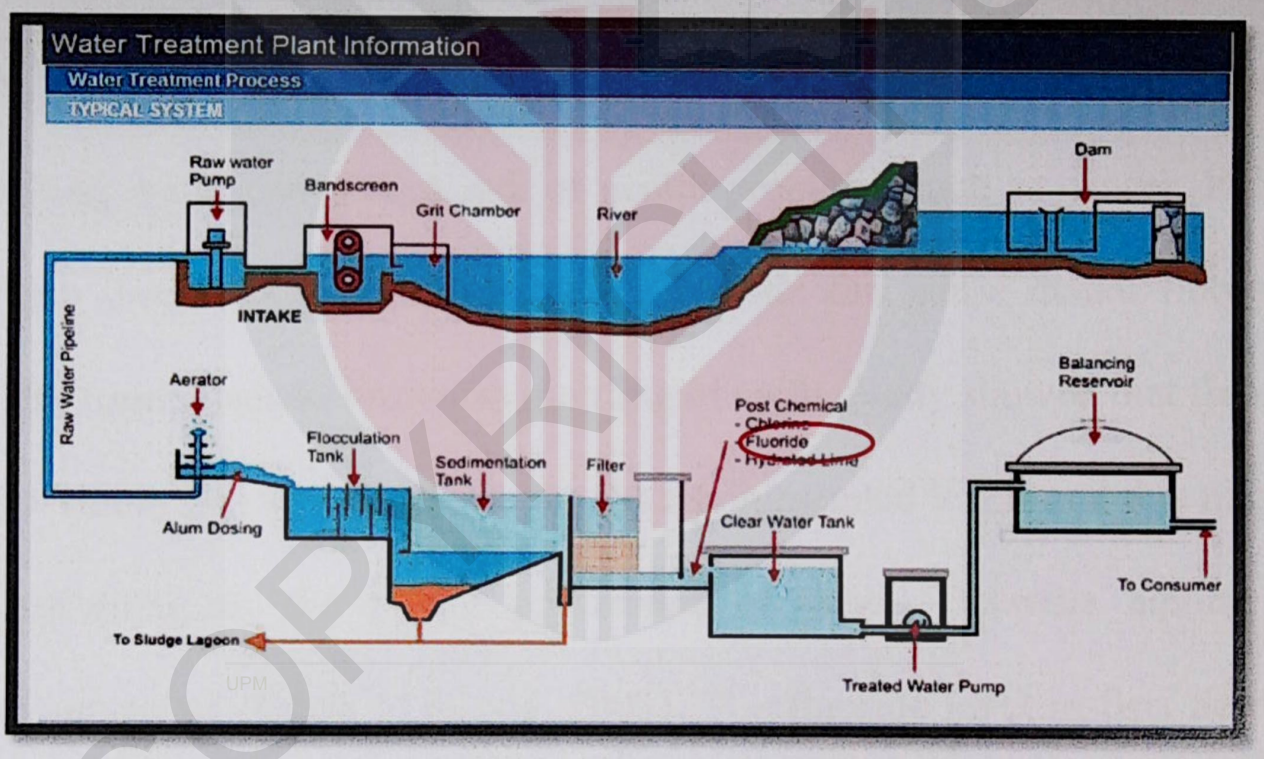

Figure 2: Water treatment process
(Retrieved from http://dribnusina.blogspot.my/2016/03/proses-rawatan-air-dan-bekalan-air-ke.html on September 26, 2016)

Standard level of fluoride in drinking water used in Malaysia is based on National Standard for Drinking Water Quality (NSDWQ) which is 0.4-0.6 mg/L. World Health Organization (WHO) recommended level of fluoride is 0.5- 1.0 mg/L (depending on climate).

Apart from drinking water, there are many other source of fluoride such as toothpaste and seafood. Foods with higher levels of fluoride consist of barley and rice with about 2 mg/kg of fluoride. Fish can contain fluoride levels of ranges 2-5 mg/kg; however canned fish and fish protein concentrations may contain fluoride levels up to 370 mg/kg (IPCS, 2002). A study showed that 34% of the fluoride in black tea remains in the oral cavity (Simpson, Shaw & Smith, 2001)

1.2 Problem Statement

Fluoride is added to water in order to reduce dental fluorosis as well as also to prevent dental caries. There is no scientific evidence to show the permitted fluoride levels in drinking water can pose a risk of health problems such as cancer, kidney failure, or bone disease. However, too much fluoride can cause dental fluorosis, which in severe form, leads to brownish mottling of teeth. Study showed that fluoride levels in a few Malaysian states were above the recommended levels and this may be a factor contributing to the higher prevalence of dental fluorosis among the population (Ministry of Health Malaysia, 2002). The fluoride level in Seri Serdang ranged from 0.68 – 0.89 mg/l (Shaharuddin et al., 2010) which the level of fluoride in drinking water is slightly higher than the recommended level.

Besides that, a study in Shanyin County, Shanxi Province, China proved that children's intelligence and growth can be affected by high concentration of arsenic or fluoride (Wang et al., 2007). Low levels of fluoride exposure in drinking water had negative effects on children's intelligence and dental health and confirmed the dose–

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response relationships between urine fluoride and IQ scores as well as dental fluorosis. (Ding et al., 2011)

The purpose of this study is to determine the relationship between levels of fluoride in drinking water with urinary fluoride collected, and to determine whether the levels are above or below the levels recommended by the health authorities. Suitable recommendation will be advised if the findings revealed the occurrence of high fluoride levels and the potential health effects.

1.3 Research Question

1.3.1 Is there any association (correlation) between fluoride in drinking and urinary fluoride level among school children?

1.3.2 Is there any significant difference in urinary fluoride level between gender?

1.4 Study Justification

Fluoride is known to give adverse effect to health in excessive or low intake. The most noticeable effect of fluoride deficiency is the increased prevalence of tooth decay. This problem is not only being address in Malaysia, but it is also part of world health concern.

Currently, there is less attention given to fluoride related studies among school children in Malaysia. Thus, by conducting this study, it can help in providing the most basic data on the level of fluoride present in urine based on the drinking water. It is also making this reasonable and useful to conduct new research on

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fluoride level in drinking water and the relationship with urinary fluoride among schoolchildren. Besides that, this study will be carried out in order to enhance better understanding, knowledge and awareness of fluoride in drinking water and the potential health effect cause by exposure on fluoride. This study also will help in suggesting the recommendation that can be taken if there is any adverse effect to the study population regarding fluoride among school children.

1.5 Objectives

1.5.1 General Objective

To determine fluoride level in drinking water and urine of school children.

1.5.2 Specific Objectives

1.5.2.1 To determine fluoride level in drinking water of school children.

1.5.2.2 To determine the urinary fluoride level in school children.

1.5.2.3 To determine significant difference in urinary fluoride level between gender.

1.5.2.4 To determine the association (correlation) between fluorides levels in drinking water and urine among school children.

1.5.2.5 To determine whether level of fluoride in drinking water is the main contributor to urinary fluoride.

1.6 Hypotheses

1.6.1 There is significant difference between in urinary fluoride level between gender.

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1.6.2 There is significant association (correlation) between fluoride levels in drinking water and urine.

1.7 Variables

1.7.1 Independent Variables

Fluoride levels in drinking water

1.7.2 Dependent Variable

Urinary fluoride level

1.8 Definition of Terms

1.8.1 Conceptual Definition

Fluoride in Drinking Water

Community water fluoridation is the process of adjusting the amount of fluoride found in water to achieve optimal prevention of tooth decay. Water fluoridation is the controlled addition of fluoride to a public water supply to reduce tooth decay. Fluoridated water has fluoride at a level that is effective for preventing cavities; this can occur naturally or by adding fluoride (CDC, 2012).

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School Children

School children can be divided into two group; Primary and Secondary. Group of primary school children are among age 7-12 years old. Group of secondary school children are among age 13-17 years old.

Urinary Fluoride Level

Urinary fluoride level in this study refers to the concentration of fluoride in urine output of the school children.

1.8.2 Operational Definition

Fluoridated Drinking Water

Maximum limit fluoride concentration in drinking water that adapted by Malaysia are range from 0.4-0.6 mg/L. The drinking water sample will collected using 250ml HDPE bottles and water sample will analysed using spectrophotometer HACH Brand model DR1900 in order to determine the fluoride concentration in the sample.

School Children

Secondary schoolchildren aged 13-17 years old. The secondary school children were taken from the SMK Seri Serdang

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Urinary Fluoride Level

Urine is the excreted waste that produced by kidney and flows out through urethra. Chemically, urine was mainly a watery solution of salt and substances called urea and uric acid. Normally, it contains others waste from body including fluoride ion.

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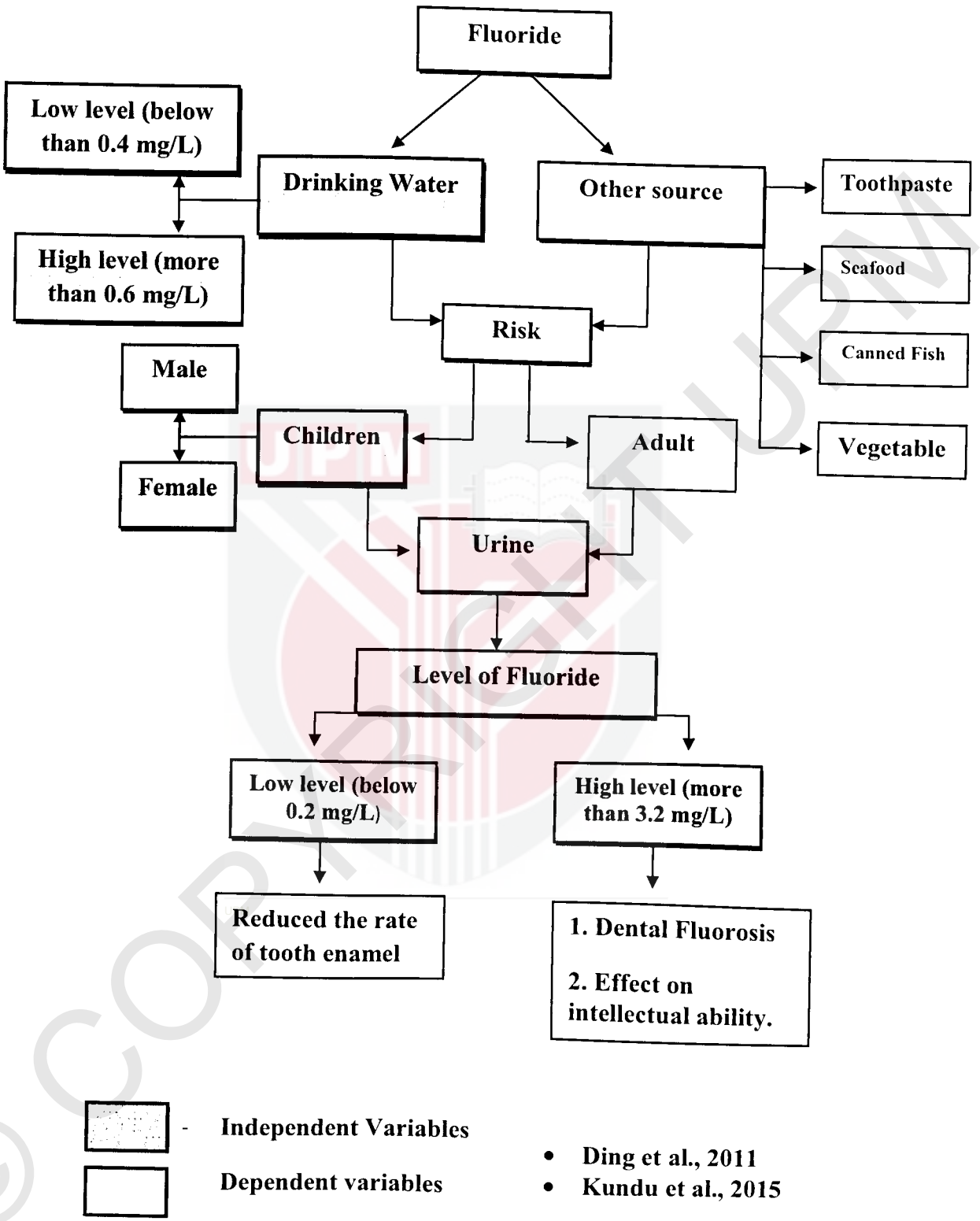

Figure 1.3: Conceptual Framework

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction of Fluoride

Fluoride is an abundant element in the earth's crust in the form of the fluoride ion. It is widely distributed in the lithosphere mainly as fluorspar, fluorapatite and cryolite, and recognized as the thirteenth most common element in the earth's crust. Fluorides are present in water, foods and air. Besides that, fluoride also is commonly associated with volcanic activity and gases emitted from the earth's crust. Average concentrations of fluoride found in the air are in the magnitude of 0.5 ng/m3 (WHO, 2004).Thermal waters, especially with high pH, are also rich in fluoride. Fluoride has different used in many industries including toothpaste, ceramics, tiles, bricks, and many more.

2.2 Urinary Fluoride

More than 90% of ingested or inhaled fluoride is excreted in urine (Czarnowski, Wrześniowska, & Krechniak, 1996). Exposure to excessive amounts of fluoride may be caused not only by elevated fluoride levels in drinking water and foodstuffs but also by pollution from fluoride compounds of industrial origin It is generally accepted that fluoride in urine is the best indicator of environmental or occupational exposure to fluoride (Ruiz-Payan, Ortiz, & Duarte-Gardea, 2005).

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Considering the wide variations in fluoride concentrations of different food and drinks, it is important to assess short-term differences in fluoride intake and consequently fractional urinary fluoride excretion (FUFE) in children, which provide an indication of fluoride body burden (Omid et al., 2016). Based on NIOSH Method 8308, urinary fluoride levels in normal non-occupationally exposed person have been reported within the range from 0.2 to 3.2 mg/L (depending on dietary intake).

2.3 Source of Fluoride

2.3.1 Natural Source

Fluoride is widely found in natural waters and exists in combination with other elements as fluoride compound. In most natural waters, the fluoride ion (F^-) is generally the predominant species that comprises over 95 % of the total F^- and the magnesium fluoride (MgF^+) complex is a common form of existence (Ding et al., 2011). In seawater, fluoride are found at a concentration of around 1.2 – 1.4 mg/liter, in ground waters at concentrations up to 67 mg/liter, and in most surface waters at concentrations less than 0.1 mg/liter. Fluoride is also found in foods particularly fish and tea (IPCS, 2002). As for foods, it has been shown that vegetables and fruits have low levels of fluoride with ranges of 0.1 – 0.4 mg/kg (WHO, 2004). Foods with higher levels of fluoride consist of barley and rice with about 2 mg/kg of fluoride. Fish can contain fluoride levels of ranges 2-5 mg/kg; however canned fish and fish protein concentrations may contain fluoride levels up to 370 mg/kg (IPCS, 2002).

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2.3.2 Artificial Source

Fluoride is added in drinking water to ensure healthy teeth of the community. Fluoridation of public drinking water system is the last segment in the process of turning raw water from the river into potable water suitable for human consumption. Before the processed water is sent into holding tanks, fluoride in the form of sodium fluoride (NaF) or hydrofluoric acid (HF) is added into the water (Shaharuddin et al., 2010). Level of fluoride that reach household are in the range from 0.5 mg/L to 1.0 mg/L. Level of fluoride that added in drinking water may be different at other country. Apart from drinking water, fluoride also is added in toothpaste and dental product to decrease the prevalence of dental carries. A study conduct in Aragua state, Venezuela revealed that dental product was the main source of fluoride (55.5%) (Hector et al., 2009). Toothpastes containing >1,500 ppm fluoride (2,500-2,800 and 5,000 ppm F) provide an additional caries preventive effect on root caries lesions in elderly patients compared to traditional dentifrices (1,000-1,450 ppm F) (Ektrand, 2016).

2.4 Routes of Entry and Absorption

Fluorides can enter the body through inhalation of gases and vapors, through swallowing, and through skin absorption. Studies indicate that fluoride as hydrofluoric acid is absorbed through the skin in humans and animals. However, the degree of absorption is not known, nor is it known whether other forms of fluoride would be absorbed, and to what extent .It can be stored in bones and teeth, and any tissues of the body. Fluoride absorption from gastrointestinal tract is rapid and, for

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fluorides in solutions, reasonably complete. For skin absorption, no experimental data on the extent of skin absorption of fluoride from dilute aqueous solutions are available. As fluoride is an ion it is expected to have low membrane permeability and limited absorption through the skin from dilute aqueous solutions at near neutral pH (such as water used for bathing and showering). This exposure pathway is unlikely to contribute to the fluoride body burden (Tylenda, 2011).

2.5 Distribution of Fluorides in Body

Fluoride is rapidly distributed throughout the organism after absorption (Buzalaf, 2011). Plasma fluoride levels begin to increment inside 10 min taking after fluoride admission and pinnacle fixations are come to inside 20–60 min. Standard plasma fluoride levels are typically come to inside 3–11 hour after ingestion, contingent upon the sum ingested (Whitford, 1996). From a pharmacokinetic perspective, plasma is viewed as the focal compartment for fluoride circulation, since it is the liquid from which and into which fluoride must go to be conveyed to hard and delicate tissues and discharged. A little part (<1%) of ingested fluoride is found in delicate tissues, where a relentless state circulation amongst extracellular and intracellular liquids is set up (Whitford, 1996). This implies when there is an expansion or diminishing in plasma fluoride levels, a corresponding change happens in the fluoride centralizations of the extracellular and intracellular liquids. Most fluoride ingested (around 35% for sound grown-ups) is taken up by calcified tissues where fluoride is reversibly bound and can be discharged over into plasma when plasma fluoride levels fall (Whitford, 1994).

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2.6 Excretion of Fluoride

Fluoride renal excretion is one of the most important mechanisms for the regulation of fluoride level in the body (Afonso, Buzalaf, & Marc, 2011). About 60% and 45% of daily ingested fluoride is excreted in urine of healthy adults and children, respectively (Villa et al., 2010). Thus, plasma and kidney excretion rate constitutes the physiologic balance determined by fluoride intake, uptake to and removal from bone and the capacity of fluoride clearance by the kidney (Gracia & Borgnino, 2015)

2.7 Retention of Fluoride in Body and Bioaccumulation of Fluoride in Human Body

Most of the study shows that fluorides are excreted through urine. However, almost all of the fluoride retained in the body is found in calcified (hard) tissues, such as bones and teeth. The ion is incorporated into the mineral matrix of bone. Approximately 50% of the fluoride absorbed each day by young or middle-aged adults becomes associated with hard tissues within 24 hours while virtually all of the remainder is excreted in the urine. Approximately 99% of the fluoride present in the body is associated with hard tissues (American Dental Association, 2011). An individual's age and stage of skeletal development will affect the rate of fluoride retention. The amount of fluoride taken up by bone and retained in the body is inversely related to age. More fluoride is retained in young bones than in the bones of older adults. It is generally accepted that fluoride retention occurs almost entirely in hard tissues and that fluoride retention in soft tissue is almost negligible. As the

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age increased, the level fluoride of accumulates in the bone also increase (ATSDR, 2003).

2.8 Fluoride and Health Effect

Fluoride has proven effectiveness in the prevention of caries and providing maximum protection against dental caries while minimizing the likelihood of enamel fluorosis. Regular fluoride exposure during the time of teeth development contributes to long lasting protection against enamel fluorosis and dental decay (Dey & Giri, 2016). Study revealed that fluoride, at a concentration close to the concentration present in the serum after environmental exposure, induced a significant tubular dysfunction, resulting in diluted urine, impaired protein reabsorption, and increased calcium and phosphate urinary excretion (Santoyo-Sanchez et al., 2013). Other study conducted at Inner Mongolia, China support the result that low levels of fluoride exposure in drinking water had negative effects on children's intelligence and dental health and confirmed the dose–response relationships between urine fluoride and IQ scores as well as dental fluorosis (Ding et al., 2011)

2.9 Water Source as Contributor to Fluoridated Drinking Water

Most of the human studies are ecological studies examining communities with fluoridated water or naturally high levels of fluoride in water (Tylenda, 2011). Fluoride is one of the most abundant anions present in groundwater worldwide and creates major problem in safe drinking water. Though groundwater contributes only 0.6% of the total water resources on earth, it is major and preferred source of

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drinking in rural as well as urban areas, particularly in developing countries like in India (Jagtap et al., 2012). There is study that shows different level of fluoride were obtained from different source. Study conducted in Northern Mexico shows that fluoride content in wells and tap water samples of Villa Ahumada ranged from 5.0 to 5.7 mg/L. Fluoride content of these samples was above the level permitted by Mexican regulations. The fluoride content in bottled water obtained from local stores in Villa Ahumada ranged from 0.3 to 3.7 mg/l (Ruiz-Payan et al., 2005). In person who not exposed to excessive level the mean urinary fluoride level usually does not exceed 1.0-1.5 mg F-/L and depends mainly on the water supply (Czarnowski & Krechniak, 2002).

2.10 Systemic and Topical used of Fluoride

There are two types of fluoride; systematic and topical. Both of have different function and used. Systemic fluoride is swallowed and benefits the teeth before and after they erupt in the mouth while Topical fluoride is applied directly to teeth. Topical fluoride benefits teeth that have already erupted into the mouth. A possible adverse effect associated with the use of topical fluoride is the development of dental fluorosis due to the ingestion of excessive fluoride by young children with developing teeth (Ding et al., 2011). Systemic methods are now being questioned due to the fact that many studies have indicated that fluoride's action relies mainly on its post- eruptive effect from topical contact with the tooth structure (Sampaio & Levy, 2011)

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2.11 Dental Fluorosis

Dental fluorosis is a developmental disturbance of enamel caused by excessive fluoride on ameloblasts during enamel formation (Wang et al., 2013). Dental fluorosis is a change in the appearance of the tooth's enamel. These changes can vary from barely noticeable white spots in mild forms to staining and pitting in the more severe forms. Dental fluorosis only occurs when younger children consume too much fluoride, from any source, over long periods when teeth are developing under the gums (CDC, 2015). High fluoride content is a risk factor for dental fluorosis and problem of dental fluorosis increased with passage of time suggesting that the fluoride content in the water has perhaps increased over time (Kotecha et al., 2012

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CHAPTER 3

METHODOLOGY

3.1 Study Design

This study was a cross-sectional study where the variables were studied in a specific point of time.

3.2 Study Location

This study was conducted at a school at Serdang, Selangor.

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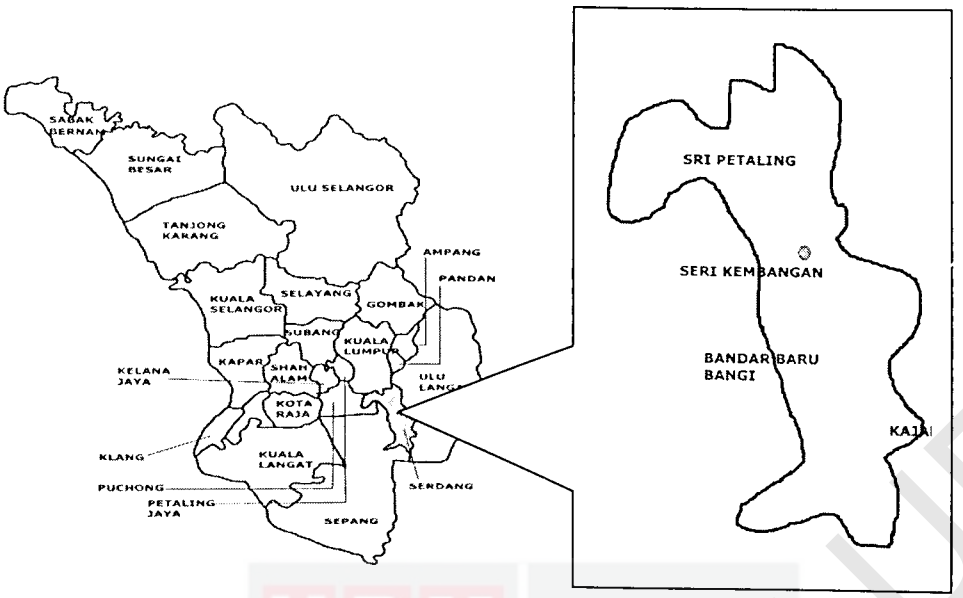

Figure 3.1: Maps of Peninsular Malaysia, Selangor and Serdang.

3.3 Study Population

The populations studied were students' age 13-17 years at SMK Seri Serdang.

3.4 Sampling

3.4.1 Sampling Frame

The sampling frame was the student name list from the SMK Seri Serdang. The students were selected from the name list which obtained from the Student Affairs Department of the school.

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3.4.2 Sampling Method

The sampling method to be used in this study was purposive sampling as non representative subset of some larger population and it is constructed a very specific need and purpose. The respondents were selected based on a few inclusive and exclusive criteria. The inclusive and exclusive criteria were set in order to determine which schoolchildren can participate in this research study. Schoolchildren who meet inclusive criteria were selected as a respondent. Below were the inclusive and exclusive criteria:

Inclusive Criteria:	**Exclusive Criteria:**
a) Using boiled tap water as source of drinking water b) Free from kidney disorder/disease	a) The schoolchildren that participate during the study are relocated to a new place or drop out from the school.

Respondent who meet the inclusive criteria were selected randomly. Selected respondent who participate in this research were asked for their parents' permission. Respondents were free to withdraw from the study if they feel uncomfortable.

3.4.3 Sampling Size

The sample size is determined by using a formula establishes by Kirkwood and Sterne (2003):

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$$N = p\,(1-p) / e^2$$

Where,

N= sample size

P= Prevalence of high fluoride in drinking water (Shaharuddin et al. 2010)

e= sampling error

Sample size determination calculation:

$$N = 0.316\,(1 - 0.316) / 0.05^2$$

$$= 86$$

- 86 Respondents

The prevalence (p value) was determined by a study by Shaharuddin et al. (2010), therefore, the number of respondents in this study is 86.

3.4.4 Study Instrumentation

3.4.4.1 Questionnaire

A set of questionnaire were given to respondents to gather information from the selected respondents. The questionnaire contained socio-demographic data, socio-economic, health status, and water supply usage. The questionnaire is important to ensure the respondents comply with the inclusive criteria

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3.4.4.2 Drinking Water

Water samples were collected from the tap water that used for drinking purposes. Water samples were collected in 250 ml HDPE bottle from each respondent's home. The analysis used to analyse the sample was SPADNS method. The method was accepted by USEPA for drinking water and wastewater analysis (HACH Company USA, 2012). The samples was analysed within 24 hours using a DR1900 HACH brand direct reading spectrophotometer. The SPADNS method was used which involve the reaction of fluoride with red zirconium dye-solution. This method analysis was accepted by USEPA for drinking water and wastewater analysis (HACH Company USA, 2012).

3.4.4.3 Urine

Urine container bottles (50 ml) were distributed and urine was collected from each respondent. Urine samples were directly analysed within 24 hours after collected by using spectrophotometer DR1900.

3.5 Equipment and Reagent

3.5.1 Questionnaire

To gather information about socio-demographic data, socio-economic, health status and water supply types from the respondents.

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3.5.2 Sample Bottle

Urine was collected in 50 ml sample of container and 250 ml sample bottle for drinking water.

3.5.3 Spectrophotometer DR1900

To determine the level of fluoride in urine and drinking water

3.6 Analysis of Fluoride

Fluoride in both urine and drinking water were analysed by using USEPA method 8029. The SPADNS reagent solution method was being used. The step as below:

a. Prepare blank: Pipette was used to add 10.0 mL of deionised water to the sample cell.
b. Prepare sample: Pipette was used to add 10.0 mL of sample to the sample cell.
c. Pipette was used to add 2.0 ml of SPADNS Reagent solution into each sale sample solution Swirl to mix
d. The instrument timer was started for one minute
e. When the timer expired, the blank sample cell was cleaned.
f. The blank was inserted into the cell holder
g. Push ZERO. The displayed showed 0.00 mg/L F
h. The prepared sample cell was cleaned

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i. The sample prepare was inserted into the cell holder.

j. Push READ. The result was shown in mg/L F.

3.7 Data Collection

Letter of approval from Ministry of Education Malaysia was forwarded to the headmaster of selected school before data collection. Earlier briefing was given to the respondents in order to inform them about the objectives of the study and a consent form was forwarded to their parent for approval. After obtain the consent from their parent, a questionnaire were distributed to the respondents in order to get information about their socio-demographic, health status and water supply usage. Respondents were guided by the parents while answering the questionnaire.

3.8 Data Collection Method

3.8.1 Questionnaire

Set of questionnaire were distributed to the respondents. Questionnaire was used to collect information such as

I. socio-demographic data

II. health status

III. water supply usage

The questionnaires were given to respondents before the collection of the sample (Urine sample and drinking water sample).

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3.8.2 Sample Collection

Before sample collection, detail briefing was conducted to all chosen respondents who participate in this study. Question on the sources of drinking water was asked before collections of the sample from the respondent were taken. It was to make sure the drinking water sample were taken from their pipe water that not using any filtration system at home.

3.9 Data Analysis

The data obtained were analyzed by using the latest IBM SPSS (Statistical Package for the Social Sciences) version 21. The type of analysis which was used for this study is shown in the Table 1, based on the objectives of this study.

Table 1: Type of Data Analysis

Objectives	Type of Analysis
To determine the urinary fluoride level in school children	Descriptive Analysis
To determine fluoride level in drinking water of school children	Descriptive Analysis
To determine significant different in urinary fluoride level between gender.	Parametric: T-test Non- Parametric: Mann Whitney U
To determine the association (correlation) between fluoride in drinking and urinary fluoride level among school children.	Parametric: Pearson Correlation Non- Parametric: Spearmen

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	Correlation
To determine whether level of fluoride in drinking water is the main contributor to urinary fluoride.	Regression Analysis

3.9 Study Ethics

This proposal was submitted to the University Ethics Committee for Researches Involving Human of University Putra Malaysia. Permission from respondents who was selected to participate in this study was obtained from written consents of the respondents before study is conducted. Privacy of information and confidentiality of respondents were protected.

3.10 Ethical Consideration

Approval from Medical Research Committee, Faculty of Medicine and Health Science, University Putra Malaysia was obtained.

I. The respondents was given some explanation about the whole of the study activities involved.

II. The respondents were given some explanation about the methodology that involve in term of the purpose of the assessment, the procedure taken, and also respondents' right in this study.

III. Approval from Ministry of Education were given to each school representative to obtain the consent of the resident involved in this study.

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IV. Approval letter were given to the respondents to get their consent to be participant in this study

3.11 Study Limitation

The information given by respondents could not be verified to be 100 % valid. In term of this limitation, we assumed the answer and the data given will meet validity. Another limitation is the actual number of respondent does not fulfil the actual number of respondent.

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CHAPTER 4

RESULTS AND DATA ANALYSIS

4.1 Socio Demographic Data

This study was carried in Sekolah Menengah Kebangsaan Seri Serdang and involved 71 respondents. From 71 respondents, 40.8% respondents were male and 59.2% respondents were female. The total respondents' response rate is 82% from the actual total number of respondents.

The respondents were among 15-17 years old student. From the 71 respondent, 16.9% were 15 years old, 52.1% were 16 years old and 31.0% were 17 years old.

Table 4.1 Distribution of Respondents

Variables		N= 71	
		Frequency	Percentage (%)
Gender	Male	29	40.8
	Female	42	59.2
Age	15	12	16.9
	16	37	52.1
	17	22	31.0

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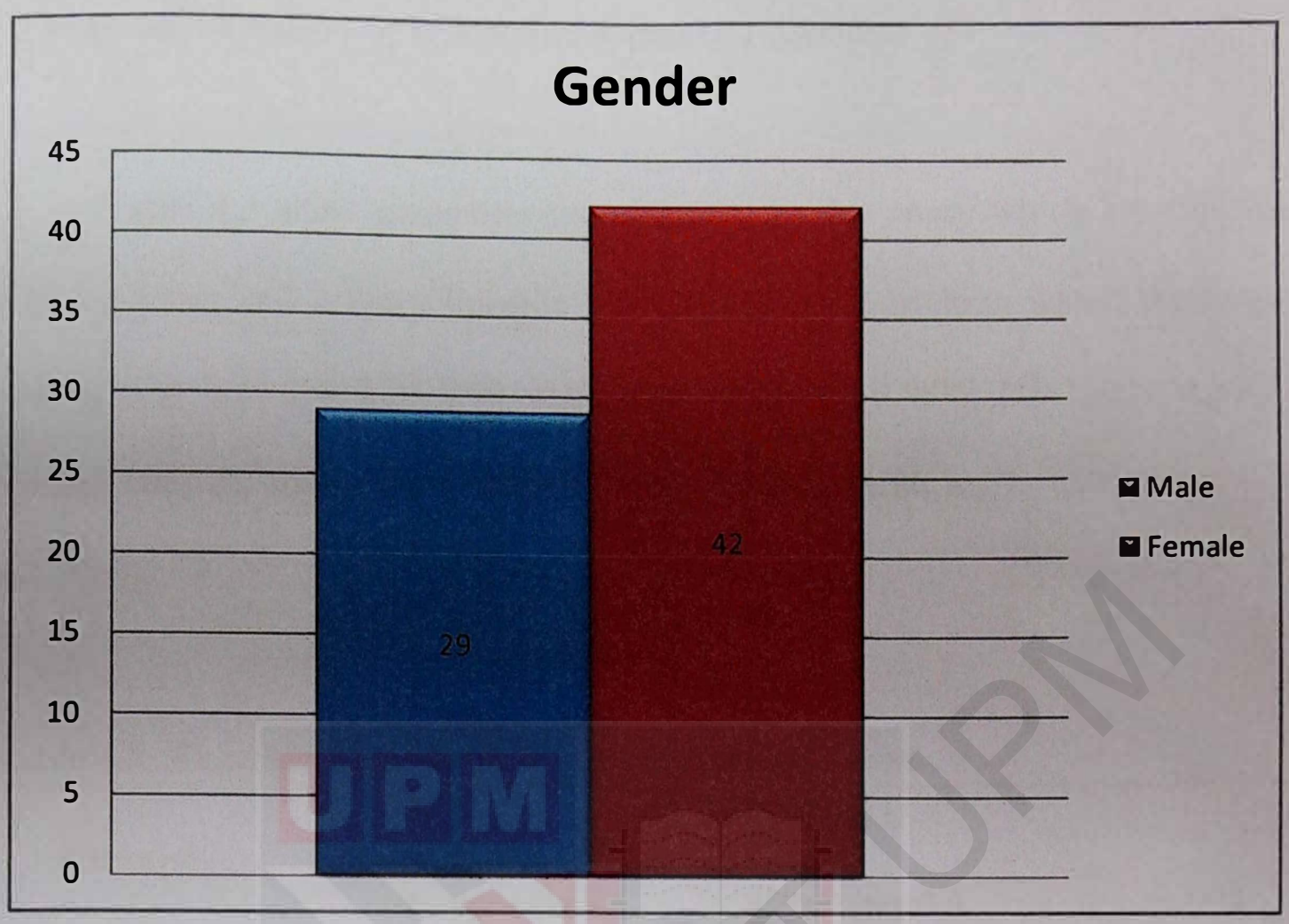

Figure 4.1 Distribution of respondents based on gender

Figure 4.2 Distribution of respondents based on age

4.2 Fluoride in Drinking Water and Urinary Fluoride

Table 4.2 show parameter that measure in this study which are fluoride in drinking water and urinary fluoride level. Fluoride in drinking water, the range of reading was between 0.23-0.99 mg/L with mean of 0.4899 (±0.1201) mg/L. For urinary fluoride, the reading range is between 0.39- 1.96 mg/L with mean 1.2865 (±0.3958).

Table 4.2: Fluoride Level in Drinking Water and Urine

Parameters	N=71		
	Range (mg/L)	Mean (mg/L)	(±)SD
Fluoride in Drinking Water	0.23-0.99	0.4899	0.1201
Urinary Fluoride	0.39-1.96	1.2865	0.3958

4.3 Significant Difference in Urinary Fluoride Level between Gender

The Independent Sample t test was used to determine the significant difference in urinary fluoride level between genders. When the significant value of T-Test is less than the significance value which was set to 0.05, $p<0.05$, then the null hypothesis was rejected.

The value of significant (2-tailed) with equal variances not assumed was $p=0.06$ which represents $p>0.05$. The conclusion is there is no significant difference of mean urinary fluoride level between male and female. The mean difference of urinary fluoride level is about equal in both group of gender.

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Table 4.3 Comparison between Mean Urinary Fluoride Levels between Gender

Variables	Mean (sd)		Mean difference (95% CI)	t-statistic (df)	p-value
	Male	Female			
Urinary fluoride level	1.145(±0.454)	1.405(±0.351)	0.260 (0.078,0.4425)	2.858 (60)	0.06

4.4 Relationship between Urinary Fluoride Level and Fluoride in Drinking Water

Since both of the variables which are urinary fluoride levels and fluoride in drinking water not normally distributed, spearman's rho test was used to determine the correlation between fluoride in drinking water and urinary fluoride level.

The null hypothesis is rejected when the p-value is less than the significance level which is 0.05 ($p \leq 0.05$). The significant value indicate in this study is $p=0.177$ ($p>0.05$) and the null hypothesis was failed to be rejected. This concluded that there are no significant relationship between urinary fluoride level and fluoride in drinking water.

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Table 4.4: Correlation between Urinary fluoride Level and Fluoride in Drinking Water

Parameters	N= 71	
	Coefficient correlation, *r*	p-value
Urinary Fluoride Level	0.162	0.177
Fluoride in Drinking Water		

4.5 Fluoride Level in Drinking Water is the Main Contributor to the Urinary Fluoride

Regression analysis was used to determine the relationship between fluoride level in drinking water and urinary fluoride. It measures the change in the response, which corresponds to a given change in the explanatory variable.

According to Table 4.5, when the p-value was less than the significance level which was set to 0.05, $p \leq 0.05$, then the null hypothesis was rejected. The significant value was at $p=0.148$ ($p>0.05$) and the null hypothesis was failed to be rejected. It can be conclude that water is not the main contributor to the urinary fluoride.

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Table 4.5: Regression analysis to determine relationship between fluoride levels in drinking water and urine

Parameter	b (95% CI)	t-statistics	p-value	r^2
Urinary Fluoride	0.572 (-0.208,1.351)	1.463	0.148	0.030

***significant at p≤0.05**

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CHAPTER 5

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 DISCUSSION

5.1.1 Socio-Demography Background

This study involved a total of 71 schoolchildren from Sekolah Menengah Kebangsaan Seri Serdang, Selangor. All the respondents were selected based on the inclusive criteria which were 13-17 years old primary schoolchildren, free from kidney related disorders/diseases, and did not using any water filtration from their water supply at home. However, upon the request from the selected school, only respondent from age 15-17 years old involved in this study.

Children between aged 13 to 19 years old were choose as respondents as they were on the move amongst youth and adulthood, and their expanding autonomy achieves new difficulties and dangers. This outcomes in stamped contrasts in examples of dreariness also, mortality for teenagers contrasted and more youthful youngsters (AIHW, 2008).

The selection of respondents based on inclusive and exclusive criteria were done as to control the representativeness of fluoride levels in drinking water and urine but exposure of fluoride from other sources which consider as confounding factors were not controlled.

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Urinary fluoride levels are the best indicator of fluoride intake (Raja, 2012). It is known that approximately 50% - 80% of the fluoride absorbed is excreted through the urine primarily by glomerular filtration (Santoyo-Sanchez et al., 2013).

5.1.2 Fluoride in Drinking Water and Urinary Fluoride Level

From the data analysis, the two parameters measured were fluoride in drinking water and urinary fluoride. The drinking water fluoride ranged from 0.23-0.99 mg/L with a mean of 0.4899 ±sd 0.1201 mg/L. The level recommended by The National Standard for Drinking Water Quality (NSDWQ) range of 0.4-0.6 mg/L. By comparing the result obtained with the permissible fluoride levels range, the mean level of artificially fluoride did not exceed the national standard. From the total 71 drinking water sample, 12 (16.9%) respondents exceeded permissible range of fluoride levels in drinking water which is more than 0.6 mg/L. High level of fluoride is generally the result of natural background resulting from the geological composition of local soils and bedrock (Environmental Protection Agency,2011). The other 10 (14.1%) respondents were below permissible range of fluoride levels in drinking water, and the remaining 49 (69.0%) respondents were in the permissible range of fluoride levels in drinking water. In another words, fluoridation of water supply in Seri Serdang area were within the standard range for fluoridation levels. Optimally fluoridated drinking water can be classified as a diet that influences the prevention of tooth-related diseases (WHO, 2012).

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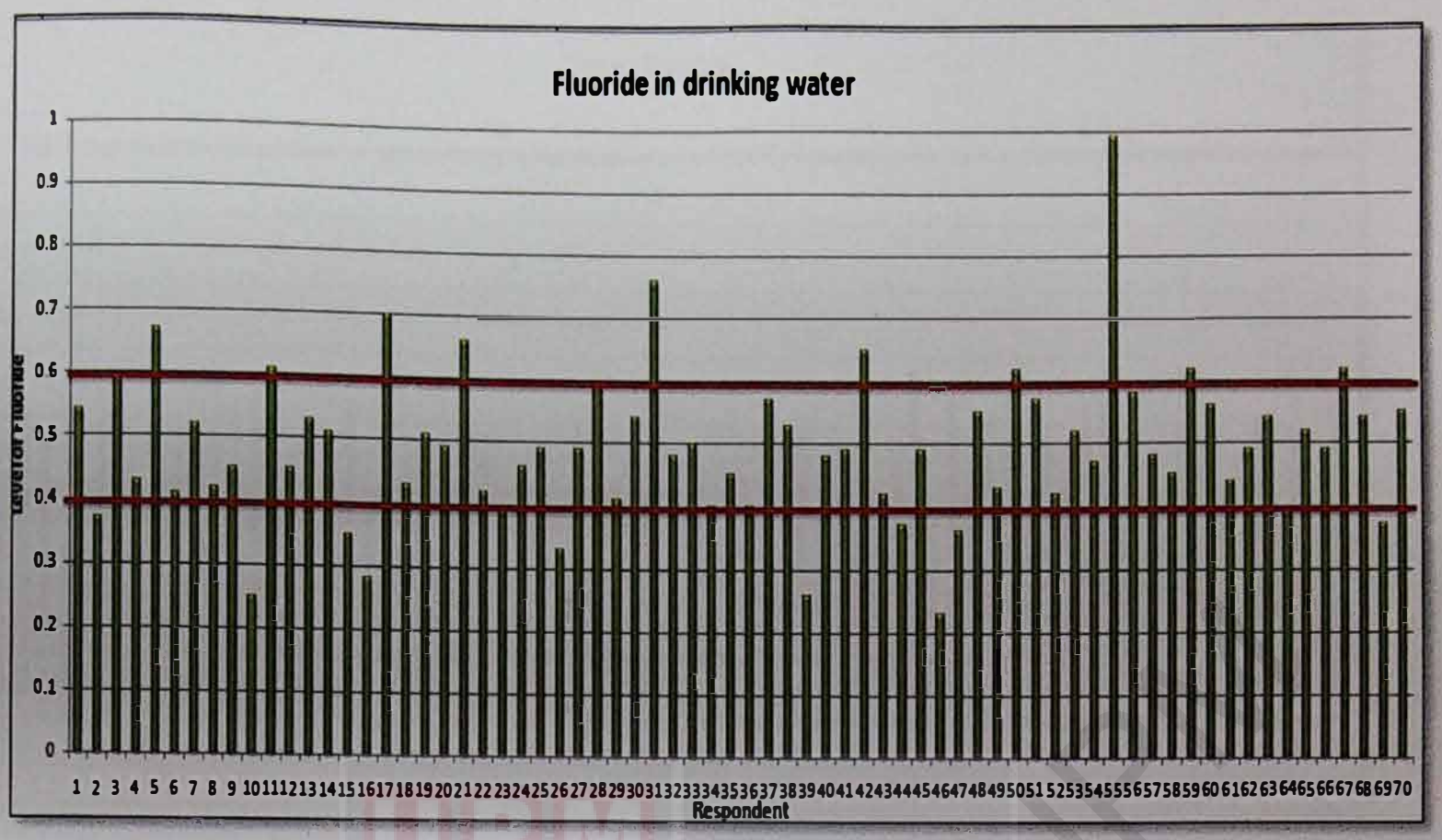

Figure 5.1.2.1 Comparison Fluoride Level in Drinking Water with National Standard

For the second parameter, urinary fluoride was analysed based on standard method of USEPA SPADNS method. Urinary fluoride water ranged from 0.2-3.2 mg/L and the mean value was 1.2865 (±0.3958) mg/L. Based on NIOSH Method 8308, urinary fluoride levels in normal non-occupationally exposed person have been reported within the range from 0.2 to 3.2 mg/L (depending on dietary intake). Comparison between ranges of urinary fluoride with the range obtained from the literature review, urinary fluoride for all respondents is within the range.Results also showed all 71 (100%) respondents' urinary fluoride levels were in normal range which is between 0.2 to 3.2 mg/L.

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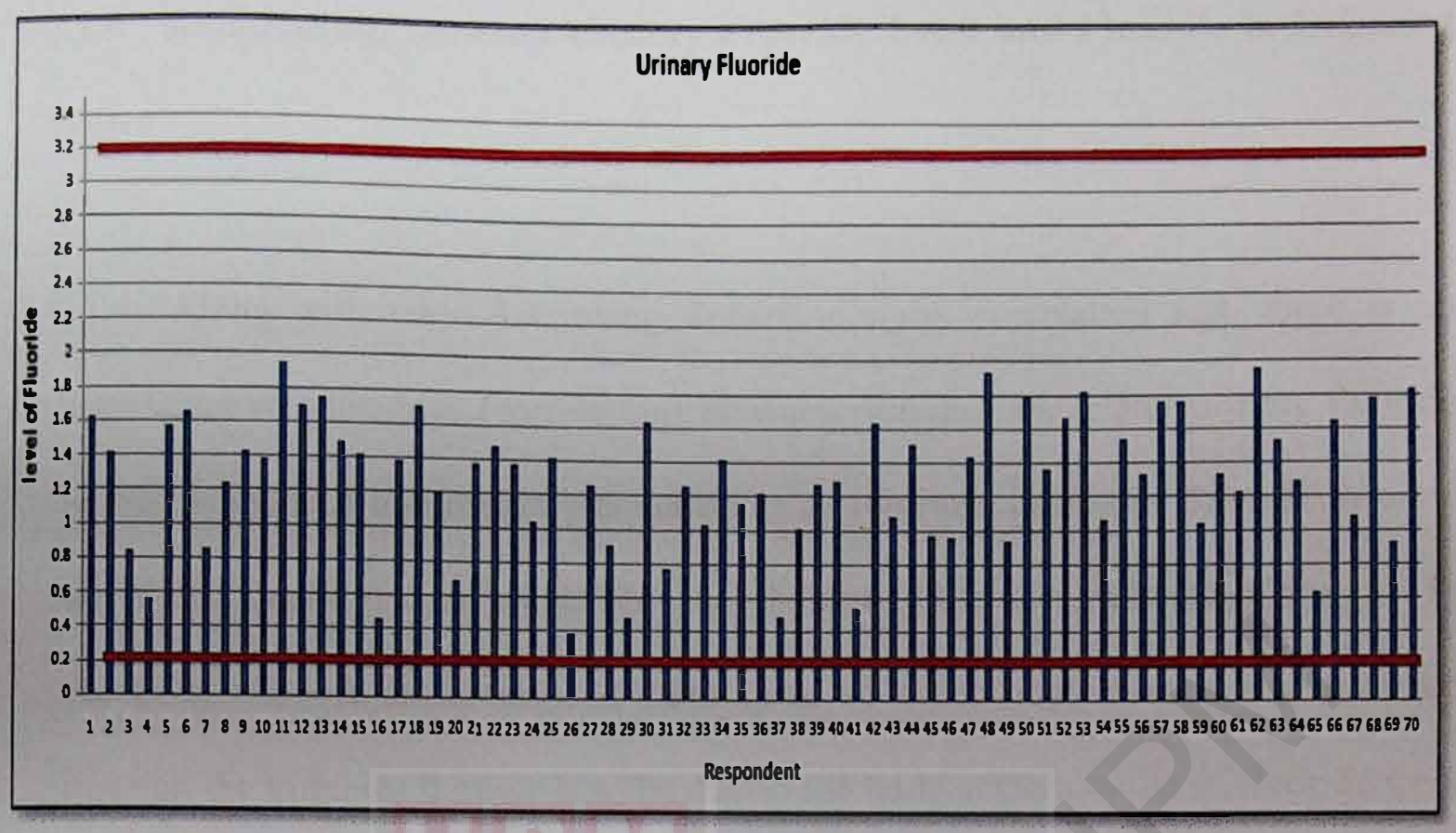

Figure 5.1.2.2 Comparison Urinary Fluoride Level with Standard in NIOSH Method 8303

5.1.3 Urinary Fluoride Levels based on Gender

From the analysis performed, the data reveal that there was no significant difference between male and female urinary fluoride levels. Thus, it's failed to reject null hypothesis. Urinary fluoride levels between genders did not differ much as the socio-demographic background of the respondents was almost the same. This is because all respondents lived at the same housing area which using same water resources. Age and gender did not affect urine total volume, urinary flow rate, urinary fluoride concentration and fluoride excretion rate (Hector et al., 2009). This is also due to the dietary intake of male and female which almost the same. A study by Martinez et al., (2003), showed that there were no statistical different between children residing in Veracruz and Mexico cities who have similar dietary patterns.

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5.1.4 Relationship between Urinary Fluoride Level and Fluoride in Drinking Water

Along with table 4.4, using Spearman's rho correlation test, there is no significant relationships (correlation) between drinking water and urinary fluoride levels. Thus, null hypothesis was failed to be rejected. Levels of fluoride in urine are higher than drinking water. This may be due to the accumulation of fluoride in the body; i.e., fluoride released from bone or other body tissues and excreted through the kidneys. It could also be due to the body accumulation of fluoride from other sources such as tea, local-grown vegetables, fruits or animals. This process could take place over a long period of time (Chen et al., 2013). Apart drinking water, there are several source that can cause fluoride such as dental product, processed food and beverages, mechanically deboned meat and tea. Tea (*Camellia sinensis*) is a plant exhibiting high tendency for accumulation of fluorides. Up to 98 % of fluorides are accumulated in the leaves used for the preparation of widely consumed tea infusions (Janiszewska & Balcerzak, 2013). Several factors can affect fluoride metabolism and consequently fluoride retention, including acid–base disturbance, altitude, physical activity, diet, and genetic predisposition (Zohoori & Duckworth, 2017).

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5.1.5 Fluoride Level in Drinking Water is the Main Contributor to the Urinary Fluoride

Data analysed by regression test showed that there is no significant relationships between fluoride levels in drinking water with urinary fluoride. Thus, it's failed to reject null hypothesis. Urinary fluoride might be affected by other sources of fluoride besides drinking water. Most people are potentially exposed to fluoride through a variety of sources, such as food, beverages, medicine, and dental products (ATSDR, 2003). Due to other sources of fluoride such as food, beverages and others, drinking water was not the main contributor to urinary fluoride. Main sources of fluoride intake are diet and the unintentional swallowing of fluoridated dental products (Zohoori & Duckworth, 2017). This can be conclude that drinking water was not the main contributor to urinary fluoride.

5.2 Conclusions

This study was conducted to determine fluoride in drinking water and urine of school children. As we know, fluoride was added in drinking water as an effort to reduce dental caries. Excessive fluoride to human can give negative effect such as dental fluorosis.

Result obtained from this study showed that, more than half of the respondent received the permissible range of fluoride levels in drinking water which indicate the level of fluoride that added in drinking water at Seri Serdang are were in optimal range. Even though most of fluoride levels in drinking water were within the

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recommended range, it should be monitored regularly due to several reading that exceed the range. All 71 respondents (100%) have normal ranges of urinary fluoride which range between 0.2-3.2 mg/L.

Other findings showed that, urinary fluoride levels are not influence by gender. In short, second hypothesis was rejected. Therefore, further investigations on other source of fluoride exposure, total excretion of fluoride and retention time of fluoride need to be done.

Besides that, there were no significant relationship between fluoride in drinking water and urinary fluoride. Thus, third hypothesis was rejected. However, other exposure and source of fluoride that may contributes to urinary fluoride level were not taking into consideration and not measured in this study as the main focus in this study is fluoride exposure from drinking water.

Optimal range of fluoride level may help in preventing dental caries. However, everyone should be concerned about the fluoride level because it may give impact to human especially children in excessive intake.

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5.3 Recommendation

Study should be conducted in wider area and the scope of the study should be increase so it can represent more group that being exposed to fluoride. Other factor such as dietary intakes and dental product should be includes in study as it can affect the result. Since urinary fluoride level is affected by kidney function status, creatinine test should be done to determine the urine output.

Study regarding knowledge, attitude and practice regarding safe drinking water can be initiated to determine the awareness and perception of community about these issues. Health authorities play major role in taking action effectively to make sure the fluoride level in drinking water are within the optimal level recommended by WHO.

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APPENDIX A

Questionnaire

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JAWATANKUASA ETIKA UNIVERSITI UNTUK PENYELIDIKAN MELIBATKAN MANUSIA (JKEUPM) UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG, SELANGOR, MALAYSIA

BACHELOR SAINS (KESIHATAN PERSEKITARAN DAN PEKERJAAN)

FAKULTI PERUBATAN DAN SAINS KESIHATAN

BORANG SOAL SELIDIK

HUBUNGAN ANTARA KANDUNGAN FLUORIDA DI DALAM AIR MINUM DENGAN FLUORIDA DI DALAM AIR KENCING DI KALANGAN KANAK-KANAK DI SMK SERI SERDANG

NAME : NURUL SHAFINA BINTI MOHAMED SHARIF

MATRIC NUMBER : 174469

SUPERVISOR : DR. SHAHARUDDIN BIN MOHD SHAM

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APPENDIX A:BORANG SOAL SELIDIK

Semua maklumat adalah untuk kegunaan kajian sahaja dan maklumat ini akan dianggap sulit. Maklumat anda hanya digunakan untuk membahagi responden mengikut kategori yang sama.

Arahan: Sila jawab semua soalan dan tandakan (/) pada ruang yang disediakan.

Bahagian A: Maklumat Responden

1. Umur : ☐☐ Tahun
2. Jantina : ☐ Lelaki ☐ Perempuan
3. Berat : .....kg
4. Tinggi : .....cm

Bahagian B: Maklumat penggunaan air paip

1. Apakah sumber air di rumah?

   ☐ Paip

   ☐ Telaga

   ☐ Lain-lain, sila nyatakan .....

2. Berapa gelas air yang anda minum setiap hari?

   ..... gelas (200 ml)

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3. Penggunaan air dari dapur:

☐ Memasak

☐ Minum

☐ Kegunaan domestik

☐ Lain-lain, sila nyatakan .....

4. Adakah anda menggunakan sistem penapisan air persendirian di rumah?

☐ Ya ☐ Tidak

Jika ya, sila nyatakan jenama yang digunakan: .....

Bahagian C: Maklumat kesihatan

5. Adakah anda mempunyai masalah buah pinggang?

☐ Ya ☐ Tidak

6. Adakah anda mengalami masalah kesihatan lain?

☐ Ya ☐ Tidak

Jika ya, sila nyatakan .....

TERIMA KASIH ATAS KERJASAMA ANDA

-TAMAT-

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APPENDIX B

Consent Form

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JAWATANKUASA ETIKA UNIVERSITI UNTUK
PENYELIDIKAN MELIBATKAN MANUSIA (JKEUPM)
UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG,
SELANGOR, MALAYSIA

BORANG B1: PENERANGAN DAN PERSETUJUAN RESPONDEN

Sila baca maklumat berikut dengan teliti. Sekiranya anda mempunyai sebarang pertanyaan, sila kemukakan kepada penyelidik.

1.TAJUK KAJIAN

Kajian mengenai hubungan antara kandungan flourida di dalam air minuman dengan fluorida di dalam air kencing di kalangan kanak-kanak sekolah di Serdang, Selangor

2. PENGENALAN

Di Malaysia, kerajaan telah meluluskan pemfluoridaan air pada tahun 1972 dalam usaha untuk mengurangkan kaviti gigi. Kajian ini adalah untuk menentukan fluorida dalam air dan fluorida kencing kanak-kanak sekolah minum. Kajian ini akan dijalankan dalam usaha untuk meningkatkan pemahaman yang lebih baik, pengetahuan dan kesedaran fluorida dalam air minuman dan potensi kesan kesihatan punca oleh pendedahan mengenai fluorida

3. APAKAH YANG PERLU ANDA LAKUKAN?

Sebagai responden/peserta, anda diperlukan untuk menandatangani borang persetujuan yang menunjukkan anda berminat dan bersedia untuk bekerjasama dengan kajian ini. Kemudian, responden diminta untuk melengkapkan borang soal selidik, memberi sampel air minuman di rumah dan memberikan sampel air kencing kepada penyelidik selama tiga hari berturut-turut

4. SIAPA YANG TIDAK BOLEH MENYERTAI KAJIAN INI?

Responden/peserta yang mempunyai penyakit buah pinggang atau sebarang penyakit kronik

5. APAKAH FAEDAH MENYERTAI KAJIAN INI?

a) KEPADA ANDA SEBAGAI PESERTA?

Responden/peserta akan dapat mengetahui tahap fluorida dalam air kencing dan juga memperoleh pengetahuan mengenai tahap fluorida standard dalam air minuman.

b) KEPADA PENYELIDIK?

Pengkaji berharap dapatan kajian ini akan menyediakan data berasaskan kaitan antara flourida dalam air minuman dengan fluorida kencing kanak-kanak sekolah.

6. ADAKAH IA BERISIKO?

Tiada risiko yang mungkin dikenali untuk menyertai kajian ini.

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7. ADAKAH MAKLUMAT DAN IDENTITI SAYA KEKAL RAHSIA?
Semua maklumat dan identiti yang disediakan oleh responden/peserta akan kekal sulit

8. SIAPA YANG SAYA PERLU HUBUNGI SEKIRANYA SAYA MEMPUNYAI SOALAN TAMBAHAN SEMASA MENGIKUTI PENYELIDIKAN INI?
Jika anda mempunyai sebarang pertanyaan anda boleh menghubungi penyelidik yang bertanggungjawab untuk kajian atau penyelia kajian ini

Nurul Shafina Binti Mohamed Sharif
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shaha@upm.edu.my

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9. PERSETUJUAN

Saya..... No Kad Pengenalan. .....
beralamat.....
.....dengan ini bersetuju untuk mengambil bahagian secara sukarela dalam penyelidikan yang tersebut di atas *(kajian klinikal/percubaan ubat-ubatan/rakaman video/kumpulan sasaran/temuduga/ soal selidik).

Saya telah diberi penjelasan secara menyeluruh mengenai penyelidikan ini dari segi metodologi, risiko dan komplikasi (seperti tertulis pada Helaian Penerangan Responden). Saya memahami bahawa saya berhak menarik diri dari penyelidikan ini pada bila-bila masa tanpa memberi sebarang alasan.Saya juga memahami bahawa sebarang maklumat yang berkaitan identiti saya akan dirahsiakan.

Saya* berminat / tidak berminat untuk mengetahui keputusan kajian yang melibatkan saya.

I setuju/tidak bersetuju untuk imei/gambar/rakaman video/ rakaman suara digunakan dalam apa jua bentuk penerbitan atau pembentangan. (sekiranya berkaitan).

*potong yang tidak berkenaan

Tandatangan .....
(*Responden*)

Tandatangan .....
(*Saksi*)

Tarikh :.....

Nama :.....

No. K/P: .....

Saya mengesahkan bahawa saya telah menerangkan kepada responden ini sifat dan tujuan penyelidikan yang tersebut di atas.

Tarikh .....

Tandatangan .....
(*Penyelidik*)

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JAWATANKUASA ETIKA UNIVERSITI UNTUK
PENYELIDIKAN MELIBATKAN MANUSIA (JKEUPM)
UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG,
SELANGOR, MALAYSIA

BORANG B2: PENERANGAN DAN PERSETUJUAN IBUBAPA/PENJAGA

Sila baca maklumat berikut dengan teliti. Sekiranya anda mempunyai sebarang pertanyaan, sila kemukakan kepada penyelidik.

1.TAJUK KAJIAN

Kajian mengenai hubungan antara kandungan flourida di dalam air minuman dengan fluorida di dalam air kencing di kalangan kanak-kanak sekolah di Serdang, Selangor

2. PENGENALAN

Di Malaysia, kerajaan telah meluluskan pemfluoridaan air pada tahun 1972 dalam usaha untuk mengurangkan kaviti gigi. Kajian ini adalah untuk menentukan fluorida dalam air dan fluorida kencing kanak-kanak sekolah minum. Kajian ini akan dijalankan dalam usaha untuk meningkatkan pemahaman yang lebih baik, pengetahuan dan kesedaran fluorida dalam air minuman dan potensi kesan kesihatan punca oleh pendedahan mengenai fluorida

3. APAKAH YANG PERLU ANDA LAKUKAN?

Sebagai ibu bapa / penjaga kepada responden/peserta, anda dikehendaki untuk menandatangani borang persetujuan yang menunjukkan bahawa anda membenarkan anak/jagaan anda untuk bekerjasama dengan kajian ini.

4. SIAPA YANG TIDAK BOLEH MENYERTAI KAJIAN INI?

Responden/Peserta yang mempunyai penyakit buah pinggang atau sebarang penyakit kronik

5. APAKAH FAEDAH MENYERTAI KAJIAN INI?

a) KEPADA ANAK/JAGAAN SAYA SEBAGAI PESERTA?

Responden/Peserta akan dapat mengetahui tahap fluorida dalam air kencing dan juga memperoleh pengetahuan mengenai tahap fluorida standard dalam air minuman.

b) KEPADA PENYELIDIK?

Pengkaji berharap dapatan kajian ini akan menyediakan data berasaskan kaitan antara flourida dalam air minuman dengan fluorida kencing kanak-kanak sekolah.

6. ADAKAH IA BERISIKO?

Tiada risiko yang dikenali untuk menyertai kajian ini.

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7. ADAKAH MAKLUMAT DAN IDENTITI ANAK/JAGAAN SAYA KEKAL RAHSIA?
Semua maklumat dan identiti yang disediakan oleh responden/peserta akan kekal sulit

8. SIAPA YANG SAYA PERLU HUBUNGI SEKIRANYA SAYA MEMPUNYAI SOALAN TAMBAHAN SEMASA MENGIKUTI PENYELIDIKAN INI?
Jika anda mempunyai sebarang pertanyaan anda boleh menghubungi penyelidik yang bertanggungjawab untuk kajian atau penyelia kajian ini

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9. PERSETUJUAN

Saya..... No Kad Pengenalan. ..... beralamat..... .....dengan ini secara sukarela bersetuju membenarkan *anak / jagaan saya ..... menyertai **penyelidikan tersebut di atas *(klinikal/percubaan ubat-ubatan/rakaman video/kumpulan sasaran/temuduga/ soal selidik).**

Saya telah diberi penjelasan secara menyeluruh mengenai penyelidikan ini dari segi metodologi, risiko dan komplikasi (seperti yang tercatat dalam Helaian Penerangan). Saya memahami bahawa *anak / jagaan saya berhak menarik diri dari penyelidikan ini pada bila-bila masa tanpa memberi sebarang alasan.Saya juga memahami bahawa sebarang maklumat yang berkaitan identiti *anak / jagaan saya akan dirahsiakan.

Saya* berminat / tidak berminat untuk mengetahui keputusan kajian yang **melibatkan** *anak / jagaan saya.

I setuju/tidak bersetuju untuk imej/gambar/rakaman video/ rakaman suara berkaitan dengan anak/ jagaan saya digunakan dalam apa jua bentuk penerbitan atau pembentangan. (sekiranya berkaitan).

*potong yang tidak berkenaan

Tandatangan .....
(*Ibubapa/ Penjaga*)

Tandatangan .....
(*Saksi*)

Tarikh :.....

Nama :.....

No. K/P: .....

Saya mengesahkan bahawa saya telah menerangkan kepada ibubapa/penjaga responden mengenai sifat dan tujuan penyelidikan tersebut di atas.

Tarikh .....

Tandatangan .....
(*Penyelidik*)

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APPENDIX C

Approval Letters

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