



UNIVERSITI PUTRA MALAYSIA

***DETERMINATION OF FLUORIDE IN DRINKING WATER AND URINE
AMONG SECONDARY SCHOOL CHILDREN IN SMK AMINUDDIN
BAKI, KUALA LUMPUR***

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ABSTRACT

DETERMINATION OF FLUORIDE IN DRINKING WATER AND URINE AMONG SECONDARY SCHOOL CHILDREN IN SMK AMINUDDIN BAKI, KUALA LUMPUR

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Introduction: Fluorine is the lightest member of the halogen group and is one of the most reactive of all chemical elements. In drinking water, fluoride can either be naturally present due to the specific geological environment from which the water is obtained, or artificially added for the prevention of dental caries. Fluoride is added into finished drinking water as a measure to control and eradicate dental caries. On the other hand, fluoride is known to have significant adverse effect if the levels are higher than the maximum allowable limit. The most common symptom of excessive fluoride effect is dental fluorosis. With exposure to high levels of fluoride, skeletal fluorosis may result. **Objectives:** To determine fluoride levels in drinking water and urine among 14 years old school children in SMK Aminuddin Baki, Kuala Lumpur. **Methodology:** This study has been conducted among students at SMK Aminuddin Baki, Kuala Lumpur. A total of 40 respondents were chosen based on the inclusive and exclusive criteria. Drinking water samples were taken from each of the respondent's house, while urine samples were obtained from the respondents. The samples were analyzed using a direct reading spectrophotometer (HACH brand DR 1900) and a set questionnaire was used to obtain socio demographic information. **Results and Discussion:** The mean fluoride level in drinking water was 0.3543 (\pm SD 0.09798) mg/L. For urinary fluoride level, the mean value was 1.5643 (\pm SD 0.23878) mg/L. It was found that fluoride level in drinking water and urine has not exceeded the standard. There was no significant difference in urinary fluoride levels between male and female respondents ($p = 0.312$) and no significant differences between fluoride in drinking water and urinary fluoride ($p = 0.325$). It can be conclude that water is not the main contributor to the urinary fluoride ($p = 0.316$). **Conclusion:** All respondents were exposed to lower levels of fluoride in drinking water and excreted normal level of urinary fluoride.

Keywords: Fluoride, Dental caries, Adverse effects, Drinking water, Urine, Dental fluorosis, Skeletal fluorosis.

ABSTRAK

PENENTUAN FLUORIDA DI MINUM AIR DAN AIR KENCING DI KALANGAN KANAK-KANAK SEKOLAH MENENGAH DI SMK AMINUDDIN BAKI, KUALA LUMPUR

AHMAD SOLIHIN BIN ZULKARNAIN

Pendahuluan: Fluorin adalah elemen yang paling ringan daripada kumpulan halogen dan adalah salah satu elemen yang paling reaktif daripada semua unsur-unsur kimia. Dalam air minuman, fluorida hadir sama ada secara semula jadi disebabkan oleh persekitaran geologi tertentu dari mana air itu diperolehi, atau ditambah untuk mencegah karies gigi. Fluorida ditambah ke dalam air minuman sebagai langkah untuk mengawal dan membasmi karies gigi. Sebaliknya, fluorida diketahui mempunyai kesan sampingan yang ketara jika terdedah kepada tahap melebihi daripada had maksimum yang dibenarkan. Gejala yang paling biasa dikesan akibat berebihan fluorida adalah fluorosis gigi. Dengan pendedahan kepada tahap fluorida yang tinggi, fluorosis rangka mungkin berlaku. **Objektif:** Untuk menentukan tahap fluorida dalam air minuman dan air kencing antara kanak-kanak berumur 14 tahun di SMK Aminuddin Baki, Kuala Lumpur. **Kaedah:** Kajian ini telah dijalankan dalam kalangan pelajar di Sekolah Menengah Kebangsaan Aminuddin Baki, Kuala Lumpur. Seramai 40 responden telah dipilih berdasarkan kriteria yang ditetapkan. Sampel air minuman telah diambil daripada setiap rumah responden, dan sampel air kencing telah diambil daripada setiap responden. Sampel telah dianalisis dengan menggunakan HACH Spectrophotometer DR 1900 dan borang soal selidik telah dijawab oleh setiap responden untuk mendapatkan maklumat sosiodemografi. **Keputusan dan Perbincangan:** Tahap purata fluorida dalam air minuman adalah 0.3543 (\pm SD 0.09798) mg /L. Untuk tahap fluorida dalam air kencing, nilai purata adalah 1.5643 (\pm SD 0.23878) mg / L. Hasil dapatan mendapati bahawa tahap fluorida dalam air minuman dan air kencing tidak melebihi paras piawaian. Tidak ada perbezaan yang signifikan untuk tahap fluoride dalam air kencing antara responden lelaki dan perempuan ($p = 0.312$) dan tiada perbezaan yang signifikan antara fluorida dalam air minuman dan air kencing ($p = 0.325$). Oleh itu, boleh di ambil kira bahawa fluoride dalam air minuman adalah bukan penyumbang utama kepada fluoride air kencing ($p = 0.316$). **Kesimpulan:** Kesemua responden telah terdedah kepada tahap kadar fluorida yang rendah dalam air minuman dan mengeluarkan tahap normal untuk fluorida dalam air kencing.

Kata kunci: Fluorida, Karies gigi, Kesan kesihatan, Air minuman, Air kencing, Fluorosis gigi., Fluorosis tulang

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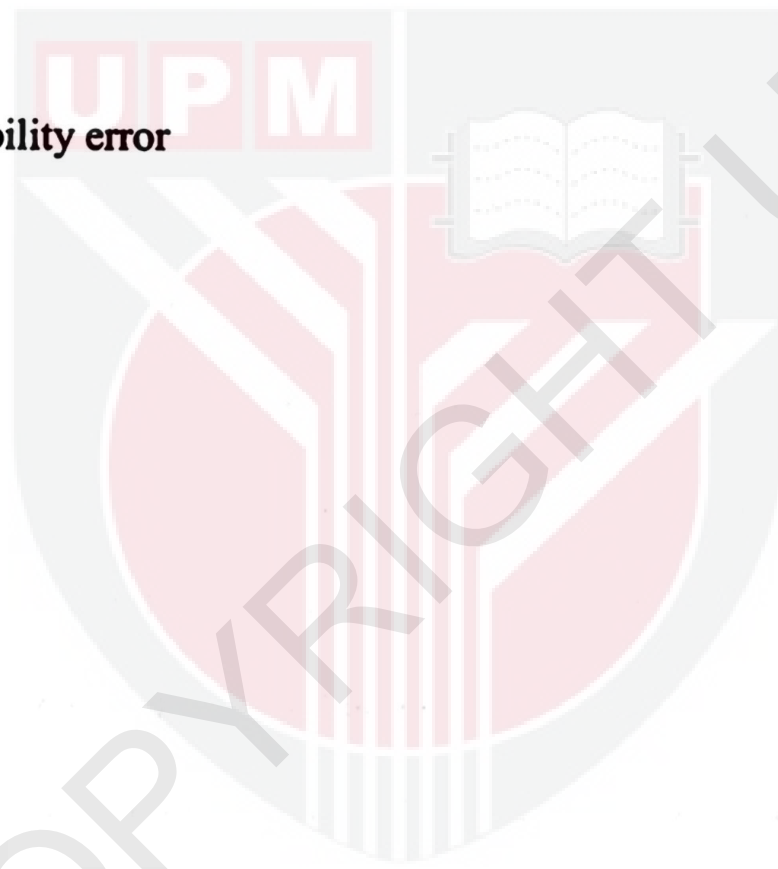
LIST OF ABBREVIATIONS

% **Percentage**

N **Sample Size**

P **Prevalence**

e **Probability error**



CHAPTER 1

INTRODUCTION

1.1 Background

Fluoride is an ionic compound derived from fluorine, which is the single most reactive element; it is naturally found in many rocks. Fluorine is the lightest member of the halogen group and is one of the most reactive of all chemical elements. About 95 percent of the fluoride added into public water supplies is produced from phosphorite rock (CDC, 2014). Phosphorite is mainly used for manufacturing phosphate fertilizer. Fluorine is also a significant industrial pollutant, which is emitted from industrial processes such as aluminium smelting, coal-fired power generation, glass and ceramics manufacturing, and fertilizer production (Weinstein and Davison, 2004).

Fluoride is naturally found in most all water sources, rivers, lakes, wells and even the oceans at some concentration. For the past 70 years, fluoride has been added to public water supplies to bring fluoride levels up to the amount necessary to help prevent tooth decay. Fluoride is known to have a significant adverse effect on public health and well-being. Fluoride has beneficial effect on teeth at low concentration in drinking water, but excessive exposure to fluoride from other source can give rise to a number of adverse effects (Fawell et al., 2006).

The effects of fluoride on health are multiple. The most common symptom of excessive fluoride effect is dental fluorosis. It is a condition involving staining or blackening, weakening and eventual loss of teeth. With high exposure to fluoride, skeletal fluorosis can result. In addition to skeletal and dental fluorosis, excessive fluoride exposure can also cause many other hazards, such as structural and functional damages to the nervous system (Wu et al., 2006), decreases in fertility (Izquierdo-Vega et al., 2008), decreasing children's intellectual ability (Ding et al., 2011), gastrointestinal problems and urinary tract malfunction (Jha et al., 2011). Additionally, studies in China revealed that the levels of mental work capacity and the Intelligence Quotient of children who were born and raised in an area with endemic fluorosis were found to be lower than normal (Ortiz-Perez et al., 2003).

1.2 Problem Statement

In drinking water, fluoride can either be naturally present due to the specific geological environment from which the water is obtained, or artificially added for the prevention of dental caries. Fluoride is found as supplements in water supply which have been recommended in several countries for the consumption by the populations. In general, fluoride enters in the human body through drinking water (Ayoob and Gupta, 2006). A few manufacturers provide lozenges or chewing tablets, to provide the teeth with a topical exposure to fluoride before ingestion. Commonly, public receives processed water with artificial fluoridation and the levels are between 0.4 - 0.6 mg/L (Ministry of Health, Malaysia, 2010). Another study by the Ministry of Health Malaysia in the year 2002 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 Kuala Lumpur ranged from 0.05 – 0.78 mg/l (Shaharuddin et al., 2010), which the range level of fluoride in drinking water are slightly higher than the recommended level.

Fluoride is used as a mean to control dental caries. It is important to know the amount of fluoride to be used and the types of treatment for each exposure. Fluoride has the potential to become toxic which can be either chronic or acute. 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).

1.3 Study Justification

This research was conducted to determine the level of fluoride in drinking water and urine. The results will then be compared to the standard established by Engineering Services Division, Ministry of Health Malaysia. We carried out this review to determine the fluoride level in drinking water and in urine among secondary school children in SMK Aminuddin Baki, Kuala Lumpur.

Since there are no current research driven concerning urinary fluoride level among school youngsters, subsequently making this sensible and accommodating to coordinate new research on fluoride level in drinking water and the relationship with urinary fluoride among school children in SMK Aminuddin Baki, Kuala Lumpur. By determining the level of fluoride in drinking water and urine, we can determine the potential health effects of fluoride exposure in drinking water, and suggestion and recommendations can be given if there were adverse effect observed in the study population. In addition, the study was done with a specific end goal to upgrade better understanding and consciousness of fluoride in drinking water and the potential wellbeing impact cause by fluoride introduction.

1.4 Conceptual Framework

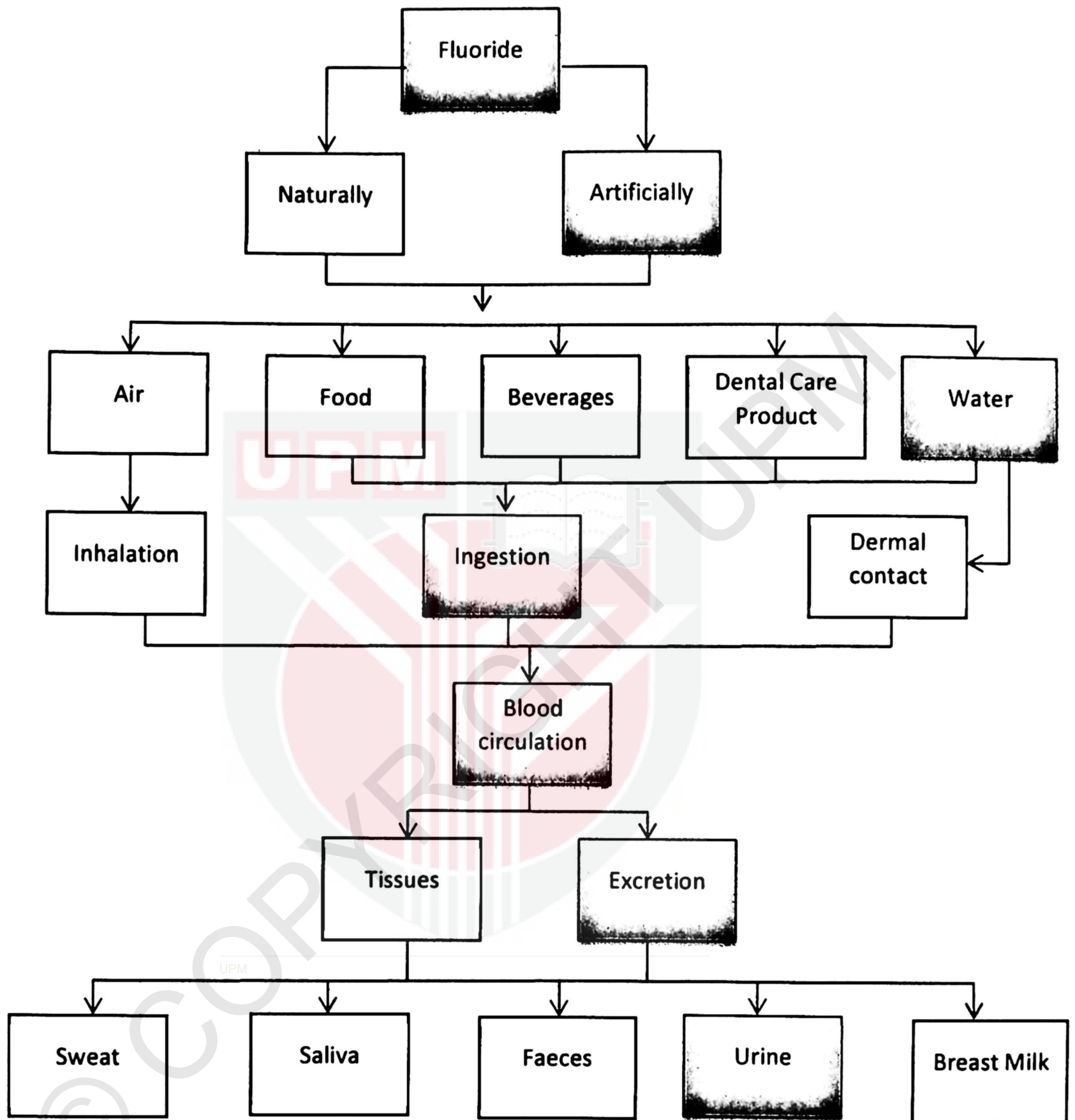
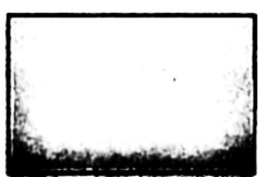


Figure 1.4: Conceptual Framework (Watanabe et al., 1994)



- **Subject of interest**

Independent variable:

- **Fluoride in drinking water**

Dependent variable:

- **Urinary fluoride**

1.5 Definition

1.5.1 Conceptual Definition

1.5.1.1 Fluoride

Fluorine is the 13th most abundant naturally occurring element in the Earth's crust and is the lightest member of the halogens. It is the most electronegative and reactive of all the elements and as a result, elemental fluorine does not occur in nature but is found as fluoride mineral complexes (Muralidhara et al., 2016).

1.5.1.2 Secondary School Children

Groups of children, age 13 - 17 years old.

1.5.1.2 Urinary fluoride

Urine is the excreted waste produced by the kidney and flows out through urethra. Urine is mainly a watery solution of salt and substances called urea and uric acid as well as containing others waste from body including fluoride ion.

1.5.1.4 Fluoridated Water Supply

The water that have been treated and fluoridated before being supplied to the residential area those pay for the services in this country.

1.5.2 Operational Definition

1.5.2.1 Fluoride

Fluorine is ubiquitous in the nature and is consequently an inevitable part of the biosphere and human life. The adequate intake (AI) of fluoride ion from all sources is set at 0.05 mg/day/kg body weight, this intake was recommended for all ages above 6 months, because it confers a high level of protection against dental caries (National Academy of Sciences, 1997).

1.5.2.2 Secondary School Children

Secondary school children aged 14 years old. The secondary school children were taken from the SMK Aminuddin Baki, Kuala Lumpur.

1.5.2.3 Urinary Fluoride Level

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

1.5.2.4 Fluoridated Water Supply

Maximum limit fluoride concentration in drinking water adapted by Ministry of Health, Malaysia ranged from 0.4-0.6 mg/L. The drinking water sample was collected using 250ml HDPE bottles and water sample was analysed using a spectrophotometer HACH Brand model DR1900 in order to determine the fluoride concentration in the sample.

1.6 Objective

1.6.1 General Objective

- a) To determine fluoride levels in drinking water and urine among 14 years old school children in SMK Aminuddin Baki, Kuala Lumpur.

1.6.2 Specific Objective

- a) To determine fluoride levels in drinking water among the study population.
- b) To determine fluoride levels in urine among the study population
- c) To determine whether there is a significant difference in urinary fluoride levels between genders among the study population.
- d) To determine whether there is a relationship between fluoride level in drinking water and urinary fluoride among the study population.
- e) To determine whether fluoride level in drinking water is the main contributor of urinary fluoride.

1.6.3 Hypothesis

- a) There is significant difference in urinary fluoride levels between genders among the study population.
- b) There is relationship between fluoride level in drinking water and urinary fluoride among the study population.
- c) Fluoride level in drinking water is the main contributor to the urinary fluoride.

CHAPTER 2

LITERATURE REVIEW

2.1 Definition of Fluoride

Fluoride is a compound containing fluorine and another element or radical. Fluoride is a naturally occurring compound that can help prevent dental decay (American Dental Association, 2005). Fluorine combines readily with nearly all the other elements, except the noble gases, to form fluorides. Sodium fluoride (CAS No. 7681-49-4) appears as an odourless white powder or colourless crystals, with a water solubility of 4% at 15°C and a pH (saturated solution) of 7.4 (Budvari, 1989). Fluorides comprise 0.06–0.08 % of the Earth's crust, but their average abundance is low (300 mg kg⁻¹) (Fordyce et al. 2007).

Fluorides are ubiquitous in the environment and the amount of fluoride occurring naturally is depending on the individual geological environment (Harrison, 2005). In arrangement, fluorine has a tendency to ionize to the anion fluoride (F⁻). Since fluoride has the same charge and is a comparative size as hydroxide (OH⁻), it has a tendency to supplant hydroxide on mineral structures (Hem, 1985).

2.2 Sources of Fluorides

2.2.1 Natural fluoride

Fluoride is a characteristic mineral found all through the worlds outside layer and broadly appropriated in nature. A few sustenance's and water supplies contain fluoride. Fluoride is frequently added to drinking water to decrease tooth decay. The fluoride admission in the overall public gets essentially from drinking water and dietary sources. The ideal fluoride level in drinking water should be in the range 0.7-1.2 mg/l. Fluoride intake at 0.5–1.5 mg/day will benefit teeth and bone development (Varol et al., 2010).

2.2.2 Artificial fluoride

Fluoride was added as artificial source to help prevent tooth decay. The origins of the national program to add fluoride to the public water supply are discussed in several scientific reports (Bryson, 2004). Level of fluoride that additional in drinking water might be different in other countries. Before the handled water is sent into holding tanks, fluoride as sodium fluoride (NaF) or hydrofluoric corrosive (HF) is added into the water (Shaharuddin et al., 2010).

2.2.3 Occurrence in air

Fluoride usually occur in air is directly from industrial effluent, and volcanic activity. It is widely spread in our atmospheric dust particles. It is possible that in areas where fluoride intake via routes other than drinking-water (e.g., air, food) is elevated, dental fluorosis will develop at level of concentrations in drinking-water below than 1.5 mg/litre (Cao et al., 1992). The distribution and deposition of airborne fluoride depend on various factors, such as level of emission (Yanchenko and Baranov, 2010). They also depend on meteorological conditions such as temperature, wind direction, wind speed, turbulence, and precipitation (Gasic et al., 2010).

2.2.4 Food

Several food products usually contain fluoride during the processing work. Vegetables and organic products regularly have low levels of fluoride (e.g. 0.1–0.4 mg kg⁻¹) and therefore ordinarily contribute little to presentation. In other cases, more elevated amounts of fluoride have been found in grain and rice (e.g. around 2 mg kg⁻¹) and taro, yams and cassava been found to contain generally high fluoride levels (Murray, 1986). In addition, it has been shown that vegetables and fruits have low levels of fluoride with ranges of 0.1 – 0.4 mg/kg (Fawell et al., 2006)

2.2.5 Beverages

Beverages include fruit juices, coffee, soft drink, wine and others. Fluoride is well established to be additives for processing beverages. Kids usually like to drink fruit juices and soft drink. Estimated mean intakes from the analysed beverages were 0.36 mg/day for 2–3-year-old children and 0.60 mg/day for 7–10-year-olds (Heilman et al., 1999). Conventional estimates are that about 75% of dietary fluoride comes from water and water-based beverages (U.S. Department of Agriculture, 2005).

2.2.6 Dental Care Product

Fluoride is use to prevent tooth decay. But excessive exposure to fluoride will affect health. Dental care product such as toothpaste and mouth wash was well known to be used by people usually contains fluoride. Dental-care products are also a special consideration for children, because many of them tend to use more toothpaste than needed, their swallowing control is not as well developed as that of adults, and many children under the care of a dentist experience fluoride treatments (NRC, 2006).

2.3 Route of Entry

Three main route of entry in our body includes gastrointestinal tract (by ingestion), lungs (by inhalation) and skin (by dermal contact). Due to the exposure of fluoride, we need to consider the fluoride physical properties such as its compound whether in gases, water or solid. In any case, fluoride retention through direct contact is entirely unprecedented instead of the other two routes. This exposure pathway is unlikely to contribute to the fluoride body burden (Tylenda, 2011).

Almost all water-soluble fluoride will be absorbed by the digestive system rather than the insoluble one (American Dietetic Association, 1994). In humans and animals, ingested fluoride occurs as hydrogen fluoride (HF) in the acidic environment of the stomach and is effectively absorbed from the gastrointestinal tract, although there is no proved absorption from the oral cavity. In humans, the predominant route of absorption of fluoride is via the gastrointestinal tract (Ponikvar, 2008).

2.4 Systemic and Topical Used of Fluoride

There are two ways of fluoride to reach our body which are topical and systematic. Both of them have different function and used. Systemic fluorides are those that are swallowed. Examples include fluoridated water and dietary fluoride supplements. Topical fluorides are applied directly to the tooth enamel. Some examples include fluoride toothpastes and mouth rinses, as well as fluoride treatments in the dental office (American Dental Association, 2007). The maximum reduction in dental caries can be achieved when fluoride is available in both topically and systemically.

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 and Levy, 2011). There is 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 (Wong et al.,

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).

2.6 Retention of Fluoride in Body

Fluoride is usually excreted out via urine which is called as urinary fluoride. But, not all of the fluoride amount that enters the body will stay. Relative to the amount of fluoride ingested, high concentrations of cations that form insoluble complexes with fluoride (e.g. calcium, magnesium and aluminium) can markedly decrease gastrointestinal fluoride absorption (IPCS, 2002). Once absorbed into the blood, fluoride readily distributes throughout the body, with approximately 99 per cent of the body burden of fluoride retained in calcium rich areas such as bone and teeth (dentine and enamel) where it is incorporated into the crystal lattice (WHO, 2006)

Fluorides are found naturally in the environment, we cannot avoid being exposed to them. Approximately 99% of the fluoride present in the body is associated with hard tissues (American Dental Association, 2011). Fluoride crosses the placenta and is found in breast' milk at low levels basically equivalent to those in blood (IPCS, 2002). In addition, Most of the fluoride ion that stays in your body is stored in your bones and teeth (ATSDR, 2003). If fluoride accumulates in bone with a high level over long period time, health effects which is skeletal fluorosis could happen. It has been found that the consumption of higher fluoride in drinking water has damaged skeletal and dental systems (Denbesten and Li, 2011).

2.7 Excretion through Urine

Fluoride is excreted primarily via urine (IPCS, 2002). Urinary fluoride clearance increases with urine pH due to a decrease in the concentration of hydrogen fluoride (HF). The urinary fluoride excretion is the most important metabolic pathway for fluoride elimination from the body (Meenakshi and Maheshwari, 2006).

Urinary fluoride discharge is fundamentally reliant on the fluoride fixations on the other hand rather on the fixation crests in the plasma. On account of dependable accumulations (e.g. 6–10 hours), the pinnacles tend to level out and the varieties in the aggregated pee are littler. The principle favourable position of utilizing urinary fluoride discharge to gauge add up to fluoride presentation is that pee accumulations are non-obtrusive, no blood should be taken, and are along these lines more reasonable than different strategies for checking group fluoridation plans (WHO, 2014).

2.8 Health Effects

2.8.1 Dental fluorosis

In long term exposure of fluoride, there will be some side health effects occur to the related exposed person. Dental fluorosis is the most common health effects of excessive exposure of fluoride for chronic exposures. Dental fluorosis is an adjustment in the presence of the tooth's lacquer. These progressions can differ from scarcely discernible white spots in gentle structures to recoloring and setting in the more extreme structures. Dental fluorosis just happens when more youthful kids devour an excessive amount of fluoride, from any source, over long stretches when teeth are creating under the gums (CDC, 2015).

Fluoride interfaces with mineralized tissues and when present in abundance irritates dental veneer improvement. As seriousness of fluorosis builds, changes in the porosity of subsurface lacquer expand further into the tissue bringing about hypo mineralized regions secured by a characterized zone of much mineralized tissue that may influence the whole lacquer surface (Aoba and Fejerskov, 2002).

2.8.2 Skeletal fluorosis

Skeletal fluorosis is a bone disease caused by accumulation of excessive amount of fluoride in the bones. In advanced skeletal fluorosis, it causes pain and damage to bones and joints. Skeletal fluorosis is known as arthritic bone disease. Skeletal fluorosis in India and China has been accounted for when the fluoride fixation in water surpasses 1 ppm, but was also found in groups with just 0.7 ppm. The Chinese government now considers any water supply containing more than 1 ppm fluoride a hazard for skeletal fluorosis (Gupta et al., 2007).

Fluoride interfered with bone mineralization and increased osteoid content, which was most evident in osteomalacia and the mixed bone disorder. Also, fluoride may connect with aluminium to intensify the osteomalacia injury (Ng et al., 2004). It is for the most part expressed that a measurement of 10–20 mg/day for no less than 10 years is important for the advancement of devastating skeletal fluorosis, however singular variety, variety in nourishing status, and the trouble of deciding water fluoride levels in such circumstances make it hard to decide the basic measurements (ATSDR, 2003).

2.8.3 Acute Effect

A number of overdosing incidents have occurred, mostly in small water supplies that practice artificial fluoridation. Historically, most cases of serious acute fluoride toxicity have followed accidental ingestion of insecticides or rodenticides (Richard and Mark, 2016). Symptom onset usually occurs within minutes of exposure, but may be delayed. Manifestations of fluoride toxicity are predominantly gastrointestinal (GI), but neurologic and cardiovascular effects also occur (Jha et al., 2013). To produce signs of acute fluoride intoxication, it is estimated that minimum oral doses of at least 1 mg fluoride per kg of body weight are required (WHO, 1996). Indeed, such doses could be expected from water with a fluoride content of approximately 30 mg l⁻¹. The PTD is defined as the minimum dose that could cause serious or life-threatening systemic signs and symptoms and that should trigger immediate therapeutic intervention and hospitalization. This does not mean that doses lower than 5.0 mg/kg should be regarded as innocuous. (Whitford, 2011)

Chapter 3

METHODOLOGY

3.1 Study Design

A cross-sectional study was chosen in order to determine the fluoride exposure among 14 year-old secondary school children in the study population through examination of the concentration of urinary fluoride and determination of fluoride in drinking water.

3.2 Study Area

Study location was conducted at SMK Aminuddin Baki, Kuala Lumpur.



Figure 3.2 Map of SMK Aminuddin Baki, Kuala Lumpur

3.3 Sampling Techniques

3.3.1 Study Population

The study population was consisting of students with current age 14 years-old from SMK Aminuddin Baki, Kuala Lumpur.

Adolescents who age in 13 to 19 years olds are 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. They will probably participate in dangerous practices, (for example, substance use, perilous driving and risky sexual practices), prompting high rates of brutality and harm among youngsters (AIHW, 2008).

3.3.2 Sampling Frame

The sampling frame of this study was name lists of 14 year old student from SMK Aminuddin Baki, Kuala Lumpur that was involve in this study.

3.3.3 Sampling Technique

The sampling method to be used in this study is purposive sampling. The sampling unit for this study is secondary school children of SMK Aminuddin Baki, Kuala Lumpur aged 14 years old. The samples of study are selected based on those inclusive and exclusive criteria stated below:

Inclusive Criteria:

- 1. 14 years old students, study at SMK Aminuddin Baki, Kuala Lumpur.**
- 2. Using tap water as source of drinking water**
- 3. Free from kidney disorder/disease**

Exclusive Criteria:

- 1. The schoolchildren that participate during the study are relocated to a new place or drop out from the school**
- 2. Do not use any water filtration at home.**

Selected school children who participated in this research were asked for their parents' consent. Respondents were free to withdraw from the study if they feel uncomfortable.

3.3.4 Sample Size

The sample size is calculated using formula establish by Kirkwood and Sterne (2003):

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

N- Sample size

p- Prevalence of high fluoride in drinking water

e- Sampling error (0.05)

Sample size determination calculation:

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

$$= 0.2161/0.0025$$

$$= 86 \text{ respondents}$$

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 Data Collection

Letter of approval from Ministry of Education Malaysia were forwarded to the headmaster of the school before data collection. Prior 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 obtaining the consent from their parent, a questionnaire was distributed to the respondents in order to obtain information about their personal details, socio-demographic, and to ensure the respondents comply with the inclusive criteria.

3.4.1 Questionnaire

A set of questionnaires adapted from Amirul (2010), was used to gather information from the selected respondent. The questionnaire was important to ensure the respondents comply with the inclusive criteria.

3.4.2 Drinking water

Water samples were collected from the tap water that was used for drinking purposes. Water samples were collected in three replicate of 250 ml HDPE bottles for one day only.

Urine

Generally, urine is the best indicator of fluoride exposure in drinking water (Watanabe et al., 1994). Thus, one bottle of 50 ml urine container bottles was collected from each respondent.



3.5 Equipment and Reagent

Below are the list of equipment and reagents (Table 3.5) with their function that were used during data collection.

Table 3.5: The list of equipment and reagent

Equipment and reagent	Function
Questionnaire	To gather information and requirement from the respondent.
Sample Bottle	50 ml sample of container for urine collection and 250 ml sample bottle for drinking water.
HACH Spectrophotometer DR1900	To determine the level of fluoride in urine and drinking water

3.6 Analyse of fluoride

Fluoride in both urine and drinking water were analysed by using USEPA SPADNS Method 8029. The SPADNS reagent solution method was used. The procedures were:

- 1) Prepare blank: Pipet was used to add 10.0 mL of deionized water to the sample cell.
- 2) Prepare sample: Pipet was used to add 10.0 mL of sample to the sample cell.
- 3) Pipet was used to add 2.0 ml of SPADNS Reagent solution into each sale sample solution.
- 4) Swirl to mix.
- 5) The instrument timer was started for one minute.
- 6) When the timer expired, the blank sample cell was cleaned.
- 7) The blank was inserted into the cell holder.
- 8) Push ZERO. The displayed showed 0.00 mg/L F.
- 9) The prepared sample cell was cleaned.
- 10) The sample prepare was inserted into the cell holder.
- 11) Push READ. The result was shown in mg/L F.

3.7 Data Analysis

Data collected were analyzed using the IBM SPSS 21 (Statistical Package for Social Science). Descriptive statistic including mean, median, and standard deviation were used to analyze the distribution of all variable included in this study. Statistical analysis employed was Spearman's Rho Correlation Coefficient which was used to determine the correlation between urinary fluoride and fluoride level in drinking water. T-test was used in order to determine whether there was significant difference in urinary fluoride between genders.

3.8 Quality Controls and Quality Assurances

3.8.1 USEPA SPADNS Method 8029

Before starting the samples analysis:

- **The sample and deionized water must be at the similar temperature. Temperature modification can be made before or after the reagent addition.**
- **The sample cells need to be clean and dry before the test.**
- **The volume of the reagent must be precise. Use a pipet if possible.**
- **Minor variations between reagents become measurable above 1.5 mg/L. The result above 1.5 mg/L was usable for most purposes, for the best precision the sample will diluted to a lower concentration.**
- **Do not pour-through cell or sipper module (for application instruments) with this test.**

3.8.2 Sample Collection

Before sample collection, detail briefing was conducted to all chosen respondent who participate in this study. Below are the quality control precautions taken in order to achieve high quality of sample.

- Make sure the urine were first morning urine and drinking water container were filled completely tightly closed.
- During collection of the sample from the respondent, question on the sources of drinking water was asked to make sure that the drinking water sample was taken from their pipe water that not using any filtration system at home.

3.9 Ethical Consideration

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

- The respondents were given some explanation about the whole of the study activities involved.
- 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.
- Approval from Ministry of Education were given to each school representative to obtain the consent of the resident involved in this study.
- Approval letter were given to the respondents to get their consent to be participant in this study.

3.10 Limitations

This study is a cross-sectional study, which only measure exposure status and outcome at a specific of time frame. This study method was used due to time and cost limitation. In addition, the total numbers of respondent in this research are less than the needed sample size which were only 40 respondents from 86, which will effect the result findings. This is due to the lack of cooperation from the school involved due to limited time frame. Furthermore, the purposive sampling method that had been used in this research had a potential bias in the researcher criteria and the resulting sample selection might not represent the whole population.

Lastly, recall bias and confounders can affect the final result. Recall bias might alter the accuracy of result when respondent had to recall the past event. Confounding factors such as other sources of fluoride should be noted in this study.

CHAPTER 4

RESULTS AND DATA ANALYSIS

4.1 Socio Demographic Data

This study was carried out in secondary school, SMK Aminuddin Baki, Kuala Lumpur. There are 40 (100%) 14 years old respondents that had been involved in this research. The name list of the students involved was obtained from the headmasters.

Total 40 students were chosen based on the inclusive and exclusive criteria that had been listed. From the 40 respondent, 19 (47.5%) were male students while the rest 21 (52.5%) were female (Table 4.1 & Figure 4.1).

Table 4.1 Distribution of respondents based on gender and age

N= 40			
Variables		Frequency	Percentage (%)
Gender	Male	19	47.5
	Female	21	52.5
Age	14	40	100

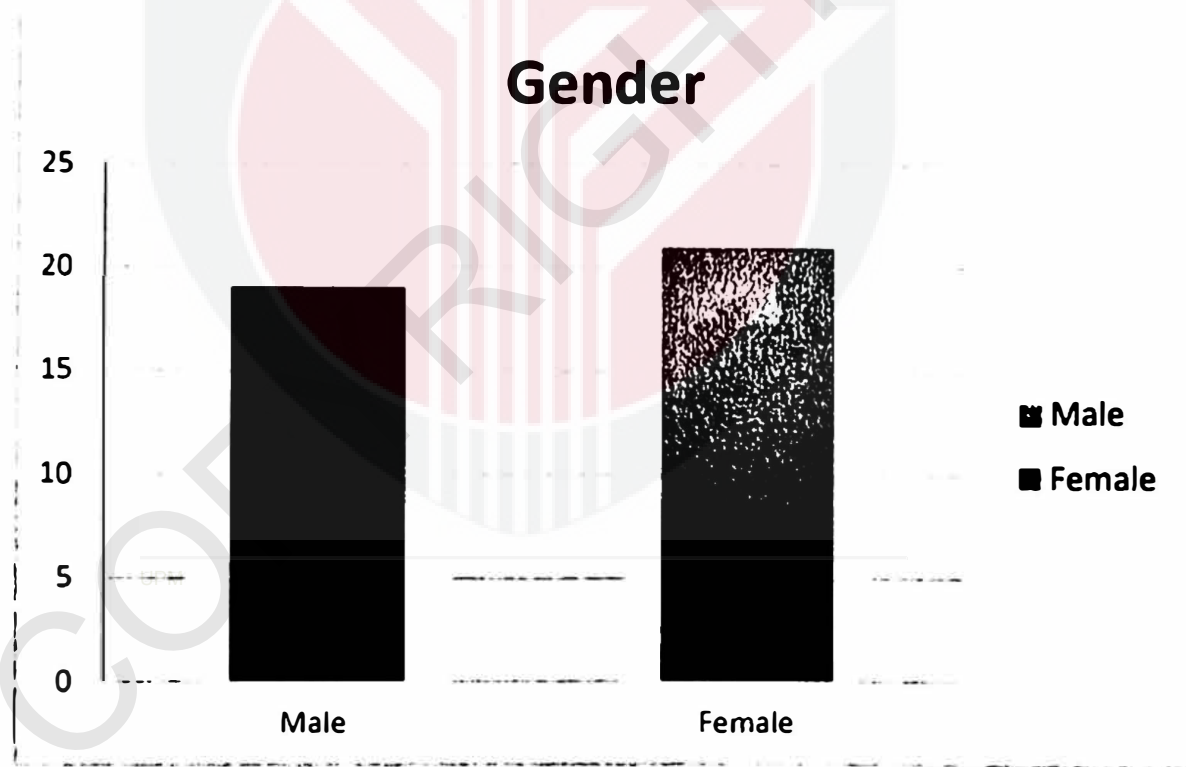


Figure 4.1 Distribution of respondents based on gender

Fluoride in drinking water and urinary fluoride level

There were 2 parameters measured in the study, which were fluoride levels in drinking water and fluoride levels in urine. Based on Table 4.2, for fluoride level in drinking water, the range of was 0.16 - 0.55 mg/L with mean reading of 0.3543 (\pm SD 0.09798) mg/l while for urinary fluoride level, the range was 1.07 - 1.90 mg/L and the mean value was 1.5643 (\pm SD 0.23878) mg/L.

Table 4.2: The fluoride level in drinking water and urine

Items	N	Range mg/L	Mean (mg/L)	\pm SD
Fluoride level in drinking water	40	0.16 - 0.55	0.3543	0.09798
Urinary fluoride	40	1.07 - 1.90	1.5643	0.23878

4.3 Significant difference in urinary fluoride level between genders

Based on Table 4.3, the minimum and maximum value of urinary fluoride levels among male respondents was 1.07 and 1.74 mg/L with mean of 1.5047 (\pm SD 0.24398) mg/L. While from female respondents, the minimum value of urinary fluoride levels was 1.09 and the maximum value was 1.93 mg/L with value of 1.6181 (\pm SD 0.22627) mg/L.

The Independent Sample T Test was used to determine the significant difference in urinary fluoride. When significant value for Lavene's Test for Equality of Variance, $p > 0.05$, equality of variance is assumed, since the significant value for the Levene's Test for equality of Variance is $p = 0.312$, then Independent T Test will be used. When the significant value of T Test is less than the predetermined significance level which was set to 0.05, $p < 0.05$, then the null hypothesis was rejected. The value of Sig. (2-tailed) with equal variances assumed was $p = 0.868$ which represents $p > 0.05$, hence it failed to reject the null hypothesis and means that there was no significant difference in urinary fluoride levels between male and female respondents.

Table 4.3 Urinary fluoride level based on gender

Variables	Mean		Mean difference (95% CI)	t- statistic (df)	p- value
	(SD)				
	Male	Female			
Urinary fluoride	1.5047 (±0.24398)	1.6181 (±0.22627)	- 0.11336 (-0.26387,0.03716)	- 1.525 (38)	0.579

*significant at $p \leq 0.05$

4.4 Relationship between urinary fluoride level and fluoride in drinking water

Spearman's rho test was used to determine the correlation between fluoride level in drinking water and urinary fluoride levels because both of the variables not normally distributed.

From Table 4.4, when the p-value was less than the predetermined significance level which was set to 0.05, $p \leq 0.05$, then the null hypothesis was rejected. The significant value was at $p = 0.325$ ($p > 0.05$) and the null hypothesis was failed to be rejected. It can further concluded as there was no significant relationship between urinary fluoride level and fluoride level in drinking water.

Table 4.4: Spearman's rho analysis to determine relationship between urinary fluoride level and fluoride levels in drinking water

Parameter	N	Coefficient correlation, r	p
Urinary Fluoride	40	0.160	0.325
Flouride level in drinking water	40		

*significant at $p \leq 0.05$

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 predetermined significance level which was set to 0.05, $p < 0.05$, then the null hypothesis was rejected. The significant value was at $p = 0.316$ ($p > 0.05$) and the null hypothesis was failed to be rejected. It can be conclude that water is not the main contributor to the urinary fluoride.

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

Parameter	b (95% CI)	t-statistics	p-value	r^2
Urinary Fluoride	1.486 (-0.393, 1.186)	1.017	0.316	0.026

*significant at $p < 0.05$

CHAPTER 5

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Discussions

5.1.1 Socio-Demography Background

This study involved 40 secondary schoolchildren from SMK Aminuddin Baki, Kuala Lumpur. All the respondents were selected based on the inclusive criteria which were 14 years old secondary schoolchildren, free from kidney and nephrological related disorders/diseases, living at fixed housing area for the past 6 years, and did not using any water filtration from their water supply at home.

The selection of respondents were done as to control the representativeness of fluoride levels in drinking water and urine but the confounding factors including exposure of fluoride from other sources were not controlled. Optimally fluoridated drinking water can be classified as a diet that influences the prevention of tooth-related diseases (WHO, 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). Hence, the best indicator of fluoride exposure is the urinary fluoride levels in the population under investigation and accepted (Watanabe et al., 1994).

5.1.2 Fluoride in drinking water and urinary fluoride level

From the result and data analysis, the two parameters that were being measured in this study were drinking water fluoride and urinary fluoride. The drinking water fluoride ranged from 0.16 - 0.55 mg/L with mean reading of 0.3543 (\pm SD 0.09798) mg/L. The recommended level of fluoride level in water is a range of 0.4-0.6 mg/L, by The National Drinking Water Quality Standard (NDWQS). By comparing the result obtained with the recommended level range, this shows that the mean level of artificially fluoride did not exceed the national standard. From the total 40 drinking water sample, 25 (62.5%) of them were below the permissible range of fluoride levels in drinking water which is less than 0.4 mg/L, and the remaining 15 (37.5%) respondents were in the permissible range of fluoride levels in drinking water. The fluoride contents decreased up to 93% ratio depending on the mixing with the different sources of water (Davraz et al., 2008). In another words, it can be said that fluoridation of water supply in Kuala Lumpur area are in under control below the maximum standard for fluoridation levels.

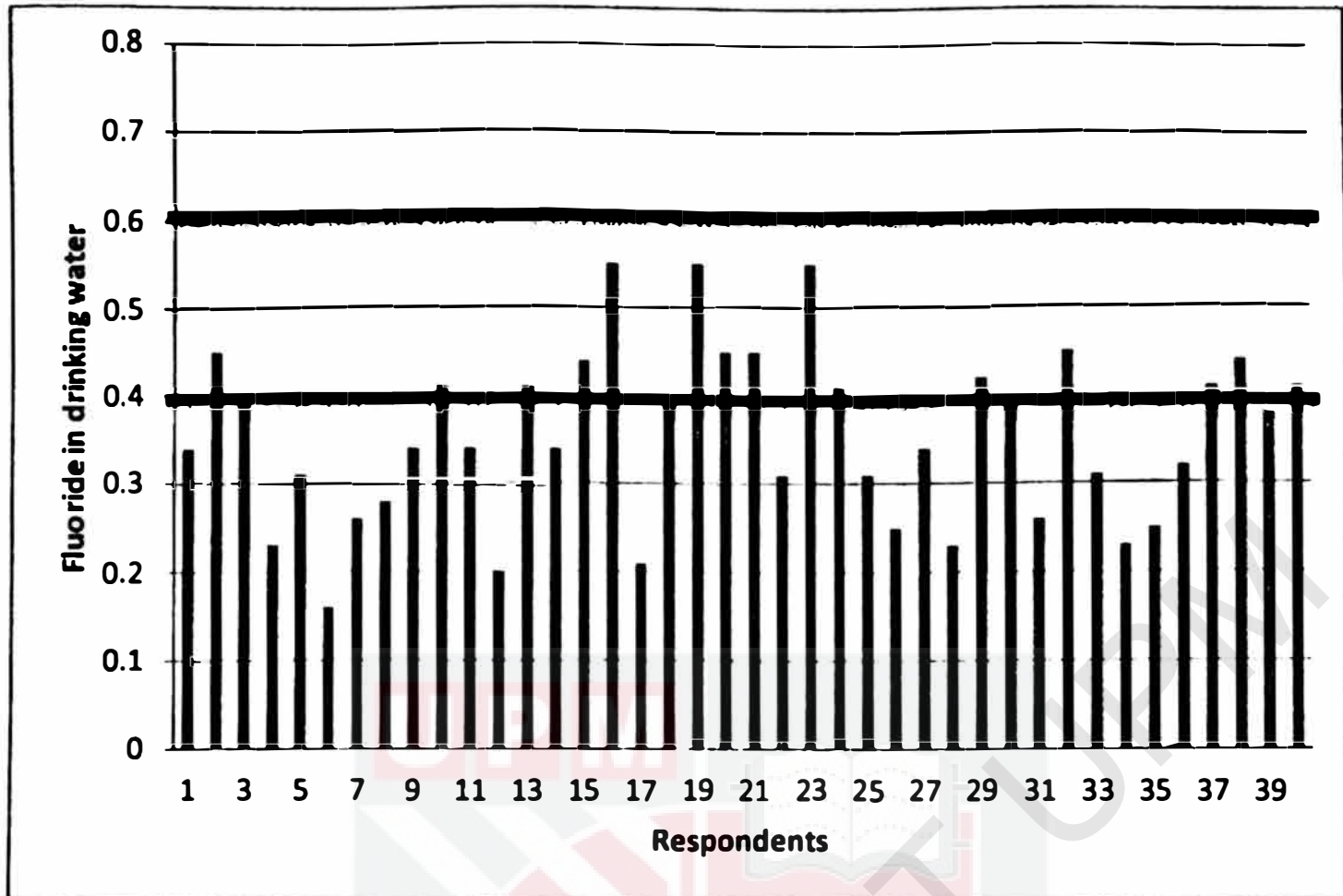


Figure 5.1.2.1 Comparison fluoride level in drinking water with National Standard

For the second parameter which was urinary fluoride, it was analysed based on standard method of USEPA SPADNS 8029 method. Urinary fluoride water ranged from 1.07 - 1.90 mg/L and the mean value was 1.5643 (\pm SD 0.23878) mg/L. Recommended urinary fluoride levels are between 0.2 - 3.2 mg/L, by NIOSH Method 8303. With comparison the range of urinary fluoride that been obtained and recommended level, urinary fluoride level can be simplified as still in between the range. Results also showed all 40 (100%) respondents' urinary fluoride levels were in normal range which is between 0.2 to 3.2 mg/L.

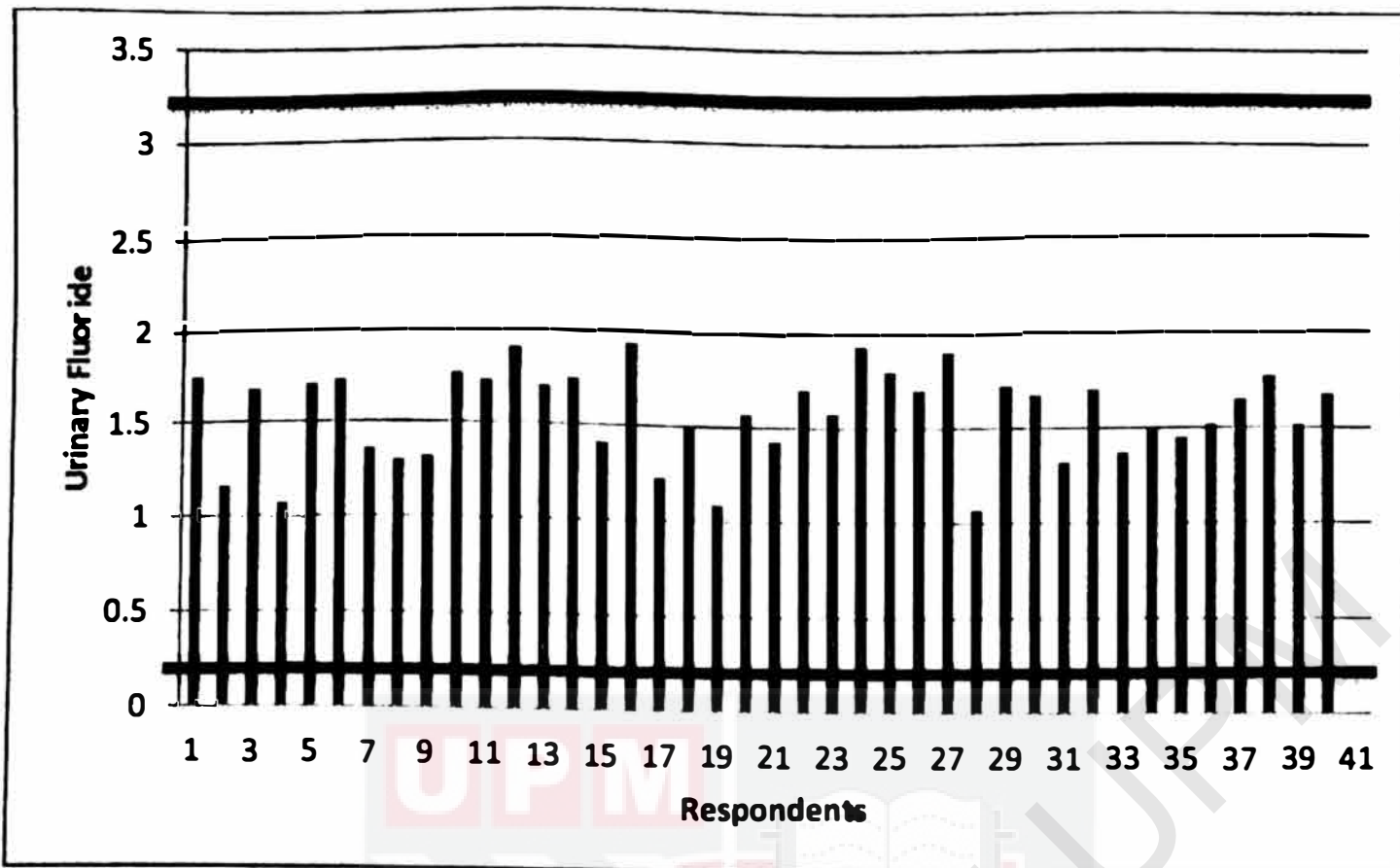


Figure 5.1.2.2 Comparison Urinary Fluoride Level with Standard in NIOSH Method 8303

5.1.3 Urinary fluoride levels based on gender

From the data analysis performed, the data reveal there was no significant difference of urinary fluoride levels between male and female. 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 were almost similar. This is because the entire respondents are living within the same district which use the same water resource. A study from Hector et al. (2009), show that there was no difference of urinary fluoride between genders. This is due to the diet habit of both genders is quite similar. There is also a study by Martinez et al. (2003), show that children residing in Veracruz and Mexico cities represent similar dietary patterns.

5.1.4 Relationship between urinary fluoride level and fluoride in drinking water

Based on the result and data analysed, using Spearman's rho correlation test drinking water, there's no significant relationships with urinary fluoride levels. Thus, it failed to reject null hypothesis. There is no significant due to the exposure of fluoride was assumed originated from factors other than drinking water. This study location was located in cities which mean maybe all of the respondent get the water from the same source. The amount of urinary fluoride may come from other sources such as dentifrices. A study from Hector et al. (2009) in Venezuela stated that fluoridated dentifrice was the main source of fluoride. The other factor is due to the accumulation of fluoride in the body. The fluoride was absorbed then being distributed into the body before it was being excreted through urine. This process could take place over a long period of time (Chen et al., 2013). Several factors can affect fluoride metabolism and consequently fluoride retention, including acid-base disturbance, altitude, physical activity, diet, and genetic predisposition (Zohoori and Duckworth, 2017).

5.1.5 Fluoride level in drinking water is the main contributor to the urinary fluoride

Based on the result and data analysed, using Regression test drinking water, there's no significant relationships with urinary fluoride levels. Thus, it failed to reject null hypothesis. This was due to the other sources of fluoride that affect the urinary fluoride level. Doses of fluoride are difficult to estimate for large populations, however, because most people are potentially exposed to fluoride through a variety of sources, such as food, beverages, medicine, and dental products (ATSDR, 2003). Drinking water was not the main contributor to the urinary fluoride due to other sources of fluoride such as food, beverages and others. A study by Zohoori and Duckworth (2017) stated that the main sources of F intake are diet and the unintentional swallowing of fluoridated dental products. It can be conclude that drinking water is not the main contributor to urinary fluoride.

5.2 Conclusions

This study was conducted at SMK Aminuddin Baki, Kuala Lumpur to determine fluoride in drinking water and urine among school children. Fluoride has been added to public water supplies to help prevent tooth decay. Fluoride may cause an adverse effect if being exposed to excessive amount such as dental fluorosis and skeletal fluorosis.

Result obtained from this study showed that, more than half of the respondent received the permissible range of fluoride levels in drinking water while the other received under the permissible range of fluoride levels. Even though the fluoride levels in drinking water were within the recommended range, it should be monitored regularly to control and maintain the optimal range. All of the respondents 40 (100%) were exposed to lower levels of fluoride in drinking water and excreted normal level of urinary fluoride.

Other findings showed that, there were no significant differences between fluoride in drinking water and genders. Thus, the second hypothesis was rejected. Male and female were exposed to the similar low levels of fluoride in drinking water. This is due to the diet habit of both genders is quite similar and entire respondent is live at the same district.

Next, findings showed that there were no significant relationship between fluoride in drinking water and urinary fluoride. Thus, third hypothesis was rejected. The main focus in this study is exposure of fluoride from drinking water. Unfortunately, other sources of fluoride that may contribute to urinary fluoride level were not being measured in this study.

Lastly, finding shows that fluoride level in drinking water was not the main contributor to the urinary fluoride. The fourth hypothesis was rejected. Main contributor of urinary fluoride may come from food and beverages. Therefore, further study and research on other source of fluoride exposure, consequently fluoride retention and total fluoride excretion are needed.

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

5.3 Recommendations

There are several recommended ways to protect the health of the children in SMK Aminuddin Baki, Kuala Lumpur. Health authority should play their role by considering children health not merely the economic benefit from water supplies usage but also for future generations. Firstly, the health authorities should take action systemically in order to make the fluoride levels in drinking water are optimal in accordance to the WHO guidelines for drinking water.

Secondly, an advance study needs to be performed in order to support this study. The number of respondent should be increased to improve the power of accuracy in the study. Then, number of school involved also should be added in that particular area. Furthermore, the food study including total dietary intake of fluoride should also be included as its can effects the results and the urine sample should be measured by the creatinine test to determine the health status of the kidneys that affects the urinary fluoride levels. Thus, the study represents a particular population to a particular area of study.

Finally, health education should be given regardless of their ages in order to increase the awareness of the community towards the effects of fluoride on health whether acute or chronic. Nowadays, community was still lacking the knowledge regarding the fluoride even though most of the element had been in human consumer product for a long time such as toothpaste, food, and beverages. Health care parties should be more active in distributing the knowledge in order to increase the awareness of pros and cons of fluoride towards human health.



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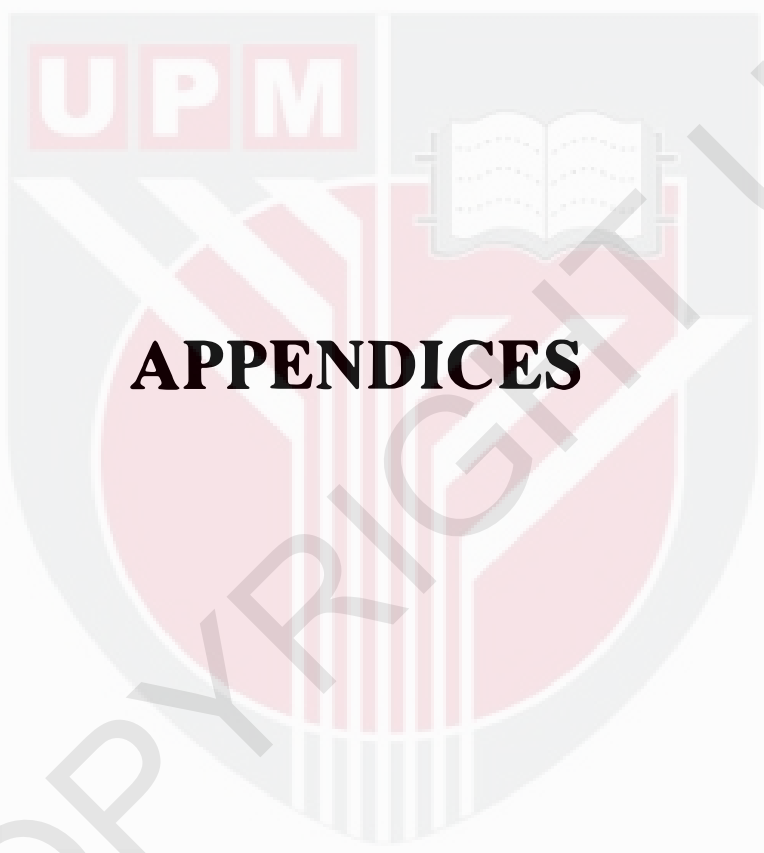
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APPENDICES



APPENDIX A:
FORM B1: RESPONDENT'S INFORMATION SHEET AND CONSENT

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UNIVERSITI PUTRA MALAYSIA

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

FORM B1: RESPONDENT'S INFORMATION SHEET AND CONSENT

Please read the following information carefully and do not hesitate to discuss any questions you may have with the researcher.

1. STUDY TITLE :

Determination of fluoride in drinking water and in urine among secondary school children in SMK Aminuddin Baki, Kuala Lumpur.

2. INTRODUCTION:

Fluoride is naturally found in most all water sources, rivers, lakes, wells and even the oceans at some concentration. The study is to determine fluoride in drinking water and urinary fluoride of school children. 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.

3. WHAT WILL YOU HAVE TO DO?

As a respondent, you are need to sign the consent form which indicate that you are interested and willing to cooperate with this study. Then, the respondent are ask to complete the questionnaire, provide drinking water sources at home and give the urine sample to the researcher for three consecutive days.

4. WHO SHOULD NOT PARTICIPATE IN THE STUDY?

Respondent who having kidney disease or any chronic disease.

5. WHAT WILL BE THE BENEFITS OF THE STUDY:

(a) TO YOU AS THE SUBJECT?

The respondent will determine their level of fluoride in the urine as well as knowledge about the standard level fluoride in drinking water.

(b) TO THE INVESTIGATOR?

The researcher hope that the finding of this study will provide evidence based data on the association of fluoride in drinking water with urinary fluoride level of school children.

6. WHAT ARE THE POSSIBLE RISKS?

There are no possible risks known for joining this study.

7. WILL THE INFORMATION THAT YOU PROVIDE AND YOUR IDENTITY REMAIN CONFIDENTIAL?

All the information and identity that are provided by the respondents will remain confidential.

8. WHO SHOULD YOU CONTACT IF YOU HAVE ADDITIONAL QUESTIONS DURING THE COURSE OF THE RESEARCH?

If you have any inquiries you can contact the researcher responsible for the study or the project leader of the researcher.

Ahmad Solihin Bin Zulkamain (Researcher)
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Dr. Shahrudin Bin Mohd Sham
Supervisor,
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Faculty Of Medicine And Health Sciences
Universiti Putra Malaysia
Tel: 03-89472407 / faks: 03-89472395
shaha@upm.edu.my

Please initial here if you have read and understood the contents of this page _____

9. CONSENT

Identity Card No.

address.....

.....hereby voluntarily agree to take part in the research stated above *(clinical /drug trial/video recording/ focus group/interview-based/ questionnaire-based).

I have been informed about the nature of the research in terms of methodology, possible adverse

effects and complications (as written in the Respondent's Information Sheet). I understand that I have the right to withdraw from this research at any time without giving any reason whatsoever. I also understand that this study is confidential and all information provided with regard to my identity will remain private and confidential.

I* wish / do not wish to know the results related to my participation in the research

I agree/do not agree that the images/photos/video recordings/voice recordings related to me be used in any form of publication or presentation (if applicable)

* delete where necessary

Signature
(Respondent)

Signature
(Witness)

Date :.....

Name :.....

I/C No. :.....

I confirm that I have explained to the respondent the nature and purpose of the above-mentioned research.

Date


Signature
(Researcher)



APPENDIX B:
FORM B2: RESPONDENT'S INFORMATION SHEET AND GUARDIAN'S/PARENT'S CONSENT

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PENYELIDIKAN MELIBATKAN MANUSIA (JKEUPM)
UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG,
SELANGOR, MALAYSIA**

**FORM B2: RESPONDENT'S INFORMATION SHEET AND GUARDIAN'S/PARENT'S
CONSENT**

Please read the following information carefully. Do not hesitate to discuss any questions you may have with the researcher.

1. STUDY TITLE:

Determination of fluoride in drinking water and in urine among secondary school children in SMK Aminuddin Baki, Kuala Lumpur.

2. INTRODUCTION:

Fluoride is naturally found in most all water sources, rivers, lakes, wells and even the oceans at some concentration. The study is to determine fluoride in drinking water and urinary fluoride of school children. 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.

3. WHAT WILL YOU HAVE TO DO?

As a guardian's/parent's respondent, you are need to sign the consent form which indicate that you allow the children to cooperate with this study. Then, the guardian's/parent's need to monitor, consult and guide their children to give full cooperation in this study.

4. WHO SHOULD NOT PARTICIPATE IN THE STUDY?

Children who having kidney disease or any chronic disease.

5. WHAT WILL BE THE BENEFITS OF THE STUDY:

(a) TO YOU AS THE SUBJECT?

The respondent will determine their level of fluoride in the urine as well as knowledge about the standard level fluoride in drinking water.

(b) TO THE INVESTIGATOR?

The researcher hope that the finding of this study will provide evidence based data on the association of fluoride in drinking water with urinary fluoride level of school children.

6. WHAT ARE THE POSSIBLE RISKS?

There are no possible risks known for joining this study.

7. WILL THE INFORMATION THAT YOU PROVIDE AND YOUR IDENTITY REMAIN CONFIDENTIAL?

All the information and identity that are provided by the respondents will remain confidential.

8. WHO SHOULD YOU CONTACT IF YOU HAVE ADDITIONAL QUESTIONS DURING THE COURSE OF THE RESEARCH?

If you have any inquiries you can contact the researcher responsible for the study or supervisor of this research

Ahmad Solihin Bin Zulkamain (Researcher)
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Universiti Putra Malaysia
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shaha@upm.edu.my

Please initial here if you have read and understood the contents of this page_____

9. GUARDIAN'S/PARENT'S CONSENT

..... Identity Card No.
address.....

.....hereby voluntarily agree to allow my
*son / daughter / ward..... to take part in the
research stated above *(clinical/ questionnaire/drug trial/video recording/ focus
group/interview).

I have been informed about the nature of the research in terms of methodology, possible
adverse effects and complications (as written in the Respondent's Information Sheet). I
understand that my *son / daughter / ward has the right to withdraw from this research at any
time without giving any reason whatsoever. I also understand that this study is confidential
and all information provided with regard to the identity of my* son / daughter / ward will
remain private and confidential.

I* wish / do not wish to know the results related to my my *son's / daughter's / ward's
participation in the research

I agree/do not agree that the images/photos/video recordings/voice recordings related to my
son/daughter/ward be used in any form of publication or presentation. (if applicable).

* delete where necessary

Signature
(Parent/Guardian)

Signature
(Witness)

Date :.....

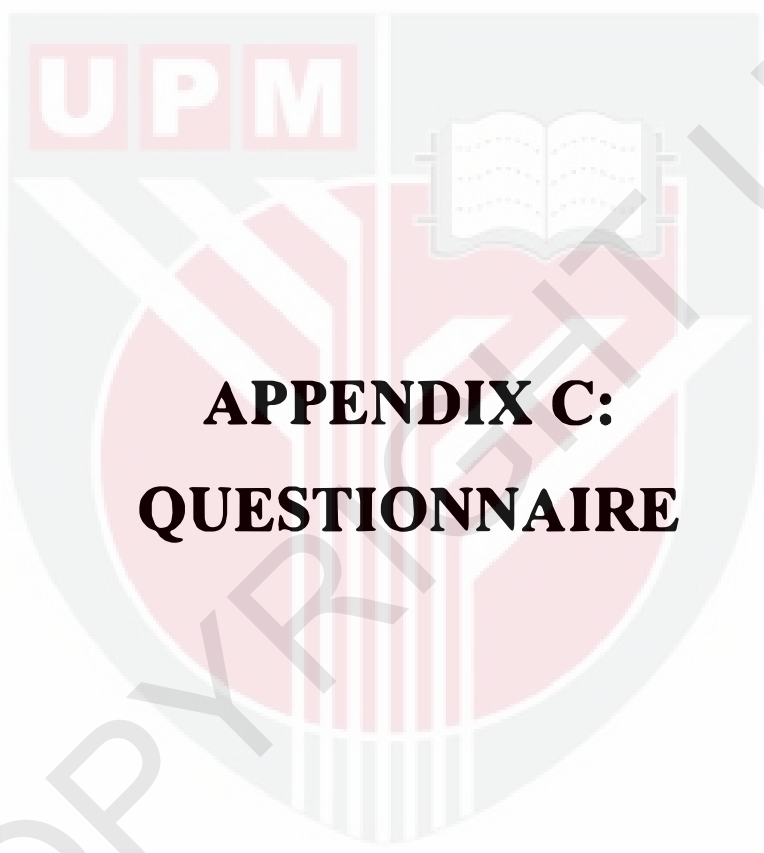
Name :.....

I/C No. :.....

I confirm that I have explained to the respondent's parent/guardian the nature and purpose
of the above-mentioned research.

Date

Signature
(Researcher)



**APPENDIX C:
QUESTIONNAIRE**

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SELANGOR, MALAYSIA

BACHELOR SCIENCE (ENVIRONMENTAL AND OCCUPATIONAL HEALTH)

FACULTY OF MEDICINE AND HEALTH SCIENCES

QUESTIONNAIRE

**DETERMINATION OF FLUORIDE IN DRINKING WATER AND IN URINE
AMONG SECONDARY SCHOOL CHILDREN IN SMK AMINUDIN BAKI,
SELANGOR**

NAME : AHMAD SOLIHIN BIN ZULKARNAIN

MATRIC NUMBER : 175035

SUPERVISOR : DR. SHAHARUDDIN BIN MOHD SHAM

QUESTIONNAIRE

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. No ID

:

2. Tarikh lahir

Hr bln thn

:

3. Umur

Tahun :

4. Jantina

: Lelaki Perempuan

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)

3. Penggunaan air dari dapur:

- Memasak
- Minum
- Kegunaan domestik
- Lain-lain, sila nyatakan

4. Adakah anda berpuas hati dengan kualiti air paip yang digunakan?

- Ya
- Tidak
- Tidak pasti

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

- Ya
- Tidak

Jika ya, sila nyatakan jenama yang digunakan:

Bahagian C: Maklumat kesihatan

6. Adakah anda mempunyai masalah buah pinggang?

- Ya
- Tidak

7. Adakah anda mengalami masalah kesihatan lain?

- Ya
- Tidak

Jika ya, sila nyatakan

TERIMA KASIH ATAS KERJASAMA ANDA

-TAMAT-



APPENDIX D:
PICTURES OF EQUIPMENT AND REAGENT

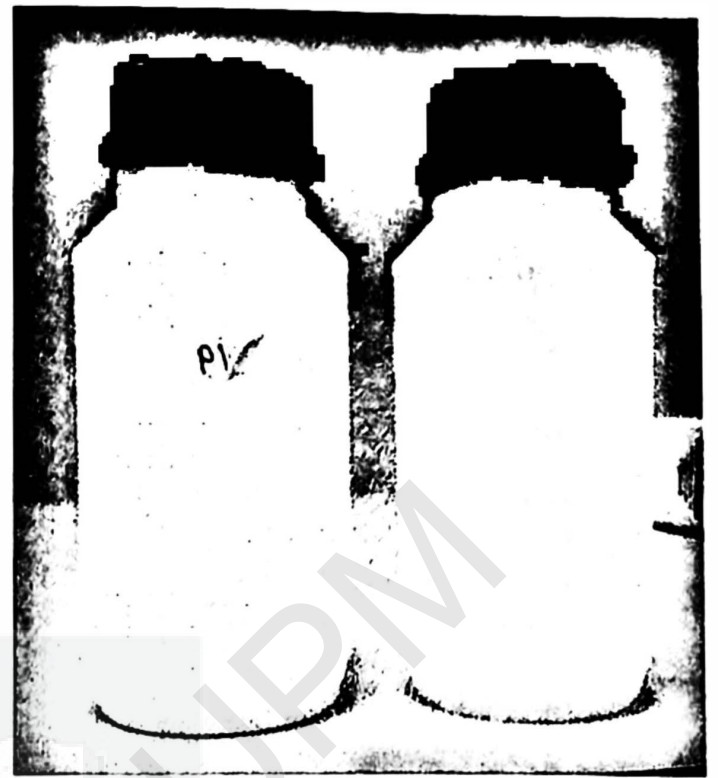


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Spectrophotometer DR1900 HACH



250 ml sample bottle for drinking water



50 ml sample container for urine



SPADNS Reagent solution



Briefing session at SMK Aminuddin Baki, Kuala Lumpur



Student of SMK Aminuddin Baki, Kuala Lumpur



APPENDIX E:
ETHICAL COMMITTEE CONSENT LETTER



UPM

