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Dental Fluorosis and Associated Risk Factors Among Palestinian Children in Gaza Governorates

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Dedication

"I would like to dedicate this work to all my family: father, mother, sisters, brothers, lovely nephew Osama, lovely niece Samira, to my friends and to all Palestinian children".

Lamis Abu Haloub

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Abstract

Dental Fluorosis is a specific disturbance of tooth formation caused by excessive fluoride intake. In Gaza Strip, drinking water contains more than the optimal amount of Fluoride. Gaza population has suffered from this problem for decades. Thus, the Dental Fluorosis is high among children in Gaza strip.

Consequently, a cross-sectional study was conducted to study the prevalence and severity of Dental Fluorosis and to explore its possible associated risk factors among Palestinian children aged 12-18 years in Gaza Governorates. For this purpose the study was planed to estimate the prevalence and severity of Dental Fluorosis among children aged 12-18 years in Gaza Governorates, to explore risk factors associated with Dental Fluorosis, to examine the association between Dental Fluorosis and fluoride concentration in drinking water wells in Gaza Governorates and to study the public perception of Dental Fluorosis.

The study population was children in the preparatory and secondary school age (12-18 years old) in all Gaza Governorates, who were born and have spent their first seven years of age in the same house that they live in at the time of study. And mothers of the selected children are involved in the study. The sample size was 350 children and it was selected as a stratified cluster random sample from the five Gaza strip governates (North Gaza, Gaza City, Midzone, Khan-Younis and Rafah). Each selected cluster was served for water supplies by wells with Known past chemical examination for Fluoride concentration. Data was collected using closed and open-ended questionnaire.

The study estimated the prevalence of Dental Fluorosis among children is 78%. Among them 63.4% have questionable to moderate Dental Fluorosis (TFI score 1-4) and 14.6% have severe Dental Fluorosis (TFI score 5-8). Concerning the average Fluoride concentration in municipal wells the results revealed that 57.1% is more than 1ppm.

The highest prevalence of Dental Fluorosis was in Mid-zone and Rafah. Children living in Khan-Younis are the most exposed children to Sever Dental Fluorosis. The children of Professional and Managerial fathers or fathers finished 13 years of education and more are less exposed to it. Furthermore, the children of working mothers outside house are less exposed. On the other hand, almost all families in Gaza strip use fluoridated toothpaste. Covering the brushes with pea size fluoridated toothpaste highly statistically significant decreases the likelihood of having Dental Fluorosis. Not to swallow fluoridated toothpaste minimizes the risk of Dental Fluorosis. There is an observed lack in Knowledge of the mothers and children around Dental Fluorosis causes and preventing methods, leads to increase the risk of exposure to it. Living in houses near dust decreases the chances of having it, while living in houses near main road increases the chances of having it. Moreover, using open fire as heating system during winter highly statistically significant increases Dental Fluorosis.

There is highly statistically significant negative association between the consumption level of the Protein during the first 7 years of age and severity of Dental Fluorosis. A highly statistically significant positive association was observed between the severity of Dental Fluorosis and Fluoride concentration in drinking water.

The people in Gaza strip generally illustrated negative public perception towards Dental Fluorosis. They believe that the responsibility of solving this problem lies on government institutions but they are ready to participate in proposed solutions.

In conclusion, not only the Fluoride existence in drinking water is the cause of high Dental Fluorosis in Gaza strip, but also there are other risk factors contribute in maximize Dental Fluorosis and this obviously singes to the increased poisoning of children by excessive fluoride intake. Meaning that, there is an urgent need to conduct a quick intervention towards solving this problem.

الخلاصة

يعاني الشعب الفلسطيني في قطاع غزة و منذ عقود من مشكلة تسمم الأسنان الفلوري. و قد أشار لهذه المشكلة د. رمزي صنصور في سنة 1991 ، حيث شدد على خطورة هذه المشكلة. و بعد لذلك أوضحت تقارير برنامج الصحة المدرسية ارتفاعا في معدل انتشار التسمم الفلوري للأسنان بين طلاب المدارس .

تسمم الأسنان الفلوري هو تشوه في هيكل السن، نتيجة تعرض الجسم لكمية فلور زائدة. أن مدى انتشار التسمم الفلوري يعتمد على كمية الفلور الداخلة للجسم، وفترة التعرض له، وعمر الطفل. و من جهة أخرى التعرض لنسبة عالية من الفلور يتسبب في مضارا صحية أخرى قد تظهر بعد سنوات. لذلك أدرك كثير من الباحثين مدى خطورة تسمم جسم الإنسان الناجمة عن أخذ كمية فلور زائدة، و بالأخص خلال فترة الطفولة، ولذلك قام الباحثون بعمل دراسات لتحرى عوامل الخطر لهذه المشكلة بهدف السيطرة والقضاء على آثارها الصحية السيئة.

ولتحقيق نفس الهدف قام الباحث بعمل هذه الدراسة في قطاع غزة، ليحدد معدل التسمم الفلوري بين الأطفال الفلسطينيين في محافظات قطاع غزة في العمر ما بين 12 و18 سنة. و تهدف هذه الدراسة لتحديد خطورة المشكلة، وقياس مدى تأثير عوامل أخرى في زيادة حدة هذه المشكلة.

وقد كانت الأهداف الخاصة لهذه الدراسة هي قياس معدل وشدة انتشار التسمم الفلوري بين الأطفال في محافظات غزة، في العمر ما بين 12 و18 سنة، والبحث عن عوامل الخطر المرتبطة بالتسمم الفلوري للأسنان وفحص العلاقة بين التسمم الفلوري للأسنان ونسبة تركيز الفلور في آبار مياه الشرب في محافظات غزة، و دراسة الإدراك العام تجاه التسمم الفلوري للأسنان.

تتكون عينة البحث من 350 طفلا في عمر المراحل الدراسية الإعدادية والثانوية ما بين (12-18 سنة) في كل محافظات قطاع غزة، الذين ولدوا و قضوا السبع السنوات الأولى من عمرهم في نفس المنزل الذي يعيشون فيه أثناء وقت الدراسة، وتشمل الدراسة مقابلة مع أمهات الأطفال المختارين.

اختار الباحث عينة عشوائية عنقودية طبقية من المحافظات الخمس في قطاع غزة (شمال غزة - مدينة غزة - المنطقة الوسطى- خانيونس – رفح)، كل عنقود مختار مزود ببئر مياه معروف الفحص الكيميائي للتركيز الفلوري له، و قد قام الباحث بمقابلة و توجيه أسئلة للأطفال وأمهاتهم لجمع البيانات، و ذلك باستخدام استبانه تشتمل على أسئلة مغلقة ومفتوحة. أعطى الباحث البيانات رموزا و أدخلها وحللها باستخدام برنامج التحليل الإحصائي SPSS و برنامج Epi Info 6.

و من نتائج هذه الدراسة فأن اكبر فئة عمرية في عينة الدراسة تشمل الأطفال ما بين 12 و13 سنة وتشكل الإناث 56,9 % من عينة الدراسة، و معظمهم غير متزوجين أو خاطبين . كما أوضحت هذه الدراسة أن نسبة العاطلين عن العمل من آباء الأطفال 48,6 % و40,3% منهم عدد سنوات دراستهم ما بين 7-12 سنة، و إن معظم الأمهات ربات منزل و61,4% منهن انهين ما بين 1-9 سنوات من الدراسة، وهناك 46,9% من العائلات دخلهم الشهري يتراوح ما بين 200 و 1500شيكلا و53.1% دخلهم ما بين 1600 إلى 4000 شيكلا، يعتبر الدخل الشهري الحالي مقارنة بالسنوات الماضية أسوأ بنسبة 88,3% من عينة الدراسة، و أن العائلات التي يوجد بها من 1-8 أطفال تشكل 54,6% من عينة الدراسة، و أن نسبة 65% من أطفال العينة يقع ترتيبهم في أسرهم بين الأول والرابع ، إضافة لذلك وجدت الدراسة أن كل العائلات يستخدمون معجون الأسنان الحاوي على الفلوريد، ولا يوجد في قطاع غزة أي طفل تلقى عقاقيرا فلورية أو معالجة داعمة بالفلور خلال السبع السنوات الأولى من عمره ، بالإضافة إلى

عدم معرفة الأمهات والأطفال في قطاع غزة بما هو التسمم الفلوري للأسنان ، و أوضحت الدراسة أيضا أن معظم الأمهات والأطفال لم يتلقوا أية معلومات عنه، و ذلك يعني أن عدم معرفة الأمهات والأطفال ماهية التسمم الفلوري في قطاع غزة يؤدي لزيادة خطر التعرض للتسمم الفلوري للأسنان.

وجدت هذه الدراسة أن تركيز الفلور في 57,1% من آبار البلدية اكثر من 1 جزء بالمليون، إضافة لذلك لا تملك أية أسرة جهاز تنقية للمياه خلال السبع السنوات الأولى من عمر أطفال عينة الدراسة، و تستخدم كل الأسر المشاركة في الدراسة مياه الشرب من شبكة المياه للبلدية.

التحليل الإحصائي لبيانات الدراسة كشفت أن معدل انتشار التسمم الفلوري بين أطفال فلسطين البالغين من العمر 12-18 سنة في قطاع غزة حسب مؤشر Tyllstrup-Fejerskov للتسمم الفلوري للأسنان يساوي 78%. و لوحظ أن أعلى معدل للتسمم الفلوري الخفيف و المتوسط الشدة - درجة TFI ما بين 1-4 - في الفئة العمرية ما بين 12- 13 سنة، بينما اتضح أن أعلى معدل للتسمم الفلوري الشديد - درجة TFI ما بين 5-8 - موجود في الفئة العمرية 16 سنة واكثر.

بالإضافة لذلك أوضحت الدراسة أن أعلى معدل انتشار للتسمم الفلوري موجود في المنطقتين الوسطى و رفح، و بالرغم من أن معدل الانتشار مرتفع أيضا في منطقة خانيونس إلا أن شدة التسمم بين هؤلاء الأطفال كانت الأعلى.

كذلك أوضحت الدراسة أن معدل انتشار تسمم الأسنان الفلوري ذو دلالة إحصائية بدرجة عالية بين أطفال الأباء العاملين في المهن المتوسطة، و أطفال الأسر التي دخلها الشهري قليل مقارنة بالسنوات الماضية، و الأسر التي تستخدم الحطب للتدفئة في الشتاء، و الأسر التي استهلاكها منخفض أو متوسط للبروتين الحيواني خلال سبع السنوات الأولى من عمر الطفل. وكذلك ثبت إحصائيا بدرجة عالية ارتفاع معدل التسمم الفلوري للأسنان الشديد مع ارتفاع نسبة الفلور في مياه الشرب.

بالإضافة لذلك أوضحت الدراسة وجود علاقة طردية ذات دلالة إحصائية بين التسمم الفلوري وبين العوامل الآتية : أطفال الأمهات ربات المنزل، وبلع معجون الأسنان الحاوي على الفلوريد خلال سبع السنوات الأولى من العمر، والسكن بقرب مصدر شارع رئيسي ، و شرب حليب بقري أو حليب بقري مع حليب بودرة، واستهلاك منخفض للبروتين النباتي الموجود في الجوز والبندق والبازلاء والفاصوليا والحبوب مثل الأرز والقمح والذرة.

هذه الدراسة أظهرت علاقة طردية بين التسمم الفلوري للأسنان وعوامل أخرى ولكن هذه العلاقة لم تكن ذات، دلالة إحصائية مثل: أن يكون الطفل في عمر 16سنة أو اكثر، أو أن يكون ذكرا، و أن يكون الدخل الشهري للأسرة بالشيكل منخفضا، و في الأسر التي تحتوي على اقل من 9 أطفال، و عندما يكون ترتيب الطفل بين اخوته قبل الخامس، و تفريش الأسنان بمعجون يحتوي على الفلوريد خلال سبع السنوات الأولى من العمر، و عدم المضمضة جيدا بعد تفريش الأسنان خلال سبع السنوات الأولى من العمر، ووجود اهتمام بمركبات معجون الأسنان، و هناك عوامل أخرى مثل عدم استخدام الفحم أو الكهرباء للتدفئة خلال الشتاء، و إعطاء Formula للأطفال بعد الشهر الثاني ، وعدم تقديم الرضاعة الطبيعية حصريا ، و أكل السمك اكثر من مرتين في الشهر، وبدء شرب الحليب بعد الشهر الخامس عشر من العمر، وشرب أقل من ثلاثة أكواب حليب في اليوم من عمر سنة إلى 3 سنة، و شرب الشاي منذ السنة الأولى من العمر، وشرب أكثر من كوبي شاي خلال العمر من 4 إلى 7 سنوات، و إضافة أقل من ملعقتي سكر لكل كوب شاي ، و استهلاك منخفض للبروتين النباتي من عدس و بذر اليقطين وبذر عباد الشمس واستهلاك منخفض من الكالسيوم وكذلك فيتامين C من الفواكه مثل البرتقال.

بالنسبة إلى الإدراك (التقبل) العام للتسمم الفلوري للأسنان، أبدى الأمهات و الأطفال في قطاع غزة بشكل عام تقبل سلبي للتسمم الفلوري للأسنان ، إضافة لذلك هم يؤمنون بأن مسئولية حل هذه المشكلة تقع على عاتق المؤسسات الحكومية ولكن هم على استعداد للمشاركة في الحلول المقترحة.

خلاصة لما سبق ، ليس فقط وجود الفلور في أبار البلديات التي تزود مياه الشرب هو السبب الوحيد لتسمم الأسنان في قطاع غزة و لكن هناك عوامل خطر أخرى تساهم في زيادة التسمم الفلوري للأسنان وزيادة تسمم الأطفال الفلسطينيين في قطاع غزة بواسطة أخذ كمية زائدة من الفلور. بالتالي يجب أن تضع السلطة الفلسطينية خطة وطنية تهدف إلى توجيه جهود جادة وتدخل سريع باتجاه حل هذه المشكلة بواسطة الحد أو على الأقل تقليل الأثر السيء لعوامل المسببة للتسمم الفلوري عند الاطفال .

List of abbreviations

DF	Dental Fluorosis
DI	Dean Index
F	Fluoride
HMIS	Health Management Information System
Km^2	Square Kilometer
mg/l	millie gram per liter
mm	millie meter
MoH	Ministry of Health
n	number
NGOs	Non Governmental Organizations
OR	Odds Ratio
PCBS	Palestinian Central Bureau of Statistics
PHC	Primary Health Care
ppm	part per million
SD	Standard Deviation
SPSS	Statistical Package of Social Sciences
TFI	Thylstrup-Fejerskov Index
TSIF	Tooth Surface Index of Fluorosis
UNRWA	United National Relief and Work Agency
WHO	World Health Organization

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Chapter 1

Introduction

Dental Fluorosis or "mottled enamel" is a disfigurement associated with the ingestion of toxic amounts of fluorides during the period of calcification of the teeth in infancy and early childhood from birth to 6 years old (Dean, 1936). By other words, Dental Fluorosis is an enamel defect caused by an excessive intake of fluorides during the time of enamel formation. Because of high fluoride intake, the forming enamel becomes "hypomineralized", meaning under - or demineralized. And they added that the calcium content is found depleted in Fluorosis teeth and the tooth matrix becomes demineralized (Rajan & Gnanasundaram,, 1989; Susheela et al, 1993).

In 1991, Dr. Ramzi Sansur studied this problem in Gaza strip and emphasizes on the seriousness of this problem in Gaza strip. After the return of Palestinian authority and establishing school health and oral and dental health departments in Ministry of Health, reports of school health illustrated high prevalence of dental Fluorosis among pupils in Gaza strip. These reports raise the awareness of the risk of high concentration of fluoride in drinking-water. The dental Fluorosis prevalence increased from 19.7% to 28.8% among 12 years old school children from1996 to 2002 and from 17.3% to 30.7% among 15 years old school children from 1996 to 2002.

In Gaza strip 1999, The prevalence of dental Fluorosis among the 7th class (12years old) was the highest in Rafah 60% then Khan-Younis 50.5% while in North Gaza it does not exceed 7.1% where fluoride concentration is very low (Ministry of Health, 2000).

In Gaza strip, groundwater is the only single source for water supply. Unfortunately, there is annual deficit in water availability in Gaza Strip, nearly 50 million m^3/y, leads

to graduate degradation in water quality because of unaware overuse (Abuzahrah, 1995).

Consequently, the drinking water contamination by fluoride is increasing, specially, in wells of the southern and eastern zones. Gaza population has suffered from this problem for decades.

Furthermore, the Dental Fluorosis prevalence 7.1% in the areas where fluoride in drinking water is less than 1.5 ppm, such in North Governorates in Gaza Strip as illustrated in reports of Environmental Health Laboratory "Public health lab: food and water" at Ministry of Health, means that there are other factors contributed to Fluorosis and increasing the risk of fluoride poisoning in non contaminated areas. Even they contribute in increasing the severity of Dental Fluorosis and the poisoning by fluoride component among children in contaminated areas like tea drinking, hot climate, malnutrition and using fluoridated toothpaste.

This contamination causes also other bad health-effects that appear after years of using contaminated water such as: hip fracture, osteosarcoma cancer in children, and skeletal Fluorosis (Babiuk, 1998). In Gaza, it is very difficult to measure the prevalence of these diseases except Dental Fluorosis, because Dental Fluorosis is the first visible sign indicating that much fluoride has poisoned the whole body. Beside the health hazards there are other bad effects as the costs of other medical and dental problems and the effect on the victims and their loss of time.

Furthermore, Palestinian people are not aware enough about the methods that minimize this problem. And the treatment of Dental Fluorosis problem is costly and Palestinian people cannot afford it, and it will cause burden on Palestinian people and government. Even treatment of drinking water from fluoride is very costly. Many developing countries that suffered from this problem found an appropriate solution so we can get

benefit of their experiences for solving our problem. There are other factors must be considered in solving dental Fluorosis problem such climate, fluoride intake, nutrition, population awareness and participation, tea drinking, imported juice, fluoridated toothpaste and income. On the other hand, the researcher found that Dental Fluorosis has bad psychological effect on children suffering from it. In addition, it negatively affects the public perception which will be reflected on the public manner with people who suffer from this problem generally and children especially.

So, in this study, the researcher plan to determine the prevalence and the severity of Dental Fluorosis among Palestinian children12-18 years old in Gaza Governorates in order to determine the seriousness of the problem and to measure the effect of other factors in increasing the severity of problem.

1.1 Objectives

Main Objective

To study the prevalence and severity of Dental Fluorosis and to explore its possible associated risk factors among Palestinian children aged 12-18 years in Gaza Governorates.

Specific Objectives

1. To estimate the prevalence and severity of Dental Fluorosis among children aged 12-18 years in Gaza Governorates.
2. To explore risk factors associated with Dental Fluorosis.
3. To examine the association between Dental Fluorosis and fluoride concentration in drinking water wells in Gaza Governorates.
4. To study the public perception of Dental Fluorosis.

1.2 Feasibility

The researcher can obtain agreement and ethical approval from Ministry of Health (Annex 1, 2, 3) and UNRWA (Annex 4). Even, the researcher will secure the Helsinki Committee agreement (Annex, 5) and informed consent from the children and their mothers (Annex 6, 7). The research could be funded by the researcher himself.

1.3 Context of the study

Through the coming paragraphs the researcher will mention some historical and political background about Gaza Strip and presented some demographic trends and socioeconomic characteristics. Moreover, the researcher will provide a brief about Oral and Dental health and School health services in Gaza strip.

1.4 Geographical Distribution

Palestinian National Authority territories comprise two areas separated geographically: West Bank and Gaza Strip (Annex 8). West Bank lies within an area of 5,800 Km^2 west of the river Jordan. Gaza Strip is a narrow piece of land lying on the coast of Mediterranean Sea (Annex 9). Its position on the crossroads from Africa to Asia made it a target for occupiers and conquerors over the centuries. Gaza Strip is very crowded place with an area of 360 Km^2. The population is mainly concentrated in the cities, small village, and eight refugee camps that contain two third of the population. Part of the refugee population is moving from camps to new areas (MoH-HMIS, 2003).

The principal water resources available to Palestinian include groundwater, springs and harvested rainwater. The major water resources in West Bank consist of groundwater and springs, while additional sources include rainwater harvesting. In Gaza Strip, most municipals use groundwater without any treatment except for disinfection. Moreover, about 95% of Gaza residents have access to water supply system (MoH-HMIS, 2003).

1.5 Historical and Political background

West Bank has been under Israeli military occupation, together with East Jerusalem since June 1967. Gaza strip had been occupied by Israel from Egyptian in 1967.

The population of Gaza Strip -as all Palestinian population- has lived through several consecutive wars (1948, 1956, 1967) and long stressful periods under Israeli occupation, during the years from 1987 to 1992, Intifada - the Palestinian uprising- erupted spontaneously. It was led by children and youth, who chose to face the Israel occupation by stones, burning tires and roads blocks. Since 29 September 2000, Al-Aqsa Intifada has been erupted to face the Israeli neglecting of Palestinian national rights (MoH-HMIS, 2003).

1.6 Demographic trends

The estimated number of Palestinian population all over the world by the mid of 2002 is 9,209,773. In Palestinian territories 3,465,550, in Gaza Strip the population size is estimated at 1,261,909. According to population pyramid that shows age and sex distribution of population, in Gaza Strip 49.6% of population is under 15 years. Sex ratio in the Palestine equals 102.2 males per 100 females (MoH-HMIS, 2003). Population density in the Gaza Strip is very high compared with the density in West Bank and the neighborhood countries. Density rate is about 3,505 inhabitants per one square kilometer in Gaza Strip and about 380 inhabitants per one square kilometer in West Bank. Actually, it must be taken into consideration that a sizable area of the Gaza Strip and West Bank is still occupied by Israeli settlers. Therefore, the actual density rates are higher than the estimated figures. The dependency ratio for Palestine in 2002 is 101.6% -108% in Gaza Strip versus 92% in West Bank (MoH-HMIS, 2003).

1.7 Socioeconomic Characteristics

The main income sources for Gaza population are working in Israel, in addition to the limited agriculture products that have to be exported via Israel. The second year of Intifada witnessed a farther steep decline in all Palestinian economic indicators. Gross National Income (GNI) in 2002 declined to 40% less than in 2000. Real per capita incomes are now only half of their September 2000 level. Unemployed stand at 40% of the workforce (MoH-HMIS, 2003). It is worth mentioning that there is large number of Palestinians employed at ministries of Palestinian authority.

1.8 Oral and Dental health services

In Palestine, MoH, UNRWA, NGOs, Police Medical Services and private sector provide dental health services. MoH operates 43 dental clinics in PHC centers in 2002. These clinics served people and the referred students through school health programs. UNRWA operates 11 clinics in Gaza Strip and number of clinics in West Bank. In Gaza Strip and West Bank, there are 10 dental clinics in non MoH health providers and 16 dental clinics operated by Police Medical Services. The main dental treatment in dental clinics are filling, minor surgery, gingival treatment and teeth scaling. In addition to dental X ray for diagnosis and others medical treatment for dental patients (MoH-HMIS, 2003). The private sector contains a large number of dental clinics which provide all dental treatments, but there is not specified number for these clinics.

1.9 School Health Programs

The government school health program is aiming students who are currently enrolled in governmental and private schools in Gaza Strip and West Bank respectively from 1st to 12th grades. The target health program is the student in 1st grade (3rd grade and West Bank) 7th grade and 10th grade students. In addition to UNRWA health programs targeted the refugee students in Gaza Strip and West Bank (MoH-HMIS, 2003).

School health teams have examined the student general health status including oral and dental health. Individual medical file is prepared for each student, then the detected cases are referred for treatment and subsequences follow up. School health also provides programs such as vaccination, health education and promotion, school health environment and psychological health care (MoH-HMIS, 2003). NGOs also contribute in School Health Programs

Chapter 2

Literature review

2.1 Definition and clinical features of Dental Fluorosis

Dean (1936) had defined Dental Fluorosis or "mottled enamel" as a disfigurement associated with the ingestion of toxic amounts of fluorides during the period of calcification of the teeth in infancy and early childhood from birth to 6 years old. The permanent teeth, mainly, are affected, although Dental Fluorosis can sometimes appear in baby teeth. The mottling has been described by the American Medical Association as the most delicate criterion of harm from fluoride and acknowledged that this will inevitably result from water containing 1 ppm Fluoride.

Others confirmed the previous definition and defined Dental Fluorosis as an enamel defect caused by an excessive intake of fluorides during the time of enamel formation. Because of high fluoride intake, the forming enamel becomes "hypomineralized", meaning under - or demineralized. And they added that the calcium content is found depleted in fluorosed teeth and the tooth matrix becomes demineralized (Rajan & Gnanasundaram, 1989; Susheela et al, 1993).

Logan and Kronfeld (1933) illustrated that the calcification of enamel of all teeth - except third molars – complete nearly in the first seven years of child age (Annex 18).

This research will indicate the resources of Fluoride ingested to child body during the first 7 years of age, because Dean clarified that ingestion of toxic amounts of fluorides during the period of calcification of the teeth in infancy associated with Dental Fluorosis problem.

In United States of America, the Public Health Service at the Department of Health and Human Services (1991) had given more detailed definition and had illustrated the clinical features of dental Fluorosis. It said that Dental Fluorosis is a hypoplasia or

hypomineralization of the dental enamel caused by the consumption of excessive amounts of fluoride during the years of tooth calcification. Long-term intake of fluoride during enamel formation results in a continuum of clinical changes of the enamel varying from fine white lines in the enamel to severely chalky, opaque enamel which breaks apart soon after tooth eruption. The severity of changes depends on the amount of fluoride ingested during the long-lasting period of tooth formation.

The first signs of Dental Fluorosis appear as thin white stria across the enamel surface. In slightly more affected teeth, the fine white lines become broader and more pronounced. Occasional merging of several lines occurs to produce smaller irregular, cloudy or paper-white areas scattered over the surface. With increasing severity, the entire tooth surface exhibits distinct, irregular, opaque, or cloudy white areas. The next degree of severity manifests in irregular opaque areas, which merge until the entire tooth surface appears chalky white. Yet more severe stages exhibit a tooth surface which is entirely opaque with focal loss of the outermost enamel. Such small enamel defects are usually designated "pits". With increasing severity these pits merge to form horizontal bands. Ultimately, the most severely fluorotic teeth exhibit an almost total loss of surface enamel whereby the normal morphology is severely affected. The remaining part of the tooth often exhibits a dark brownish discoloration. The discoloration is entirely dependent on post-eruptive environmental conditions such as dietary habits (Public Health Service, 1991).

Awadia et al. shared all previous researcher when he said Dental Fluorosis is characterised by lusterless, opaque white, patches in the enamel which may become stained yellow to dark brown and in severe forms cause marked pitting and brittleness of teeth. It is a serious health problem in many Eastern African countries. Dental

Fluorosis is associated with excessive fluoride exposure at the age of tooth formation (Awadia et al., 2000).

2.2 Measurement of Dental Fluorosis

Pereira and Moreira (1999) discussed two distinct groups of indexes have been proposed for measuring enamel defects, specific Fluorosis indexes and descriptive indexes, including all types of defects. The specific Fluorosis indexes are used for checking enamel defects due to the chronic, accumulated ingestion of fluoride. Dean (1934) developed a Fluorosis index which classified individuals into 5 categories, depending on the degree of enamel alteration, and which was based on the identification of the 2 most severely affected teeth, giving ordinal numbers as the severity of the enamel alteration increased. Moller (1982) illustrated that Dean later modified this index.

Classification and Criteria of Dental Fluorosis as defined by Dean (1942): (Annex 10)

Normal - The enamel represents the usual translucent semi-vitriform type of structure. The surface is smooth, glossy, and usually of a pale creamy white color.

Questionable – the enamel discloses slight aberrations from the translucency of normal enamel, ranging from a few white flecks to occasional white spots. This classification is utilized in those instances where a definite diagnosis of the mildest form of Fluorosis is not warranted and classification of 'normal' not justified.

Very Mild - Small, opaque, paper white areas scattered irregularly over the tooth but not involving as much as 25 percent of the tooth surface. Frequently included in this classification are teeth showing no more than about 1-2 mm of white opacity at the tip of the summit of the cusps of the bicuspids or second molars.

Mild - The white opaque areas in the enamel of the teeth are more extensive. But do not involve as much as 50 percent of the tooth.

Moderate - All enamel surfaces of the teeth are affected, and the surfaces subject to attrition show wear. Brown stain is frequently a disfiguring feature.

Severe - All enamel surfaces are affected and hypoplasia is so marked that the general form of the tooth may be affected. The major diagnostic sign of this classification is discrete or confluent pitting. Brown stains are widespread and teeth often present a corroded-like appearance.

Thyllstrup and Fejerskov (1978) developed an index 'T-F' based on the biological aspects of Dental Fluorosis, classifying individuals into 10 categories characterizing the macroscopic degree of Fluorosis in relation to histological aspects. In the original classification, buccal, occlusal and lingual surfaces were examined.

The Thyllstrup-Fejerskov index of dental Fluorosis as defined by Thyllstrup and Fejerskov (1978): (Annex 11)

Normal - The enamel surface is smooth, glossy, and usually of a pale creamy white color.

TF score 1 - Thin white opaque lines are seen running across the tooth surface. Such lines are found on all parts of the surface. The lines correspond to position of the perikymata. In some cases, a slight "Snow-capping" of cusps / incisal edges and may also be seen.

TF score 2 - The opaque white lines are more pronounced and frequently merge to form small cloudy areas scattered over the whole surface. "Snow-capping" of incisal edges and cusp tips is common.

TF score 3 - Merging of the white lines occurs, and cloudy areas of opacity occur spread over many parts of the surface. In between the cloudy areas white lines can also be seen.

TF score 4 - The entire surface exhibits a marked opacity, or appears chalky white. Parts of the surface exposed to attrition or wear may appear to be less affected.

TF score 5 - The entire surface is opaque, and there are round pits (focal loss of the outermost enamel) that are less than 2mm in diameter.

TF score 6 - The small pits may frequently be seen merging in the opaque enamel to form bands that are less than 2mm in vertical height.

TF score 7 - There is loss of the outermost enamel in irregular areas, outermost enamel in irregular areas, and less than half the surface is so involved. The remaining intact enamel is opaque.

TF score 8 - The loss of the outermost enamel involves more than half the enamel. The remaining intact enamel is opaque.

TF score 9 - The loss of the major part of the outer enamel results in a change of the anatomical shape of the surface/ tooth. A cervical rim of opaque enamel is often noted.

Horowitz et al. (1984) developed a Fluorosis index based on aesthetic aspects of tooth surface 'TSIF' 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'.

Granath et al. (1985), comparing the Dean and T-F indexes 'TFI', concluded that the latter was more detailed and sensitive because it was based on biological aspects where there is an increase in hypomineralization with a simultaneous increase in the depth of the enamel surface in direction of the amelo-dentin junction. The Dean index (1934) emphasized the aesthetic aspects of Dental Fluorosis.

In this study the researcher is going to use Thyllstrup and Fejerskov index 'TFI'. Because Thyllstrup and Fejerskov (1978), in the study which gave rise to the T-F index, considered that the Dean index was not capable of distinguishing the different aspects of

the severity of dental Fluorosis in areas of high fluoride concentrations in the water supply (above 3 part per million of Fluoride). This conclusion was sustained by Wenzel and Thyllstrup in 1982. Furthermore, Pereira and Moreira confirmed that the Dean classification was capable of outlining the severity of Dental Fluorosis in populations residing in areas having less than 3 part per million of Fluoride in the water supply (Pereira & Moreira, 1999). Moreover, there is a possibility to correspondent between Dean Index and Thyllstrup and Fejerskov Index. Mabelya et al. (1994) conducted a study aimed to compare the TFI and DI in low, moderate and high Dental Fluorosis among Tanzanian population. They illustrated that the large majority of DI score 0 (normal) corresponded with TFI score 0 (normal). Dean's questionable score corresponded mainly with TFI scores 1 and 2, whereas the large majority of Dean's very mild and mild scores corresponded with one or two higher scores of TFI. Dean's moderate score corresponded mainly with TFI score 4, whereas Dean's severe score corresponded with TFI scores 5-9. The age of subjects of this study will be between 12 and 18 years old. In this age the nearly all teeth of child had erupted so the researcher can record the TFI score and it is the nearest age to the first 7 years of child age so the recall bias of past history will be diminished. The 18 years old is the end of childhood according of WHO.

The three Fluorosis indexes had similar prevalences using the same measuring methods for clinical examination (Pereira & Moreira, 1999).

2.3 Prevalence of Dental Fluorosis

Many countries have suffered from Dental Fluorosis for decades. This problem has appeared in some developed countries after water fluoridation. It also exists in developing and non-developed societies, mainly as a result of high concentration of

fluoride in drinking water. Furthermore, the researchers read about existence of Dental Fluorosis in societies supplied water free fluoride.

A total of 1,663 children in fluoridated or non fluoridated communities, ranging in age from 7 to 17 years, were examined during 1981-82. The prevalence of dental Fluorosis in non fluoridated communities ranged from 1.7 percent in 16-year-olds to 13.9 percent in 10-year-olds and, in fluoridated communities, ranged from 17.1 percent in 13-year-olds to 33.0 percent in 14-year-olds. At all age levels common to the two types of communities, the difference in prevalence of Dental Fluorosis was statistically significant (Leverett, 1986).

Public Health Service at the Department of Health and Human Services (1991) found that the overall, Dental Fluorosis remains more prevalent in fluoridated than non-fluoridated areas. Dental Fluorosis appears to have increased in both non-fluoridated and fluoridated communities, but has increased much more in non-fluoridated or low-fluoride areas. In low-fluoride areas the total prevalence of Dental Fluorosis has increased from the early 1940's to the mid-1980 from less than 1% to approximately 6%. In optimally fluoridated communities, the total prevalence of Dental Fluorosis apparently has increased from approximately 13% to 22%. It should be emphasized that this increase has been limited almost entirely to the milder forms of Dental Fluorosis.

Irish, dental surgeon, Donal McAuley, confirmed previous percentage when he wrote in the British Medical Journal that fifty per cent of our population has Dental Fluorosis (McAuley, 2001).

In England, this translates to nearly three million individuals who have fluorosed teeth to some degree. For three-quarters of a million people, Dental Fluorosis is of the

"moderate to severe" degree. The condition is characterised by white chalky spots or brown staining and pitting of their teeth (McDonagh et al., 2000).

In Western Australia from 1989 to 1990, 659 children 12-year-olds in Perth (Fluoride 0.8 mg/L) and the Bunbury region (Fluoride approximately 0.25 mg/L), Dental Fluorosis prevalences were 40.2% and 33.0% (Riordan, 2002).

In United States, Several detailed reviews of the literature are comparing Fluorosis data over time. In addition to other recent research, concluded that the prevalence of Dental Fluorosis reported in optimally fluoridated areas (both natural and added) in recent years ranged from 8% to 51 %, compared with 3% to 26% in non fluoridated areas. More recently, a prevalence of 80.9% was reported in children 12-14 years old in Augusta, Georgia, the highest prevalence yet reported in an optimally fluoridated community. Moderate-to-severe Fluorosis was found in 14% of these children. Wash said that "Russell (1962), in the Grand Rapids fluoridation study, noted that Fluorosis was twice more prevalent among African-American children than white children. In the Texas surveys in the 1980's, the odds ratio for African-American children having Dental Fluorosis compared with Hispanic and non-Hispanic white children was 2.3 to 1. Dental Fluorosis also tended to be more severe among African-American children than white children in the Georgia study" (Wash, 1993).

A review of the literature was undertaken to demonstrate the changing trends in the prevalence of Dental Fluorosis in North America, Using Dean Index. Results of more recent prevalence surveys were used to establish a range for the occurrence of Dental Fluorosis today. These results suggest that the prevalence of Dental Fluorosis now ranges somewhere between 35% and 60% in fluoridated communities and between 20% and 45% in non fluoridated areas, depending on the influence of difference local conditions. While the increase has occurred primarily in the very mild and mild

categories of Dental Fluorosis, there is also some evidence that the prevalence is increasing in the moderate and severe classifications as well (Clark, 1994).

The prevalence of mottled enamel in the permanent dentition of children participating in a fluoride program at the dental school of the Vrije Universities in Amsterdam was investigated in a study utilizing the Thyllstrup-Fejerskov TF index. From the children examined, 74% exhibited mottled enamel in a slight to moderate degree (Woltgens et al., 1989).

In Singapore, Prevalence and severity of Dental Fluorosis was assessed in 1739 Singaporean children aged 9, 12 and 16 years in three different ethnic groups. In this sample, prevalence was 82.6%. 9.2% of children had severe Fluorosis and 26.2% had moderate Fluorosis. There were no significant gender or racial differences (Lo & Bagramian, 1996).

A study was conducted among young Belgian children in the municipality of Leuven, Belgium. The sample consisted of 750 boys and girls (3 years = 200, 4 years = 200 and 5 years = 350). It found that early signs of Dental Fluorosis were identified in 19% (3 years), 17% (4 years) and 9% (5 years) of children (Carvalho et al., 1998). Prevalence of Dental Fluorosis, in 8-10 and 13-16 years old schoolchildren who were lifelong residents in Broken Bow, Holdrege and Kewanee, was similar in the three communities and approximately 15% (Selwitz et al., 1998). About prevalence of Dental Fluorosis and associated risk factors in Alappuzha district, Kerala, Dental Fluorosis is considered endemic in 15 states of India. A community-based, cross-sectional survey of 1142 school children (630 girls, 512 boys) in the age group of 10-17 years, using a multistage random cluster sampling technique, was conducted to determine the prevalence of Dental Fluorosis among school children in Ambalappuzha taluk, Alappuzha district, Kerala, using Dean's Index. The overall prevalence of Dental Fluorosis in our study

sample was 35.6%. And in girls compared to boys (39.2% versus 31.3%; P-value < 0.01) (Gopalakrishnan et al., 1999).

Dental Fluorosis is endemic in Eastern Africa and a high prevalence has been found even in low-fluoride (approximately 0.5 ppm) areas. In Sudan, in Treit el Biga (TeB) and Abu Groon (AG), Dental Fluorosis in children aged 7-16 years who had been lifelong residents was assessed. Dental Fluorosis was recorded on maxillary central incisors according to Dean's index. In Treit el Biga 91% of the children showed signs of Dental Fluorosis whereas in Abu Groon all children had fluorotic teeth. There was a significantly higher degree of Fluorosis in boys than in girls in the low-fluoride area. In Treit el Biga, older boys tended to have more Fluorosis than younger boys; the difference, however, was not statistically significant. No significant sex or age differences in Fluorosis were found in Abu Groon. In both villages great inter-individual variations in Dental Fluorosis were recorded (Ibrahim et al., 1995).

Regarding the areas surrounding Gaza strip, In West Bank in Palestinian territories the Prevalences of Dental Fluorosis in scholar year 1999/2000 were 1.3%, 1% and 1.5% among 3rd, 7th and 10th schoolchildren respectively (MOH-HMIS, 2001).

2.4 Risk factors

2.4.1 Fluoride concentration in drinking-water

Water fluoridated at the recommended level of 1 part per million used for drinking, in food preparation and manufacture, as well as in beverages, is usually the main source of fluoride intake. The degree of severity depends mainly on the level of fluoride consumption but some children are more sensitive to fluoride and develop severe Dental Fluorosis even with a low intake (Dowell & Bechal, 1981; Benfield, 1973).

Fifty-five years ago they said that in order to have healthy teeth, we needed to have one part fluoride in each million parts of water. That's the same as one milligram of fluoride

per litre – about one-quarter milligram per 8-ounce cup. According to the National Academy of Sciences, reduction in the average number of dental caries per child was nearly maximal in communities having water fluoride concentrations close to 1.0 mg/litre. This is how 1.0 mg/litre became the 'optimal' concentration. That is, it was associated with a high degree of protection against caries and a low prevalence of the milder forms of enamel Fluorosis (Institute of Medicine, 1999). The quantity of fluorine ingested in food is a relatively unimportant variable; the average diet contains 0.2 to 0.3 mg. daily. Of greater import is the variable quantity ingested in drinking water (National Research Council, 1951). Daily quantities of fluoride ingested only from water in infants from birth until age 9 months was estimated and it ranged to 0.43 mg (Levy & Muchow, 1992).

In 1989/90, in 659 children 12-year-olds in Perth (F 0.8 mg/L) and the Bunbury region of Western Australia, extended residence in a fluoridated area (OR 4.06) was significant risk factors (Riordan, 2002).

The prevalence of Dental Fluorosis reported in optimally fluoridated areas "both natural and added" in recent years ranged from 8% to 51 %, compared with 3% to 26% in non-fluoridated areas. More recently, a prevalence of 80.9% was reported in children 12-14 years old in Augusta, Georgia, the highest prevalence yet reported in an optimally fluoridated community in the United States. Moderate-to-severe Fluorosis was found in 14% of these children (Wash, 1993).

The more recent studies performed in Toronto concluded that the prevalence of Dental Fluorosis may fall as the recently imposed reduction in concentration of fluorides in city water takes effect (Leake et al., 2002).

The results of a cross sectional epidemiological survey, are used for evaluating the state of dental health of schoolchildren (aged 6-7 and 12-13) living in Sampacho and Portena.

Two towns in the Province of Cordoba (Argentina), supplied with drinking water containing quite different levels of fluoride, are described and analysed. In Sampacho Fluoride level is 9.05 mg/l. While in Portena the concentration is of 0.19 mg/l. No cases of Dental Fluorosis were recorded in Portena, but in Sampacho, there was a high proportion of children with mild Fluorosis (aged 6-7) and mild or severe Fluorosis (aged 12-13) (Azcurra et al., 1995).

There is a dose-response relationship between the prevalence of the questionable category of Dental Fluorosis as reported by various authors and the drinking water fluoride level. While the possibility that chance could have produced this trend cannot be conclusively ruled out, a distinct pattern of increasing prevalence with increasing water fluoride level can be discerned. Such a pattern is not compatible with the concept of a threshold level for the action of fluoride ion on the enamel organ (Myers, 1983).

Several recent studies have reported an increase in the prevalence of Dental Fluorosis in the United States, thought to be due to the widespread adoption of various preventive dentistry initiatives using fluoride. Several retrospective studies have found associations between Dental Fluorosis and these fluoride exposures, especially water fluoridation and fluoride tablets and drops (Levy, 1992)

Riordan and Banks conducted a study to measure Fluorosis in 12-year-olds in fluoridated and non-fluoridated areas of Western Australia and to relate this to exposure was conducted. School dental clinics in Perth (Fluoride 0.8 mg/L) and the Bunbury area (Fluoride less than 0.2 mg/L) were the sampling units. Clinical examinations (upper left central incisor) based on the TF classifications of Fluorosis (which requires teeth to be dried) were conducted for 338 children in Perth and 321 in the Bunbury region. Re-examinations (n = 50) gave a weighted kappa of 0.78. Contingency analysis estimated bivalent relationships, and multiple logistic regression estimated odds ratios

(OR) for risk factors. Fluorosis prevalence in the Perth region was 0.40, and in the Bunbury region 0.33. Prevalence was 44 % in children with fluoride exposure equivalent to optimal water fluoridation and 20% among those with the lowest exposure (Riordan & Banks, 1991).

Another study was conducted to examine the prevalence of Dental Fluorosis in relation to fluoride levels in water among children aged 12-15 years in the states of Plateau and Bauchi, Nigeria. Fluoride levels in the water ranged from 0.0-0.4 mg/L. Prevalence of Dental Fluorosis in the sample was 51%. Forty-one percent had very mild Fluorosis, 7% had mild Fluorosis and 3% had moderate to severe Fluorosis (El-Nadeef & Honkala, 1998).

To monitor changes, in the prevalence of Dental Fluorosis, examinations was performed in February 1992 and December 1994, for children who were residents of one of three communities with varying levels of fluoride and their communal water supply were examined for Dental Fluorosis. The prevalence of Fluorosis increased in fluoridated areas (Jackson et al., 1999).

A study used data from the 1986-87 National Survey of US School children. Fluoride levels of school water were used as an indicator of the children's water fluoride exposure. It illustrated that the Dental Fluorosis prevalence was 13.5 percent, 21.7 percent, 29.9 percent, and 41.4 percent for children who consumed <0.3, 0.3 to <0.7, 0.7 to 1.2, and >1.2 ppm fluoride in water (Heller et al., 1997).

Fourteen-year-old boys from three regions of Saudi Arabia were surveyed in 1992/3. These regions were Jeddah (which receives desalinated water containing 0.22 mg fluoride/l), Riyadh (receiving water containing 0.78 mg fluoride/l) and Qassim (2.66 mg fluoride /l). A total of 1,539 children were examined who had been continuously resident in that community. Overall, 83% of subjects had one or more enamel defects

with a mean number of teeth affected per person of 9.6. Diffuse defects were the most common. Prevalence of Dental Fluorosis was highest in the region with the highest water fluoride concentration (Rugg-Gunn et al., 1997).

The prevalence of Dental Fluorosis was assessed among 807 schoolchildren in four areas of Illinois where the respective water supplies contained natural fluoride at concentrations of 1, 2, 3, and 4 times the recommended optimal for the geographic area. The prevalence of Dental Fluorosis was characteristically low in the optimal fluoride area. Substantial increases in Fluorosis occurred in the above-optimal fluoride areas, with the condition being most pronounced in the 4-times optimal area (Driscoll et al., 1983).

In Gokwe District, water from artesian wells was found to contain between 5ppm and 10ppm fluoride ion concentration and as a result, Dental Fluorosis was found to be extremely severe in those communities solely dependent on artesian wells. In Chimanimani District, water from hot springs was found to contain five to six ppm fluoride ion concentration and in the catchment area of schools, drinking from hot springs Fluorosis was also found to be very (Tobayiwa et al., 1991).

Studies in the Guadiana Valley in northwestern Mexico, found that the drinking water supply comes from underground wells and is characterized by a high content of fluoride (higher than 12 mg fluoride/L). The prevalence of Dental Fluorosis among children in the school age (6-12 years) and adult was nearly 35% according to Dean Index (Teresa et al., 2001).

In this study the researcher will get fluoride concentrations in drinking water wells from Environmental Health Laboratory "Public health lab: food and water" at Ministry of Health. And associate between the existence and severity of Dental Fluorosis within the

can also cause Dental Fluorosis (Dowell & Bechal, 1981; Benfield, 1973).

In 1989/90, in 659 12-year-olds in Perth (fluoride

subject teeth and fluoride concentrations in drinking water wells that serve his/her house.

2.4.2 Toothpaste

Fluoride toothpastes are some of which is inevitably swallowed by young children and can also cause Dental Fluorosis (Dowell & Bechal, 1981; Benfield, 1973).

In 1989/90, in 659 12-year-olds in Perth (fluoride 0.8 mg/L) and the Bunbury region of Western Australia, toothpaste ingestion variables had ORs greater than unity (Riordan, 2002).

The early use of fluoride dentifrice and use of larger quantities recently have been identified as risk factors for Dental Fluorosis. Dental Fluorosis percentages among whose teeth were brushed at age 6, 9, and 12 months were 12.9%, 36.7%, and 64.5%, respectively. Percentages brushing with fluoride dentifrice were 1.9%, 11.7%, and 31.7%. Among those using dentifrice, the percentages using fluoride dentifrice were 94-97%. Among those using dentifrice, mean estimated quantities of fluoride from dentifrice used per brushing were 0.11, 0.14, and 0.17 mg fluoride (range up to 0.88 mg). Among users, mean quantities of fluoride from dentifrice used per day were 0.21, 0.20, and 0.19 mg fluoride (range up to 1.75 mg). Consequently, fluoride dentifrice use among infants varies greatly, can be substantial, and can be a risk factor for Dental, Fluorosis (Levy et al., 1997).

Some researchers indicated that young children might be exposed to more fluoride for a longer period of time with child dentifrice. Because they found that The mean weight of child dentifrice the children used (0.689 g, 0.43 SD) was significantly greater than that of an adult dentifrice (0.509 g, 0.41 SD, P = 0.02, Wilcoxon's signed rank test). The mean time spent brushing with child dentifrice was significantly greater than for an adult dentifrice. A "risk factor" (dentifrice weight x usage time) was derived to estimate

the relative fluoride exposure of each child. The mean risk factor for child dentifrice was significantly greater than that for an adult dentifrice. Most children did not expectorate or rinse after brushing (Adair et al., 1997).

Ellwood and O'Mullane (1994) conducted a study that consider the association between tooth brushing behaviour and dental enamel defects in 1,934 children from areas in North Wales with low levels of fluoride in the drinking water (< 0.1 ppm fluoride). They found that Children who brushed more frequently were at greater risk of having diffuse types of enamel opacity present.

Concerns regarding an increased risk of Dental Fluorosis related to ingesting fluoride-containing toothpastes by pre-school children have led to recommendations to reduce the amount of toothpaste used for young children to a pea-sized amount. This was a result of study was conducted to determine the effect on salivary fluoride levels of reducing the amount of toothpaste used in a pre-school age (4-5 years) population. Salivary fluoride concentrations were determined for 10 children whose teeth were brushed with both 0.25 g and 1.0 g of fluoridated toothpaste on two separate days. Initial salivary fluoride levels following the use of 0.25 g of toothpaste were less than half of the salivary fluoride concentrations when 1.0 g of toothpaste was used, and levels returned to baseline more rapidly (DenBesten & Ko-HS, 1996).

Other researchers confirmed previous result when they indicated that the ingestion of fluoridated dentifrice by young children may be a major contributing factor to Dental Fluorosis, prevalent in the United States. Brushing habits of a small group of pre-schoolers were monitored to document parental involvement and amounts of dentifrice used (Levy et al., 1993).

Pilot study determined the tooth brushing habits of 12 to 24 month old children and estimated the quantity of fluoride ingested during tooth brushing. It found that of the 36

parents, who cleaned the teeth of their children, 69% used toothpaste. And 20% of the children ingested more than 0.25 mg of fluoride per day by tooth brushing alone (Simard et al., 1991).

Warren and Levy (1999) observed that Dental Fluorosis prevalence has increased in United States because of widespread fluoride dentifrice use and attributed much of the increase in Fluorosis prevalence to early use of fluoride dentifrice.

While Horowitz (1992), in United state, observed that the direct dose-response relation between effectiveness and fluoride concentration of toothpastes is far from clear-cut and, at best, is weak and ingestion of fluoride toothpastes by pre-school-aged children may not be the major contributor to the increase in Fluorosis. But he did not ignored the findings of at least four studies suggest that the use of fluoride toothpastes by young children is a risk factor.

Riordan (1993) conducted a study in Perth in Western Australia and 14 school classes were selected. He found eighty-five percent liked toothpaste, 60.7% had swallowed it, and the mean age of starting to use it was 1.5 (SD 0.96) years. The prevalence of Dental Fluorosis was 0.48; 63% of Fluorosis was TF score 1, so that swallowing toothpaste and liking toothpaste were statistically significant risk factors. Highly significant associations were found between estimated fluoride ingestion from toothpaste and Dental Fluorosis. When Rock and Sabieha were studied the relationship between reported toothpaste usage in infancy and Fluorosis of permanent, they suggested that toothpaste swallowing may be a factor in the production of Dental Fluorosis (Rock & Sabieha, 1997).

Depending on previous literatures, the researcher of this study will study the tooth brushing behaviour of the study subjects during the first 7 years of their age.

2.4.3 Fluoride Tables and Supplements

Fluoride tablets are swallowed by young children and also cause Dental Fluorosis (Dowell & Bechal, 1981; Benfield, 1973).

Stephen (1993) mentioned in his study that fluoride tablets have been held responsible for an increase in Dental Fluorosis prevalence.

Kalsbeek et al. (1992) found a significant relation between the use of fluoride tablets and the prevalence of Fluorosis. On the other hand D'-Hoore and Van-Nieuwenhuysen (1992) concluded that using fluoride tablets appropriately in non fluoridated areas, results in minor damage.

As it was mentioned before, several retrospective studies, in the United States, have found associations between Dental Fluorosis and these fluoride exposures, especially water fluoridation and fluoride tablets and drops (Levy, 1992).

A study conducted for the period between 1989 and 1990 on 659 children 12-year-olds in Perth where fluoride concentration in drinking water was 0.8 mg/L and the Bunbury region of Western Australia. It concluded that fluoride supplements (OR 4.63) was significant risk factors (Riordan, 2002).

Abstract presented at the Dietary Fluoride Supplement Conference in 1994 illustrated that although fluoride supplements have been used for years to prevent dental caries, there are three reasons why their use is inappropriate today among young children in the United States. There is evidence for the efficacy of fluoride supplements in caries prevention is not strong, supplements are a clear risk for Dental Fluorosis, and fluoride's pre-eruptive effects in caries prevention are weak. The risks of using fluoride supplements in young children outweigh the benefits. Since there are alternative forms of fluoride to use in high-risk individuals, fluoride supplements should no longer be used for young children in North America (Burt, 1994).

In addition, Riordan (1993) illustrated in his study in Perth in Western Australia that because Supplement use was minimal, it was unrelated to caries or Dental Fluorosis in this area.

Ismail (1994) pointed to the critical review of the literature was conducted to determine the current effectiveness of fluoride supplements in caries prevention and their role as risk factors for Dental Fluorosis. Use of fluoride supplements by young children is idiosyncratic and all of the studies that investigated the effectiveness of this regimen suffered from a significant drop in the number of participants receiving daily supplements. The scientific evidence supports the efficacy of fluoride supplements in caries prevention but there is weaker support for their effectiveness. Fluoride supplements are a risk factor for Dental Fluorosis, though their contribution to the increase in Dental Fluorosis prevalence is less than that of water fluoridation and fluoridated dentifrices because of their more limited and shorter use. There is also evidence that fluoride supplements are used inappropriately in fluoridated areas. The availability of optimal levels of fluorides in beverages in non-fluoridated communities raises the question of whether fluoride supplements are needed in the 1990s, and whether it is time to consider the total fluoride intake not only from water but also from foods, beverages, and dentifrices when recommending supplements. A re-evaluation of the need for and dosage schedules of fluoride supplements is warranted.

A study used data between 1986 and 1987 from National Survey of US School children. It confirmed that the use of fluoride supplements was associated with both fewer caries and increased Fluorosis (Heller et al., 1997). Holt and Murray (1997) illustrated that risk factors for Fluorosis include inappropriate fluoride supplements.

In spite of the fact that an individual lives in a low fluoride community, the risk of Fluorosis exists through fluoride consumption in beverages as well as from the water

supply and fluoride therapy. It is therefore important for dental practitioners to carefully evaluate their patients' entire fluoride exposure before prescribing fluoride supplements (Turner et al., 1998).

In Gaza strip there is no studies indicate the use of fluoridated tables or supplement so that the researcher of this study will determine that.

2.4.5 Knowledge

Knowledge about Dental Fluorosis reasons may considered on of associated risk factors that increases Dental Fluorosis problem because it will be reflected on people practice and attitude.

In 1991, a questionnaire aimed at evaluating the knowledge, attitudes and practices with regard to fluoride and Dental Fluorosis was mailed to all the general practitioners and paediatricians of the Montreal West Island territory. It found that there are educational needs concerning fluoride, fluoride prescribing and prevention of Dental Fluorosis. Public health dentists should assist the medical profession in this educational process (Vallee & Kandelman, 1993).

Then a telephone survey was carried out in 1994, in the Quebec City region, among 1006 people living in two municipalities where tap water is fluoridated and 1003 people living in two municipalities where there is no fluoridation. Knowledge of the main benefit associated with the use of fluoride (prevention of tooth decay) in drinking water was not different in fluorated versus non-fluoridated municipalities. Knowledge of its main disadvantage (increase of Dental Fluorosis) was very low and similar in both groups. Opposition to fluoridation was slightly higher in fluoridated areas (22.0% versus 18.3%, $p = 0.04$), and the use of fluoridated supplements for children was much less important in fluoridated areas. No changes in the measures of association (odds ratios) were found after adjustment for the different characteristics of the participants

(age, family income, education). Opposition to fluoridation was lower among those who believed their tap water was fluoridated. This study demonstrates that there is still need for public health education on the uses of fluorides (Levallois et al., 1998).

2.4.6 Socio-economic status

Some studies found an association between the Socio-economic status of the community and the prevalence and severity of Dental Fluorosis.

Villa and Guerrero (1996) assessed the Dental Fluorosis prevalence in 8-year-old children belonging to different Socio-economic classes in two Chilean twin cities that are served by optimally fluoridated community water from the same waterworks facility. Prevalence of enamel Fluorosis in the permanent teeth of Low Socio-economic status children was 0.79, significantly higher than the value 0.59 found in high Socio-economic status children. The proportion of Dean's scores 2, 3, 4 and 5 in first molars, mandibular and maxillary incisors in Low Socio-economic status children was higher than in high Socio-economic status children ($P < 0.001$). They contributed the differences in prevalence and severity of Dental Fluorosis between both groups are tentatively attributed to a different pattern of tap water and tea consumption at pre-school ages.

Furthermore, a study was conducted in three regions of Saudi Arabia and it concluded that Dental Fluorosis prevalence was highest in the region with the highest water fluoride concentration, in rural areas and in malnourished subjects (Rugg-Gunn et al., 1997).

In contrast, another study determined the relationship between the Socio-economic status and Dental Fluorosis among Brazilian school children. By using TFI (Thyllstrup and Fejerskov Index) and the Socio-economic level was determined according family income and parents' educational level. Its results illustrated that parent's educational

level data revealed a strong Pearson's correlation with income and no correlation was observed between Dental Fluorosis and the studied social economic variables (Maltz et al., 2001).

2.4.7 Altitudes

A study was to assess the prevalence and severity of Dental Fluorosis of children living in four rural areas in the central south region of Mexico. The altitude of the four communities was higher than 2,000 m above the sea level. The prevalence and severity of Dental Fluorosis found in the population examined was higher than that observed in developed countries, with similar levels of fluoride in water. So the researcher concluded that the high altitude of the areas may be a factor that contributed to the high prevalence of Fluorosis found in these rural Mexican children (Irigoyen et al., 1997).

Others stated that it has been found that the retention and tissue levels of fluoride are increased by residence at high altitude (Angmar-Mansson & Whitford, 1990). And altitude of the area may be a factor that contributed to the high prevalence and severity of Dental Fluorosis in Mexican schoolchildren (Moline Fresher et al., 1999).

Thus, fluoride balance and tissue concentrations and the risk of Fluorosis are increased by factors such as residence at high altitude, and certain metabolic and respiratory disorders that decrease pH such as caused by iodine deficiency (Whitford, 1997).

Many researches found that altitude was a significant risk indicator for Dental Fluorosis after controlling for potential confounders (Rwenyonyi et al., 1999). Like the results demonstrated that Dental Fluorosis in Tibetan children living at an elevation of 2000 meters was significantly lower than that of children at 4300 meters ($P<0.01$). Higher elevation can worsen the extent of Fluorosis (Cao et al., 2001).

This variable does not exist in Gaza Strip so there is no need to indicate its effect during this study.

2.4.8 Air pollution

The combustion of high fluoride-content coal as an energy resource for heating, cooking, and food drying is a major exhaust emission source of suspended particulate matter and fluoride. High concentrations of these pollutants have been observed in indoor air of coal-burning families in some rural areas in China. For human health, fluoride in indoor air has not only been directly inhaled by residents, but also it has been absorbed in stored food such as corn, chillies, and potatoes. In the Fluorosis area in China, concentrations of urinary fluoride in the residents have been much higher than in the non fluoridated area in China and in the rural area in Japan. Data suggest that bone resorbtion was extremely stimulated in the residents in China and that fluoride may stimulate both bone resorbtion and bone formation. Because indoor fluoride from combustion of coal is easily absorbed in stored food and because food consumption is a main source of fluoride exposure, it is necessary to reduce airborne fluoride and food contamination to prevent serious Fluorosis in China (Ando et al., 1998).

This study will indicate if there is any sources of environmental pollution surrounding the subject during the first 7 years of his/her age such as living near dust, main road or industries and using coal, open fire, electronic or others (e.g. gas) as heating system during winter.

2.4.9 Nutrition

2.4.9.1 Baby formulas

Baby formulas are considered one of risk factors contributing to increase prevalence and severity of Dental Fluorosis. Some researchers found that baby formulas prepared with fluoridated water can contain over 100 times more fluoride than mothers' milk, which studies have shown to contain 0.004 - 0.008 ppm fluoride (Ekstrand, 1984).

Buzalaf et al. (2001) advised to limit fluoride intakes to amounts <0.1 mg/kg/day, by avoiding use for fluoridated water (around 1 ppm) to dilute powdered infant formulas.

A major source of fluoride in infancy is considered to be infant formula, which has been implicated as a risk factor for Fluorosis in a number of studies. Because if infant formula is reconstituted with water containing 1.0 ppm fluoride they should all provide a daily fluoride intake of above the suggested threshold for Fluorosis with intakes up to 2-3 times the recommended upper 'optimal' limit of 0.07 mg/kg body mass. Under these conditions the water used to reconstitute the formulae would provide 65-97 per cent of the fluoride ingested (Silva & Reynolds, 1996).

2.4.9.2 Breastfeeding

Breastfeeding can prevent from developing Dental Fluorosis. Mother's milk contains some fluoride, and while the amount is small, it seems to be perfectly suited to the baby's need. As long as your baby is thriving on human milk alone, he has no need for additional vitamins, iron, fluoride, or other supplements in the early months (Vondriska, 1996).

2.4.9.3 Fish consumption

Most foods contain only very low levels of fluoride, exceptions are some fish and tea, which is particularly high in fluoride (Dowell & Bechal, 1981; Benfield, 1973).

In spite that, Gikunju et al. (1992) found that The F content of fish fillet does not appear to be a major contributor to the prevalent and severe human Dental Fluorosis in the Rift Valley area. But Gikunju (1992) study about Fluoride concentration in Tilapia fish (Oreochromis leucostictus) from Lake Naivasha, Kenya confirmed that the fluoride content of fish muscle may contribute to the total daily intake of fluoride and hence predispose to Dental Fluorosis.

2.4.9.4 Milk consumption

Milk that did not reconstitute in high fluoride water can reduce the occurrence of Dental Fluorosis because its high content of calcium inhabits fluoride absorption through gastric membrane. And Whitford (1997) said that fluoride absorption is inversely related to dietary calcium which, at high concentrations.

In China, a study found that the incidence among milk-consuming children was lower than that of non-milk consuming children (Chen et al., 1997).

2.4.9.5 Soft drinks consumption

Some study considered soft drinks as possible risk factor increase Dental Fluorosis.

In study on young Saudi men, the results showed that soft-drink consumption in the sample was high and the Dental Fluorosis was a common finding (Johansson et al., 1996).

In addition, Kiritsy et al. (1996) has investigated fluoride exposures from juices and juice-flavored drinks manufactured with water. They found that fluoride ion concentrations ranged from 0.02 to 2.80 parts per million, because of variations in fluoride concentrations of water used in production, children's ingestion of fluoride from juices and juice-flavored drinks can be substantial and a factor in the development of Fluorosis.

2.4.9.6 Tea consumption

As illustrated before tea is particularly high in fluoride (Dowell & Bechal, 1981; Benfield, 1973).

Cao et al. (1996) mentioned that Dental Fluorosis and skeletal Fluorosis have been found in the Sichuan Province of China in Tibetans with a long history of drinking brick tea.

That because It has long been accepted that fluoride accumulates in the leaves of the tea plant (Kavanagh & Renehan, 1998).

The daily intake of fluoride in the ordinary brick tea group was 0.3 mg, and this group developed Dental Fluorosis characterized as brown and white horizontal marks

Another study stated that brick tea is one of factors that are responsible for the Dental Fluorosis in Tibetan children in the nature reserve of Mount Qomolangma (Cao et al., 2001).

Sergio et al. (1989) found sixty eight per cent of children drinking tea as usual beverage, therefore it was estimated that about 22.1% of this sample have risk of Dental Fluorosis.

2.4.9.7. Nutrition status

Nutritional deficiencies increase the severity and prevalence of Dental Fluorosis in our children. Nutrients such as calcium, vitamin C, magnesium, etc. offset the toxicity of fluoride.

In China, in the Province of Jiangxi, it found that Protein intake was above the national standard of 0.75 g/kg body weight/day among children, But the protein was derived mainly from plant sources. Calcium intake was found to be insufficient. The areas with a better nutritional status were found to have a lower incidence of Dental Fluorosis (Chen et al., 1997).

In study that compared the prevalence and severity of Dental Fluorosis among vegetarian and non vegetarian children and adolescents living in an area where Dental Fluorosis is endemic. It illustrated significantly lower prevalence and severity of Dental Fluorosis among the vegetarian group compared to the non vegetarians would seem to be related to diet (Awadia et al., 1999).

While Infant foods, especially those containing chicken, have the highest fluoride concentrations found in infant foods, and that should be considered when determining total fluoride intake (Heilman et al., 1997).

At the study around Severe Dental Fluorosis in a Tanzanian population, the researchers found that malnutrition is variable that may be contributing to the severity of Dental Fluorosis (Yoder et al., 1998).

When three regions of Saudi Arabia were surveyed in 1992/3, the Dental Fluorosis prevalence was highest in the region with the highest water fluoride concentration, in rural areas and in malnourished subjects (Rugg-Gunn et al., 1997).

Fluoride absorption is inversely related to dietary calcium, which at high concentrations may cause net fluoride secretion into the gastrointestinal tract. The excretion of absorbed fluoride occurs almost exclusively via the kidneys, a process which is directly related to urinary pH. Thus, fluoride balance and tissue concentrations and the risk of Fluorosis are increased by factors such as high protein diets, residence at high altitude, and certain metabolic and respiratory disorders that decrease pH. Factors that increase urinary pH and decrease the balance of fluoride include vegetarian diets, certain drugs and some other medical conditions (Whitford, 1997).

Zohouri and Rugg-Gunn (1999) studied fluoride content of foods in Iran and determined the effect of variation in the fluoride concentration of drinking water on the fluoride concentration of prepared foods. Foods and drinks were collected from three areas of Iran where water fluoride concentrations were 0.32, 0.58 and 4.05 mg/L. They indicated that Fluoride concentrations in the cereals group (which constituted much of the diet) were mainly between 0.2 and 0.3 microgram/g, when prepared for consumption. And they conclude that concentration of fluoride in water influences

positively fluoride concentration in foods cooked in water, but the increase in foods was less than the increase in fluoride concentration in water.

The researcher in this study will determined the nutrition status of children and amount of their consumption of specific foods during their first 7 years of age through the description of their mother

2.4.10 Climate

Higher concentrations and increase in water consumption may lead to excessive exposure and adverse health effects varying from mottling of teeth to crippling skeletal Fluorosis. The Guidelines of WHO recommends that a concentration of 1.5mg/l on the assumption that the daily per capita consumption of drinking water is a bout 2 Litres. In hot climates, an average water consumption of 5 litres l day is not unusual and in such cases, Fluoride levels in drinking water should be decreased accordingly, that explains why some people in hot countries suffer of Dental Flourish despite low Fluoride concentrations (WHO, 1993)

The optimum Fluoride level for a community depends on climate conditions because the amount of water (and consequently the amount of Fluoride) was ingested by children primarily influenced by air temperature. This relationship was first studied and reported by Galagan and associates in the1950's. But it has been farther investigated and supported by Richards in 1967 (Cunningham & Saigo, 1990).

As mentioned before, Gaza Strip is a narrow piece of land lying on the coast of Mediterranean Sea. Its climate has four months of dry hot summer and a short winter with rain from November to March (MoH-HMIS, 2003).

2.5 The Prevalence Dental Fluorosis in Gaza Strip

According to School Health Program records, the Dental Fluorosis prevalence among governmental school children in Gaza strip, exceeded from 19.7% to 28.8% among 12

years old school children from1996 to 2002 and from 17.3% to 30.7% among 15 years old school children from 1996 to 2002. The records of School Health Program illustrated a gradual increase in Dental Fluorosis among Palestinian children in Gaza Strip (Annex 12). While the records of UNRWA in Gaza Strip illustrated that in scholastic year 2001/2002, the prevalence of Dental Fluorosis is .99% among 6 years old school children, 13.26% among 10 years old school children, and 16.10 among 13 years old school children.

In 1999 in Gaza strip, The prevalence of Dental Fluorosis in 7th class (12years old) was the highest in Rafah 60% then Khan-Younis 50.5% while in North Gaza it does not exceed 7.1% where fluoride concentration is very low (Ministry of Health, 2000).

2.6 Risk factors in Gaza Strip

2.6.1 Water fluoride risk factor

In Gaza Strip, There is a high level of dissolved salt in water due to excessive utilization of this limited water resource leading to intrusion of seawater into the groundwater reservoirs. And the under groundwater wells have an average depth 53 m and are covered by sandy soils making them liable to pollution by human activities (Sansur, 1991).

Consequently, the drinking water contamination by fluoride is increasing, specially, in wells of the southern and eastern zone. Gaza population has suffered from this problem for decades. After the return of Palestinian authority and establishing school children and oral and dental health departments in Ministry of Health, The reports of school children illustrated high prevalence of Dental Fluorosis (poisoning by fluoride) among pupils that arise risk of high concentration of fluoride in drinking-water.

Studies in Gaza Strip show that from 1987 to 1994 most wells in the Gaza Strip (81%) can be considered suitable for drinking. All wells in Northern and middle zone are

considered suitable for drinking, 79% of wells in Gaza city are considered suitable but only 57% of wells in the southern Zone are considered suitable (Kuhail; Zoarob, 1994). Kuhail and Zoarob (1994) illustrated that the required concentration of fluoride is 0.7-1,5 ppm. So the number of wells in Gaza Strip which are suitable are 47 wells of 60 wells tested in spring 1994 (Annex, 13).

In 1994 the highest concentration of fluoride did not exceed 3 ppm, while in 1999 UNRWA well in Khan-Younis reached 4 ppm from 0,33 ppm in 1994 (Annex, 13).

The reports of Environmental Health Laboratory at Ministry of Health "Public health lab: food and water" illustrated that there is an increase in concentration of fluoride in other wells especially in Khan-Younis (for example: Janopy and Aia). This increase in fluoride concentration reflects degree of degradation in drinking water quality in Gaza strip during the last decade.

2.6.2 Tea

Sansur (1991), in his study on naturally occurring fluorides in underground water and their effect on Dental Fluorosis among UNRWA school children in the Gaza strip, observed that the average tea cups which school children drank per day in all Gaza strip regions was approximately 3 cups, the highest 3.19 cups was in Rafah and the lowest 2.4 cups was in Bani Suhila.

2.7 Impact of Dental Fluorosis and excessive fluoride ingestion

2.7.1 Health status

It worth to mention that the optimal fluoride concentration in drinking water reduces the dental caries, Before illustrating the bad effects of excessive fluoride ingestion on health status. This fact proved by many researchers such David (1997) who demonstrated that the reduction in dental carries experienced at optimal fluoride concentration. The dental

carries diminished by as much as 50% when Fluoride concentration is 0.2 mg/l below the optimum.

WHO in May (1991) indicated that Fluoride levels of about 1mg/l provide substantial protection against dental caries. However, for fluoride the margin between beneficial and toxic effects is rather small. Higher concentrations and increase in water consumption may lead to excessive exposure and adverse health effects varying from mottling of teeth to crippling skeletal Fluorosis (WHO, 1993).

Many studies proved the impact of Dental Fluorosis and poisoning by fluoride on health status. Zhou et al. (1996) on their study around Morphometry and autoradiography of altered rat enamel protein processing due to chronic exposure to fluoride, they found extended retention of enamel proteins in fluoride-exposed maturation enamel as well as reduced enamel protein synthesis and/or secretion in the secretory stage, and negative linear correlation between extended enamel protein retention and reduced enamel protein secretion among groups and repression of enamel protein removal. The data are also consistent with the concept that the fluoride effect is multifactorial.

Bucher et al. (1991) found that animals receiving sodium fluoride developed effects typical of Dental Fluorosis, and female rats given 175 ppm had increased osteosclerosis. There was equivocal evidence of carcinogenic activity of sodium fluoride in male rats based on the occurrence of a small number of osteosarcomas in treated animals.

Fluoride can have adverse effects on people of all ages. Reversible adverse effects include eczema, dermatitis, epigastric distress, headache, excessive thirst, chronic fatigue, muscular weakness, mouth ulcers, lower urinary tract infection and the flare-up of old allergies. These complaints tend to disappear relatively quickly after patients discontinue using fluoridated water, tablets or toothpaste. The causal link has been established through double-blind tests. Prolonged ingestion of water fluoridated at 1

ppm can lead to Skeletal Fluorosis, rheumatic arthritic complaints and impaired renal function, to name but a few of the more serious health effects. These, like fluoride-mottled teeth, are irreversible (Juncos & Donadio, 1972). A recent study on children with Dental Fluorosis indicated structural bone change (Chlebna-Sokol & Czerwinski, 1993).

The moderately and severely fluorosed enamel contained an uneven distribution of areas which were more electron-absorbent with a relative increased carbon content. The changes in the physical characteristics of the teeth could be quantitated by measurements of light reflectance. The color of the teeth was significantly different between groups, with all groups significantly different than normal (Giambro et al., 1995).

Human and animal studies have shown that it is possible to develop Dental Fluorosis by exposure during enamel maturation alone. It is less apparent whether an effect of fluoride on the stage of enamel matrix secretion, alone, is able to produce changes in enamel similar to those described as Dental Fluorosis in man. The clinical concept of post-eruptive maturation of erupting sound human enamel, resulting in fluoride uptake, most likely reflects subclinical caries. Incorporation of fluoride into enamel is principally possible only as a result of concomitant enamel dissolution (caries lesion development). At higher fluoride concentrations, calcium-fluoride-like material may form, although the formation, identification, and dissolution of this compound are far from resolved. It is concluded that Dental Fluorosis is a sensitive way of recording past fluoride exposure because, so far, no other agent or condition in man is known to create changes within the dentition similar to those induced by fluoride (Fejerskov et al., 1994).

Teresa et al. (2001) found in study in Mexico that all the children surveyed exhibited Dental Fluorosis, and 35% of them had suffered serious damage to their teeth. A linear correlation between the Dean index of Dental Fluorosis and the frequency of bone fractures was also observed among both children and adults.

A recent three-year study conducted in Sosnivka, Ukraine investigated the health of children afflicted with Dental Fluorosis and compared results to children without such enamel defects, and the only such study we know of. It was found that children with Dental Fluorosis had more gastrointestinal diseases 37%, respiratory diseases 29.5%, bone and muscle diseases 13.8%, mental disorders 11.3%, skin diseases 9.4%, and 8.2% suffered from diseases of the nervous system and sensory dysfunction. As children grew older, there was also in increase in urino-genital diseases. Boys suffered more from mental, bone-muscle, and birth anomalies. The girls had more sight problems and vaginal venereal disease. In all tested groups boys were shorter than the control. In addition children with Dental Fluorosis had much higher caries occurrence (Miroshnychenko & Sosnivka, 2000).

According to a memo by the Environmental Protection Agency, very preliminary data from recent health studies indicate that fluoride may be a carcinogen. There is also a convincing relationship between dose and response: the more fluoride, the more cancers. Pathologist David Kaufman of the University of North Carolina, warns that the rat data must be examined to see if the cancers appeared in the long bones of the arms and legs, as osteosarcomas do in humans, or in other places, which might make the results less relevant to people (Begley, 1990).

Fluoride has been used widely in dentistry to prevent dental caries. While there is little doubt regarding its efficacy, the safety of fluoride has been a controversial issue. Abundant scientific data accumulated over the years have demonstrated that other than

Dental Fluorosis, there are no known adverse effects of long-term fluoride ingestion for caries prevention. However, the risk of an overdose is real, and it can result in serious acute toxicity, even death. Understanding potential risks and taking cautions can virtually eliminate the acute adverse effects of fluoride. These potential risks need to be recognized in order to take full advantage of fluoride's benefits (Li, 1993).

Kumari and Rao (1991) demonstrated that the red cells from humans exposed chronically to toxic levels of fluoride through drinking water showed significant increase in lipid peroxidation and membranous cholesterol and phospholipids.

Lantz et al. (1987) suggested a causal relationship between fluoride intoxication and renal failure. And Muller et al. (1992) illustrated that fluoride induces gastric mucosal lesions.

Shen et al. (1992) illustrated that there is a adverse relationship between height, collagen metabolism, hair zinc and excessive fluoride intake, after eliminating confounding factors.

Drs. Carton and Marcus noted this and a number of other problems, including the fact that many of the cancers found by Battelle's histopathologists were downgraded to commoner types, or eliminated altogether, over the objections of outside experts (Carton & Marcus, 1990). Despite the manipulations, the occurrence of osteosarcomas in male rats showed a statistically significant positive relationship to fluoride dose (more fluoride, more cancers). The original unexpurgated Battelle results showed statistically significant dose-related occurrence of cancers of various sorts, including an extremely rare form of mixed bile-duct/liver cancer-hepatocholangiocarcinoma (Carton & Marcus, 1990).

The osteosarcomas in male rats become even more significant in the light of an epidemiological study of a large human population by the State Board of Health in New Jersey (Cohn, 1992).

The cumulative dose of fluoride ingested by average people in fluoridated communities reaches the low dose rats after only 38 years, many people will equal the mid-dose rats in a lifetime, and some even approach the high dose rats. Citing a Scandinavian study, Danielson et al. (1992) said that Fluoridation of water supplies was initiated prior to long-term studies of its effects on bone density. Recent studies suggest that fluoride accumulates with age and may reach toxic bone levels in a person's lifetime (at water content of 0.97 ppm). Many people exceed the average, some by 6 times or more. With increasingly widespread fluoride contamination these amounts will rise, and the time to accumulate similar doses to the rats will thus fall. Carton and Marcus (1990) quoting an earlier study note that people accumulate up to 7,000 ppm of fluoride in their bones, when ingesting water containing 4 ppm, while the high dose rats had only 5,470 ppm. They comment that it is the first time he can remember test animals having lower concentrations of a suspected substance than humans at the site of adverse effect.

Li et al. (1995) in a study on the effect of Fluoride Exposure on Intelligence in Children he found a high fluoride intake was associated with a lower intelligence. No correlation was found between age and intelligence in the areas with a medium and severe prevalence of Fluorosis. The effect of exposure to a high level of fluoride on intelligence may occur at an early stage of development of the embryo and infant when the differentiation of brain nerve cells is occurring and development is most rapid.

While, Tohyama (1996) studied the relationship between fluoride concentration in drinking water and mortality rate from uterine cancer in Okinawa prefecture, in Japan. A significant positive correlation was found between fluoride concentration in drinking

water and uterine cancer mortality. Even after adjusting for the potential confounding variables, such as tap water diffusion rate, primary industry population ratio, income gap, stillbirth rate, divorce rate, this association was considerably significant. Furthermore, the time trends in the uterine cancer mortality rate appear to be related to changes in water fluoridation practices.

Freni (1994) found that exposure to high Fluoride concentrations in drinking water is associated with decreased birth rates.

2.7.2 Health economics

People suffering from Dental Fluorosis, especially moderate to severe Dental Fluorosis, seek treatment to improve their cosmetic appearance. Unfortunately, dental treatment is expenses for these cases. Many researchers understand this fact and they illustrated it in their studies.

Glasser and Jones (2001) said that in England, Cosmetic veneers provide an extremely lucrative spin-off for the privatised dental profession. Its charges range from £150 to £450 per tooth and repeat treatments are required every five or six years throughout the victim's life.

In a recent trend-setting case in Britain, Colgate-Palmolive paid an out-of-court "goodwill" payment of 1000 sterling $2300 to the parents of a 10 year old boy in Essex who was diagnosed by an independent specialist as suffering from Dental Fluorosis caused by fluoridated toothpaste. Lawyers observing the payout said that the settlement was a significant breakthrough, even though the manufacturer has denied any liability and is refusing to discuss the case (Individual Inc., 1996).

On the other hand, other health problems resulted from excessive fluoride intake can not be ignored. Hip fractures are a serious and very costly community health problem. Kleerekoper (1992) quotes a US DHHS directive to reduce hip fractures by 15%.

Danielson et al. (1992) quoted the annual cost of hip fractures in the US as $7 billion US, so a 15% reduction would save over $1 billion. Factors which increase hip fracture rates by even small amounts will cost many millions (even for Canada) at a time when health care costs have been cut to the bone.

Chrischilles et al. (1994) quoted $45.2 billion US as the cost of osteoporetic fractures of the forearm, spine and hip, describing the estimate as "conservative". Hip fractures are especially expensive as they are most frequent amongst the over 65s and involve extensive nursing home utilization. But given the findings of Riggs et al. (1990) the whole $45.2 billion cost is the relevant total one ought to worry about in terms of the effect of fluoride on increasing the fracture rates.

2.7.3 Perception of Dental Fluorosis

This negative public perception has led to a defined pattern of prejudice, discrimination and social exclusion. Teachers often prejudge a child's intellect and personality based on appearance alone. Such negative perceptions have been found to impact adversely on the victims' personalities.

In England, in 1985, following a review commissioned by the United States Environmental Protection Agency, an independent panel of behavioural scientists found that people with moderate to severe Fluorosis are at increased risk of experiencing psychological and behavioural problems (Welbury & Shaw, 1991). People afflicted with Dental Fluorosis are more likely to experience discrimination from an early age. Teachers often prejudge a child's intellect and personality based on appearance alone. These children are more often likely to be considered as troublemakers or non-scholars. Such biased views reinforce a negative stereotype, with self-fulfilling results. People who cannot afford cosmetic veneers, professional bleaching or micro-abrasive treatment

have no option but to live with their fluoride-damaged teeth and the attendant social stigma and psychological trauma (Tauber-Robert, 1998).

Hawley et al. (1996) conducted a study around dental caries, Fluorosis and the cosmetic implications of different Thyllstrup-Fejerskov TF index scores in 14-year-old adolescents in England. The responses of the subjects regarding their desire for treatment matched closely with their opinions on appearance, the majority of subjects expressed concern over the appearance of teeth with TF scores of 3 and higher. It is concluded that the prevalence of aesthetically objectionable Dental Fluorosis was low and that mild Fluorosis was associated with a lower risk of dental caries and a more acceptable appearance.

English researchers noted that the prevalence of Dental Fluorosis appears to be on the increase. Although in its mild form the condition is not considered to be of cosmetic significance, the more severe forms can cause great psychological distress to the affected individual (McKnight et al., 1998).

The stains of endemic Dental Fluorosis can have a tremendous psychological impact on the patient. Perhaps this might be a contributory factor in the psychological make-up of the individual who displays anti-social behaviour. If so, it might be possible to effect change by removing the stains. Many patients have been pleased with the results of bleaching of teeth, and even displayed a willingness to smile (Colon, 1972).

Irish dental surgeon, McAuley (2001) wrote in the British Medical Journal: "I see patients daily in my surgery who are damaged by fluoride. They do not smile, they are teased at school, and they are traumatized by having 'rotten' teeth".

In 1994, a Kenyan survey noted that between 60 % and 84% of respondents viewed Dental Fluorosis as an important problem because of its unfavourable effects on an individual's personality. (Mwaniki et al., 1994).

A later Canadian study examined the influence of fluoride exposures on the widespread "aesthetic problems" caused by Dental Fluorosis. It acknowledged that forty six percent (nearly half) of the participants had Dental Fluorosis. The effect on personal appearance, as defined by the participants themselves, was more prevalent in the over-11 age group (Clark & Berkowitz, 1997).

An Australian Health Department analyzed society's perceptions of Dental Fluorosis, based on over 3,000 responses. Lay and professional observers recognized that higher degrees of Fluorosis increasingly embarrass the child. All observers, except the dentists, felt that the more severe Fluorosis indicated neglect on the part of the child (Riordan, 1993).

In addition, Egyptian researchers observed that friends and relatives ridicule the patient by inferring that these stains are associated with smoking and/or poor oral hygiene. They noted that such personal remarks lead an individual into severe psychological depression (Rahmatulla, 1995).

Fluorosis as a contributing factor to parents' satisfaction with children's tooth colour was studied by Lalumandier and Rozier (1998) and they found the worst aesthetic aspects of tooth surface TSIF score was the only factor associated with parent satisfaction.

In a study published in the British Dental Journal in 2000, leading UK researchers from Newcastle City Health NHS Trust found that the prevalence of Dental Fluorosis among 8 - 9-year-old children in fluoridated Newcastle was 54%. They also found that in "fluoride-deficient" Northumberland, 23% of 8 - 9-year-old children have Dental Fluorosis. They concluded that the prevalence of "aesthetically important" Dental Fluorosis in the fluoridated area was 3% - six times higher than found in the non-fluoridated area - where 0.5% of the children were affected (Tabari et al., 2000).

In 2000, the same year as the Newcastle study appeared in the British Dental Journal, the British Medical Journal published a systematic scientific review of water fluoridation. It reported that 48% of the populations living in fluoridated areas develop Dental Fluorosis of all types. This figure is somewhat lower than that found by the Newcastle researchers. However, the York reviewers stated that 12.5% of those exposed to water fluoridation - 1,250 people in every 10,000 - exhibit DF "of concern"(McDonagh et al., 2000).

In the studies discussed above, researchers are agreed that Dental Fluorosis is widespread. They differ only on the degree of prevalence of aesthetically important Dental Fluorosis. In either case, it is clear that Fluorosis of aesthetic concern affects a large subset of the population. Neither of these studies acknowledged that Dental Fluorosis may have other profound consequences for individuals and society as a whole.

The psycho-social impact of Dental Fluorosis was discussed through numerous studies published in prominent dental journals. They demonstrate that dental professionals have been aware for many years that unattractive teeth can adversely affect the psychological wellbeing of children and adults (Newton et al., 2002). A 1981 study on the attractiveness of teeth concluded the hypothesis that children with a normal dental appearance would be judged to be better looking, more desirable as friends, more intelligent, and less likely to behave aggressively was upheld (Shaw,1981).

Spencer et al. (1996) acknowledged the findings of three studies published in 1993 showing that children from 10 - 17 years of age readily recognize "very mild" and "mild" Dental Fluorosis and those even mild changes in coloration cause embarrassment and self consciousness. Spencer demonstrated that the psycho-behavioural impact was similar to that of crowding and overbite; both considered key occlusal traits driving the

demand for orthodontic care (Spencer et al., 1996; Van Palenstein Helderman & Mkasabuni, 1993).

Dental Fluorosis is visible as soon as the secondary teeth erupt. While developing social and early life skills, children are at their most vulnerable to the psychological impact of discrimination (Ritter& Langlois, 1988). Further research in 2002 confirmed that participants in a study of the psycho-social perception of dental abnormalities, such as DF, believed that people with dirty (stained) teeth have a lack of social skills, lower intelligence and poor psychological adjustment (Newton et al., 2002).

Studies sponsored by Government and industry have repeatedly established that Dental Fluorosis and dental abnormalities have negative psycho-social impacts and that the public commonly perceives people with dental abnormalities to have poor health, low intelligence, poor psychological adjustment, poor personal hygiene, lack of social skills (Davis et al., 1998).

On the other hand, there is a psycho-behavioural impact. The consequences of artificial water fluoridation and widespread, poorly- or unregulated use of fluoridated products have created a growing subset of the population more likely to endure lifelong discrimination and develop psycho-behavioural problems (Collins & Zebrowitz, 1995).

Rodd and Davidson (1997) observed that, Dental Fluorosis mild form does not have adverse effect on cosmetic appearance, but severe forms cause great psychological distress (Rodd & Davidson, 1997).

Children who develop Dental Fluorosis-related behavioural problems are more likely to be disruptive in school, underachieve academically, regularly truant from school, have histories of antisocial behaviour (police records), and become drug and/or alcohol abusers. Many of these children carry these negative behavioural traits into adulthood.

They are more likely to live on welfare benefits, fail to obtain or retain work, become homeless, fail to make or maintain relationships, be more prone to violence, spend time in prison, become repeat offenders, suffer from some form of mental illness, suffer from drug addiction/alcoholism, have suffered from child abuse and are child abusers. Such well-documented negative outcomes indicate the existence of an important Socio-economic element which is never included in 'cost-benefit' analysis of water fluoridation (Arthur, 2001).

2.8 Intervention policies

The intervention policies were directed either to wards reducing fluoride concentration in water and its ingestion from other factors to human body especially during childhood to prevent Dental Fluorosis occurrence, or providing Dental treatment for affected teeth. Environmental protection agency office of water supply at National interim primary drinking water regulations mentioned that communities with excessively high natural Fluoride levels have effectively reduced Fluorosis by partial defluoridation and by change to a water source with more acceptable Fluoride concentration.

WHO at 1995 indicated that high Fluoride level above 5mg/litre, has been found in several countries (e.g., Algeria, china, Egypt, India, and Thailand). Such high levels have at times led to dental or skeletal Fluorosis. Fluoride removal techniques have been developed for both community water supplies and individual households.

WHO at 1995 also said that the most frequently employed fluoride removal technique uses ion exchange/adsorption with either charred bone meal or activated alumina. Fall-scale activated alumina facilities and house hold defluoridators using charred bone male have been reported to reduce Fluoride levels from 5-8mg/litre to less than 1mg/litre. Fluoride bone meal and activated alumina are usually regenerated for future use.

WHO (1997) illustrated that high Fluoride levels, in ground waters, are locally common in some areas of the world, and in most such circumstances it may be more practical and cost-effective to use alternative water sources.

There are policies changed about supplements and toothpaste, when Dental Fluorosis prevalence seems to have fallen in parallel with a reduction in discretionary intake from supplements and toothpaste and because people are slow to change health habits (Riordan, 2002).

In Toronto, Public Health advised to continue to monitor levels of Dental Fluorosis and caries and should continue its efforts to inform parents of very young children about the safe use of fluoridated dentifrice (Leake et al., 2002).

It has been observed that the ingestion of calcium, vitamin C or vitamin D, individually, is effective in protection from fluoride toxicity to a certain extent. Therefore, a double blind control trial was conducted to examine the effect of a combination of calcium, vitamin D and ascorbic acid supplementation in Fluorosis-affected children. The children were given ascorbic acid, calcium and vitamin D well below the toxic dosages in a double blind manner, using lactose as a placebo. Follow up revealed a significant improvement in dental, clinical and Skeletal Fluorosis and relevant biochemical parameters in these children. Thus, the study indicated that Fluorosis can be reversed, at least in children, by a therapeutic regimen that is fairly cheap, simple and easily available and without any side effects (Gupta et al., 1996).

At study to prevent Dental Fluorosis in Ethiopia suggests that although the problem of Dental Fluorosis is obviously understood by the local community when the process of destruction is completed. Because of the prevalence of the recognizable disease with high degree of destruction is also very high, it is appropriate that preventive programs target the entire public in an endemic area without any screening. Therefore,

continuous mass public sensitization programs with timely and privately in an office space are offered by the schools. The school community is especially suited for mass education program because it is a very captive audience with clear risk of developing the problem and students will serve as a communication media to convey messages to the community (Berhane et al., 2002).

It can also be done in a sustainable way if schoolteachers are provided with appropriate and education materials. This may have dual effects in the prevention of Dental Fluorosis. First, it provides protection to students by reducing the level of exposure. Second, a spill over effect to the community arising from the demand of students for treated water at home may motivate parents to use local means to reduce fluoride concentration in drinking water and also to put pressure on the local government to provide treated water (Berhane et al., 2002).

In the United States, the rise in Dental Fluorosis directed the health care practitioners to change their recommendations for fluoride supplementation in babies and young children, since many infants apparently ingest enough fluoride from other sources (Vondriska, 1996).

Finally, it is important to mention the experience of Ban Sankayom in Thailand in solving Dental Fluorosis problem, where the children drink high fluoride water at home and every one has Dental Fluorosis in their permanent teeth. To solve the problem, a teacher shared information about water problems and Fluorosis in school children. Newspapers, TV media and radio programs paid attention to this release and encouraged people in the government and private sectors to support funding to solve this problem. A schoolteacher tried to seek funding and succeeded in 1998. A school defluoridator was built. Community preparation, presenting information about Fluorosis and education in conferences, exhibitions, preventive campaigns and a well-

contest were carried out with the participation of villagers, school and health organizations. After that, they considered appropriate alternatives (consuming rainwater, low fluoride water from dug wells, bottled drinking water and using defluoridators) and planned to solve the problem by community participation. In conclusion, solving the Fluorosis problem in this village focuses on community participation. Health organizations and other supervisors can act as supporters and co-staff, not organizers, for sustainable results (Puangpinyo, 2000).

2.9 Fluoride sources

Fluorine is the most electronegative of all chemical elements. It has an atomic weight of 19.0 and an atomic number of 9. Combined chemically in the form of fluorides, chiefly as fluorspar (CaF_2), fluorapatic (Ca_{10} $[PO_4]_6$ F_2) or cryolite (Na_3AlF_6), it is seventeenth in the order of abundance of elements in the earth's crust (Fleischer, 1953).

Food and Nutrition Board of the National Research Council in (1968) has stated that fluoride is a normal constituent of all diets and is an essential nutrient. Fluoride originates from the weathering of fluoride concentrating minerals and enters surface waters through run-off, liquid and gas emissions from certain industrial process (e.g., mental and chemical bases manufacturing) and incineration can also contribute fluoride ions (F-) to water bodies (chapman, 1992). Fluoride in groundwater depends principally on the solubility of the fluoride containing rocks with which the water is in contact (abuzahra, 1995). WHO in (1993) added that fluoride is released during use of phosphates fertilizers which contain up to 4% Fluorine.

In addition, water pollution is increased gradually as result of loosing big a mounts of surface and ground water and increase the pollution of agriculture and industries waste (Abd-Alwarith, 1998).

As mentioned before, in Gaza Strip, There are many of these factors available. There is a high level of dissolved salt in water due to excessive utilization of this limited water resource leading to intrusion of seawater into the groundwater reservoirs. And the under ground water wells has an average depth 53 m and are covered by sandy soils making them liable to pollution by human activities (Sansur, 1991).

So that there is periodic measurement of Fluoride concentration in drinking water in Gaza to illustrate suitable and unsuitable wells for water supply.

2.10 Absorption of fluoride in human body

Fluoride is readily absorbed into the body. Absorption occurs mainly from the stomach, is passive in nature, and no active transport mechanism is involved. Carlson et al. (1960a) demonstrated that 1 mg of fluoride labelled with ^{18}F and ingested by two adult humans was rapidly absorbed. The maximum plasma radio fluoride concentration was reached within 60 minutes. .

Absorption can also occur from the lungs by inhalation of fluoride dusts and gases. A third and very rare route of absorption is through the skin. Fluoride absorption may occur when hydrogen fluoride is applied to the skin; however, the resulting burn to the skin is more serious than is the fluoride is absorbed (Goodman and Gilman, 1965). It is rapidly excreted via the kidney.

Chapter 3

Material and Methods

3.1 Study design and Study population

This is a cross-sectional study. The study population is children in the preparatory and secondary school age (12-18 years old) in all Gaza Governorates. Based on Palestinian Central Bureau of Statistics (**PCBS**) estimate for population the year 2002, approximately the total number is around 222,500 children (12-18 years old) in all Gaza Governorates.

3.2 Study timeline

The timeline for the study was from March 2003 through November 2003. The researcher started by confirming the ethical approval. The data collection took around 5 weeks, followed by data coded, entry and analysis which took 8 weeks. The rest of the period was necessary to complete the study and writing up the report.

3.3 Place of the study

The study was carried out in the five Gaza Strip Governorates (North Gaza, Gaza City, Midzone, Khan-Younis, and Rafah). The clusters were chosen randomly from each governorate. The researcher interviewed the subjects with their mothers within their homes.

3.4 Sample size

The sample size, according to **Epi Info 6** statistical programs, was 350 children. The researcher selected a stratified cluster random sample from the five Gaza strip Governorates (North Gaza, Gaza City, Midzone, Khan-Younis, and Rafah). Each selected cluster was served for water supplies by known wells examined chemical for fluoride concentration. The researcher divided the sample – with consideration of

population size in each Governorates - as following: 50 subjects from North Gaza, 100 subjects from Gaza City, 50 subjects from Midzone, 100 subjects from Khan-Younis and 50 subjects from Rafah.

3.5 Eligibility Criteria

Inclusive Criteria: Children (12-18 years old) who were born and have spent their first seven years of age in the same house that they live in at the time of study and their mothers.

Exclusion Criteria: Children (12-18 years old) who did not spend their first seven years of age in the same house that they live in at the time of study. Or mainly did not supply drinking water from the same drinking water well serving them at the time of study during their first seven years of age and their mothers.

3.6 Methods of the study and Questionnaire design

Data had been collected using closed and open-ended questionnaire (Annex 14,15). The content of questionnaire included:

- Socio-economic and demographic data.
- Thyllstrup-Fejerskov Index (**TFI**) of Dental Fluorosis. The researcher asked the child to brush his/her teeth well before observing them. Then the researcher recorded the TFI score of the buccal surfaces of all teeth, including the permanent molars.
- Risk factors were assessed through questionnaire to children and their mothers.
- The fluoride concentrations in drinking water wells had been gotten from Environmental Health Laboratory "Public health lab: food and water" at Ministry of Health. The average fluoride concentration for three years (1988, 1995, 2002) for each drinking water well were calculated and considered as fluoride concentrations in drinking water of this well serving the selected cluster. In case that data is not available, the researcher selected a year before or after to replace the missing year. The

distribution of all drinking water wells are illustrated in (Annex 16). The drinking water wells which serving the selected clusters in the study sample at all Gaza governorates are clarified with their average fluoride concentration for three years (1988, 1995, 2002) in (Annex 17).

- The public perception of Dental Fluorosis was studied through questionnaire to children and their mothers.

The questionnaire had been written in Arabic language because it is the mother language of subject. 350 questionnaires, each one will take about 15 minutes to be filled out. Researcher interviewed and directed the questions to children and their mothers to fill the questionnaire. The researcher spent daily tow and half hours to collect data.

3.7 Ethical consideration procedures

All ethical concepts were considered, respect for people and respect for truth, anonymity and confidentially were maintained by using serial number for each subject and the city, block and building number were not be inserted to SPSS program.

The researcher secured the Helsinki Committee agreement (Annex, 5) and informed consent from the children and their mothers. The informed consent provided complete explanation about the research purposes, confidentiality and informed that participation with research is optional. Ethical approval was obtained from MoH (Annex, 1, 2, 3) and UNRWA (Annex 4).

3.8 Validation

To check for the validity of the questionnaire, a list of 12 experts was prepared. They included psychological, nutritional, environmental, public health, dentistry, and dental public health specialists. Their replies were revised and integrated in the questionnaire.

3.9 Reliability

To secure high reliability, the researcher collected the data herself. Thus, the inter-observer variation was eliminated.

3.10 Piloting

The questionnaire was piloted among 10 children with their mothers from different areas in all Gaza governorates. To test the suitability of the questionnaire before the data collection, the questionnaires were revised in the light of piloting, such as many changes like verbal and sequential changes of questions. Some questions were completely replaced. The pilot sample was excluded from the study.

3.11 Data collection

MoH gave permission to researcher that allowed him to seek the help and consultation from Environmental Health departments in each Governorates. The Environmental Health departments provided complete explanation to researcher about the different areas and the drinking water wells that supply them. Then, the researcher selected randomly a cluster within the each Governorates and the Environmental Health department help him to reach the chosen area. The researcher himself directed the questions to subjects in Arabic language to fill the questionnaire.

The researcher - before leaving the subject house - was ensuring that the subject answered all questions in the questionnaire.

3.12 Response rate

The response rate was 100% because the researcher compensated the expected non-respondents by selecting children from neighborhood.

3.13 Data entry and analysis

The researcher used Statistical Package of Social Sciences **SPSS** and **Epi Info 6** statistical program for data coding, entry and analysis.

The researcher followed the following steps:

1. Giving serial number for each questionnaire.
2. Designing data entry model by SPSS.
3. Define variables.
4. Coding variables.
5. Data cleaning: providing general view of data and check its frequency.
6. Presentation for the study variables using frequency tables and graphs.
7. Data analysis:

A-Cross tabulations between dependant variable – Dental Fluorosis – and independent variables such as socioeconomic characteristics, toothpaste using behavior, applications of Fluoride tablets and supplements, knowledge around Dental Fluorosis, environment pollution, baby formula, exclusive breastfeeding, nutrition behavior and Fluoride concentration in drinking water wells.

B- Statistical testing using:

- **Chi square test**: to study the relation between two or more qualitative variables. It compares the observed frequencies with expected frequencies to determine whether the deviations are significant (Kuzma, 1992).
- **Fisher test**: to study the relation between variables when expected frequencies less than 5. Because Chi square test not appropriate for this situation (Kuzma, 1992).

Results were considered statistically significant when P-value< 0.05.

P-value is the probability that the value of the calculated test statistics occurred by chance alone (Kuzma, 1992).

The researcher categorized TFI scores of Dental Fluorosis into 3 categories, the first one represents children who are free of Dental Fluorosis and their TFI score is 0, means, normal. The second group comprises of children whose TFI score of their teeth is between1-4 it represent the children who suffer from questionable to moderate Dental Fluorosis and it will labeled by moderate Dental Fluorosis. The third group consists of those children whose TFI score of their teeth is TFI score 5 or more and this is considered Sever Dental Fluorosis. It is worth demonstrating that the highest TFI score of Dental Fluorosis, the researcher diagnosed among the children of the study sample is TFI score 8, so that the researcher determined the third category between TFI score 5-8.

3.14 Study limitations

- **Political:** the study necessitates travel of the investigator to all Gaza Strip Governorates, the investigator spent hours on check points and the Israeli barriers especially in south of Gaza Strip "Khan-Younis and Rafah".
- **Economical:** the study was not funded by any agency and the investigator had to complete the study from his own resources.

Chapter 4

Results

This chapter presents the findings of the study. It is worth remembering that, the study population is 350 children in the preparatory and secondary school age (12-18 years old) in all Gaza Governorates, who were born and have spent their first seven years of age in the same house that they live in at the time of study and their mothers. The results includes the Socio-demographic and economic characteristics of the study population, possible risk factors associated to Dental Fluorosis during first 7 years of age of children in Gaza strip.

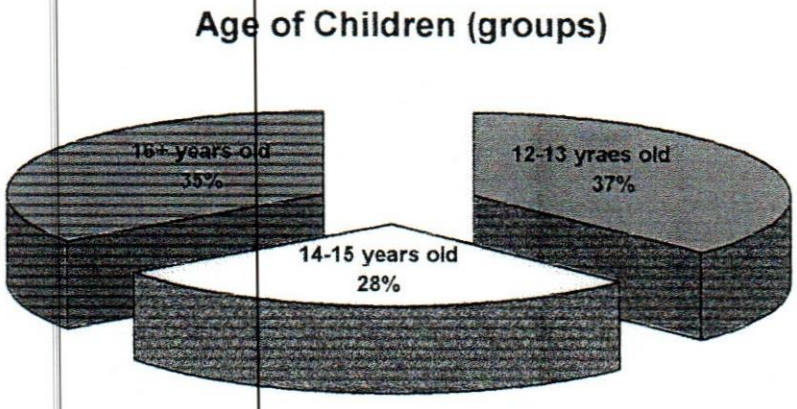
These risks include: Use of toothpaste , Applications of Fluoride tablets and supplements, Knowledge of the mother and child around Dental Fluorosis in Gaza strip, Environmental sources of pollution by Fluoride, Baby formula usage during child infancy, Breastfeeding, Children consumption of Fish, Milk and Tea consumption behavior , Nutrition status, Availability of water purification system, Source of drinking water and average Fluoride concentration in municipal wells by ppm that are supplying drinking water.

The results demonstrated the outcome variable, the Thyllstrup-Fejerskov Index (TFI) score of Dental Fluorosis among Palestinian children in Gaza strip and it is associated with the study independent variables. And Public Perception for Dental Fluorosis in Gaza strip.

4.1 Socio-demographic and economic characteristics of study population

Children age was categorized into three groups as shown in figure (1). The larger age group in the study sample is 12-13 years old.

Figure (1) children age groups in Gaza strip in the study sample



The females composed 56.9% of the study population while the males composed 43.1%.

Most children in the study sample are single. Fathers of children are 48.6% unemployed and 40.3% their years of education in the group of 7-12 years. Most mothers are householders and 61.4% of them finish between 1-9 years of study. Just 192 families have monthly income. Depending on the relative poverty line (equals 1624 NIS) in Gaza strip, the families who have monthly income were divided into two groups the first around 46.9% of the families their monthly income is in the 200-1500 NIS group and the second around 53.1% in the group of 1600-4000 NIS. Current monthly income compared to previous years is worse among 88.3%. Families in the study

sample who have 1-8 children comprise 54.6% and 56% of the subjects (children) of the sample have the order between 1st and 4th in their families. Table (1) .

Table (1) Summary of the subjects' Socio-demographic and economic characteristics

Characteristics	Count	%
Address by Governorate		
North	50	14.3
Gaza City	100	28.6
Mid-zone	50	14.3
Khan-Younis	100	28.6
Rafah	50	14.3
Total	350	100.0
Marital Status of children		
Single	340	97.1
Engaged	6	1.7
Married	4	1.1
Total	350	100.0
Fathers' occupational level		
Professional/Managerial	16	4.6
Technical/clerical	52	14.9
Skilled worker Artisan	19	5.4
Partly skilled	75	21.4
Unskilled worker	18	5.1
Unemployed/Pensioner	170	48.6
Total	350	100.0
Fathers' Years of Education		
0-6	127	36.3
7-12	141	40.3
13+	82	23.4
Total	350	100.0
Mothers' Occupational level		
Householder	321	91.7
Working outside house(paid)	29	8.3
Total	350	100.0
Mothers' Years of Education (groups)		
1-9	215	61.4
10+	135	38.6
Total	350	100.0
Current Family Monthly Income by NIS (groups)		
200-1500	90	46.9
1600-4000	102	53.1
Total	192	100.0

Table (1) Summary of the subjects' Socio-demographic and economic characteristics

Characteristics	Count	%
Compared to previous years is the Current monthly income		
Better	24	6.9
Worse	309	88.3
The same	17	4.9
Total	350	100.0
Composition of the Family of the Child (Number of Children) groups		
1-8	191	54.6
9+	159	45.4
Total	350	100.0
Order of Child in his Family (groups)		
1-4	196	56.0
5+	154	44.0
Total	350	100.0

4.2 Possible risk factors associated to Dental Fluorosis

4.2.1 Using Toothpaste behavior of children in Gaza strip during their first 7 years of age

The study indicates that 52.6% of children in the sample brush their teeth by toothpaste. Age in which the child started to use toothpaste by years is 93.5% in age group 4-5 years old. Children who did not know that the toothpaste was fluoridated or not are 38.2% and 48.4% of children were brushing their teeth once a day. Children spent in brushing their teeth 1-2 minutes formalize 84.2% of study population. Whereas, there are 57.1% of children were covering all the head of brush by toothpaste. Children did not swallowed the toothpaste are 47.8% but 33.7% swallowed it. The percentage of children who rinsed their mouths well after brushing teeth is 81.5%. All mothers did not clean their children teeth by toothpaste during the children infancy. Finally, all toothpastes, that the families use now, are fluoridated. Table (2).

Table (2) Use of Toothpaste by children during their first 7 years old

Variable		Count	%
Child brushes teeth by toothpaste	yes	184	52.6
	no	166	47.4
	Total	350	100.0
Age in which the child started to use toothpaste by years (groups)	4-5	172	93.5
	6-7	12	6.5
	Total	184	100.0
toothpaste was fluoridated	yes	29	15.8
	no	2	1.1
	do not know	153	83.2
	Total	184	100.0
times aday you brushed your teeth	1	89	48.4
	2	66	35.9
	3	29	15.8
	Total	184	100.0
Time which child was spent in brushing his/her teeth by minutes	groups		
	1-2	155	84.2
	3+	29	15.8
	Total	184	100.0
toothpaste covered of the head of brush	all	105	57.1
	half	31	16.8
	part(pea size)	48	26.1
	Total	184	100.0
Child swallowed the toothpaste	yes	62	33.7
	no	88	47.8
	Sometimes	34	18.5
	Total	184	100.0
Child rinsed his/her mouth well after brushing teeth	yes	150	81.5
	no	34	18.5
	Total	184	100.0

4.2.2 Applications of Fluoride tablets and supplements to children their first 7 years of age

The study found that no child had fluoride tablets and supplements during his/her first 7 years of age in Gaza strip.

4.2.3 Knowledge of the mother and child around Dental Fluorosis

The Knowledge of the children and mothers around Dental Fluorosis in Gaza strip is illustrated in table (3). Most of children and all mothers do not know what Dental Fluorosis is and have not received any information about Dental Fluorosis in Gaza strip. Just two children know what Dental Fluorosis is and have received information about it from school health education program. Furthermore, they do not know its causes and how to prevent Dental Fluorosis or minimizing its severity. Just 2.3% of mothers and no child know what advantages of fluoride in drinking water are, and no one knows what disadvantages of fluoride in drinking-water are. Those who prefer fluoride existence in drinking water are 52.6% of children and 59.1% of mothers.

On other hand, 89.7% of children and 80.3% of mothers are not interest in quality (contents) of toothpaste and 80.6% of children and 80.3% of mothers, who interest in quality(contents of the toothpaste) of toothpaste, know if the toothpaste has fluoride or not.

Table (3) The Knowledge of the mother and child around Dental Fluorosis

Variables		Child		Mother	
		No.	%	No.	%
I know, what is Dental Fluorosis					
	yes	2	.6		
	no	348	99.4	350	100.0
	Total	350	100.0	350	100.0
I have received information about Dental Fluorosis in Gaza strip					
	yes	2	.6		
	no	348	99.4	350	100.0
	Total	350	100.0	350	100.0
I know the causes of Dental Fluorosis					
	yes	1	.3		
	no	349	99.7	350	100.0
	Total	350	100.0	350	100.0
I know what to do to prevent Dental Fluorosis or minimize its severity					
	yes	1	.3		
	no	349	99.7	350	100.0
	Total	350	100.0	350	100.0
I know what are fluoride in drinking-water advantages					
	yes			8	2.3
	no	350	100.0	342	97.7
	Total	350	100.0	350	100.0
I know what are fluoride in drinking-water disadvantages					
	no	350	100.0	350	100.0
	Total	350	100.0	350	100.0
I prefer fluoride existence in drinking water					
	yes	184	52.6	207	59.1
	no	166	47.4	143	40.9
	Total	350	100.0	350	100.0
I interest in quality(contents) of toothpaste					
	yes	36	10.3	69	19.7
	no	314	89.7	281	80.3
	Total	350	100.0	350	100.0
I know, if the toothpaste has fluoride or not (who responses Yes at previous item)					
	yes	29	80.6	61	88.4
	no	7	19.4	8	11.6
	Total	36	100.0	69	100.0

4.2.4 Environment pollution by Fluoride

The Sources of air pollution indoors and outside the houses of children are observed in figure (2), Findings show that no industries are near the houses of children in Gaza strip. Children who do not live near main road compromise 78.9% and 67.1% of children their houses were not surrounded by dust.

Families use open fire as heating system during winter in the study sample formalized 25.1%. Figure (3)

Figure (2) Sources of air pollution by Fluoride

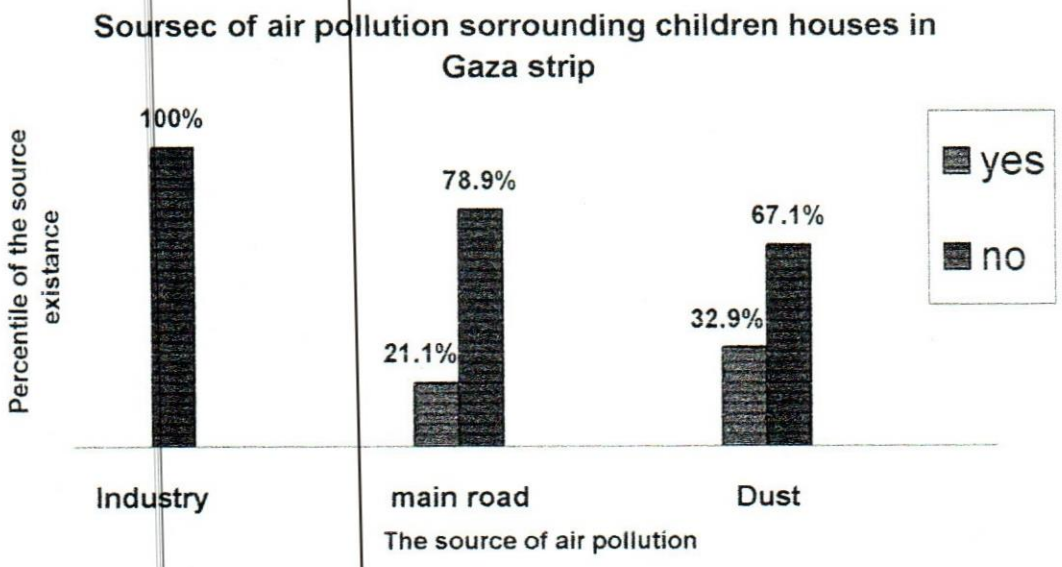
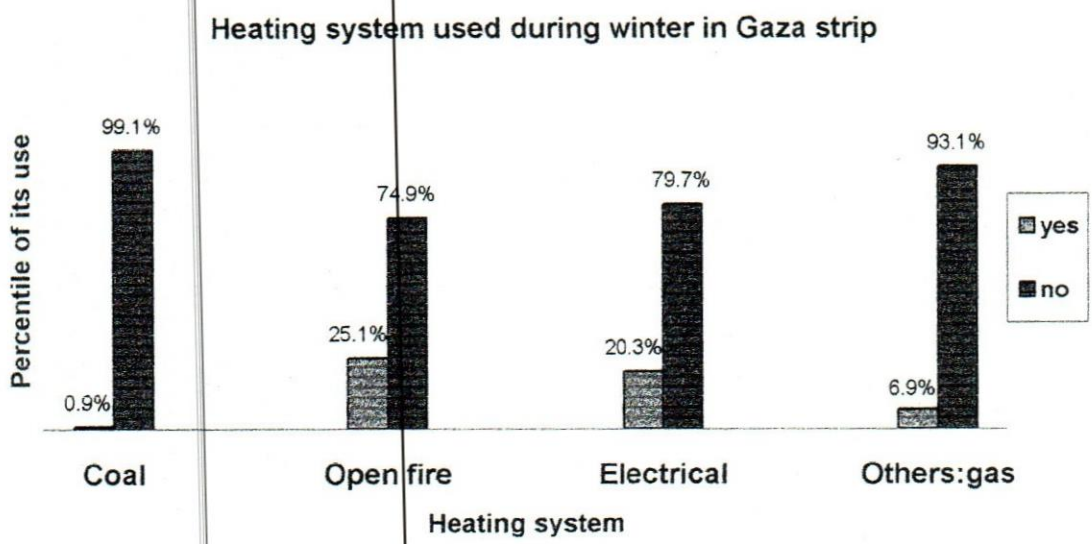


Figure (3) Heating system in winter in Palestinian houses



4.2.5 Nutrition behavior of Palestinian Children during their first 7 years of age

4.2.5.1 Baby formula usage and Exclusive Breastfeeding during child infancy in Gaza strip

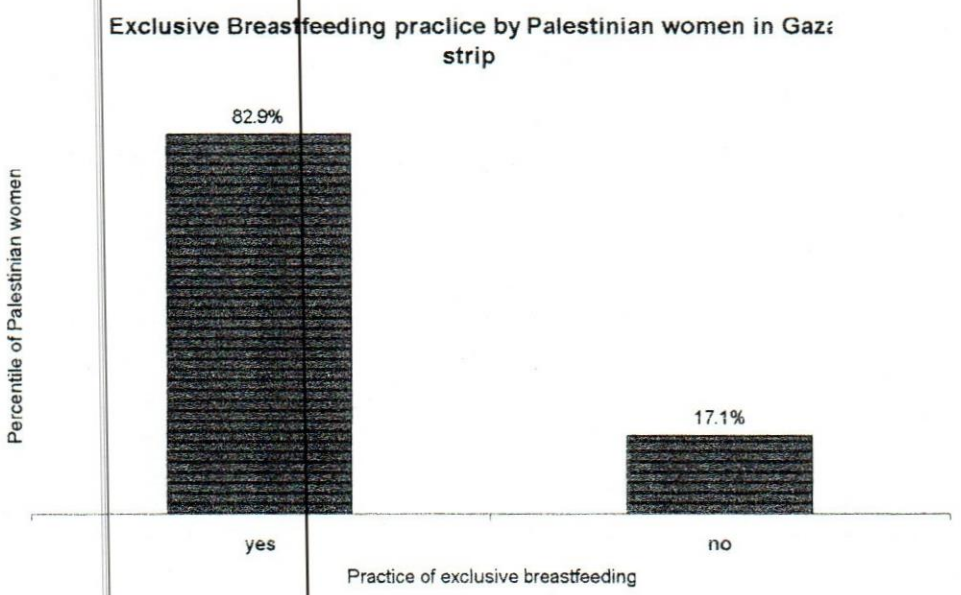
Group of mothers started to use Formula to child in 1-2 months of children ages comprises 61.9% of study sample as it is observed in table (4). The type of water used to reconstitute formula, 96.8% was tap water.

Table (4) Baby formula usage during child infancy

Variable	groups	Count	%
The month when the mother started to use Formula to child	1-2	39	61.9
	3+	24	38.1
	Total	63	100.0

The study found that 82.9% of Palestinian mothers practiced Exclusive Breastfeeding in first six months of children age in Gaza strip. Figure (4).

Figure (4) Practice of Exclusive Breastfeeding in first six months of children age by Palestinian mothers



4.2.5.2 Milk consumption behavior

Milk consumption behavior of Palestinian children during their first 7 years of age in Gaza strip is shown in table (5). The children started to have milk in the group of 16 months and more compromise 51.1% of the children who had milk during their first 7 years of age in Gaza strip. Children who have 3 and more cups of milk that the child had a day during 1-3 years of old formalized 51.6% and 92.7% of children had 1 cup of milk a day in 4-7 years of old. The study demonstrated that 80.8% consumed artificial milk only. In addition, 99.4% of those who consumed artificial milk reconstituted it in tap water.

Table (5) Milk consumption behavior of Palestinian children during their first 7 years of age

Variable	Groups	No.	%
Month in which the child started to have milk	1-15	89	48.9
	16+	93	51.1
	Total	182	100.0
Number of cups of milk that the child had a day during 1-3 years of old	1-2	88	48.4
	3+	94	51.6
	Total	182	100.0
Number of cups of milk the child had a day in 4-7 years of old	1	114	92.7
	2	9	7.3
	Total	123	100.0
Type of milk	Artificial milk	147	80.8
	Animal milk	26	14.3
	Artificial and Animal milk	9	4.9
	Total	182	100.0
if it was Artificial milk, the type of water is use to reconstitute the Artificial milk	Tap water	155	99.4
	mineral water	1	6.
	Total	156	100.0

4.2.5.3 Tea consumption behavior

The child started to have tea in the group of 2 years old and more compromise 55.9% of the children who had tea during their first 7 years of age in Gaza strip. The research illustrated that 98.1% have one cup of tea a day during 1-3 years of old and 58.1% had 1-2 cups of tea a day in 4-7 years of old. Furthermore, 58.7% of children reconstituted two spoons of sugar in each cup of tea, while 98.6% of tea was prepared with tap water. Tea consumption behavior of Palestinian children during their first 7 years of age in Gaza strip is shown in table (6).

Table (6) Tea consumption behavior of Palestinian children during their first 7 years of age

Variable	Category	No.	%
	year		
The year in which the child started to have tea	1	124	44.1
	2+	157	55.9
	Total	281	100.0
Number of cups of tea that child had a day during 1-3 years of old	Cups groups		
	1	259	98.1
	2+	5	1.9
	Total	264	100.0
Number of cups of tea that the child had a day during 4-7 years of old	Cups groups		
	1-2	155	58.1
	3+	112	41.9
	Total	267	100.0
Number of spoons of sugar, the child added for each cup of tea	spoons of sugar		
	1	115	40.9
	2	165	58.7
	3	1	4.
	Total	281	100.0
Type of water used to prepare the tea	Type of water		
	Tap water	277	98.6
	mineral water	4	1.4
	Total	281	100.0

4.2.5.4 Fish consumption

It is clear in table (7) that the group of 1-2 times the child ate fish per month formalizes 52.4% of children who ate fish during their first 7 years of age in Gaza strip.

Table (7) the children consumption of Fish during their first 7 years of age

Number of times that the child ate fish per month (groups)	Count	%
1-2	150	52.4
3+	136	47.6
Total	286	100.0

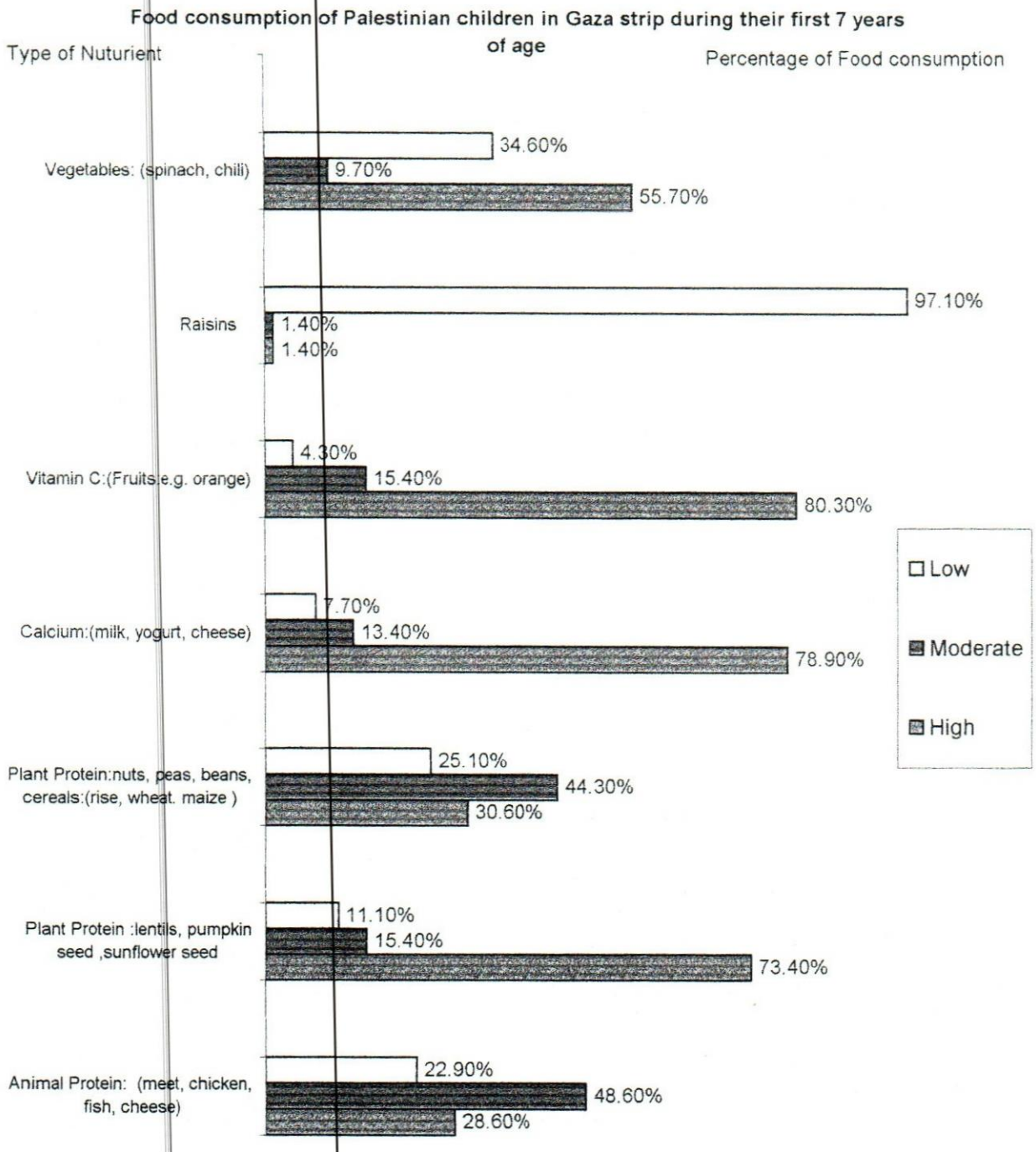
4.2.5.5 Food consumption of Palestinian children during their first 7 years of age

Concerning the Food consumption of Palestinian children during their first 7 years of age in Gaza strip, as it is illustrated in figure (5), 48.6% had moderate consumption of Animal Protein: (meet, chicken, fish and cheese), while 73.4% had high consumption of Plant Protein: (lentils, pumpkin seed and sunflower seed) and 44.3% are moderate in consumption of Plant Protein: nuts, peas, beans, cereals: (rise, wheat and maize).

The study found that 78.9% of children had high consumption of Calcium: (milk, yogurt, and cheese).

On other hand, 80.3% had high consumption of Vitamins(C) from Fruits (e.g. orange), whereas 55.7 % had high consumption of Vegetables: (spinach, chili). Generally, the consumption of Raisins is very low.

Figure (5) Food consumption of Palestinian children during their first 7 years of age



4.2.5.6 Nutrition status of Palestinian children during their first 7 years of age

The growth of the majority (98.3%) of Palestinian children in the study sample was prescribed by their families as normal, during their first 7 years of age in Gaza strip. Table (8)

Table (8) Nutrition status of Palestinian children during their first 7 years of age

The growth of the child during infancy			The growth of the child during his/her first 7 years of age		
	Count	%		Count	%
Normal	344	98.3	Normal	344	98.3
Underweight	2	.6	Underweight	2	.6
Overweigh	4	1.1	Overweigh	4	1.1
Total	350	100.0	Total	350	100.0

4.2.6 The availability of water purification system in houses

In fact, there is no family has water purification system during first 7 years of child age. All participated families are received the drinking water from municipal water network.

4.2.7 Fluoride concentration in municipal wells

Regarding the Fluoride concentration in municipal wells (average) by ppm, 42.9% of average of Fluoride concentration in Municipal water network equals 1 ppm of fluoride or less and 57.1% is more than 1ppm of fluoride. Table (9)

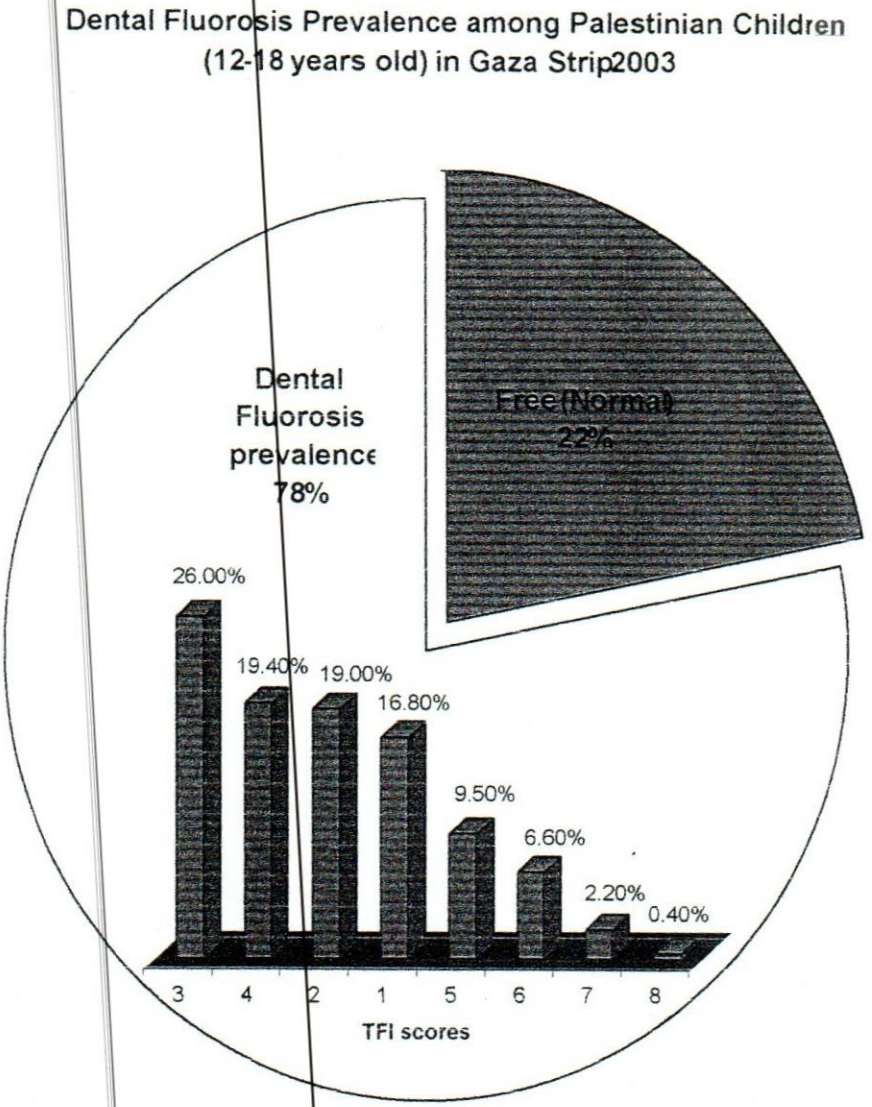
Table (9) The Fluoride concentration in municipal wells (average) by ppm

Fluoride concentration in municipal wells (average) by ppm	Groups	Count	%
	0-1	150	42.9
	1.1+	200	57.1
	Total	350	100.0

4.3 Prevalence of Dental Fluorosis among Palestinian children

Depending on the Thyllstrup-Fejerskov index of Dental Fluorosis ‹Free children are 22% while the prevalence of Dental Fluorosis among Palestinian children in Gaza strip is 78%. There are 63.4% in the group of 1-4 TFI score of Dental Fluorosis. The highest prevalent group for those with 3 TFI score while the lowest one for those with 1 TFI score. There are also 14.6% in the group of 5-8 TFI score of Dental Fluorosis, The highest prevalent group for those with 5 TFI score while the lowest once for those with 8 TFI score. Figure (6).

Figure (6) Prevalence and Severity of Dental Fluorosis



4.4 Public Perception towards Dental Fluorosis

The study concerned in providing a view around Public Perception for Dental Fluorosis in Gaza strip. It found that 87.7% of children do not have problem with their teeth color and 88.6% of their mothers have the same observation. It was observed also, 86.3% of the children accept their teeth appearance and 87.4% of the mothers illustrated the acceptance of children appearance. Among the children who do not accept their teeth appearance, 87.5% due to teeth color and 86.4% of the mother say the same fact. In

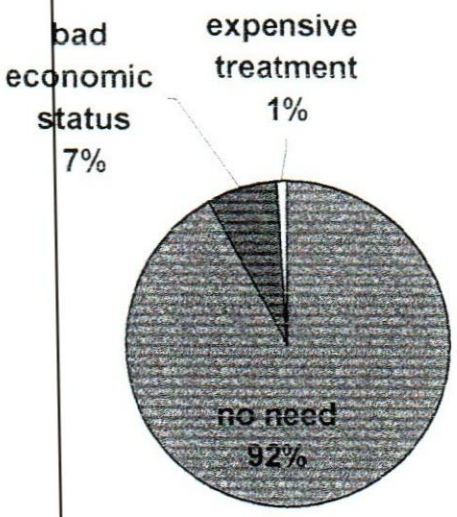
addition, 86.6% of children do not desire to treat their teeth to have better appearance and 87.4% of mothers have the same view.

All respondents feel that others with stained teeth (fluorosed) do not have good appearance. Even, 99.7% of children and 99.4% of mothers think that stained teeth (Dental Fluorosis) affect aesthetic appearance and personality. Children who do not hide their smile comprise 96.9% of the sample of study. All respondents interest with child aesthetic appearance so that all concern with child teeth (Dental Fluorosis). The respondents' perception around children with white teeth appearance is, that they are more Desirable as friends and more intelligence, furthermore, 98.6% of children agree with this idea and 95.4% of mothers agree, also, 98.3% of children and 95.4% of mothers found that they are more kind, and 98.9% of children and 96% of mothers see that they have better looking.

The participants who believe people with Dental Fluorosis (stained teeth) have Lack social skills is 100% of children and 97.1% of mothers, also, 98.6% of children and 95.4% of mothers believe that they are less intelligent and 98.9% of children and 97.1% of mothers expect that they suffer of poor social adjustment.

The study shows that mothers who participate in study are 89.7% satisfied with the color of their children teeth, 98.9% do not feel guilty about their children teeth color and 99.4% have not sought treatment for their children teeth color and most of them contribute that for acceptable appearance so no need to treatment, while the rest mothers have not sought treatment because of bad economic status and expensive treatment, figure (7).

Figure (7) Reasons prevent seeking treatment to Dental Fluorosis in Gaza strip



On other hand, 99.7% of participated mothers think that the government can find immediate solution for this problem and they are ready to participate in solving the problem but the participation will be not monetary. Table (10)

Table (10) Public Perception for Dental Fluorosis

Variable	Child Count	Child %	Mother Count	Mother %
Child has a problem with his/her teeth color				
yes	43	12.3	40	11.4
no	307	87.7	310	88.6
Total	350	100.0	350	100.0
Child accepts his/her teeth appearance				
yes	302	86.3	306	87.4
no	48	13.7	44	12.6
Total	350	100.0	350	100.0
The child does not accept his/her teeth appearance because of				
teeth color	42	87.5	38	86.4
other reasons	6	12.5	6	13.6
Total	48	100.0	44	100.0
Child desires to treat his/her teeth to have better appearance				
yes	47	13.4	44	12.6
no	303	86.6	306	87.4
Total	350	100.0	350	100.0
The opinion about others with stained teeth (fluorosed)				
Not good appearance	350	100.0	350	100.0
Total	350	100.0	350	100.0
I thinks that stained teeth (Dental Fluorosis) affect aesthetic appearance and personality				
yes	349	99.7	348	99.4
no	1	3.	2	6.
Total	350	100.0	350	100.0
Child hides her/his smile				
yes	11	3.1	11	3.1
no	339	96.9	339	96.9
Total	350	100.0	350	100.0
The interest with child aesthetic appearance				
yes	350	100.0	350	100.0
Total	350	100.0	350	100.0

Table (10) Public Perception for Dental Fluorosis

Variable		Child		Mother	
		Count	%	Count	%
The concern with child teeth (dental Fluorosis)					
yes		350	100.0	350	100.0
Total		350	100.0	350	100.0
I think children with white teeth appearance is more :					
Desirable as friends	yes	345	98.6	334	95.4
	no	5	1.4	16	4.6
	Total	350	100.0	350	100.0
Intelligence	yes	345	98.6	334	95.4
	no	5	1.4	16	4.6
	Total	350	100.0	350	100.0
Kind	yes	344	98.3	334	95.4
	no	6	1.7	16	4.6
	Total	350	100.0	350	100.0
Have better looking	yes	346	98.9	333	96.0
	no	4	1.1	14	4.0
	Total	350	100.0	347	100.0
I believe people with Dental Fluorosis(stained teeth) have:					
Lack social skills	yes	349	100.0	340	97.1
	no	///	///	10	2.9
	Total	349	100.0	350	100.0
Lower intelligence	yes	345	98.6	334	95.4
	no	5	1.4	16	4.6
	Total	350	100.0	350	100.0
poor social adjustment	yes	346	98.9	340	97.1
	no	4	1.1	10	2.9
	Total	350	100.0	350	100.0

Table (10) Public Perception for Dental Fluorosis

Variable	Mother answer	Count	%
I am satisfied with the color of my child teeth	yes	314	89.7
	no	36	10.3
	Total	350	100.0
I feel guilty about my child teeth color	yes	4	1.1
	no	346	98.9
	Total	350	100.0
I have sought treatment for my child teeth color	yes	2	6.
	no	348	99.4
	Total	350	100.0
I think that the government can find immediate solution for this problem	yes	349	99.7
	no	1	3.
	Total	350	100.0
I am ready to participate in solving the problem	yes	349	99.7
	no	1	3.
	Total	350	100.0
If yes, the participation can be	Not monetary	349	100.0
	Total	349	100.0

This study is a cross-sectional study. The statistical analysis examines the association between Dental Fluorosis and possible risk factors associate with. Regarding the prevalence of Dental Fluorosis among Palestinian children 12-18 years old in Gaza strip, the research estimated that, the prevalence of Dental Fluorosis is 78% while 22% of the children in the study sample are free of Dental Fluorosis. The highest prevalence 23.1% of children - who are free - was between 12-13 years old. The highest prevalence of moderate Dental Fluorosis - TFI score between 1-4 - 64.6% is observed also among the same age group. While the highest prevalence of Sever Dental Fluorosis - TFI score between 5-8- 17.1% is illustrated among age group 16 and more. However, there are no statistically significant differences in the prevalence of Dental Fluorosis among different age groups, Table (11)

Table (11) Dental Fluorosis and Age of Child

Age groups	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
12-13	30	23.1%	84	64.6%	16	12.3%	130	100.0%
14-15	21	21.6%	62	63.9%	14	14.4%	97	100.0%
16+	26	21.1%	76	61.8%	21	17.1%	123	100.0%
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0%

χ^2 =1.187 P-value = .880

The females, who are free of Dental Fluorosis, are 22.1%, while 21.9% of male are free. The highest prevalence of Dental Fluorosis - TFI score between1-4 – is among females but males are more exposed to Sever Dental Fluorosis - TFI score between 5-8. Differences in the prevalence of Dental Fluorosis among different sex are not statistically significant. Table (12)

Table (12) Dental Fluorosis and Sex of child

Sex	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
male	33	21.9%	93	61.6%	25	16.6%	151	100.0%
female	44	22.1%	129	64.8%	26	13.1%	199	100.0%
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0%

χ^2 = .862 P-value = .650

The lowest prevalence of Dental Fluorosis is in the North Governorate, while the highest is in Rafah and Mid-zone. Whereas, the highest prevalence of Dental Fluorosis - TFI score between 1-4 – is in Rafah 76.0% and children living in Khan-Younis are the most exposed children in Gaza strip to Sever Dental Fluorosis - TFI score between 5-8. As clearly observed in Table (13), the differences of the prevalence of Dental Fluorosis among different governorates in Gaza strip reached highly statistically significant level (P- value=0.000).

Table (13) Dental Fluorosis and Address by Governorate

Governorates	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
North Governorate	21	42.0%	29	58.0%	0	0.00%	50	100.0%
Gaza City	30	30.0%	60	60.0%	10	10.0%	100	100.0%
Midzone	5	10.0%	34	68.0%	11	22.0%	50	100.0%
Khan-Younis	16	16.0%	61	61.0%	23	23.0%	100	100.0%
Rafah	5	10.0%	38	76.0%	7	14.0%	50	100.0%
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0%

χ^2 = 37.603 P-value = .000

Singles have higher prevalence of Dental Fluorosis. The study illustrated no statistically significant relationship between prevalence of Dental Fluorosis and marital status, table (14).

Table (14) Dental Fluorosis and Marital Status of Child

Marital status	TFI score of Dental Fluorosis					
	0		1-8		Total	
	No.	%	No.	%	No.	%
Single	73	21.5%	267	78.5%	340	100.0%
Engaged or married	4	40.0%	6	60.0%	10	100.0%
Total	77	22.0%	273	78.0%	350	100.0%

Fisher exam: 2-tailed P-value: 0.236

The children of Professional and Managerial fathers are the least exposed to Dental Fluorosis. This differences reach a statistically significant difference (P-value=0.002). Table (15).

Table (15) Dental Fluorosis and Father's occupational level

Father's occupational level	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
Professional/ Managerial	8	50.0%	8	50.0%	0	0	16	100.0%
Technical/clerical	6	11.5%	40	76.9%	6	11.5%	52	100.0%
Skilled worker Artisan	6	31.6%	10	52.6%	3	15.8%	19	100.0%
Partly skilled	23	30.7%	46	61.3%	6	8.0%	75	100.0%
Unskilled worker	6	33.3%	11	61.1%	1	5.6%	18	100.0%
Unemployed/Pensioner	28	16.5%	107	62.9%	35	20.6%	170	100.0%
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0%

χ^2 =27.555 P-value = .002

Table (16) illustrates that the exposure to Dental Fluorosis of children whose fathers finished 13 years of education and more is the least and they have the least prevalence of Severe Dental Fluorosis - TFI score between 5-8. Moreover, this group of children is the most group suffers from Dental Fluorosis - TFI score between 1-4. Children whose fathers' years of education are between 0-6 years have the least prevalence of Dental Fluorosis - TFI score between 1-4. The negative association between Dental Fluorosis in children and the Father's Years of Education is not statistically significant.

Table (16) Dental Fluorosis and Father's Years of Education

Father's Years of Education (groups)	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
0-6	31	24.4%	76	59.8%	20	15.7%	127	100.0 %
7-12	24	17.0%	91	64.5%	26	18.4%	141	100.0 %
13+	22	26.8%	55	67.1%	5	6.1%	82	100.0 %
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0 %

χ^2 =8.859 P-value = .065

On other hand, table (17) demonstrates that the children of working mothers outside house are less exposed than those whose mothers are householder. In addition, the prevalence of Dental Fluorosis is higher among the children of householder mothers. And the differences of the prevalence of Dental Fluorosis among children of working outside house or householder mothers are statistically significant.

Table (17) Dental Fluorosis and Mother's Occupational level

Mother's Occupational level	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
House-holder	65	20.2%	207	64.5%	49	15.3%	321	100.0%
Working outside house(paid)	12	41.4%	15	51.7%	2	6.9%	29	100.0%
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0%

χ^2 =7.359 P-value = .025

Regarding the relation between Dental Fluorosis and Mother's Years of Education, as revealed in table (18), the prevalence of free children of Dental Fluorosis is higher among the children whose mothers finished between 1and 9 years of education. In contrast, they suffers from higher prevalence of Dental Fluorosis - TFI score between 1-4. While the children whose mothers finished 10 years of education and more exposed to higher prevalence of Sever Dental Fluorosis - TFI score between 5-8. These differences of the prevalence of Dental Fluorosis in children among difference groups of mother's years of education are not statistically significant.

Table (18)Dental Fluorosis and Mother's Years of Education

Mother's Years of Education (groups)	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
1-9	48	22.3%	141	65.6%	26	12.1%	215	100.0 %
10+	29	21.5%	81	60.0%	25	18.5%	25	100.0 %
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0 %

χ^2 =2.784 P-value = .249

Children in the families whose Current Family Monthly Income by NIS between 1600 and 4000, are less exposed to Dental Fluorosis 28.4% and less exposed to Sever Dental

Fluorosis - TFI score between 5-8. While the prevalence of Dental Fluorosis - TFI score between 1-4- among them is higher than children in the families whose Current Family Monthly Income by NIS between 200 and 15000 NIS. However, these differences of the prevalence of Dental Fluorosis in children are not statistically significant. Table (19)

Table (19) Dental Fluorosis and Current Family Monthly Income by NIS

Current Family Monthly Income by NIS (groups)	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
200-1500	23	25.6%	56	62.2%	11	12.2%	90	100.0%
1600-4000	29	28.4%	67	65.7%	67	5.9%	102	100.0%
Total	52	27.1%	123	64.1%	17	8.9%	192	100.0%

χ^2 =2.406 P-value = .300

Furthermore, in table (20), 45.8% of children in the families whose Current Monthly Income is better Compared to previous years are free of Dental Fluorosis and they formalize the least group exposed to Dental Fluorosis. The prevalence of Dental Fluorosis among the children in the families whose Current Monthly Income is worse Compared to previous years is the highest. These differences of the prevalence of Dental Fluorosis in children are highly statistically significant.

Table (20) Dental Fluorosis and the Current monthly income Compared to previous years

Current monthly income Compared to previous years	TFI score of Dental Fluorosis					
	0		1-8		Total	
	No.	%	No.	%	No.	%
Better	11	45.8%	13	54.2%	24	100.0%
Worse	60	19.4%	249	80.6%	309	100.0%
The same	6	35.3%	11	64.7%	17	100.0%
Total	77	22.0%	222	78.0%	350	100.0%

χ^2 =10.90 P-value = .0043

The children of families having 9 children and more are less exposed to Dental Fluorosis and the prevalence of Dental Fluorosis - TFI score between 5-8 – among them is lower. The prevalence of Dental Fluorosis - TFI score between 1-4 – among the two groups is nearly the same. There is no statistically significant difference in the prevalence of Dental Fluorosis among the groups of composition of the family of the child, table (21).

Table (21) Dental Fluorosis and Composition of the Family of the Child (Number of Children)

Composition of the Family (groups)	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
1-8	41	21.5%	121	63.4%	29	15.2%	191	100.0%
9+	36	22.6%	101	63.5%	22	13.8%	159	100.0%
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0%

χ^2 =.163 P-value = .922

Table (22) shows that when the child order in his family is fifth and more, he/she is less exposed to Dental Fluorosis and the prevalence of Severe Dental Fluorosis - TFI score between 5-8 – among them is lower. The prevalence of Dental Fluorosis - TFI score between1-4 – among the same group is higher. However, there is no statistically significant difference in the prevalence of Dental Fluorosis among the groups of order of child in his/her family.

Table (22)Dental Fluorosis and Order of Child in his/her Family

Order of the child (groups)	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
1-4	39	19.9%	123	62.8%	34	17.3%	196	100.0%
5+	38	24.7%	99	64.3%	17	11.0%	154	100.0%
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0%

χ^2 =3.282 P-value = .194

The research studied the association between toothpaste using behavior and Dental Fluorosis and it found that 25.9% of chilren who do not brush their teeth by toothpaste during their first 7 years of age are free of Dental Fluorosis, while 18.5% of those who brush their teeth by toothpaste during their first 7 years of age are free of Dental Fluorosis. The prevalence of Dental Fluorosis - TFI score between 1-4 - is slightly higher among chilren who brush their teeth by toothpaste during their first 7 years of age than those who do not. And the prevalence of Sever Dental Fluorosis - TFI score between 5-8- is higher among chilren who brush their teeth by toothpaste during his/her first 7 years of age. Meaning that, Brushing teeth by Fluoridated toothpaste during the first 7 years of age, does not only increase possibility of having Dental Fluorosis but olso increase its severity. However, this relationship is not statistically significant. Table (23)

Table (23)Dental Fluorosis and Child brushes teeth by toothpaste during his/her first 7 years of age

Child brushes teeth	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
yes	34	18.5%	117	63.6%	33	17.9%	184	100.0%
no	43	25.9%	105	63.3%	18	10.8%	166	100.0%
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0%

χ^2 =5.200 P-value =.074

Regarding Dental Fluorosis and age in which the child started to use fluoridated toothpaste, table (24) revealed that the earlier age the child uses fluoridated toothpaste, the lower Dental Fluorosis the child had. But this result is not statistically significant.

Table (24) Dental Fluorosis and Age in which the child started to use fluoridated toothpaste by years (groups)

Age groups	TFI score of Dental Fluorosis					
	0		1-8		Total	
	No.	%	No.	%	No.	%
4-5	32	18.6%	140	81.4%	172	100.0%
6-7	2	16.7%	10	83.3%	12	100.0%
Total	34	18.5%	150	81.5%	184	100.0%

Fisher exam: 2-tailed P-value: 1.000

Table (25) presents that children who brushed their teeth once a day during their first 7 years of age are less exposed to Dental Fluorosis and the prevalence of Dental Fluorosis - TFI score between 1-4- among them is lower. The positve relationship between the prevalence of Dental Fluorosis and the Times aday the child brushed his/her teeth during his/her first 7 years of age does not reach the statistically significant level.

Table (25)Dental Fluorosis and Times aday Child brushed teeth during his/her first 7 years of age

Times aday	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
1	21	23.6%	52	58.4%	16	18.0%	89	100.0 %
2 or 3	13	13.7%	65	68.4%	17	17.9%	95	100.0 %
Total	34	18.5%	117	63.6%	33	17.9%	184	100.0 %

χ^2 =3.17 P-value = .205

Children covered the brushes with pea size toothpaste are less exposed to Dental Fluorosis. In addition, there is highly statistically significant positive association between the quantity of toothpaste covered the head of brush and the Dental Fluorosis, table (26)

Table (26)Dental Fluorosis and Toothpaste covered of the head of brush during first 7 years of child age

Quantity of toothpaste	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
all	13	12.4%	72	68.6%	20	19.0%	105	100.0%
half	3	9.7%	19	61.3%	9	29.0%	31	100.0%
Part (pea size)	18	37.5%	26	54.2%	4	8.3%	48	100.0%
Total	34	18.5%	117	63.6%	33	17.9%	184	100.0%

χ^2 =18.585 P-value = .001

Free children of Dental Fluorosis is the highest among who did not swallow the toothpaste during their first 7 years of age . They also have the lowest prevalence of Dental Fluorosis - TFI score between 1-4. The children who swallowed the toothpaste during their first 7 years of age have the highest prevalence of Dental Fluorosis - TFI score between 5-8. The difference reaches statistically significant level, table (27)

Table (27) Dental Fluorosis and Child swallowed the toothpaste during his/her first 7 years of age

Child swallowed the toothpaste	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
yes	6	9.7%	40	64.5%	16	25.8%	62	100.0 %
no	23	26.1%	52	59.1%	13	14.8%	88	100.0 %
Sometimes	5	14.7%	25	73.5%	4	11.8%	34	100.0 %
Total	34	18.5%	117	63.6%	33	17.9%	184	100.0 %

χ^2 =9.825 P-value = .043

In addition, table (28) illustrated that 19.3%of chilren who rinsed their mouths well after brushing teeth during their first 7 years of age are free of Dental Fluorosis and 14.7% of chilren who did not rinse their mouths well after brushing teeth during their first 7 years of age are free of Dental Fluorosis. The prevalence of Dental Fluorosis - TFI score between 1-4 - is higher among chilren who did not rinse their mouths well after brushing teeth during their first 7 years of age. And the prevalence of Dental Fluorosis - TFI score between 5-8- is higher among who rinsed their mouths well after brushing teeth during his/her first 7 years of age. However, there is no statistically significant differences in the prevalence of Dental Fluorosis as a result of rinsing the mouth well after brushing teeth during the first 7 years of age.

Table (28)Dental Fluorosis and Child rinsed his/her mouth well after brushing teeth during his/her first 7 years of age

Child rinsed well after brushing teeth	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
yes	29	19.3%	94	62.7%	27	18.0%	150	100.0%
no	5	14.7%	23	67.6%	6	17.6%	34	100.0%
Total	34	18.5%	117	63.6%	33	17.9%	184	100.0%

χ^2 =.431 P-value = .806

Regarding the Knowledge of the mother and child around Dental fluorosis in Gaza strip, It is mentioned before that most of children and all mothers do not know, what is Dental fluorosis and have not received any information about Dental fluorosis in Gaza strip. Meaning that lack Knowledge of the mother and child around Dental fluorosis in Gaza strip, leads to increase the risk of exposure to Dental fluorosis.

Furthermore, table (29) presents that children who do not interest in quality (contents) of toothpaste are more free of Dental Fluorosis and the prevalence of Dental Fluorosis - TFI score between 1-4 - is lower among them. The higher prevalence of Dental

Fluorosis - TFI score between 5-8- is observed among the children who do not interest in quality(contents) of toothpaste. But the differences do not reache the statistically significant level.

Table (29) Dental Fluorosis and the child interest in quality (contents) of toothpaste

Child interest in quality of toothpaste	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
yes	7	19.4%	27	75.0%	2	5.6%	39	100.0%
no	70	22.3%	195	62.1%	49	15.6%	314	100.0%
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0%

χ^2 =3.205 P-value = .201

In table (30), Children of, mothers do not interest in quality(contents) of toothpaste, are more free of Dental Fluorosis and the prevalence of Dental Fluorosis - TFI score between 1-4 - is lower among them. While the higher prevalence of Dental Fluorosis - TFI score between 5-8- is observed among them. But the differences do not reach the statistically significant level.

Table (30) Dental Fluorosis and the mother interest in quality (contents) of toothpaste

Mother interest in quality of toothpaste	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
yes	14	20.3%	48	69.6%	7	10.1%	69	100.0%
no	63	22.4%	174	61.9%	44	15.7%	281	100.0%
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0%

χ^2 =.1.780 P-value = .411

In studying of the sources of environment pollution, it is clear in table (31) that 29.6% of children their houses are near dust and they are free of Dental Fluorosis. While 67.7% of children whose houses are not near dust, the prevalence of Dental Fluorosis -

TFI score between 1-4 – among them is higher than children whose houses are near dust. However, the latter has higher prevalence of Dental Fluorosis - TFI score between 5-8. That means, living in houses near dust elevates the severity of Dental Fluorosis. And this relationship reaches the statistically significant level.

Table (31) Dental Fluorosis and House is near dust

House is near dust	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
yes	34	29.6%	63	54.8%	18	15.7%	115	100.0%
no	43	18.3%	159	67.7%	33	14.0%	235	100.0%
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0%

χ^2 =6.612 P-value = .037

In addition, 24.6% of children their houses are not near main road and they are free of Dental Fluorosis. While 64.9% of children their houses are near main road and prevalence of Dental Fluorosis - TFI score between 1-4 – among them is higher than children whose houses are not near main road and also they suffer from higher prevalence of Dental Fluorosis - TFI score between 5-8. By other words, living in houses near main road increases the chances of having Dental Fluorosis and elevating its severity. Furthermore, this relationship reaches the statistically significant level, table (32).

Table (32) Dental Fluorosis and House is near main road

House is near main road	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
yes	9	12.2%	48	64.9%	17	23.0%	74	100.0 %
no	68	24.6%	174	63.0%	34	12.3%	276	100.0 %
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0 %

χ^2 =8.705 P-value = .013

Table (33) shows that children of families using coal as heating system during winter are less exposed to Dental Fluorosis. But the difference does not reach the statistically significant level.

Table (33) Dental Fluorosis and Heating system during winter coal

Heating system by coal	TFI score of Dental Fluorosis					
	0		1-8		Total	
	No.	%	No.	%	No.	%
yes	1	33.3%	2	66.7%	3	100.0%
no	76	21.9%	271	78.1%	347	100.0%
Total	77	22.0%	273	78.0%	350	100.0%

Fisher exam: 2-tailed P-value: 0.527

Table (34) presents that 26.0%of children of families who are not using open fire as heating system during winter are free of Dental Fluorosis. While children of families, using open fire as heating system during winter has higher prevalence of Dental Fluorosis. Consequently, using open fire as heating system during winter increases the prevalence and severity of Dental Fluorosis. Furthermore, the difference reaches highly statistically significant level (P-value = 0.001).

Table (34) Dental Fluorosis and Heating system during winter open fire

Heating system by open fire	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
yes	9	10.2%	58	65.9%	21	23.9%	88	100.0%
no	68	26.0%	164	62.6%	30	11.5%	262	100.0%
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0%

χ^2 =14.486 P-value = .001

Table (35) shows that 22.5% of children of families who are using electrical as heating system during winter are free of Dental Fluorosis and they have higher prevalence of

Dental Fluorosis - TFI score between 1-4. While children of families not using electrical as heating system during winter have higher prevalence of Dental Fluorosis- TFI score between 5-8. The difference does not reach statistically significant level.

Table (35) Dental Fluorosis and Heating system during winter electrical

Heating system electrical	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
yes	16	22.5%	46	64.8%	9	12.7%	71	100.0%
no	61	21.9%	176	63.1%	42	15.1%	279	100.0%
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0%

χ^2 =.257 P-value = .879

To demonstrate the relationship between Dental Fluorosis and heating system during winter by gas, table (36) shows that using gas as heating system during winter decreases the risk of Dental Fluorosis. However, this result did not reach the statistically significant level.

Table (36) Dental Fluorosis and Heating system during winter by gas

Heating system by gas	TFI score of Dental Fluorosis					
	0		1-8		Total	
	No.	%	No.	%	No.	%
yes	6	25.0%	18	75.0%	24	100.0%
no	71	21.8%	255	78.2%	326	100.0%
Total	77	22.0%	273	78.0%	350	100.0%

Fisher exam: 2-tailed P-value: 0.798

On other hand, 23.1% of children who were provided Formula from first or second month of age are free of Dental Fluorosis and they have higher prevalence of Dental Fluorosis - TFI score between 1-4. But the prevalence of Dental Fluorosis - TFI score between 5-8- among them is lower than those were provided Formula from third month

of age and more. But there is no statistically significant differences in the prevalence of Dental Fluorosis, table (37).

Table (37) Dental Fluorosis and The month when the mother started to use Formula to child

months (groups)	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
1-2	9	23.1%	22	56.4%	8	20.5%	39	100.0 %
3+	4	16.7%	13	54.2%	7	29.2%	24	100.0 %
Total	13	20.6%	35	55.6%	15	23.8%	63	100.0 %

χ^2 = .777 P-value = .678

Table (38) also demonstrated that using tap water to prepare formula contributes with high Dental Fluorosis. But there is no statistically significant relationship between Dental Fluorosis and type of water used to reconstitute formula.

Table (38) Dental Fluorosis and type of water used to reconstitute formula

Type of water	TFI score of Dental Fluorosis					
	0		1-8		Total	
	No.	%	No.	%	No.	%
Tap water	12	19.7%	49	80.3%	61	100.0 %
Minimal water	1	50.0%	1	50.0%	2	100.0 %
Total	13	20.6%	50	79.4%	63	100.0 %

Fisher exam: 2-tailed P-value: 0.373

Conserning exclusive Breastfeeding, table (39) illustrates that 22.1%of chilren who were provided exclusive Breastfeeding during first 6 month of age are free of Dental Fluorosis and they have lower prevalence of Dental Fluorosis than those who were not provided exclusive Breastfeeding during first 6 month of age. But there is no statistically significant differences in the prevalence of Dental Fluorosis.

Table (39) Dental Fluorosis and Mother provided exclusive Breastfeeding to her child for first 6 month of age

Providing exclusive Breastfeeding	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
yes	64	22.1%	188	64.8%	38	13.1%	290	100.0 %
no	13	21.7%	34	56.7%	13	21.7%	60	100.0 %
Total	77	22.0%	222	63.4%	51	14.6%	350	350

χ^2 =3.027 P-value = .220

Children who ate fish 1-2 times per month are more free of Dental Fluorosis and they have lower prevalence of Dental Fluorosis - TFI score between 1-4. But the prevalence of Dental Fluorosis - TFI score between 5-8- among them is higher than who eat fish three times and more. There is no statistically significant differences in the prevalence of Dental Fluorosis. table (40)

Table (40) Dental Fluorosis and Number of times that the child ate fish per month

Number of times	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
1-2	34	22.7%	90	60.0%	26	17.3%	150	100.0 %
3+	26	19.1%	94	69.1%	16	11.8%	136	100.0 %
Total	60	21.0%	184	64.3%	42	14.7%	286	100.0 %

χ^2 =2.856 P-value = .240

Table (41) presents that children who were provided milk in 1-15 month of age are more free of Dental Fluorosis and they have slightly higher prevalence of Dental Fluorosis - TFI score between 1-4. But the prevalence of Dental Fluorosis - TFI score between 5-8- among them is lower than who were provided milk in 16 month of age

and more. There is no statistically significant differences in the prevalence of Dental Fluorosis.

Table (41) Dental Fluorosis and Month in which the child started to have milk

Months' groups	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
1-15	22	24.7%	55	61.8%	12	13.5%	89	100.0%
16+	20	21.5%	57	61.3%	16	17.2%	93	100.0%
Total	42	23.1%	112	61.5%	28	15.4%	182	100.0%

χ^2 = .615 P-value = .735

Children who were provided 1-2 cups of milk during 1-3 years of age are less free of Dental Fluorosis and they have higher prevalence of Dental Fluorosis - TFI score between 1-4. While the prevalence of Dental Fluorosis - TFI score between 5-8- among them is lower than who were provided 3 cups of milk during 1-3 years of age and more. But there is no statistically significant differences in the prevalence of Dental Fluorosis, table (42).

Table (42) Dental Fluorosis and Number of cups of milk that the child had a day during 1-3 years of old

Number of cups of milk	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
1-2	20	22.7%	56	63.6%	12	13.6%	88	100.0%
3+	22	23.4%	56	59.6%	16	17.0%	94	100.0%
Total	42	23.1%	112	61.5%	28	15.4%	182	100.0%

χ^2 = .469 P-value = .791

Table (43) presents those children, who consume more two cups of milk a day in 4-7 years of old, are less exposed to Dental Fluorosis. However, this relationship did not reach the statistically significant level.

Table (43) Dental Fluorosis and Number of cups of milk the child had aday in 4-7 years of old

Number of cups of milk	TFI score of Dental Fluorosis					
	0		1-8		Total	
	No.	%	No.	%	No.	%
1	27	23.7%	87	76.3%	114	100.0 %
2	4	44.4%	5	55.6%	9	100.0 %
Total	31	25.2%	92	74.8%	123	100.0 %

Fisher exam: 2-tailed P-value: 0.228

Children who were provided Artificial milk are the most free of Dental Fluorosis and the least exposed to Dental Fluorosis - TFI score between 5-8. And the differences between tow groups reaches the statistically significant level, table (44).

Table (44) Dental Fluorosis and Type of milk

Type of milk	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
Artificial milk	36	24.5%	93	63.3%	18	12.2%	147	100.0%
Animal milk or Artificial and Animal milk	6	17.1%	19	54.3%	10	28.6%	35	100.0%
Total	42	23.1%	112	61.5%	28	15.4%	182	100.0%

$\chi^2 = 5.93$ P-value = .05

Regarding Dental Fluorosis and the year in which the child started to have tea, as revealed in table (45), Children who were provided tea since first year of age are less free of Dental Fluorosis but they have lower prevalence of Dental Fluorosis - TFI score between 1-4, the prevalence of Dental Fluorosis - TFI score between 5-8- among them is higher than who were provided tea since second year of age and more. But there is no statistically significant differences in the prevalence of Dental Fluorosis.

Table (45) Dental Fluorosis and the year in which the child started to have tea

Year	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
1	20	16.1%	78	62.9%	26	21.0%	124	100.0 %
2+	34	21.7%	104	66.2%	19	12.1%	157	100.0 %
Total	54	19.2%	182	64.8%	45	16.0%	281	100.0 %

χ^2 =4.621 P-value = .099

Children who were provided 1-2 cups of tae during 4-7 years of age are less free of Dental Fluorosis and they have highrer prevalence of Dental Fluorosis - TFI score between 1-4. But the prevalence of Dental Fluorosis - TFI score between 5-8- among them is lower than who were provided 3 cups of milk and more during 4-7 years of age. But there is no statistically significant differences in the prevalence of Dental Fluorosis, table (46).

Table (46) Dental Fluorosis and Number of cups of tea that the child had a day during 4-7 years of old

Number of cups (groups)	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
1-2	31	20.0%	104	67.1%	20	12.9%	155	100.0%
3+	23	20.5%	71	63.4%	18	16.1%	112	100.0%
Total	54	20.2%	175	65.5%	38	14.2%	267	100.0%

χ^2 =.604 P-value = .739

Regarding Dental Fluorosis and number of spoons of sugar, the child added for each cup of tea, as revealed in table (47), Children who added one spoon of suger for each tea cup are less free of Dental Fluorosis but they have lower prevalence of Dental Fluorosis - TFI score between 5-8, the prevalence of Dental Fluorosis - TFI score between 1-4- among them is higher than who added two or three spoons of suger for

each tea cup. But there is no statistically significant differences in the prevalence of Dental Fluorosis.

Table (47) Dental Fluorosis and number of spoons of sugar, the child added for each cup of tea

Number of spoons of sugar	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
1	21	18.3%	77	67.0%	17	14.8%	115	100.0%
2 or 3	33	19.9%	105	63.3%	28	16.8%	166	100.0%
Total	54	19.2%	182	64.8%	45	16.0%	281	100.0%

χ^2 =0.42 P-value = .810

Using Tap water to prepare the tea increases the risk of Dental Fluorosis, as shown in table (48). The relationship between Dental Fluorosis and type of water used to prepare the tea did not reach the statistically significant level.

Table (48) Dental Fluorosis and type of water used to prepare the tea

Type of water	TFI score of Dental Fluorosis					
	0		1-8		Total	
	No.	%	No.	%	No.	%
Tap water	52	18.8%	225	81.2%	277	100.0 %
Minimal water	2	50.0%	2	50.0%	4	100.0 %
Total	54	19.2%	227	80.8%	281	100.0 %

Fisher exam: 2-tailed P-value: 0.168

Table (49) presents that children who were consumed high Animal Protein during the first 7 years of their age are the least exposed of Dental Fluorosis and they have the lowest prevalence of Dental Fluorosis - TFI score between 5-8. But the prevalence of Dental Fluorosis - TFI score between 1-4 – is the lowest among who were consumed low Animal Protein during the first 7 years of their age. There is highly statistically

Children who were consumed high Plant Protein: nuts, peas, beans, cereals : (raise, wheat, maize) during the first 7 years of their age are the least exposed of Severe Dental Fluorosis. This negative relationship reaches the statistically significant level, table (51).

Table (51) Dental Fluorosis and The consumption of your child for Plant Protein: nuts, peas, beans, cereals: (rise, wheat. maize)

Consumption level	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
High	35	32.7%	60	56.1%	12	11.2%	107	100.0%
Moderate	27	17.4%	105	67.7%	23	14.8%	155	100.0%
Low	15	17.0%	57	64.8%	16	18.2%	88	100.0%
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0%

χ^2 =11.053 P-value = .026

Chilren who were consumed low Calcium (milk, yogurt, cheese) during the first 7 years of their age are the least exposed of Dental Fluorosis and they have the lowest prevalence of Dental Fluorosis - TFI score between 1-4. But the prevalence of Dental Fluorosis - TFI score between 5-8 – is the highest among them. But there is no statistically significant differences in the prevalence of Dental Fluorosis, table (52)

Table (52) Dental Fluorosis and The consumption of child for Calcium

Consumption level	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
High	63	22.8%	175	63.4%	38	13.8%	276	100.0%
Moderate	7	14.9%	33	70.2%	7	14.9%	47	100.0%
Low	7	25.9%	14	51.9%	6	22.2%	27	100.0%
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0%

χ^2 =3.475 P-value = .482

Furethermore, table (53) shows that chilren who were consumed low Vitamins(C) as Fruits: (e.g. orange) during the first 7 years of their age are the least exposed of Dental Fluorosis and they have the lowest prevalence of Dental Fluorosis - TFI score between 1-4. but the prevalence of Dental Fluorosis - TFI score between 5-8 – is the highest among them. But there is no statistically significant differences in the prevalence of Dental Fluorosis.

Table (53) Dental Fluorosis and The consumption of child for Vitamins(C): Fruits (e.g. orange)

Consumption level	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
High	67	23.8%	175	62.3%	39	13.9%	281	100.0%
Moderate	5	9.3%	40	74.1%	9	16.7%	54	100.0%
Low	5	33.3%	7	46.7%	3	20.0%	15	100.0%
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0%

χ^2 =7.541 P-value = .110

Chilren who were consumed low Raisins during the first 7 years of their age are the least exposed of Dental Fluorosis. But there is no statistically significant differences in the prevalence of Dental Fluorosis, table (54).

Table (54) Dental Fluorosis and The consumption of child for Raisins

Consumption level	TFI score of Dental Fluorosis					
	0		1-8		Total	
	No.	%	No.	%	No.	%
High	1	20.0%	4	80.0%	5	100.0%
Moderate	1	20.0%	4	80.0%	5	100.0%
Low	75	22.1%	265	77.9%	340	100.0%
Total	77	22.0%	222	63.4%	350	100.0%

χ^2 =0.02 P-value = .988

Chilren who were consumed low Vegetables: (spinach, chilli) during the first 7 years of their age are the least exposed of Dental Fluorosis and they have the lowest prevalence of Dental Fluorosis - TFI score between 1-4. But the prevalence of Dental Fluorosis - TFI score between 5-8 – is the highest among chilren who were consumed high from Vegetables: (spinach, chilli) during the first 7 years of their age. But there is no statistically significant differences in the prevalence of Dental Fluorosis, table (55).

Table (55) Dental Fluorosis and the consumption of child for Vegetables (spinach, chili)

Consumption level	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
High	43	22.1%	121	62.1%	31	15.9%	195	100.0%
Moderate	4	11.8%	26	76.5%	4	11.8%	34	100.0%
Low	30	24.8%	75	62.0%	16	13.2%	121	100.0%
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0%

$\chi^2 = 3.628$ P-value = .45

Concerning Dental Fluorosis and average Fluoride concentration in municipal wells, table (56) shows that children who were drinking water from municipal wells where the average of fluorid concentration is 1.1 ppm and more are less exposed to Dental fluorosis. But they have higher prevalence of Severe Dental Fluorosis - TFI score between 5-8 whereas the prevalence of Dental Fluorosis - TFI score between 1-4 among them is lower than those were drinking water from municipal wells where the average of fluorid concentration is 1 ppm and less. There is highly statistically significant positive association between the sevirity of Dental Fluorosis and Fluoride concentration in municipal wells which supply drinking water.

Table (56) Dental Fluorosis and average of Fluoride concentrations in municipal wells by ppm

Average of Fluoride concentrations	TFI score of Dental Fluorosis							
	0		1-4		5-8		Total	
	No.	%	No.	%	No.	%	No.	%
0-1	31	20.7%	107	71.3%	12	8.0%	150	100.0%
1.1+	46	23.0%	115	57.5%	39	19.5%	200	100.0%
Total	77	22.0%	222	63.4%	51	14.6%	350	100.0%

χ^2 =10.577 P-value = .005

Chapter 5

Discussion

The present study was designed to study the prevalence and severity of Dental Fluorosis and to explore its possible associated risk factors among Palestinian children aged 12-18 years in Gaza Governorates.

As mentioned before, Dental Fluorosis is the first visible sign indicating much fluoride has poisoned the whole body and leading to health hazards and bad effects such as costs of other medical, dental problems, bad psychological effect on children and their loss of time. In addition, there was lack of researches point to other risk factors that may contribute in ingesting excessive amount of fluoride to the body of the child in Gaza strip, beside fluoride ingested to child body from drinking water.

Through this chapter the researcher will present and explain the results of this study and the study results will be compared to other studies investigated the same problem.

5.1 Prevalence of Dental Fluorosis

Depending on the Thyllstrup-Fejerskov index of Dental Fluorosis, this study found that the prevalence of Dental Fluorosis among Palestinian children in Gaza strip is 78%. Among them 63.4% are in the group of 1-4 TFI score of Dental Fluorosis- meaning moderate Dental Fluorosis- and 14.6% are in the group of TFI score 5-8 meaning Sever Dental Fluorosis. This result is higher than those in Irish, dental surgeon, Donal McAuley, confirmed that fifty per cent of their population has Dental Fluorosis (McAuley, 2001). In Western Australia, in Perth and the Bunbury region, Dental Fluorosis prevalences were 40.2% and 33.0% among children 12-year-olds (Riordan, 2002).

Clark illustrated that the prevalence of Dental Fluorosis now ranges somewhere between 35% and 60% in fluoridated communities and between 20% and 45% in

nonfluoridated areas, depending on the influence of difference local conditions. While the increase has occurred primarily in the very mild and mild categories of Dental Fluorosis, there is also evidence that the prevalence is increasing in the moderate and severe classifications as well (Clark, 1994).

The prevalence of Dental Fluorosis in Amsterdam was 74% among school children of the Vrije Universities (Woltgens et al., 1989). A prevalence of 80.9% was reported in children in Augusta, Georgia, in an optimally fluoridated community in the United States (Wash, 1993). These nearly consist with the prevalence in Gaza strip.

In developing and undeveloped countries, the prevalence of Dental Fluorosis, in schoolchildren who were lifelong residents in Broken Bow, Holdrege and Kewanee, was similar in the three communities and approximately 15% (Selwitz et al., 1998). Concerning the prevalence of Dental Fluorosis and associated risk factors in Alappuzha district, Kerala in India. Dental Fluorosis is considered endemic in 15 states of India, among school children in Ambalappuzha taluk, Alappuzha district, Kerala, the overall prevalence of Dental Fluorosis was 35.6% (Gopalakrishnan et al., 1999).

In contrary to that, Prevalence and severity of Dental Fluorosis among Singaporean children was 82.6% (Lo & Bagramian, 1996). It is higher than prevalence in Gaza strip. Moreover, In Singapore 9.2% of children had severe Fluorosis and 26.2% had moderate Fluorosis (Lo & Bagramian, 1996). While in Gaza strip severe and moderate Fluorosis is higher.

A study in Arabic country such Sudan illustrated that the prevalence of Dental Fluorosis is higher than its prevalence in Gaza strip, In Treit el Biga 91% of the children showed signs of Dental Fluorosis whereas in Abu Groon all children had fluorotic teeth (Ibrahim et al., 1995).

The Dental Fluorosis prevalence in this study in Gaza strip, is higher than the Dental Fluorosis prevalence in West Bank in Palestinian territories where the Prevalences of Dental Fluorosis in scholar year 1999/2000 were 1.3%, 1% and 1.5% among 3rd, 7th and 10th schoolchildren respectively (MOH-HMIS, 2001).

In addition, Dental Fluorosis prevalence in this study is also higher than previous records of Dental Fluorosis prevalence in Gaza strip. Reports of School Health Program in Gaza strip illustrated that Dental Fluorosis prevalence – among governmental school children - increased from 19.7% to 28.8% among 12 years old school children from1996 to 2002 and from 17.3% to 30.7% among 15 years old school children from 1996 to 2002 (Annex 12). While the records of UNRWA in Gaza Strip illustrated that in scholastic year 2001/2002, the prevalence of Dental Fluorosis is 0.99% among 6 years old school children, 13.26% among 10 years old school children, and 16.1% among 13 years old school children.

5.2 Dental Fluorosis and Socio-demographic and economic characteristics

This study found that, in Gaza strip, as the child age increases the prevalence and severity of Dental Fluorosis increase. A study in Sudan, in Treit el Biga, found similar results where older boys tended to have more Fluorosis than younger boys, while no significant age differences in Fluorosis were found in Abu Groon (Ibrahim et al., 1995).

On the other hand, this study illustrated that males are more exposed to Dental Fluorosis than Females, in specific, Severe Dental Fluorosis.

Comparing to study in Sudan, in Treit el Biga and Abu Groon, There was a significantly higher degree of Fluorosis in boys than in girls in the Treit el Biga, low-fluoride area (Ibrahim et al., 1995). No significant sex differences in Fluorosis were found in Abu Groon (Ibrahim et al., 1995). But in contrast of the result in Gaza Strip, a study in India

demonstrated that prevalence of Dental Fluorosis in girls was statistically significant higher than boys (Gopalakrishnan et al., 1999).

In Gaza strip, the highest Socio-economic status, the least prevalence and severity of Dental Fluorosis among children.

Villa & Guerrero (1996) reached similar result in two Chilean twin cities. Where the Prevalence of Dental Fluorosis in low Socio-economic status children was significantly higher than in high socioeconomic status children. Even, the proportion of Dean's scores 2, 3, 4 and 5 in first molars, mandibular and maxillary incisors in Low Socio-economic status children was higher than in high socioeconomic status children. They contributed the differences in prevalence and severity of Dental Fluorosis between both groups to a different pattern of tap water and tea consumption at pre-school ages.

A study was conducted in three regions of Saudi Arabia and it concluded that Dental Fluorosis prevalence was highest in the region with the highest water fluoride concentration, in rural areas and in malnourished subjects (Rugg-Gunn et al., 1997).

In contrast, anther study determined the relationship between the socioeconomic status and Dental Fluorosis among Brazilian school children. Its results illustrated that parent's educational level data revealed a strong Pearson's correlation with income and no correlation was observed between Dental Fluorosis and the studied social economic variables (Maltz et al., 2001).

School Health Program determined that in Gaza Strip in 1999, The prevalence of Dental Fluorosis among the 7th class (12years old) was the highest in Rafah then Khan-Younis while in North Gaza it is very low (Ministry of Health, 2000). These results consist with the results of this study that illustrated that the highest prevalence of Dental Fluorosis is in Rafah and Midzone and then Khan-Younis and in North Governorates is the lowest.

5.3 Tooth brushing behavior and Dental Fluorosis

In this study, Swallow the Fluoridated toothpaste during their first 7 years of age statistically significant increases the prevalence and severity of Dental Fluorosis and rinsing the mouth well after brushing teeth reduces the likelihood of having Dental Fluorosis. Confirming to this results, other researcher found that, Fluorides toothpastes are some of which is inevitably swallowed by young children and can also cause Dental Fluorosis (Dowell & Bechal, 1981; Benfield, 1973). Riordan (1993) conducted a study in Perth in Western Australia for school children and confirmed that swallowing toothpaste and liking toothpaste were statistically significant risk factors. Furthermore, highly significant associations were found between estimated fluoride ingestion from toothpaste and Dental Fluorosis, when Rock and Sabieha were studied the relationship between reported toothpaste usage in infancy and Fluorosis of permanent. They suggested that toothpaste swallowing might be a factor in the production of Dental Fluorosis (Rock & Sabieha, 1997).

Levy et al (1997) found that the early use of fluoride dentifrice and use of larger quantities recently have been identified as risk factors for Dental Fluorosis. This fact consists with the results in Gaza strip where, the earlier use of toothpaste elevate the severity of Dental Fluorosis and there is highly statistically significant positive association between the quantity of toothpaste covered the head of brush and the Dental Fluorosis.

Some researchers indicated that young children might be exposed to more fluoride for a longer period of time with child dentifrice. Because they found the mean weight of child dentifrice was significantly greater than that of an adult dentifrice and the mean time spent brushing with child dentifrice was significantly greater than for an adult dentifrice. Most children did not expectorate or rinse after brushing (Adair et al., 1997).

Ellwood and O'Mullane (1994) found that children who brushed more frequently were at greater risk of having diffuse types of enamel opacity present. Also in Gaza strip, There is positive relationship between the prevalence and severity of Dental Fluorosis and the times a day the child brushed his/her teeth during his/her first 7 years of age.

An increased risk of Dental Fluorosis related to ingesting fluoridated toothpastes by preschool children have led to recommendations to reduce the amount of toothpaste used for young children to a pea-sized amount. Because a study determined that initial salivary fluoride levels following the use of 0.25 g of toothpaste were less than half of the salivary fluoride concentrations when 1.0 g of toothpaste was used, and levels returned to baseline more rapidly (DenBesten & Ko-HS, 1996).

Other researchers also confirmed previous result when they indicated that the ingestion of fluoridated dentifrice by young children may be a major contributing factor to Dental Fluorosis prevalent in the United States (Levy et al., 1993).

In this study, No mother clean their children teeth by toothpaste during the children infancy so that cleaning children teeth by toothpaste during infancy is not considered as risk factor in Gaza strip. There is a Pilot study determined the tooth brushing habits of 12- to 24-month-old children and estimated the quantity of fluoride ingested during tooth brushing. It found that of the 36 parents, who cleaned the teeth of their children, 69% used toothpaste. And 20% of the children ingested more than 0.25 mg of fluoride per day by tooth brushing alone (Simard et al., 1991).

In Gaza strip, all toothpastes, that the families use now, are fluoridated. Warren and Levy (1999) observed that Dental Fluorosis prevalence has increased in United States because of widespread fluoridated dentifrice use and attributed much of the increase in Fluorosis prevalence to early use of fluoride dentifrice.

While Horowitz (1992), in United state, observed that the direct dose-response relation between effectiveness and fluoride concentration of toothpastes is far from clear-cut and, at best, is weak and ingestion of fluoride toothpastes by preschool-aged children may not be the major contributor to the increase in Fluorosis. But he did not ignored the findings of at least four studies suggest that the use of fluoride toothpastes by young children is a risk factor.

5.4 Dental Fluorosis and Applications of Fluoride tablets and supplements to children

This study confirms that no child had fluoride tablets and supplements during his/her first 7 years of age in Gaza strip. However, Riordan (1993) illustrated in his study in Perth in Western Australia that because Supplement use was minimal, it was unrelated to caries or Dental Fluorosis in this area.

Other studies illustrated the risk of Dental Fluorosis as a result of applying fluoride tablets and supplements during childhood. They said that Fluoride tablets are swallowed by young children and cause Dental Fluorosis (Dowell & Bechal, 1981; Benfield, 1973). Stephen (1993) mentioned in his study that fluoride tablets have been held responsible for an increase in Dental Fluorosis prevalence. Kalsbeek et al. (1992) found a significant relation between the use of fluoride tablets and the prevalence of Fluorosis. On the other hand, D'-Hoore and Van-Nieuwenhuysen (1992) concluded that using fluoride tablets appropriately in non fluoridated areas, results in minor damage. Several retrospective studies, in the United States, have found associations between Dental Fluorosis and these fluoride exposures, especially water fluoridation and fluoride tablets and drops (Levy, 1992).

Ismail (1994) pointed to the scientific evidence that supports the efficacy of fluoride supplements in caries prevention but there is weaker support for their effectiveness. In

addition, Fluoride supplements are a risk factor for Dental Fluorosis, although their contribution to the increase in Dental Fluorosis prevalence is less than that of water fluoridation and fluoridated dentifrices because of their more limited and shorter use. Moreover, There is also evidence that fluoride supplements are used inappropriately in fluoridated areas.

5.5 Knowledge around Dental Fluorosis

Regarding the knowledge of the mother and child around Dental Fluorosis in Gaza strip, as mentioned before, there is lack in knowledge of the mother and child around Dental Fluorosis, leads to increase the risk of exposure to Dental Fluorosis.

Furthermore, when the mothers and children do not interest in quality (contents) of toothpaste, they will be more exposed to severe Dental Fluorosis. The results of this study consist with most previous studies, which demonstrated that Knowledge about Dental Fluorosis may be considered associated risk factor that increases Dental Fluorosis problem because it will be reflected on people practice and attitude.

Vallee & Kandelman, made a study in the Montreal West Island territory, and they found that there are educational needs concerning fluoride, fluoride prescribing and prevention of Dental Fluorosis. Public health dentists should assist the medical profession in this educational process (Vallee & Kandelman, 1993).

In addition, a study in the Quebec City region, in two municipalities where tap water is fluoridated in one of them and in the other tap water is no fluoridated. It found that the Knowledge of the main benefit associated with the use of fluoride in drinking water was not different in fluoridated versus non-fluoridated municipalities. Knowledge of its main disadvantage was very low and similar in both groups. This study demonstrates that there is still need for public health education on the uses of fluorides (Levallois et al., 1998).

5.6 Environment Pollution

In studying of the sources of environment pollution, it is clear that children who are living in houses near dust are more exposed to Severe Dental Fluorosis. In addition, this study discovered that living in houses near main road increases the chances of having Dental Fluorosis and elevating its severity. Using open fire as heating system during winter is a risk factor that causing Dental Fluorosis. But children of families who are using electrical as heating system during winter are less exposed to Severe Dental Fluorosis.

Because of rare use of coal as heating system during winter in Gaza Strip, the study could not demonstrate its effect on Dental Fluorosis.

The results of study in Gaza strip do not go with previous studies in China and Japan when they found that the combustion of high fluoride-content coal as an energy resource for heating, cooking, and food drying is a major exhaust emission source of suspended particulate matter and fluoride. High concentrations of these pollutants have been observed in indoor air of coal-burning families in some rural areas in China. In the Fluorosis area in China, concentrations of urinary fluoride in the residents have been much higher than in the nonfluoridated area in China and in the rural area in Japan. Because indoor fluoride from combustion of coal is easily absorbed in stored food and because food consumption is a main source of fluoride exposure, it is necessary to reduce airborne fluoride and food contamination to prevent serious Fluorosis in China (Ando et al., 1998).

5.7 Nutrition Behavior and Dental Fluorosis

5.7.1 Exclusive Breastfeeding and Baby formulas

Concerning exclusive breastfeeding in Gaza strip, children who were provided exclusive breastfeeding during first 6 month of age are less exposed to Dental Fluorosis

in specific severe Dental Fluorosis. This finding consists with the conclusion of Vondriska when he said that Breastfeeding can prevent from developing Dental Fluorosis (Vondriska, 1996).

On the other hand, children who were provided Formula from first or second month of age are more free of Dental Fluorosis and less exposed to severe one than those were provided Formula from third month of age and more. But there are no statistically significant differences in the prevalence of Dental Fluorosis.

In contrast, the studies in other countries illustrated that Baby Formulas are considered one of risk factors contributing to increase prevalence and severity of Dental Fluorosis. Some researchers found that baby formulas prepared with fluoridated water can contain over 100 times more fluoride than mothers' milk (Ekstrand, 1984).

Buzalaf et al. (2001) advised to limit fluoride by avoiding use for fluoridated water (around 1 ppm) to dilute powdered infant formulas.

Silva et al. pointed that a major source of fluoride in infancy is considered to be infant formula Because if infant formula is reconstituted with water containing 1.0 ppm fluoride, they should all provide a daily fluoride intake of above the suggested threshold for Fluorosis. Under these conditions the water used to reconstitute the formulae would provide 65-97 per cent of the fluoride ingested (Silva & Reynolds, 1996).

5.7.2 Milk consumption

In Gaza strip, the earlier the child has milk the less exposed to Dental Fluorosis, specially, severe one. During 1-3 years of age, consumption more cups of milk associated with less prevalence of Dental Fluorosis. Artificial milk decreases Dental Fluorosis and its severity. However, there are no statistically significant differences.

Other studies consist that such a study In China, found that the incidence among milk-consuming children was lower than that of non-milk consuming children (Chen et al.,

1997). In addition, Whitford (1997) said that fluoride absorption is inversely related to dietary calcium which, at high concentrations.

5.7.3 Fish consumption

This study found that children who ate fish less times per month are more exposed to severe Dental Fluorosis.

In contrast, other studies pointed to that most foods contain only very low levels of fluoride; exceptions are some fish and tea, which is particularly high in fluoride (Dowell & Bechal,1981; Benfield, 1973).

In spite that, Gikunju et al. (1992) found that the Fluoride content of fish fillet does not appear to be a major contributor to the prevalent and severe human Dental Fluorosis in the Rift Valley area. But Gikunju (1992) study about Fluoride concentration in Tilapia fish (Oreochromis leucostictus) from Lake Naivasha, Kenya confirmed that the fluoride content of fish muscle may contribute to the total daily intake of fluoride and hence predispose to Dental Fluorosis.

5.7.4 Tea consumption

This study discovered that children who were provided tea since first year of age are in the risk of having Dental Fluorosis and elevating its severity more than those were provided tea since second year of age and more. Moreover, having more cups of tea during 4-7 years of age are more exposed to Dental Fluorosis. But there are no statistically significant differences in the prevalence of Dental Fluorosis.

Previous studies confirmed these results. As illustrated before tea is particularly high in fluoride (Dowell & Bechal, 1981; Benfield, 1973). Cao et al. (1996) mentioned that Dental Fluorosis and Skeletal Fluorosis have been found in the Sichuan Province of China in Tibetans with a long history of drinking brick tea. That because It has long been accepted that fluoride accumulates in the leaves of the tea plant (Kavanagh &

Renehan, 1998). The daily intake of fluoride in the ordinary brick tea group was 0.3 mg, and this group developed Dental Fluorosis characterized as brown and white horizontal marks. Another study stated that brick tea is one of factors that are responsible for the Dental Fluorosis in Tibetan children in the nature reserve of Mount Qomolangma (Cao et al., 2001). Sergio et al. (1989) found sixty eight percent of children drinking tea as usual beverage, therefore it was estimated that about 22.1% of this sample have risk of Dental Fluorosis (Sergio et al., 1989).

Sansur (1991) conducted a study among UNRWA school children in the Gaza strip. It found that the average tea cups which school children drank per day in all Gaza stripe regions was approximately 3 cups, the highest 3.19 cups was in Rafah and the lowest 2.4 cups was in Bani Suhila.

5.7.5 Nutrition status

This study find a negative relationship between Dental Fluorosis and consumption of Protein during the first 7 years of age. While Whitford (1997) opposites this fact when he illustrated that the risk of Fluorosis is increased by high protein diets. The result in Gaza Strip could be explained by the effect of Socio-economic status on Dental Fluorosis where low Socio-economic class receives less animal protein.

In Gaza Strip, children who were consumed high Calcium during the first 7 years of their age have less prevalence of Severe Dental Fluorosis. The low consumption of Vitamins(C) during the first 7 years of their age reduces the chances of Dental Fluorosis. Meaning that, the malnutrition increases the risk of Dental Fluorosis. This result consists with previous studies which mentioned that in China, in the Province of Jiangxi, in areas with a better nutritional status were found to have a lower incidence of Dental Fluorosis (Chen et al., 1997). Even in a Tanzanian population, the researchers

found that malnutrition is a variable which may be contributing to the severity of Dental Fluorosis (Yoder et al., 1998).

In study, that compared the prevalence and severity of Dental Fluorosis among vegetarian and non-vegetarian children and adolescents living in an area where Dental Fluorosis is endemic. It illustrated significantly lower prevalence and severity of Dental Fluorosis among the vegetarian group compared to the non-vegetarians would seem to be related to diet (Awadiaet al., 1999). While Infant foods, especially those containing chicken, have the highest fluoride concentrations found in infant foods, and that should be considered when determining total fluoride intake (Heilmanet al., 1997).

In Saudi Arabia, The Dental Fluorosis prevalence was highest in the region with the highest water fluoride concentration, in rural areas and in malnourished subjects (Rugg-Gunn et al., 1997).

Fluoride absorption is inversely related to dietary calcium which, at high concentrations, may cause net fluoride secretion into the gastrointestinal tract (Whitford, 1997).

5.8 Fluoride concentration in drinking-water and Dental Fluorosis

In this study, the researcher discovered that there is highly statistically significant positive relationship between the severity of Dental Fluorosis and Fluoride concentration in municipal wells.

Many previous studies confirm this fact. In Perth and the Bunbury region of Western Australia, extended residence in a fluoridated area was significant risk factors (Riordan, 2002).

The prevalence of Dental Fluorosis, which is reported in optimally fluoridated areas in recent, is high, compared with non-fluoridated areas. More recently, a prevalence of 80.9% was reported in children in Augusta, Georgia, the highest prevalence yet reported

in an optimally fluoridated community in the United States. Moderate-to-severe Fluorosis was found in 14% of these children (Wash, 1993).

The studies in Toronto concluded that the prevalence of Dental Fluorosis may fall as the recently imposed reduction in concentration of fluorides in city water takes effect (Leake et al., 2002). In Sampacho and Portena, two towns in the Province of Cordoba (Argentina), supplied with drinking water containing quite different levels of fluoride, are described, and analyzed. In Sampacho Fluoride level is 9.05 mg/l. while in Portena the concentration is of 0.19 mg/l. No cases of Dental Fluorosis were recorded in Portena, but in Sampacho, there was a high proportion of children with mild Fluorosis and mild or severe Fluorosis (Azcurra et al., 1995). There is a dose-response relationship between the prevalence of the questionable category of Dental Fluorosis as reported by various authors and the drinking water fluoride level. In the United States, Several retrospective studies have found associations between Dental Fluorosis and fluoride exposures, especially water fluoridation and fluoride tablets and drops (Levy, 1992)

The prevalence of Dental Fluorosis in relation to fluoride levels in water among children aged 12-15 years, was studied in the states of Plateau and Bauchi, Nigeria. Fluoride levels in the water ranged from 0.0-0.4 mg/L. Prevalence of Dental Fluorosis in the sample was 51%. Forty-one percent had very mild Fluorosis, 7% had mild Fluorosis, and 3% had moderate to severe Fluorosis (El-Nadeef & Honkala, 1998).

Jackson et al. (1999) performed examinations of prevalence of Dental Fluorosis for children who were residents of one of three communities with varying levels of fluoride and their communal water supply were examined for Dental Fluorosis. They found that the prevalence of Fluorosis increased in fluoridated areas (Jackson et al., 1999).

National Survey of US School children concluded that as Fluoride levels of school water increases the Dental Fluorosis prevalence increases (Heller et al., 1997).

Fourteen-year-old boys from three regions of Saudi Arabia were surveyed and the Prevalence of Dental Fluorosis was highest in the region with the highest water fluoride concentration (Rugg-Gunn et al., 1997). Moreover, In Sudan, Dental Fluorosis was increased as Fluoride concentration in water increased (Ibrahim et al., 1995).

The prevalence of Dental Fluorosis was assessed among school children in four areas of Illinois where the respective water supplies contained natural fluoride at concentrations of 1, 2, 3, and 4 times the recommended optimal for the geographic area. The prevalence of Dental Fluorosis was characteristically low in the optimal fluoride area. Substantial increases in Fluorosis occurred in the above-optimal fluoride areas, with the condition being most pronounced in the 4-times optimal area (Driscoll et al., 1983).

In Gokwe District, water from artesian wells was found to contain between 5ppm and 10ppm fluoride ion concentration and as a result, Dental Fluorosis was found to be extremely severe in those communities solely dependent on artesian wells. In Chimanimani District, water from hot springs was found to contain five to six ppm fluoride ion concentration and in the catchment area of schools, drinking from hot springs Fluorosis was also found to be very (Tobayiwa et al., 1991).

Studies in the Guadiana Valley in northwestern Mexico, found that the drinking water supply comes from underground wells and is characterized by a high content of fluoride (higher than 12mg fluoride/L). The prevalence of Dental Fluorosis among children in the school age (6-12 years) and adult was nearly 35% according to Dean index (Teresa et al., 2001).

While the possibility that chance could have produced this trend cannot be conclusively ruled out, a distinct pattern of increasing prevalence with increasing water fluoride level

can be discerned. Such a pattern is not compatible with the concept of a threshold level for the action of fluoride ion on the enamel organ (Myers, 1983).

5.9 Public Perception towards Dental Fluorosis

Generally, this study illustrated a negative public perception for Dental Fluorosis in Gaza strip. All respondents feel that others with teeth (fluorosed) do not have good appearance. Even, majority of children and mothers think that Dental Fluorosis affect aesthetic appearance and personality. The respondents' perception around children with white teeth appearance is, that they are more Desirable as friends and more intelligence. Furthermore, Most of children agree and mothers agree with this idea, also, nearly all children and mothers found that they are more kind and have better looking. All participants believe that people with Dental Fluorosis have Lake social skills, less intelligent and suffer of poor social adjustment.

Many Studies conducted for investigate the Perception of Dental Fluorosis around the world, and most of them consist with the study in Gaza strip.

In England, people with moderate to severe Fluorosis are at increased risk of experiencing psychological and behavioral problems (Welbury & Shaw, 1990). People afflicted with Dental Fluorosis are more likely to experience discrimination from an early age. Teachers often prejudge a child's intellect and personality based on appearance alone. People who cannot afford cosmetic veneers, professional bleaching or micro-abrasive treatment have no option to live with their fluoride-damaged teeth and the attendant social stigma and psychological trauma (Tauber, 1998).

Hawley et al. (1996) conducted a study in England. They concluded that the prevalence of aesthetically objectionable Dental Fluorosis was low and that mild Fluorosis was associated with a lower risk of dental caries and a more acceptable appearance.

English researchers noted that the prevalence of Dental Fluorosis appears to be on the increase. Although in its mild form the condition is not considered to be of cosmetic significance, the more severe forms can cause great psychological distress to the affected individual (McKnight et al., 1998; Rodd & Davidson, 1997).

The stains of endemic Dental Fluorosis can have a tremendous psychological impact on the patient. Perhaps this might be a contributory factor in the psychological make-up of the individual who displays ant-social behavior. Many patients have been pleased with the results of bleaching of teeth, and even displayed a willingness to smile (Colon, 1972).

Irish dental surgeon, Donal McAuley, wrote in the British Medical Journal: "I see patients daily in my surgery who are damaged by fluoride. They do not smile, they are teased at school, and they are traumatized by having 'rotten' teeth." (McAuley, 2001). But in Gaza Strip, Most of children do not hide their smile.

Kenyan survey noted that Dental Fluorosis as an important problem because of its unfavorable effects on an individual's personality (Mwaniki et al., 1994).

A Canadian study acknowledged that nearly half of the participants had Dental Fluorosis. The effect on personal appearance, as defined by the participants themselves, was more prevalent in the over-11 age group (Clark & Berkowitz, 1997). An Australian Health Department analyzed society's perceptions of Dental Fluorosis. Lay and professional observers recognized that higher degrees of Fluorosis increasingly embarrass the child. All observers, except the dentists, felt that the more severe Fluorosis indicated neglect on the part of the child (Riordan, 1993). In addition, Egyptian researchers observed that friends and relatives ridicule the patient by inferring that these stains are associated with smoking and/or poor oral hygiene. They noted that

such personal remarks lead an individual into severe psychological depression (Rahmatulla, 1995).

UK researchers from Newcastle City Health concluded that the prevalence of "aesthetically important" Dental Fluorosis in the fluoridated area was six times higher than found in the non-fluoridated area, (Tabari et al., 2000).

Researchers are agreed that Dental Fluorosis is widespread. They differ only on the degree of prevalence of aesthetically important Dental Fluorosis. In addition, they demonstrate that dental professionals have been aware for many years that unattractive teeth can adversely affect the psychological wellbeing of children and adults (Newton et al., 2002).

The hypothesis that children with a normal dental appearance would be judged to be better looking, more desirable as friends, more intelligent, and less likely to behave aggressively was upheld (Shaw, 1981).

Spencer et al. (1996) illustrated that the psycho-behavioral impact was similar to that of crowding and overbite, both considered key occlusal traits driving the demand for orthodontic care (Spencer et al., 1996; Van Palenstein Helderman & Mkasabuni 1993).

Dental Fluorosis is visible as soon as the secondary teeth erupt. While developing social and early life skills, children are at their most vulnerable to the psychological impact of discrimination (Ritter& Langlois, 1988).

Further research confirmed that participants in a study of the psycho-social perception of dental abnormalities, such as Dental Fluorosis, believed that people with dirty (stained) teeth have a lack of social skills, lower intelligence and poor psychological adjustment (Newton et al., 2002).

Studies sponsored by Government and industry have repeatedly established that Dental Fluorosis and dental abnormalities have negative psycho-social impacts and that the

public commonly perceives people with dental abnormalities to have poor health, low intelligence, poor psychological adjustment, poor personal hygiene, lack of social skills (Davis et al., 1998). Others declare that there is a psycho-behavioral impact. The consequences of artificial water fluoridation and widespread, poorly- or unregulated use of fluoridated products have created a growing subset of the population more likely to endure lifelong discrimination and develop psycho-behavioral problems (Collins & Zebrowitz, 1995).

Lalumandier and Rozier (1998) found that the worst aesthetic aspects of tooth surface was the only factor associated with parent satisfaction. As in Gaza Strip, most of the children and mothers do not accept teeth appearance, because of teeth color.

In 2000, the same year as the Newcastle study appeared in the British Dental Journal, the British Medical Journal reported that nearly half populations living in fluoridated areas develop Dental Fluorosis of all types. This figure is somewhat lower than that found by the Newcastle researchers. However, the York reviewers stated that 12.5% of those exposed to water fluoridation - 1,250 people in every 10,000 - exhibit Dental Fluorosis "of concern"(McDonagh et al., 2000). While in this study in Gaza strip, all people are concern with Dental Fluorosis.

Chapter 6

Conclusion and Recommendation

6.1 Conclusion

This study was conducted to measure the prevalence and severity of Dental Fluorosis and to explore its possible associated risk factors among Palestinian children aged 12-18 years in Gaza Governorates. The researcher wanted to point to the magnitude of this problem and explore possible risk factors contributing in elevating the risk of Dental Fluorosis among Palestinian children in Gaza Strip, to illustrate the seriousness of children poisoning by excessive Fluoride intake in Gaza Strip. Furthermore, this study hoped to modify the traditional views that focus only on high Fluoride concentration in drinking water as the only risk factor of high Dental Fluorosis in Gaza Strip. Although, a study of Dr. Sansur (1991) illustrated that tea consumption among children is heavy in Gaza and is a contributing factor in the total dietary intakes of Fluoride beside high Fluoride concentration in drinking water. Consequently, these risk factors will be considered in the proposed solution to secure the best results in solving this problem.

This chapter will present the conclusion of this study and provide the appropriate recommendations that may contribute in collecting and directing the effective efforts towards minimizing or eradicating Dental Fluorosis problem in Gaza Strip.

Regarding *Socio-demographic and economic risk factors,* this study concluded that older children and males are more exposed to Dental Fluorosis. Children living in Mid-zone and Rafah have the highest prevalence of Dental Fluorosis, while those living in Khan-Younis are the most exposed children in Gaza strip to Sever Dental Fluorosis. As the occupational and educational level of parents decreases, the risk of Dental Fluorosis elevates. Even bad economic status contributes in this problem.

Toothpaste Using behaviour during the first 7 years of child age affect badly Dental Fluorosis when child used to Cover the head of brush by more than pea size of fluoridated toothpaste and swallow it.

Rare *Knowledge of the mother and child around Dental Fluorosis in Gaza strip* maximise Dental Fluorosis problem.

Living near main roads or using open fire as Heating System during winter cause higher *Environmental Pollution by Fluoride* that exposes children to high Dental Fluorosis.

Practising *Exclusive Breastfeeding during the first 6 month of child age* and abandonment using *Baby Formula during the first 6 month of child age* are important to minimize Dental Fluorosis.

The earlier the child having Animal or Artificial and Animal *Milk* and the more cups the child drinks, the less risk of Dental Fluorosis will expose the child.

Drinking *Tea* in early age increases the risk of Dental Fluorosis.

Low *consumption of Animal and Plant Protein, Calcium and Vitamin C during the first 7 years of child age* exposes the child to severe Dental Fluorosis. While high *Consumption of Raisins and spinach, chilli* increase the risk of Dental Fluorosis.

There is highly statistically positive relationship between *Fluoride concentration in drinking water* and Dental Fluorosis. The study found that supplying drinking water with fluoride concentration more than 1 ppm elevates the risk of Dental Fluorosis.

Furthermore, No Family had got *Water Purification System* during the first 7 years of child age in the study population.

Palestinian mothers and children believe that Dental Fluorosis has a negative effect on the aesthetic appearance and personality. They illustrated negative public perception for Dental Fluorosis. They believe that the government is the first responsible one in solving this problem and they are ready to help in proposed solutions.

6.2 Recommendation

Establishing national plan to solve Dental Fluorosis problem includes:

1-Elevating the occupational and educational level of parents and improving economic status of Palestinian families through providing facilities that encourage parents to seek higher educational levels, which consequently will elevate their occupational and economical status.

2-Encouraging Media and all health service providers to illustrating the magnitude of Dental Fluorosis problem in Gaza strip, especially in Mid-zone, Rafah and Khan-Younis Governorates.

3-Building Health Education program aims to improve the Palestinians Knowledge around Dental Fluorosis, its causes, risks, and how to minimize it, then involving this program into:

- Curriculum of schools and universities
- Health education programs in School Health, Oral Health Department and Oral Health Education for pregnant women that are provided by Ministry of health and others health service providers.

4- The Health Education program should begin in changing community behaviour through emphasising on:

- Minimizing the used amount of fluoridated toothpaste and preventing to swallow it.
- Encouraging the use of non-fluoridated toothpaste.
- Improving of environmental conditions by living away of main road and minimizing using open fire as heating system during winter.
- Encouraging the practice of Exclusive Breastfeeding during the first 6 month of child age and abandonment using Baby Formula in this period.
- Improving nutrition status through encouraging the consumption of Calcium and Vitamin C in earlier age, by having milk and its products and fruits.
- Preventing high Consumption of Raisins, spinach, chilli and tea in early age.
- Importance of community participation by changing behaviour.

5-Collaborating and organising the efforts of Ministry of Environment, water Authority and all sectors providing environmental services.

6-Solving the problem of high concentration of Fluoride in drinking water by:

- Treating high concentration of Fluoride in municipal wells supplying drinking water.
- Establishing Governmental Water Purification Station.
- Encouraging the householders to participate in establishing small Water Purification Unit supplies pure drinking water to surrounding houses.
- Using Water Purification System in houses to reduce Fluoride concentration in drinking water.

- Securing Water Purification System for drinking water in all governmental, UNRWA, and private preliminary schools.

7-Encouraging advanced researches around Dental Fluorosis problem.

8-Studying the solutions applied to solve Dental Fluorosis problem in other societies in order to infer the most appropriate solutions to our status.

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Annex

Annex 1: Approval letter

بسم الله الرحمن الرحيم

السيد / مدير عام الرعاية الأولية   حفظه الله

تحية الوطن ،

مقدمة الطلب : د. لميس محمد عزت أبو طلوب / طالبة ماجستير صحة عامة

الموضوع :

أرجو من سيادتكم التكرم والسماح لي بالحصول على نتائج فحص تركيز الفلور من آبار مياه الشرب في المحافظات الجنوبية ، من مختبر الصحة العامة بوزارة الصحة ، لأنني بحاجة لهذه البيانات لبحث التخرج .

وتفضلوا بقبول فائق الاحترام

مقدمة الطلب

د. لميس أبو طلوب

١٨/٤/٢٠٠٣

= الأخ / مدير المختبر المحترم
= يرجى ..... نتائج الفلور في المحافظات الجنوبية

الأخ / ....
......

١٨/٤/٢٠٠٣

......

14.04.2003

Annex 2: Approval letter

بسم الله الرحمن الرحيم

PALESTINIAN NATIONAL AUTHORITY
Ministry of Health - Primary Health care
Directorate of School Health

السلطة الوطنية الفلسطينية
وزارة الصحة - الرعاية الأولية
دائرة الصحة المدرسية

التاريخ: ١٢/ ٥/ ٢٠٠٣م

السيد/ مدير دائرة الصحة المدرسية المحترم

السلام عليكم ورحمة الله وبركاته

الرجاء من سيادتكم السماح لي بالحصول على المعلومات المتعلقة بنسبة التسمم الفلوري للأسنان عند الأطفال في المدارس في قطاع غزة.

ولكم جزيل الشكر،،،

مقدمة الطلب

د.لميس محمد عرفة أبو حالوب

الاخوه الزملاء - ادارة الصحة المدرسية

رجاء تسهيل الطلب

والمساعدة ما أمكن

مدير دائرة الصحة المدرسية

١٤/١٤

مقر دائرة الصحة المدرسية : مركز شهداء الشيخ رضوان الصحي / غزة تلفاكس: ٠٨-٢٨٥٤٩٤٨
Address : El-Sheikh Rodwan martyrs Health Center \ Gaza Telefax :08-2854948

Annex 3: Approval letter

Palestinian National Authority
Ministry Of Health

السلطة الوطنية الفلسطينية
وزارة الصحة

الرقم :
التاريخ: 9 / 7 / 2003

الأخوة / مدراء صحة المناطق المحترمين

تحيه طيبة وبعد ,,,,,

الموضوع: تسهيل مهمة لعمل بحث حول التسمم الفلوري للأسنان

للطبيبة/لمس أبو حلوب

يرجى التكرم بعمل اللازم نحو تسهيل مهمة الطبيبة المذكورة عاليه وذلك لامكانية عمل بحث حول التسمم الفلوري للأسنان في قطاع غزة .

واقبلوا التحية,,,,,

مدير عام الرعايه الاوليه
بوزارة الصحه
دكتور/عبد الجبار الطيبى

* صورة للسيد / نائب مدير عام الرعاية الأولية

وزارة الصحة
الإدارة العامة للرعاية الأولية
الرقم: ٢٢٢٣
التاريخ: ٢٠٠٣/٧/٩

Annex 4: Approval letter

وزارة الصحة

13 6 2003

جامعة القدس

كلية الصحة العامة-فلسطين

School of Public Health

فلسطين-القدس

السيد/ مدير خدمات الصحة – وكالة الغوث

الدكتور أيوب العالم المحترم

تحية طيبة وبعد...

الموضوع: مساعدة الطالبة لميس أبو حلوب

تقوم الطالبة المذكورة أعلاه بإجراء دراسة بعنوان:

Dental fluorosis and its associated risk factors among Palestinian children in Gaza Strip.

كمتطلب للحصول على درجة الماجستير في الصحة العامة علما بأن المعلومات سوف تكون متوفرة لدى الباحثة فقط. و عليه نرجو من سيادتكم التكرم بالإيعاز لمن تروونه مناسب لتسهيل مهمة الطالبة في جمع البيانات الخاصة بالبحث.

موافقتكم دعما للمسيرة الأكاديمية

و اقبلوا التحية،،

عميد كلية الصحة العامة المساعد

د. سوزان شعشاعه

2003/12/3

2003/11/15

Annex 5: Helsinki Committee agreement

بسم الله الرحمن الرحيم

Palestinian National Authority
Ministry of Health
Helsinki Committee

السلطة الوطنية الفلسطينية
وزارة الصحة
لجنة هلسنكي

Date: 6/7/2003

التاريخ: ٢٠٠٣/٧/٦

Mss./ Lamis M. Abu Haloob

الانسة: لميس محمد أبو حلوب

I would like to inform you that the committee has discussed your application about:

نفيدكم علماً بأن اللجنة قد ناقشت مقترح دراستكم حول:-

Dental Fluorosis and Associated Risk Factors Among Palestinian Children in Gaza Governorates.

التسمم الفلوري وعوامل الخطر المرتبطة بها بين أطفال قطاع غزة

In its meeting on July 2003 and decided the Following:-

و ذلك في جلستها المنعقدة لشهر يوليو ٢٠٠٣

و قد قررت ما يلي:-

To approve the above mention research study.

الموافقة على البحث المذكور عاليه.

Signature

توقيع

Member	Member	Chairperson
عضو	عضو	

Ministry of Health
Helsinki Committee

Conditions:-

- Valid for 2 years from the date of approval to start.
- It is necessary to notify the committee in any change in the admitted study protocol.
- The committee appreciate receiving one copy of your final research when it is completed.

غزة - التوام -تلفاكس ٩٧٢-٧-٢٨٧٨١٦٦ ص ب (٥٣١٤) البريد الإلكتروني: ghsrc@palnet.com
Gaza Etwam Telefax 972-7-2878166 P.O.Box (5314) E. Mail ghsrc@palnet.com

Annex 6

Informed Consent

We understand that this research aims to study the prevalence and severity of Dental Fluorosis and to explore its associated risk factors among Palestinian children aged 12-18 years in Gaza Governorates.

We understand that I was selected with my child, who was born and spent his/her first 9 years of age in the same house that we live in now, to participate as subjects in this study and we just will be interviewed once. During the interview, we will answer the questions of study questionnaire that will be directed to us by the researcher and this data is important to study.

We have been informed that the researcher is a postgraduate student conducts this study as a thesis, in order to have master degree in Public Health from Al Quds University. The interview will take about 15 minutes. No risk or discomforts are anticipated as a result of our participation. Furthermore, we will receive no monetary cost or direct benefit as a result of our participation.

This interview granted freely. The researcher illustrated that the interview is entirely voluntary, and even after the interview begins we can refuse to answer any specific questions or decide to terminate the interview at any point. All information that we give will be kept confidential. Anonymity will be maintained by using serial number instead the name.

We understand that the results of this research will be given to us if we ask for them and that Dr. Lamis Abu Haloob is the person to contact if we have any question about the study or about our rights as a study participant. Dr. Lamis Abu Haloob can be reached through a collect call at 059-831892.

In signing this document, I am confirming my child consent and mine to be interviewed by a researcher.

Researcher: I confess that I read the informed consent. *Researcher's signature* *Date*

---------- / /2003

For Respondent: Do you agree with what is written above? ☐ Yes ☐ No

Annex 7

بلاغ الموافقة

لقد تفهمنا أن هدف هذا البحث هو دراسة معدل انتشار وشدة التسمم الفلوري للأسنان واستكشاف عوامل الخطر المرتبطة به بين الأطفال الفلسطينيين في العمر ما بين اثني عشر وثمانية عشر عاماً في محافظات غزة.

وأنا أتفهم أنه قد تم اختياري مع طفلي الذي ولد وترعرع خلال سبع السنوات الأولى من عمره في نفس المنزل الذي نقطنه الآن – للمشاركة كأحد عناصر عينة هذه الدراسة وسنقابل مرة واحدة. و خلال المقابلة سنجيب على أسئلة استبيان الدراسة التي ستوجهها الباحثة لنا حيث تعتبر هذه بيانات مهمة للدراسة.

قد تم إبلاغنا بأن الباحثة طالبة دراسات عليا وهذه الدراسة هي رسالة الماجستير وهي متطلب دراسي عليها إنهاؤه للحصول على درجة الماجستير في الصحة العامة من جامعة القدس، المقابلة ستستغرق حوالي خمس عشرة دقيقة. ان ينتج أي خطر أو إزعاج نتيجة مشاركتنا. إضافة لذلك لن نتلقى أي تعويض مالي أو منفعة مباشرة نتيجة المشاركة.

هذه المقابلة غير مموّلة وقد أوضحتْ الباحثة أن المقابلة تطوعية، وحتى إن بدأت المقابلة بإمكاننا رفض إجابة أي سؤال معين أو إنهاء المقابلة عند أية نقطة . كل المعلومات – التي سنقدمها– ستُحفظ خصوصيتها . السرية ستصان باستخدام التسلسل الرقمي عوضاً عن الاسم.

نوقن أن نتائج هذا البحث ستعطى لنا في أية لحظة نسأل عنها وأن الدكتورة / لميس أبو حلوب هي الشخص الذي سيتم الاتصال به للاستفسار عن الدراسة أو عن حقوقنا كمشاركين بالدراسة. يمكن الاتصال بها من خلال الهاتف الخلوي رقم 831892 – 059

بتوقيعي هذه الوثيقة، أ أكدّ موافقتي وموافقة طفلي بمقابلة الباحثة.

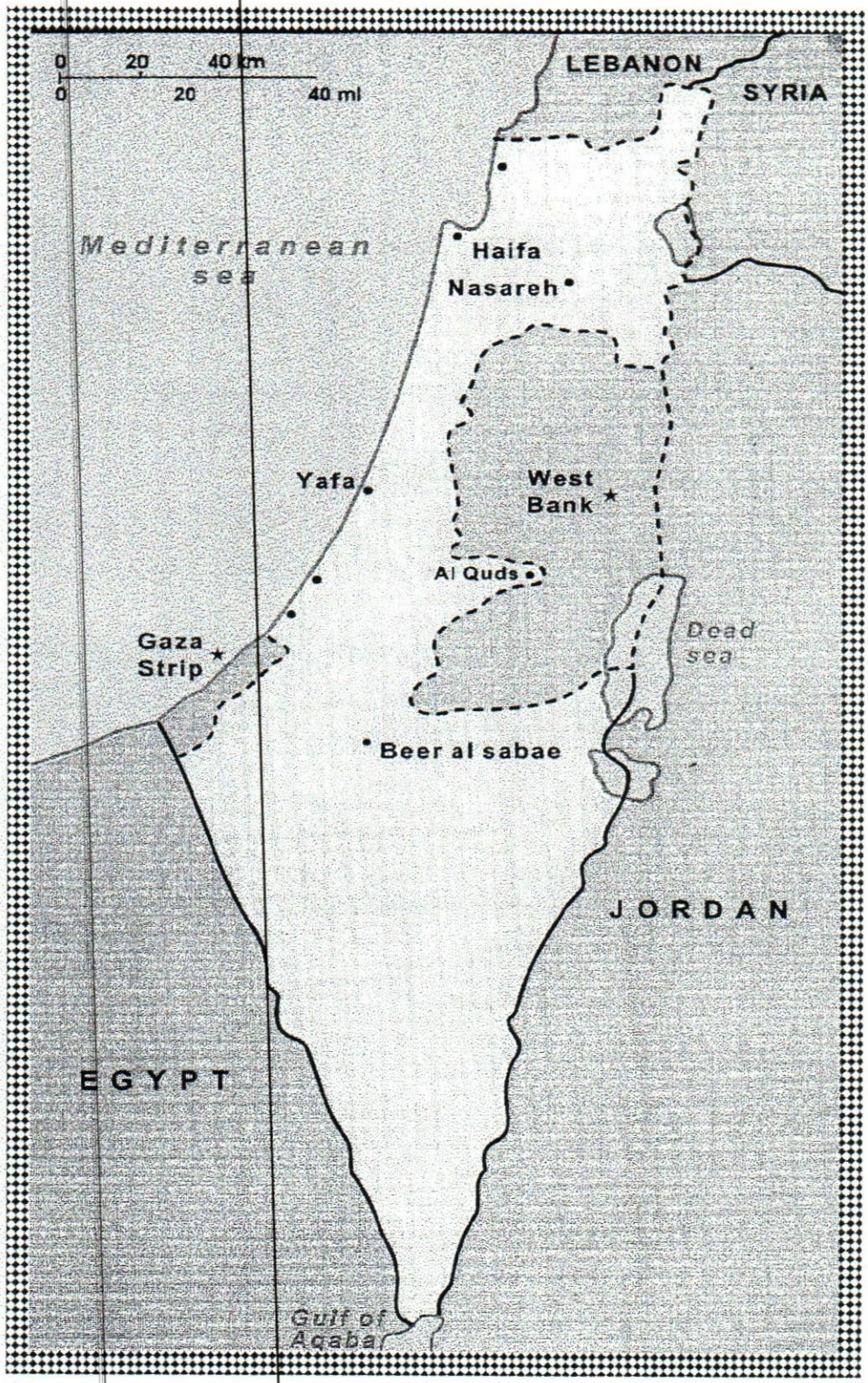
الباحثة: اقر بأنني قرأت بلاغ الموافقة. توقيع الباحث التاريخ

..... / / 2003

للمستجيب: هل توافق على ما سبق؟ ☐ نعم ☐ لا

Annex 8

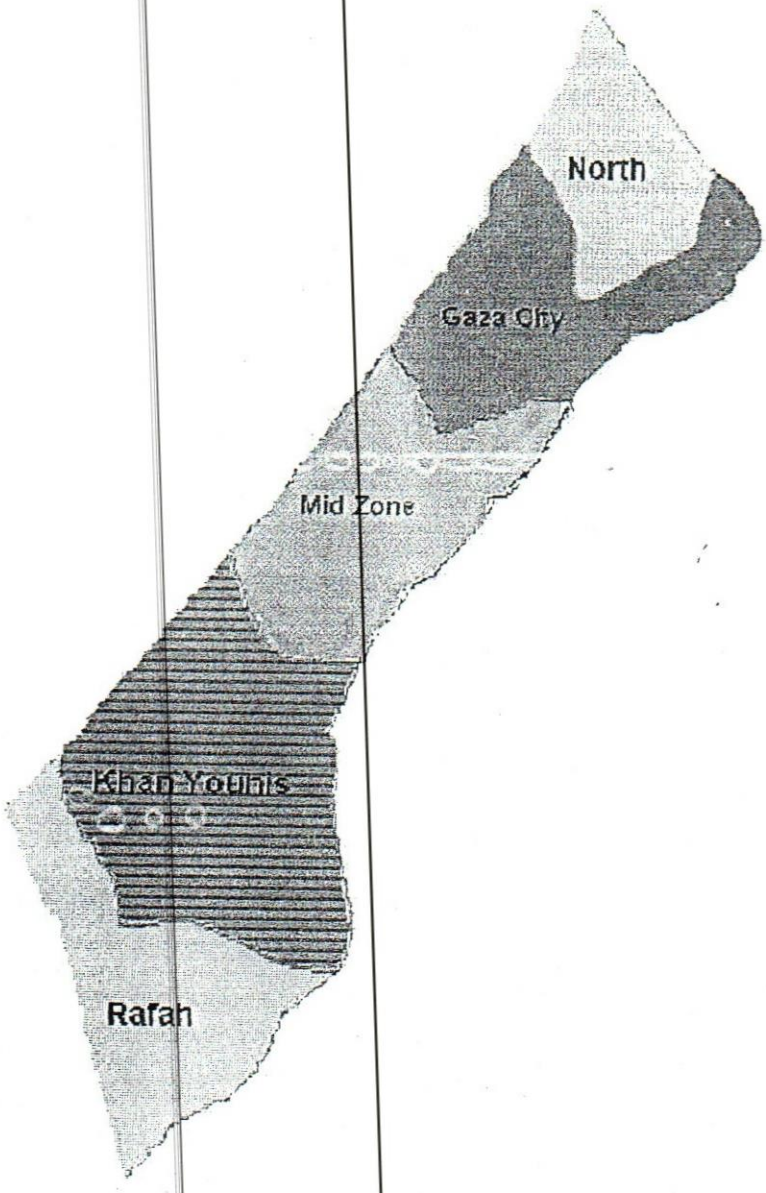
PALESTINE



Source: Ministry of Health, Health Management Information System (2003, Jul). ***The Status of Health in Palestine: annual report 2002.*** Palestine: MoH, HMIS.

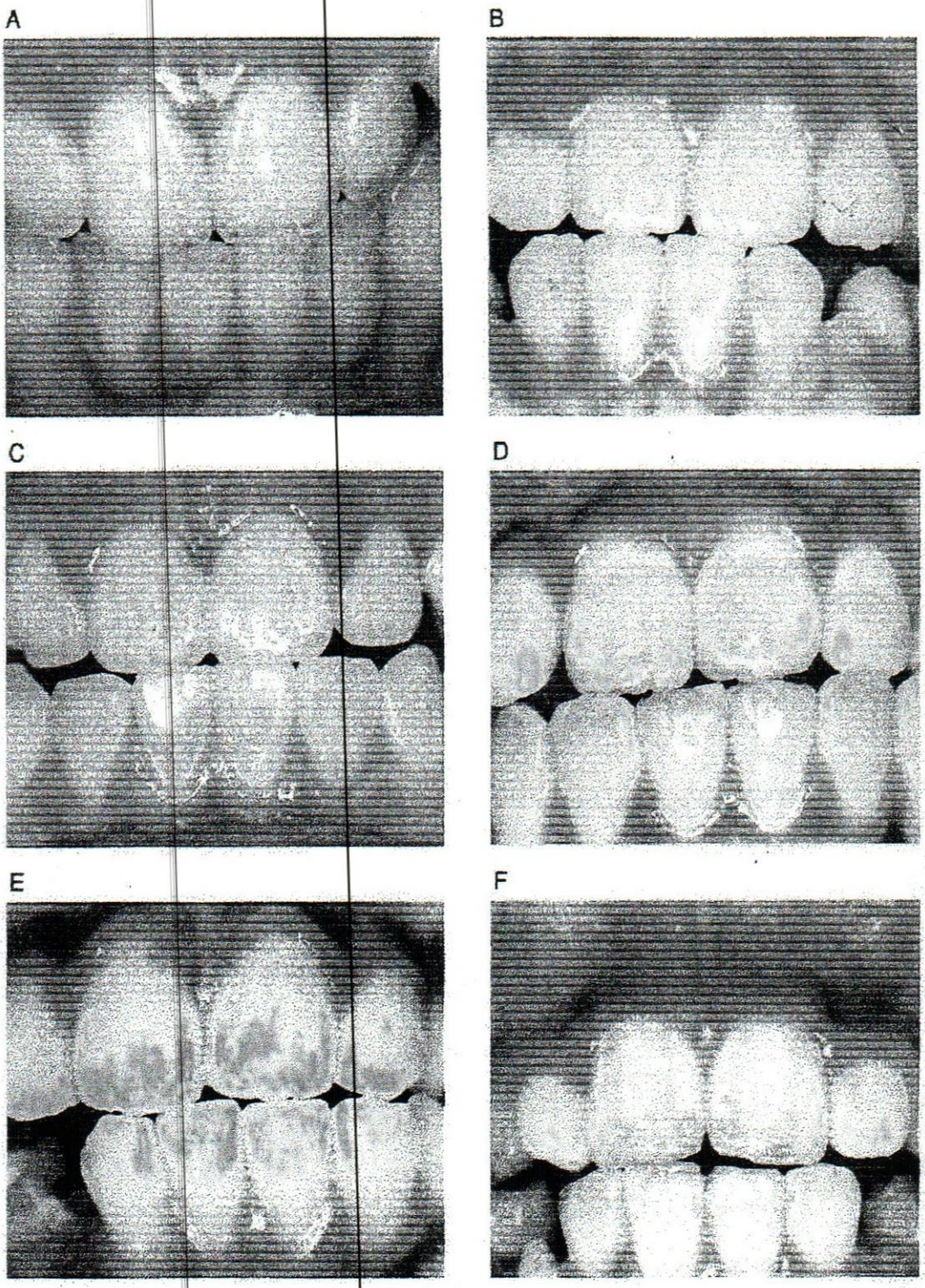
Annex 9

Map of the Gaza Strip



Source: Ministry of Health (1999). ***The Status of Health in Palestine: annual report 1998.*** Palestine: MoH.

Annex 10: Dean Index of Dental Fluorosis



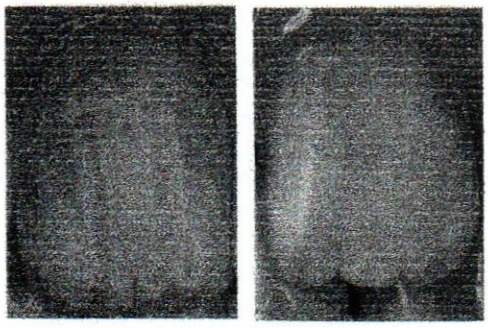
Examples of coding of fluorosis according to Dean's index criteria
A: code 0 (normal); B: code 1 (questionable); C: code 2 (very mild); D: code 3 (mild); E: code 4 (moderate); F: code 5 (severe). (Photographs provided by Dr R. W. Evans, University of Melbourne, Melbourne, Australia.)

Annex 11:

The Tyllstrup-Fejerskov index of dental fluorosis

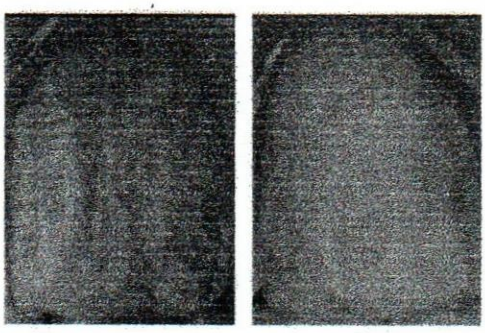
TF score 1

Thin white opaque lines are seen running across the tooth surface. Such lines are found on all parts of the surface. The lines correspond to the position of the perikymata. In some cases, a slight "snow- capping" of cusps/incisal edges may also be seen.



TF score 2

The opaque white lines are more pronounced and frequently merge to form small cloudy areas scattered over the whole surface. "Snow-capping" of incisal edges and cusp tips is common.



TF score 3

Merging of the white lines occurs, and cloudy areas of opacity occur spread over many parts of the surface. In between the cloudy areas white lines can also be seen.

TF score 4

The entire surface exhibits a marked opacity, or appears chalky white. Parts of the surface exposed to attrition or wear may appear to be less affected.

Classification of the characteristic clinical appearance of fluorotic enamel (Published with agreement from Thylstrup & Fejerskov, 1978).

WHO Collaborating Centre for Oral Health Care Planning and Future Scenarios

Faculty of medical sciences University of Nijmegen

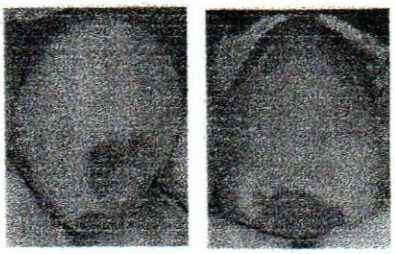
The Tyllstrup-Fejerskov index of dental fluorosis

TF score 5

The entire surface is opaque, and there are round pits (focal loss of the outermost enamel) that are less than2 mm in diameter.

TF score 6

The small pits may frequently be seen merging in the opaque enamel to form bands that are less than 2 mm in vertical height.



TF score 7

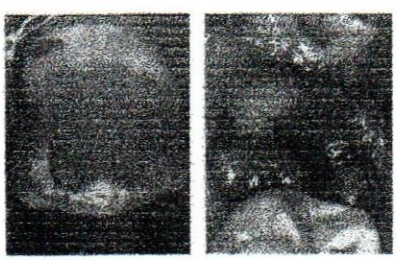
There is a loss of the outermost enamel in irregular areas, outermost enamel in irregular areas, and less than half the surface is so involved. The remaining intact enamel is opaque.

TF score 8

The loss of the outermost enamel involves more than half the enamel. The remaining intact enamel is opaque.

TF score 9

The loss of the major part of the outer enamel results in a change of the anatomical shape of the surface/ tooth. A cervical rim of opaque enamel is often noted.



Classification of the characteristic clinical appearance of fluorotic enamel
(Published with agreement from Thylstrup & Fejerskov, 1978)

WHO Collaborating Center for
Oral Health Care Planning
and Future Scenarios

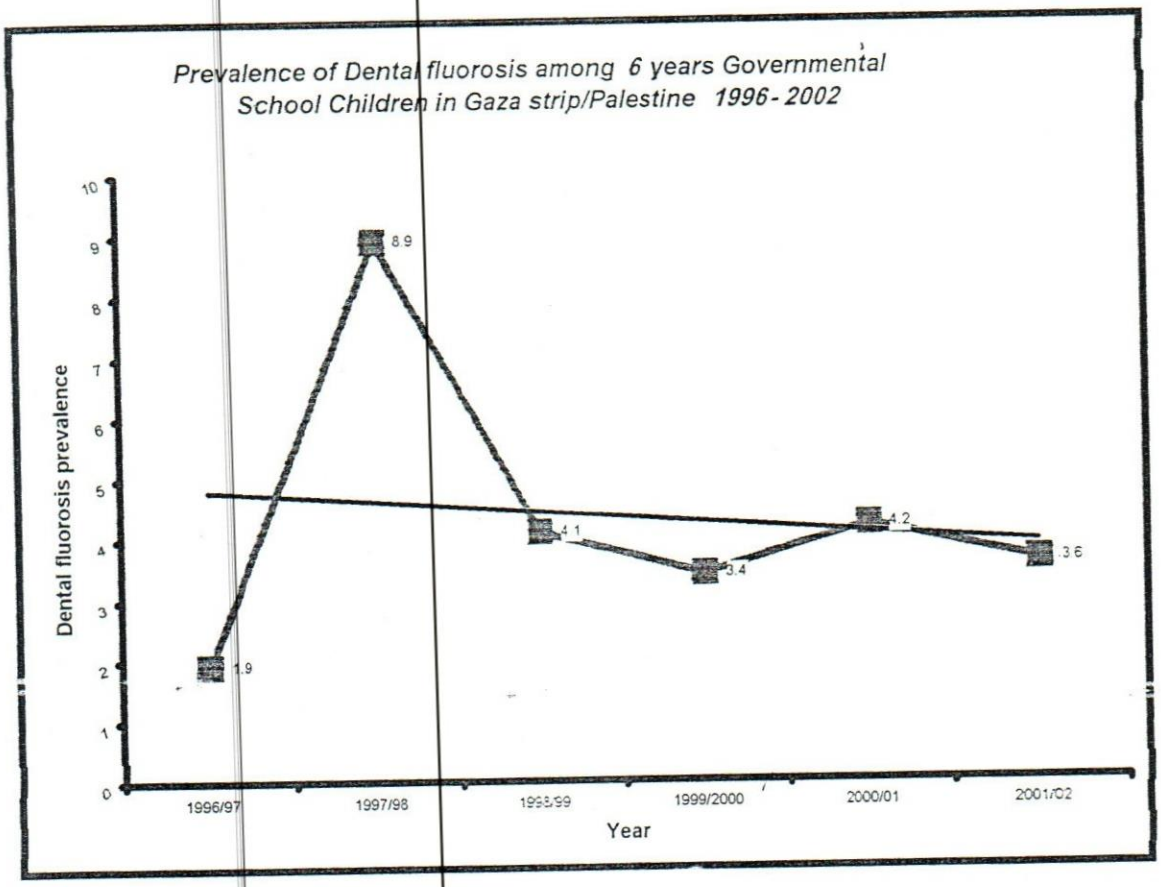
Faculty of
medical sciences
University of
Nijmegen

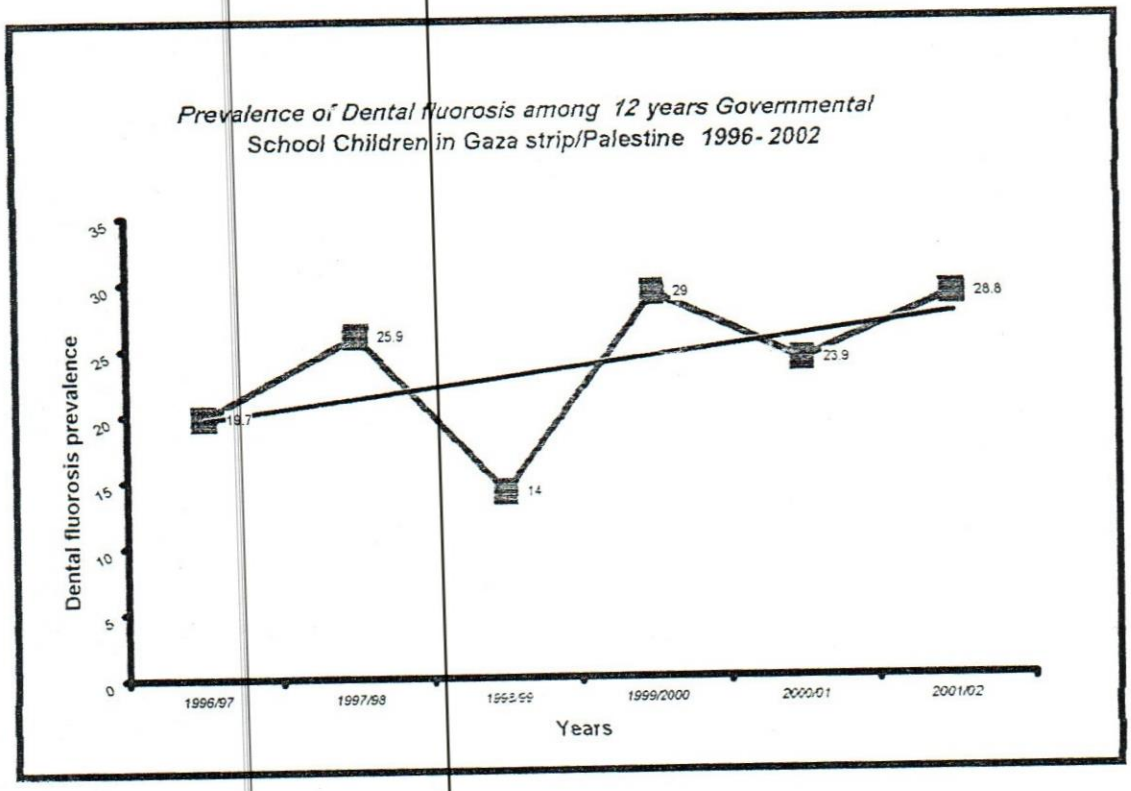
Annex 12

Prevalence of Dental Fluorosis (Df) among Governmental School Children (GSC) according to School Health Program at MoH in Gaza strip/Palestine 1996-2002

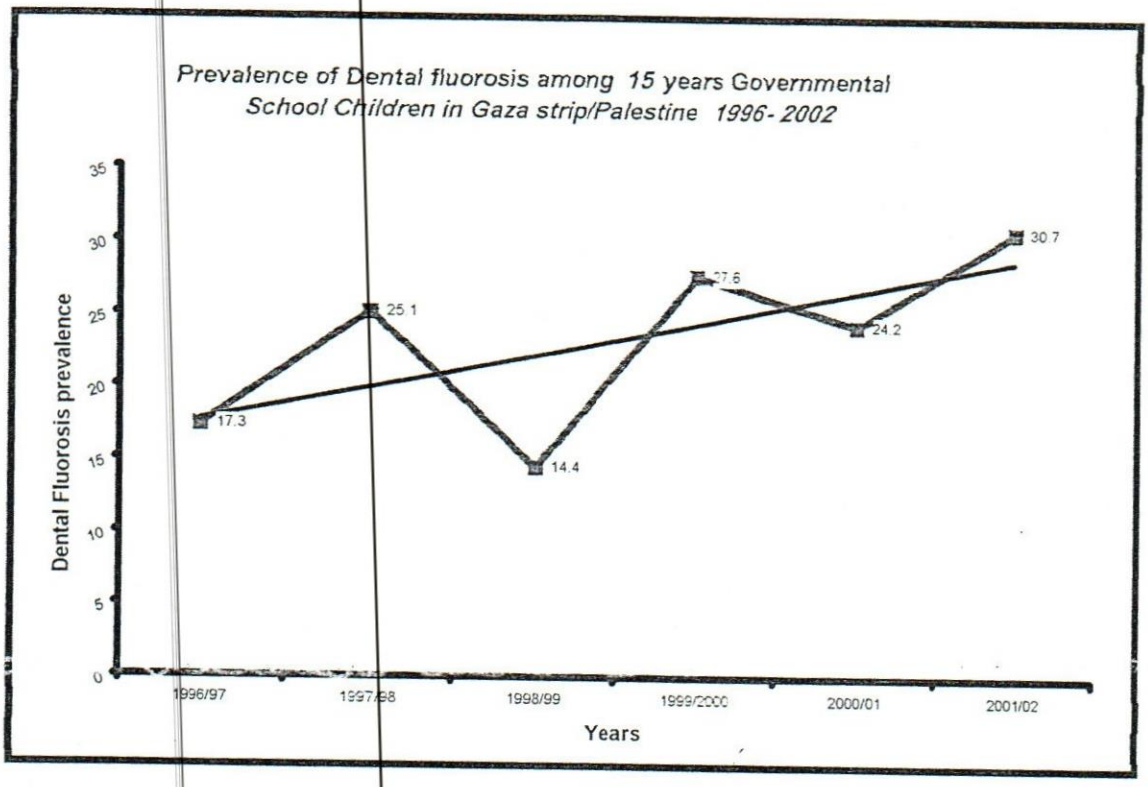
year	1996/97	1997/98	1998/99	1999/2000	2000/01	2001/02
% 0f Df in 6 years old GSC	1.9	8.9	4.1	3.4	4.2	3.6
% of Df in 12 years old GSC	19.7	25.9	14	29	23.9	28.8
% of Df in 15 years old GSC	17.3	25.1	14.4	27.6	24.2	30.7
% of Df of all stages	12.2	18.9	10.9	19	17.4	20.7

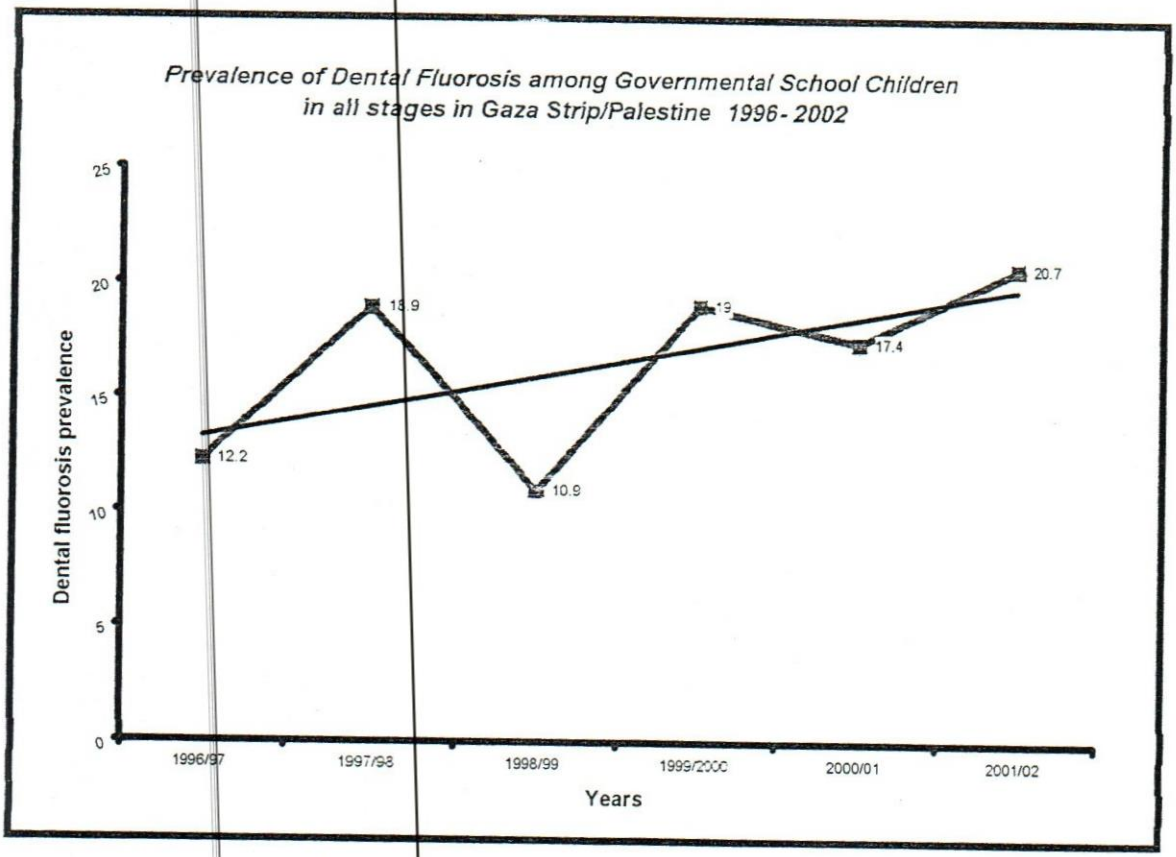
Annex 12


Prevalence of Dental fluorosis among 6 years Governmental School Children in Gaza strip/Palestine 1996- 2002
Dental fluorosis prevalence
10
9
8
7
6
5
4
3
2
1
0
8.9
4.1
3.4
4.2
3.6
1.9
1996/97
1997/98
1998/99
1999/2000
2000/01
2001/02
Year


Prevalence of Dental fluorosis among 12 years Governmental School Children in Gaza strip/Palestine 1996- 2002
Dental fluorosis prevalence
35
30
25
20
15
10
5
0
25.9
19.7
14
29
23.9
28.8
1996/97
1997/98
1998/99
1999/2000
2000/01
2001/02
Years

Annex 12


Prevalence of Dental fluorosis among 15 years Governmental School Children in Gaza strip/Palestine 1996- 2002
Dental Fluorosis prevalence
35
30
25
20
15
10
5
0
17.3
25.1
14.4
27.6
24.2
30.7
1996/97
1997/98
1998/99
1999/2000
2000/01
2001/02
Years


Prevalence of Dental Fluorosis among Governmental School Children in all stages in Gaza Strip/Palestine 1996- 2002
Dental fluorosis prevalence
25
20
15
10
5
0
12.2
18.9
10.9
19
17.4
20.7
1996/97
1997/98
1998/99
1999/2000
2000/01
2001/02
Years

FLORIDE (PPM), 1994

Drinking Wells in Gaza Strip

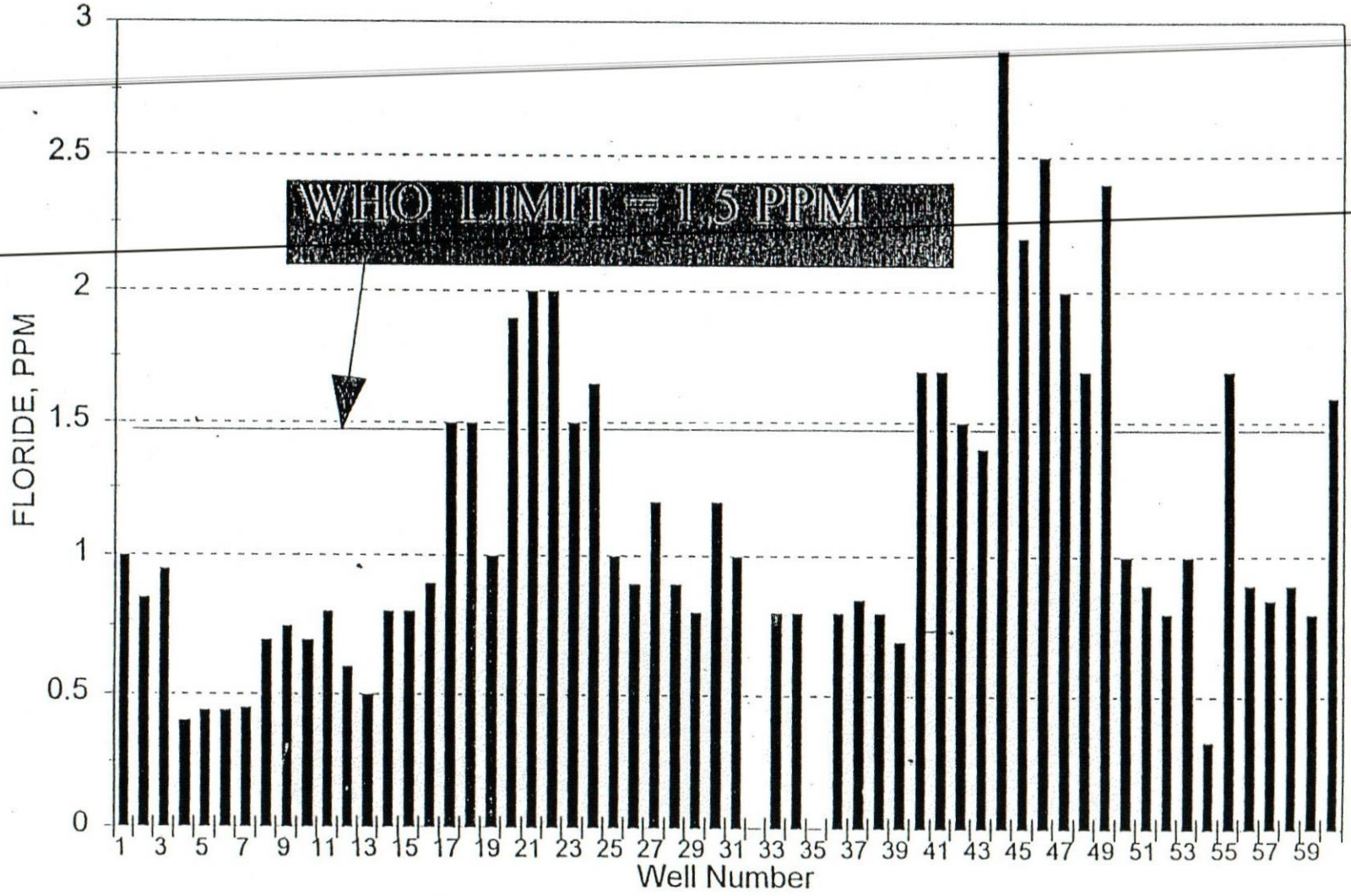


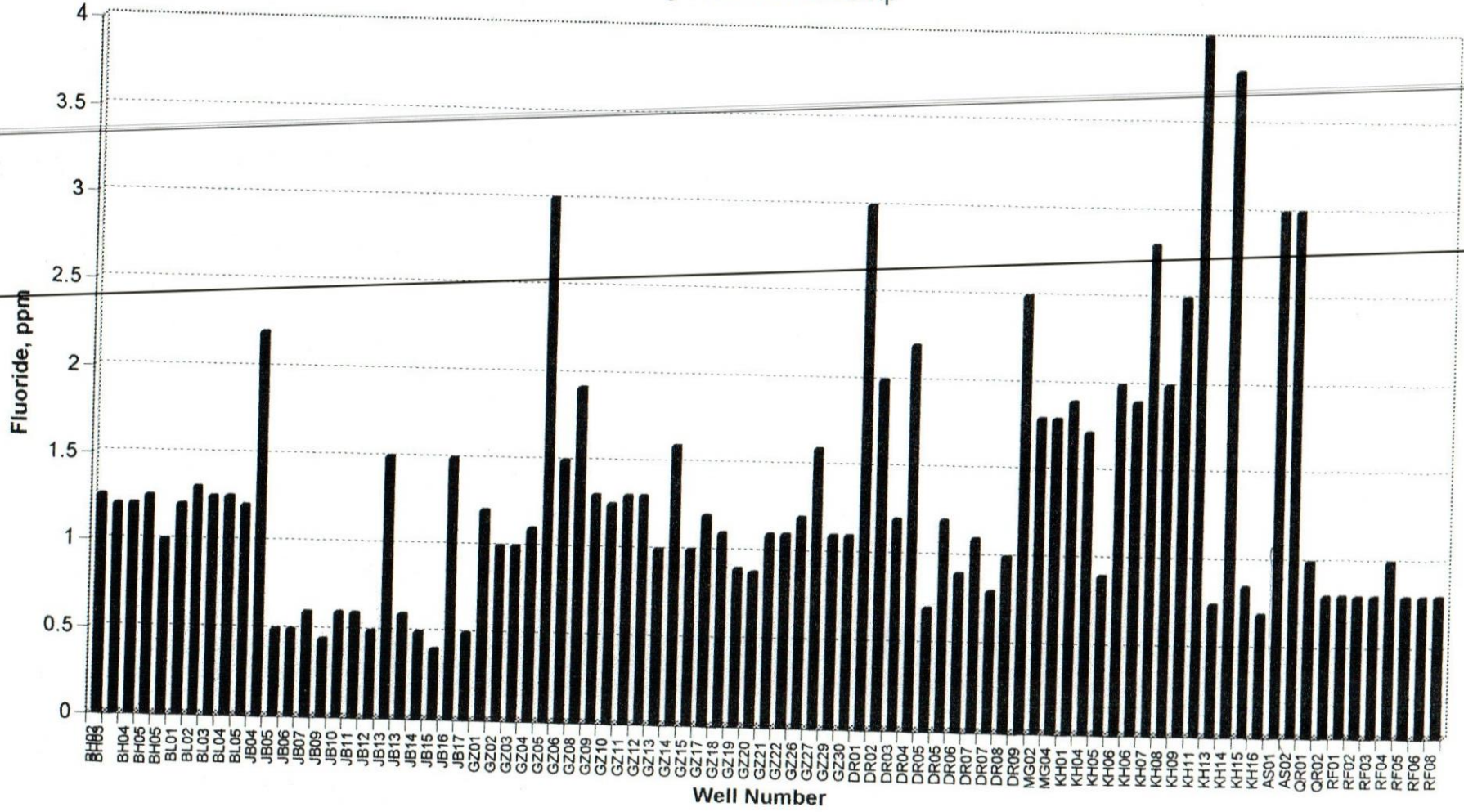
Figure (6)

Current quality of drinking water in Gaza Strip.

Well NO.	COD	TDS	SO4	Hard	Ca	F	Na	ALKALINITY	NO3	CL	K	Mg
1	H_A135	269	10	198	40	1	40	182	65	35	2.3	23
2	H_C127	424	14	247	54	0.85	46	154	80	70	2.6	27
3	H_C128	880	32	266	56	0.95	101	266	55	234	2	30
4	L_A32	728	46	437	88	0.4	41	275	135	96	7.8	52
5	L_A185	644	10.5	266	51	0.44	51	184	90	99	16.1	33
6	L_D67	383	10.5	266	51	0.44	29	184	50	49	1.8	33
7	L_A180	401	14	247	48	0.45	26	194	60	49	0.8	31
8	J_E11A	1130	50	700	141	0.7	72	225	265	230	3.9	86
9	J_E11C	836	50	494	103	0.75	45	170	250	161	2.9	57
10	J_E11B	941	30	568	112	0.7	56	209	250	189	2.4	69
11	J_E156	689	30	355	64	0.8	120	215	105	147	4	46
12	J_E92	1126	90	588	120	0.6	170	307	230	224	32	69
13	J_E90	726	35	406	79	0.5	90	225	115	133	1.8	50
14	J_E4	435	38	300	60.5	0.8	40	164	100	84	27	35
15	J_D60	658	54	426	95	0.8	50	213	135	119	1.8	45
16	J_Nmr	680	40	274	60.5	0.9	120	225	250	125	5.1	29
17	G_R25A	1513	143	324	58	1.5	450	389	170	392	3.2	43
18	G-R25C	2775	280	496	87	1.5	570	451	215	840	5.5	55
19	G_R25B	1966	227	649	120	1	370	440	225	511	17	84
20	G_R25D	1873	180	263	49	1.9	460	410	105	480	3.3	33
21	G_R64	2346	124	243	48	2	490	451	85	725	2.5	29
22	G_R112	1586	132	357	67	2	370	307	125	490	6.7	46
23	G_R254	1500	125	263	54	1.5	372	348	85	434	3.9	31
24	G_R75	2270	192	436	91	1.65	460	399	135	686	3.3	50
25	G_R162G	1380	129	466	91	1	290	307	115	399	8.4	57
26	G_RDWN	485	21	266	56	0.9	30	195	90	70	2	30
27	G_D68	546	36	223	45	1.2	70	196	50	91	1.6	26
28	G_E157	612	22	266	56	0.9	52	195	80	105	2.1	36
29	G_E154	549	36	267	53	0.8	70	205	90	105	2	32
30	G_R162H	1633	95	446	80	1.2	340	332	195	469	7.8	60
31	G_R162H	2100	220	570	112	1	420	381	250	574	13.2	72
32	G_R162F											
33	G_R162C	1660	40	467	90.5	0.8	330	192	105	546	6.3	58
34	G_R162B	1653	70	558	116	0.8	300	229	150	539	5.3	64
35	G_R162E											
36	G_R162I	1160	77.5	408	88	0.8	106	297	135	259	3.4	63
37	G_R162I	953	44	437	90	0.85	87	234	135	238	2.2	51
38	D_SAHL4	488	47	182	34	0.8	90	178	150	112	0.8	23
39	D_SAHL5	533	87	233	43	0.7	79	232	130	112	1.8	27
40	D_J146	1560	176	234	41	1.7	380	258	80	511	3.2	31
41	D_S69	1213	162	230	46	1.7	300	221	60	399	3.6	28
42	Q_T44	3453	710	384	83	1.5	620	159	80	1295	5.2	43
43	Q_L179	1413	200	142	28.7	1.4	390	291	90	434	3.9	17
44	A_N9	3293	590	296	56	2.9	840	235	165	959	7.4	38
45	A_N22	3813	625	828	163	2.2	900	205	500	1069	7.8	91
46	S_M2A	3840	650	436	84	2.5	1058	266	225	1148	7.3	54
47	S_M2B	3923	610	265	61	2	610	272	90	1106	7.3	34.3
48	K_L176	1320	148	192	46	1.7	320	156	80	427	2.9	18.7
49	K_L41	2719	290	323	63	2.4	570	274	195	861	4.3	40
50	K_L87	2353	270	608	116	1	440	188	225	868	6.7	77
51	K_L43	1900	160	570	120	0.9	360	266	215	623	4.6	65
52	K_L127	1569	155	456	76	0.8	310	168	205	525	3.4	52
53	K_L159	1569	135	665	129	1	112	170	380	476	5.1	82
54	K_L86a	2195	100	912	192	0.33	360	246	550	681	6.3	104
55	K_L86b	953	93	163	33	1.7	250	164	90	350		7.6
56	R_P15	1893	176	382	72	0.9	340	170	115	560	7.2	49
57	R_L138	1193	78	213	52	0.85	240	161	65	385	21.6	31
58	R_P124	1213	85	345	72	0.9	200	161	100	371	11.4	43
59	R_CNDn	666	65	121	22	0.8	160	116	65	189	1.4	18
60	R_P10	3347	470	494	88	1.6	620	200	205	1190	6	46

FIUORIDE (PPM), 1999

Drinking Well in Gaza Strip



تركيز الفلوريد في آبار مياه الشرب لكافة محافظات غزة للعام ١٩٩٩

المحافظة	رقم البئر	تركيز الفلوريد
الشمالية	BH02	1.25
الشمالية	BH03	1.2
الشمالية	BH04	1.2
الشمالية	BH05	1.25
الشمالية	BH05	1
الشمالية	BL01	1.2
الشمالية	BL02	1.3
الشمالية	BL03	1.25
الشمالية	BL04	1.25
الشمالية	BL05	1.2
الشمالية	JB04	2.2
الشمالية	JB05	0.5
الشمالية	JB06	0.5
الشمالية	JB07	0.6
الشمالية	JB09	0.45
الشمالية	JB10	0.6
الشمالية	JB11	0.6
الشمالية	JB12	0.5
الشمالية	JB13	1.5
الشمالية	JB13	0.6
الشمالية	JB14	0.5
الشمالية	JB15	0.4
الشمالية	JB16	1.5
الشمالية	JB17	0.5
متوسط		1
غزة	GZ01	1.2
غزة	GZ02	1
غزة	GZ03	1
غزة	GZ04	1.1
غزة	GZ05	3
غزة	GZ06	1.5
غزة	GZ08	1.85
غزة	GZ09	1.3
غزة	GZ10	1.25
غزة	GZ11	1.3
غزة	GZ12	1.3
غزة	GZ13	1
غزة	GZ14	1.6
غزة	GZ15	1
غزة	GZ17	1.2
غزة	GZ18	1.1
غزة	GZ19	0.8
غزة	GZ20	0.88
غزة	GZ21	1.1
غزة	GZ22	1.1
غزة	GZ26	1.2
غزة	GZ27	1.6
غزة	GZ29	1.1
غزة	GZ30	1.1
متوسط		1.3

المحافظة	رقم البئر	تركيز الفلوريد
الوسطى	DR01	3
الوسطى	DR02	2
الوسطى	DR03	1.2
الوسطى	DR04	2.2
الوسطى	DR05	0.7
الوسطى	DR05	1.2
الوسطى	DR06	0.9
الوسطى	DR07	1.1
الوسطى	DR07	0.8
الوسطى	DR08	1
الوسطى	DR09	2.5
الوسطى	MG02	1.8
الوسطى	MG04	1.8
متوسط		1.4
خانيونس	KH01	1.9
خانيونس	KH04	1.72
خانيونس	KH05	0.9
خانيونس	KH06	2
خانيونس	KH08	1.9
خانيونس	KH07	2.8
خانيونس	KH08	2
خانيونس	KH09	2.5
خانيونس	KH11	4
خانيونس	KH13	0.75
خانيونس	KH14	3.8
خانيونس	KH15	0.85
خانيونس	KH16	0.7
خانيونس	AS01	3
خانيونس	AS02	3
خانيونس	QR01	1
خانيونس	QR02	0.8
متوسط		2
رفح	RF01	0.8
رفح	RF02	0.8
رفح	RF03	0.8
رفح	RF04	1
رفح	RF05	0.6
رفح	RF06	0.8
رفح	RF08	0.8
متوسط		0.8

Governerate	Name	Number
الشمال	جباليا-صلية	JB01
الشمال	جباليا-الوكالة٢	JB02
الشمال	جباليا-المجلس	JB03
الشمال	جباليا-ابو راشد	JB04
الشمال	جباليا-البهتيمي	JB05
الشمال	جباليا-الغزالي	JB06
الشمال	جباليا-الشنطي	JB07
الشمال	جباليا-الوكالة١٨	JB08
الشمال	جباليا-الوكالة٣٤	JB09
الشمال	جباليا-شرخ شرقي	JB10
الشمال	جباليا-شرخ غربي	JB11
الشمال	جباليا-عامر	JB12
الشمال	جباليا-مراد	JB13
الشمال	جباليا-تعمر الادارة	JB14
الشمال	ابو طاش جباليا-المجلس الجديد المعسكر	JB15
الشمال	جباليا-الترك	JB16
الشمال	جباليا-ابو شعبان	JB17
الشمال	بئر ابو حصيرة -تل الزعتر جباليا	JB18
جباليا	جباليا رقم ١ الوكالة الجديد	JB18
جباليا	جباليا رقم ٢ خليط الوكالة	JB19
خانيونس	خانيونس-صبة	KH01
خانيونس	خانيونس-الاحراش	KH02
خانيونس	خانيونس-الامل جديد	KH03
خانيونس	خانيونس-الامل قديم	KH04
خانيونس	خانيونس-التحلية الشرقي	KH05
خانيونس	خانيونس-الجديد الجنوبي	KH06
خانيونس	خانيونس-السطر	KH07
خانيونس	خانيونس-السعادة	KH08
خانيونس	خانيونس-الشرقي	KH09
خانيونس	خانيونس-الوكالة الجديد	KH11
خانيونس	خانيونس-سيكوريت	KH12
خانيونس	خانيونس-محطة تحلية السعادة	KH13
خانيونس	خانيونس-خزان ابو رشوان	KH14
خانيونس	ميراج ١-الشمالي-بني سهيلا	KH15
خانيونس	ميراج٢-الجنوبي-بني سهيلا	KH16
خانيونس	بئر ابو رشوان 8	KH17
خانيونس	ميراج ٣	KH17
خانيونس	بئر الشعبي	KH18
خانيونس	الارشوان ١	KH19
المغازي	المغازي-ابو عانم	MG01
المغازي	المغازي-بن سعيد	MG02
المغازي	المغازي-مسلم	MG03
الوسطى	المغازي الجديد	MG04
الوسطى	بئر الشرقاني-النصيرات	Ns01
الوسطى	بئر ابو فحص-النصيرات	Ns02
رفح	رفح-ابو زهري	RF01
رفح	رفح-البحر	RF02
رفح	رفح-الحشاش	RF03
رفح	رفح-الوكالة	RF04
رفح	رفح-رقم ١٥	RF05
رفح	رفح-شرقي ١٢٤	RF06
رفح	رفح-كريم شعير	RF07
رفح	رفح-كندا	RF08
رفح	رفح-مزرعة شعير	RF09
رفح	رفح المطار	RF11
رفح	الاسكان الصيد رفح	RF12

Governerate	Name	Number
خانيونس	عبسان ك-الدوار	AS01
خانيونس	[illegible] عبسان	AS02
الشمال	حانون العزبة	BH02
الشمال	حانون-ابو غزالة	BH03
الشمال	حانون-الصناعية	BH04
الشمال	بيت حانون-الاوقاف	BH05
الشمال	لاهيا-الشوا	BL01
الشمال	لاهيا-المشروع	BL02
الشمال	لاهيا-سلاطين قديم	BL03
الشمال	لاهيا-سلاطين جديد	BL04
الشمال	لاهيا-عين -	BL05
الوسطى	بئر البلدية الجديد-البريج	BR02
الوسطى	البريج-التبريزي	BR1
خانيونس	بني سهيلا-الغربي	BS01
خانيونس	بني سهيلا الشرقي	BS02
الوسطى	دير البلح-ابو ناصر	DR01
الوسطى	دير البلح-البشير	DR02
الوسطى	دير البلح-التحلية	DR03
الوسطى	دير البلح-بن سعيد ابو مروان	DR04
الوسطى	الساحل ٢	DR05
الوسطى	الساحل ٣	DR06
الوسطى	الساحل ٤	DR07
الوسطى	الساحل ٥	DR08
الوسطى	دير البلح-ابو حمام	DR09
الوسطى	بئر البركة ١	DR10
الوسطى	بئر البركة ٢	DR11
غزة	الصفاء٥-	DZ29
غزة	غزة-رضوان ١ جديد	GZ01
غزة	غزة-ابو رمضان	GZ02
غزة	غزة-الاشغال ٥جارن ٢	GZ03
غزة	غزة-الصفا ١	GZ04
غزة	غزة-الصفا ٢	GZ05
غزة	غزة-الصفا ٤	GZ06
غزة	غزة-الصوراني	GZ07
غزة	غزة-القصبين	GZ08
غزة	غزة-رضوان ١ قديم	GZ09
غزة	غزة-رضوان ١٠	GZ10
غزة	غزة-رضوان ١١	GZ11
غزة	غزة-رضوان ١٢	GZ12
غزة	غزة-رضوان ١٣	GZ13
غزة	غزة-رضوان ١٥	GZ14
غزة	غزة-رضوان ٧ جديد	GZ15
غزة	غزة-رضوان ٧ قديم	GZ16
غزة	غزة-رضوان ٨	GZ17
غزة	غزة-رضوان ٩	GZ18
غزة	غزة-عطلي ١	GZ19
غزة	غزة-عطلي ٢	GZ20
غزة	غزة-عطلي ٣	GZ21
غزة	غزة رضوان ٥	GZ22
غزة	غزة-رضوان ١٦	GZ27
غزة	غزة-الصفا ٣	GZ28
غزة	المسلخ الجديد	GZ30
غزة	بئر مضخة الزهراء	GZ31
غزة	الشيخ عجلين الجديد	GZ32
خانيونس	القرارة-الجديد	QR01
خانيونس	القرارة-القديم	QR02

Annex 14 (questionnaire in English)

1-Serial number:---------- 2-Date: / / 2003

3-Age:----------years old 4-Sex: ☐ 1-Male 2-Female

5-Address: Governorate : ☐ 1- North Gaza 2-Gaza 3-Midzone 4-Khanyounis 5- Rafah

City---------- Block---------- Building number------

6-Marital status: ☐ 1-Single 2-Engaged 3-Married 4-Others:----------

7-Father: Occupational level: ☐

1-Professional/Managerial
2-Technical/clerical
3-Businessman/landholder
4-Skilled worker Artisan
5-Partly skilled
6-Unskilled worker
7-Unemployed/Pensioner

Years of Educational : ☐ ☐

8-Mother: Occupational level: ☐

1-Householder
2-Working outsidehouse (paid)

Years of Educational : ☐ ☐

9-Current family monthly income: ----------NIS

10-Compared to previous years is the Current monthly income: ☐
1 Better 2 Worse 3 The same

11-Composition of child family(number of children):---------- Order of subject ----------

Toothpaste (during first 7 years of child age)

For child:

12-Do you brush your teeth by toothpaste? ☐ 1-Yes 2-No

13-If yes, In which age did you start to use toothpaste? ------- years old

14-Was the toothpaste fluoridated? ☐ 1-Yes 2-No 3-Do not Know

15-How many times aday did you brush your teeth? ----------times

16-How long time did you spend in brushing your teeth? ----------minutes

17-Does the toothpaste cover: ☐ l-all 2-half 3-part(pea size) of the head of brush.

18-Did you swallow the toothpaste? ☐ 1-Yes 2-No 3- Sometimes

19-Did you rinse your mouth well after brushing teeth? ☐ 1-Yes 2-No 3- Sometimes

For Mother

20-Did you clean your child teeth by toothpaste during his/her infancy? ☐ 1-Yes 2-No

21- Is the toothpaste you use now, fluoridated? ☐ 1-Yes 2-No

Fluoride tablets and supplements (during first 7 years of child age)

22-Have your child ever had fluoride tablets and supplements? ☐ 1-Yes 2-No

23-If yes, At which age? ----------years old 24-How many times?----------times

Knowledge	Child	Mother
25-Do you know, what is Dental fluorosis? 1-Yes 2-No	☐	☐
26-Have you ever recieved information about Dental fluorosis in Gaza? 1-Yes 2-No	☐	☐

Knowledge(cont.) Child Mother

27-If yes, from which sources? _____ _____

28-Do you know the causes of Dental fluorosis? 1-Yes 2-No ☐ ☐

29-If yes, what they are? _____ _____

_____ _____

30-Do you know what to do to prevent Dental fluorosis or minimize its severity? 1-Yes 2-No ☐ ☐

31-If yes, How? _____ _____

_____ _____

The WHO recommended the concentration of Fluoride in drinking water does not exceed 1.5 ppm.

32-Do you know what are fluoride in drinking-water advantages? 1-Yes 2-No ☐ ☐

33-Do you know what are fluoride in drinking-water disadvantages? 1-Yes 2-No ☐ ☐

Explanation for those who do not know

34-Do you prefer fluoride existence in drinking water? 1-Yes 2-No ☐ ☐

35-Do you interest in quality(contents) of toothpaste? 1-Yes 2-No ☐ ☐

36-if Yes, Do you know, if your toothpaste has fluoride or not? 1-Yes 2-No ☐ ☐

Air pollution

37- house is near: 1- Industry: ☐ 1- Yes 2-No if yes specify:_____

2- Main road ☐ 1- Yes 2-No

3- Dust ☐ 1- Yes 2-No

38- Heating system during winter 1-Coal: ☐ 1- Yes 2-No

2-Open fire: ☐ 1- Yes 2-No

3-Electrical: ☐ 1- Yes 2-No

4-Others: ☐ 1- Yes 2-No if yes specify:_____

For Mother

Baby formula

39-When did you start to use formula to child? _____month

40-What type of water did you use to reconstitute formula? ☐

1-Tap water 2-mineral water 3-desalted water

Breastfeeding

41-Did you provide exclusive Breastfeeding to your child for first 6 month of age? ☐

1-Yes 2-No

Fish consumption (during first 7 years of child age)

42-How many times did your child eat fish per month? _____times

Milk consumption (during first 7 years of child age)

43-When did your child start to have milk? ----------months

44-How many cups of milk did your child have a day? 1-3 years of old----------cups

4-7 years of age ----------cups

45-Was the milk: ☐ 1-Artificial milk 2-Animal milk 3- Artificial and Animal milk

46-if it was Artificial milk, What type of water did you use to reconstitute the Artificial milk? ☐

1-Tap water 2-mineral water 3-desalted water

Tea consumption (during first 7 years of child age)

47-When did your child start to have tea? ----------years old

48-How many cups of tea did your child have a day? 1-3yers of age----------cups

4-7years of age----------cups

49-How many spoons of sugar did you add for each cup of tea? ----------tea spoons

50- What type of water did you use to prepare the tea? ☐

1-Tap water 2-mineral water 3-desalted water

Nutrition status of child (during first 7 years of child age)

51-How do you describe the growth of your child during infancy? ☐

1-Normal 2-Underweight 3-Overweigh

52-How do you describe the growth of your child during his/her first 7 years of age? ☐

1-Normal 2-Underweight 3-Overweigh

53-How do you describe the consumption of your child for

	1- High	2- Moderate	3-Low
Animal Protein:(meet, chicken, fish, cheese)	----------	----------	----------
Plant Protein:			
-lentils, pumpkin seed ,sunflower seed	----------	----------	----------
-nuts, peas, beans, cereals:(rise, wheat. maize)	----------	----------	----------
Calcium (milk, yogurt, cheese)	----------	----------	----------
Vitamins(C)			
-Fruits (e.g. orange)	----------	----------	----------
Raisins	----------	----------	----------
Vegetables: (spinach, chilli)	----------	----------	----------

Public Perception for Dental fluorosis	Child	Mother
54-Does child have a problem with his/her teeth color?1-Yes 2-No	☐	☐
55-Does child accept his/her teeth appearance? 1-Yes 2-No	☐	☐
if no, because of 1- teeth color 2- other reasons	☐	☐
56-Does child desire to treat his/her teeth to have better appearance? 1-Yes 2-No	☐	☐

Public Perception (cont.)

	Child	Mother
57-What do you think about others with stained teeth? 1-Not good appearance 2-OK 3-Good appearance	☐	☐
58-Do you think that stained teeth (Dental fluorosis) affect aesthetic appearance and personality? 1-Yes 2-No	☐	☐
59-Does the child hide her/his smile? 1-Yes 2-No	☐	☐
60-Do you interest with your/child aesthetic appearance? 1-Yes 2-No	☐	☐
61-Do you concern with your/child teeth (dental fluorosis)? 1-Yes 2-No	☐	☐
62-Do you think children with white teeth appearance is more:		
Desirable as friends 1-Yes 2-No	☐	☐
Intelligence 1-Yes 2-No	☐	☐
Kind 1-Yes 2-No	☐	☐
Have better looking 1-Yes 2-No	☐	☐
63-Do you belief people with Dental fluorosis(stained teeth) Have:		
Lack social skills 1-Yes 2-No	☐	☐
Lower intelligence 1-Yes 2-No	☐	☐
Poor social adjustment 1-Yes 2-No	☐	☐
64-Are you satisfied with the color of your child teeth? 1-Yes 2-No		☐
65-Do you feel guilty about your child teeth color? 1-Yes 2-No		☐
66-Have you ever seek treatment for your child teeth color? 1-Yes 2-No		☐
67-If no, what did prevent you?	----------	
You know that Dental Fluorosis is a public health problem in Gaza strip		
68-Do you think that the government can find immediate solution for this problem? 1-Yes 2-No		☐
69-Are you ready to participate in solving the problem? 1-Yes 2-No		☐
70-If yes, the participation can be 1-Monetary 2-Not monetary		☐

DENTAL fluorosis

71- TFI score: ☐

72-Did you have water purification system (eg.OR) during first 7 years of your child age? ☐

1-Yes 2-No

73-Source of drinking water: ☐

1- Municipal well 2- private well 3- Municipal water network

74- Municipal well number ----------

75-Fluoride concentration in municipal well (average) ----------ppm.

Annex 15 (questionnaire in Arabic)

1- التسلسل الرقمي:..... 2- التاريخ: / / 2003

3- العمر: ..... 4- الجنس: ☐ 1-ذكر 2-أنثى

5- العنوان: المحافظة: ☐ 1-شمال غزة 2-غزة 3- المنطقة الوسطى 4-خانيونس 5- رفح

المدينة:..... القسيمة:..... رقم المنزل: .....

6- الحالة الاجتماعية: ☐ 1- عازب/ة 2- خاطب/ ة 3- متزوج /ة 4- أشياء أخرى.....

7- الأب: المستوى الوظيفي ☐

1-مؤهلون(أطباء،مهندسين،محاسبون،محامون)

2- مهن متوسطة(مدير،مدرس،كاتب إداري،موظف)

3- تاجر،مالك أراضى أو عقار

4- أصحاب مهارات(رئيس عمال،طباخ،

طابع على آلة كاتبة،سائق)

5- أنصاف المهرة(عامل،ميكانيكي،كهربائي)

6- غير مهرة(عمال نظافة،حراس)

7- لا يعمل / متقاعد.

عدد سنوات الدراسة: ☐ ☐

8- الأم: المستوى الوظيفي ☐

1- ربة منزل

2- تعمل خارج المنزل (بأجر)

عدد سنوات الدراسة: ☐ ☐

9- الدخل الشهري الحالي للأسرة: .....شيكل.

10- مقارنة بالسنين الماضية هل الدخل الشهري الحالي: ☐ 1- أفضل 2- أسوء 3- نفس الشيء

11- تركيبة الأسرة : (عدد الأطفال) :..... ترتيب الطفل بين اخوته:.....

معجون الأسنان (خلال السبع السنوات الأولى من عمر الطفل)

للطفـــل:

12- أ تفرشي أسنانك بمعجونُ الأسنان ؟ ☐ 1- نعم 2- لا

13- إذا نعم، في أي عمر بدأت استعمال معجون الأسنان؟ .....سنة.

14- أ كان معجون الأسنان يحتوي على فلوريد؟ ☐ 1- نعم 2- لا 3-لا اعلم

15- كم مرة في اليوم كنت تفرشي أسنانك ؟.....مرات

16- كم كنت تقضي من الوقت في تفر يش أسنانك ؟.....دقيقة

17- أيغطي معجون الأسنان: ☐ 1- كل 2- نصف 3- جزء (بحجم حبة الفاصوليا) من رأس الفرشاة.

18- ا كنت تبتلع معجون الأسنان ؟ 1- نعم 2-لا 3- أحياناً

19- أ كنت تمضمض فمك جيداً بعد تفرَ يش الأسنان ؟ ☐ 1- نعم 2- لا 3-أحيانا

لـــلأم:

20- أ كنت تنظفين أسنان طفلك بالمعجون خلال فترة الطفولة؟ ☐ 1- نعم 2- لا 3-أحيانا

21- هل يحتوى معجون الأسنان الذي تستعملينه الآن فلوريد؟ ☐ 1- نعم 2- لا

عقاقير وإضافات الفلوريد (خلال السبع سنوات الأولى من حياة الطفل)

22- أ تناول طفلك عقاقير أو إضافات فلوريد في حياته ؟ ☐ 1- نعم 2- لا

23- إذا نعم، في أي عمر ؟.....سنة

24- وكم مرة ؟ .....مرات

المعرفة

		الطفل	الأم
-25	أ تعلم ما هو التسمم الفلوري للأسنان ؟ 1- نعم 2- لا	☐	☐
-26	أ تلقيت معلومات عن التسمم الفلوري للأسنان من قبل في غزة؟ 1- نعم 2- لا	☐	☐
-27	إذا نعم، من أي مصدر؟	....	....
-28	أتعرف ما هي أسباب التسمم الفلوري للأسنان؟ 1- نعم 2- لا	☐	☐
-29	إذا نعم، ما هي؟	....	....
-30	اتعرف ما العمل لمنع أو تقليل شدة التسمم الفلوري للأسنان ؟ 1- نعم 2- لا	☐	☐
-31	إذا نعم ، كيف؟	....	....

توصي منظمة الصحة العالمية بأن لا يزيد تركيز الفلور في مياه الشرب عن 1.5 جزء بالمليون

-32	أتعرف ما مميزات وجود الفلور بمياه الشرب؟ 1- نعم 2- لا	☐	☐
-33	أتعرف ما مساوئ وجود نسبة عالية من الفلور بمياه الشرب ؟ 1- نعم 2- لا	☐	☐

شرح لمن لا يعرفوا

-34	هل تفضل وجود الفلوريد في مياه الشرب ؟ 1- نعم 2- لا	☐	☐
-35	هل تهتم بنوعية ومحتويات معجون الأسنان ؟ 1- نعم 2- لا	☐	☐
-36	إذا نعم، أتعرف إن كان معجون أسنانك يحتوي فلوريد أم لا ؟ 1- نعم 2- لا	☐	☐

لـــلأم:

تلوث الهواء

37- المنزل بجوار:1- مصنع: ☐ 1- نعم 2- لا (إذا نعم حدد.....)
2- طريق رئيسي: ☐ 1- نعم 2- لا
3- غبار (تراب): ☐ 1- نعم 2- لا

38- نظام التدفئة خلال الشتاء : 1-فحم ☐ 1- نعم 2- لا
2-حطب ☐ 1- نعم 2- لا
3-كهرباء ☐ 1- نعم 2- لا
4- أشياء أخرى ☐ 1- نعم 2- لا (إذا نعم حدد.....)

حليب الطفل (فورميولا)

39- متى بدأت بإعطاء حليب فورميولا لطفلك ؟ .....شهر

40- بأي نوع من الماء كنت تذيبي حليب فورميولا ؟ ☐
1- ماء الأنابيب 2- مياه معدنية 3- ماء منزوع الملح (مقطر)

الرضاعة الطبيعية

41- أ أرضعت طفلك رضاعة طبيعية فقط (مكثفة) خلال الست أشهر الأولى من عمره ؟ ☐ 1- نعم 2- لا

استهلاك السمك (خلال السبع سنوات الأولى من عمر الطفل)

42- كم مرة في الأسبوع كان طفلك يتناول السمك ؟.....مرات

استهلاك الحليب (خلال السبع سنوات الأولى من عمر الطفل)

43- متى بدأ طفلك بتناول الحليب ؟ .....شهر

44- كم كوب من الحليب كان يتناول باليوم ؟ 1-3 سنوات .....أكواب
4-7 سنوات.....أكواب

45- أ كان الحليب : ☐ 1- حليب صناعي 2- حليب طبيعي 3- حليب صناعي و طبيعي

46- إذا كان حليب صناعي، أي نوع من الماء كنت تستعملين لإذابة الحليب الصناعي ؟ ☐
1- ماء الأنابيب 2- مياه معدنية 3- ماء منزوع الملح (مقطر)

استهلاك الشاي (خلال السبع سنوات الأولى من عمر الطفل)

47- متى بدأ طفلك بتناول الشاي ؟.....سنة

48- كم كوب من الشاي كان يتناول باليوم ؟ 1-3 سنوات .....أكواب
4-7 سنوات.....أكواب

49- كم ملعقة سكر كنت تضيفي لكل كوب شاي؟ .....ملعقة شاي

50- بأي نوع من الماء كنت تحضرين الشاي ؟ ☐
1- ماء الأنابيب 2- مياه معدنية 3- ماء منزوع الملح (مقطر)

الوضع الغذائي للطفل (خلال السبع سنوات الأولى من عمر الطفل)

51- كيف تصفين نمو طفلك خلال فترة الطفولة ؟ ☐

1- طبيعي 2- قليل الوزن 3- زائد الوزن.

52- كيف تصفين نمو طفلك خلال السبع سنوات الأولى من عمره؟ ☐

1- طبيعي 2- قليل الوزن 3- زائد الوزن.

53- كيف تصفين استهلاك طفلك لـــ: 1- عالي 2- متوسط 3- منخفض

البروتين الحيواني: (لحم، دجاج ، سمك، جبن).	.....	.....	.....
البروتين النباتي: -عدس – بذر اليقطين – بذر عباد الشمس.	.....	.....	.....
-جوز-بندق-بازلاء- فاصوليا-حبوب : أرز ، قمح ، ذرة.	.....	.....	.....
كالسيوم: حليب ، لبن ، جبن.	.....	.....	.....
فيتامين (C) : الفواكه(مثلا: برتقال)	.....	.....	.....
الزبيب.	.....	.....	.....
الخضراوات (سبانخ ، فلفل حار).	.....	.....	.....

الإدراك الحسي العام للتسمم الفلوري للأسنان

الطفل | الأ

54- أيشعر الطفل بمشكلة من لون أسنانه ؟ 1- نعم 2- لا

55- أيقبل الطفل مظهر أسنانه ؟ 1- نعم 2- لا

إذا لا، بسبب 1- لون الأسنان 2- لاسباب أخرى

56- أيرغب الطفل بمعالجة أسنانه للحصول على مظهر أفضل؟ 1- نعم 2- لا

57- ما رأيك بالذين لديهم تلون بأسنانهم (تلون فلوري) ؟

1- مظهر ليس جيد 2- لا باس 3- مظهر جيد

58- أتعتقد تلون الأسنان (تسمم فلوري للأسنان) يؤثر بالمظهر الجمالي والشخصية ؟

1- نعم 2- لا

59- أيخفي الطفل ابتسامته ؟ 1- نعم 2- لا

60- أتهتم بمظهر الطفل الجمالي ؟ 1- نعم 2- لا

61- أتهتم بمظهر الأسنان (تسمم فلوري للأسنان) ؟ 1- نعم 2- لا

62- أتعتقد أن الأطفال ذوي الأسنان البيضاء أكثر:

مرغوب كصديق 1- نعم 2- لا

ذكـــــاء 1- نعم 2- لا

لطف 1- نعم 2- لا

يملك مظهر أجمل 1- نعم 2- لا

63- أتؤمن أن الناس الذين يعانون من التسمم الفلوري للأسنان (تلون الأسنان) يملكون:

نقص في المهارات الاجتماعية 1- نعم 2- لا

أقل ذكاء 1- نعم 2- لا

فقر في التوافق (القبول) الاجتماعي 1- نعم 2- لا

64- أ أنت راضية من لون أسنان طفلك ؟ 1- نعم 2- لا

65- أتشعرين بالذنب حيال لون أسنان طفلك؟ 1- نعم 2- لا

66- أ سعيت لمعالجة لون أسنان طفلك من قبل؟ 1- نعم 2- لا

67- إذا لا. ما الذي منعك ؟

.....

.....

ان التسمم الفلوري للأسنان (تلون الفلوري للأسنان) هو مشكلة صحية عامة في غزة

68- أ تعتقدي أن الحكومة تستطيع إيجاد حل سريع لهذه المشكلة ؟ 1- نعم 2- لا

69- أ أنت مستعدة للمشاركة في حل هذه المشكلة؟ 1- نعم 2- لا

70- إذا نعم ، 1- مشاركة مادية 2- مشاركة غير مادية

التسمم الفلوري للأسنان

71- درجة TFI ☐

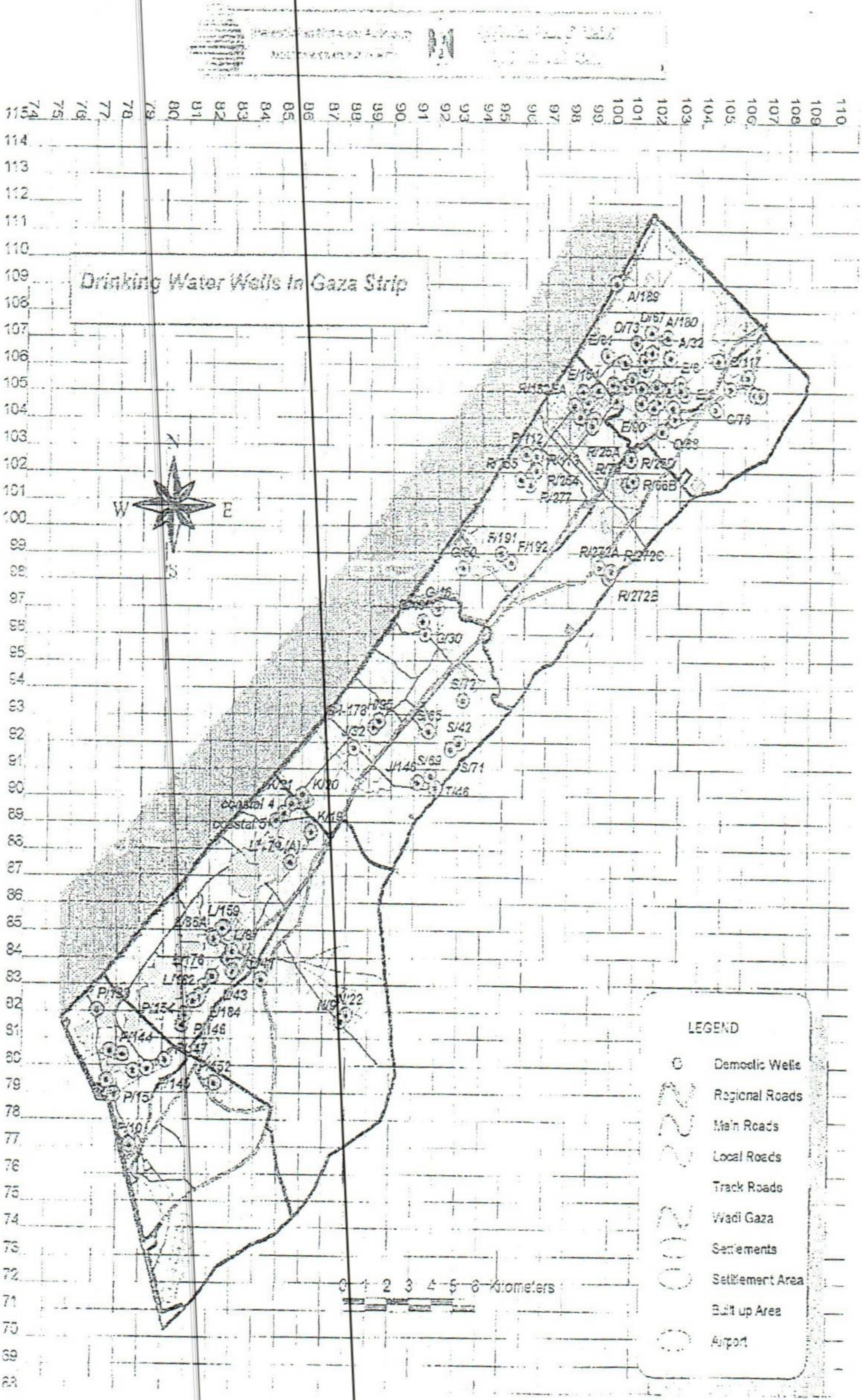
72- أ كنت تملك جهاز تنقية للماء خلال السبع سنوات الأولى من عمر طفلك ؟ ☐
1- نعم 2- لا

73- مصدر مياه الشرب : ☐ 1-آبار البلدية 2-بئر خاص 3- شبكة آبار البلدية

74- رقم بئر البلدية .....

75- تركيز الفلور في بئر البلدية (معدل) ..... جزء بالمليون.

Annex 16


Drinking Water Wells In Gaza Strip
LEGEND
Democlic Wells
Regional Roads
Main Roads
Local Roads
Track Roads
Wadi Gaza
Settlements
Settlement Area
Built up Area
Airport
Kilometers
W
E
S

Chronology of the human dentition*

	Tooth		Formation of enamel matrix and dentine begins	Amount of enamel matrix formed at birth	Enamel completed	Emergence into oral cavity	Root completed
Primary dentition	Maxillary	Central incisor	4 mo. in utero	Five-sixths	1½ mo.	7½ mo.	1½ yr.
		Lateral incisor	4½ mo. in utero	Two-thirds	2½ mo.	9 mo.	2 yr.
		Canine	5 mo. in utero	One-third	9 mo.	18 mo.	3¼ yr.
		First molar	5 mo. in utero	Cusps united	6 mo.	14 mo.	2½ yr.
		Second molar	6 mo. in utero	Cusp tips still isolated	11 mo.	24 mo.	3 yr.
	Mandibular	Central incisor	4½ mo. in utero	Three-fifths	2½ mo.	6 mo.	1½ yr.
		Lateral incisor	4½ mo. in utero	Three-fifths	3 mo.	7 mo.	1½ yr.
		Canine	5 mo. in utero	One-third	9 mo.	16 mo.	3¼ yr.
		First molar	5 mo. in utero	Cusps united	5½ mo.	12 mo.	2¼ yr.
		Second molar	6 mo. in utero	Cusp tips still isolated	10 mo.	20 mo.	3 yr.
Permanent dentition	Maxillary	Central incisor	3 - 4 mo.	----------	4 - 5 yr.	7- 8 yr.	10 yr.
		Lateral incisor	10 -12 mo.	----------	4 - 5 yr.	8- 9 yr.	11 yr.
		Canine	4 - 5 mo.	----------	6 - 7 yr.	11-12 yr.	13-15 yr.
		First premolar	1½- 1¾ yr.	----------	5 - 6 yr.	10-11 yr.	12-13 yr.
		Second premolar	2 - 2¼ yr.	----------	6 - 7 yr.	10-12 yr.	12-14 yr.
		First molar	At birth	Sometimes a trace	2½- 3 yr.	6- 7 yr.	9-10 yr.
		Second molar	2½- 3 yr.	----------	7 - 8 yr.	12-13 yr.	14-16 yr.
		Third molar	7 - 9 yr.	----------	12 -16 yr.	17-21 yr.	18-25 yr.
	Mandibular	Central incisor	3 - 4 mo.	----------	4 - 5 yr.	6- 7 yr.	9 yr.
		Lateral incisor	3 - 4 mo.	----------	4 - 5 yr.	7- 8 yr.	10 yr.
		Canine	4 - 5 mo.	----------	6 - 7 yr.	9-10 yr.	12-14 yr.
		First premolar	1¾- 2 yr.	----------	5 - 6 yr.	10-12 yr.	12-13 yr.
		Second premolar	2¼- 2½ yr.	----------	6 - 7 yr.	11-12 yr.	13-14 yr.
		First molar	At birth	Sometimes a trace	2½- 3 yr.	6- 7 yr.	9-10 yr.
		Second molar	2½- 3 yr.	----------	7 - 8 yr.	11-13 yr.	14-15 yr.
		Third molar	8 -10 yr.	----------	12 -16 yr.	17-21 yr.	18-25 yr.

*From Logan, W. H. G., and Kronfeld, R.: Development of the human jaws and surrounding structures from birth to the age of fifteen years, J.A.D.A. 20:379, 1933; slightly modified by McCall and Schour.

Annex 17

The drinking water wells which serving the selected clusters in the study sample at all Gaza governorates with their average fluoride concentration for three years (1988, 1995, and 2002):

North Gaza (one cluster)

GHABEN (A-180) / MASHROA (A-185) / SALATIN (D-73) / SALATIN (D-67) / EL SHAWA (E-6). The average Fluoride concentration of this network equals .80 ppm

Gaza City (two clusters)

- RODWAN WELLS: 3 (R-162-b) / 4 (R-162-c) / 9 (E-157) / 10 (D-68) / 11 (D-69) / 12 (D-70) / 15 (D-75) / 16 (D-76). The average Fluoride concentration of this network equals 1.2 ppm
- SAFA WELLS: 1 (R-25-B) / 2 (R-25-a) / 3 (GZ28) / 4 (R-25-d). The average Fluoride concentration of this network equals 1.4 ppm

Midzone (one cluster)

BALAH1 (J-146) / BALAH2 (S-69) / ELBERKA1 (K-20) / ELBERKA2 (K-21) / ABOHAMAM (D-46) / TAHLIA (R-25-1). The average Fluoride concentration of this network equals 1.4 ppm

Khan-Younis (two clusters)

- ELMERAJ WELLS: 1 (KH15) / 2 (KH16) / 3 KH17) + MAKAROT (KH12). The average Fluoride concentration of this network equals .8 ppm
- SAADA (L-87) / JANOPY (L-176) / ABORASHWAN WELL 2 (L-1-286). The average Fluoride concentration of this network equals 1.5 ppm

Rafah (one cluster)

RAFAH UN (P-10) / GHARBI (P-15) / SHARKI (P-124) / ZOHRY (L-138) / SEA (P-139) / KANADA (P-144) / EL HSHASH (P-145). The average Fluoride concentration of this network equals .92 ppm