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FLUORIDE IN DRINKING WATER: A KNOWLEDGE AND PERCEPTION AMONG RESIDENTS AT SUNGAI BULOH PRISON QUARTERS, SELANGOR.

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BY

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ABSTRACT

FLUORIDE IN DRINKING WATER: A KNOWLEDGE AND PERCEPTION AMONG RESIDENTS AT SUNGAI BULOH PRISON QUARTERS, SELANGOR

KHAIRUMI BINTI KASIM

Introduction: Fluoride is an ionic form of fluorine by the ionization process occurring in the earth's crust. It is also high in natural water bodies such as the ocean, rivers, and lakes. The addition of fluoride into the main water supply system has been practiced since the 1930s to help prevent dental caries, especially among young children. **Objectives:** This cross-sectional study aims to determine the relationship between socio-demographical data, knowledge level, and perception level of fluoride in drinking water among residents at Sungai Buloh Prison Quarters, Selangor. **Methodology:** A cross-sectional study was conducted among residents at Sungai Buloh Prison Quarters, Selangor, by purposive and simple random sampling. A total of 255 respondents participated in this study, and they were required to answer the online questionnaire that consisted of three sections which were section A:Socio demograhic characteristics,Section B: Knowledge of Fluoride in Drinking Water and Section C: Perception of Fluoride in Drinking Water. Then, the data were analysed by using IBM SPSS Statistics 26. **Results and Discussion:** The highest frequency (percentage) of residents at Sungai Buloh Prison Quarters were residents around age 18-64 years old 247(96.9%), male 167(65.5%), tertiary education 155(60.8%) and one to five years lived at study area 82(32.2%). Out of 255 respondents, 247(96.9%) had poor knowledge, and 83(32.5%) had a medium perception towards fluoride in drinking water.Furthermore, chi-square analysis found no association between knowledge level and sociodemographic factors and no association between perception level and sociodemographic factors among residents at Sungai Buloh Prison Quarters, Selangor (P-Value > 0.05). **Conclusion:** In conclusion, Fluoride intake from drinking water may lead to different health effects that may either benefit or harm consumers' health. Therefore, the residents at Sungai Buloh Prison Quarters can further improve their current knowledge and perception level towards fluoride in drinking water by the government's support in providing better education and more awareness specific on fluoride in drinking water.

Keywords: Fluoride in drinking water, knowledge of fluoride, perception of fluoride, fluoride,health effect of fluoride

ABSTRAK

FLORIDA DALAM AIR MINUMAN: PENGETAHUAN DAN PERSEPSI DIKALANGAN PENDUDUK KUATERS PENJARA SUNGAI BULOH, SELANGOR.

KHAIRUMI BINTI KASIM

Pengenalan: Fluorida ialah bentuk ionik fluorin melalui proses pengionan yang berlaku di kerak bumi. Ia juga tinggi dengan badan air semula jadi seperti lautan, sungai, dan tasik. Penambahan fluorida ke dalam sistem bekalan air utama telah diamalkan sejak tahun 1930-an untuk membantu mencegah karies gigi, terutamanya di kalangan kanak-kanak kecil.**Objektif:** Kajian keratan rentas ini bertujuan untuk mengetahui hubungan antara data sosiodemografi, tahap pengetahuan, dan tahap persepsi fluorida dalam air minuman dalam kalangan penduduk di Kuaters Penjara Sungai Buloh, Selangor. **Metodologi:** Kajian keratan rentas telah dijalankan di kalangan penduduk di Kuaters Penjara Sungai Buloh, Selangor, secara purposive dan simple random sampling. Seramai 255 orang responden telah mengambil bahagian dalam kajian ini, dan mereka dikehendaki menjawab soal selidik dalam talian yang terdiri daripada tiga bahagian iaitu Bahagian A: Ciri-ciri sociodemgrafik, Bahagian B; Pengetahuan tentang Florida didalam Air Minuman dan Bahagian C: Persepsi tentang floride di dalam air minuman Kemudian, data dianalisis menggunakan IBM SPSS Statistics 26. **Keputusan dan Perbincangan:** Kekerapan (peratusan) tertinggi penghuni Kuaters Penjara Sungai Buloh ialah penduduk berumur sekitar 18-64 tahun 247(96.9%), lelaki 167(65.5%), pendidikan tinggi 155(60.8%) dan satu hingga lima tahun tinggal di kawasan kajian 82(32.2%). Daripada 255 responden, 247 (96.9%) mempunyai pengetahuan yang lemah, dan 83 (32.5%) mempunyai persepsi sederhana terhadap fluorida dalam air minuman.Tambahan pula, analisis chi-square mendapati tiada perkaitan antara tahap pengetahuan dan faktor sosiodemografi dan tiada perkaitan antara tahap persepsi dan faktor sosiodemografi dalam kalangan penduduk di Kuaters Penjara Sungai Buloh, Selangor (P-Nilai > 0.05). **Kesimpulan:** Kesimpulannya, pengambilan Fluorida daripada air minuman boleh membawa kepada kesan kesihatan yang berbeza yang boleh memberi manfaat atau membahayakan kesihatan pengguna. Oleh itu, penduduk di Kuaters Penjara Sungai Buloh boleh meningkatkan lagi pengetahuan dan tahap persepsi mereka terhadap fluorida dalam air minuman dengan sokongan kerajaan dalam memberikan pendidikan yang lebih baik dan kesedaran yang lebih khusus mengenai fluorida dalam air minuman.

Kata kunci: Pengetahuan florida dalam air minuman, persepsi florida dalam air minuman, florida dalam air minuman, florida, kesan kesihatan daripada florida.

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

NSDWQ	National Standard Drinking Water Quality
CDC	Centre for Disease Control
WHO	World Health Organization
US EPA	The United States Environmental Protection Agency
T3	Triiodothyronine
T4	Thyroxine

TABLE OF CONTENT

CHAPTER 1

1.0 INTRODUCTION

1.1 Research Background

Knowledge of fluoride in drinking water is information and fact consuming fluoride obtained through formal or non-formal education. In contrast, the perception of fluoride in drinking water is the ability to create an awareness of fluoride in drinking water by identifying any possible adverse health effects in humans by consuming fluoride in drinking water. However, the health problem caused by the level of fluoride consumption in drinking water that is not within the provided range by the National Standard for Drinking Water Quality (NSDWQ) can lead to medical conditions like dental fluorosis, skeletal fluorosis, neurological problem, and thyroid problem if the level of fluoride exceeds in drinking water. According to the Engineering Service Division, Ministry of Health Malaysia (2010), Malaysia's standard fluoride ion drinking water level is 0.4 mg/L to 0.6 mg/L provided by NSDWQ. This is lower than the standard that has been provided by the World Health Organization (WHO), which is 1.5 mg/L (Thakre et al., 2009).

According to the U.S. EPA, 2010, water and water-based beverages are the primary sources of systemic ingestion. Approximately 75% of dietary fluoride intake among adults and children living in communities has fluoridated their water supply in the United States. Some fluoride may stay in the body, and some will be excreted. There are several ways to evacuate fluorides, such as urine and feces. About 75 to 90% of fluoride has been absorbed through the duodenum and stomach. The fluoride will be excreted through urine (Maha et al., 2015). According to Haftenberger et al., 2001 the unabsorbed fluoride from the gastrointestinal tract will be eliminated through feces because the maximum fecal elimination can go up to 10% of the ingested fluoride.

In Malaysia, it has a variety of sources of drinking water supply. For example, 99% of communities in Malaysia use water supply for daily use from surface water, and only 1% use water supply from groundwater (Ab Razak et al., 2015). According to Scott, 2017, water fluoridation was started in 1972 to reduce dental caries. On average, 75.7 per cent of our country's

population, around 20.7 million, receives fluoridated water. The three primary agents used in drinking water fluoridation are sodium fluoride, sodium fluorosilicate, and fluorosilicic acid. These fluorides are considered "not classifiable as to their carcinogenicity to humans" (Group 3) (Agents Classified by the IARC Monographs, Volumes 1–129– IARC Monographs on the Identification of Carcinogenic Hazards to Humans, 2011).

Usually, Malaysia's primary drinking water sources are tap water, bottled drinking water, and bottled mineral water (Azrina Azlan et al., 2011). From the early studies of "Public Health Service report on fluoride benefits and risks," 2017, when drinking water was the only source of fluoride other than fluoride that occurs naturally in foods, beverages, dental products. Despite this, studies prove that water fluoridation continues to be effective in reducing dental decay by 20% - 40% (Newbrun, 1989).

Therefore, the management of the water treatment plants, both public and private, must ensure that fluoride levels are maintained to avoid any adverse health effects. Jones et al. (1997) demonstrated that children in lower socio-economic groups lead an even more significant benefit from water

fluoridation with an average 54% reduction in dental decay. Therefore, children with the most significant dental problem need to use the most from water fluoridation. Thus, water fluoridation is the most effective method of reaching the whole population without bias on social classes. Still, some have a non-fluoridated water supply, especially people who live in rural areas and consume water directly from the river (World Health Organization, 1983). But in some areas, especially in an urban area, the level of fluoride may exceed the recommended range of fluoride in drinking water (Ameer et al., 2018). Therefore, it may cause consequences to the health, especially for the children that will develop permanent teeth and bones. Therefore, fluoridation at the control level in drinking water remains the most appropriate public health measure to prevent and control dental and bone problems in Malaysia, especially for children, because it can cause long-term health problems. So, the knowledge and perception of fluoride between adults are essential to provide accurate information and create awareness about fluoride in drinking water.

1.2 Problem Statement

Nowadays, due to the development of the countries, the use of fluoride has become widespread to decrease tooth decay, especially among children. Fluoride can enter the body in various ways, such as drinking water, breathing, and food uptake. But the most crucial source of human contact with fluoride in drinking water (Dobaradaran et al., 2009). Moreover, the water fluoridation process is needed to put the fluoride into the safe range for the community, especially children. They are more vulnerable to getting health effects when exposed to fluoride in drinking water. Therefore, this encourages the researcher to research fluoride in food sources instead of focusing on significant sources. Thus, narrowing down the line of fluoride dose between its essentiality and harmful effects on the health of drinking water. Since the researcher has identified the health risk of excess and lack of fluoride, the researcher wants to observe the knowledge and perception of community to fluoride in drinking water

Moreover, several studies are available and reported in the peer-reviewed literature that has convincingly shown that there are not many people

aware of fluoride in drinking water. But, most of these concerns are with rural areas rather than urban areas. It focuses on a state located in the central west of Malaysia, Sungai Buloh, Selangor. A lack of studies raises concerns about whether fluoride may give a health risk to the residents, significantly elevated fluoride concentration in drinking water from the urban area. This stated that the number of alternatives to reduce the excess level of fluoride concentration in drinking water are not possible to achieve, especially when living in an urban area with more advanced technology to improve the fluoride level.

Drinking water is a significant source of human consumption daily, especially for those living in easily accessed areas. But there are various types of drinking water they can access, likeboiling water, filter water, and bottled water. The main concern is people consuming drinking water directly on tap water, boiling water because the level of fluoride remains the same even after cooking. Usually, people who drink drinking water directly from tap water are fromlow-income families that live in urban areas. Therefore, for some reason, the level of fluoride directly from tap water is not suitable for human consumption because it can cause danger for humans due to some contamination that happens in the distribution system before the water is

distributed to the consumer.

Moreover, according to WHO (2018), millions of people suffer from long-term health problems related to fluoride in drinking water. Therefore, the data provided to address the concentration of fluoride level in drinking water and health effects must be up to date or not it will be neglected and unrecognised. Therefore, adults play a vital role in knowledge and perception of fluoride in drinking water because their actions can significantly impact children.

1.3 Study Justification

The study was designed to determine the association between knowledge and perception of fluoride in drinking water among residents at Sungai Buloh Prison Quarters, Selangor residents. Some people at Sungai Buloh, especially young children in low-income families, are exposed to adverse health effects of fluoride in drinking water. According to MABAS, 2020, children under permanent teeth have a high possibility of changing the tooth enamel's appearance due to excess fluoride exposure. Knowledge is fact or information one of the procedures to estimate the adverse health effect

caused by consuming fluoride in drinking water. Fluoride can enter the body in various ways, such as drinking water, breathing, and food uptake. But the most crucial source of human contact with fluoride in drinking water (Dobaradaran et al., 2009). Therefore, drinking water is the primary source of daily fluoride exposure compared to other sources. Also, according to WHO Guidelines for Drinking-water Quality (2018), about 90% of fluoride in drinking water is absorbed in the digestive system, while only 30% – 60% of fluoride in the food is interested in the digestive system.

Fluoride in drinking water could cause health effects if the level of the fluoride were not within the recommended range by NSDWQ, which is 0.4 – 0.6 mg/L. If the fluoride in drinking-water concentrations is between 0.9 and 1.2 mg/L, it can cause adverse effects on tooth enamel. It may give rise to mild dental fluorosis based on a 12% – 33% (WHO,2018.). Usually, dental fluorosis happens when excess ingestion of fluoride during tooth formation occurs during childhood (DenBesten & Li, 2011).

Some researchers overlook the excess fluoride concentration level in drinking water. Instead, they are more focused on a minor resource of fluoride,

especially in the urban areas, because they assume the development of technology in developing countries can control the level of fluoride concentration (Warren, 2006). But some reasons can cause fluoride contamination at a distribution system that can lead to a change level of fluoride in drinking water when reaching the consumer (Aoun et al., 2018).

In Selangor, there is a widely used water supply from surface water as drinking water in Malaysia withdrawn from Sungai Langat and Sungai Selangor (Ab Razak et al., 2015). Since the majority of the area in Selangor are urban areas. There are various types of drinking water consumed by the communities: boiling water, filter water, reverse osmosis, and bottled water. Thus,with this variety of drinking water, the fluoride content may be disturbed by the process to make the drinking water and will influence the level of fluoride in drinking water that the NSDWQ has recommended.

Therefore, this study will be conducted to identify the knowledge and perception level of fluoride in drinking water in residents in urban areas to reduce the health risk, especially to children there. It is crucial for water supply management to check the level of fluoride in drinking water frequently

before reaching residents in the urban areas for early prevention and control of the arising risk of health problems. Hence, it is crucial to conduct a study on knowledge and perception of fluoride in drinking water among residents to control the rising number of health problems. The knowledge and perception that they receive from the adult will create an awareness and against the misunderstanding information of fluoride in drinking water.

1.4 Research Question

Many concerns arose in this research study. Therefore, the questions were formulated solely on the variables of the research. The central, crucial questions that will be addressed in this study are asfollows:

- What are sociodemographic factors of fluoride in drinking water among residents at Sungai Buloh Prison Quarters,Selangor?
- What is the knowledge level of fluoride in drinking water among residents at Sungai Buloh Prison Quarters,Selangor?
- What is the perception level of fluoride in drinking water among residents at Sungai Buloh Prison Quarters,Selangor?

- Is knowledge level related to sociodemographic factors of fluoride in drinking water among residents at Sungai Buloh Prison Quarters, Selangor?
- Is perception level related to sociodemographic factors of fluoride in drinking water among residents at Sungai Buloh Prison Quarters, Selangor?

1.5 Research Objective

General objective:

- To determine a knowledge and perception level of fluoride in drinking water among residents at Sungai Buloh, Selangor.

Specific objective:

- To determine the knowledge level of fluoride in drinking water among residents at Sungai Buloh Prison Quarters,Selangor.
- To determine the perception level of fluoride in drinking water among residents at Sungai Buloh Prison Quarters,Selangor.
- To determine sociodemographic factors of fluoride in drinking water among residents at Sungai Buloh Prison Quarters,Selangor.

- To determine the association between knowledge level and sociodemographic factors of fluoride in drinking water among residents at Sungai Buloh Prison Quarters, Selangor.
- To determine the association between perception level and sociodemographic factors of fluoride in drinking water among residents at Sungai Buloh Prison Quarters, Selangor.

1.6 Research Hypothesis

The research hypothesis of the study is as follows:

There is no significant association between the sociodemographic characteristics and knowledge level of fluoride in drinking water among the residents at Sungai Buloh Prison Quarters, Selangor.

There is no significant association between the sociodemographic characteristics and perception level of fluoride in drinking water among the residents at Sungai Buloh Prison Quarters, Selangor.

1.7 Study Variable

Independent variable: Fluoride in drinking water.

Dependent variable: Knowledge and Perception of fluoride in drinking water

1.8 Definition Of Terms

Fluoride in drinking water

Conceptual: Based on the National Standard for Drinking Water Quality (NSDWQ), the standardlevel of fluoride in drinking water in Malaysia is 0.4 – 0.6 mg/L to reduce dental caries (Engineering Services Division, Ministry of Health Malaysia, 2010).

Operational: Drinking water was taken from tap water, collected using clean HDPE bottles, and analysed using the SPADNS method on a direct reading spectrophotometer HACH Brandmodel DR1900.

Knowledge and perception of fluoride in drinking water

Conceptual: *Merriam-Webster Dictionary* (2021) stated knowledge is the fact or condition of knowing about fluoride in drinking water through gaining an experience or from a person, while perception is the element of awareness on fluoride in drinking water through the senses.

Operational: A knowledge and perception can be evaluated through the questionnaire that consists of three sections which are sociodemographic factors, knowledge and perception, and it will be distributed to the residents through the online survey, the residents will be answered, and after that, it will be run on SPSS analysis to get the value the knowledge and perception of fluoride in drinking water.

1.9 Conceptual Framework

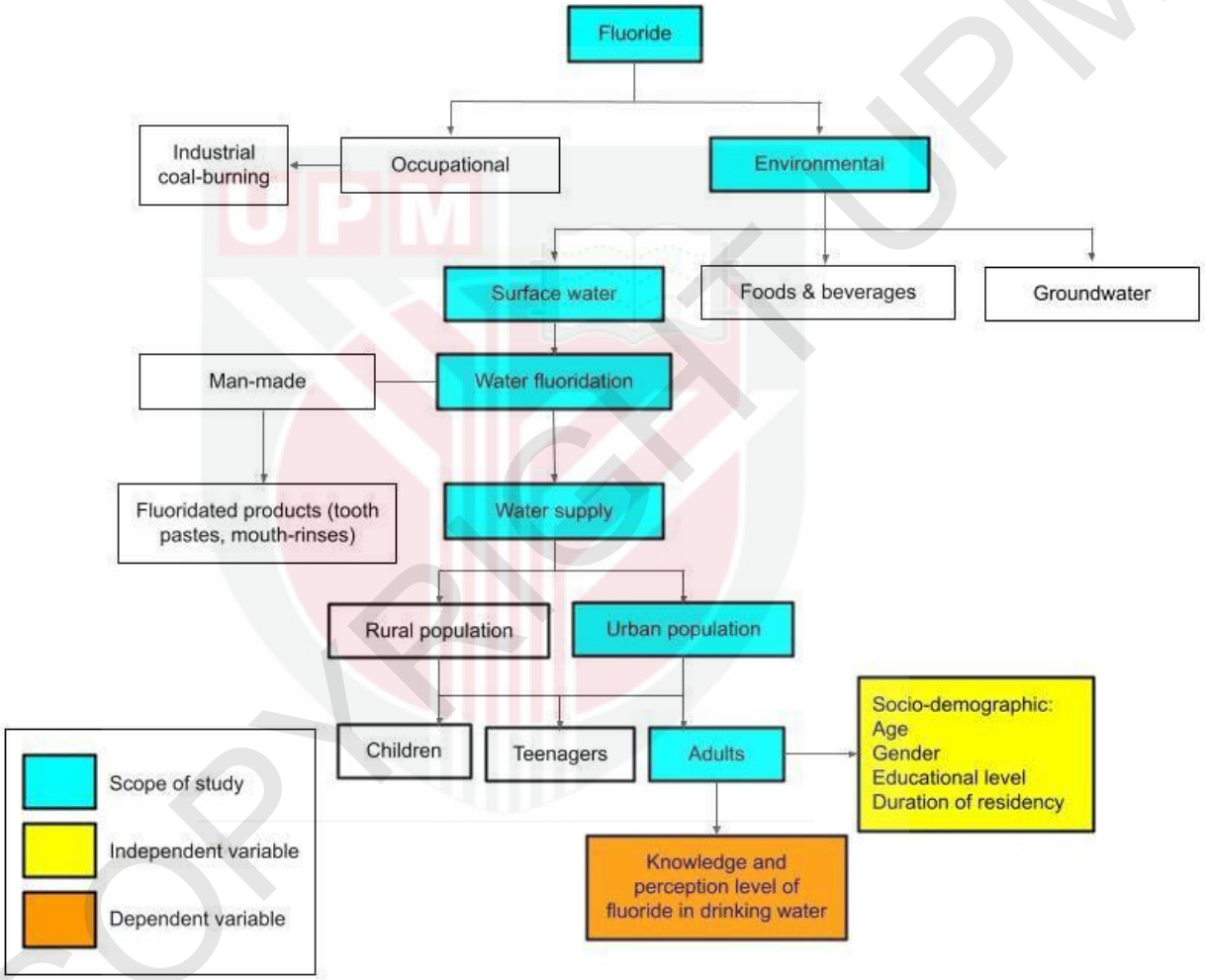

Figure 1.9 Conceptual Framework

CHAPTER 2

2.0 LITERATURE REVIEW

2.1 History of Fluoride

Fluoride is a salt compound of fluorine, typically white, or it can also be colorless. Besides, fluoride has a particularly bitter taste and does not have any odor emitted from the compound. Fluoride is an element that is naturally produced from the deep layers of the earth, and it may be discovered in all-natural water bodies such as the ocean and rivers. Water bodies with a high fluoride concentration are significantly related to remains of marine origin in mountain areas and volcanic, granitic, and gneissic rocks (Kitalika et al., 2018).

Fluoride is a chemical derived from the negatively charged fluorine ion (PubChem, 2022). When negatively charged fluorine ions react with positively charged ions such as sodium ions, they will produce fluoride compounds (American Dental Association, 2021). Fluorine is essential for bone preservation and strengthening, as well as avoiding tooth decay (Unde et al., 2018). But, if fluorine is taken too excessively, it may have the opposite effect,

which may cause tooth decay, osteoporosis, and damage to the kidney, bone, nerve, and muscle (Dey & Giri, 2016).

Malaysia's local government also followed this health's recommendation in 1972 by adding fluoride into public drinking water systems because fluoride may reduce tooth decay cases in this country (Oral Health Division Ministry of Health Malaysia, 2006). In 1957, Johor became the first state to introduce fluoride into their drinking water supplies in Malaysia, followed by other towns in the same state. Furthermore, scientific research regarding fluoridation of drinking water was conducted in Johor from 1964 until 1976, which had also proved that the addition of fluoride lowered the level of dental caries cases by 60 per cent. Therefore, it is best to add fluoride within the recommended level (Oral Health Division Ministry of Health Malaysia, 2006).

2.2 Overview of water fluoridation

According to Michigan (1945), fluoride was added to their city's water supply system, as fluoride had been proven to protect tooth decay. This process was called community water fluoridation. The main reason why community water fluoridation was so important is to adjust the fluoride level to the right

recommended amount to prevent tooth decay problems after discovering that children who drank water with high fluoride levels had fewer tooth decay problems (Water Fluoridation Basics, 2021). Because of the aggressive decline in tooth decay over the past 7 decades after a scientific research program has been made, most countries worldwide are applying this water fluoridation process in their city water supply system (Water Fluoridation Basics, 2021).

The water fluoridation method was initiated to enhance water quality through adding a recommended level of fluoride into untreated groundwater or surface water; this process may be carried out after all of the massive filtering operations are completed (Centers for Disease Control and Prevention (CDC), 2015). After the water fluoridation process is completed, then the water will be distributed to the consumers by the city's water supply system. This additional procedure is beneficial for teeth since it may help permanently strengthen teeth that have formed under the gums, as well as reinforce tooth enamel and retain teeth with fewer cavities, pain, and suffering from tooth decay issues. (Griffin, et al.,2001) reported that community water fluoridation was identified as the most cost-effective method of delivering fluoride to all the community to reduce the tooth decay problems by 25% (Effectiveness of

Fluoride in Preventing Caries in Adults, 2007).

However, in Malaysia, water fluoridation was gazette as a national policy in 1972. This strong collaboration with the government and stakeholders was dramatically improving the pipedwater supplies in Malaysia, and in 2013, resulted in more than 80% Malaysian population receiving water fluoridation and without noticing the number of Malaysian tooth decay problemswas significantly reduced by the time (Water Fluoridation and Oral Health in Malaysia: A Review of Literature, 2021).

2.3 Fluoride in Drinking water

Most of the drinking water came from natural sources that either surface water or groundwater. Most commonly, the water itself may contain minerals and other inorganic compounds, and some of it may be beneficial for consumers. Some of it needs to filter before being consumed as drinking water. Even so, the natural sources themselves may vary in terms ofthe concentration of fluorides associated with their places. The fluoride concentration in seawater, river and other ground sources may differ due to natural exposure or

industrial discharges (World Health Organizations, 2018).

Drinking water is a common important element for humans to stay hydrated, and forsome reason, the existence of fluoride in drinking water can improve dental health. To ensure an optimal concentration of fluorides in drinking water, all ground source water needs to pass the filtration process first and go through the community water fluoridation before it isgoing to be distributed to all consumers. After the filtration process, the drinking water will comply with the basic characteristics of drinking water quality standard that has been standardised by the Ministry of Health Malaysia, which first, drinking water should be clear, andtasteless, colorless, and odorless. Moreover, it must be free from all harmful organisms,chemicals, and radionuclides that may affect consumers' health (National Standard for Engineering Services Division Ministry of Health Malaysia, 2003.).

There is a list containing drinking water after the filtration process is done. These parameters are listed due to the very small amount of unwanted organic substances, and the amount also is a Drinking Water Quality Standard and Frequency of Monitoring which is a must to respect. Fluoride parameters

in the table stated that the maximum acceptable amount is in the range of 0.4 - 0.6 mg/l (National Standard for Engineering Services Division Ministry of Health Malaysia, 2003).

These drinking water quality standards may differ within countries for some reason, but astudy has been made for fluoride concentration in drinking water by the World Health Organization, WHO (2018) to avoid any health problems with either the least or the most concentration inside the drinking water. In a range of 1.5 - 1 mg/L concentration of fluoride is an acceptable range based on the national standards or local guidelines by considering the intakes of water by the population of interest and the intake of fluoride from other sources that are probable to approach, or greater than, 6 mg/day (WHO Guidelines for Drinking-water Quality, 2018.)

2.4 Knowledge of fluoride in drinking water

Knowledge of fluoride in drinking water has some information and facts about the fluoride in drinking water that can be received through the formal and non-formal education. The knowledge of fluoride can have an ability to differentiate Fluoride concentrations in drinking water will give

different impact on health. Fluoride concentration between 0.6 to 1.2 mg/L in drinking water is beneficial for bone and teeth development as scientists find out that fluoride plays a crucial role to prevent dental caries, and especially for young children. However, there is always a bad effect coming through when there is excessive exposure. In this case, an excessive amount of fluoride in drinking water will directly affect consumers' body's health in any other part such as dental, skeletal, thyroid, and insulin secretion.

First, if a person ingested an excessive amount of fluoride which is mainly from drinking water, he or she may develop fluorosis on their teeth and bones. Dental fluorosis can generate much faster than skeletal fluorosis as skeletal fluorosis requires a large dose of fluoride for long-term fluoride exposure. Dental fluorosis can be identified clinically by the presence of discoloration and pitting of the teeth, or it also can cause damage to the enamel layer for more severe cases. Iheozor et al. (2015) had stated an increase in dental fluorosis. Most of the affected populations that may develop a high risk of dental fluorosis are children aged 8 years and younger as they are still developing their permanent teeth (Centre for Disease Control, 2019).

Second, higher doses of fluoride also may result in adverse changes in bone structure, for instance, when the fluoride-contaminated drinking water at 3 to 4 mg/L. When the level of fluoride in drinking water goes over 10 mg/L, there will be a development of a more severe disease known as crippling skeletal fluorosis. Long-term exposure to an excessive amount of fluoride can cause skeletal fluorosis (WHO, 2018). The early signs of getting skeletal fluorosis are such as stiffness and pain in the joints. If the severity of the skeletal fluorosis is increased, the bone structure can alter and ligaments calcification which may cause complications to muscles. These symptoms may be developed when there is a continuous accumulation of fluoride in the skeletal tissues over many periods (WHO, 2018).

Third, there is a study in Iran that reported that <0.5 mg/L dose of fluoride affects the human thyroid hormone activity (Kheradpisheh et al., 2018). An excessive amount of fluoride intake (100-200 ppm) may disrupt the thyroid gland, histopathology of brain parts, acetylcholine esterase cycle, and disturbance to cognitive functions and memorisation in multi-generation rats (Dey & Giri, 2016). This is due to fluoride having antagonistic effects on the iodine element in the thyroid gland. Fluoride may elevate the level of thyroid-

stimulating hormone (TSH) and lower the concentration of T3 and T4 hormones, so it may cause hypothyroidism among the population (Dey & Giri, 2016). Triiodothyronine (T3) and Thyroxine (T4) are the hormones released by the thyroid gland. If humans lack these hormones, there must be complications in controlling weight, metabolic rate, muscle control, bone strength, and menstrual cycle (Hormone.org, 2018). Iodine modified the association between the fluoride concentration in urine and thyroid-stimulating hormone (TSH) level among adults that have moderate-to-severe iodine deficiencies.

Finally, fluoride might be a silent cause of the rise of diabetes cases among the world population. Although fluoride is a low-dose endocrine disturber, it may have significant effects on diabetic patients. People who are exposed to the high concentration of fluoride throughdrinking water is highly associated with people who have insulin resistance have been proved by various scientific research (Dey & Giri, 2016). Furthermore, the blood glucose level will increase, resulting from glycolysis inhibition by excessive fluoride ions (Dey & Giri, 2016). Diabetic patients will have a much greater impact than a typical healthy human because they consume much more amount of

fluoridated water and will accumulate more fluoride in their bodies.

2.5 Perception of fluoride in drinking water among residents in Sungai Buloh, Selangor.

According to Lisa M.Given (2012) Perception is the apprehending mode of reality and can be experienced with the senses. Thus, with the ability of form, figure, behavior, language, and action some individual perception can change and influence some opinion and judgement. Adults play a major role in influencing and can give a greatly action affect to the children (Holycross, 2017) Water and water-based beverages are the main sources of systemic ingestion and approximately 75% of dietary fluoride intake among adults and children that live in communities have been fluoridating their water supply in the United States. But the children are the more vulnerability group the get health effect when exposed to lack and excess level of fluoride because some fluoride may stay in the body and some will be excreted. Therefore, the adults must have a perception to influencing and educate the children through the sense but the most greatly effective influencing the children is through the action.

Fluoride may stay in the body, and some will be excreted fluoride. Thus, there are several ways of excreting fluorides, such as urine and feces. About 75 to 90% of fluoride has been absorbed through the duodenum and stomach, and the fluoride will be excreted through urine (Maha et al., 2015). According to Haftenberger et al. (2001) the unabsorbed fluoride from the gastrointestinal tract will be eliminated through feces because the maximum fecal elimination can go up to 10% of the ingested fluoride. Scher. (2011) stated for the fluoride that absorb in the body through the stomach and intestines, and passes rapidly round the body in the bloodstream but, the most soluble fluoride compounds are sodium fluoride in water, tablets and toothpaste,are almost completely absorbed in the blood, fluoride is gradually removed through the kidneys by reducing to half of original level of fluoride. The long-term blood level of fluoride can be influenced by daily exposure from consumption of fluoride in drinking water since its major fluoride intake through the ingestion as well as by take-up in growing bone and children clearly absorb fluoride more rapidly than adults with approximately 99 percent remains in bones and teeth. Therefore, perception of fluoride in drinking water is important for adult to influence the children to prevent the excess and lack fluoride especially in drinking water.

2.6 The association of knowledge and perception of fluoride in drinking water among residents at Sungai Buloh Prison Quarters, Selangor.

Fluoride may enter the body via a variety of routes, including drinking water, breathing, and food consumption. However, the most important route of human fluoride exposure is via drinking water. (Dobaradaran et al., 2009). In Malaysia, fluoridation of water started the fluoridation of water in 1972 to reduce dental caries. On average, 75.7 percent of our country's population is between 20.7 million and receives fluoridated water (Scott, 2017). Fluoride was added into the public water supplies with an average concentration of 1 ppm (part per million), but groundwater may contain much higher fluoride levels (Main, 2015).

In Selangor is an extensively utilised surface water source as drinking water in Malaysia, derived from Sungai Langat and Sungai Selangor. (Ab Razak et al., 2015). Since the majority area in Selangor are urban area. There are various types of drinking water consumed by the communities which are boiling water, filter water, reverse osmosis, and bottled water. Thus, with this variety of drinking water the contain of fluoride may be disturbance by the process to make the drinking water and will influence the level of fluoride in

drinking water that have been recommended by the NSDWQ. Therefore, the main concern in this study was adults with knowledge and perception of fluoride in drinking water because adults had more knowledge than children. The children can use the knowledge and practice the perception to create an awareness and influence the other children about the fluoride in drinking water.

CHAPTER 3

3.0 METHODOLOGY

3.1 Study Design

In a research study, determining the appropriate epidemiological study design is one of the first fundamental issues to achieve the study's objectives (Checkoway, 2007). Furthermore, it is the most crucial decision to choose the proper research in determining the methodology of any research study (Omair, 2015).

The study design for this research was quantitative data with an observational method. There were several examples of observational studies such as cohort study, case-control study, and cross-sectional study. A cross-sectional study was chosen in this research to generate the data from a population at a specific point in time. A cross-sectional study was the most used because it's easy and fast to conduct due to the information collected from subjects at a single point in time. One of the advantages of using this type of observational study is that the prevalence of an outcome or risk factor can be determined (Omair, 2015).

3.2 Study Location

The study was conducted at a residential area in Sungai Buloh, Selangor since it is a development area with a high population density and can fulfil the researcher requirement in this research. Therefore, the more focusing area the residential in Sungai Buloh Prison Quarters. The target population that the study title has mentioned a specific study location at Sungai Buloh Prison Quarters, Selangor.

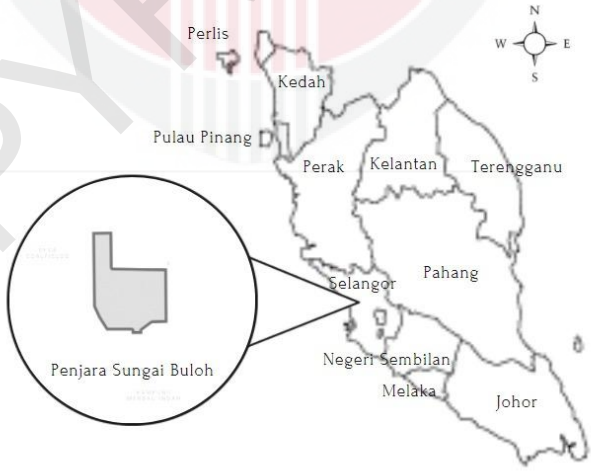

Figure 3.1 Residential area in Sungai Buloh Prison Quarters, Selangor

3.3 Study Population

The study population of this survey was residents at the Prison of Sungai Buloh.

3.4 Study sample

The study sample is crucial as it is a subset of the population representing the whole population. Therefore, the study sample was residents of an urban area from a chosen residential area at Sungai Buloh, Selangor, which is residents at Sungai Buloh Prison Quarters with a high density of residents and has met the requirement in this study.

3.5 Inclusion and Exclusion Criteria

In this study, there were a few inclusion and exclusion criteria for choosing or accepting responses from the respondent.

3.5.1 Inclusion criteria

Those with all criteria listed below were included or allowed to partake in this study.

I. People aged more than 18 years old

II. Stay at Sungai Buloh Prison Quarters, Selangor.

3.5.2 Exclusion criteria

Those with one of the listed criteria were prohibited from partaking in this study, and the already filled questionnaire was discarded.

I. disable people

II. young children

III. non-malaysian

3.6 Sample Size

The study was designed to determine the perception level of fluoride in drinking water among residents at Sungai Buloh Prison Quarters, Selangor, within 5% of the true prevalence with 95% confidence.

3.6.1 Sample Size Calculations

The sample size calculation was determined following the specific objective to determine the perception level of fluoride in drinking water.

The calculation sample size formula used for this specific objective was the prevalence or one proportion sample size. From a prevalence pilot study, it is observed that a cross-sectional questionnaire survey of a national sample of

517 Australian adults (response rate = 34.7 percent) aged 18-92 years a do cross-sectional questionnaire survey of a national sample of risk perception and water fluoridationsupport and opposition in Australia (Armfield & Akers, 2010)

$$n = \frac{z^2 P(1-p)}{d^2}$$

Table 3.6.1 Equation for Sample Size Calculations (Sullivan, 2021)

$$221 = \frac{1.96^2 0.15(1-0.2)}{0.05^2}$$

$$n = 221 \times 15\%$$

$$n = 254$$

Figure 3.6.1 Calculation for Sample Size

The sample size is 221 with a 5% true prevalence and 95% confidence interval. Therefore, but the total sample size of this research study is 221 respondents x 15 % = 254 respondents, considering 15% being the response rate to consider non-response.

3.7 Sampling Method

The sampling method used non-probability sampling, a purposive sampling to choose a residential area in Sungai Buloh, Selangor and the resident area at Sungai Buloh Prison Quarters had been selected. Then continues with probability sampling, which is simple random sampling with respondents chosen based on their age more than 18 years old and above with asking the head of residential area at Sungai Buloh Prison Quarters a list name of residents and select them based on age.

3.8 Study Instrument

The study instruments in this research are questionnaires. The questionnaire consists of open-ended and close-ended questions with three sections which are: Section A: Sociodemographic Characteristics, Section B: Knowledge of Fluoride in Drinking Water and Section C: Perception of Fluoride in Drinking water with using a multi languages which are Bahasa Melayu and English. 21 questions was structured based on similar published literature on knowledge and perception towards the addition of fluoride to drinking water . This online questionnaire was adapted based on the study from Environmental Health Directorate (2012), Wilger et al., (2004),

Quinonez & locker(2009), Sabti et al., (2018) and Whyman et al., (2016). This questionnaire was graded using a percentage score of 50 percent, 51 percent -75 percent, or 76 percent -100 percent for poor, moderate, or good knowledge, respectively (Vanaja et al., 2016). Meanwhile, the perception score was also based on the percentage score obtained by each respondent, which was 10-20 percent, 21-35 percent, 36-60 percent, 61-85 percent, and 86-99 percent for very low, low, medium, high, and very high perception (Jusoh et al., 2015).

3.8.2 Procedure of Data Collection

The link of google form that contained the online questionnaire and consent form were distributed publicly through different social medias such as Facebook, Instagram and

WhatsApp. To accommodate better understanding among respondents, the questionnaire had been companioning with national language translation or bilanguage for every element in the questionnaire. All data collected will remain confidential and will be used only for the research study. Lastly, the online questionnaire collected were undergoing analysation by using IBM SPSS Statistic 26.

3.8.3 Quality Assurance and Quality Control

On the different population, a reliability test was performed to see if the questionnaire could be understood and to avoid using novel phrases. A reliability test was carried out prior to data collection. Internal consistency was calculated using Cronbach's alpha. Cronbach's alpha values between 0.6 and 1.0 are deemed acceptable. The actual result is 0.7734, indicating that the questionnaire was reliable and acceptable. The study population that took part in the pre-testing represented 10% of the study sample size with similar characteristics. As a result, 25 respondents were chosen to participate in the pre-testing to ensure the reliability of the study's data.

3.9 Data Analysis

Data analysis in the research is an essential part because it will draw conclusions about the collected data. In this study, several tests will be used to run collected data on the target population. Therefore, results can be generated to answer the hypothetical questions of this research. The tests used will be based on the specific goals described earlier.

3.9.1 Descriptive Analysis

Descriptive analysis is the description of the data set, which can be used to identify and explain the main characteristics of the data in this study. This method will identify core patterns and calculations of variability or dispersion in data collection. The mean, median, and mode are measures of central tendency. At the same time, variability measures include the smallest or largest variable, skewness, and standard deviation or variance. Descriptive research provides a valuable description of security benefits when conducting empirical and observational research because it provides detailed and comprehensive benefit behaviors. The specific goals for which descriptive analysis will be used are:

- To determine knowledge level of fluoride in drinking water among residents at Sungai Buloh Prison Quarters, Selangor.
- To determine sociodemographic factor of fluoride in drinking water among residents at Sungai Buloh Prison Quarters, Selangor.
- To determine perception level of fluoride in drinking water among residents at Kuaters Penjara Sungai Buloh Prison Quarters, Selangor.

3.9.2 Chi-square

The Chi-Square Test of Independence determines whether there is an association between categorical variables.

- To determine association between knowledge level and sociodemographic factors of fluoride in drinking water among residents at Sungai Buloh Prison Quarters, Selangor.
- To determine the association between perception level and sociodemographic factors of fluoride in drinking water among residents at Sungai Buloh Prison Quarters, Selangor.

3.10 Ethical Consideration

Ethical consideration was a necessary part of getting approval in conducting any studies or research. For this research study, ethical issue was submitted to obtain approval from Research Committee of Universiti Putra Malaysia, (JKEUPM) prior to data collection. This study had been approved by the Research Committee of Universiti Putra Malaysia (Ref No:

UPM/TNCPI/RMC/JKEUPM/1.4.18.2). Before answering the questionnaire, a detailed research explanation was conducted on the respondents. There was enough time allocated for them to decide to participate. If the interviewee agrees to continue participating, a written informed consent form will be provided to obtain their signature as an agreement. The confidentiality of all data will be strictly controlled and maintained because only researchers can retrieve.

CHAPTER 4

4.0 RESULTS

4.1 Study Background

The study was conducted from 19 November until 9 December 2021. From the sample size calculation, 255 respondents were recruited from the survey with considering 15% response rate through purposive and simple random sampling method. The response rate of this study is 100%, as this research was able to obtain the required number of respondents.

4.2 Sociodemographic information among residents at Sungai Buloh Prison Quarters, Selangor

Table 4.2 shows the sociodemographic information distribution. Descriptive analysis was used to reproduce the collected data in terms of frequency and counts to draw out the demographic features of the respondents concerning their:

1. Age
2. Gender
3. Education level

4. Duration lived at study area

4.2.1 Age

Most of the respondents were aged between 18 years old until 64 years old, 247 (96.9%) respondents, of which most of the age population lived there. Meanwhile, more than 64 years old recorded 8 (3.1%) respondents.

4.2.2 Gender

The result shows that males contributed to the majority, which is 167 (65.5%) respondents were male. Meanwhile, 88 (34.5%) of the respondents represent lesser female than male respondents.

4.2.3 Educational level

Most respondents are in tertiary education, with 155 (60.8%) respondents. Next, only 10 (3.9%) is from primary education. Meanwhile, 86 (33.7%) respondents for secondary education and lastly did not receive any formal education, which is 4 (1.6%) respondents.

4.2.4 Duration lived in the study area

Most of the respondents lived in the study area for about one to five years, with 82 (32.2%). Next, about 71 (27.8%) lived less than a year. Meanwhile, for more than ten years, about 54 (21.2%) lived in the study area for about six until ten years 48 (18.8%).

Table 4.1 sociodemographic information

	Parameter	Frequency	Percent (%)
Age	18 – 64 years old	247	96.9
	More than 64 years old	8	3.1
Gender	Male	167	65.5
	Female	88	34.5
Educational level	Primary education	10	3.9
	Secondary education	86	33.7
	Tertiary education	155	60.8
	Did not receive any formal education	4	1.6
	Less than a year	71	27.8
Duration lived at	1 – 5 years	82	32.2

Study area	6 – 10 years	48	18.8
	More than 10 years	54	21.2

4.3 Knowledge level of fluoride in drinking water among residents at Sungai Buloh Prison, Selangor.

To evaluate the level knowledge of fluoride in drinking water, descriptive analysis has been conducted to calculate the frequency and the percent of each question from the knowledge section. Tables 4.3 and 4.4 below illustrate the result of the analysis.

4.3.1 Knowledge items

From table 4.2 knowledge items, most of the 178 (69.8%) respondents know about fluoride and 172 (67.5%) respondents have heard and read about fluoride. The most source respondents had heard and read about fluoride are from electronic media, which is 66 (25.8%). Some respondents had heard or read about fluoride from educational institutions 31 (12.2%), Print media 21 (8.2%) and their friends is 20 (7.8%). There are 114 (44.7%) who know about the addition of fluoride in drinking water, and only 115 (45.1%) know the purpose of fluoride in drinking water. The 159 (62.4%) believe that using fluoride in drinking water can prevent dental caries and preserve oral health, and only 45 (17.6%) believe it can strengthen the bone. Then, only 76 (29.8%)

respondents know the optimal level of fluoride in drinking water implemented by the National Standard Drinking Water Quality (NSDWQ). There are 113 (44.3%) respondents who know the health effect of lack of fluoride in drinking water, and 119 (46.7%) know the health effect excessive of fluoride in drinking water. For the health effect excessive of fluoride, 28 (11%) respondents believe it can lead to dental fluorosis. The remaining 10 (3.9%) respondents believe it can lead to skeletal fluorosis, 4 (1.6%) respondents know it can lead to insulin secretion problem and 5 (2%) respondents know it can lead to Neural Development Problem and Thyroid Gland Problem. Lastly, only 18 (7.1%) respondents know the health effect lack of fluoride in drinking water can cause tooth decay, and 7 (2.7%) know it can cause weak bone structure.

Table 4.2 Distribution knowledge of Fluoride in Drinking Water

Knowledge items	**Correct n (%)**
General Knowledge	
Fluoride	
Know about fluoride	
1. Yes	178 (69.8)
2. No	77 (30.2)
Heard or read about fluoride before	
1. Yes	172 (67.5)
2. No	83 (32.5)

Source of heard or read about fluoride before	
1. Print media	21 (8.2)
2. Electronic media	66 (25.9)
3. Educational Institution	31(12.2)
4. Friends	20(7.8)
Know about addition of fluoride in drinking water	
1. Yes	114 (44.7)
2. No	141 (55.3)
Know purpose of fluoride in drinking water	
1. Yes	115(45.1)
2. No	140 (54.9)
Purpose addition of fluoride	
Prevent dental caries	159 (62.4)
Preserve Oral health	159 (62.4)
Strengthen bone	45 (17.6)
Know optimal level of fluoride addition in Drinking water that implemented by National Standard Drinking Water Quality (NSDWQ)	
1. Yes	76 (29.8)
2. No	179 (70.2)
Know health effect lack of fluoride	
1. Yes	113 (44.3)
2. No	142 (55.7)

Know health effect excessive of fluoride	
1. Yes	119 (46.7)
2. No	136 (53.3)
Health effect excessive of fluoride	
1. Dental fluorosis	28(11)
2. Skeletal fluorosis	10(3.9)
3. Insulin Secretion Problem	4(1.6)
4. Neural Development Problem	5(2)
5. Thyroid Gland Problem	5(2)
Health effect lack of fluoride	
1. Tooth decay	18 (7.1)
2. Weak bone structure	7 (2.7)

4.3.2 Level of Knowledge

Based on table 4.3, most respondents, 247 (96.9%), have poor level knowledge of fluoride in drinking water. Meanwhile, only 8 (3.1%) have a moderate knowledge level of fluoride in drinking water.

Table 4.3 Level of Knowledge

Level of Knowledge	Frequency	Percentage
Poor	247	96.9
Moderate	8	3.1

Good	0	0

The scoring method based on Vanaja et al., 2016

I. 1 – 50 %: Poor
II. 51 – 75 %: Moderate
III. 76 – 100 %: Good

4.4 Perception level of fluoride in drinking water among residents at Sungai Buloh, Selangor

To determine the level perception of fluoride in drinking water, descriptive analysis has been conducted to calculate the frequency and the percent of each question from the perception section. Tables 4.4 and 4.5 below show the result of the analysis.

4.4.1 Perception Items

Table 4.4 shows that most respondents, 134 (52.5%), use filter water as the main source of drinking water, 60 (23.5%) consume tap water from drinking water supply, and 58 (22.7%) consume drinking water from store-bought bottled water. They choose their source of drinking water because 32(12.5%) of them because of the taste, smell, and color of the drinking water, 10 (3.9%) of them because to guarantee the safety of drinking water consumption, and the remaining 27 (10.6%) respondents because of it can save money and time. Then, only 103 (40.4%) respondents believe the addition of fluoride in drinking water is safe, and 96 (37.6%) of them stated the effectiveness of fluoride in the drinking water supply. 124 (48.6%) of them stated that fluoride could

help prevent tooth decay and only 111 (43.5%) respondents into the addition of fluoride in drinking water.

Table 4.4 Distribution perception of fluoride in drinking water

Perception item	Correct N (%)
General Perception	
Fluoride	
Source of drinking water	
1. Tap water from public drinking water supply	60 (23.5)
2. Store bought bottled water	58 (22.7)
3. filter water	134 (52.5)
Reason chooses source of drinking water	
The taste, smell, and color of the drinking water	32(12.5)
To guarantee the safety of the drinking water consumption	10 (3.9)
Save money and time	27 (10.6)
Addition of fluoride in public drinking	

water supply safe	
1. Yes	103 (40.4)
2. No	152 (59.6)
Addition of fluoride in public drinking	
water supply is effective	
1. Yes	96 (37.6)
2. No	159 (62.4)
Addition of fluoride can help prevent	
tooth decay	
1. Yes	124 (48.6)
2. No	131 (51.4)
Into the addition of fluoride in drinking water	
1. Yes	111 (43.5)
2. No	144 (56.5)

4.4.2 Level of Perception

Table 4.5 stated that most respondents from residents at Sungai Buloh Prison Quarters, 83 (32.5%), have a medium-level perception of fluoride in drinking water. There are 81 (31.8%) who have a low level of perception, and 73 (28.6%) respondents, have a very low level of perception. Meanwhile, the remaining 18 (7.1%) respondents have a high-level perception of fluoride in drinking water.

Table 4.5 level of perception

Level of perception	Frequency (%)
Very Low	73 (28.6)
Low	81 (31.8)
Medium	83 (32.5)
High	18 (7.1)

Scoring method based on Taquddin Hj et al., 2015

i. 10 – 20 %: Very low
ii. 21 – 35 %: Low
iii. 36 – 60 %: Medium
iv. 61 – 85 %: High

4.5 Association between knowledge level and sociodemographic factors of fluoride in drinking water among residents at Sungai Buloh Prison Quarters, Selangor.

Chi-square was conducted to determine the association between level of knowledge and sociodemographic factor. Based on the results in table 4.5, none of the sociodemographic factors and level of knowledge is significant association. The p-value of each item was $p > 0.05$.

Table 4.6 Association between knowledge and sociodemographic factors of fluoride in drinking water

Sociodemographic Characteristic		Knowledge level (%) N =255			Expected Count, x^2	P – value (p < 0.05)
		Low	Moderate	Good		
Age	18 – 64 years old	239 (96.8)	8 (100)	0 (0)	0.268	1.0 [b]
	More than 64 years old	8 (3.2)	0 (0)	0 (0)	0.268	1.0 [b]
Gender	Male	160 (64.8)	7 (87.5)	0 (0)	1.770	0.269 [b]
	Female	87 (35.2)	1 (12.5)	0 (0)	1.770	0.269 [b]
Educational level	Primary Educational	10 (4)	0 (0)	0 (0)	0.914	0.820 [b]
	Secondary Educational	84 (34)	2 (25)	0 (0)	0.914	0.820 [b]
	Tertiary education	149 (96.1)	6 (75)	0 (0)	0.914	0.820 [b]
	Did not receive any formal education	4 (1.6)	0 (0)	0 (0)	0.914	0.820 [b]
Duration lived at study area	Less than a year	70 (28.3)	1 (1.4)	0 (0)	4.110	0.258 [b]
	1 – 5 years	78 (31.6)	4 (50)	0 (0)	4.110	0.258 [b]

	6 – 10 years	48 (19.4)	0 (0)	0 (0)	4.110	0.258 [b]
	More than 10 years	51 (20.6)	3 (37.5)	0 (0)	4.110	0.258 [b]

b = Fisher Exact Test, * p-value is significant at p

4.6 Association between perception level and sociodemographic factors of fluoride in drinking water among residents at Sungai Buloh Prison Quarters, Selangor.

Chi-square was conducted to determine the association between perception and sociodemographic factors. Based on the results in table 4.6, the finding showed there was no significant association between sociodemographic factors and levels of perception The p-value of each item was $p > 0.05$.

Table 4.7 Association between the level of perception and sociodemographic factors of fluoride in drinking water

Sociodemographic characteristics		Perception level				Expected Count, x^2	p-value $p < 0.05$
		Very low	low	Medium	High		
Age	18 – 64 years old	71 (97.3)	79 (97.5)	80 (96.4)	17 (6.9)	0.566	0.779 [b]
	More than 64 years old	2 (2.7)	2 (2.5)	3 (3.6)	1 (5.6)	0.566	0.779 [b]
Gender	Male	54 (74)	56 (69.1)	48 (57.9)	9 (50)	6.866	0.076[b]
	Female	19 (26)	25 (30.9)	35 (42.2)	9 (50)	6.866	0.076[b]

Educational Level	Primary Educational	4 (5.5)	4 (4.9)	2 (2.4)	0 (0)	13.279	0.164[b]
	Secondary Educational	23 (31.5)	31 (38.3)	22 (26.5)	10 (55.6)	13.279	0.164[b]
	Tertiary education	45 (61.6)	43 (53.1)	59 (71.1)	8 (44.4)	13.279	0.164[b]
	Did not receive any formal education	1 (1.4)	3 (3.7)	0 (0)	0 (0)	. 13.279	0.164[b]
Duration lived at the study area	Less than a year	18 (24.7)	26 (32.1)	22 (26.5)	5 (27.8)	2.876	0.969[b]
	1 – 5 years	23 (31.5)	28 (34.6)	25 (30.1)	6 (33.3)	2.876	0.969[b]
	6 – 10 years	14 (19.2)	13 (16)	18 (21.7)	3 (16.7)	2.876	0.969[b]
	More than 10 years	18 (24.7)	14 (17.3)	18 (21.7)	4 (22.2)	2.876	0.969[b]

b = Fisher Exact Test, * p-value is significant at p

CHAPTER 5

5.0 DISCUSSION

5.1 Sociodemograhic Characteristics

In total, 255 respondents who participated in the survey show that most of them aged between 18 to 64 years old, male, have tertiary education level, and lived in Sungai Buloh Prison Quarters one until five years. The majority of respondents (96.9%) were between the ages of 18 and 64, with 247 (96.9%) being over the age of 64, while 8 (3.1%) were over the age of 64.The age group of the Malaysian population was based on data from the Department of Statistics Malaysia in 2021, which shows that 22.7 million (69.6 percent) of Malaysians were dominated by the age group of 18-64 years old, with only 2.4 million belonging to the elderly age group more than 64 years old (7.4 percent).

Male respondents made up the majority of those who took part in this survey, with 167 (65.5 percent) compared to 88 (34.5 percent) female respondents.. A study

conducted by Sham et al., (2018) a total of 67 participants, all of whom were 14 years old consist with 36 responders (53.7 percent) were male, while 31 were female (46.7 percent). In addition to this, the result of this study also aligns with In addition to this, the result of this study also aligns with BOP Statistics: Staff Gender,(2022) in US male prison officer 26 026(71.3%) more than Female prison officer 10 713 (28.7%).Therefore most of the respondent on this survey from officer at Sungai Buloh Prison were male. Furthermore, the majority of them had more than 12 years of education, which is consistent with this study, which found that the majority of respondents in this survey were in or graduated from tertiary education level by 155 (60.8 percent) among the rest of the respondents' educational level categories.

According to this study, higher education graduates of Sungai Buloh Prison Quarters in Selangor have a higher overall knowledge and perception of fluorides. However, a recent study conducted by Muralidharan and Paul (2018) discovered no significant improvement in fluoride knowledge among fresh graduates and preclinical batch of tertiary education. Following that, the duration of residency revealed that the majority of respondents, 82 (32.2 percent), had been Sungai Buloh Prison Quarters residents for more than one to five years. This will almost certainly result in a slight overestimation of overall fluoride knowledge and perception among different

communities or newcomers. In the current study, residents who lived in the study area for a longer period of time scored higher on all levels of knowledge and perception of overall fluorides, with a poor level of knowledge and perception being the most common.

5.2 Knowledge of Fluoride in Drinking Water

In this study, the percentage of residents who showed poor knowledge of fluoride in drinking water was high compared to moderate knowledge. In contrast to this, the majority, 79%, had knowledge of the presence of fluoride in drinking water, 73% were not aware that fluoride in permissible concentration strengthens the tooth against decay, and 68% of people were not aware of the presence of fluoride in the foods they consumed (Knowledge, Attitude, and Practice of Parents about Dental Fluorosis in their Children, 2018).

In this study, most residents know about fluoride in drinking water from their read or heard. In addition, most of them received information from electronic media, educational institutional, Print media, and friends. According to Lowry et al. (2021), one-third of respondents (283/761, 37%) had read or heard about fluoridation in the previous 12 months from local newspapers, followed by dental

practises, and a significant minority believed that their water supply was already fluoridated.. Correspondingly to Shearer & Mitchell (2021), electronic media access to information has become quick, cheap, and simple to implement. Electronic media devices such as personal computers, smartphones, digital radio, and television can read digital content. One of the most popular forms of electronic media is presenting information on hypermedia websites via the global Internet network. Therefore, the percentage of respondents who had heard or read fluoride from electronic media sources is the highest of other information sources.

In addition, in 2013, 80 per cent of the population received water fluoridation as a result of strong collaboration among stakeholders and the extensive network of piped water supplies. Still, in 2018 due to the end of water fluoridation in Pahang, the coverage fell to 74.1 percent because lack of funding, weak legislation, the use of reverse osmosis water filtration systems, the difficulty of maintaining an optimal level of fluoride in the water, a lack of local data on the impact of Water Fluoridation cessation on oral health and cost-effectiveness were some of the significant challenges in Water Fluoridation (Faizah et al., 2020). Thus, in this study, only some people know about the purpose and addition of fluoride in drinking water due to the significant challenges of water fluoridation in Malaysia.

MS et al. (2017) have shown that consuming high fluoride levels from unregulated or untested sources can cause dental fluorosis, characterized by brownish mottling of the teeth in its most severe form. Some participants in both groups, dentists and medical practitioners, believed that fluoride could have adverse effects on general human health, cause allergies in some people, have a negative impact on human bones, cause cancer in humans, cause neurological side effects, and be environmentally expensive (Sabti et al., 2019). Furthermore, the World Health Organization (WHO) supports and recommends community water fluoridation because it is cost-effective in preventing tooth decay for both families and the health care system (Griffin et al. 2001). Despite having limited knowledge about the status of water fluoridation in Kuwait, approximately 77 percent of both dentists and medical practitioners believed that water supplies in Kuwait should be fluoridated (Sabti et al., 2019).

Despite the fact that numerous scientific studies have been conducted to demonstrate the effectiveness of fluoride in preventing oral and skeletal-related diseases through its addition to the drinking water system, there are still many opposing opinions and beliefs that do not support water fluoridation. According to

Seymour et al. (2015), there has been an increase in anti-fluoridators who choose to remove fluoride from their drinking water. According to the previous study, Fluorida County needed to reverse its decision to discontinue fluoridation entirely and fluoridate them again in 2013 due to public opposition to fluoridation in 2011. (Pinellas County Utilities, 2017). Furthermore, the Fluoride Action Network (FAN) is one of many organisations actively opposing the addition of fluoride to drinking water (Fluoride Action Network, 2021). Thus, it is critical to conduct this type of research because there are numerous rumours about fluoride use, and anti-fluoride groups may be able to disprove the rumours by clarifying the situation with scientific knowledge and source references.

5.3 Perception level

The residents of Sungai Buloh Prison Quarters primarily used a filtered water system as their primary drinking water source, followed by tap water. Only a few of them drink bottled water purchased from a store. This is because they believe it is safe for them to consume drinking water from their preferred drinking water source. A study was conducted in Mexico, where the majority of the population chose to drink water from readily available bottled water and filtered water systems. The unpleasant taste, cloudy appearance of the water, and foul odour of the water led them to believe that the

municipal drinking water supply in their country was unsafe to use as a drinking water supply to be consumedFurthermore, Due to corroded pipes, an air conditioning system, poor infrastructure, and possibly agricultural contamination, the Latina population claimed that using a filtered water system at their home was necessary due to their water supply appearing unclean and unsafe to drink. As a result, consumers will be sceptical of the municipal drinking water supply provided by the municipality (Scherzer et al., 2010).

According to Azlan et al. (2011), in their study conducted in Malaysia's Peninsular, tap water was first treated at the drinking water treatment plant before being released to the public for consumer use to ensure the parameters of the drinking water were within the permissible limit based on the Malaysian Drinking Water Standards implemented by the Ministry of Health (MOH). As a result, the drinking water was safe to drink without any treatment. However, the water can become contaminated due to old and corroded plumbing pipes, causing the drinking water to lack the physical properties (taste, smell, and colour) that it should have before reaching consumers. As a result, Malaysians were willing to spend hundreds of ringgits on a filtered water system for their home in order to ensure the safety of their drinking water consumption (Mat Salleh, 2007).

Most Malaysians placed less emphasis on other important parameters in ensuring water quality, such as fluoride concentration in drinking water, and more emphasis on physical properties such as taste, smell, and clarity of the water (Bahari et al., 2018; Mat Salleh, 2007). However, the majority of respondents in this study have a medium perception of fluoride in drinking water. This is because they agreed and supported the addition of fluoride to drinking water as a health benefit, such as effective prevention and treatment of developing dental caries, particularly in younger children. According to Gussy et al. (2008), fluoride exposure may have a protective effect and reduce the risk of dental caries from fluorides in drinking water as well as fluoridated oral products such as fluoridated toothpaste. Furthermore, according to the study's findings, 74 percent of parents agreed that fluoride could help prevent tooth decay in their children.

Fluoride was proven to be one of the most significant achievements in public health in the twentieth century because it was effective in preventing and controlling dental caries problems, particularly among young schoolchildren (The Story of Fluoridation | National Institute of Dental and Craniofacial Research, 2018). Despite the fact that numerous scientific studies had been conducted to demonstrate fluoride's effectiveness in combating dental caries, there were still some negative aspects or perceptions about drinking water fluoridation. The Fluoride Action Network (FAN) is

the most well-known organisation actively opposing the addition of fluoride to the public drinking water supply. Their goal, according to them, is to educate the public about the fluoride toxicity effect that most people and governments overlook, which is more than just treating tooth decay problems (Fluoride Action Network | About FAN, n.d.).

In agreement with Connett (2004), he identified the reasons for disagreement on drinking water fluoridation. One of the reasons was that fluoride intake was difficult to control once fluoride was added to drinking water because different people drank different amounts of water. People with chronic illnesses, such as diabetes patients, athletes, and common labourers, for example, drank more water than the average person, potentially exposing them to an excessive amount of fluoride. Furthermore, he stated that fluoride was not the only source of fluoride, but that fluoride can be found in a variety of places that may cause an excessive dosage of fluoride intake daily, such as tea drinks and toothpaste. Fluoride is abundant in tea beverages, particularly brewed black tea, which contains approximately 3 to 4 ppm of fluoride (Izuora et al., 2011). According to the study conducted by Lung et al., black tea has the highest amount of fluoride infused than other types of tea (2008). A person who consumes a lot of tea

drinks in a day may be more likely to develop dental or skeletal fluorosis (Tokalolu et al., 2004).

5.4 Association between Sociodemographic Characteristics with Knowledge and Perception on Fluride in Drinking Water

According to the findings of this study, the sociodemographic characteristics of age, gender, educational level, and residential duration had no significant association with knowledge level. Knowledge is an important factor in determining one's behaviour. One of the degrees of knowledge is application; if someone reaches this level, his knowledge will be used or applied in accordance with well-established principles (Efendi & Makhfduli, 2009).

The sociodemographic characteristics of age, gender, educational level, and residential duration were found to have no significant association with perception level in this study. Perhaps this is because the perception items were not specific enough to describe the respondents' personal opinion regarding the fluoridation of the drinking water supply, as determining perception and knowledge involved extracting the public's subjective rather than objective aspects or views about fluoride in drinking water. Aside

from that, it is possible that the respondents were unaware of the fluoride addition to the public's drinking water system, which prevented them from clarifying or voicing their opinions on the subject through this research.

CHAPTER 6

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

In Malaysia, implementing water fluoridation is a public health intervention to assure the most significant benefit in preventing tooth decay, resulting in better oral health and a higher quality of life. The Oral Health Division leads the effort to determine the ideal fluoride amount in drinking water to guarantee safety and effectiveness in preventing tooth decay. The standard level for fluoride in drinking water is incorporated into the National Guidelines for Drinking Water Quality document to conduct water fluoridation throughout the country (National Standards of Drinking Water Quality Revised 2000). All operators of water treatment facilities are responsible for adhering to the standard. Any changes to the recommended level will need the agreement of the National Drinking Water Quality Technical Committee.

Based on this study, they have low knowledge and moderate perception of fluoride in drinking water and no significant association between sociodemograhics

factors with knowledge and perception level of fluoride in drinking water due to limited access to sources of information that are more specific on fluoride. They only know fluoride from toothpaste advertisements and ingredients. It can be improved further by a good propagation of policies and measures by the government that can also help the residents enhance the perception of fluoride in drinking water. The program's availability and easy access are required to assure its cost-effectiveness, safety, and advantages, improving oral health and increasing the population's quality of life. The findings from this study should inspire government authorities to promote existing fluoride in drinking water even more.

6.2 Study Limitation

Several study limitations were discovered during the data collection process, which may have an impact on the outcome of the study. To begin, there has been limited research on the level of fluoride knowledge and perception in drinking water, particularly in Malaysia. Only a few studies were conducted in Malaysia, limiting the study's ability to obtain enough references from locals. Second, there is a lack of detailed questions because we did not have enough time to investigate the possible reasons for each answer choice. As a result, more research is needed to diversify the socio-demographic background of the public's awareness and satisfaction level with fluoride in

their water supply. Finally, this research was carried out using online platforms. Some people were unfamiliar with the online questionnaire and did not fully comprehend the instructions.

6.3 Recommendation

In order to overcome the study limitation, caution must be taken when making generalizations especially to other urban populations, other socio-demographic strata, or different geographic regions of fluoridated drinking water to ensure that the study are representative. We only received responses from a few people who had no formal education and many who had secondary and tertiary education. As a result, having a diverse range of individuals with varying educational levels participate in the study would yield the most accurate level of knowledge and perception about fluoride in drinking water.The researcher conducts the study face-to-face following the Standard Of Operation by the government during the sampling data and giving explicit instruction to the respondents that the result will be more accurate.

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ETHICS COMMITTEE FOR RESEARCH INVOLVING HUMAN SUBJECTS
(JKEUPM)
UNIVERSITI PUTRA MALAYSIA

Research title	:	**Fluoride In Drinking Water: A Knowledge And Perception Among Residents At Penjara Sungai Buloh, Selangor.**
Study Site	:	**Sungai Buloh, Selangor.**
JKEUPM Ref No.	:	**JKEUPM-2021-679**
Researcher	:	**Khairumi Binti Kasim**
Supervisor	:	**Dr Shaharudin Bin Mohd Sham**

Documents received and reviewed with reference to the above study:

1. Ethics Application Form, Version 1 dated 07/09/2021
2. Respondent's Information Sheet / Consent (English), Version 2 dated 19/11/2021
3. Proposal (English), Version 2 dated 9/11/2021
4. Questionnaire / Interviews (English), Version 1 dated 07/09/2021
5. Curriculum Vitae of:
    a. Dr. Shaharudin bin Mohd Sham

The University Research Ethics Committee, Universiti Putra Malaysia (JKEUPM) operates in accordance to the ICH-GCP Guidelines.
Decision by JKEUPM:

[X] Approved

[X] **Permission MUST BE OBTAINED from the respective hospitals/ institutions before conducting the research**

[ ] Disapproved

Please note that the approval is **VALID UNTIL 19 NOVEMBER 2022**

Researchers should comply with the following:

I. Complete a Study Final Report upon study completion (Form 3.2).

II. Ethical approval is required in the case of amendments/ changes to the study documents/ study sites/ study team.

III. Applicable for Clinical Trial Studies and Clinical interventional Studies only: Progress Report has to be submitted to JKEUPM at every 6 months from the date of approval (Form 3.1). Report occurrences of all Serious Adverse Events (SAEs), Suspected Unexpected Serious Adverse Reaction (SUSARs) and Protocol Deviation/ Violation at all JKEUPM approved sites to JKEUPM. SAEs are to be reported within 15 calendar days from awareness of event by investigator. Initial report of SUSARs are to be reported as soon as possible but not later than

Questionnaire

FLUORIDE IN DRINKING WATER : A KNOWLEDGE AND PERCEPTION AMONG RESIDENTS AT PENJARA SUNGAI BULOH , SELANGOR .

FLORIDE DALAM AIR MINUMAN : PENGETAHUAN DAN PERSEPI KALANGAN PENDUDUK DI PENJARA SUNGAI BULOH , SELANGOR.

QUESTIONNAIRE/SOAL SELIDIK

This set of questionnaires will be used as the instrument for obtaining information related to study matter from the respondents for the study purposes. The respondents need to answer all of the questions provided in the questionnaire below. The questionnaire consists of open-ended questions and has three sections. The three sections which are: **Section A: Socio-demographic Characteristics**, **Section B: Knowledge of Fluoride in Drinking Water** and **Section C: Perception of Fluoride in Drinking Water.**

Set soal selidik ini akan digunakan sebagai instrumen bagi memperoleh maklumat yang berkaitan dengan kajian daripada para responden untuk tujuan kajian. Responden perlu menjawab ke semua soalan yang disediakan dalam soal selidik di bawah. Soal selidik ini mengandungi soalan terbuka dan mempunyai tiga bahagian. Tiga bahagian yang disediakan dalam soal selidik ini antaranya ialah: **Bahagian A: Ciri-ciri Sosio-demografi**, **Bahagian B: Pengetahuan mengenai Fluorida di dalam Air Minuman** dan **Bahagian C: Persepsi mengenai Fluorida di dalam Air Minuman.**

Introduction

Fluoride is an ionized form of the element fluorine that will be beneficial to teeth because it will help to prevent tooth decay. In Malaysia, fluoride is added to drinking water to prevent tooth decay among children and has been a main concern to public health. All public water supplies intended for human consumption are subjected to drinking water quality standards known as the National Standard Drinking Water Quality (NSDWQ). NSDWQ is a set of guidelines designed to help determine the proper raw

water treatment that meets the drinking water quality standards for safe and potable water supply. Therefore, an optimum range for fluoride is 0.4mg/L - 0.6 mg/L to make sure the public did not receive lack or excess fluoride in drinking water that will lead to health risk such as dental fluorosis, skeletal fluorosis, insulin secretion problem, neural development problem, thyroid gland problem and tooth decay. A variety of sources of exposures to fluoride is through food, water and extreme usage of toothpaste. However, drinking water shows the highest prominence as the exposure to fluoride towards the public since it is a major consumption of fluoride through ingestion.

Pengenalan

Fluorida adalah bentuk terion dari unsur fluorin yang memberi manfaat kepada gigi kerana dapat membantu mencegah kerosakan gigi. Di Malaysia, fluorida ditambahkan ke bekalan air orang awam untuk mencegah kerosakan gigi terutama di kalangan kanak-kanak dan menjadi tumpuan utama kesihatan awam. Semua sumber bekalan air awam adalah tertakluk kepada standard kualiti air minuman yang dikenali sebagai Kualiti Air Minum Standard Nasional (NSDWQ). NSDWQ adalah satu garis panduan yang dirancang untuk membantu pengguna menentukan rawatan air yang betul dan memenuhi standard kualiti air bagi bekalan air yang selamat. Oleh itu, julat optimum yang ditetapkan oleh NSDWQ ialah 0.4mg / L - 0.6 mg / L untuk memastikan orang ramai tidak kekurangan atau berlebihan menggunakan fluorida dalam air minum yang akan menyebabkan risiko kesihatan seperti fluorosis gigi, fluorosis rangka, masalah rembesan insulin, masalah perkembangan saraf, masalah kelenjar tiroid dan kerosakan gigi. Pelbagai sumber pendedahan kepada fluorida seperti melalui makanan, air dan penggunaan ubat gigi yang berlebihan. Namun begitu , air minum menunjukkan keutamaan tertinggi kerana pendedahan fluorida kepada orang ramai melalui majoriti pengambilan florida melalui pencernaan.

Please tick (/) on the blank space provided.

Sila tandakan (/) pada ruangan kosong yang disediakan.

SECTION A: SOCIO-DEMOGRAPHIC CHARACTERISTICS

BAHAGIAN A: CIRI-CIRI SOSIO-DEMOGRAFI

1. Age/Umur:

☐ 18-64 years old / 18-64 tahun

☐ More than 64 years old / Lebih daripada 64 tahun

2. Gender/Jantina:

☐ Male / Lelaki

☐ Female / Wanita

3. Educational level/Tahap pembelajaran:

☐ Primary education / Pendidikan rendah

☐ Secondary education / Pendidikan menengah

☐ Tertiary education / Pendidikan tinggi

☐ Did not receive any formal education / Tidak menerima sebarang pendidikan formal

4. How long have you lived in the study area/Sudah berapa lama anda tinggal di kawasan penyelidikan?

☐ Less than a year / Kurang dari setahun

☐ 1-5 years / 1-5 tahun

☐ 6-10 years / 6-10 tahun

☐ More than 10 years / Lebih dari 10 tahun

SECTION B: KNOWLEDGE OF FLUORIDE IN DRINKING WATER

BAHAGIAN B: PENGETAHUAN MENGENAI FLUORIDA DI DALAM AIR MINUMAN

5. Do you know what fluoride is?/Adakah anda tahu apa itu fluorida?

- ☐ Yes / Ya
- ☐ No / Tidak
- ☐ Not sure / Tidak pasti

6. Have you heard or read about fluoride before?/Pernahkah anda mendengar atau membaca tentang fluorida sebelum ini?

- ☐ Yes / Ya
- ☐ No / Tidak
- ☐ Not sure / Tidak pasti

7. Where did you hear or read about fluoride? Please select all that apply./Di manakah anda mendengar atau membaca tentang fluorida? Sila tanda yang berkenaan.

- ☐ Print media / Media cetak
- ☐ Electronic media / Media elektronik
- ☐ Educational institution / Institusi pendidikan
- ☐ Friends / Rakan-rakan
- ☐ Others, please specify / Lain-lain, sila nyatakan: _____
- ☐ Not applicable / Tidak berkaitan

8. Do you know there is the addition of fluoride in your drinking water?/Adakah anda tahu terdapat penambahan fluorida di dalam air minuman anda?

- [ ] Yes / Ya
- [ ] No / Tidak
- [ ] Not sure / Tidak pasti

9. Do you know the purpose of the addition of fluoride in drinking water?/ Adakah anda tahu tujuan penambahan fluorida di dalam air minuman?

- [ ] Yes / Ya
- [ ] No / Tidak
- [ ] Not sure / Tidak pasti

10. What is/are the purpose(s) of the addition of fluoride in drinking water?/ Apakah tujuan penambahan fluorida di dalam air minuman?

- [ ] Prevent dental caries / Mengelakkan daripada karies gigi
- [ ] Preserve oral health / mengekalkan kesihatan oral
- [ ] Strengthen bones / Menguatkan tulang
- [ ] Not sure / Tidak pasti

11. Do you know the optimal level of fluoride addition in drinking water that is implemented by the National Standard Drinking Water Quality (NSDWQ)?/ Adakah anda tahu tahap optimal penambahan fluorida di dalam air minuman yang dilaksanakan oleh Kualiti Air Minum Standard Nasional (NSDWQ)?

- [ ] Yes / Ya
- [ ] No / Tidak
- [ ] Not sure / Tidak pasti

12. Lack of fluoride exposure can cause diseases/ Kurang pendedahan kepada fluorida boleh menyebabkan penyakit.

- [ ] Yes / Ya
- [ ] No / Tidak
- [ ] Not sure / Tidak pasti

13. Excessive exposure of fluoride can cause diseases/ Pendedahan fluorida yang berlebihan boleh menyebabkan penyakit.

- [ ] Yes / Ya
- [ ] No / Tidak
- [ ] Not sure / Tidak pasti

14. What are the health effects that may be caused by excessive levels of fluoride in drinking water?/ Apakah kesan kesihatan yang disebabkan oleh pendedahan fluorida yang berlebihan di dalam air minuman?

- [ ] Dental fluorosis / Fluorosis gigi
- [ ] Skeletal fluorosis / Fluorosis tulang
- [ ] Insulin secretion problem / Masalah pada perembesan insulin
- [ ] Neural development problem / Masalah pada perkembangan pembelajaran
- [ ] Thyroid gland problem / Masalah pada kelenjar tiroid
- [ ] Tooth decay / Pereputan gigi
- [ ] Not sure / Tidak pasti

15. What are the health effects that may be caused by lack of fluoride exposure in drinking water? / Apakah kesan kesihatan yang disebabkan oleh kurang pendadahan fluorida di dalam air minuman?

- [ ] Dental fluorosis / Fluorosis gigi
- [ ] Weak bones structure / Struktur tulang yang lemah
- [ ] Tooth decay / Pereputan gigi
- [ ] Not sure / Tidak pasti

SECTION C: PERCEPTION OF FLUORIDE IN DRINKING WATER

BAHAGIAN C: PERSEPSI MENGENAI FLUORIDA DI DALAM AIR MINUMAN

16. What is your most commonly used source of drinking water? / Apakah sumber bekalan air minuman yang sering digunakan?

☐ Tap water from public drinking water supply / Air paip daripada sistem air minuman awam

☐ Store bought bottled water / Air botol yang dibeli

☐ Others, please specify:

17. State the reason for your choice of the drinking water source/ Nyatakan sebab pilihan sumber air minuman anda.

*You can choose more than one answer/ *Anda boleh memilih lebih daripada satu jawapan.

☐ The taste, smell and color of the drinking water / Rasa, bau dan warna air minuman

☐ Save money and time / Jimat kos dan masa

☐ To guarantee the safety of the drinking water consumption / Yakin dengan keselamatan air minuman

☐ Others, please specify / Lain-lain, sila nyatakan:

18 Do you think that the addition of fluoride to the public drinking water supply is safe? / Adakah anda berpendapat bahawa penambahan fluorida ke dalam bekalan air minuman awam adalah selamat?

☐ Yes / Ya

☐ No / Tidak

☐ Not sure / Tidak pasti

19. Do you think that the addition of fluoride to the public drinking water supply is effective? / Adakah anda berpendapat bahawa penambahan fluorida ke dalam bekalan air minuman awam adalah berkesan?

- ☐ Yes / Ya
- ☐ No / Tidak
- ☐ Not sure / Tidak pasti

20. Do you think that the addition of fluoride to public drinking water supply can help prevent tooth decay? / Adakah anda berpendapat bahawa penambahan fluorida ke dalam bekalan air minuman awam dapat membantu mengelakkan pereputan gigi?

- ☐ Yes / Ya
- ☐ No / Tidak
- ☐ Not sure / Tidak pasti

21. Are you into the addition of fluoride in drinking water? / Adakah anda menyokong penambahan fluorida di dalam air minuman?

- ☐ Yes / Ya
- ☐ No / Tidak
- ☐ Not sure / Tidak pasti