



UNIVERSITI PUTRA MALAYSIA

***URINARY FLUORIDE AND FLUORIDE EXPOSURE IN DRINKING
WATER AMONG SCHOOL CHILDREN AT KUDAT, SABAH***

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The logo of Universiti Putra Malaysia (UPM) is a shield-shaped emblem. It features a red and white color scheme. At the top left, the letters 'UPM' are written in white on a red rectangular background. In the center, there is a stylized white figure that resembles a bird or a person with arms raised, set against a red background. To the right of this figure is an open book with white pages. The shield is bordered by a grey outline.

**BY
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First and above all, I praise God, the almighty for providing me this opportunity and granting me the capability to proceed successfully.

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ABSTRAK

URINARY FLUORIDE AND FLUORIDE EXPOSURE IN DRINKING WATER AMONG SCHOOLCHILDREN AT KUDAT, SABAH

FEDOLFIE BIN RUSILEH

Introduction: The cross-sectional study was conducted in two primary school at Kudat, Sabah. **Objectives:** This study was conducted to determine the fluoride content in drinking water and urine samples among schoolchildren aged 11-12 years living in Kudat, Sabah and their correlation. **Methodology:** A total of 89 drinking water sources in the studied habitations were assessed for fluoride levels. Fluoride was estimated in urine of 89 schoolchildren randomly selected based on inclusive and exclusive criteria from two different primary school of these habitations. The fluoride concentration in drinking water and urine samples was determine using USEPA fluoride SPANS method. **Result:** The mean fluoride concentration in drinking water was 0.3578 (± 1.16452) mg/L with range of 0.17-0.76 mg/L respectively. The mean urinary fluoride concentration was 1.4107 (± 0.32781) mg/L with range of 0.70-2.37 mg/L. The National Standard for Drinking Water Quality (NSDWQ) stated a range of 0.4 – 0.6 ppm fluoride as the optimal range of fluoride level in drinking water. The number of Drinking water samples that contained fluoride levels higher than optimal range was 9 (10.1%) samples. While, 22 (24.7%) drinking water samples contained fluoride levels within the optimal range and 58 (65.1%) drinking water samples contained fluoride levels below the optimal range. Baselt (1980) reported that normal non-occupationally person has urinary fluoride level range from 0.2 to 3.2 mg/L. Result shows that all 89(100%) respondents had urinary fluoride levels within the normal range. There was no significant difference in urinary fluoride levels between male and female respondents ($p=0.892$). This study also found that there was no significant relationship between fluoride in drinking water and urinary fluoride ($p=0.177$) as additional fluoride exposure was assume to originate from other factor than drinking water such as food and fluoridated toothpaste. **Conclusion:** The results suggest that water supplies should be optimally fluoridated and further investigations on others factors of fluoride exposure, total fluoride excretion, and consequently fluoride retention are needed. Fluoride health effects either chronic or acute also should be regularly monitored

Keywords: fluoride, urinary fluoride, fluoride in drinking water, gender

ABSTRAK

FLORIDA DALAM AIR MINUM DAN URIN MANUSIA DI KALANGAN MURID SEKOLAH RENDAH DI KUDAT, SABAH.

FEDOLFIE BIN RUSILEH

Pengenalan: sebuah kajian keratan rentas ini telah dijalankan di dua buah sekolah rendah di sekitar Kudat, Sabah. **Objektif:** Kajian ini dijalankan adalah untuk mengenal pasti tahap kandungan florida di dalam air minuman dan air urin di kalangan murid berumur 11-12 tahun yang menetap di sekitar Kudat, Sabah. **Metodologi:** Sejumlah 89 sumber air minum di kawasan kajian telah dianalisa untuk mengetahui tahap kandungan florida. Kandungan florida di dalam urin 89 murid terdiri daripada dua sekolah yang telah dipilih secara rawak berdasarkan inclusive dan exclusive kriteria telah dianalisa. Kepekatan kandungan florida di dalam air dan urin sampel diketahui menggunakan kaedah SPADNS. **Keputusan:** Min kepekatan florida di dalam air minuman adalah 0.3578 (± 1.16452) mg/L dengan julat 0.17-0.76 mg/L. Min kepekatan florida di dalam urine adalah 1.4107 (± 0.32781) mg/L dengan julat 0.70-2.37 mg/L. The mean urinary fluoride concentration was 1.4107 (± 0.32781) mg/L dengan julat 0.70-2.37 mg/L. Standard Kebangsaan untuk Kualiti Air Minum atau The National Standard for Drinking Water Quality (NSDWQ) menyatakan julat kandungan optimum bagi florida dalam air minum ialah 0.4-0.6 mg/L. Jumlah sampel air minum yang mempunyai kandungan florida lebih tinggi dari julat kandungan optimum ialah 9 (10.1%) sampel. Manakala 22 (24.7%) sampel air minum mengandungi tahap kandungan florida yang dibenarkan dan 58 (65.1%) sampel air minum mempunyai kandungan florida yang lebih rendah berbanding julat optimal. Baselt (1980) telah melaporkan bahawa julat kandungan florida normal di dalam urin bagi orang yang bukan pekerja ialah berkadar dari 0.2 sehingga 3.2 mg/L. keputusan menunjukkan semua 89 (100%) responden mempunyai tahap kandungan florida yang normal. Didapati tiada perbezaan yang signifikan bagi tahap kandungan florida di dalam urin diantara lelaki dan perempuan ($p=0.892$). Kajian ini juga mendapati bahawa tiada hubungan signifikan bagi tahap kandungan florida didalam air minum dan tahap kandungan florida didalam urin ($p=1.77$) sebagaimana tambahan pendedahan florida dijangka berasal daripada factor lain selain daripada air minuman seperti makanan dan ubat gigi berflorida. **Kesimpulan:** Berdasarkan keputusan, dicadangkan supaya sumber air difloridakan secara optimum dan memerlukan siasatan selanjutnya keatas faktor lain pendedahan florida, jumlah perkumuhan florida, dan akibatnya pengekatan florida. Kesan florida keatas kesihatan samada kronik atau akut sepatutnya dipantau senantiasa.

Kata kunci: florida, air minuman, florida dalam urine, jantina.

CHAPTER II LITERATURE REVIEW

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LIST OF ACRONYMS AND ABBREVIATIONS

Mg/L	Milligrams per Litre
ppm	Part per million
WHO	World Health Organization
NSDWQ	National Standard for Drinking Water Quality for Malaysia
ISE	Ion-Selective Electrode
AI	Adequate intake
USEPA	United States Environmental Protection Agency
EDTA	Ethylenediaminetetraacetic Acid
SPSS	Statistical Package for Social Science
NGO	Non Government Association

CHAPTER 1

INTRODUCTION

1.1 Background

Fluoride is an essential trace element, widely distributed in the environment at a variety of concentrations. It is found in water, soil, food, dental products and drug. Considerable interest has recently been focused on fluoride pharmacokinetics due to its world-wide use for dental caries prevention, emphasized in view of the clinical use of fluoride as a treatment for osteoporosis. Drinking water is the main sources of fluoride and fluoride is sometimes added to public water supplies to help prevent dental problems (Indermitte et al., 2009).

Fluoride is the anion F^- , the reduced form of fluorine as an ion and when bonded to another element. Both organofluorine compounds and inorganic fluorine containing compounds are called fluorides. Fluoride has been recognized that may have both beneficial and harmful effects on human health depending on the total

intake. Small amount of fluoride have been proven to be beneficial in preventing dental carries. On other hand, excessive exposure to fluoride through consumption or ingestion has significant relationship with dental fluorosis (Levy et al., 2010).

Depending on dosage, moderate amounts of fluoride may lead to dental effect, but long term of ingestion of large amounts can lead to potentially severe skeletal problems. However, low-intake of fluoride can help to prevent dental carries. Dental carries can be prevented when only a small amount of fluoride is ingested, 1 mg/ml in ingested water generally conceded to have a beneficial effect on the rate of occurrence of it (Czanowski et al., 1996).

The control of drinking water quality which prevents exposure to high fluoride level is critical in preventing dental fluorosis. However, fluoride may not be the only cause of dental enamel defects. Enamel opacities similar to dental fluorosis are associated with other conditions, such as malnutrition with deficiency of vitamin D with low protein-energy diet. Ingestion of fluoride after six year of age will not cause dental fluorosis (WHO, 2012).

Generally the best indicator of fluoride exposure is urinary fluoride concentration in the population under investigation (Watanable et al., 1994). Fluoride level in urine and hair of children living in the vicinity of phosphate fertilizer plant were direct

proportionate to the fluoride level in drinking water (Czarlowski & Krechniak, 2002).

1.2 Problem Statement

Artificial fluoride in drinking water was stopped 22 years ago in Sabah because of the fear on the effect of fluoride in water could endanger the health of the community. The government of Sabah restarted its fluoridation program in 2013 and builds another 11 water treatment plant which included one in the district of Kudat. The fluoridation of drinking water in Kudat started in 2013 as the new water treatment plant is ready to operate (InsightSabah, 2011).

By reflecting to this situation, the fluoride level in drinking water and the correlation with the urinary levels among schoolchildren in primary schools in this area were not yet known. Moreover, the level of fluoride in drinking water need to be determine in order to compare level recommended by the health authorities. According to (WHO, 2002), the fluoride content in the urine will approximate to that of the water.

Appropriate recommendation should be taken if the findings revealed the occurrence of high fluoride levels and the potential health effects. Information on total fluoride exposure is important for public health planners and healthcare professionals when planning effective community-based fluoride therapy for the prevention of dental caries, while avoiding dental fluorosis (Maguire et al., 2007) especially when comes to the decision of fluoridating water supplies. High levels of fluoride in urine found in participants from higher concentrations area may be linked to a chronic exposure of fluoride from drinking water (Payan et al., 2005).

Fluoride levels of 1.0 mg/L in drinking water would not increase the severity of dental fluorosis. However, fluoride levels must be controlled and the standard of 1.0 mg/L is still adhered to until today. Fluoride has the potential to become toxic. As fluoride is used as a means to control and eradicate dental caries, it is important to know the amount of fluoride to be used and the types of treatment for each exposure. The toxic effect of fluoride can be chronic or acute. Acute toxicity will result in death when a person ingests doses of 2.5 g to 5.0 g which is equivalent to 2,500 to 5,000 litres of water containing 1.0 mg/L of fluoride. For dissolved fluoride such as hydrofluoric acid and sodium fluoride, the acute dosage is 2.0 to 10.0 g (Horowitz, 1986).

The primary adverse effects associated with chronic, excess fluoride intake are skeletal and dental or enamel, fluorosis. Other effects, including hypersensitivity reactions, renal insufficiency, immunological effects, and possible association with repetitive strain injury, birth defects and cancer have been observed and discussed (Ponikvar, 2008).

Dental caries remains one of the most common preventable public health problems throughout the world. It is the primary cause of oral pain and tooth loss, which lead to chewing difficulties, speech problems, general health disorders, psychological problems, and ultimately lowers quality of life. Although caries prevalence is in constant decrease in the western world, caries still remains a major public health problem for the vast majority of individuals living in developing countries and for the populations with low socioeconomic status in developed countries (Maguire et al., 2007).

1.3 Study Justification

This study was conducted in order to identify the source of water supply in the study area and determine the level of fluoride in the drinking water. The results will then be compared to the standard established by Ministry of Health Malaysia. Since there were no recent research conducted regarding to urinary fluoride level among schoolchildren 11-12 years old at Kudat, this making it reasonable and useful to conduct new research on fluoride level in drinking water and the relationship with urinary fluoride among primary schoolchildren in district of Kudat, Sabah.

Moreover, the other aspect to be concerned were the current level of fluoride exposure among school children aged 11-12 years old which will be determine from the urinary fluoride level. High level of fluoride in drinking water can cause various health effect (WHO, 1970).

This research will pertain to determine the potential health effect of fluoride exposure in drinking water and the recommendation that can be taken if there ware adverse effect to the study population. Also, the study was carried out in order to enhance better understanding and awareness of fluoride in drinking water and the potential health effect cause by exposure on fluoride. Last but not least, the finding may be useful to generate a baseline data for future research.

1.3.1 Definition Of Term

1.3.2 Conceptual Definition

1.4.1.1 Fluorides

Elemental fluorine was a member of the halogen family, is a pale yellow-green, irritating gas with a sharp odor and atomic mass of 18.998. Fluorine is chemically the most reactive of all the elements and does occur naturally in the free state. In combination it comprises 0.065% of the earth's crust, being the 13th element in abundance and inevitable part of the biosphere and human life. The term 'fluorine' was used to denote the element in any of its forms and 'fluoride' to denote free inorganic fluoride to which a fluoride ion-selective electrode (ISE) responds (Ponikvar, 2008).

1.4.1.2 Primary schoolchildren

Groups of children, age 11-12 years old.

1.4.1.3 Urinary fluoride

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. The major route of fluoride excretion was via the kidney and urine (Ponikvar, 2008).

1.4.1.4 Fluoridated water supply

The water that have been treated and fluoridated before being supply to the residential area that pay for the services in this country. Compounds that commonly used for water fluoridation are sodium or potassium fluoride or hexafluorosilicic acid (H_2SiF_6) and its sodium salt (Na_2SiF_6) (Ponikvar, 2008).

1.4.2 Operational Definition

1.4.2.1 Fluorides

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 and not associated with any adverse health effects.

1.4.2.2 Primary schoolchildren

Primary schoolchildren aged 11-12 years old. The primary schoolchildren were recruited from the following list of primary school at district of Kudat:

- SK Pekan II
- SK Tun Dato Haji Mustapa

1.4.2.3 Fluoride urine concentration

Urinary fluorides concentration in normal non-occupationally exposed workers have been reported to range from 0.2 to 3.2 mg/L depending on dietary intake (Baselt et al., 1980). Fluoride concentration in urine was determined using direct reading spectrophotometer HACH Brand model DR/2500 and urine samples was collected in 50ml polypropylene plastic bottles for 3 consecutive days and were analysed within 24 hours using the SPADNS method (HACH Company USA, 2012).

1.4.2.4 Fluoride concentration in water supply.

Referring to the National Standard For Drinking Water Quality 2000 by Ministry of Health Malaysia, the maximum limit fluoride concentration in drinking water that adapted by Malaysia were range from 0.4-0.6 mg/L. The drinking water sample was collected using 250ml polypropylene bottle and water sample were analysed using spectrophotometer HACH Brand model DR/2500 in order to determine the fluoride concentration in the sample.

1.5.1 OBJECTIVES

1.5.2 General objective

To determine fluoride levels in drinking water and urine among 11-12 years old schoolchildren in the district of Kudat, Sabah.

1.5.3 Specific Objective

1.5.3.1 To determine fluoride levels in drinking water used by the study population.

1.5.3.2 To determine the fluoride levels in urine among the study population.

1.5.3.3 To determine whether there is significant difference in urinary fluoride levels between genders.

1.5.3.4 To determine whether there is a relationship between urinary fluoride level and fluoride level in drinking water among the study population.

1.6 RESEARCH HYPOTHESIS

- 1.6.1 There is significant difference in urinary fluoride between genders.
- 1.6.2 There is significant relationship between urinary fluoride level and fluoride level in drinking water.

1.7 STUDY LIMITATION

There are few limitations regarding this study. Firstly, the results cannot be generalized nationally because this study focused on one area only. Secondly, other possible sources of fluoride, such as inhalation of ambient air, dental/care products, foods, drinks and beverages, medicine, and through skin contacts were not determine in this study. The effects of excessive exposure to fluoride such as dental fluorosis, skeletal fluorosis and other metabolic changes were not taken into account in this study, but only mentioned as potential health effects.

1.8 Conceptual Framework

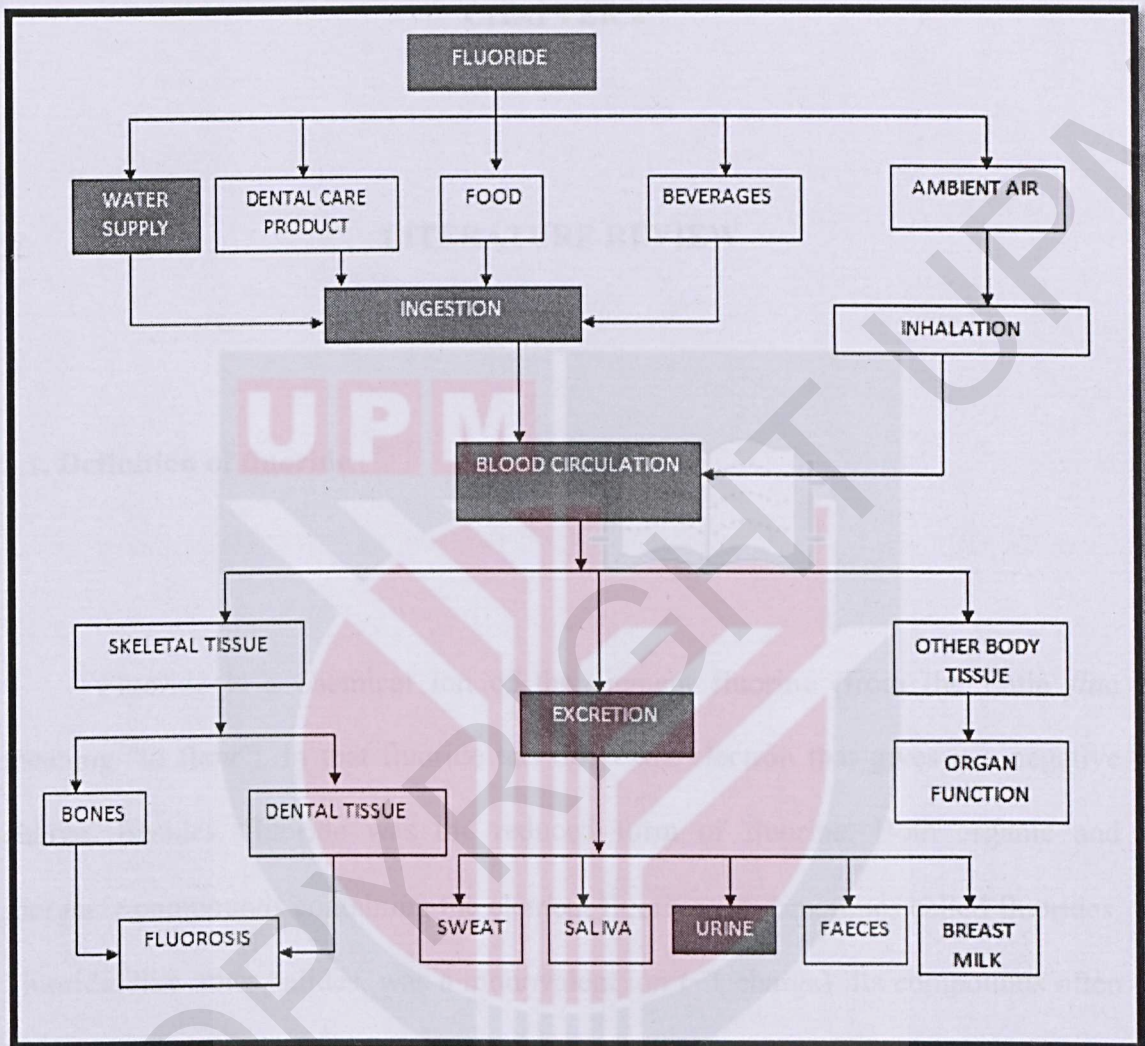


Figure 1.8 Conceptual Framework

CHAPTER 2

LITERATURE REVIEW

2.1. Definition of fluoride

Fluoride is a chemical ion of the element fluorine (from the Latin *fluo* meaning "to flow"), in that fluoride has one extra electron that gives it a negative charge. Besides, fluoride was the reduced form of fluorine. Both organic and inorganic compounds containing the element fluorine are sometimes called fluorides. Fluoride, like other halides, was a monovalent ion (-1 charge). Its compounds often have properties that are distinct relative to other halides. Structurally, and to some extent chemically, the fluoride ion resembles the hydroxide ion (Crosta, 2009).

2.2 Sources of fluorides

2.2.1 Natural resources

Fluorides are released into the environment naturally through the weathering and dissolution of minerals, in volcano emissions and in marine aerosols. Fluorides are released into the environment via coal combustion, process waters and waste from various industrial processes, including steel manufacturing, metals production, phosphate ore processing and glass manufacturing (WHO, 2002).

Fluorides can be found in most waters in varying concentrations, if not in all, potable waters (WHO, 1970). Water is a vital element for human in order to live and sources of water can be varying but the major was groundwater sources. High fluoride groundwater occurs in many areas of the world.

Majority of epidemiological studies about fluoride levels in drinking water and their health effects have been carried out in developing countries in Asia, Africa and Middle-East, where there were significantly elevated concentrations of fluoride (Indermitte et al, 2009). As stated by Meenakshi & Maheshwari (2006), drinking

water was the major contributor (75–90% of daily intake), other sources of fluoride poisoning are food, industrial exposure, drugs, cosmetics, etc.

2.2.2 Dental care product

Dental care product was the one of identifies source of fluoride exposure, there are various types of dental care products that focus on protecting dental health mainly on preventing dental caries. Among the popular products were fluoridated toothpaste, fluoridated mouth rinse, fluoridated tablet and dental surgery and treatment products; such as gel, varnish and paints (Whelton, 2003).

A study was conducted by Rahimah et al., (1998) was to determine the fluoride level in 20 toothpaste samples in the market. It was found that only two products out of twenty samples comply with the standard. The fluoride level was mainly at 20-1970 ppm. The toothpaste that was used for School Dental Care contains 750 ppm of fluoride.

In the United States, it was proposed that toothpastes that contain fluoride more than 1100 ppm should be labeled “not suitable for children below 6 years old (Rahimah et.al., 1998). It was found that only a few toothpastes do not contain fluoride; such as Sensodyne, Zact and Zaitun (Musa & Saub, 1998).

2.2.1 Drinks and beverages

Tea is one of the most common beverages in the world yet tea was also one of the beverages which with contains fluoride, depending on the type. Tea dry leaves contain about 75-100 ppm of fluoride. When the dry leaves immersed in the water, fluoride from the leaves will be extracted out into the water, thus ingested by our body (Rahimah, 1989). Besides that, other fruit juices also contain significant amount of fluoride, such as grape juice, apple juice and cherry juice. Grape juice was one of the juices that contain highest amount of fluoride, with 1.45 ppm. Grape juice was one of the favorite's drinks among children and frequent intake of such drinks might increase the exposure to fluoride (Kiristy et al., 1996).

2.2.2 Food

Examples of high-fluoride foods are fishes; especially sardines (Zubaidah, 1992). Cabbage was the vegetable that has the highest amount of fluoride (more than 40 mg/kg). Vegetables that were processes by using fluoridated water causing the fluoride content to double.

2.3 Route of entry and bioaccumulation of fluoride in human

There were three routes of entrance for fluoride into the body. The ways were through gastrointestinal tract (by ingestion), lungs (by inhalation) and skin (by direct contact). However, fluoride absorption through direct contact was quite uncommon rather than the other two mentioned. The absorption duration was different depending on the solubility of the fluoridated compounds. Almost all water-soluble fluoride will be absorbed by the digestive system rather than the insoluble one (American Dietetic Association, 1994).

Fluoride does not bind to plasma proteins in the blood (Taves, 1968). Absorbed fluoride will be distributed to the whole body and stored in the tissues. In humans and laboratory animals, approximately 99% of the total body burden of fluoride was retained in bones and teeth (Kaminsky et al., 1990), with the remainder distributed in highly vascularized soft tissues and the blood (McIvor, 1990). The ion is usually stored in calcified tissues, such as bone and teeth (WHO, 2002).

2.4 Fluoride health effect

2.4.1 Chronic effect

Chronic effects caused by exposure to high fluoride level in early of life tends to produce fluorosis in early forming and erupting permanent teeth, the incisors and first molars, whereas excessive ingestion in the later preschool years affects later forming and erupting permanent teeth, the canines, premolars, and second molars which called dental fluorosis. Dental fluorosis was defined as hypomineralisation of enamel of teeth caused by the chronic ingestion of excessive amounts of fluoride during the period when teeth are forming within the jaw. Milder forms of dental fluorosis are characterized by whitish spots, striations, or diffuse opacities of teeth. Fluorosis does not affect the health of teeth or of an individual, but, in its more severe forms, may cause cosmetic concerns (Horowitz, 1986).

Chronic high-level exposure to fluoride also can lead to skeletal fluorosis. In skeletal fluorosis, fluoride accumulates in the bone progressively over many years. The early symptoms of skeletal fluorosis include stiffness and pain in the joints. In severe cases, the bone structure may change and ligaments may calcify, with resulting impairment of muscles and pain (WHO, 2012).

Besides skeletal and dental fluorosis, it was also responsible for alterations in the functional mechanisms of liver, kidney, digestive system, respiratory system, excretory system, central nervous system and reproductive system, destruction of about 60 enzymes. The effects of fluoride in drinking water on animals were analogous to those on human beings. The continuous use of water having high fluoride concentration also adversely affects the crop growth. (Meenakshi & Maheshwari, 2006).

2.4.2 Acute effect

Acute high-level exposure to fluoride causes immediate effects of abdominal pain, excessive saliva, nausea and vomiting. Seizures and muscle spasms may also occur (WHO, 2012). The excessive consumption of fluoride may lead to muscle fibre degeneration, low hemoglobin levels, deformities in RBCs, excessive thirst, headache, skin rashes, nervousness, neurological manifestations (it affects brain tissue similar to the pathological changes found in humans with Alzheimer's disease), depression, gastrointestinal problems, urinary tract malfunctioning, tingling sensation in fingers and toes, reduced immunity, repeated abortions or still births, male sterility, etc (Meenakshi & Maheshwari, 2006).

2.5 Urinary fluoride

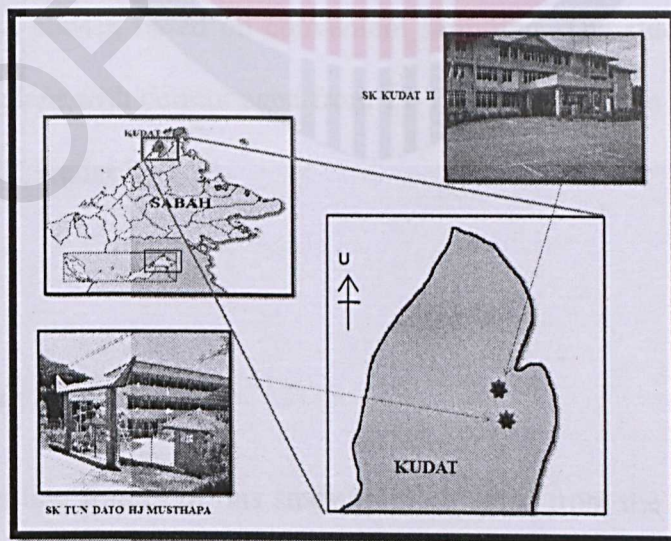
The relationship between fluoride absorption was inversely related to the calcium absorption, which fluoride will be less absorbed when the concentration of calcium is high in the body. Fluoride balance, fluoride tissue concentration and fluorosis risks increase along with the increase of protein nutrients, topological factors of the residential area and metabolism, which all the factors will reduce urine pH value. On the other hands, intake of vegetable nutrients and medical conditions will reduce the balance of fluoride and reduce the risks of fluorosis (Whitford, 1989).

CHAPTER 3

METHODOLOGY

3.1 Location of study area

This research was conducted at two primary schools at Kudat, Sabah, namely, SK Tun Datu Haji Mustapa and SK Pekan II.



Picture 3.1: Study location in Kudat

3.2 Study design

A cross-sectional study design was chosen in order to determine the fluoride exposure among 11-12 Year-old primary school children in the study population through examination of the concentration of fluoride in urine and determination of fluoride in drinking water.

3.3 Sampling Techniques

3.3.1 Study population

The study population was the primary school children with current age of 11-12 years-old and chosen based on convenient sampling. The study population was consisting of student with current aged from 11-12 years-old from SK Tun Dato Haji Musthapa and SK Kudat II.

3.3.2 Sampling frame

The sampling frames of this study were obtained from the name list of 11-12 year old student from each of the school that involve in this study.

3.3.3 Sampling Technique

The sampling technique was purposive sampling technique. A purposive sample is a non-representative subset of some larger population and it is constructed with a very specific need or purpose. The inclusive and exclusive criteria were set in order to determine schoolchildren with 11-12 years old that can participate in this research study. Schoolchildren who met inclusive criteria were selected as a respondent. Selected schoolchildren who participate in this research were asked for their parents consent. Respondent were free to withdraw from the study if they feel uncomfortable. Below were the inclusive and exclusive criteria:

Table 3.3.3: The inclusive and exclusive criteria

Inclusive criteria	Exclusive Criteria
<ul style="list-style-type: none">❖ schoolchildren aged 11-12 years-old❖ Do not use any water filtration at home❖ Using tap water as a source of drinking water❖ Free from kidney and nephrological disorders/diseases	<ul style="list-style-type: none">❖ The schoolchildren that participate during the study is migrate to new place or drop out from the school.

3.4 Sample Size

The sample size was determined using a formula established by Kirkwood and Sterne (2003):

$$N = p(1-p)/e^2 \text{ where:}$$

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.

3.5 Data collection

Letter of permission was forwarded to the headmaster of each 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 given to their parent for approval. After obtain the consent from their parent, a questionnaire was distributed to the respondents in order to get information about their personal details, socio-demographic, socio-economic, parents working background, and disease history.

3.5.1 Questionnaire

A set of questionnaire was used to gather information from the selected respondent. The questionnaire contained socio-demographic data, socio-economic, health status, uses of water filtration and water supply types. The questionnaire was important to ensure the respondents comply with the inclusive criteria.

3.5.2 Drinking water

The water samples were collected from the tap water that used for drinking purposes. Water samples were collected in three replicate of 250 ml container bottle from each respondent for three consecutive days. No preservation will be needed according to United States Environmental Protection Agency (USEPA) as the holding time for the sample was 28 days from the sampling date. The samples were analyzed within 24 hours for demining the fluoride levels using a DR/2500 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).

3.5.2 Urine

Urinary fluoride was the best indicator of fluoride exposure in drinking water (Watanable et al., 1994) and three replicate of 50 ml urine container bottles were distributed and collected from each respondent for three consecutive days. Urine was preserve by adding 0.2g Ethylenediaminetetraacetic Acid (EDTA) to avoid fluoride in the urine binds with other cat ion, such as calcium. Urine samples were directly analyzed within 24 hours after collected by the same spectrophotometer.

3.6 Equipment and reagent

Below were the list of equipment and reagent with their function that using during data collection.

Table 3.6: The list of equipment and reagent

Equipment and reagent	Function
1. Questionnaire	To gather information and requirement from the respondent.
2. Sample Bottle	50 ml sample of container for urine collection and 250 ml sample bottle for drinking water.
3. Spectrophotometer DR2500 with SPADNS method	To determine the level of fluoride in urine and drinking water
4. EDTA (Ethylenediaminetetraacetic acid)	As a masking agent to trap the metal ions that would interfere with the analyses.

3.7 Data analysis

All the data analysis were analyze using the statistical analysis by performing IBM SPSS 21 (Statistical Package for Social Science) Descriptive statistic including mean, median, and standard deviation will be run to analyze the distribution of all variable included in this study. Statistical analysis that involved will be pearson correlation coefficient or spearman's rank correlation coefficient which used to determine the correlation between urinary fluoride and fluoride level in drinking water. Moreover, T-test or Man-whitney U-test will be used in order to determine whether there is significant difference in urinary fluoride between genders.

3.8 Quality controls and Quality assurances

3.8.1 USEPA SPADNS Method

Before starting the samples analysis:

- ❖ Install the instrument cap on the cell holder before Zero or Read was Pushed
- ❖ The sample and deionized water must at the same temperature. Temperature adjustment can be made before or after the reagent addition.
- ❖ The sample cells were clean and dry before the test.
- ❖ The volume of the reagent was accurate. 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 accuracy the sample were dilute to a lower concentration.
- ❖ Do not pour-thru 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 is the quality control precaution in order to get high quality of sample.

- ❖ Make sure urine and drinking water container were fully filled by the sample and closed tightly.
- ❖ During collection of the sample from the respondent, question on the sources of drinking water was asked to make sure the drinking water sample was taken from their pipe water.

Table 4.1 Distribution of respondents based on gender and school

School	Gender		Total
	Male	Female	
SK, Kudat II	15	17	32 (37.1%)
SK, Tun Dato Hajji Mustapha	27	29	56 (62.9%)

CHAPTER 4

RESULT AND DATA ANALYSIS

4.1 Socio Demographic Data

This study took place at two primary schools, Sekolah Kebangsaan Kudat II and Sekolah Kebangsaan Tun Dato Haji Mustapha and involved 89 respondent ages 11-12 year-old students. The name list of the students for each school was obtained from the headmasters. A total of 33 (37.1%) students was from Sekolah Kebangsaan Kudat II and 56 (62.9%) were from Sekolah Kebangsaan Tun Dato Haji Mustapha. Total 89 of the students was chosen based on inclusive and exclusive criteria. From the 89 respondent, 46 (51.7%) were female students while the rest 43 (48.3) were male.

Table 4.1 Distribution of respondents based on gender and school

School	Gender		Total
	Male	Female	
SK Pekan II	16	17	33 (37.1%)
SK Tun DAto Hj Mustapha	27	29	56 (62.9%)
Total	43 (48.3%)	46 (51.7%)	89 (100%)

N= 89

4.1.2 Parent educational levels

The respondent's parent educational levels were obtained on their basic knowledge about fluoride. A total of 45(50.56%) of the respondent father's studied until high school, 23(25.84%) secondary school and 21(23.6%) does not attend school at all. While for the mother, 60(67.42%) attended high school, 31(34.83%) primary school and 8(8.98%) did not attended school at all.

4.1.3 Parent occupational levels

For the occupational background, 41 (46.06%) of the respondent father's worked as farmer, 29 (32.58) % worked as factory worker, 10 (11.23%) as government servant and 9(10.11%) worked on their own. For the respondent's mother, 61(68.53%) of them were housewives, 23(25.84%) worked as factory workers and 15(16.85%) worked in private sectors.

4.2 Fluoride in drinking water and urinary fluoride levels

There were 2 parameters measured in the study, which were fluoride levels in drinking water and fluoride levels in urine. For the first parameter, the range of drinking water fluoride was 0.17-0.76 mg/L with mean reading of 0.3578 (± 0.16452) mg/L. For the second parameter, the range of fluoride levels in urine was 0.70-2.37 mg/L and the mean value was 1.4107 (± 0.32781) mg/L.

Table 4.2: The fluoride in drinking water and urine

Items	N	Range mg/L	Mean (mg/L)	±S.D.
Fluoride level in drinking water	89	0.17-0.76	0.3578	0.16452
Fluoride level in urine	89	0.70-2.37	1.4107	0.32781

4.3 The significant difference in urinary fluoride level between genders

Based on Table 4.3, the minimum value of urinary fluoride levels among male respondents was 0.70 and the maximum value was 2.37 mg/L with mean value of 1.4058 (± 0.35359) mg/L. While from female respondents, the minimum value of urinary fluoride levels was 0.70 and the maximum value was 2.32 mg/L with mean value of 1.4154 (± 0.30563) mg/L.

As the respondents for male and female were 43 and 46 respectively so the Shapiro-Wilk test of normality was used. When significant value for normality test, $p < 0.05$ was not normally distributed, then the value of significant level for male's urinary fluoride was normally distributed as $p = 0.180$ and also normally distributed for female's urinary fluoride as $p = 0.280$. Because there was independent observation between two groups and both groups were normally distributed then the

comparison was determined by using independent t-test analysis. When the p-values 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 $p = 0.892$ 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

Urinary Fluoride Level	N	Range	Mean	SD	95% C.I		t	P
					Lower	Upper		
Male	43	0.70 - 2.37	1.4058	0.35359	-0.12944	0.14854	0.137	0.892*
Female	46	0.70- 2.32	1.4154	0.30563				

*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 one the variables not normally distributed which is urinary fluoride levels.

According to 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 $p=0.177$ ($p > 0.05$) and the null hypothesis was failed to be rejected. It can further be concluded that there was no significant relationship between urinary fluoride level and fluoride level in drinking water. It can further concluded as there was no significant relationship between urinary fluoride level and fluoride level in drinking water. Guildford rule of thumb was also not relevant.

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

Parameter	N	Mean	Standard Deviation	r^s	p
DWF	89	0.16452	0.16452	0.144	0.177*
UF	89	1.4107	0.32781		

*significant at $p \leq 0.05$

CHAPTER 5

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 DISCUSSION

5.1.1 Socio-Demography Background

This study involved a total of 89 primary schoolchildren from two different schools in Kudat, Sabah. The respondents were selected based on the inclusive criteria such as 11-12 years old primary schoolchildren, free from kidney and nephrological disorders/diseases, free from diabetes mellitus, lived in the same housing area for past 6 years, and did not using any water filtration at home as it might influence the levels of fluoride in water.

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. The water supply that used by the entire respondent was the same which were transfer by pipe water system from Milau water treatment plant which fluoridation process were implemented.

The exposures of fluoride were determined via urine as urine and kidney is the major route of fluoride excretion where about 40-60% of the daily intake is excreted in the urine (WHO, 2002). Urine tests have been used to ascertain rates of excretion in order to set upper limits in exposure to fluoride compounds and associated detrimental health effects (Baez et al., 2000). Hence, the best indicator of fluoride exposure was the urinary fluoride levels in the population under investigation and accepted as stated by Watanable et al., (1994).

5.1.2 Fluoride in drinking water and urine

According to the data analysis performed, the two parameters measured in the study were drinking water fluoride and urinary fluoride. The drinking water fluoride water supply ranged from 0.17-0.76 mg/L with a mean of 0.3578 (± 0.16452) mg/L. The National Standard for Drinking Water Quality (NSDWQ) stated a range of 0.4 – 0.6 ppm fluoride was cited as the implementation range for water authorities (Malaysian Ministry of Health, 2004). By comparing the result obtained with the permissible fluoride levels range, this shows that the mean level of artificially fluoride did not surpassed it. In another words, fluoridation of this water supply

needs to be reviewed again as it was not within the standard range for fluoride levels. This also might have been due to the distribution of water supplies and the monitoring of water fluoridation in water treatment plants. Optimally fluoridated drinking water can be classified as a diet that influences the prevention of tooth-related diseases (WHO, 2012).

For the second parameter, urinary fluoride was analyzed based on standard method of USEPA SPADNS method. Urinary fluoride water ranged from 0.70-2.37 mg/L and the mean value was 1.4107 (± 0.32781) mg/L. Baselt (1980), found that urinary fluoride levels in normal non-occupationally exposed person have been reported to range from 0.2 to 3.2 mg/L depending on dietary intake. With comparison to the range of urinary fluoride with the range obtained from the literature review, urinary fluoride can be conclude as still in between the range. Even the highest level recorded was 2.37 mg/L, which showed that the urinary fluoride was low as the intake fluoride from water supplies.

From the total 89 drinking water samples, 9 (8.9%) of them exceeded permissible range of fluoride levels in drinking water, 58 (65.1%) respondents were below permissible range of fluoride levels in drinking water, and the remaining 22 (24.7%) respondents were in the permissible range of fluoride levels in drinking water.

Results also showed all 89 (100%) respondents' urinary fluoride levels were in normal range. Probably they were not exposed to high sources of fluoride other than drinking water. Many factors may contribute to the normal range of urinary fluoride excretion which the respondents might be had healthy kidneys and exposed to fluoride other than drinking water such foods examples high-fluoride foods were fishes; especially sardines (Zubaidah, 1992) and fluoridated toothpaste (Whelton, 2003).

5.1.3 Urinary fluoride level based on gender

There was no significant difference between male and female urinary fluoride levels. Urinary fluoride levels between genders did not differ much as the socio-demographic background of the respondent was almost the same. This is because the entire respondent is live at the same district which using same water resources. Chen (2013) stated that respondents with same socio-demographic showed same urinary fluoride levels.

5.1.4 Relationship of fluoride level in drinking water and urinary fluoride levels

When statistical analysis was performed drinking water not had significant relationships with urinary fluoride levels. Instead, exposure of fluoride was assumed to originate from factors other than drinking water such foods (Rahimah, 1989) and fluoridated toothpaste (Whelton, 2003). It was observed that none of the respondents were exposed to high level of fluoride in air or water since this study area was not industrial area such a steel manufacturing, metals production, phosphate ore processing and glass manufacturing (WHO, 2002).

5.2 Conclusions.

In short, more than half of the respondents 58 (65.1%) were exposed to lower level of fluoride in drinking water and all of the respondents 89 (100%) excreted urine with normal level of urinary fluoride. However, other exposures to fluoride were not measured in this study as to focus on fluoride exposure from drinking water consumption. Urinary fluoride levels are well-established indicators of fluoride intake for individuals and to determine current fluoride exposure. There was no significant relationship between drinking water fluoride and urinary fluoride. In addition, there was no significant difference between fluoride levels in both water supplies and also between urinary fluoride levels between genders. Therefore, further investigations on others factors of fluoride exposure, total fluoride excretion and consequently fluoride retention are needed. Fluoride health effects either chronic or acute should also be regularly monitored.

5.3 Recommendation

There are several recommended ways to protect the health of the children living in the study area where water supplies are still major concern of health. Health authority should play their role by considering children health not merely the economical benefit from water supplies usage but also for future generations.

Firstly, an advance study needs to be performed in order to support this study yet the study was first time for this study area. Then, the data of dental fluorosis including its severity score should be taken into consideration as to correlate directly with fluoride exposure to health effects. The competent dentist should be involved to ensure the validity of dental fluorosis score. In order to compare between past exposure and current exposure of fluoride, retrospective study can be done.

Next, the study should be conducted in a wider area so it can represent more exposed groups. Then, the food study including total dietary intake of fluoride should also be included as its can effects the results. Urine should also be measured the creatinine test to determine the health status of the kidneys that affects the urinary fluoride levels.

The government or party involved such as Health District Office should give a full commitment to monitoring the water supplies in order to provide safe drinking water especially on fluoride levels. In addition, the health authorities should take action systemically in order to make the fluoride levels in drinking water achieved the optimal levels that has been stated in WHO guidelines for drinking water.

Last but not least, concerned parties such NGO should also play their roles to educate and create awareness about the impacts of fluoride exposure especially that come from consumption of water as water was vital for human life. Another study about the knowledge and perception towards safe drinking water can be initiated to ensure the programs for public health education is effective.

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**FORM B1: RESPONDENT'S INFORMATION SHEET CONSENT AND
GUARDIAN'S/PARENT CONSENT**

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

1. STUDY TITLE

URINARY FLUORIDE LEVEL AND FLUORIDE EXPOSURE IN DRINKING WATER AMONG PRIMARY SCHOOLCHILDREN IN KUDAT, SABAH.

2. INTRODUCTION

This study area had been using treated water from a treatment water plant that start operate since 2013, therefore this will be conducted to determine if there is any excess fluoride exposure through drinking water to the population and at the same time, to determine the relationship with fluoride excreted through urine.

3. WHAT WILL YOU HAVE TO DO?

In this study, some urine and drinking water samples will be taken. Two sample bottles which is 250ml container bottle for drinking water and 50ml container bottle for urine will be distributed to each respondent. Respondent will be asked to return back the bottle sample which filled with the sample. All samples will be collected within 3 days and the fluoride analysis within 24 hours after sample is collected. The respondent will be primary schoolchildren aged 11-12 years old. Therefore, consent from both parents is required for urine sample to be taken. Consent letter will be distributed to all respondents to obtain consent agreement from their parent.

4. WHO SHOULD NOT ENTER THE STUDY?

Respondent are primary schoolchildren 11-12 years-old and has permission from their parents.

5. WHAT WILL BE BENEFITS OF THE STUDY?

- (a) TO YOU AS THE SUBJECT?



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SELANGOR MALAYSIA**

They will get more information about the potential impact on high exposure to fluoride. Moreover they will know current fluoride level in urine and drinking water.

b) TO THE INVESTIGATOR?

The main benefit of this study to the researcher is to obtain primary data on fluoride in drinking water and urine. As the study area has never been study before, the data is very important to ascertain the extent of fluoride exposure on the study population in the area.

6. ARE THERE ANY RISKS?

There is absolutely no health risk associated with subject who participated in the study.

7. WILL THE INFORMATION AND MY IDENTITY REMAIN CONFIDENTIAL?

All the information and data collected during this study will be strictly confidential.



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

For inquiries, please contact:

Researcher contact information

Researcher : Fedolfie Bin Rusileh
Contact number : 019-8504018
E-mail : fedoupm@gmail.com

Research Supervisor information

Research supervisor : Dr. Shahrudin Mohd Sham
Contact number : 012-3387305
Title : Lecturer FPSK UPM Serdang

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



9. CONSENT

I Identity Card No.
address.....

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

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

I wish to *know/don't wish to know my son's/ daughter/ ward's results of the tests performed on my
sample.

I agree/ do not agree that the image/photo/video recording 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 the nature and purpose of the above –mentioned
clinical research.

Date

Signature

(Researcher)



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5. WHAT WILL BE BENEFITS OF THE STUDY?

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They will get more information about the potential impact on high exposure to fluoride. Moreover they will know current fluoride level in urine and drinking water.

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Research supervisor : Dr. Shaharuddin Mohd Sham
Contact number : 012-3387305
Title : Lecturer FPSK UPM Serdang

Please initial here if u have read and understood the contents of this page.....



9. CONSENT

I Identity Card No.
address.....
.....hereby voluntarily agree to take part in the
clinical research *(clinical study, questionnaire based study/ drug trial/ video recording/ focus group) .

I have been informed about the nature of the clinical research in terms of methodology, possible adverse effects and complications (refer to Information Sheet). I understand that I have the right to withdraw from this clinical research at any time without assigning any reason whatsoever. I also understand that this study is confidential and all information provided with regards to my identity will remain private and confidential.

I wish to *know/don't wish to know the results of the tests performed on my sample.
I agree / do not agree that the image/ photo video recording related to me be used in any form of publication or presentation (if applicable)

* delete where necessary.

Signature Signature
(Respondent) (Witness)

Date : Name :

I/C No. :

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

Date Signature
(Researcher)



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 UNIVERSITI PUTRA MALAYA
 PUTRAJAYA

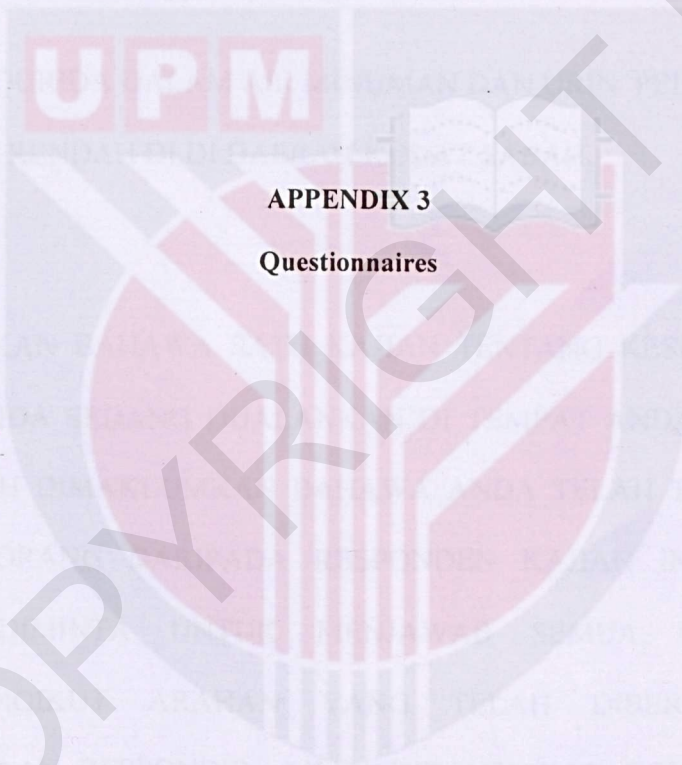
NOMOR SRI

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JABATAN KESIHATAN PERSEKITARAN DAN PEKERJAAN

FAKULTI PERUBATAN DAN SAINS KESIHATAN

UNIVERSITI PUTRA MALAYSIA



APPENDIX 3
Questionnaires

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JABATAN KESIHATAN PERSEKITARAN DAN PEKERJAAN

FAKULTI PERUBATAN DAN SAINS KESIHATAN

UNIVERSITI PUTRA MALAYSIA

**KAJIAN TENTANG FLOURIDA DALAM AIR MINUMAN DAN URIN PELAJAR SEKOLAH
RENDAH DI DI DAERAH KUDAT SABAH.**

ADALAH DIMAKLUMKAN BAHAWA SATU KAJIAN TENTANG KESIHATAN AKIBAT
PENDEDAHAN FLUORIDA SEDANG DIJALANKAN DI TEMPAT ANDA. SEHUBUNGAN
DENGAN ITU, ADALAH DIMAKLUMKAN BAHAWA ANDA TELAH TERPILIH UNTUK
MENJADI SALAH SEORANG DARIPADA RESPONDEN KAJIAN INI. OLEH YANG
DEMIKIAN, ANDA DIMINTA UNTUK MENJAWAB SEMUA SOALAN YANG
DIKEMUKAKAN MENGIKUT ARAHAN YANG TELAH DIBERIKAN. SEGALA
MAKLUMAT BERKENAAN RESPONDEN AKAN DIRAHSIAKAN DAN HANYA AKAN
DIGUNAKAN UNTUK KAJIAN INI.

RESPONDEN	
TARIKH KAJIAN	
NO TELEFON	(HP)
	(R)

SULIT

ARAHAN SOALAN:

1. KERTAS SOALAN INI MENGANDUNGI LIMA (5) BAHAGIAN IAITU:
BAHAGIAN A: LATAR BELAKANG RESPONDEN
BAHAGIAN B: MAKLUMAT MAKLUMAT KELUARGA
BAHAGIAN C: MAKLUMAT KESIHATAN RESPONDEN (DISIS OLEH IBUBAPA/PENJAGA)
2. ANDA DIMINTA MENJAWAB SEMUA DALAM YANG ADA DALAM BUKU SOALAN INI.
3. UNTUK MENJAWAB, ANDA PERLU MENANDAKAN (/) PADA RUANGAN KOTAK YANG DISEDIAKAN.
CONTOH SEPERTI DI BAWAH.



4. BUKU SOALAN INI HENDAKLAH DISERAHKAN SEMULA KEPADA PENKAJI SETELAH SELESAI MENJAWAB SEMUA SOALAN YANG TERDAPAT DALAM BUKU INI.

BAHAGIAN A: LATAR BELAKANG RESPONDEN

1. TARIKH:
2. NAMA MURID:
3. TARIKH LAHIR:
4. UMUR:
5. BANGSA:
6. KELAS:
7. NAMA SEKOLAH:
8. ALAMAT RUMAH:
9. MAKLUMAT SEKOLAH RENDAH

BIL	NAMA SEKOLAH RENDAH	DARJAH

BAHAGIAN B: MAKLUMAT KELUARGA

10. PEKERJAAN BAPA ATAU PENJAGA.
 - a. PPROFESSIONAL
 - b. PEGAWAI KERAJAAN/BERUNIFORM
 - c. PEGAWAI SWASTA

- d. PEKERJA UPAHAN
- e. PEASARA
- f. BEKERJA SENDIRI

11. PEKERJAAN IBU.

- a. PROFESSIONAL (CONTOH PENSYARAH)
- b. PEGAWAI KERAJAAN/BERUNIFORM/GURU
- c. PEGAWAI SWASTA
- d. PEKERJA UPAHAN
- e. PESARA
- f. BEKERJA SENDIRI

12. PENDAPATAN IBU DAN BAPA (PENJAGA) SEBANYAK RM.....

13. TARAF PENDIDIKAN IBU BAPA(TANDAKAN (/) PADA KOTAK)

	BAPA	IBU	PENJAGA
TIDAK BERSEKOLAH:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SEKOLAH RENDAH:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SEKOLAH MENENGAH:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
UNIVERSITI:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LAIN-LAIN:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

14. BILANGAN AHLI KELUARGA:.....ORANG

BAHAGIAN C: MAKLUMAT KESIHATAN RESPONDEN (DIISI OLEH IBU/ BAPA /PENJAGA)

15. ADAKAH ANAK ANDA MEMPUYAI SEBARANG PENYAKIT SEPERTI DIABETES MELITUS(KENCING MANIS) ATAU PENYAKIT BUAH PINGGANG?

- YA
- TIDAK

16. ADAKAH ANDA MEMPUYAI SEBARANG ALAT PENAPIS AIR DI RUMAH ?

- YA
- TIDAK

PEJABAT TERAHAN NAIS DANSELOR (PENYELIDIAN DAN INOVASI)

OFFICE OF THE DEPUTY VICE CHANCELLOR (RESEARCH AND INNOVATION)

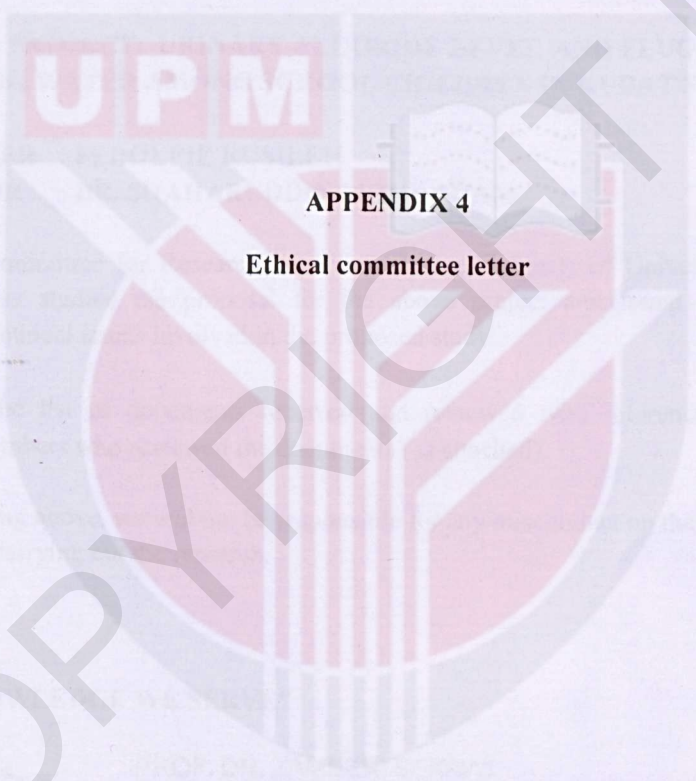
Kat: (03) 8921 2000 / 2001 / 2002 / 2003

Date: 12/05/2021

Dr. [Name]
Department of [Department Name]
Faculty of [Faculty Name]
University of Putra Malaysia

Dear Sir,

RESEARCH IN
INNOVATION
RESEARCH IN
SUSTAINING



APPENDIX 4

Ethical committee letter

The Ethics Committee
DECLINES to grant
approval for the
proposed research project
because the
submissions do not
meet the requirements
of the ethical committee
of the university.

Thank you.

Yours faithfully,
[Signature]
[Name]
[Title]
[Department Name]
[Faculty Name]
[University Name]

Dr. [Name]
[Title]
[Department Name]
[Faculty Name]
[University Name]



JKEUPM Ref No. : FPSK_November(13)28

- a) Members of the JKEUPM who reviewed the documents:
 - Prof. Dr. Patimah Ismail
- b) Date of approval: 6/12/2013

Endorsed at JKEUPM Meeting on 10/1/2014, attended by:

NAME	DESIGNATION	GENDER	TICK IF PRESENT
Prof. Dr. Norlijah Othman	Paediatrics & Dean, Faculty of Medicine and Health Sciences	Female	
Prof. Dr. Zamberi Sekawi	Medical Microbiologist & Deputy Dean of Research and Internationalization, Faculty of Medicine and Health Sciences	Male	√
Prof. Dato' Dr. Lye Munn Sann	Medical Statistician, Dept of Community Health, Faculty of Medicine and Health Sciences	Male	√
Prof. Dr. Tengku Aizan Abd Hamid	Gerontologist & Director, Institute of Gerontology	Female	
Prof. Dr. Lekhraj Rampal	Medical Statistician, Dept of Community Health, Faculty of Medicine and Health Sciences	Male	√
Prof. Dr. Elizabeth George	Pathologist, Dept of Pathology, Faculty of Medicine and Health Sciences	Female	√
Prof. Dr. Lim Thiam Aun	Anesthesiologist, Dept of Surgery, Faculty of Medicine and Health Sciences	Male	√
Prof. Dr. Wan Omar Abdullah	Medical Parasitologist, Dept of Medical Microbiology and Parasitology, Faculty of Medicine and Health Sciences	Male	
Prof. Dr. Patimah Ismail	Professor of Biomedicine, Dept of Biomedical Sciences, Faculty of Medicine and Health Sciences	Female	√
Prof. Dr. Johnson Stanlas	Pharmacologist, Dept of Medicine, Faculty of Medicine and Health Sciences	Male	√
Assoc. Prof. Dr. Mansor Abu Talib	Assoc. Professor of Guidance and Counselling, Dept of Human Development and Family Studies, Faculty of Human Ecology	Male	
Assoc. Prof. Dr. Azmawani Abd. Rahman	Operations and Technology Management / Deputy Dean of Research and Graduate Studies	Female	√
Assoc. Prof. Dr. Noritah Omar (Lay Person)	Assoc. Professor of English Language, Dept of English Language, Faculty of Communication and Modern Languages	Female	√
Dr. Rojanah Kahar (Lay Person)	Senior Lecturer of Dept of Human Development and Family Studies, Faculty of Human Ecology	Female	√
Tan Sri Dato' Napsiah Omar (Independent Member)	Chairman, National Population and Family Development Board	Female	√

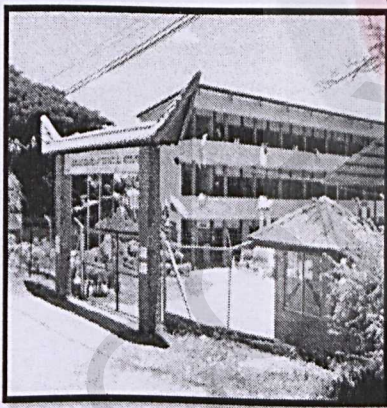
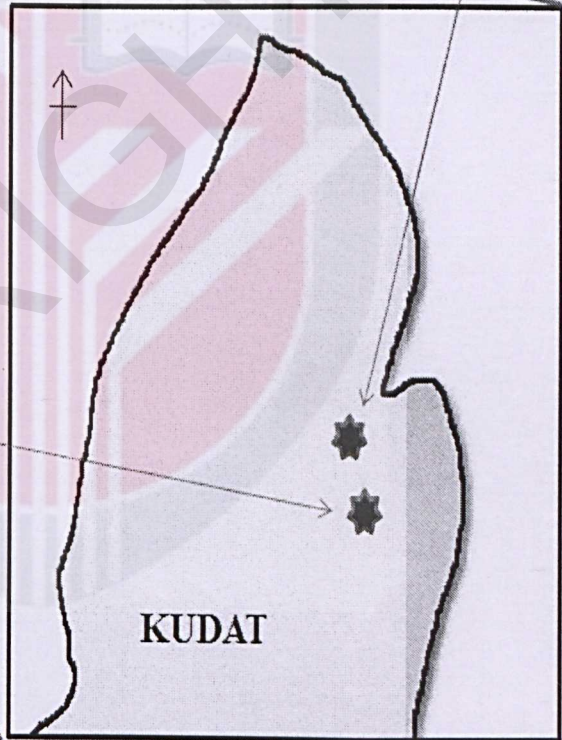
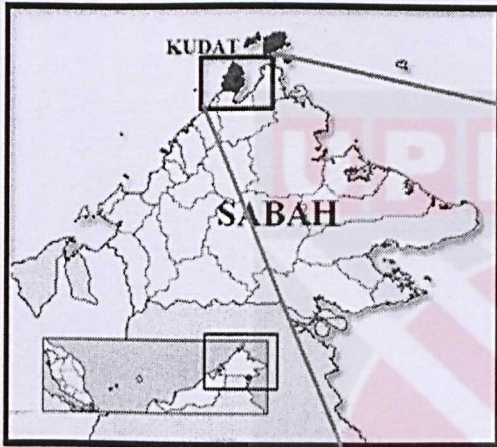
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APPENDIX 5

Map of Study Location



SK KUDAT II



SK TUN DATO HJ MUSTHAPA