UNIVERSITI PUTRA MALAYSIA

THE PREVALENCE AND SEVERITY OF DENTAL FLUOROSIS AND FLUORIDE EXPOSURE AMONG 12-YEAR-OLD SCHOOL CHILDREN IN PUCHONG,SELANGOR

BY
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The Prevalence and Severity of Dental Fluorosis and Fluoride Exposure Among 12-year-old school children in Puchong, Selangor

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ABSTRACT

A cross-sectional study was carried out to determine the prevalence and severity of dental fluorosis among school children. This study included 71 children age 12 years old from Sekolah Kebangsaan Puchong Indah. Thirty of them were male and 41 were female. Respondents were recruited after fulfilling a few inclusive and exclusive criteria. Drinking water and urine samples were collected for three consecutive days and were analysed for fluoride using a DR/2800 direct reading spectrophotometer using the SPADNS method. Dental fluorosis was visually determined by a competent dentist using the Tooth Surface Index of Fluorosis (TSIF). A questionnaire was used to investigate information on fluoride exposure and breastfeeding duration among respondents. The mean for fluoride concentration in drinking water was 0.40±SD 0.12 mg L^{-1} and the mean for urinary fluoride was 1.14±SD 0.34 mg L^{-1}. The prevalence of dental fluorosis in this study was 57.75%. Spearman's Rho test showed that fluorosis prevalence was not significant with the concentration of fluoride in drinking water and urine ($p>0.05$). Independent T test showed that there was no significant difference of dental fluorosis prevalence between genders ($p>0.05$). Dental fluorosis was not a problem in the area studied as the mean score obtained was less than 1.

Key word: fluoride, dental fluorosis, urine, drinking water, score

Prevalens dan Severiti Fluorosis Gigi dan Pendedahan Fluorida Di kalangan Pelajar Sekolah Rendah di Puchong, Selangor.

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ABSTRAK

Satu kajian keratan rentas telah dijalankan untuk melihat kejadian fluorosis gigi dikalangan pelajar sekolah rendah. Seramai 71 orang pelajar sekolah rendah berumur 12 tahun yang bersekolah di Sekolah Kebangsaan Puchong Indah telah terlibat di dalam kajian ini. Tiga puluh orang dari mereka adalah lelaki manakala 41 oang adalah perempuan. Pemilihan responden telah dijalankan setelah mengambil kira beberapa faktor inklusif dan eksklusif. Persampelan air minuman dan urin telah dijalankan selama 3 hari berturut-turut. Spektrofotometer DR 2800 digunakan untuk mengukur kepekatan fluorida dalam air minuman dan urin menggunakan kaedah SPADNS. Fluorosis gigi pula dikenalpasti melalui pemeriksaan fizikal gigi menggunakan Indeks Permukaan Gigi Untuk Fluorosis oleh seorang doktor gigi yang kompeten. Maklumat berkenaan pendedahan fluorida dan tempoh penyususan dikalangan pelajar telah dicerap menggunakan borang kaji selidik yang diedarkan. Kajian menunjukkan bahawa kepekatan fluorida di dalam air minuman adalah 0.40±SD 0.12 mg L^{-1} dan di dalam urin pula 1.14±SD 0.34 mg L^{-1}. Kadar prevalent fluorosis di dalam kajian ini adalah sebanyak 57.75%. Ujian Spearman's Rho menunjukkan bahawa tiada perhubungan signifikan diantara prevalent fluorosis gigi dan kepekatan fluorida di dalam air minuman dan urin. Kesimpulannya, kejadian fluorosis gigi bukanlah masalah di kawasan kajian berdasarkan skor min yang kurang dari 1.

Kata Kunci: fluorida, fluorosis gigi, urin, bekalan air minuman, skor

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LIST OF ABBREVIATIONS

CDC	*Centers for Disease Control and Prevention*
EDTA	*Ethyelene Dinitrolotetraacetic Acid*
NIOSH	*National Institute of Occupational Safety and Health*
SK	*Sekolah Kebangsaan*
SPSS	*Statistical Package for Social Science*
TSIF	*Total Surface Index of Fluorosis*
USDHHS	*United States Department of Health and Human Services*
UPM	*University Putra Malaysia*
WHO	*World Health Organizations*

CHAPTER 1

INTRODUCTION

1.1 Background

Fluoride is one of the chemical elements necessary for human life. Deficiency or excess of fluoride in the environment is closely associated with human health (Zhang et al., 2003). Fluoride concentration in the environment is closely associated with human health. Fluorosis is a result of the destruction of metabolic calcium and phosphorus, leading to inhibition of active enzymatic process in the human body, which interrupts the function of the endocrine system, leading to fluorosis (Xiang et al., 2004).

There has been increasing prevalence of dental fluorosis over recent decades, both in cities with and without fluoridated water, because of the widespread use of other forms of fluoride. While the necessity of fluoride to human health is still open to debate, its toxicity is currently the cause of considerable concern in many countries where fluoride is found in excessive quantities in the drinking water (Chandrajith et al., 2007).

1.2 Problem Statement

More than 200 million people from all over the world suffer from dental fluorosis caused mainly by an excess of fluoride in drinking water (Chandrajith et al., 2007). Water is the main source of ingested fluoride for most children (Levy et al., 1995). Total fluoride intake from water depends on 2 factors, the water fluoride concentration and the total water volume consumed. Water can be consumed either by itself or when incorporated into other foods and beverages such as occurs when reconstituting powdered or diluting concentrated infant formula. Prior to 1979, studies suggested that some formula-fed infants were at increased fluorosis risk due to the high fluoride concentration of some infant formulas (Singer et al., 1979).

Fluoridation of community drinking water is a major factor responsible for the decline in dental caries (tooth decay) during the second half of 20th century. Although other fluoride containing products are available, water fluoridation remains the most equitable and cost effective method of delivering fluoride to all members of all communities.

Researcher has made an observation that human with dental fluorosis do experience lower incidence in dental caries compare to those who do not experience dental fluorosis. Fluoride which present naturally in the main water source is identified

to become major contributor to the occurrence. However, higher fluoride intake among children or adult might lead to dental fluorosis.

Concurrently, the prevalence of dental caries is declining in Malaysia, which was apparent between 1976 and 1985 after the widespread water fluoridation programme and the availability of the fluoridated toothpaste in the market (Razak, 2005). However, with the advent of the fluoridated dentifrices, fluoridated infant formulas and commercially prepared beverages with fluoridated water, the incidence of DF are increasing (Simko, 1997).

1.3 Study Importance

For more than a century, fluorides have been used to prevent dental caries. Although it has been scientifically proven that small concentrations of fluoride can significantly reduce dental caries without any ill-effects, the use of fluoride is still regarded as a controversial issue and is still under investigation (Ethel and Paula, 2011). 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 (Pizzo et al., 2007).

In the past, the anticariogenic effect of fluoride was thought to be mainly due to incorporation of systemically ingested fluoride into actively developing tooth structure thus improving crystal stability and reducing enamel solubility. Current research has shown that the major anticariogenic benefit from fluoride is due to aposteruptive topical effect that inhibits demineralization and enhances remineralization of early caries thus upsetting the balance that leads to tooth decay (Brothwell and Limeback, 2003).

Fluorosis in the maxillary anterior incisors is an undesired side effect of excessive fluoride ingestion at critical tooth developmental stages, generally considered to be the period from birth until three years of age. A 2002 World Health Organization (WHO) reviews on dental surveys conducted in the United States over 60 years ago by H Trendley Dean and co-workers of the US Public Health Service concluded that the 'optimum' level of fluoride in drinking water associated with maximum protection against dental caries and a minimum amount of dental fluorosis was approximately 1 mg F ion/L.

A study by Ministry of Health Malaysia (2002) found that drinking water in few states in the country has higher fluoride content than the recommended national average. This may alleviate the prevalence of dental fluorosis (Ministry of Health Malaysia, 2002). However, high and continuous exposure to more optimum level will lead to dental fluorosis (Rahimah, 1989). Dental fluorosis is actually a manifestation of toxic resulting from intake of fluoride in chronic manner.

Fluoride is identified to cause dental fluorosis if were exposed excessively especially among school children. Fluorosis report in Malaysia among 12 to 16 years old children show prevalence level of 62% to 88%. This research is meant to analyze the concentration amount of fluoride present in urine of respondents. Relationship of fluoride exposure factors with fluorosis score need to be taken into account. This research also interested in studying the health risks coming from continues use of other source of fluoride.

1.4 Research Objective

1.4.1 General Objective

To study the prevalence and severity of dental fluorosis among 12-year-old primary school children when using fluoridated water supply.

1.4.2 Specific Objectives

1. To determine concentration of fluoride in urine and drinking water of respondents.
2. To study the prevalence and severity of dental fluorosis among 12-year-old school children in S.K Puchong Indah.
3. To study the relationship between dental prevalence of dental fluorosis with fluoride concentration in drinking water.
4. To study the relationship between prevalence of dental fluorosis with urinary fluoride concentration.
5. To determine the fluoride exposure on maxillary central incisors.
6. To compare the prevalence of dental fluorosis between male and female respondents.
7. To determine the duration of breastfeeding among respondents and its effect to severity of dental fluorosis.

1.5 Study Hypothesis

1. There is a significant relationship between severity of dental fluorosis with fluoride concentration in drinking water.

2. There is a significant relationship between severity of dental fluorosis with urinary fluoride.
3. There is a significant difference in the prevalence of fluorosis between male and female respondents.

1.6 Study Limitations

There were students with dental fluorosis refuse to become respondent (healthy workers effect). Next, there was no 24 hours collection of urine excretion by the respondents. This research did not consider fluoride excretion via sweat(1-3 µmol/L) and faeces (10-25 µmol/L).

There might also be instrument bias occur in this study which might affect the reading of the samples of urine and drinking water measure. Lastly, there is possibility of recall bias in data collection of breastfeeding history questionnaire.

CHAPTER 2

LITERATURE REVIEW

2.1 Fluoride

Chemicals found as contaminants in drinking water can be grouped conveniently into three classes; inorganic, organic and radionuclides (Neal, 1985). One such example is fluoride and this inorganic compound is purposely added into water supplies as a prophylactic against dental caries.

Fluorine, a member of the halogen family, is an element essential for normal growth, development and maintenance of human health. Fluoride plays an important role in preventive dentistry due to its cariostatic potential. However, excessive intake of fluoride leads to dental and skeletal fluorosis (Saravanan et al., 2008).

Fluoride has played a key role in caries prevention for the past 50 years but excessive ingestion of fluoride during tooth development may lead to dental fluorosis. Dental fluorosis is form of hypoplasia of the enamel that results from an abnormally high consumption of fluoride during tooth development. This condition varies depending on the amount and the length of time when fluoride is ingested during tooth calcification. The effect ranges from barely visible to dark brown sustain with some pitting (Indiana State Department of Health, 2003).

Clinical dental fluorosis being the most convenient biomarker of fluoride exposure evoked the thought of conducting the present study (Saravanan et al., 2008). Fluoridated drinking water can be classified as a diet that influences the prevention of tooth-related diseases (Ericsson and Ribellius, 1971).

2.2 Fluoride Sources

The main reason for the decline in the caries prevalence in industrialized countries is recognized to be the introduction of fluoridated toothpaste in the early 1970s (Pizzo et al., 2007). The diminishing benefit from community water fluoridation has been also attributed to the large use of the other fluoride-containing products, including mouth rinse, dietary supplements, and professionally applied or prescribed gel, foam, or varnish.

Consumption of canned and bottled soft drinks in infancy may have been a more common practice among the elementary school children at that age. The displacement of water from the diet by other beverages has been documented in older children. However, there is a wealth of evidence to suggest that a wide range of factors may produce enamel defects by disturbing calcification during the developmental period. Such factors may be environmental or hereditary (Hamdan, 2003).

Following a linked series of investigations, Dean described the quantitative relationship between fluoride content in drinking water and occurrence of enamel mottling. Dean first suggested that a range of enamel defects could occur in endemic areas. More detailed investigations led Dean to conclude that there was a definite relationship between the concentration of fluoride in water and the appearance of mottled teeth in the area of supply (Hamdan, 2003).

Table 2.1 : Levels of fluoride in foodstuffs (World Health Organization, 2002)

Food	Fluoride Concentration (mg/kg)	Comment	References
Milk and products	0.01-0.8	Range of concentrations in 12 varieties of dairy products in Canada	Dabeka & McKenzie (1995)
	0.045-0.51	Range of mean concentrations in 13 varieties of dairy products in Hungary	Schamschula et al. (1988a)
	0.019-0.16	Range of concentrations in milk and milk products samped between 1981 and 1989 in Germany	Bergmann (1995)
Meat and Poultry	0.04-1.2	Range of concentrations in 17 varieties of (cooked and raw)meat and poulty in Canada	Dabeka & Mc Kenzie (1995)
	0.01-1.7	Range of mean concentrations in 7 varieties of meat and poultry in Hungary	Schamschula et al. (1988a)
	0.29	Mean concentration in canned meat and sausage sampled between 1981 and 1989 in Germany	Bergmann (1995)

Fluorides are released into the environment naturally through the weathering and dissolution of minerals, in emissions from volcanoes and in marine aerosols. Fluorides are also released into the environment via coal combustion and process waters and waste from various industrial processes, including steel manufacture, primary aluminium, copper and nickel production, phosphate ore processing, phosphate fertilizer production and use, glass, brick and ceramic manufacturing, and glue and adhesive production. The uses of fluoride-containing pesticides as well as the controlled fluoridation of drinking-water supplies also contribute to the release of fluoride from anthropogenic (WHO, 2002)

Phosphate fertilizers are the major source of fluoride contamination of agricultural soils. They are manufactured from rock phosphates, which generally contain around 3.5% fluorine (Hart et al., 1934). However, during the manufacture of phosphate fertilizers, part of the fluoride is lost into the atmosphere during the acidulation process, and the concentration of fluoride in the final fertilizer is lowered further through dilution with sulfur (superphosphates) or ammonium ion (ammoniated phosphates); the final product commonly contains between 1.3 and 3.0% fluorine (McLaughlin et al., 1996).

2.3 Usage Of Fluoride

Since the discovery of the importance of adding fluoride in water treatment for reducing the prevalence of caries at population level, its risks in terms of dental fluorosis development have been minimized through maintaining a so-called "optimal" concentration of fluoride in water (Catani et al., 2007).

The use of fluoride as a preventive measure for dental caries over the latter half of the last century has clearly contributed to the overall reduction in prevalence of dental caries worldwide, the effect being predominantly on the smooth surfaces (Brambilla, 2001; Ellwood and Fejeskov, 2003). Most of the improvements in children's dental health, in fact, are attributable to the widespread availability of fluoride-containing toothpastes since the 1970s (Pizzo et al., 2007).

In most industrialized countries, the prevalence of dental caries in children has decreased over the last two decades. The joint FDI/WHO working group for Oral Health Research and Epidemiology indicated that the factor common to all countries with substantial reductions in caries prevalence was fluoride, either as fluoridated water or in toothpaste (Petunici et al., 2005).

Calcium fluoride is used as a flux in steel, glass and enamel production, as the raw material for the production of hydro fluoric acid and anhydrous hydrogen fluoride, and as an electrolyte in aluminium production. Sodium fluoride is used in the controlled fluoridation of drinking-water, as a preservative in glues, in glass and enamel production, as a flux in steel and aluminium production, as an insecticide and as a wood preservative.

Sulfur hexafluoride is used extensively in various electronic components and in the production of magnesium and aluminium. Fluorosilicic acid (H_2SiF_6) and sodium hexafluorosilicate (Na_2SiF_6) are used for the fluoridation of drinking-water supplies (WHO, 2002).

2.4 Effects of fluoride exposure on health

By mid -1980s , however, the relative effectiveness of CWF has declined, whereas there has been an increase in the prevalence of fluorosis. Several diseases, including cancer, Down's Syndrome , and an increase in fracture rate have been linked to CWF, but to date no evidence is available to support claims of harmful fluoride ingested during the period of tooth formation (Pizzo et al., 2007).

The mild form is characterized by opaque white lines along perikymate which may fuse to form opaque white patches, mottled enamel. It may be stained yellow to dark brown by uptake of pigments from food and drinks after the teeth have erupted. In more severe cases discrete pits and larger areas of hypoplasia of enamel may occur to the extent that the normal morphology of the tooth is lost.

A major risk factor in fluorosis is the inappropriate use of fluoride toothpaste in young children who may not be able to expectorate it adequately. In addition, some risk of increasing fluorosis may be attributed to the ingestion of powdered infant formula reconstituted with fluoridated water (in fluoridated areas only) (Pizzo et al., 2007).

Foods and beverages processed in fluoridated areas, as well as the bottled waters with high fluoride concentration, can be significant sources of ingested fluoride for young children. Furthermore, the use of dietary fluoride supplements during the first 6 years of life is associated with a significant increase in the risk of developing fluorosis.

Consequently, fluoride dentifrice use has been identified as a risk factor for fluorosis. Nine dietary fluoride supplementation has also been identified as a risk factor in communities with and without water fluoridation (Steve et al., 1999).

Skeletal fluorosis is a pathological condition that may arise following long-term exposure (either by inhalation or by ingestion) to elevated levels of fluoride. Although the incorporation of fluoride into bone may increase the stability of the crystal lattice and render the bone less soluble, bone mineralization is delayed or inhibited and consequently the bones may become brittle and their tensile strength may be reduced (Grynpas,1990).

The severity of the effects associated with skeletal fluorosis is related to the amount of fluoride incorporated into bone. In a preclinical phase, the fluorotic patient may be relatively asymptomatic, with only a slight increase in bone mass, detected radiographically (WHO, 2002).

The occurrence of endemic skeletal fluorosis has been well documented in case reports and surveys of individuals residing in certain areas of the world (e.g., India, China, northern, eastern, central and southern Africa), where the intake of fluoride may be inordinately high as a result of the often significant consumption of drinking-water containing substantial amounts of naturally occurring fluoride, the indoor burning of fluoride-rich coal for heating and cooking, the preparation of foodstuffs in water containing increased fluoride and/or the consumption of specific foodstuffs naturally rich in fluoride (WHO, 2002)

2.5 Fluoride Metabolism

The use of tropical fluoride results in an additional caries reduction beyond what is provided by CWF. When these products are used, in fact, fluoride can be retained for 2-6 hours in saliva and plaque at concentration which can have significant effect on enamel demineralization/remineralization (Pizzo et al., 2007).

Fluorosis occurs as a result of long-term intake of fluoride during the pre eruptive development of teeth. It is a hypomineralization of enamel characterized by an increased surface and subsurface porosity causing opacity, pitting or staining of the enamel.

Although both primary and permanent teeth may be affected by fluorosis, under uniform conditions of fluoride availability, fluorosis tends to be greater in permanent teeth than in primary teeth. This disparity may be related to the fact that the period of enamel formation for primary teeth is shorter than for permanent teeth, and that the enamel of primary teeth is thinner and has greater opacity than that of permanent teeth, which makes the detection of fluorosis more difficult (Petunici et al., 2009).

No tooth is immune to dental fluorosis, but all teeth are not equally affected. According to Fejerskov et al , teeth that develop early in life, such as incisors and permanent first molars are the least affected (Awadia et al., 1997). Among the former

group, dental trauma and periapical infection of the primary incisors could produce minor enamel defects particularly in the permanent incisors (Hamdan, 2003).

The rate of clearance of fluoride from plasma by bone is higher than that of calcium. In humans and laboratory animals, approximately 99% of the total body burden of fluoride is retained in bones and teeth (Kaminsky et al., 1990; Hamilton, 1992), with the remainder distributed in highly vascularized soft tissues and the blood (McIvor, 1990).

The degree to which fluoride is stored in the skeletal tissue is related to the turnover rate of skeletal components and the level of previous exposure (Caraccio et al., 1983). Levels of fluoride in calcified tissues are generally highest in bone, dentine and enamel. The concentration of fluoride in bone varies with age, sex and the type and specific part of bone and is believed to reflect an individual's long-term exposure to fluoride (WHO, 2002).

During the growth phase of the skeleton, a relatively high portion of an ingested fluoride dose will be deposited in the skeleton. In infants and children with skeletal growth or individuals not consuming fluoridated drinking-water, up to 75% of the daily amount of fluoride that is absorbed may be incorporated into skeletal tissue (United States Department of Health and Human Services, 1991).

When a fluoride dose (e.g., a fluoride tablet or an infant formula diluted with fluoridated drinking-water) is given to infants, the retention will be strongly correlated with the absorbed fluoride dose per kilogram body weight: the higher the fluoride dose, the higher the fluoride retention. Retention of fluoride following intake of a fluoride supplement of 0.25 mg given to infants was shown to be as high as 80–90%. In a study with adults (aged 23–27 years) in which fluoride was given as a single intravenous injection, about 60% of the injected dose (3 mg fluoride as sodium fluoride) was retained (Ekstrand et al., 1978).

2.6 Urinary Fluoride

Urine is the most commonly utilized biomarker for fluoride excretion in public health and epidemiological studies on normal children (Ketley and Lennon, 2001). Approximately 30–50% of fluoride is excreted through urine in children (Ketley and Lennon, 2001; Villa, Anabalon and Cabezas, 2000).

Some dietary factors can increase or reduce the absorption and excretion of ingested fluoride, making the body's retention of fluoride an important yet variable consideration (Maguire et al., 2007) and affect the urinary fluoride concentration. Some of these discrepancies in urinary concentrations can be explained partially by the fact

that the subjects were unable to maintain uniform food and liquid intake during the study.

Fluoride excretion is influenced by a number of factors, including glomerular filtration rate, urinary flow and urinary pH. The excretion of fluoride in urine is reduced in individuals with impaired renal function. Urine fluoride excretion is 0.79 mg/day in humans with normal renal function, 0.53 mg/day in those with questionable and 0.27 mg/day in those with impaired renal function (Singer et al., 1982).

The main pathway of fluoride excretion was via the kidney, and urinary fluoride excretion corresponded to about 50% of fluoride intake (Cross et al., 2003).Many studies found that urinary fluoride concentration was correlated to the amount of fluoride intake, and then fluoride content in urine is considered as a good indicator for reflecting fluoride exposure (Symonds et al., 1988).

2.7 Fluoride In Drinking Water

Fluoride is ubiquitous in the environment, and, therefore, sources of drinking-water are likely to contain at least some small amount of fluoride. The amount of fluoride present naturally in non-controlled fluoridated drinking-water (drinking-water to which fluoride has not been intentionally added for the prevention of dental caries) is

highly variable, being dependent upon the individual geological environment from which the water is obtained (WHO, 2002).

It is estimated that over 300 million people in 39 countries worldwide live in areas where water supplies are fluoridated (Hamdan, 2003). Community water fluoridation (CWF) is the addition of a controlled amount of fluoride to the public water supply with the intention to prevent dental caries in the population.

The recommended fluoride concentration ranges from 0.7 to 1.2 part per million (ppm) , it depends on the climate temperature and water intake in that area . The effectiveness of CWF in preventing caries has been well established and in 2001 the Centers for Disease Control and Prevention (CDC) recognized fluoridation as one of the major public health measures on the 20th century (Pizzo et al., 2007).

In areas of the world in which endemic fluorosis of the skeleton and/or teeth has been well documented, levels of fluoride in groundwater supplies have been reported to range from 3 to more than 20 mg/litre (WHO, 1984; Krishnamachari, 1987; Kaminsky et al.,1990; US DHHS, 1991). In Tanzania, 30% of waters used for drinking-water contained fluoride at concentrations above 1.5 mg/litre, levels in the Rift Valley being up to 45 mg/litre (Latham and Gretch, 1967).

CHAPTER 3

METHODOLOGY

3.1 Study Area Background

The research was conducted in a primary school located in Puchong, District of Petaling, Selangor and the chosen school was Sekolah Kebangsaan Puchong Indah. Students in the school consisted of three major races, Malays, Indian and Chinese. The location is in the middle of Puchong and can be accessed easily by main roads. The school was surrounded by residential areas and shop lots.

3.2 Study Design

The type of study design was cross sectional and it was conducted in order to observe the prevalence of dental fluorosis occurring in the primary school children in Puchong. The independent variables (exposure to fluoride from drinking water) and the

dependent variables (urinary fluoride and dental fluorosis prevalence and severity) for this study were obtained at the current time.

3.3 Sampling Techniques

The population for this study consisted of 12 years old primary school children of Sekolah Kebangsaan Puchong Indah consist of male and female students. Regarding the study sample, the student must fulfill the inclusive criteria such as 12 year-old and living in that same area in first 6 years of his life. This is based on study who indicated that the highest absorption of fluoride and teeth growth occur in the first 6 years of life. (Jackson et al., 1999; Pendrays and Stamms 1990).

The name list of the respondents was obtained from the school authorities and parents consent were taken into account in selecting the respondents. In addition, respondent selections were also based on the inclusive and exclusive criteria. Both of the criteria are shown in the Table 3.1 below.

Table 3.1: Inclusive and Exclusive Criteria of Respondents

Inclusive Criteria	Exclusive Criteria
Standard 6 students	Experiencing kidney problems
Lifelong residents of the study area	Experiencing Diabetes Mellitus
Physically healthy during sample collection	Using water filter at home
Exclusive usage of tap water for drinking and cooking	

3.4 Sample size

The sample size of this study was calculated based on formula by Kirkwood and Sterne, (2009).

$$N = \frac{P(1-P)}{e^2}$$

N= Sample size

P= Prevalence

e= Probability error

According to Kamarul (2001), the prevalence children with dental fluorosis was at 75%.

Therefore, by computing the prevalence (0.75) as well as setting the probability error at 0.05, the sample size was calculated as below;

$$N = \frac{0.75(1-0.75)}{0.05^2}$$

$$= 75$$

However, to ensure the data are representative and to take into consideration missing and damaged data, respondent were increased to rise up the amount of respondent approximately 100 respondent. As the result, 100 respondents were selected as the respondents of this study after the consideration of inclusive and exclusive criteria.

3.5 Data Collection

3.5.1 Urine

Three urine samples were collected from respondents for three consecutive days. Urine samples were collected using a sampling container (50 ml) which was filled beforehand with 0.2 g Ethylene dinitrilotetraacetic acid (EDTA) for preservation purposes.

3.5.2 Drinking Water

Three replicate of drinking water samples were collected from each respondent for three consecutive days. The samples were then analyzed for fluoride using a DR/2800 HACH brand direct reading spectrophotometer. The SPADNS method was used to determine fluoride levels in the water samples which involve the reaction of fluoride with a red zirconium-dye-solution. This method is accepted by USEPA for reporting for drinking and wastewater analysis (HACH Company USA, 2003).

3.5.3 Questionnaire Form

A set of questionnaires was used based on the questionnaire taken from Ministry of Health Malaysia and consisted of two sections which is Section A and Section B. Section A is for personal respondents information whereas Section B is for fluoride exposure information. The purpose of the questionnaire was to obtain information such as socio-demographic and also the history of fluoride exposure on each respondent.

3.5.4 Dental Fluorosis Score

Dental fluorosis score was determined by a competent dentist using the Tooth Surface Index of Fluorosis (TSIF) improvised by Horowitz et al., (1984). This method was used as there was no need to dry the tooth prior to the determination of score of fluorosis. The minimum score is (0), while the maximum score is (7).

3.6 Reliability Test

Pre- testing of questionnaire was conducted on 10% of sample size before data collection to ensure that every question asked in the questionnaire was easily understood and would be answered by the respondents. It was conducted on 12 year-old primary school students of Sekolah Kebangsaan Puchong Utama.

Calibration and reading of the DR/2800 for 10 % of the samples was conducted in order to make sure the instrument was in good condition.

3.7 Equipment and reagents

Below are the equipment and reagents that used in this study:

- Spectrophotometer DR/2800 with SPADNS method to analyse the concentration of fluoride in urine and drinking water
- Questionnaire – to obtain information regarding fluoride exposure
- Tooth Surface Index of Fluorosis (TSIF) score card – to record the occurrence of dental fluorosis and to analyse the severity of dental fluorosis
- EDTA (Ethylenedinitrilo Tetraacetic acid)
- Sample bottle (50 ml sample container for urine collection and 250 ml sample bottle for drinking water collection)

3.8 Measurement of fluoride in drinking water

3.8.1 Urine

Before sampling, 0.2g EDTA was prepared in the container sample. The function of EDTA was to prevent fluoride from binding to other cations such as calcium which will impair the result. Before analysing the samples, each sample was shaken for few

times. This was to dissolve any precipitation that might be exist in the solution. Besides that, bacterial growth was avoided by shaking the sample.

3.8.2 Fluoride concentration analysis

Fluoride concentration in urine and drinking water were analysed using a Spectrophotometer DR/2800 by using SPADNS method. This method was approved by United States Environmental Protection Agency (US EPA). SPADNS method works by the reaction of fluoride with zirconium dye. The reaction forms a clear solution. The wavelength was set at 580 nm. To analyse the sample, 100 ml of urine must be at room temperature before conducting the analysis.

3.9 Tooth Surface Index of Fluorosis (TSIF)

TSIF is a method proposed by Horowitz et al. (1984) based on aesthetic aspects of tooth surface classifying individuals into 8 categories. In this index, a value is given for each anterior tooth surface not restored (buccal and lingual) and three values for posterior tooth surfaces (buccal, lingual and occlusal). These dental fluorosis indexes have been compared in several scientific articles.

Table 3.2: Tooth Surface Index of Fluorosis (TSIF) (Horowitz et al., 1984)

Scores	Description
0	Enamel shows no evidence of fluorosis
1	Enamel shows definite evidence of fluorosis, namely areas which parchment-white colour that total less than one-third of the visible enamel surface.
2	Parchment-white fluorosis totals at least one-third of the visible surface, but less than two-thirds
3	Parchment-white fluorosis totals at least two-thirds of the visible surface
4	Enamel shows staining in conjunction with any of the preceding levels of fluorosis. Staining is the definite discoloration of teeth ranging from light to very dark brown
5	Discrete pitting of enamel exists, unaccompanied by evidence of staining of intact enamel.
6	Both discrete pitting and staining of the intact enamel exist
7	Confluent pitting of the enamel surface exists. Dark brown stain usually present. Anatomy of tooth might be altered and large portion of enamel might be lost.

3.10 Data Analysis

All data obtained were analyzed by using Statistical Package for Social Science (SPSS) Version 15.0. Descriptive statistic was used to analyze the socio-demographic data of the respondents. Among the descriptive statistics were mean, median, standard deviation, range and percentiles/quartiles.

Other tests that were used are normality test (to determine the data is normally distributed) and correlation test. If the data was not normal, data was logged and the normality test was repeated. If the data was still not normal, non-parametric test was used instead.

3.11 Ethical Consideration

This study received ethical approval from the Research and Ethical Committee, Faculty Medicine and Health Sciences of University Putra Malaysia.

i) The respondents were given explanation about the whole study activities involved.

ii) The respondents were given explanation about the purpose of taking drinking water and urine samples.

iii) The respondents were given explanation about the test in term of the purpose of the test, the procedure taken, and also the respondents' right in this study.

CHAPTER 4

RESULTS

4.1 Socio Demographic Data

The study took place in SK Puchong Indah, in Petaling District, Selangor Darul Ehsan. It involved 71 twelve year-old Malay and Indian children. Before the research took place, the name list of the standard six students were obtained from the head master. A total number of 71 students were chosen after fulfilling the inclusive and exclusive criteria.

From 71 respondents, 27 (38.02%) were male while the rest 44 (61.97%) were female.

Table 4.1: Gender Distributions of Respondents

Gender	Number of respondent	Percentage %
Male	27	38.02
Female	44	61.97

N=71

Regarding the location of respondents houses, 60 (84.5%) of them stayed in urban areas while 11 (84.5%) stayed in suburban areas. In the occupation category, 30 (42.3%) of the students' fathers worked in the non government sector and 31 (57.7%) worked in the government sector.

Regarding respondents' mothers occupation, 39 (54.9%) of them were housewives and 32 (45.1%) work either in the government or non-government sectors.

In the parent's education part, 60 (84.5%) of the student's father did finished their secondary education and 11 (15.5%) of them did further their studied in higher education.

In the other hand, 62 (87.3%) of the student's mother did finished their secondary school education and 9 (12.7%) of them did further their study in higher education level.

4.2 The prevalence and severity of dental fluorosis

The degree of dental fluorosis was determined by a competent dentist from the Dental Department, Student Health Centre, University Putra Malaysia and the result showed the mean score for the dental fluorosis was 0.97± SD 1.00, with the minimum value is 0 and the maximum value is 3.The prevalence of dental fluorosis in this study was 57.75%.

Table 4.2: Respondent's Dental Fluorosis Information

Variables	Mean	Standard deviation	Minimum	Maximum
Dental Fluorosis	0.97	1.000	0	3

Table 4.3: Respondent's Dental Fluorosis Severity

Score	Frequency	Percentage (%)
0	30	42.3
1	19	26.8
2	16	22.5
3	6	8.5

Respondents with score 0 were 30 (42.3%), 6 (8.5%) of respondents had score 3, 16 (22.5%) had score 2, 19 (26.8%) had score 1 and 30 (42.3%) had score 0.

4.3 Fluoride in drinking water and urine

Mean for urinary fluoride was 1.14 ± SD 0.34 mg L^{-1}. The minimum reading obtained was 0.3 and the highest value was 1.75.

Mean fluoride contained in drinking water was 0.40 ± SD 0.12 mg L^{-1}. The minimum reading obtained was 0.12 and the highest reading was 0.64.

Table 4.4: Fluoride Concentration in Drinking Water and Urine

	Mean (mg L^{-1})	Std. Deviation	Minimum	Maximum
Urine	1.14	0.34	0.30	1.75
Drinking Water	0.40	0.12	0.12	0.64

4.4 Relationship of dental fluorosis score with fluoride concentration in drinking water

A correlation test was conducted to find the relationship between dental fluorosis score and fluoride concentration in water. The correlation test used was Spearman Rho's correlation as both data were not normal. It was found that there was no significant relationship between the variables as the p value more than 0.05. The r value was 0.03 and the p value was 0.81.

Table 4.5: Relationship of dental fluorosis score with fluoride concentration in drinking water

Variable	r	p
Fluoride concentration in drinking water	0.03	0.81

4.5 Relationship of dental fluorosis score with urinary fluoride concentration

A correlation test was conducted to find the relationship between dental fluorosis score and urinary fluoride concentration. The correlation test used was Spearman Rho's correlation as both data were not normal. It was found that there was no significant relationship between the variables as the p value more than 0.05. The r value was -0.09 and the p value was 0.45.

Table 4.6: Relationship of dental fluorosis score with urinary fluoride concentration

Variable	r	P
Urinary fluoride concentration	-0.09	0.45

4.6 To determine the fluoride exposure on maxillary central incisors.

Maxillary central is a good indicator of fluorosis exposure in early stage of life. From the study, 6 (5.4%) of the respondents did experienced fluorosis on maxillary

central incisors and 65 (58.6%) of the respondents did not experienced fluorosis on maxillary central incisors.

4.7 Comparison of fluorosis prevalence between male and female respondents

In this study, prevalence of fluorosis was 55.56 % among male respondents and 59.09 % among female respondents. Chi- Square test was conducted in order to figure out any difference of fluorosis prevalence between genders. This study showed that there was no significant difference of dental fluorosis prevalence between male and female respondents (X^2=0.086, p=0.770).

4.8 The duration of breastfeeding

Regarding breastfeeding duration among respondents, 22 (62.89%) of those breastfeed for less than 12 months experienced dental fluorosis, 13 (37.11%) of those breastfed for less than 12 months did not experienced dental fluorosis and in the other hand 19 (54.29%) of those breastfeed for more than 12 months experienced dental fluorosis and 16 (45.71%) of those breastfed for more than 12 months did not experienced dental fluorosis.

Chi Square test was conducted in order to figure out any difference of fluorosis prevalence between respondents who were breastfed more than 12 months and less than 12 months. This study showed that there was no significant difference of dental fluorosis prevalence between respondents who were breastfed more than 12 months and less than 12 months.

Table 4.7: Breastfeeding Duration and Fluorosis Occurrence

Variable	<12 months	>12 months	X^2	p
With fluororsis	11 (45.83%)	30 (63.83%)	2.109	0.146
Without Fuororsis	13 (54.17%)	17 (36.17%)		

N = 71

CHAPTER 5

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5. 1 DISCUSSION

5.1.1 Socio-demographic of respondents

In this study, respondent selection were done on students of SK Puchong Indah. This school is situated in Puchong Indah in the district of Petaling, Selangor. The location of this school is in the urban area. It was chosen to show the prevalence of dental fluorosis among children in an urban area in Selangor.

In the study, respondents were selected based on several criteria such as the children must be 12 years old (WHO 1997) and must stay in the same area for at least 6 years (Kumar, 2004).

A total of 71 respondents were chosen as study sample which consisted of 27 (38.02%) male and 44 (61.97%) female.

5.1.2 The Prevalence and Severity of Dental Fluorosis

The mean score for dental fluorosis was 0.97±SD 1.00. The minimum reading was 0 and maximum reading was 3. Majority of the respondents had TSIF score 0 and 6 respondent obtain the highest score which was 3. Respondents with score 0 were 30 (42.3%), 6 (8.5%) of respondents had score 3, 16 (22.5%) had score 2, 19 (26.8%) had score 1 and 30 (42.3%) had score 0.

In a study to determine fluorosis score in three states, Shaharuddin et al. (2010) reported that prevalence of fluorosis in Kuala Terengganu, Pasir Mas and Kota Kinabalu were 31.6% which was lower compared to the current study which was 57.75%.

This result reflected that the increase of fluorosis is likely to be related to other intake of fluoride containing products by the respondents, one example of fluoride containing products that may contribute to fluorosis is tea beverage which is one of the popular beverages among Malaysian. Some tea beverages intended for children's nutrition may appreciably increase children's fluoride exposure. None of these products mentioned fluoride content on the label (Opydo-Szymaczek and Opydo, 2010).

5.1.3 Fluoride in Drinking Water and Urine

From the data obtained, mean for urinary fluoride was 1.14± SD 0.34 mg L^{-1} .The minimum reading obtains throughout the study was 0.3 and the highest value was 1.75. From the result, it showed that all the reading were within the normal value as stated by NIOSH. In addition, the reading also indicated that all respondents were not exposed to excessive levels of fluoride.

The mean for urinary fluoride 1.14±SD 0.34 mg L^{-1} in this study was also consistence with other published articles. The persons, who are not exposed to excessive levels of fluoride have a urinary fluoride concentration in the range of1.0–1.5 mg/L (Murray, 1986).

From the data obtained, mean of fluoride in drinking water was 0.40±SD 0.12 mg $L^{-1.}$ The minimum reading was 0.12 and the highest reading was 0.64. It showed that the mean value was within the standard value and there was no reading above the standard. However, there were 17 (23.94%) readings below the standard.

Fluctuations in the fluoride concentration of monthly water samples from both artificially and naturally fluoridated drinking water have been reported from various regions of the world (Larsen et al., 1989). A retrospective study from the city of Porto Alegre, Brazil revealed that fluoride was not added to the drinking water for almost a

quarter of the observed period (13 years). Even when fluoride was added, fluctuations (between 0.6 mg/L and 2.0 mg/L) were observed (Borros et al., 1990).

5.1.4 Relationship between dental fluorosis score with fluoride concentration in drinking water

It was found that there was no significant relationship between dental fluorosis score with fluoride concentration in drinking water as the p value was more than 0.05. The r value was 0.03 and the p value was 0.81.

The result also showed that fluoride present in drinking water was not the only source of children exposure to fluoride. This study suggested that other sources such as tooth paste could be one of the important sources of fluoride exposure among children.

Children who began using fluoride toothpaste under 2 years of age were at a higher risk of enamel fluorosis than those who did not use fluoride toothpaste at all or began to use it later. Excess fluoride can be ingested if children inadvertently swallow too much toothpaste (Centers for Disease Control and Prevention, 2001).

In addition, the amount of tooth paste applied also may serve as contributing factor for dental fluorosis occurrence. A pea-sized amount of toothpaste on the brush is

more than adequate to clean young children's teeth but this amount (0.25–0.3 g) is often exceeded (CDC, 2001).

Accidental ingestion of tooth paste may also lead to dental fluorosis which is known to be other sources of fluoride other than drinking water. When children have not learned how to adequately rinse out their mouths, they in turn, ingest too much toothpaste (Berkowitz, 1992). Other than that, dental fluorosis was also caused by ingested fluoride as a result after consuming food products which contained a high amount of fluoride such infant foods.

Among various infant foods, milk formulas (especially in the form of powdered concentrate),foods containing chicken, some bottled waters and beverages, were identified as significant sources of ingested fluoride (Centers for Disease Control and Prevention, 2001; Fomon et al., 2000; Heilmanet al., 1997; Hujoel et al., 2009; Van Winkle et al., 1995).

This was supported by a research conducted by Levy et al., (2010) who revealed that fluoride intake from reconstituted powdered formulas (when participants were aged 3–9 months) increased fluorosis risk and that prevalence of mild dental fluorosis can be reduced by avoiding ingestion of large quantities of fluoride from reconstituted powdered concentrate infant formula.

5.1.5 Relationship of dental fluorosis score with urinary fluoride concentration

It was found that there was no significant relationship between dental fluorosis score with urinary fluoride concentration as the p value was less than 0.05. The r value was -0.09 and the p value was 0.45.

From this study, the mean for urinary fluoride concentration was 1.14±SD 0.12 mg L^{-1} and it is within the normal range as stated by NIOSH (0.2-3.2 mg L^{-1}) , however the mean value was higher compare to a research conducted by Hamid (2010) in Iran but consistent with research conducted by Rugg-Gunn (1993) in Sri Lanka. As mentioned in that report, a higher daily urinary F excretion in Sri Lankan children can be attributed to higher urine volume due to greater water consumption with higher air temperatures.

This reason may be applicable in this study as Malaysia is a tropical country and drinking water consumption in Malaysia may also be high due to the high temperature and its climates.

5.1.6 Determination of fluoride exposure on maxillary central incisors

From the study, 6 (5.4%) respondents did experienced fluorosis on maxillary central incisors and 65 (58.6%) respondents did not experienced fluorosis on maxillary central incisors. The importance of determining fluorosis occurrence on maxillary central incisors was because it may serve as indicator of period for dental fluorosis exposure on each respondent.

The most sensitive period for the development of dental fluorosis in the permanent incisor teeth from ingested fluoride appears to be from beginning of enamel formation at age 3–4 months to 5 years of age (Mc Donald et al., 2004).

The occurrence of dental fluorosis is reported to be most strongly associated with cumulative fluoride intake during critical period of enamel development. Enamel is no longer susceptible once its pre-eruptive maturation is complete, so concerns regarding the risk for dental fluorosis are limited to children aged<8 years. Thus, excessive fluoride intake must occur during early childhood, to affect the most aesthetically important teeth (Centers for Disease Control and Prevention, 2001; Fomon et al., 2000; Honget al., 2006; Pang et al., 1992).

The results of this study showed that majority of the respondents were not exposed to high amounts of fluoride during early stage of enamel formation and it can

probably due to consumption of food which contained very low level of fluoride including breast milk.

5.1.7 Comparison of fluorosis prevalence between male and female respondents

In this study, prevalence of fluorosis was 55.56% among male respondents and 59.09% among female respondents. Chi-Square test was conducted in order to figure out any difference of fluorosis prevalence between genders. This study showed that there was no significant difference of dental fluorosis prevalence between male and female respondents (X^2=0.086, p=0.770).

The result of this study consistent with study conducted in Kerala, India by Gopalakrishnan (1999) and also a study conducted in Yemen by Alkholani (1999).

5.1.8 Duration of breastfeeding among respondents

Regarding breastfeeding duration and its relationship with dental fluorosis, 22 (62.89%) of those breastfed for less than 12 months experienced dental fluorosis and 19 (54.29%) of those breastfeed for more than 12 months experienced dental fluorosis.

Chi Square test was conducted in order to figure out any difference of fluorosis prevalence between respondents who were breastfed more than 12 months and less than 12 months. This study showed that there was no significant difference of dental fluorosis prevalence between respondents who were breastfed more than 12 months and less than 12 months.

This study suggested that breastfeeding infants for a longer period may help to protect against dental fluorosis in fluoridated areas and mothers should be advised that they may be able to protect their children from dental fluorosis by breastfeeding their infants from birth and extend the duration of breastfeeding.

5.2 CONCLUSION

The main objectives of this study which was to study the prevalence and severity of dental fluorosis among 12-year-old old primary school children when using fluoridated water supply. The first hypothesis was rejected because there were no significant relationships between severity of dental fluorosis with fluoride concentration in water supply

Second hypothesis was also rejected because there was no significant relationship between severities of dental fluorosis with urinary fluoride concentration.

The third hypothesis of this study, there was difference in prevalence of dental fluorosis between male and female respondents was also rejected because there was no significant difference between prevalence of dental fluorosis and gender. The conclusion of this research is all of the objectives of the research were achieved.

5.3 RECOMMENDATION

There are several recommendations which are appropriate in order to enhance this type of study in the future. One of them is to consider a study on the prevalence and severity of fluorosis among 12-year-old children between Malays, Indians and Chinese.

Next is every parent should monitor their children especially in oral hygiene aspects. They should make sure that their children start brushing teeth only after 2 years old. This will ensure that their exposure towards fluoride in toothpaste is reduced and it will help in preventing dental fluorosis.

In addition, the parents should also make sure that the amount of toothpaste used do not exceed the suggested amount which is a pea-sized (0.25-0.3) gram. Parents should also provided fluoride-free tooth paste for the use of their children.

Toothpaste with special flavors for children such as the taste of fruity strawberries and bananas should be abolished because this encourages children to swallow it while they are brushing their teeth. Hence it should be controlled to prevent fluorosis due to extra intake of fluoride. This is to make sure that the child does not accidently ingested potential sources of fluoride while brushing their teeth.

Lastly, children below 6 years of age should not use mouth rinse without prior consultation with a dentist as fluorosis could occur if such mouth rinses are swallowed. Parents should also take the initiative to bring their children to perform regular check up on oral health as the dentist will be able to give advice and give proper treatment whenever necessary.

REFERENCES

Awadia, A. K., Bjorvatn, K., Birkeland, J.M., Dental Fluorosis With Special Referece To Incisors And Molars Of Tanzanian School Children. *2nd International Workshop On Fluorosis Prevention and Defluoridation of water.*

Beltran, E. D., Burt, B.A. (1988) The pre- and posteruptive effects of fluoride in the caries decline. *J Pub Health Dent.* ; 48(4):233-240.

Berkowitz, J. (1997). The influence of various fluoride exposures on the prevalence of esthetic problems resulting from dental fluorosis. *Journal of Public Health Dentistry..*

Boros, I., Keszler, P. (1999). Study of saliva secretion and the salivary fluoride concentration of the human minor labial glands by a new method. *Archives of oral biology.*

Centre for Disease Control and Prevention. (2001). Record for using fluoride to prevent and control dental caries in the U.S. Morbidity and Mortality Weekly Report ; 50:1–42

Chandrajith, R., Abeypala, U., Dissanayake, C. B., & Tobschall, H. J. (2007). Fluoride in Ceylon tea and its implications to dental health. *Environmental Geochemistry and Health*, 29(5), 429–434.

Cury J.A., Tenuta L. M. A., Ribeiro. (2004) The importance of fluoride dentifrices to the current dental caries prevalence in Brazil. *Braz Dent J* 15:167–174.

Brambilla, E., Strohmenger, L. (2001). The use of fluoride varnishes in the prevention of dental caries: a short review. *Oral Disease.* 7, 71–80.

Brothwell, D., Limeback, H. (2003) Breastfeeding Is Protective Against Dental Fluorosis in a Non fluoridated Rural Area of Ontario, Canada. 386-389.

Dean, H. T., Arnold, F.A., Elvove, E. (1942). Domestic water and dental caries, v. additional studies of the relation of fluoride domestic waters to dental caries experience in 4425 white children aged 12-14 years, of 21 cities in 4 states. *Public Health Report* 1942; **57**: 1155-1179.

Ellwood, R., Fejerskov, O., Cury, J.A., Clarkson, B. (2008). Fluoride in caries control. In: Dental caries: the disease and its clinical management. 2nd ed. Oxford: Blackwell Munksgaard, pp. 287-323.

Ericsson, Y., & Ribellius. (1971). Wide Variations of fluoride supply to infants and young children. *Pediatric Dentist*, 1: 44-54.

Ethel, V., Paula, V. (1987). Dental Fluorosis Among Schoolchildren in Gozo, Malta. *British Medical Journal.*

Fernanado, N.H., Silvia, C., Maria, L.R. (2007). Relationship between fluoride levels in the public water supply and dental fluorosis. Rev *Saúde Pública*. 41(5):732-39.

Fomon, S.J., Ekstrand, J., Ziegler, E.E., (2000). Fluoride intake and prevalence of dental fluorosis: trends in fluoride intake with special attention to infants. *J. Public Health Dent*. 60, 131–139.

Pizzo, G., & Maria R. Piscopo & Ignazio Pizzo & Giovanna Giuliana. (2007). Community water fluoridation and caries prevention: a critical review. *Clin. Oral Invest* DOI 10.1007/s00784-007-0111-6.

Gopalakrishnan, P., Vasan, R.S., Sarma, P.S. (1999) Prevalence of dental fluorosis and associated risk factors in Allappuzha district, Kerala. *Medical Journal of India.*

Groeneveld, A., Van Eck AA, Backer, D. (1990). Fluoride in caries prevention: is the effect pre- or post-eruptive? *JDent Res.*;69:751-755.

Grynpas, D. (1990). Supplement: Journal of Bone and Mineral Research. *Journal of Bone and Mineral Research*. Volume 5, Issue Supplement S1, pages S169–S175.

Hamdan, M. (2003) The prevalence and severity of dental fluorosis among 12-year-old schoolchildren in Jordan ,*International Journal of Paediatric Dentistry* 2003; **13:** 85–92.

Hamid, R.P., Payam, K. (2010). Fluoride intake and urinary excretion in preschool children residing in Koohbanan, Iran, A city with high fluoride water and food. (2010). *Fluoride*, 43(1), 67–70.

Hamiton, M. (1992). Water fluoridation: A risk assessment perspective. *Journal of Environment and Health.* Vol. 54, no. 6, pp. 27-31.

Hong, L., Levy, S.M., Broffitt, B., Warren, J.J., Kanellis, M.J., Wefel, J.S., Dawson, D.V. (2006). Timing of fluoride intake in relation to development of fluorosis on maxillary central incisors. *Community Dent. Oral Epidemiol.* 34, 299–309.

Horowitz, H. S., Driscoll W. S., Meyers R.J., Heifetz S.B., Kingmann A. (1984). A new method for assessing the prevalence of dental fluorosis-the tooth surface index of fluorosis. *J Public Health Dent*, 55(2), 79-84.

Jackson, R. D., Kelly,S.A., (1999). Dental fluorosis in children residing in communities with different water fluoride levels: 33-month follow-up *Pediatric Dentistry.*

Jones, S., Burt, B.A., Petersen, P.E. (2005) The effective use of fluorides in public health. *Bull World Health Organ* 83:670–676.

Kirkwood, B.R., Sterne, J.A.C. (2003). Essential Medical Statistics, Chapter 24: Poisson Regression.Oxford: Blackwell Science Ltd., 249–262.

Ketley, C.E., Lennon, M.A., (2001). Determination of fluoride intake from urinary fluoride excretion detain children drinking fluoridated school milk. *Caries Res.* 35, 252–257.

Krishnamachari, K.A. (1986). Skeletal fluorosis in humans: a review of recent progress in the understanding of the disease. *Progress in Food & Nutrition Science*.10(3-4):279-314.

Larsen, M.J., Kirkegaard, E., Poulsen, S., Fejerskov, O. (1989). Dental fluorosis among participants in a non-supervised Ouoride tablet program. *Community Dent Oral Epidemiol*; 17; 204-6.

Laurence, S., Kaminsky, Martin, C. (1990). Fluoride: Benefits and Risks of Exposure. *Oral Biology and Medicine.*

Levy, S.M., Kohout F.J., Heilman J.R., Wefel J.S. (1995). Infants' fluoride intake from drinking water alone and from water added to formula, beverages, and food. *J Dent Res.*; 74:1399-1407.

McIvor, M. E. (1990). Acute fluoride toxicity. Pathophysiology and management. *Drug Saf.* Mar-Apr;5(2):79-85.

Murray, J. (1986). Appropriate use of fluoride for human health, World Health Organization, Ginebra, p. 3.

Ministry of Health Malaysia, (2002). Annual Report, Engineering Division. http://vlib.moh.gov.my/cms/documentstorage/com.tms.cms.document.Document_752b015d-c0a81049-1a82e920-420527fd/Annual%20Report%202007.pdf

Morgan, S.N., Murray, A.M. (1987). Fluoride in saliva and plaque following use of fluoride-containing mouthwashes. *Joural of dental.*

Opydo-Szymaczek J., Jadwiga O. (2011). Dietary fluoride intake from infant and toddler formulas in Poland. *Food and Chemical Toxicology,* 49 : 1759–1763.

Rahimah, A.K., & Latifah, A.L. (1998). Fluoride level in dentrifices. Ann. Dentist. Univ. Malaya, 5:2-5 http://majlis.fsktm.um.edu/my/document.aspx?FileMame=468.pdf.

Rugg-Gunn A.J., Nunn J.H., Ekanavake L, Saparamadu K.D., Wright W.G. (1993). Urinary fluoride excretion in 4-year-old children in Sri Lanka and England. *Caries Res* ;27(6):478-3.

Shaharuddin, M.S., Kidahus, M.N., Sumarlan, S. (2010). Dental Fluorosis (DF) and its relationship with fluoride levels in Drinking Water in Three States in Malaysia, *Research Journal of Medical Sciences* 4(1): 20-24.

Maguire, A., Zohouri, F.V., Hindmarch, P.N., Hatts J, Moynihan, P.J.(2007). Fluoride intake and urinary excretion in 6- to 7-year-old children living in optimally, sub-optimally and non-fluoridated areas. *Community Dent Oral Epidemiol* .35: 479–488.

MacLaughlin, E. Rebecca, S. Danny, M. (2006). Management of Age-Related Osteoporosis and Prevention of Associated Fractures. September; 2(3): 281–295.

Neal R. A. (1985). Chemicals and Safe Drinking Water: National and International Prospective. 1st Edn, In: Rice, RG (Ed.). Safe Drinking Water. The impact of chemicals on a limited sources.pp: 1-8,183-195.

Pang, D.T.Y., Phillips, C.L., Bawden, J.W. (1992). Fluoride intake from beverage consumption in a sample of North Carolina Children. *J. Dent. Res*, 71, 1382–1388.

Petinuci, P.A., Kaneshiro, K.P., Rabelo, M.A. (2005). Dental Caries and Dental Fluorosis in 7-12 Year old School Children In Catalao, Brazil. *J Appl Oral Sci*; 13(1):35-40.

Razak, I. A.(1986). Changing trends in the pattern of dental caries of 12-year-old schoolchildren between 1979- 1985. *Sing Dent J*; 1: 11-14.

Simko, L.C. (1997). Water fluoridation: Time to reexamine the issue. *Pediatric Nurse*, 23(2): 155-159.

Saravanan, S., Kalyani, C., Vijayarani, M.P. (2008). Prevalence of Dental Fluorosis Among Primary School Children in Rural Areas of Chidambaram Taluk, Cuddalore District, Tamil Nadu, India .*Indian Journal of Community Medicine*, Vol. 33, Issue 3, July 2008.

Steven, M., Adair, M.S., Carole M. Hanes, Carl, M. (1999) Dental caries and fluorosis among children in a rural Georgia area *Pediatric Dentistry – 21:2.*

Symonds, R.B., Rose. W.I., Reed, M.H., (1988). Contribution of Cl- and F-bearing gases to the atmosphere by volcanoes. *Nature*, 334:415-418.

Thylstrup, A. (1990). Clinical evidence of the role of pre-eruptive fluoride in caries prevention. *J Dent Res*. 1990;69:742-750.

USDHHS, PHS, NIH, NIDR (1991). Oral health surveys of the National Institute of Dental Research: diagnostic criteria and procedures. NIH Publication No. 91-2870. Bethesda, MD: US Department of Health and Human Services, NIH.

Van Winkle, S., Levy, S.M., Kiritsy, M.C., Heilman, J.R., Wefel, J.S., Marshall, T. (1995). Water and formula fluoride concentrations: significance for infants fed formula. *Pediatr. Dent*. 17, 305–310.

Villa, A., Anabalo, M., Cabezas, L. (2000). The fractional urinary fluoride excretion in young children under stable fluoride intake conditions. *Community Dent Oral Epidemiol* .28: 344–55.

Whelton, H.P., Ketley, C.E., McSweeney, F., O'Mullane, D.M. (2004). A review of fluorosis in the Europen Union: A review of fluorosis in the Europen Union: Prevalence, risk factors and aesthetic issues. *Community Dent Oral Epidemiol* 32(Suppl. 1): 9-18.

World Health Organisation, (2002). Fluorides, Environmental Health Criteria 227, International Programme on Chemical Safety, Geneva.

Xiang, Q. Y., Liang, Y. X., Chen, B. H., Wang, C. S., Zhen, S.Q., Chen, X. D. (2004). Serum fluoride and dental fluorosis in two villages in China. *Fluoride*, 37(1), 1–10

Zhang, B. O., Hong, M., Zhao, Y., Lin, X., Zhang, X., & Dong, J. (2003). Distribution and risk assessment of fluoride in drinking water in the west plain region of Jilin Province, China. *Environmental Geochemistry and Health*, 25, 421– 431.

Appendix 1 Ethical approval letter from UPM

Appendix 2 Application form for research project

KEMENTERIAN PELAJARAN MALAYSIA
BAHAGIAN PERANCANGAN DAN PENYELIDIKAN PENDIDIKAN
ARAS 1 - 4, BLOK E8
KOMPLEKS KERAJAAN PARCEL E
PUSAT PENTADBIRAN KERAJAAN PERSEKUTUAN
62604 PUTRAJAYA.

Telefon: 03-88846591
Faks : 03-88846579

BORANG BPPDP 1

PERINGATAN KEPADA PENYELIDIK

1. Tiap-tiap permohonan hendaklah menggunakan satu salinan Borang BPPDP 1.
2. Satu salinan cadangan penyelidikan yang lengkap hendaklah juga disertakan.
3. Satu salinan instrumen kajian dan satu salinan senarai sampel hendaklah juga dilampirkan sekiranya cadangan penyelidikan tidak mengandungi perkara-perkara tersebut. Penyelidik tidak digalak melibatkan kelas-kelas peperiksaan dalam penyelidikan..
4. Sila sertakan permohonan bersama TIGA sampul surat (21.5 cm x 10.5 cm) bersetem 50 sen tiap-tiap satu.
5. Satu naskah disertasi/tesis/laporan kajian ini hendaklah dihantar kepada Pengarah, Bahagian Perancangan dan Penyelidikan Dasar Pendidikan, Kementerian Pelajaran Malaysia sebaik sahaja ia siap.
6. Kementerian Pelajaran Malaysia berhak menolak sebarang permohonan untuk menjalankan penyelidikan di institusi di bawah Kementerian Pelajaran dan membatalkan kebenaran yang telah diberi tanpa memberi apa-apa sebab.

SENARAI SEMAK

1. Disertakan satu salinan Borang Penyelidikan BPPDP I.	☐ Ya ☐ Tidak
2. Disertakan satu salinan cadangan penyelidikan yang lengkap.	☐ Ya ☐ Tidak
3. Disertakan satu salinan instrumen kajian sekiranya cadangan penyelidikan tidak mengandunginya.	☐ Ya ☐ Tidak
4. Disertakan satu salinan senarai sampel kajian sekiranya cadangan penyelidikan tidak mengandunginya.	☐ Ya ☐ Tidak
5. Sampel kajian melibatkan pelajar yang akan mengambil peperiksaan UPSR, PMR, SPM dan STPM.	☐ Ya ☐ Tidak
6. Disertakan tiga sampul surat (21.5 cm x 10.5 cm) bersetem 50 sen tiap-tiap satu.	☐ Ya ☐ Tidak

8263445989

Borang BPPDP 1
(Diisi dalam satu salinan saja)

Tarikh Diterima:

Pengarah
Bahagian Perancangan dan Penyelidikan Dasar Pendidikan
Kementerian Pelajaran Malaysia
Aras 1 - 4, Blok E8
Kompleks Kerajaan Parcel E
Pusat Pentadbiran Kerajaan Persekutuan
62604 PUTRAJAYA.

Permohonan Untuk Menjalankan Penyelidikan Di Sekolah-Sekolah, Maktab-Maktab Perguruan, Jabatan-Jabatan Pelajaran dan Bahagian-Bahagian di Bawah Kementerian Pelajaran Malaysia

BAHAGIAN A: Butir-Butir Diri Penyelidik (*Untuk diisi oleh pemohon*)

1. Nama Penyelidik: (Encik/Puan/Cik/Dr.)

2. No. Kad Pengenalan

3. Alamat surat menyurat

Poskod Bandar Negeri

4. No. Telefon 5. No. Telefon Bimbit

6. Alamat emel

7. Pekerjaan (Untuk mereka yang berkerja)

BAHAGIAN B: Maklumat mengenai institusi tempat anda belajar

8. Nama Institusi

9. Alamat Institusi

10. No. Telefon

11. Fakulti/Jabatan/Tahun Pengajian

BAHAGIAN C: Maklumat Mengenai Penyelidikan

12. Tajuk Penyelidikan

13. Peringkat Penyelidikan (Tandakan X di dalam kotak yang berkenaan)

☐ Diploma ☐ B.A/B.Sc ☐ M.A/M.Ed./M.Sc ☐ Ph.D/Ed.D ☐ Kajian Am

		Hari	Bulan	Tahun		Hari	Bulan	Tahun
14. Tarikh menjalankan kajian rintis:	Dari				hingga			
15. Tarikh penyelidikan sebenar:	Dari				hingga			
16. Tarikh laporan/tesis/disertasi dijangka siap								

17. Dengan ini saya _____ mengaku bahawa saya akan mematuhi segala syarat yang ditetapkan oleh Kementerian Pelajaran. Saya memberi jaminan bahawa satu naskah disertasi/tesis/laporan yang berkenaan akan dihantar kepada Bahagian Perancangan dan Penyelidikan Dasar Pendidikan, Kementerian Pelajaran Malaysia melalui Ketua Jabatan/Fakulti saya sebaik sahaja ianya siap.

Tarikh _____

_____

Tandatangan Penyelidik

BAHAGIAN D: Untuk Diisi oleh Ketua Jabatan/Fakulti Penyelidik

Permohonan ini ☐ Disokong ☐ Tidak disokong

Ulasan (jika ada)

Penyelidik telah membuat pengakuan bahawa satu salinan disertasi/tesis/laporan akan dihantar kepada Bahagian Perancangan dan Penyelidikan Dasar Pendidikan, Kementerian Pelajaran Malaysia apabila ianya siap melalui Ketua Jabatan/Fakulti.

Tarikh _____

_____

Tandatangan Ketua Jabatan/Fakulti

Nama _____

Cop Rasmi:

BAHAGIAN E: Ringkasan Cadangan Penyelidikan (*Untuk diisi oleh pemohon*)

1. Objektif Kajian

2. Kepentingan kajian kepada Kementerian Pelajaran

3. Tempat kajian akan dijalankan (Senaraikan nama sekolah, maktab perguruan, Jabatan Pelajaran atau Bahagian-Bahagian di bawah Kementerian Pelajaran di mana kajian akan dijalankan.)

4. Sampel kajian (Nyatakan bilangan murid, Guru Besar/Pengetua/guru/pensyarah/pegawai-pegawai yang akan dijadikan sampel dalam kajian ini. Sekiranya menggunakan pelajar-pelajar sekolah sila nyatakan Tahun/Tingkatan mereka belajar.)

5. Instrumen kajian

BAHAGIAN F: Penilaian Cadangan Penyelidikan (*Untuk kegunaan pejabat*)

1. Masalah penyelidikan - kesesuaiannya dengan keutamaan Kementerian Pelajaran.

☐ Sangat Sesuai ☐ Sesuai ☐ Tidak Sesuai

2. Kaedah penyelidikan - data yang dikumpul dan kaitannya dengan dasar kerajaan

☐ Tidak Bercanggah ☐ Bercanggah

3. Sampel kajian - kesesuaian sampel dari segi tidak mengganggu perjalanan sekolah/Jabatan-Jabatan Pelajaran/Bahagian-Bahagian di Kementerian Pelajaran.

☐ Sangat Sesuai ☐ Sesuai ☐ Tidak Sesuai

4. Hasil penyelidikan - faedah penyelidikan kepada Kementerian Pelajaran.

☐ Sangat Sesuai ☐ Sesuai ☐ Tidak Sesuai

Ulasan dan Pandangan

Kelulusan Permohonan

☐ Diluluskan ☐ Diluluskan dengan bersyarat ☐ Tidak diluluskan

Disediakan oleh:

_____

(Tandatangan Pegawai Penilai)

b.p. Panel Penilai Cadangan Penyelidikan
Bahagian Perancangan dan Penyelidikan Dasar Pendidikan
Kementerian Pelajaran Malaysia

Tarikh Hari Bulan Tahun ☐☐ ☐☐ ☐☐☐☐

5609453912

Appendix 4 Permission letter from

Selangor Education Department

Appendix 5 Permission form from parents

PENERANGAN KEPADA PESERTA

Tajuk Kajian: Prevalent fluorosis gigi dan pendedahan fluorida di kalangan pelajar sekolah rendah di Puchong, Selangor.

Terima kasih kerana membantu kami dalam menjalankan kajian ini.

Apakah kajian ini?
Kajian ini adalah berkenaan pendedahan fluorida yang terdapat di dalam air minum ke atas tubuh badan manusia. Florida yang terkandung di dalam air minuman, makanan, dan juga udara diserap oleh tubuh tanpa disedari. Kadar fluorida yang berlebihan boleh mendatangkan pelbagai masalah kesihatan seperti fluorosis gigi dan tulang. Kesan florida ke atas tubuh badan manusia dapat dikenalpasti melalui kadar fluoride dalam air kencing dan juga keadaan gigi.

Apakah tujuan kajian ini dijalankan?
Tujuan utama kajian ini dijalankan adalah untuk mengetahui kadar fluorosis gigi dikalangan pelajar sekolah rendah yang berumur 12 tahun.

Berapa ramaikah yang terbilat sebagai responden dalam kajian ini?
Seramai 100 orang pelajar akan dipilih berdasarkan kretaria yang telah ditetapkan.

Apakah jenis ujian yang akan dijalankan?
Responden akan diberikan satu set soalan yang perlu dijawab oleh mereka sebelum memulakan ujian. Ujian lain yang akan dijalankan adalah pemeriksaan gigi oleh seorang doktor gigi bagi mengenalpasti skor fluorosis gigi kanak- kanak tersebut.

Adakah bayaran akan dikenakan terhadap respondent?
Sebarang bayaran tidak akan dikenakan keatas responden. Pengkaji akan menanggung segala pembiayaan yang diperlukan untuk menjalankan ujian-ujian tersebut.

Adakah maklumat peribadi responden dijamin sulit?
Semua maklumat berkenaan responden adalah dijamin sulit. Tiada huraian individu dari segala aspek akan dibincangkan.

Apakah hak anda?
Kajian ini adalah menggunakan responden yang sukarela untuk mengikuti ujian ini. Responden berhak untuk menarik diri pada bila-bila masa sekiranya merasakan tidak selesa memberi maklumat kepada pengkaji.

Apakah yang akan anda dapati?
Hasil kajian ini akan digunakan untuk penambahbaikan, pengetahuan dan pengendalian racun serangga pada masa akan datang. Maklumat juga akan digunakan untuk menggubal polisi dan pelaksanaan program dalam usaha meningkatkan taraf kesihatan generasi akan datang.

Apa yang harus anda lakukan?

Anda hanya perlu menandatangani borang responden yang menyatakan minat anda untuk menyertai kajian ini sebagai responden. Hal ini boleh dilakukan setelah anda membaca dan memahami isi kandungan penerangan ini. Borang penyertaan harus dikembalikan kepada pengkaji sebelum menjalankan sebarang ujian.

Terima kasih atas kerjasama dan bantuan anda.

ZAWAWI BIN SHAFIE
Penyelidik,
Bacelor Sains Kesihatan Persekitaran dan Pekerjaan
Universiti Putra Malaysia

BORANG PENYERTAAN PESERTA

Nama : .....
No. Kad Pengenalan : .....

1. Dengan ini saya bersetuju untuk menyertai kajian bertajuk **PREVALENT FLUOROSIS GIGI DAN PENDEDAHAN FLUORIDA DI KALANGAN PELAJAR SEKOLAH RENDAH DI PUCHONG, SELANGOR.**

2. Saya telah membaca dan memahami isi kandungan kajian berdasarkan apa yang telah dinyatakan dalam 'PENERANGAN KEPADA PESERTA' yang telah dilampirkan bersama surat kebenaran ini dan penerangan tambahan daripada penyelidik.

3. Saya faham bahawa kajian ini dijalankan untuk mengenalpasti kaitan di antara pendedahan organofosfat individu terhadap prestasi neurokognitif manusia.

4. Saya faham mungkin kajian ini akan melibatkan fizikal dan mental berdasarkan aktiviti pengutipan daya yang dijalankan.

5. Saya faham bahawa segala maklumat yang diberikan dan segala keputusan yang saya perolehi adalah sulit dan hanya akan digunakan untuk tujuan penyelidikan dan rujukan penyelidik.

6. Saya faham bahawa maklumat ini boleh digunakan untuk penerbitan tetapi setiap individu tidak dinyatakan identitinya.

7. Saya faham bahawa saya mempunyai hak untuk menarik diri dan mempunyai hak untuk menarik semula keizinan pada bila-bila masa sekiranya perlu apabila merasa tidak selesa pada mana-mana ujian atau aktiviti yang dijalankan oleh penyelidik semasa kajian dijalankan dan tiada sebarang tindakan boleh dikenakan ke atas saya atas tindakan tersebut.

Sekian.

Yang benar,

.....
(Tandatangan responden)

Tarikh: .....

Yang Benar,

.....
(Tandatangan Penjaga)

Tarikh:.....

Appendix 6 Questionnaire form

No Siri: | | | | |

JABATAN KESIHATAN KOMUNITI
FAKULTI PERUBATAN DAN SAINS KESIHATAN
UNIVERSITI PUTRA MALAYSIA

PREVALENT FLUOROSIS GIGI DAN PENDEDAHAN FLUORIDA DI KALANGAN PELAJAR SEKOLAH RENDAH DI PUCHONG, SELANGOR.

Adalah dimaklumkan bahawa satu kajian tentang kesihatan akibat pendedahan fluorida sedang dijalankan di tempat kerja anda. Sehubungan dengan itu, sukacita dimaklumkan bahawa anda telah terpilih untuk menjadi salah seorang responden kajian ini. Oleh demikian, anda diminta menjawab semua soalan yang dikemukakan dengan mengikut arahan yang telah diberikan. Segala maklumat berkenaan responden akan dirahsiakan dan hanya akan digunakan untuk kajian ini.

ID Responden: | | | | | | | | | | |

Tarikh kajian: .....

No Kad Pengenalan: | | | | | | | | | | | | |

No Telefon: **(R)** | | | | - | | | | | | | |

(Hp) | | | | - | | | | | | | |

ARAHAN SOALAN:

1. Kertas soalan ini mengandungi enam (6) bahagian iaitu:

   Bahagian A: Latar belakang responden
   Bahagian B: Maklumat Kesihatan Pergigian Murid
   Bahagian C: Maklumat pendedahan Fluorida
   Bahagian D: Maklumat Keluarga
   Bahagian E: Skor Fluorosis
   Bahagian F: Lain-lain perkara

2. Anda diminta menjawab semua soalan yang ada dalam buku soalan ini.

3. Untuk menjawab, anda perlulah menandakan (√) pada ruangan kotak yang disediakan. Contoh yang terbaik ialah seperti berikut:

√

4. Buku soalan ini hendaklah diserahkan semula kepada pengkaji setelah selesai menjawab semua soalan yang ada dalam buku soalan ini.

Bahagian A (Latar Belakang Murid)

1. Nama Murid :……..

2. Tarikh Lahir :……

3. Darjah :……

4. Bangsa :……

5. Nama Sekolah:……..

6. Alamat Rumah:……..

7. Maklumat Sekolah Rendah Darjah 1 hingga Darjah 6

Bil	Nama Sekolah Rendah	Dari Darjah	Ke Darjah

<u>Bahagian B</u> (Maklumat Tentang Kesihatan Pergigian Murid)

8. Sejauh manakah anda berpuas hati dengan keadaan gigi anda sendiri?

   Tandakan (/) pada jawapan yang paling tepat

   a. Sangat memuaskan …terus ke soalan 11 ☐
   b. Memuaskan …terus ke soalan 11 ☐
   c. Tidak Memuaskan …terus ke soalan 10 ☐

9. Berapa kerapkah anda berjumpa doktor gigi?

   a. 3 bulan sekali ☐
   b. 6 bulan sekali ☐
   c. 12 bulan sekali ☐
   d. Tidak pernah ☐

10. Sejauh manakah anda berpuas hati dengan warna gigi hadapan anda?
Tandakan(/) pada jawapan yang paling tepat

a. Sangat memuaskan
b. Memuaskan
c. Tidak memuaskan

12 (a). Jika anda menjawab c= tidak memuaskan, Mengapa?

Untuk menjawab soalan ini anda boleh menjawab lebih dari satu jawapan. Sila tandakan (/) pada kotak berkaitan.

a. Kerana gigi saya berjalur/ tompok putih
b. Kerana gigi saya berwarna kuning/coklat/kelabu
c. Sebab- sebab lain
(nyatakan.....)

11. Adakah anda melakukan perkara berikut kerana keadaan warna gigi hadapan anda?
Untuk menjawab soalan ini anda boleh menjawab lebih dari satu jawapan. Sila tandakan (/) pada kotak berkaitan.

a. Menutup mulut bila senyum dan ketawa
b. Mengelak dari keluar bersama rakan- rakan
c. Menggunakan bahan-bahan pemutih gigi
d. Berjumpa doktor gigi

13 (a). Jika anda berjumpa doktor gigi, apakah yang doktor gigi lakukan?

a. Memberikan rawatan
b. Memberikan nasihat

12. Adakah anda pernah mengalami perasaan berikut kerana keadaan gigi hadapan anda?

Untuk menjawab soalan ini anda boleh menjawab lebih dari satu jawapan. Sila tandakan(/) pada kotak berkaitan.

a. Runsing kerana warna gigi ☐
b. Tidak yakin dalam pergaulan ☐
c. Perasaan lain ☐
(nyatakan:……..)

Bahagaian C (Maklumat pendedahan fluoride)

13. Jenis kawasan tempat tinggal?
a. Bandar ☐
b. Luar Bandar ☐
c. Pekan(Separuh Bandar) ☐

14. Jenis bekalan air yang anda terima di rumah?

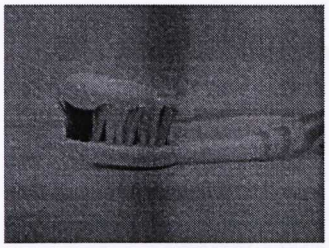
a. Paip JBA ☐
b. Telaga ☐
c. Gabungan mana- mana di atas ☐
d. Lain-lain ☐
(nyatakan:….

15. Apakah jenama ubat gigi yang anda selalu gunakan?
(nyatakan:……)

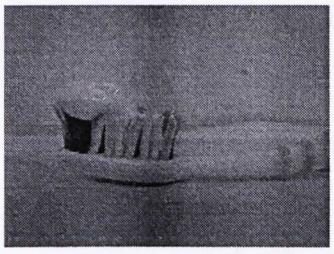
16. Berapa kerapkah anda menggosok gigi dalam sehari?

……..kali sehari

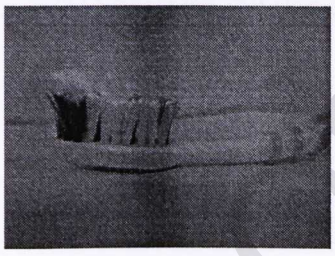
17. Berapakah kuantiti ubat gigi berfluorida yang anda gunakan setiap kali menggosok gigi? (*Rujuk gambar dan tandakan(/) pada kotak)*



☐



☐



☐

18. Berapakah gelas air masak atau air tapisan yang anda minum sehari?

……..gelas sehari

19. Apakah air minuman kegemaran anda dan berapa gelas anda minum sehari?

.....gelas sehari

Bahagiaan D (Maklumat keluarga)

20. Pekerjaan bapa atau penjaga(tandakan (/) pada kotak)

a. Professional
b. Peniaga
c. Pegawai kerajaan
d. Pekerja upahan
e. Pesara
f. Bekerja sendiri
g. Lain-lain(nyatakan:.....)

21. Pekerjaan ibu (tandakan(/) pada kotak)

a. Professional
b. Pegawai kerajaan
c. Peniaga
d. Pesara
e. Pekerja upahan
f. Suri rumah
g. Lain-lain (nyatakan:.....)

22. Pendapatan ibu-bapa (penjaga) sebanyak RM.....

23. Taraf pendidikan ibu-bapa (tandakan (/) pada kotak)

	Bapa	Ibu	Penjaga

Tidak Bersekolah: ☐ ☐ ☐

Sekolah rendah: ☐ ☐ ☐

Sekolah menengah: ☐ ☐ ☐

Universiti: ☐ ☐ ☐

Lain-lain:……..

24. Bilangan ahli dalam keluarga.
……..orang

Bahagian F (Maklumat untuk diisi oleh ibu-bapa/ penjaga)

1. Pada umur berapakah anak anda mula diberikan susu ibu?

a. Sejak lahir ☐

b. Selepas umur 6 bulan ☐

c. Selepas umur 1 tahun ☐

2. Berapakah tempoh masa anak anda diberikan susu ibu?

a. Kurang dari 6 bulan ☐

b. 6 bulan hingga 1 tahun ☐

c. Lebih dari setahun ☐

3. Pada umur berapakah anak anda diberikan makanan selain dari susu ibu?

_____

4. Berapakah tempoh masa anak anda diberikan susu formula?

a. Kurang dari 12 bulan ☐

b. Lebih dari 12 bulan ☐

5. Apakah sumber air yang digunakan untuk penyediaan susu formula yang diberikan kepada anak anda.

a. Air paip ☐

b. Air telaga ☐

c. Air mineral ☐

d. Air tapisan ☐

6. Pada umur berapakah anak anda mula menggosok gigi menggunakan ubat gigi berfluorida?

Nyatakan.....

Appendix 7 Dental score card

UPM/PKM/DC

No. Daftar : _____

No. MR : _____

PERKHIDMATAN PERGIGIAN
UNIVERSITI PUTRA MALAYSIA

NAMA: _____
Name

TARIKH LAHIR: _____ JANTINA: _____
Date of Birth *Sex*

NO. KP/NO. PASPOT: _____
NIRC/Passport No.:

NO. MATRIK/NO. STAF: _____ TAHUN: _____
Metric No./Staff No. *Year*

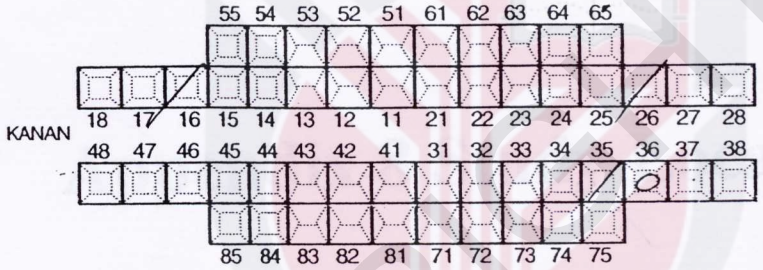
JABATAN/FAKULTI/PROGRAM: _____
Dept./Faculty/Programme

PEKERJAAN: _____ NO. TEL: _____
Occupation *Tel No*

ALAMAT: _____
Addres

Persetujuan Untuk Rawatan
Consent for Treatment

_____
Tandatangan/*Signature*



Perlu Dicabut
Telah Dicabut
Tiada Gigi

Ada Tampalan
Untuk Tampalan
Tampalan Dibuat

R Tunggul

Gigi Buatan Yang Ada	Gigi Buatan Yang Perlu	X-Ray

TANDAKAN ✓ PENYAKIT JIKA ADA

Blood Dyscrasias	☐	Jaundice	☐
Heart Disease	☐	Hypertension	☐
Congenital Heart	☐	Toxic Goitre	☐
Diabetes	☐	Allergic Tendencies	☐

On Any Drugs:

Sakit-sakit Lain:

Lain-lain Rawatan

CATITAN PERGIGIAN YANG LAMPAU

Appendix 8 Study Location