

AMERICAN UNIVERSITY OF BEIRUT

ASSESSMENT OF
DENTAL DECAYS AND ORAL HYGIENE
IN ELEMENTARY SCHOOL CHILDREN IN BEIRUT:
A COMPARISON BETWEEN PRIVATE AND PUBLIC
SCHOOLS

by

CELINE MAROUN MOUKARZEL

A thesis

Submitted in partial fulfillment of the requirements
for the degree of Master of Science in Epidemiology
to the Department of Epidemiology and Population Health
of the Faculty of Health Science
at the American University of Beirut

Beirut, Lebanon
October, 2012

AMERICAN UNIVERSITY OF BEIRUT

ASSESSMENT OF

DENTAL DECAYS AND ORAL HYGIENE

IN ELEMENTARY SCHOOL CHILDREN IN BEIRUT:

A COMPARISON BETWEEN PRIVATE AND PUBLIC

SCHOOLS

By

CELINE MAROUN MOUKARZEL


Approved by:



Dr. Miran Jaffa, Assistant professor
Epidemiology and Population Health
Advisor



Dr. Mônica Chaaya, Professor and Chair
Epidemiology and Population Health
Co-advisor



Dr. Joseph Ghafari, Professor and Head
Orthodontics and Dentofacial Orthopedics
Member of Committee



Mrs. Mayada Kanj, Instructor
Health Promotion and Community Health
Member of Committee

Date of thesis/dissertation defense: October 3, 2012

AMERICAN UNIVERSITY OF BEIRUT

THESIS RELEASE FORM

I, Celine Maroun Moukarzel

authorize the American University of Beirut to supply copies of my thesis to libraries or individuals upon request.

do not authorize the American University of Beirut to supply copies of my thesis to libraries or individuals for a period of two years starting with the date of the thesis defense.

Signature

Date

ACKNOWLEDGMENTS

I wish to express my sincere gratitude to everyone who has supported me for the past two years and made it possible for me to complete this thesis.

Special thanks to my great teacher and advisor, Dr. Miran Jaffa, for her unwavering support, encouragement, her infinite patience and for sharing her knowledge with me. I would like to extend my gratitude to Dr. Monique Chaaya for her constant kindly support and insightful guidance.

I would also like to thank Dr. Joseph Ghafari who introduced me to scientific thinking and showed faith in my work. He has inspired and guided me with his vast experience and visionary approach.

Special thanks to all the Department of Orthodontics and Dentofacial Orthopedics at AUBMC for their help and assistance.

Mr. Khalil Asmar, thank you for your precious advice and help, Mrs. Mayada Kanj, thank you for being part of this journey.

I am also thankful for Ajjalouna NGO who facilitated my work in the field and for their great help.

My sincere gratitude goes to my parents and all my friends who highly contributed to my work and for their unlimited support. Thanks are also due to Ms. Asma Shihab for her continuous assistance.

AN ABSTRACT OF THE THESIS OF

Celine Maroun Moukarzel for Master of Science
Major: Epidemiology

Title: Assessment of dental decays and oral hygiene in elementary school children in Beirut: a comparison between private and public schools.

Objective: To assess the decays and oral hygiene status in a sample of 6-11 years elementary school children in Beirut in terms of prevalence and associated factors.

Methods: A comparative cross-sectional study of elementary school children aged from 6-11 years old, grades 2 to 5, in public and private schools in Beirut-Lebanon. The units of observation were both the child and the parents. The final study sample included 655 children from 2 public and 5 private schools in Beirut. The data were collected from 2 main sources: a dental screening of the children where the DMFT (Decayed, Missing, Filled Teeth) and plaque indices were recorded and a questionnaire completed by the parents. This survey addressed 5 sections including socio-demographic background, health status, oral hygiene habits and nutritional habits, to assess potential risk factors that could be associated with oral health. Descriptive analysis, bivariate and multivariable analyses were conducted to detect differences between schools and to test for associations between risk factors and DMFT and plaque indices.

Results: The mean DMFT was 7.50 ± 3.98 in public school children compared to 3.50 ± 3.41 in private school participants ($p \leq 0.0001$). The mean plaque index was also higher in public schools, the difference being statistically significant with private schools ($p \leq 0.0001$). Similarly, the educational level of the parents and the monthly family income were lower in public schools compared to private schools ($p \leq 0.0001$). Feeding mode, maternal smoking during pregnancy were also found to be statistically significantly different between school groups. The frequency of teeth brushing was remarkably higher in private schools, whereas the frequency of sweets and soda consumptions scored higher in public schools. The bivariate analysis showed that children from low socio-economic and educational backgrounds have greater DMFT and plaque indices compared to those of higher socio-economic and educational backgrounds who had higher frequency of teeth brushing and lower frequency of soda and sweets. The multivariable analysis showed that the oral health perception, the feeding mode and the school type were associated with the DMFT index whereby a bad oral health perception is correlation with a higher DMFT and bottle-feeding with a lower DMFT compared to breast-feeding. The plaque index was found to be associated with the oral health perception, a higher index being linked with bad oral health perception compared to a good one.

Conclusion: The DMFT score in Lebanon is high, particularly in public schools, when compared to Europe and the United States. The rather alarming number, urge early detection and early interventions to prevent further complications and their effect on oral health. Of recognized major impact would be the development of educational programs to increase awareness about oral health issues that are not followed by Lebanese children in mid-childhood, especially the disadvantaged ones and thus to decrease the prevalence of dental decays. Also, parents of limited means should be informed of the availability of clinics that provide low-cost services for dental health. Finally, more research is needed to encompass epidemiologic studies of a wider scope of children at various ages, and ultimately gauge potential implementation of third party assistance in treatment costs as part of an overhaul of public health policies regarding oral health.

CONTENTS

| | PAGE |
|--|------|
| ACKNOWLEDGMENTS..... | V |
| ABSTRACT..... | VI |
| FIGURES..... | XII |
| TABLES | XIV |
| Chapter | |
| I. INTRODUCTION..... | 1 |
| II. LITERATURE REVIEW..... | 6 |
| A. Definition and Etiology of Dental Caries..... | 6 |
| 1. Anatomy of the Human Dentition..... | 6 |
| 2. Definition of Dental Caries..... | 6 |
| 3. Etiology of Dental Caries..... | 7 |
| a. Host (teeth)..... | 7 |
| b. Substrate (diet)..... | 8 |
| c. Flora (bacteria)..... | 8 |
| B. Diagnosis of Dental Caries..... | 8 |
| 1. Clinical..... | 8 |
| 2. Radiographic..... | 9 |
| C. Classification of Dental Caries..... | 9 |
| D. Epidemiology of Dental Caries..... | 10 |
| 1. At the Global Level..... | 10 |
| 2. At the Regional Level: MENA Region..... | 10 |
| 3. At the Local Level: Lebanon..... | 11 |
| E. Risk Factors of Dental Decays..... | 12 |
| 1. Age..... | 12 |
| 2. Gender..... | 12 |
| 3. Geography..... | 12 |
| 4. Socio-Economic Status (SES)..... | 13 |
| 5. Nutrition..... | 14 |

| | |
|--|-----------|
| 6. Health Status..... | 14 |
| 7. Maternal Smoking..... | 14 |
| F. Complications of Dental Caries..... | 15 |
| 1. Impact on General Health..... | 15 |
| 2. Economic Impact of Dental Caries..... | 16 |
| G. Prevention and Awareness of Dental Decays..... | 17 |
| 1. At the Community Level..... | 17 |
| a. Water Fluoridation..... | 18 |
| b. Oral Hygiene Promotion..... | 19 |
| c. School-based Interventions..... | 19 |
| 2. At the Individual Level..... | 19 |
| H. Summary..... | 19 |
| III. METHODOLOGY..... | 21 |
| A. Study Design | 21 |
| B. Sample Size and Selection | 21 |
| C. Measures | 23 |
| D. Data Collection | 24 |
| E. Statistical Analysis | 26 |
| F. Ethical Considerations | 27 |
| 1. Respect for Person..... | 27 |
| 2. Beneficence/Non-Maleficence..... | 27 |
| 3. Justice..... | 28 |
| IV. RESULTS..... | 29 |
| A. Frequency Analysis: Comparison Between Private and Public Schools..... | 29 |
| 1. Sociodemographic Characteristics..... | 29 |
| 2. Health Status Characteristics of the Child..... | 30 |
| 3. Oral Hygiene Characteristics..... | 31 |
| 4. Nutritional Habits Characteristics..... | 31 |
| 5. Oral Health..... | 32 |

| | |
|--|----|
| B. Bivariate Analysis: DMFT and Plaque Indices..... | 33 |
| 1. DMFT..... | 33 |
| a. Sociodemographic Characteristics..... | 34 |
| b. Health Status Characteristics of the Child..... | 34 |
| c. Oral Hygiene Characteristics..... | 35 |
| d. Nutritional Habits Characteristics..... | 35 |
| 2. Plaque Index..... | 35 |
| a. Sociodemographic Characteristics..... | 35 |
| b. Health Status Characteristics of the Child..... | 36 |
| c. Oral Hygiene Characteristics..... | 36 |
| d. Nutritional Habits Characteristics..... | 37 |
| C. Multivariable Analysis | 37 |
| 1. Multiple Regression | 38 |
| a. DMFT Index..... | 38 |
| b. Plaque Index..... | 39 |
| 2. Generalized Estimating Equation (GEE) Analysis: | |
| Clustering Effect | 40 |
| a. DMFT Index..... | 40 |
| b. Plaque Index..... | 41 |
| 3. General Linear Model (GLM) Analysis..... | 41 |
| D. Consented Versus Non Consented in the Public Schools..... | 42 |
| | |
| V. DISCUSSION | 42 |
| A. Epidemiology of Dental Caries | 44 |
| B. Factors Associated with Dental Caries | 47 |
| C. Strengths and Limitations | 50 |
| D. Impact of this Study at the National Level | 51 |
| | |
| VI. CONCLUSION AND RECOMMENDATIONS | 52 |

REFERENCES76

Appendices.....83

I. Consent form for public school parents.....83

II. Consent form for private school parents.....84

III. Questionnaire.....85

IV. Assent form for school children.....90

ABBREVIATIONS

| | |
|---------|--|
| AFRO | African Region |
| AMRO | American Region |
| AUBMC | American University of Beirut Medical Center |
| COHRQoL | Child Oral Health-Related Quality of Life |
| DMFT | Decayed, Missing, Filled Teeth |
| ECC | Early Childhood Caries |
| IL-1 | Interleukin-1 |
| MENA | Middle East and North Africa |
| NGO | Non-Governmental Organization |
| NHANES | National Health and Nutrition Examination Survey |
| PI | Plaque Index |
| SES | Socio Economic Status |
| SHS | Second Hand Smoking |
| US | United States (of America) |
| WHO | World Health Organization |

FIGURES

| Figure | Page |
|---|------|
| 1. Black's classification of dental caries | 72 |
| 2. Changing levels of dental caries experience (DMFT) among 12-year-olds in developed and developing countries | 73 |
| 3. DMFT for 12 years old children | 74 |
| 4. Examining kit | 75 |

TABLES

| Table | Page |
|---|------|
| 1. Percent distribution of students aged 6-11 by socio-demographic Characteristics and type of school..... | 57 |
| 2. Percent distribution of students aged 6-11 by health status characteristics and type of school..... | 57 |
| 3. Percent distribution of students aged 6-11 by oral hygiene characteristics and type of school..... | 58 |
| 4. Percent distribution of students aged 6-11 by nutritional habits characteristics and type of school..... | 58 |
| 5. Percent distribution of students aged 6-11 by DMFT index and type of school..... | 59 |
| 6. Percent distribution of students aged 6-11 by plaque index and type of school..... | 59 |
| 7. Association of DMFT and socio-demographic characteristics..... | 60 |
| 8. Association of DMFT and health status characteristics..... | 60 |
| 9. Association of DMFT and oral hygiene characteristics..... | 61 |
| 10. Association of DMFT and nutritional habits characteristics..... | 61 |
| 11. Association of plaque index and socio-demographic characteristics..... | 62 |
| 12. Association of plaque index and health status characteristics..... | 62 |
| 13. Association of plaque index and oral hygiene characteristics..... | 63 |
| 14. Association of plaque index and nutritional habits characteristics..... | 63 |
| 15. Multiple regression analysis for associations between DMFT and other variables..... | 64 |
| 16. Multiple regression analysis for associations between DMFT and other variables including schools ID..... | 65 |
| 17. Multiple regression analysis for associations between plaque index and other variables..... | 66 |
| 18. Multiple regression analysis for associations between plaque index and other variables including schools ID..... | 67 |
| 19. Generalized Estimating Equation (GEE) analysis for clustering effect at school ID level for the DMFT index..... | 68 |
| 20. Generalized Estimating Equation (GEE) analysis for clustering effect at school ID level for the plaque index..... | 69 |
| 21. GeneralLinear Model (GLM) analysis for plaque and DMFT indices..... | 70 |
| 22. Percent distribution of those who consented and those who did not in public schools for the DMFT index..... | 71 |
| 23. Percent distribution of those who consented and those who did not in public schools for the plaque index..... | 71 |
| 24. Percent distribution of those who consented and those who did not in public schools for age..... | 71 |
| 25. Percent distribution of those who consented and those who did not in public schools for gender..... | 71 |

CHAPTER I

INTRODUCTION

"Oral health is a standard of the oral and related tissues which enables an individual to eat, speak and socialize without active disease, discomfort or embarrassment and which contributes to general well-being" (WHO, 1982).

Dental caries are the most prevalent form of oral disease (WHO, 2009). Dental or tooth decay, also known as cavity, is an infectious disease that affects people from all ages (Pitts, 2004). Usually from bacterial origin, the disease causes demineralization of the hard tissues and destruction of the organic matter of the tooth, through a production of acid by hydrolysis of the food debris accumulated on the tooth surface. The two bacteria most commonly responsible for dental cavities are *Streptococcus mutans* and *Lactobacillus* (Reich et al., 1999).

A range of behavior-related factors is associated with caries prevalence encompassing such components as oral hygiene, diet and fluoride intake. Moreover, oral health also can be affected by a number of non-modifiable variables such as age, gender, geographic location, socio-economic background and general health status (Cleaton-Jones et al., 1984; Kaste et al., 1996; Winn et al., 1996; Reed, 2006; Demakakos et al., 2008; Sabbah et al., 2009; Ur Rehman et al., 2008; Brosky, 2007; Neville et al., 2002).

Indeed, the prevalence of dental caries increases with age and females have a tendency for a higher number of decays compared to males (Reed, 2006; Kaste et al., 1996), and lessened oral health motivations (Demakakos et al., 2008). Studies also showed that children whose parents/households are poorly integrated in society and have

no social networks appeared to have poorer dental health compared to those with higher socio-economic and educational backgrounds (Edelstein, 2002; Varenne et al., 2011).

Dental health is also affected by certain medical conditions, medications and treatments. Increased rates of decays have been associated with medical conditions that decrease the amount of saliva produced in the mouth, some medications such as antihistamines and antidepressants, and radiation therapy to the head and neck (Neville et al., 2002; Brosky, 2007). Smoking during pregnancy has also been associated with an increased rate of dental decays among children (Takashi et al., 2011). At a biological level, a considerable role has been demonstrated for host genes in the development of the carious disease (Rishi et al. 2008).

Carious lesions can be classified in different ways according to their anatomical site (Thomas G. Black, 1857). The impact of dental caries varies from mild to severe, depending on the decay development and progression. At initial stages, when the lesion is limited to the enamel, dental caries evolve with no symptoms. When the decay progresses and reaches the dentin, symptoms may include toothache or sensitivity to hot or cold foods and beverages. At a more advanced stage, if left untreated, the decay reaches the pulp and more severe symptoms develop such as spontaneous pain and swelling (Means, 2003; Thomas et al., 2002). Early childhood caries (ECC) referred to Baby Bottle Tooth Decay, can be rapidly formed resulting in extreme pain and discomfort, difficulty in chewing and poor nutrition, below average weight, spread of infection and extensive and costly dental treatment (Acs et al., 1999). In severe cases, children's quality of life and growth could be affected; speech development problems, psychological problems,

behavioral and social interaction problems, as well as lost of school days and learning difficulties have been reported (Majewski et al. 1988).

Two indices referred to as DMFT and plaque indices are typically used to assess oral health. Specifically DMFT index (D: number of decayed teeth, M: number of missing or extracted teeth, F: number of filled teeth), is used to record the incidence and prevalence of dental caries, whereas, the plaque index is used to assess oral hygiene and periodontal health (Silness and L oe, 1964).

The studies that were conducted in Lebanon have all shown high rates of dental decays among adults as well as among children (an average of 90% of adults, children and adolescents are affected by dental caries) (Doughan et al., 1995, 1996). This indicated that dental caries could be considered a significant oral health disease in the Lebanese community. It is worth mentioning in this context that, despite that some studies were conducted in Lebanon, no recent ones were undertaken and the data have not been updated in the last decade. More importantly, no recent studies were conducted in elementary school children to assess oral health and its associated risk factors comparing public and private schools in Beirut in order to evaluate the influence of social disparities on the development of dental caries and estimation of oral health.

The aim of this study is to assess the decays, oral hygiene status and factors that could be associated with oral health in a sample of 6 to 11 years old elementary school children in Beirut comparing between private and public schools.

Significance:

Despite the availability of some studies that were conducted in Lebanon on oral health; the specific age group we are focusing on has not been specifically targeted. More importantly we assess potential risk factors that had not been investigated previously such as smoking, a novel determinant thought to contribute to decays. In this context, and despite the presence of a legislation in Lebanese law that institutes the mandatory oral examination among children in public schools, this regulation is not yet strictly implemented. Hence we believe that conducting such a study is of great significance to our children to set the stones and lay the foundations for future bigger studies. Specifically building this oral health database and making it accessible for other investigators, raising the level of awareness on oral health and hygiene among children, schools and parents and implementing potential eventual third party participation in providing access to dental care, through prevention and/or treatment of oral disease, all lend support to the significance of this project.

Objectives:

- 1- Measure and compare the DMFT and plaque indices between private and public schools.
- 2- Investigate the association between DMFT and plaque indices and demographic factors that encompass age, gender, school grade, socioeconomic status, education, occupation and annual income of the parents.

- 3- Assess if behavioral background of both children and parents that comprises smoking, maternal smoking during pregnancy, and nutritional habits are all associated with DMFT and plaque indices.
- 4- Use the collected oral health data to establish a comprehensive database that will be used in future studies by other investigators that are addressing this specific public health problem.

Hypothesis:

Higher DMFT and plaque indices will be detected in public versus private schools and in lower versus upper socioeconomic backgrounds. Further, we anticipate that those with bad oral hygiene and unhealthy dietary habits including maternal smoking will exhibit an increase in the DMFT and plaque indices in comparison to their opposite counterparts.

CHAPTER II

LITERATURE REVIEW

A. Definition and Etiology of Dental Caries

1. Anatomy of the Human Dentition

The human dentition consists of two sets of teeth: 20 deciduous (primary) and 32 permanent (secondary) teeth including the third molars or wisdom teeth.

Arranged in the upper and lower jaws, four types of teeth form in the permanent dentition: eight incisors, four canines, eight premolars, and twelve molars including the third molars. Each tooth is divided into two parts: a visible crown and a root embedded in bone.

2. Definition of Dental Caries

Dental caries (decay, cavity) is a bacterial disease that affects people of all ages and is common in both developed and developing countries (Pitts, 2004; Featherstone, 2000).

Oral bacteria feed on sugar from foods and drinks that we consume to produce acids that demineralize the tooth surface (Griffin et al., 2005). It is a dynamic process: periods of demineralization alternate with phases of remineralization. When destruction exceeds repair, the subsurface carious lesion becomes a blunt clinical cavity that is characterized by a breakdown of surface enamel and extension of the decay into the dentin (Rolla & Saxegaard, 1990; Dawes, 1989).

3. Etiology of dental caries

Dental caries are the result of the interaction between a susceptible tooth, a dietary substrate (sugar), a chronic bacterial infection, and time. To develop, the disease needs a susceptible host, a cariogenic bacterial flora, and the bacteria need a substrate (usually refined carbohydrates), which can be metabolized to produce acid (Reich et al, 1999). These acids cause the demineralization of the hard tissue of the teeth- enamel, dentin, and cementum. Without intervention, this demineralization and later bacterial invasion of the hard tissue will result in a pulp infection, leading to loss of vitality and even extraction in more severe cases.

a. Host (teeth)

The enamel surface of each tooth is formed mainly of calcium, phosphate and hydroxyapatite. It is porous and prone to demineralization. Tooth susceptibility differs from one person to another depending on:

1. Hereditary factors: play a role in the determination of the shape and size of the teeth.
2. Saliva: has a vital role in the demineralization and remineralization process. It differs from one host to another and in certain cases where specific medications are taken or radiotherapy is undergone, the salivary effect of protection can be reduced leading to an increased risk of dental caries (Featherstone and O'reilly, 1986).

b. Substrate (diet)

Fermentable carbohydrates (sugars or cooked starches) are dietary components that contribute the most to the caries process (Edgar, 1981). Food clearance is also an important factor to take into consideration: the longer the nutrients are present in the oral cavity the more acid is produced (Hefferenn, 1986).

In subjects with normal salivary function, an acid threat occurs 10 to 15 minutes after the consumption of fermentable carbohydrates and lasts for 60 minutes. Thus, an increased time between meals allows less frequency of acid attacks, helping remineralization to occur.

c. Flora (Bacteria)

The oral cavity may be colonized by 500 different species and any individual may typically harbor 150 or more different species (Lindhe, 2003), but only a few specific species of bacteria cause dental caries: *Streptococcus mutans*, *Lactobacillus spp.*, *Veillonella spp.* and *Actinomyces spp.* Studies have shown the *Streptococcus mutans* plays a major role in the fermentation of sucrose to produce important amounts of acid (Rogers, 2008).

B. Diagnosis of Dental Caries

1. Clinical

The traditional method for detection of carious lesions involves inspection of all visible tooth surfaces, using a dental mirror and a sharp explorer. An artificial light source and air-drying of the tooth improve visibility. Although inaccurate, the sensitivity

and specificity of this technique depends on the experience of the dentist (Huysmans et al. 1998).

2. Radiographic

The clinical visual approach is usually supplemented by the radiographic identification of lesions on the hidden surfaces between adjacent teeth (interproximal caries) or recurrent caries under a restoration. Small lesions unlike large decayed areas can be difficult to identify. Good diagnosis requires a bitewing projection to minimize overlap of the teeth. This method is the most accurate radiological technique (Scarfe et al. 1994).

C. Classification of dental caries

Cariou lesions can be classified in different ways:

- according to their anatomical site: Thomas G. Black in 1857 came out with the first classification of caries lesions that is still used nowadays. (Figure 1)
- according to their activity: an active carious lesion is a progressive lesion while an arrested or inactive carious lesion is described as a lesion that may have formed earlier and then stopped

D. Epidemiology of dental caries

1. At the Global Level

Dental caries are of a great public health concern worldwide, and are the most prevalent form of oral disease (World Health Organization, 2009). In industrialized countries, 60 to 90% of children and the majority of adults suffer from dental caries (World Health Organization, 2003). Developing countries suffer more from this burden due to a lack in accessing dental care and thereby, extraction treatments are preferred to restorations.

Currently, the disease level is high in America compared to Africa where it is relatively low. However an increase in the prevalence of dental caries especially in Africa is expected due to a higher consumption of sugars and inadequate exposure to fluorides (World Health Organization, 2003).

In the permanent dentition of 12-year olds, two distinct trends can be seen: a decrease in the prevalence of dental caries in developed countries, and an increase in the prevalence of the disease in some developing countries more likely caused by a higher sugar consumption and inadequate amounts of fluoride. However, the prevalence of dental caries remains high in many developed countries. (Figure 2)

2. At the Regional Level: MENA Region

In the Eastern Mediterranean Region, dental caries prevalence rates among children are high for some countries (Saudi Arabia, Lebanon) whereas other countries show lower levels (Oman, Libya). The pattern highly reflects the distinct lifestyles in

health, the level of exposure to fluorides and development of oral health systems. (Figure 3)

3. At the Local Level: Lebanon

In the Lebanese population, the available studies showed that in 1993, 93% of children, 12 to 15 years old were affected by dental caries with a DMFT score of 5.7 (Nithila et al., 1998) and in 1996, the DMFT score was 5.0 for 12-year olds and 7.6 for 15-year olds and 92% of the 12 years old and 94% of the 15 years old were affected by dental caries (Hussein et al., 1996). In 2002, Doughan et al. showed that the DMFT index was 5.72 and 8.09 for the 12 and 15years-old children respectively and that the DMFT index increased with age. For the 6 years-old children, the DMFT index was 5.4 with a higher incidence for boys compared to girls. The 12 years-old group showed also a higher incidence for boys and for the 15 years-old group, girls had a higher incidence.

Moreover, the DMFT index was lower in private schools compared to public schools, which might reflect the difference in the socioeconomic factor (Doughan et al., 2002). In 1974, a study was done on school children aged between 7 and 12 years old in 2 public and 1 private schools in Lebanon. The results showed that at age 7, 50-60% of the children in the low-income group had one or more carious teeth and by age 12, the prevalence of caries increased to 85-90%; in the children of the slightly higher income group, the corresponding figures were 61 and 82% respectively. Moreover, no fillings were seen in the lowest income group and only 1% of the carious lesions were filled in the other group (Tamari, 1974).

The Lebanese Global School based Student Health Survey in 2005, showed that overall, 65% of students brushed their teeth less than 3 times per day and 82.36% of children seen had problems with their teeth. A recent study in 2011 done on preschool children showed that the majority of subjects had at least one carious lesion (74.7%), and 70.7% showed high to very high plaque scores (Chedid NR et al., 2011).

E. Risk Factors of Dental Decays

1. Age

The prevalence of dental caries in permanent teeth increases with age, from 26% among persons aged 5-11 years to 67% among persons aged 12-17 years and 94% for dentate adults aged ≥ 18 years (Kaste et al, 1996; Winn et al, 1996).

2. Gender

Females have higher DMFT scores due to a higher treatment of decayed teeth increasing the “Filled” component (Reed, 2006). Moreover, in a review, several studies presenting data about the gender gap of caries, mostly attributed this difference to the fact that, in general, permanent teeth erupt earlier in girls than in boys. Therefore, being exposed to the risk of caries for a longer period, it is logical to assume that girls’ teeth would decay more than the teeth of boys (Mansbridge, 1959).

3. Geography

Within the United States countries, the differences in DMFT index are less distinct today due to a more recent use of fluorides (Reed, 2006). Moreover, it has also

been reported in the United States that, although the sucrose intake is higher in Rural Black children, they showed to have fewer caries when compared to Urban White children mainly due to a higher Debris Index (Cleaton-Jones et al. 1984).

4. Socio-Economic Status (SES)

Low SES reduces access to care and oral health aspirations. It has been also associated with low self-efficacy and health behaviors, increasing caries risk (Demakakos et al. 2008).

It was also found to have a negative impact on behaviors affecting dental health in most of the developed countries, such as the United States (Sabbah et al., 2009) and Britain (Aida et al., 2009; Demakakos et al. 2008).

This association parallels regional research available, where Ur. Rehman et al. (2008) stated in Abu Dhabi, that children of high SES had a DMFT of 2.65 when compared to those in the middle-income (3.51 DMFT) and low-income groups (3.53 DMFT).

Among poor and low-income children aged 2 to 11 years with cavities, 60% have untreated disease compared with 46% of children in higher income families. Similarly the numbers of decayed teeth per child are greater for poor and low-income than higher-income children (Edelstein, 2009).

Child oral health-related quality of life (COHRQoL) has also been studied and showed that socioeconomic factors are correlated with COHRQoL (Piovesan C. et al., 2010).

5. Nutrition

The intake of sugars and other carbohydrates as well as starches is a significant etiologic factor for caries (Cleaton-Jones et al., 1984). However, uncooked or lightly cooked vegetables are less likely to cause caries due to an unsuitable microbial degradation in the mouth (Reed 2006).

6. Health Status

Medical conditions, some medications and stimulants that reduce the amount of saliva are likely to lead to tooth decay. Examples include Sjögren's syndrome, diabetes mellitus, diabetes insipidus, and sarcoidosis, antihistamines and antidepressants and methylamphetamine (Neville et al., 2002). Radiation therapy of the head and neck increase also the likelihood of caries formation because it damages the salivary glands cells.

7. Maternal Smoking

The use of tobacco may increase the risk of decay formation (Brosky, 2007). In fact, the Japanese population showed that “both maternal smoking during pregnancy and postnatal exposure to environmental tobacco smoke at home may be independently associated with an increased prevalence of dental caries in young Japanese children” (Tanaka et al., 2010). Moreover as part of the related factors to oral health and more specifically to decays, studies have shown that the association of second hand smoking (SHS) with early childhood caries exhibited potential to infer a causal association but further studies should be conducted to see whether SHS is a true risk of early childhood

caries (Takashi Hanioka et al., 2011). In the Lebanese population 80% of the children are exposed to SHS in or outside their homes (Nakkash et al., 2010). Passive smoking might influence the child's growth and hence their nutritional status. Maternal smoking was found to be significantly related to dental caries, even after controlling for social class, and there was found to be a relationship between maternal smoking and the child's nutritional status (Williams et al., 2000).

F. Complications of Dental Caries

1. Impact on General Health

Untreated dental caries with associated discomfort or toothache could lead to weight loss and affect growth and quality of life as well as the cognitive development of young children (Ratnayake et al., 2005; Thomas C W et al., 2002). In fact, 8.7% of children with caries weighed less than 80% of ideal weight compared to 1.7% of the comparison group (Ayhan H et al., 1996). Untreated caries and associated infection can cause pain and discomfort and reduce intake of foods because eating becomes painful (Acs G et al., 1999; Hayes C. 2006). Moreover, severe caries can affect children's quality of life and thereby growth leading to pain, irritability and disturbed sleeping habits (Low W et al., 1999; Reisine S T, 1985). It has also been shown that, disturbed sleep may affect glucocorticoid production and thereby, growth. Although not all untreated dental caries affects general health, it significantly impacts on the quality of life of children and their dietary intake (Low W et al., 1999; Filstrup S L. et al., 2003). The consequences of high caries levels also include a higher risk of hospitalisations and emergency dental visits (Majewski R F. et al., 1988), increased days with restricted

activity and absence from school and a diminished ability to learn (Ratnayake et al., 2005; Reisine S T. 1985; Gift H C et al., 1992). In addition, dental treatment makes a very significant difference to the psychological and social aspects of the child's life (Thomas C W. et al., 2002; Anderson H K. et al., 2004; Low W et al., 1999; Filstrup S L. et al., 2003). These improvements include less pain and improved abilities to eat and sleep. In one study, parents perceived treatment had positive social impacts on their child: more smiling, improved school performance and increased social interaction (White H et al., 2003). Another possible mechanism of how untreated severe caries with pulpitis affects growth is that chronic inflammation from pulpitis and chronic dental abscesses affects growth via chronic inflammation affecting metabolic pathways where cytokines affect erythropoiesis. For example, interleukin-1 (IL-1), which has a wide variety of actions in inflammation, can induce inhibition of erythropoiesis. This suppression of hemoglobin can lead to anemia of chronic disease as a result of depressed erythrocyte production in the bone marrow (Means R T. et al., 1992; 2003).

2. Economic Impact of Dental Caries

Dental pain has an impact not only on the child's educational development, but also on the economy due to time taken off by parents to take children to the dentist (Shepherd M A. et al., 1999; Ratnayake et al., 2005). Traditional treatment of oral disease is extremely costly; it is the fourth most expensive disease to treat in most industrialized countries. In industrialized countries, the establishment of advanced oral health systems has offered curative services to patients. Private dental practitioners provide oral health care to patients, with or without third-party

payment schemes. Some countries, have organized public health services, providing oral health care, particularly to children and disadvantaged population groups (Widström E. et al., 2004; US Department of Health, 1998). Over the past years, savings in dental expenditures have been noted in industrialized countries, which have invested in preventive oral care and where positive trends have been observed in terms of reduction in the prevalence of oral disease (Griffin SO. et al., 2001; Wang NJ. et al., 1998). In most developing countries, investment in oral health care is low. In these countries, resources are primarily allocated to emergency oral care and pain relief; if treatment were available, the costs of dental caries in children alone would exceed the total health care budget for children (Yee R et al. 2002).

G. Prevention and Awareness of Dental Decays

Dental caries preventive measures could be performed at both community and individual levels.

1. At the Community Level:

Since access to dental treatments and prevention procedures is known to be affected by the socio-economic status of individuals, especially in developed countries where most insurance schemes do not cover dental treatments (Locker, 2009), a community-based approach would reduce this social inequality by allowing all the population, regardless of socio-economic status, to seek dental care. In addition, supplementing water with fluoride is particularly useful in communities with limited resources, where access to oral care is practically non-existent or expensive and fluoride alternative sources are available (Burt, 2002).

a. Water Fluoridation:

According to the Centers of Disease Control and Prevention, water fluoridation is one of the 10 most important achievements in public health of the 20th century (Center for Disease Control and Prevention, 1999). It has been proven beneficial in reducing the prevalence of tooth decays and their associated disabilities. One of its characteristic features is the fact that it does not require the receiving individual to take any active initiative, other than drinking the provided water and using it in food preparation. In addition, it does not entail any professional intervention by dentists or staff.

In the recent years, the World Health Organization has been encouraging governments to implement some policy measures to tackle oral diseases, including fluoridation (World Health Organization, 2009).

The cost-effectiveness of such a public health initiative has also been studied. Indeed, research since 1994 has shown that the benefits of water fluoridation outweighed the costs (British Fluoridation Society, 2010). Recent studies have indicated that water fluoridation decreased the demand of tooth extraction between 35% and 67% (British Fluoridation Society, 2010). This can relieve the health care system from the burden of additional costs that could have simply been prevented by water fluoridation.

b. Oral Hygiene Promotion:

Oral health promotion, using mass media and other information tools has been found to be efficient in increasing the knowledge but less effective in changing behaviors (Kay & Locker, 1996, 1998; Sprod et al., 1996).

c. School-based Interventions:

They are practiced in several developing and developed regions and have been found to be effective specially when targeting populations with high levels of decays. They mainly consist of fluoride rinse schemes and supervised tooth-brushing programs (Marinho et al, 2003).

2. At the Individual Level:

Individuals could be targeted at a one-to-one basis, at dental offices to improving diet habits and give oral hygiene instructors. Dentists can also apply preventive measures to increase the dental resistance to decays by applying topical fluoride to the teeth surface or by using fissure sealants on newly erupted teeth

H- Summary

Having said all that we can deduce that dental health forms a major public health concern worldwide. Many countries have shown improvement concerning dental care and dental health, promoting prevention and intervention programs, use of fluoride as well as easy access to dental care and treatment.

However, oral health remains in many countries, especially developing countries, an important burden on the population and mostly affecting young generations. In fact, as

already mentioned before, the socio-economic factor plays a major role in oral health. Many studies have already shown disparities in oral health between both school types. For instance, a study done on Brazilian adolescents in private and public schools have shown a higher prevalence of dental caries in public schools compared to private schools (Moreira PV et al., 2007). Moreover, in the same study the overall DMFT index was also higher among public schools compared to private schools. Another Brazilian study concluded that the type of school (public versus private) was associated with the oral health condition of the children (FreireMdo C et al., 2010). The same trend was also observed in Saudi Arabia, whereby the DMFT index was higher among all ages and all regions where the study was done in public schools compared to private schools (al-Khateeb TL et al., 1999). This reflects the high impact of socio-economic environment on children's oral health. In addition to this, the disparities could also be explained by the fact that most private schools nowadays have annual dental visits for all their students as well as well organized dental health awareness and prevention. The role of the parents remains very important also and highly contributes to the child's oral health. This is where the importance of our study is reflected and our choice of public and private schools is well made to confirm the role of the socio-economic level in relation to the dental health of the children and draw accurate conclusions on differences in children's oral health in Beirut- Lebanon.

CHAPTER III

METHODOLOGY

A. Study Design

Our study design was comprised of a comparative cross-sectional study of elementary school children aged from 6 to 11 years old, grades 2 to 5, in public and private schools in Beirut-Lebanon. The unit of observation was both the child and the parents.

B. Sample Size and Selection

The sample size has been calculated using the “A-priori Sample Size Calculator for Multiple Regression” with an anticipated effect size (f^2) of 0.02, a statistical power level of 0.8, 7 predictors and a probability level of 0.05. This determined a sample size equal to 721. We also accounted for missing data and inflated the sample size by 1.2 and for non-response from the parents or the children we inflated it by 1.25, which gave us a final sample size of 1000 children.

The selection of the children was done in:

- 2 public schools: Tarik Jdide public school for boys and girls and Mohammad Shamel public school in Tarik Jdide
- 5 private schools: Al Ahlia School Beirut, Besancon School Beirut, College L'Elysee Baabda, College du Sacre Coeur Gemmayze and Sagesse Brazilia Baabda.

Public and private schools were handled differently concerning the ethical issues and the sample selection. The public schools were approached via a non-governmental organization (NGO) Ajjalouna that was established in 1995 in Beirut

under the notification of association #41/D. Its main goals are to work on improving life standards at many levels by engaging in multiple projects such as school health, health education programs, orphan sponsorship and textbook for public schools through employees and volunteers and experts in engineering, medicine, pharmacy, education, administration and others. Ajjalouna NGO had already the clearance from the Ministry of education and from the schools' administrations to examine the children and thus, the consent given to the parents was concerning the acceptance for using the data, for future follow-up and for filling out the questionnaire (Appendix 1). In the 2 schools, a total of 530 children were approached and examined: 350 children in Mohammad Shamel public school in Tarik Jdide and 180 children in Tarik Jdide public school for boys and girls. The total number of children who had their parents' consent on using the data was 325 out of the 530.

As for private schools, 12 were approached and only 5 schools consented. The private schools were chosen conveniently for their availability and their middle to high social level. The consent form of the private schools differed from the one of the public schools and the parents had to consent on the acceptance to screen their children, to future follow-up and to fill out the questionnaire (Appendix 2). In Al Ahlia School 110 children were approached. In Besancon School, 83 children were approached. In College L'Elysee, 171 were approached. In College du Sacre Coeur Gemmayze, 231 were approached and finally in Sagesse Brazilia School, 604 children were approached. The total number of children who had their parents' consent was 330 out of the 1119.

The total sample size including both private and public schools was equal to 665.

C. Measures

Two outcome measures were assessed:

1. The DMFT Index that measures:

- Number of decayed teeth with untreated carious lesions (D)
- Number of teeth extracted and therefore missing (M)
- Number of filled teeth (F).

2. The Plaque Index which evaluates the oral hygiene and records both soft debris and mineralized deposits on the four surfaces of 6 teeth: 3 maxillary teeth (teeth number 16-12-24) and 3 mandibular teeth (teeth number 36-32-44). Each surface is given a score from 0-3 and the scores of the four areas are added then divided by four to obtain the plaque index of the tooth. The scores represent the following:

- 0: No plaque
- 1: A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be seen in situ only after application of disclosing solution or by using the probe on the tooth surface.
- 2: Moderate accumulation of soft deposits within the gingival pocket, or the tooth and gingival margin, which can be seen with the naked eye.
- 3: Abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin.

Independent variables include a) socio demographic variables; age, gender, education and occupation of parents, and income; b) behavioral variables, such as dental hygiene (tooth brushing), nutritional habits (soda and sugar intakes) and maternal smoking during pregnancy.

D. Data Collection

Two sources have been used for data collection:

1. A dental examination where the children were screened and DMFT and plaque indices were collected. A trained fellow orthodontist from the American University of Beirut Medical Center (AUBMC), using non-invasive dental instruments including mouth mirrors and probes, performed the dental examination. Mouth mirrors and probes were all disposable and sterile to eliminate the risk of cross-infections.

Disposable latex gloves and facial masks were also used during the examination. The average time range for each examination was around 5 minutes and an average of 35-40 children were screened every day. All the examinations were done individually to ensure child's privacy, in a classroom with the child sitting on a chair with his head lied back with maximum exposure to direct sunlight.

To detect the presence of dental decay, a mouth mirror and a probe were used. The tip of the probe was run over all visible surfaces of all the erupted teeth to check for possible presence of caries.

To measure plaque index, the probe was run over the 5 surfaces of the molars and premolars and over the 4 surfaces of the incisors. The plaque index was registered for

each surface of each tooth to come up an average plaque index for each tooth and finally, the average total plaque index for each patient was calculated.

2. A questionnaire in Arabic that included 41 questions was sent to the parents. This questionnaire was divided into the following 5 different categories (Appendix 3):
 - a. The socio-demographic background of child and parents and the socio-economic status of the parents.
 - b. The general health status of the child assessing the presence or absence of a chronic disease, the breathing mode of the child as well as the smoking status of the mother during pregnancy.
 - c. Sucking habits of the child if any.
 - d. Dietary habits of the child, including questions on sugar and soda intakes, feeding mode in early childhood (breast feeding/bottle feeding)...
 - e. Oral health behaviors encompassing information on dental hygiene habits, fluoride intake, previous dental consultation...

In the case where the parents or legal guardians were illiterate or visually impaired, help was provided through assistance via an oral consent given by the research team or the school in charge of the child. To facilitate this procedure, phone numbers were given within the consent form.

Calibration of the measures including the DMFT index and the plaque index, were performed prior to the beginning of the data collection to ensure reliability and validity (Reliability and validity were greater than 0.9 for all the measures).

E. Statistical analysis

The statistical analysis of our data was comprised of different parts. First, we started by data cleaning, followed by descriptive frequency analysis, then univariate and multivariate analyses. The multivariable analysis involved regular regression, in which we ignored the cluster effect of school, hence disregarding the intra-cluster correlation among the observations of same cluster (schools). Then, regression that accounts for this correlation was conducted by implementing the cluster analysis on this data.

Data cleaning was conducted first to ensure that no errors in data collection or entry were transpired. This was achieved by graphical representation that enabled us to detect outliers if any, and by a numerical summary of the variable values. A frequency analysis was then conducted to look at the distribution of gender, sociodemographic and socioeconomic status, maternal smoking habits, presence or absence of chronic diseases, breathing, feeding modes and nutritional intake for the entire children, and then subsequently stratified by type of school whether private or public. Specifically, mean, median, standard deviation and proportions have been all reported. Bivariate and linear multivariable analyses were carried out on DMFT and plaque indices separately to come up with a model that incorporates all the covariates that are statistically and clinically relevant to the outcomes of interest and to determine whether a significant discrepancy in the outcomes is triggered by the type of school adjusting for the effect of other covariates. Our analysis was taken one step further by modeling the two outcomes DMFT and plaque indices simultaneously to assess whether the covariates under investigation concomitantly affect both outcomes. This was achieved by using the General Linear Model (GLM) via multivariate analysis. To account for clustering effect, Generalized Estimating Equation (GEE) analysis was conducted on DMFT and plaque indices.

Needless to say, we have also checked and assessed whether the assumptions pertaining for regression analysis are satisfied. This encompassed checking for normality and homoscedasticity of the residuals. The level of significance that we assumed for the bivariate analysis was 0.2 while that for the multivariable and confidence intervals was 0.05. Analysis of this project was conducted using STATA and SPSS as statistical packages.

F. Ethical considerations

1. Respect for Person

To protect privacy and confidentiality, identifiers (serial numbers), were used for schools, children and examiners.

2. Beneficence/Non-Maleficence

As we previously mentioned, for the public schools, the consent for the children's examination was already approved via Ajjalouna NGO. The consent in this case, was to approve on using the data, on follow-up and on filling out the questionnaire.

On the other hand, the consenting process was different for the private schools. Specifically, the consent sent to the parents was comprised of three parts:

- a. Approval to fill out the questionnaire
- b. Approval to have their child examined
- c. Approval to have the data collected on their child used in follow-up studies and potential future screening for the purpose of building a cohort database.

The consent was sent to the parents after acquiring schools' permission and prior to the oral screening.

Just note here that, oral screening involved examining the child with his mouth opened using non-invasive, sterile and disposable instruments that included an intraoral mirror and a dental probe.

Assistance and help were provided for the illiterate or visually impaired parents or legal guardians via an oral consent given by the research team or the schools in charge.

All children were assented orally before starting the examination by explaining to them what the procedure is all about and whether they agree or not on having it (Appendix 4). In all cases, recommendations concerning the child's oral health and treatment were sent to the parents or legal guardian(s). Each child who needs follow-up or treatment on dental decays and oral hygiene were provided with the necessary information contacts (address and phone numbers) of one of the specialized dental centers with affordable treatment cost such as Lebanese University and Saint-Joseph University.

3. Justice

The data in this study was selected as a representative random sample of elementary school children in Beirut in both private and public schools. All children had the same probability of being included in the study.

CHAPTER IV

RESULTS

A. Frequency Analysis: Comparison Between Private and Public Schools

Frequencies and percentages of missing values have not been reported in the analysis; thus, valid percentages were reported for all other values. Missing values are due to two main causes, the first one being the non-response on some questions in the questionnaire and the second one being the non-consent to fill out the questionnaire.

1. Sociodemographic Characteristics

The variables that were considered under the sociodemographic characteristics included gender, marital status of the parents, educational level of the parents and monthly family income. Chi-square test was conducted on each of these variables and type of school (private versus public) and results were presented in terms of frequencies, percentages and p-value. No significant statistical results were found concerning the distribution of gender between private and public schools ($p=0.093$). Significant differences were found at the level of the marital status of the parents with a greater percentage of married parents in the private schools (96.1%) compared to the public schools (89.8%) with a p-value equal to 0.005.

Educational level of the parents was also found to be statistically different ($p \leq 0.0001$) with a greater percentage of illiterate parents and parents who have reached elementary classes in public (45.4%) compared to private (7.70%). On the opposite, the percentage of parents who reached university was much higher in private schools (72.3%) compared to public schools with only 10.5%. Finally, the monthly family

income showed significant differences ($p \leq 0.0001$) where 84.4% of the parents in private schools reported to have a monthly income greater than or equal to 1.000.000 LL compared to only 17.1% in public schools. (Table 1)

2. Health Status Characteristics of the Child

The variables that were considered in our study under health status characteristics, included presence of chronic disease, breathing mode, maternal cigarettes smoking, feeding mode and oral health perception. Our chi-square test revealed that there is no significant association between schools (private versus public) and the presence or absence of chronic disease(s) ($p=0.2$). Furthermore, both private and public schools showed low percentages of presence of chronic disease(s) with 13.4% who reported presence of chronic disease(s) in their children for the public schools compared to 9.10% for the private schools. Breathing mode was not found to be statistically different ($p=0.433$), and the majority of children in the two types of schools reported to breath from both, their nose and their mouth with 54.2% for the public schools and 52.5% for the private schools. On the other hand, maternal smoking was found to be significantly associated with type of school ($p \leq 0.0001$). In this context, 20.4% of the mothers in public schools were smokers during pregnancy while only 7% in private schools. A significant association was also detected between feeding mode of the child and type of school ($p \leq 0.0001$); specifically, a greater percentage of breast-feeding was found in public schools (53.3%) compared to private schools (31.0%). Private schools reported greater percentage in bottle-feeding alone (24.2) and in both feeding modes (44.8%). For the oral health perception, 53.2% of the children had a good oral health perception in

private compared to only 26.2% in public schools. Meanwhile, only 8.3% showed bad oral health perception in private versus 33.9% in public. (Table 2)

3. Oral Hygiene Characteristics

Oral hygiene characteristics were centered on two variables, mainly frequency of teeth brushing and seeking previous dental consultation. A significant difference was found for both variables ($p \leq 0.0001$). Here we notice that only 1.8% rarely brushed their teeth in private compared to 17.3% in public, and about 32% brushed between 2-3 times/day in private compared to 18.6% in public. Nonetheless, interestingly, more than 60% brushed less than one time per day in both. The difference was also significant in terms of previous dental consultation, where the percentage of children who underwent previous dental consultation in private was about double that in public schools. (Table 3)

4. Nutritional Habits Characteristics

Significant discrepancy was detected in the characteristics of nutritional habits between private and public schools. For instance, fluoride intake was 4 times higher in private compared to public, while frequency of soda intake in public schools was more than double that in private. Moreover, percentage of children who occasionally consumed soda in private, was double that of public. Along the same line, we notice that percentage of children who rarely consumed sweets was about 2.5 times higher in private compared to public. (Table 4)

5. Oral Health

As was indicated earlier, dental health was assessed using DMFT and plaque indices. In this regard, we realized that there is a significant association between type of school and these two indices as shown in tables 5 and 6 respectively.

Specifically, under DMFT we noticed that the number of decayed teeth was significantly higher in public schools compared to private schools ($p \leq 0.0001$) with means of 5.67 ± 3.81 and 1.48 ± 2.19 , respectively. The maximum numbers of decayed teeth per child that we observed were 17 in the public schools and 11 in the private with a minimum of 0 in both types of schools. For the missing teeth, the public schools scored a higher mean of 0.52 ± 0.99 compared to 0.18 ± 0.54 ($p \leq 0.0001$). The maximum missing teeth within one child was 9 for the public schools and 4 for the private schools with a minimum of 0 for both schools. The filled teeth were higher in the private schools (1.85 ± 2.50) compared to the public schools (1.11 ± 1.99) ($p \leq 0.0001$). The maximum number of filled teeth was 17 for the public schools and 12 for the private schools with a minimum of 0 for both schools.

The overall DMFT scored a mean of 7.30 ± 3.98 for the public schools while it scored a mean of 3.50 ± 3.41 for the private schools ($p \leq 0.0001$). The range for the public schools was between 0 and 17 and between 0 and 12 for the private schools. (Table 5)

On the other hand, the plaque index for all the examined teeth was greater in the public schools compared to the private schools with a range between 1 and 3 for both types of schools ($p < 0.05$). The average plaque index scored a mean of 1.35 ± 0.23 for the public schools and 1.20 ± 0.15 for the private schools ($p \leq 0.0001$). The range was almost similar for both school types. (Table 6)

We also stratified the plaque index into 3 categories: between 1 and 1.99, between 2 and 2.99 and equal to 3 to see if there was any statistical significant differences between these groups in private and public schools, however no differences were found in the 3 groups between both school types.

B. Bivariate Analysis: DMFT and Plaque Indices

Our bivariate analysis was conducted using t –test for covariates with 2 levels and ANOVA for those with 3 or more categories. In the t-test setting, we also considered whether the variances among the two groups were equal or not and p-values were reported accordingly. In the ANOVA setting, Levene’s test ensured that the equality of variance across the different groups was satisfied for this data. To test for association with age, a simple linear regression was performed.

1. DMFT

a. Sociodemographic Characteristics

From all the variables included in this section, only two were significantly associated with the DMFT, the educational level of the parents and the monthly family income ($p \leq 0.0001$). The ANOVA test for the educational level of the parents revealed a negative correlation with the DMFT. That is, the higher the educational level, the lower the DMFT (a mean DMFT of 7.00 for the low educational level compared to 3.89 for

high educational level). The same trend was also observed for the monthly family income, whereby a lower DMFT was found with a higher monthly income. (Table 7)

b. Health Status Characteristics of the Child

Two main variables in the health status characteristics were found to be significantly associated with the DMFT. The first variable being the feeding mode of the child ($p \leq 0.0001$) where, breast-feeding scored a higher DMFT (6.11 ± 4.13) compared to bottle-feeding (4.85 ± 4.19). The second variable that was found to be associated with the DMFT is the oral health perception ($p \leq 0.0001$). In fact, the DMFT when a bad oral health was perceived was almost more than double of that of a good oral health perception (8.21 ± 3.65 and 3.58 ± 3.79 respectively). On the other hand, a borderline association was found between DMFT and maternal smoking during pregnancy ($p=0.059$) where, DMFT score was slightly higher (6.08 ± 4.24) for those whose mother smoked during pregnancy compared to those whose mother did not (5.15 ± 4.08). (Table 8)

c. Oral Hygiene Characteristics

In the oral hygiene characteristics that comprised two variables, only one was significantly associated with the DMFT, the frequency of teeth brushing ($p \leq 0.0001$). A positive correlation with DMFT was found where it tends to double when going from 2-3 times of teeth brushing per day to rarely (3.93 ± 3.60 and 7.68 ± 3.94 respectively). (Table 9)

d. Nutritional Habits Characteristics

From the three main characteristics included in the nutritional habits, only the frequencies of soda intake and sweet consumption were found to be significantly associated with the DMFT ($p \leq 0.0001$). A positive correlation was detected whereby, the greater the frequency of soda intake, the higher the DMFT. For instance, when decreasing the frequency of soda intake from once per day or greater to occasionally or never, the DMFT index decreases from 6.42 ± 3.89 to 4.45 ± 4.03 . The same trend was also observed for the frequency of sweets consumption, where the DMFT decreases when the consumption decreases. It is reduced from 6.02 ± 4.08 to 4.69 ± 4.07 when decreasing the consumption from more than one intake per day to once per day.

(Table 10)

2. Plaque Index

a. Sociodemographic Characteristics

Only two variables in this category were associated with the plaque index. Similar to DMFT, the t-test and ANOVA revealed an association between educational level of the parents and the monthly family income ($p \leq 0.0001$). The plaque index for both variables followed the same trend as already described in the DMFT section. For instance, the plaque index decreases when the educational level of parents is higher; it goes from 1.36 ± 0.23 for a low educational level to 1.20 ± 0.15 when parents have reached university. On the other hand, the higher the monthly family income, the lower the plaque index (1.21 ± 0.17 compared to 1.32 ± 0.22 when the monthly income was less than 1.000.000LL). (Table 11)

b. Health Status Characteristics of the Child

The two health status characteristics that were found to be associated with DMFT were also correlated with the plaque index in addition to the breathing mode ($p=0.0009$). In this context, when moving from a nose breather to a mouth breather, the plaque index tends to increase from 1.25 ± 0.17 to 1.34 ± 0.23 . For the feeding mode ($p=0.022$), breast-feeding and bottle-feeding showed close plaque index averages with a slight higher tendency for an increased plaque index for the breast-feeding (1.29 ± 0.23 compared to 1.26 ± 0.20 for the bottle-feeding). (Table 12)

c. Oral Hygiene Characteristics

Both variables related to the oral hygiene characteristics of the child were found to be associated with the plaque index. A positive trend of association was found between the plaque index and the frequency of teeth brushing ($p\leq 0.0001$). The higher the frequency of teeth brushing, the lower the plaque index. For instance, for a frequency of brushing 2-3 times per day, the mean plaque index was 1.22 ± 0.18 compared to 1.36 ± 0.29 for those who rarely brush their teeth. Moreover, a similar trend was also observed with the association between the plaque index and whether or not the child had a previous dental consultation. In fact, a previous dental consultation revealed a lower plaque index (1.25 ± 0.18) compared to those who did not have a previous dental consultation (1.33 ± 0.29). (Table 13)

d. Nutritional Habits Characteristics

All three variables including the fluoride intake ($p=0.010$), the frequency of soda intake ($p\leq 0.0001$) and the frequency of sweets consumption ($p=0.027$), were found to be significantly correlated with the plaque index. A higher plaque index was found for those who did not have any fluoride intake (1.27 ± 0.20), compared to those who did have a fluoride intake (1.21 ± 0.19). In addition, the plaque index was also higher when the frequency of soda intake increased; 1.31 ± 0.20 when the frequency was greater than once per day, compared to 1.23 ± 0.20 for a lower frequency (occasionally/never). Finally, for the frequency of sweets consumption, the higher the frequency, the greater the plaque index. In this context, the plaque index for a frequency greater than once per day scored 1.29 ± 0.23 compared to 1.25 ± 0.20 for a frequency of once per day only. (Table 14)

C. Multivariable analysis

Our multivariable analysis encompassed multiple regression, cluster analysis and general linear model analysis.

1. Multiple Regression

All variables that had a p-value equal or less than 0.2 in the bivariate analysis, were included in the multivariable analysis. Initially we adjusted for school type (private/public) in the multivariable analysis then, we added the school ID in the model to control for its effect. Before we proceeded with the linear regression analysis, we checked for whether assumptions of normality and homoskedasticity were satisfied. Our results showed that residuals were normally distributed with no emerging pattern.

a. DMFT Index

Out of all the variables that were evaluated, eight had a p-value equal or less than 0.2 at the bivariate analysis level and were included in the regression analysis. The regression comprised the educational level of the parents, the monthly family income, the maternal cigarettes smoking, the feeding mode, the oral health perception, the frequency of teeth brushing, the frequency of soda intake and the frequency of sweets consumption.

The overall model showed to be significant ($p \leq 0.0001$), and few variables showed to be statistically significant. First, the oral health perception was significantly associated with DMFT index ($p \leq 0.0001$). In this context, our results suggested that going from good to bad oral health perception increased DMFT index by 2.677 units on average. School type, was also found to be significant in the regression model. For instance, the DMFT index tends to decrease by 2.323 units when going from public to private schools. Moreover, for the feeding mode of the child, only the bottle-feeding showed to be significant ($p=0.022$) and the DMFT index appears to decrease by 0.941 units when going from breast-feeding to bottle-feeding. (Table 15)

On the other hand, when the variable school ID was added to the regression model, the oral health perception and feeding mode remained significant with a $p \leq 0.0001$ and $p= 0.010$ respectively. However, type of school lost its significance indicating collinearity effect. Hence either school type or school ID should be included in the model. However, since our research question is centered on the comparison between public and private, our final model should include school type and the results we go with are the ones generated from this model. (Table 16)

b. Plaque Index

The variables that were included in the regression model are the following: gender, marital status of the parents, educational level of the parents, monthly family income, maternal cigarettes smoking, feeding mode, breathing mode, presence of chronic disease(s), oral health perception, previous dental consultation, fluoride intake, frequency of teeth brushing, frequency of soda intake and frequency of sweets consumption.

The overall model was significant ($p \leq 0.0001$). Only one category of the oral health perception was found to be statistically significant ($p=0.017$). In this regard, plaque index appeared to increase by 0.069 when moving from a good oral health perception to a bad oral health perception. The school type did appear to be significant as well as for all other variables that were included in the model. (Table 17)

On the other hand, when school ID was included in the model, the same results were achieved and only the bad oral health perception showed to be significant ($p=0.004$). (Table 18)

2. Generalized Estimating Equation (GEE) Analysis: Clustering Effect

The variables that were included in both DMFT and plaque indices were those of the multivariate regression and clustering was taken at school ID level. The multiple linear regression analysis is considered a naïve approach since it disregards the correlation between the observations corresponding to the same school. Hence, a more appropriate approach would be Generalized Estimating Equation (GEE) analysis that

generates estimates that are adjusted for this correlation and hence accounting for any possible cluster effect.

a. DMFT Index

As was indicated before, the same variables that were included in the multiple linear regression were also incorporated in the GEE. In this context, the results have shown that there was no cluster effect on the DMFT index and the overall model was significant ($p \leq 0.0001$). The school type and the oral health perception remained significant as in the multiple linear regression. On the other hand, the category “both” in the feeding mode of the child has shown to be significant ($p \leq 0.0001$), wherein the DMFT index tends to decrease by 0.503 times when going from a breast-feeding mode to both modes. In addition, the “intermediate/secondary” category in the educational level of the parents also shown to be statistically significant ($p=0.022$). For instance, the DMFT index decreases by 0.593 when moving from a low educational level to an intermediate one. (Table 19)

b. Plaque Index

When adjusting for clustering effect on schools' ID, a cluster effect appeared to be present for the plaque index. The overall model remained significant ($p \leq 0.0001$). However, two covariates that were not significant in the linear regression model became significant in the GEE model. These covariates are the educational level of the parents and the frequency of teeth brushing of the child. For example, the plaque index decreases by 0.048 units when going from a low educational level (illiterate/elementary) to a higher

educational level (university). Moreover, the plaque index tends to increase by 0.054 times when going from 2-3 times of brushing teeth per day to rarely. (Table 20)

3. General Linear Model (GLM) Analysis:

Our statistical analysis was taken one step further and the GLM analysis was conducted to determine which variables were affecting both outcomes (DMFT and plaque indices) at the same time. In this context, both outcomes were simultaneously modeled to determine the factors that are concurrently associated with DMFT and plaque indices. All the variables that were entered in the multiple regression for the DMFT and plaque indices were also entered in the GLM analysis. The p-values generated from Wilk's Lambda F-tests are reported.

The GLM results showed that the only variable that was affecting both outcomes concomitantly was the oral health perception ($p \leq 0.0001$). This result is in concordance with the previous analysis in the multivariate regression, where the oral health perception was found to be significant for the DMFT in all its categories and with the plaque index with one category only. (Table 21)

D. Consented Versus Non Consented in the Public Schools

To assess whether inclusion of those who did not consent in the public schools would have had any effect on our results, we conducted analysis on this sub-group. T-test was conducted for DMFT, plaque index and age whereas Chi-square analysis was conducted for gender to detect any statistical significant differences. However, no statistical significant differences were found concerning the DMFT index, the plaque

index, the age and the gender, between the parents who consented and those who did not.
(Tables 22-25)

CHAPTER V

DISCUSSION

Dental caries is one of the most common preventable childhood diseases. It is the primary cause of oral pain and its progression leads consequently to tooth loss. However, it can be arrested and potentially reversed in its early stages, but without proper care, caries can progress until the tooth is destroyed. Risks for caries include physical, biological, environmental, behavioral, and lifestyle-related factors (Selwitz et al., 2007). The recent decades have shown a significant difference in caries prevalence and incidence between countries as well as between individuals living in one country (Cate, 2001). Over the past 20 years, a clear decline in the prevalence of oral disease has been observed in several Western industrialized countries, wherein the children's oral health has improved with a noticeable decrease in dental caries and an increased number of caries free individuals (Peterson, 2003). On the other hand, despite these large improvements in global oral health, many populations and communities around the world, especially developing countries and under-privileged populations in developed countries, still suffer from this burden, mainly due to lack in access to oral health services and reduced dental education and awareness (Peterson, 2004). Lebanon, a developing

country, has scored in the past decade high numbers of dental decays among children, adolescents and adults. However, this has not been followed-up over time and the number of epidemiological data on oral health status are scarce, and thus no data has been reported since then to see if the Lebanese oral health trend has improved or not. The present study provides such information as regards to elementary school children in Lebanon and assesses the relationship between possible related factors and oral health status. The study was not conducted on a national scale and consequently, the data are not representative of the country in pure statistical terms; although the epidemiological part of the study may be considered representative of the general population.

A. Epidemiology of Dental Caries

In the present study, the mean DMFT was 7.30 ± 3.98 and 3.50 ± 3.41 for public and private schools respectively. As already described in the literature (Demakakos et al., 2008; Ur.Rehman et al., 2008; Edelstein, 2009; Piovesan C. et al., 2010), this significant difference highlights the great impact of socio-economic status and social background of the parents on their child's oral health. Lebanon presents higher DMFT score (regardless of school type) when compared to Western Europe with a maximum DMFT of 2.5 for East Germany (Peterson, 2003). On the other hand, compared to Central and Eastern Europe, Lebanese private schools show a DMFT index close or even lower than some countries such as Poland with DMFT of 4.2, Hungary and Latvia with a DMFT close to 3.8. However, for some other countries (Russia, Romania and Slovenia all with a DMFT less than 3), the Lebanese private schools tend to have a higher DMFT. Public schools resulted in higher DMFT means compared to all the previously mentioned countries

(Peterson, 2003). When compared to overall Europe (mean DMFT of 2.6), the DMFT of both school types remains higher. Yet, the mean DMFT of private schools was comparable to the one of the AMRO regions wherein the mean DMFT was close to 3.5. Surprisingly enough, the AFRO regions have a mean DMFT close to 1.6, which is relatively very low, compared to all other countries and to Lebanon. This trend in the African region is prone to changes with an expectation for higher incidence of dental caries due to inadequate exposure to fluoride and an increased consumption of sugar (World Health Organization, 2003). In the US (NHANES), they found that for the same age group as in our sample (6 to 11 yrs) the DMFT index was equal to 0.56 ± 0.04 for the permanent teeth only) and 1.62 ± 0.08 for the primary teeth only (1988-1994). Similarly from 1999 to 2004 the DMFT were respectively 0.045 ± 0.02 and 1.84 ± 0.08 for the permanent teeth only and the primary teeth only. If we compare these results to our present study we can say that the DMFT index in our sample is almost three times greater than the one described in the NHANES for the private schools and almost seven times greater for the public schools. In the same study they also found that the DMFT index was greater in lower socio-economic status, which is comparable to the results of our study. On the other hand, a study done in Canada on a sample of 6 to 11 years school children, the DMFT scored 2.48 which is lower than the DMFT found in our study for both private and public schools. They also found that the DMFT index was greater in the lower income group and greater in the lower educational level, which is concordant with the results found in the present study. When comparing to the neighboring Arab countries, the DMFT score in public schools remains high but close to Saudi Arabia with a DMFT of 6.0. All other countries recorded DMFT indices equal or less than 3.0 with

the lower DMFT being for Egypt and Iran (DMFT of 1.2) (World Health Organization, 2003). In 2003, the World Health Organization has reported Lebanon as the Arab country with the 2nd highest DMFT score of 3.5 after Saudi Arabia. This DMFT score reported in the WHO in 2003 is comparable to the DMFT score in the private schools in this present study.

Moreover, the average mean of dental decays (D component of the DMFT) recorded a mean of 5.67 ± 3.81 and 1.48 ± 2.19 , for public and private schools respectively. This is reflective of the lack of access to dental care for the underprivileged population and the lack of dental awareness. This is in concordance with what has been reported in the literature and is indicating that minority and low-income children in the United States experience poorer oral health and poorer access to dental services than do their majority and higher-income peers (Edelstein et al., 2009).

In addition, due to this lack of access to proper oral health services, the child of low socio-economic background is not treated early enough before the tooth is damaged by decay and sometimes becomes untreatable. Subsequently, this will therefore lead to only one choice of treatment, which is tooth extraction. This explains the higher tendency of missing teeth that was shown in this study for the public schools compared to the private schools. Moreover, due to lack of access to dental care mostly for children in public school, our results also suggested that children in private schools had the filled component on the DMFT index higher than those children in public schools (1.85 ± 2.50 compared to 1.11 ± 1.99).

The Lebanese school children are at high risk of developing dental decays especially in public schools underlying a low socio-economic status. Such alarming rates

urge the need for dental awareness and oral health promotion as well as easy access to dental care for underprivileged populations.

Regarding the average plaque index, public schools tend to have a higher plaque index compared to private schools. These findings are in concordance with a study done in Mexico in school children aged 6 to 12 years old, the results of which suggested an average mean for plaque index of 1.10 ± 0.34 . In addition this study highlighted the fact that children belonging to a low socioeconomic status had a tendency for a higher plaque index compared to those of a higher socioeconomic class (Villalobos-Rodelo et al., 2007).

B. Factors Associated with Dental Caries

Findings of the multivariable analysis examining factors associated with DMFT and plaque indices showed that, for the DMFT, the oral health perception and the feeding mode of the child were significantly associated with DMFT. In this regard, children with good oral health perception appeared to have a lower DMFT compared to those with a bad oral health perception and bottle-feeding showed a lower DMFT compared to breast-feeding. The majority of those who responded to perceive their child's oral health as bad were in the public school with 33% compared to 8.3% in the private schools. This could indicate that despite that the parents, especially in public schools, knew about their child's bad oral health, they did not appear to be proactive in taking the initiatives to help their child, In fact, we noticed that no or little effort is done from their side in order to improve their child's oral health. This could be due to socio-economic constants that are hindering the parents from placing the oral health of their children on the top list of

priorities for health related expenditures. On the other hand, feeding mode, where bottle-feeding tends to be associated with a lower DMFT, is in concordance with a study done on Swedish children where they found that prolonged breast-feeding have a tendency to establish unsuitable dietary habits that constitutes a risk situation for developing caries at an early age (Hallonsten AL et al., 1995).

Opposed to this study and to the findings of the present study, Mohebbi SZ et al. have concluded that prolonged breast-feeding appears to have no such negative dental consequences, however, bottle-feeding at night should be limited as it was found to be a clear determinant of early childhood caries (Mohebbi SZ et al., 2008). Along with the same line of these studies, another study that was conducted on South African children, showed that the prevalence of dental decays increased more among the bottle-fed compared to others (Roberts GJ et al., 1993). In another study conducted on Brazilian children, no statistically significant relationship was found between breast-feeding and the prevalence of dental decays (Rosenblatt A et al., 2004). Finally, a recent systematic review suggested that no scientific evidence has been presented in support of the cariogenicity of human milk (World Health Organization, 2003).

Regarding the plaque index, the only variable that was significant was the oral health perception in one of its category where we found that the plaque index increases when the oral health perception moved from good to bad. This could be explained in the same context of the DMFT, where lower socio-economic level was associated with a poorer oral health status, thus a poorer oral hygiene and consequently a higher plaque index. This is where oral hygiene instructions and awareness are very important not only at the individual level but also at the parents and schools levels.

Based on our bivariate analysis, it was clearly underlined that all potential risk factors for dental decays and higher plaque index are higher for the public schools compared to private schools with statistically significant differences. The fact that the biggest majority of children in public schools belong to a low socio-economic level with low monthly income for the families and low educational level for the parents that do not exceed secondary grades, unravels a cascade of other risk factors. This low socio-economic background and educational levels result in a flagrant lack of awareness of the importance to control and restrict their children dietary intake. Specifically, dietary habits are not well-controlled, high levels of sugar and sweets are consumed, oral hygiene habits are deficient mainly due to lack of awareness and lack of control from the parents who do not seem to give importance to the oral health of their child or at least notice the problem when the damage is already there and it is too late to treat. Moreover, mothers of the lower socio-economic status are more prone to stress and to psychological disturbances, hence, cigarettes smoking becomes the only relief to their problems. This might explain the higher frequency of smoking mothers in public schools compared to private schools. In the literature, maternal smoking during pregnancy has been correlated with a higher risk of dental decays for the child (Brosky, 2007). This higher risk for dental decays is not limited to smoking during pregnancy but also to the continuous second hand smoking when the child is living in a home where at least one of the parents is a smoker. This is supported by a Japanese study where they found that both maternal smoking during pregnancy and exposure to second hand smoking might be associated with an increased rate of dental decays (Tanaka et al., 2010). In the present study, a borderline correlation (p -value=0.059) was found between maternal cigarettes smoking and DMFT, which is in

concordance with the results found in the literature. A stronger association might have been found if the sample was bigger or the percentage of smoking mothers was higher.

Finally, the rate of children who have never had a previous dental consultation in public schools is almost double the rate of those in the private schools. This could be explained by the lack or difficulty to access dental care centers and potential financial issues.

C. Strengths and Limitations

The study we carried out has a cross-sectional design. Due to the cross-sectional nature of this study, it did not allow us to draw any causal relationships between the dependant variables (DMFT and plaque indices) and the independent variables and thus, only associations were tested. Moreover, although the direction of some associations reported was clear (e.g. DMFT and socio-economic status), reverse causality cannot be ruled out. The oral health status was examined using WHO recommended dental caries status (DMFT index) and the plaque index. Details of related factors such as predisposing factors and enabling factors, were obtained by a self-administered questionnaire given to the parents. Moreover, before children's screening and examination, calibration was performed and high levels of reliability and validity were obtained. The aim of the study was clearly explained by the researcher, which would have helped the parents to respond to the questionnaire. This study was the first update on oral health in Lebanon in this particular age group and it reflected on the potential risk factors associated with dental

caries and oral hygiene. Despite that the groups that were studied were representative of this population of children, given that the study was cross-sectional, we should be very careful in generalizing our results and conclusions.

A number of several limitations were present in this study. First, some recall bias might have been present given that the questionnaire encompassed some questions that required memory of the parents, such as feeding mode or smoking during pregnancy. Second, reporting bias such as misreporting or under or over reporting might have also emerged. For instance, educational level might have been over reported whereas maternal smoking during pregnancy might have been under reported. Family monthly income as well might have been either under or over reported. In addition, some questions might have not been well understood and therefore misreporting might have popped up. It is also possible that a bigger sample could be needed in order to detect higher associations between oral health and the potential risk factors and therefore draw more accurate conclusions.

D. Impact of this Study at the National Level

This study should have a great impact at the national level since it reported important findings on children's oral health status in Lebanon. Since DMFT scores in Lebanon are relatively high compared to some European and American countries, the urge to implement a nationwide public health system would be of great importance and benefits to the children and to the entire Lebanese population. Oral health being a part of general health, the Ministry of Health, Ministry of Education, other national authorities and the private sector including academic representatives, private organizations or foundations, should cooperate to improve oral health status among the population and

among children in particular. The findings of this study wherein public schools had DMFT score double of that of the private schools highlights on the importance of initiating these national based implementations at the level of public schools where oral health education and awareness are lacking. This could start by developing educational programs to increase awareness about oral health and collaborate with dentists to follow-up every year on the dental health of these children. In fact, the majority of private schools have already implemented these educational programs wherein all children are screened at the beginning of the academic year by a pedodontist and recommendations are given to the children and their parents, thus increasing awareness and personal care for their oral health.

CHAPTER VI

CONCLUSION AND RECOMMENDATIONS

This cross-sectional study aimed at identifying the relationship between oral health status and related factors and assessed the differences between private and public schools in Lebanon in a sample of 655 school children aged between 6 and 11 years old.

Dental caries are an important burden on the population worldwide and especially in developing countries where the prevalence is high. The results of this study showed that the prevalence of dental decays in Lebanon remains high compared to other developed countries especially when it comes to the lower socio-economic group

represented here by the public schools. It has been clearly shown that the DMFT index in public schools is almost double that of private schools and that the plaque index is relatively higher in public schools compared to private schools. Within the associated factors with DMFT and plaque indices, we noticed that children in public schools were at higher risks of developing dental decays compared to children in private schools. Dental decays and plaque index were associated with the socio-economic background of the parents, the oral hygiene habits and the frequency of dental brushing as well as with the dietary habits that showed to be poorer in the public schools compared to the private schools.

The high incidence of decayed teeth reveals the importance of early detection and early treatment preventing further complications and their impact on malocclusion and oral health. This is where educational programs and lifestyle interventions (diet and oral hygiene habits) could be highly effective in reducing the number of children with dental decays and thus increasing the percentage of caries-free children.

It has been well demonstrated that the etiology of dental caries is multifactorial and the interventions to reduce it should be done at different levels including the individual level, the community level and the environmental level. Health education, awareness campaigns and policy changes have been implemented in the majority of schools in USA and Europe through adopting a comprehensive school health program.

A Comprehensive school health program is an organized set of policies, procedures, and activities designed to protect and promote the health and well being of students and staff (Cottrell et al., 2002) and to provide the skills students need to avoid negative health practices (Carnegie Council on Adolescent Development, 1989; National

Commission on Children, 1991). These programs have been shown to be highly effective. In fact, the U.S Public Health Service has found that these programs bring healthy lifestyle changes and also lead to improved school attendance and graduation rates. Moreover, School-based health education programs using a comprehensive school health approach have been found to reduce risk behaviors, such as poor nutrition (Luepker et al., 1996), physical inactivity (Kelder, Perry & Klepp, 1993), tobacco use (Perry, Kelder, Murray & Klepp, 1992), unprotected sexual behavior (Kirby, 1992) and alcohol and drug abuse (Botvin et al., 1990). Since these risk behaviors are all linked to the formation of dental caries, this program, if implemented in the Lebanese schools, especially the public one where the incidence of dental decay is much higher compared to the private schools, would be highly beneficial in educating children on health in general and on oral health in particular and thus intending at reducing the number of decays among children.

This program includes eight components (Allensworth et al., 1987):

- 1- Health education, that suggests a planned health curriculum for all students,
- 2- A healthful school environment that promotes a healthful physical and emotional environment and makes the schools as safe as possible,
- 3- Health services that encourages promoting and protecting the health of every child and includes on-site health clinics, school nurses, school physicians, school dentists, and providing immunizations and screenings for vision and oral health, hearing, healthy weight, and head lice,
- 4- Physical education to promote regular exercise in schools as part of a healthful lifestyle,
- 5- Nutrition services that encourages balanced, appealing, and varied meals and snacks

for students,

6- Counseling services,

7- Community and family involvement to encourage the involvement of parents and the community in the schools,

8- Health promotion for faculty to promote a healthy staff.

If such a program is to be adopted by all the Lebanese public schools, some challenges could be encountered. One challenge would be the financial issue where it would be necessary for the Ministry of education to allocate the necessary funds to implement the different components of such a program, starting by the schools' environment that should be re-evaluated to respond to the requirements of the program.

Another challenge is availability of expertise. A comprehensive school approach requires that a health coordinator is present in each school. This might not be a difficult thing to be achieved since all public schools now have a school health educator who can assume this role. However the level of expertise of these educators should be assessed in light of the new requirements for a coordinated approach to school health.

Currently most of the components of the comprehensive school health program related to the school environment are lacking in public schools in Lebanon. Although general health screening and physical education are implemented in the schools where we carried out this research; the schools' environment is not adequate for the children. We have noted that classrooms are not suitable for the children, food and snacks sold are all high in sugar and carbohydrates and no cafeteria is available to offer healthy meals to the children. Furthermore family and community involvement is also lacking in these schools. In fact, we were able to witness this lack of family involvement when the school

invited the parents to attend a seminar on oral health and on the importance of dental sealant, which is a protective procedure against dental caries, and only 3 parents out of hundreds were present at the seminar. This emphasizes the importance of targeting the family and the environment because they are two of the main contributors to improve children's oral health and general health.

In addition, dental insurance would be of great importance in providing easier access to dental care and dental prevention and/or treatment, giving the opportunity to the disadvantaged ones to improve on their oral health and therefore, reduce the burden of dental caries in the Lebanese population, particularly, in children. However, since most parents of children in public schools cannot afford to pay insurance this approach should be studied carefully and in a way to be accessible to all socio-economical classes.

Finally, further research should be implemented to improve the quantity and the quality of the available studies in our country. It is important to observe and monitor the progress and follow-up on the children in Lebanon and to assess if the trend of oral health is improving and whether interventions are successful in reducing the prevalence of dental caries to reach the target set by the WHO which is a DMFT score equal to 3 in all countries at 12 years of age.

Table 1: Percent distribution of students aged 6-11 by socio-demographic characteristics and type of school

| <i>Socio-demographic characteristics</i> | | School type | | | | P-value |
|--|----------------------------|----------------|------|-----------------|------|---------|
| | | Public (N=325) | | Private (N=330) | | |
| | | Frequency | % | Frequency | % | |
| Gender | Female | 154 | 47.4 | 177 | 53.6 | 0.093 |
| | Male | 171 | 52.6 | 153 | 46.4 | |
| Marital status of the parents | Married | 211 | 89.8 | 268 | 96.1 | 0.005* |
| | Divorced/ widowed | 24 | 10.2 | 11 | 3.90 | |
| Educational level of the parents | Illiterate-> Elementary | 134 | 45.4 | 24 | 7.70 | 0.000* |
| | Intermediate/ Secondary | 130 | 44.1 | 62 | 20.0 | |
| | University | 31 | 10.5 | 224 | 72.3 | |
| Monthly family income | <1.000.000LL | 242 | 82.9 | 46 | 15.6 | 0.000* |
| | ≥1.000.000LL | 50 | 17.1 | 249 | 84.4 | |

(*): p-value <0.05

Table 2: Percent distribution of students aged 6-11 by health status characteristics and type of school

| <i>Health status characteristics of child</i> | | School type | | | | P-value |
|---|----------------|----------------|------|-----------------|------|---------|
| | | Public (N=325) | | Private (N=330) | | |
| | | Frequency | % | Frequency | % | |
| Presence of chronic disease(s) | Yes | 40 | 13.4 | 29 | 9.10 | 0.201 |
| | No | 258 | 86.6 | 290 | 90.9 | |
| Breathing mode | Nose | 97 | 35.3 | 118 | 39.5 | 0.433 |
| | Mouth | 29 | 10.5 | 24 | 8.00 | |
| | Both | 149 | 54.2 | 157 | 52.5 | |
| Maternal cigarettes Smoking | Yes | 58 | 20.4 | 22 | 7.00 | 0.000* |
| | No | 227 | 79.6 | 293 | 93.0 | |
| Feeding mode | Breast feeding | 162 | 53.3 | 101 | 31.0 | 0.000* |
| | Bottle feeding | 69 | 22.7 | 79 | 24.2 | |

| | | | | | | |
|-------------------------------|---------|-----|------|-----|------|--------|
| | Both | 73 | 24.0 | 146 | 44.8 | |
| Oral health perception | Good | 79 | 26.2 | 173 | 53.2 | 0.000* |
| | Average | 120 | 39.9 | 125 | 38.5 | |
| | Bad | 102 | 33.9 | 27 | 8.30 | |

(*): p-value <0.05

Table 3: Percent distribution of students aged 6-11 by oral hygiene characteristics and type of school

| <i>Oral Hygiene characteristics</i> | | School type | | | | P-value |
|-------------------------------------|--------------|----------------|------|-----------------|------|---------|
| | | Public (N=325) | | Private (N=330) | | |
| | | Frequency | % | Frequency | % | |
| Frequency of teeth brushing | ≤Once/ day | 193 | 64.1 | 216 | 66.3 | 0.000* |
| | 2-3times/day | 56 | 18.6 | 104 | 31.9 | |
| | Rarely | 52 | 17.3 | 6 | 1.80 | |
| Previous dental consultation | Yes | 209 | 70.4 | 280 | 85.9 | 0.000* |
| | No | 88 | 29.6 | 46 | 14.1 | |

(*): p-value <0.05

Table 4: Percent distribution of students aged 6-11 by nutritional habits characteristics and type of school

| <i>Nutritional habits characteristics</i> | | School type | | | | P-value |
|---|--------------------|----------------|------|-----------------|------|---------|
| | | Public (N=325) | | Private (N=330) | | |
| | | Frequency | % | Frequency | % | |
| Fluoride intake | Yes | 19 | 5.80 | 75 | 22.7 | 0.000* |
| | No | 241 | 74.2 | 239 | 72.4 | |
| Frequency of soda Intake | ≥Once/day | 126 | 42.7 | 57 | 17.8 | 0.000* |
| | >Once/week | 73 | 24.7 | 48 | 15.0 | |
| | Occasionally/never | 96 | 32.5 | 216 | 67.3 | |
| Frequency of sweets consumption | >Once/day | 132 | 44.7 | 119 | 36.8 | 0.000* |
| | Once/day | 122 | 41.4 | 186 | 57.6 | |
| | ≤Once/week | 41 | 13.9 | 18 | 5.60 | |

(*): p-value <0.05

Table 5: Percent distribution of students aged 6-11 by DMFT index and type of school

| <i>Dental Health</i> | School type | | | | | | P-value |
|----------------------|----------------|-----|-----------|-----------------|-----|-----------|---------|
| | Public (N=325) | | | Private (N=330) | | | |
| | Min | Max | Mean±SD | Min | Max | Mean±SD | |
| D | 0 | 17 | 5.67±3.81 | 0 | 11 | 1.48±2.19 | 0.000* |
| M | 0 | 9 | 0.52±0.99 | 0 | 4 | 0.18±0.54 | 0.000* |
| F | 0 | 12 | 1.11±1.99 | 0 | 11 | 1.85±2.50 | 0.000* |
| DMFT | 0 | 17 | 7.30±3.98 | 0 | 12 | 3.50±3.41 | 0.000* |

(*): p-value <0.05

Table 6: Percent distribution of students aged 6-11 by plaque index and type of school

| <i>Dental Health</i> | School type | | | | | | P-value |
|----------------------|----------------|------|-----------|-----------------|-----|-----------|---------|
| | Public (N=325) | | | Private (N=330) | | | |
| | Min | Max | Mean±SD | Min | Max | Mean±SD | |
| PI 16 | 1 | 3 | 1.33±0.32 | 1 | 2.4 | 1.18±0.18 | 0.000* |
| PI 12 | 1 | 3 | 1.54±0.31 | 1 | 2 | 1.29±0.26 | 0.000* |
| PI 24 | 1 | 2 | 1.25±0.32 | 1 | 2 | 1.14±0.22 | 0.002* |
| PI 36 | 1 | 2.25 | 1.30±0.26 | 1 | 1.8 | 1.20±0.17 | 0.000* |
| PI 32 | 1 | 3 | 1.40±0.32 | 1 | 3 | 1.20±0.26 | 0.000* |
| PI 44 | 1 | 3 | 1.25±0.32 | 1 | 1 | 1.06±0.10 | 0.000* |
| Average PI | 1 | 2.3 | 1.35±0.23 | 1 | 2.4 | 1.20±0.15 | 0.000* |

(*): p-value <0.05

Table 7: Association of DMFT and socio-demographic characteristics

| <i>Socio-demographic characteristics</i> | | DMFT | | | |
|--|-------------------------|------|------|------|---------|
| | | N | Mean | SD | P-value |
| Age | | | | | 0.439 |
| Gender | Female | 331 | 5.42 | 4.15 | 0.834 |
| | Male | 324 | 5.35 | 4.17 | |
| Marital status of the parents | Married | 479 | 5.08 | 4.10 | 0.780 |
| | Divorced/widowed | 35 | 4.88 | 3.70 | |
| Educational level of the parents | Illiterate-> Elementary | 158 | 7.00 | 4.09 | 0.000* |
| | Intermediate/ Secondary | 192 | 5.95 | 4.24 | |
| | University | 255 | 3.89 | 3.56 | |
| Monthly family income | <1.000.000LL | 288 | 6.87 | 4.09 | 0.000* |
| | ≥1.000.000LL | 299 | 3.95 | 3.57 | |

(*): p-value <0.05

Table 8: Association of DMFT and health status characteristics

| <i>Health status characteristics of child</i> | | DMFT | | | |
|---|-------|------|------|------|---------|
| | | N | Mean | SD | P-value |
| Presence of chronic disease(s) | Yes | 69 | 5.42 | 4.24 | 0.789 |
| | No | 538 | 5.28 | 4.08 | |
| Breathing mode | Nose | 215 | 5.10 | 4.35 | 0.302 |
| | Mouth | 53 | 6.01 | 4.57 | |
| | Both | 306 | 5.48 | 4.01 | |
| Maternal cigarettes Smoking | Yes | 80 | 6.08 | 4.24 | 0.059 |
| | No | 520 | 5.15 | 4.08 | |

| | | | | | |
|-------------------------------|----------------|-----|------|------|--------|
| Feeding mode | Breast feeding | 263 | 6.11 | 4.13 | 0.000* |
| | Bottle feeding | 148 | 4.85 | 4.19 | |
| | Both | 219 | 4.69 | 3.98 | |
| Oral health perception | Good | 252 | 3.58 | 3.79 | 0.000* |
| | Average | 245 | 5.61 | 3.83 | |
| | Bad | 129 | 8.21 | 3.65 | |

(*): p-value <0.05

Table 9: Association of DMFT and oral hygiene characteristics

| <i>Oral Hygiene characteristics</i> | | DMFT | | | |
|-------------------------------------|--------------|------|------|------|---------|
| | | N | Mean | SD | P-value |
| Frequency of teeth brushing | 2-3times/day | 160 | 3.93 | 3.60 | 0.000* |
| | ≤Once/day | 409 | 5.57 | 4.19 | |
| | Rarely | 58 | 7.68 | 3.94 | |
| Previous dental consultation | Yes | 488 | 5.35 | 4.00 | 0.866 |
| | No | 134 | 5.28 | 4.68 | |

(*): p-value <0.05

Table 10: Association of DMFT and nutritional habits characteristics

| <i>Nutritional habits characteristics</i> | | DMFT | | | |
|---|--------------------|------|------|------|---------|
| | | N | Mean | SD | P-value |
| Fluoride intake | Yes | 93 | 4.80 | 3.95 | 0.304 |
| | No | 480 | 5.28 | 4.13 | |
| Frequency of soda Intake | ≥Once/day | 183 | 6.42 | 3.89 | 0.000* |
| | >Once/week | 121 | 5.89 | 4.21 | |
| | Occasionally/never | 312 | 4.45 | 4.03 | |
| Frequency of sweets consumption | ≤Once/week | 59 | 6.08 | 4.38 | 0.000* |
| | Once/day | 308 | 4.69 | 4.07 | |
| | >Once/day | 251 | 6.02 | 4.08 | |

(*): p-value <0.05

Table 11: Association of plaque index and socio-demographic characteristics

| <i>Socio-demographic characteristics</i> | | Plaque Index (Average) | | | |
|--|-------------------------|-------------------------------|-------------|-----------|----------------|
| | | N | Mean | SD | P-value |
| Age | | | | | 0.493 |
| Gender | Female | 320 | 1.25 | 0.19 | 0.075 |
| | Male | 302 | 5.35 | 4.17 | |
| Marital status of the parents | Married | 458 | 1.25 | 0.19 | 0.060 |
| | Divorced/widowed | 34 | 1.32 | 0.26 | |
| Educational level of the parents | Illiterate-> Elementary | 142 | 1.36 | 0.23 | 0.000* |
| | Intermediate/ Secondary | 185 | 1.28 | 0.22 | |
| | University | 247 | 1.20 | 0.15 | |
| Monthly family income | <1.000.000LL | 268 | 1.32 | 0.22 | 0.000* |
| | ≥1.000.000LL | 291 | 1.21 | 0.17 | |

(*): p-value <0.05

Table 12: Association of plaque index and health status characteristics

| <i>Health status characteristics of child</i> | | Plaque Index (Average) | | | |
|---|----------------|-------------------------------|-------------|-----------|----------------|
| | | N | Mean | SD | P-value |
| Presence of chronic disease(s) | Yes | 64 | 1.30 | 0.26 | 0.156 |
| | No | 515 | 1.26 | 0.20 | |
| Breathing mode | Nose | 204 | 1.25 | 0.17 | 0.009* |
| | Mouth | 50 | 1.34 | 0.23 | |
| | Both | 292 | 1.27 | 0.31 | |
| Maternal cigarettes Smoking | Yes | 76 | 1.31 | 0.23 | 0.066 |
| | No | 497 | 1.26 | 0.21 | |
| Feeding | Breast feeding | 249 | 1.29 | 0.23 | 0.022* |

| | | | | | |
|-------------------------------|----------------|-----|------|------|--------|
| mode | Bottle feeding | 138 | 1.26 | 0.20 | 0.000* |
| | Both | 212 | 1.24 | 0.19 | |
| Oral health perception | Good | 239 | 1.21 | 0.17 | |
| | Average | 233 | 1.27 | 0.18 | |
| | Bad | 123 | 1.37 | 0.26 | |

(*): p-value <0.05

Table 13: Association of plaque index and oral hygiene characteristics

| <i>Oral Hygiene characteristics</i> | | Plaque Index (Average) | | | |
|-------------------------------------|--------------|-------------------------------|-------------|-----------|----------------|
| | | N | Mean | SD | P-value |
| Frequency of teeth brushing | 2-3times/day | 155 | 1.22 | 0.18 | 0.000* |
| | ≤Once/day | 392 | 1.27 | 0.20 | |
| | Rarely | 50 | 1.36 | 0.29 | |
| Previous dental consultation | Yes | 466 | 1.25 | 0.18 | 0.000* |
| | No | 126 | 1.33 | 0.29 | |

(*): p-value <0.05

Table 14: Association of plaque index and nutritional habits characteristics

| <i>Nutritional habits characteristics</i> | | Plaque Index (Average) | | | |
|---|--------------------|-------------------------------|-------------|-----------|----------------|
| | | N | Mean | SD | P-value |
| Fluoride intake | Yes | 90 | 1.21 | 0.19 | 0.010* |
| | No | 459 | 1.27 | 0.20 | |
| Frequency of soda Intake | ≥Once/day | 175 | 1.31 | 0.20 | 0.000* |
| | >Once/week | 114 | 1.31 | 0.23 | |
| | Occasionally/never | 297 | 1.23 | 0.20 | |
| Frequency of sweets consumption | ≤Once/week | 56 | 1.29 | 0.21 | 0.027* |
| | Once/day | 295 | 1.25 | 0.20 | |
| | >Once/day | 238 | 1.29 | 0.23 | |

(*): p-value <0.05

Table 15: Multiple regression analysis for associations between DMFT and other variables

| DMFT | | Coef. | Std. Err. | P-value | 95% CI |
|---|------------------------|--------------|------------------|----------------|-----------------|
| <i>Educational level of the parents</i> | Intermediate/Secondary | -0.571 | 0.432 | 0.187 | [-1.420;0.277] |
| | University | -0.676 | 0.500 | 0.177 | [-1.658;0.307] |
| <i>Monthly family income</i> | ≥1.000.000LL | -0.350 | 0.433 | 0.419 | [-1.200;0.500] |
| <i>Maternal cigarettes smoking</i> | No | 0.412 | 0.498 | 0.408 | [-0.567;1.391] |
| <i>Feeding mode</i> | Bottle feeding | -0.941 | 0.411 | 0.022* | [-1.748;-0.134] |
| | Both | -0.488 | 0.371 | 0.188 | [-1.217;0.239] |
| <i>Oral health perception</i> | Average | 1.276 | 0.362 | 0.000* | [0.563;1.989] |
| | Bad | 2.677 | 0.457 | 0.000* | [-0.716;1.386] |
| <i>Frequency of teeth brushing</i> | ≤once/day | 0.335 | 0.535 | 0.532 | [-0.716;1.386] |
| | Rarely | 0.756 | 0.578 | 0.192 | [-0.380;1.893] |
| <i>Frequency of soda intake</i> | >Once/week | -0.362 | 0.460 | 0.432 | [-1.267;0.542] |
| | Occasionally/never | -0.337 | 0.388 | 0.386 | [-1.100;0.426] |
| <i>Frequency of sweets consumption</i> | Once/day | 0.197 | 0.699 | 0.778 | [-1.176;1.571] |
| | >Once/day | 0.875 | 0.705 | 0.215 | [-0.510;2.261] |
| <i>School</i> | Private | -2.323 | 0.494 | 0.000* | [-3.294;-1.353] |

(*): p-value <0.05

Table 16: Multiple regression analysis for associations between DMFT and other variables including schools ID

| DMFT | | Coef. | Std. Err. | P-value | 95% CI |
|---|------------------------|--------------|------------------|----------------|-----------------|
| <i>Educational level of the parents</i> | Intermediate/Secondary | -0.613 | 0.420 | 0.145 | [-1.438;0.213] |
| | University | -0.579 | 0.488 | 0.236 | [-1.539;0.380] |
| <i>Monthly family income</i> | ≥1.000.000LL | -0.220 | 0.420 | 0.601 | [-1.047;0.606] |
| <i>Maternal cigarettes smoking</i> | No | 0.002 | 0.007 | 0.727 | [-0.011;0.016] |
| <i>Feeding mode</i> | Bottle feeding | -0.786 | 0.402 | 0.050* | [-1.577;0.005] |
| | Both | -0.529 | 0.363 | 0.146 | [-1.243;0.184] |
| <i>Oral health perception</i> | Average | 1.322 | 0.356 | 0.000* | [0.621;2.023] |
| | Bad | 2.805 | 0.443 | 0.000* | [1.933;3.677] |
| <i>Frequency of teeth brushing</i> | ≤once/day | 0.451 | 0.524 | 0.390 | [-0.579;1.482] |
| | Rarely | 0.338 | 0.547 | 0.537 | [-0.738;1.414] |
| <i>Frequency of soda intake</i> | >Once/week | -0.360 | 0.445 | 0.419 | [-1.235;0.514] |
| | Occasionally/never | -0.234 | 0.375 | 0.532 | [-0.970;0.501] |
| <i>Frequency of sweets consumption</i> | Once/day | -0.280 | 0.647 | 0.665 | [-1.553;0.991] |
| | >Once/day | 0.280 | 0.657 | 0.670 | [-1.010;1.571] |
| <i>School ID</i> | Private | 0.728 | 3.495 | 0.835 | [-6.138;7.595] |
| | 2 | -1.228 | 0.475 | 0.010* | [-2.162;-0.295] |
| | 3 | -4.258 | 3.607 | 0.238 | [-11.345;2.829] |
| | 4 | -3.273 | 3.608 | 0.365 | [-10.361;3.815] |
| | 5 | -3.869 | 3.585 | 0.281 | [-10.914;3.175] |
| | 6 | -3.925 | 3.574 | 0.273 | [-10.947;3.097] |
| | 7 | -4.475 | 3.577 | 0.211 | [-11.504;2.553] |

(*): p-value <0.05

Table 17: Multiple regression analysis for associations between plaque index and other variables

| Plaque index | | Coef. | Std. Err. | P-value | 95% CI |
|---|------------------------|--------------|------------------|----------------|----------------|
| <i>Gender</i> | Male | 0.017 | 0.018 | 0.349 | [-0.019;0.055] |
| <i>Marital status of the parents</i> | Divorced/widowed | 0.012 | 0.037 | 0.731 | [-0.060;0.085] |
| <i>Educational level of the parents</i> | Intermediate/Secondary | -0.060 | 0.032 | 0.059 | [-0.123;0.002] |
| | University | -0.047 | 0.037 | 0.206 | [-0.121;0.026] |
| <i>Monthly family income</i> | ≥1.000.000LL | -0.036 | 0.026 | 0.174 | [-0.087;0.016] |
| <i>Maternal cigarettes smoking</i> | No | 0.050 | 0.031 | 0.110 | [-0.011;0.112] |
| <i>Breathing mode</i> | Mouth | 0.036 | 0.039 | 0.357 | [-0.041;0.114] |
| | Both | -0.018 | 0.020 | 0.378 | [-0.058;0.022] |
| <i>Feeding mode</i> | Bottle feeding | -0.004 | 0.024 | 0.857 | [-0.053;0.044] |
| | Both | -0.006 | 0.023 | 0.776 | [-0.052;0.038] |
| <i>Presence of chronic disease(s)</i> | No | 0.018 | 0.032 | 0.575 | [-0.045;0.081] |
| <i>Oral health perception</i> | Average | 0.027 | 0.022 | 0.208 | [-0.015;0.070] |
| | Bad | 0.069 | 0.028 | 0.017* | [0.012;0.125] |
| <i>Previous dental consultation</i> | No | 0.022 | 0.026 | 0.393 | [-0.029;0.073] |
| <i>Fluoride intake</i> | No | 0.019 | 0.026 | 0.465 | [-0.032;0.070] |
| <i>Frequency of teeth brushing</i> | ≤once/day | 0.047 | 0.033 | 0.145 | [-0.016;0.112] |
| | Rarely | 0.054 | 0.044 | 0.225 | [-0.033;0.141] |
| <i>Frequency of soda intake</i> | >Once/week | -0.006 | 0.028 | 0.828 | [-0.062;0.050] |
| | Occasionally/never | -0.034 | 0.023 | 0.144 | [-0.801;0.012] |
| <i>Frequency of sweets consumption</i> | Once/day | -0.023 | 0.042 | 0.585 | [-0.105;0.060] |
| | >Once/day | -0.005 | 0.043 | 0.900 | [-0.089;0.078] |
| <i>School</i> | Private | -0.047 | 0.031 | 0.123 | [-0.108;0.013] |

(*): p-value <0.05

Table 18: Multiple regression analysis for associations between plaque index and other variables including schools ID

| Plaque index | | Coef. | Std. Err. | P-value | 95% CI |
|---|------------------------|--------------|------------------|----------------|------------------|
| <i>Gender</i> | Male | 0.023 | 0.017 | 0.189 | [-0.012;0.058] |
| <i>Marital status of the parents</i> | Divorced/widowed | 0.024 | 0.035 | 0.478 | [-0.043;0.093] |
| <i>Educational level of the parents</i> | Intermediate/Secondary | -0.049 | 0.028 | 0.086 | [-0.104;0.007] |
| | University | -0.019 | 0.033 | 0.559 | [-0.085;0.046] |
| <i>Monthly family income</i> | ≥1.000.000LL | -0.034 | 0.023 | 0.143 | [-0.080;0.012] |
| <i>Maternal cigarettes smoking</i> | No | 0.000 | 0.000 | 0.502 | [-0.000;0.001] |
| <i>Breathing mode</i> | Mouth | 0.014 | 0.034 | 0.679 | [-0.053;0.081] |
| | Both | -0.009 | 0.018 | 0.615 | [-0.045;0.027] |
| <i>Feeding mode</i> | Bottle feeding | 0.017 | 0.023 | 0.432 | [-0.027;0.063] |
| | Both | -0.014 | 0.021 | 0.495 | [-0.055;0.026] |
| <i>Presence of chronic disease(s)</i> | No | 0.000 | 0.000 | 0.890 | [-0.0008;0.0009] |
| <i>Oral health perception</i> | Average | 0.031 | 0.020 | 0.128 | [-0.009;0.070] |
| | Bad | 0.074 | 0.026 | 0.004* | [0.023;0.125] |
| <i>Previous dental consultation</i> | No | -0.0007 | 0.001 | 0.508 | [-0.002;0.001] |
| <i>Fluoride intake</i> | No | 0.000 | 0.000 | 0.531 | [-0.0005;0.0009] |
| <i>Frequency of teeth brushing</i> | ≤once/day | 0.053 | 0.029 | 0.068 | [-0.004;0.109] |
| | Rarely | 0.044 | 0.035 | 0.212 | [-0.025;0.113] |
| <i>Frequency of soda intake</i> | >Once/week | -0.009 | 0.026 | 0.723 | [-0.041;0.060] |
| | Occasionally/never | -0.017 | 0.021 | 0.415 | [-0.059;0.024] |
| <i>Frequency of sweets consumption</i> | Once/day | -0.040 | 0.038 | 0.297 | [-0.114;0.035] |
| | >Once/day | -0.029 | 0.039 | 0.464 | [-0.105;0.048] |
| <i>School</i> | Private | 0.043 | 0.170 | 0.801 | [-0.293;0.379] |
| <i>ID</i> | 2 | -0.166 | 0.028 | 0.000* | [-0.223;-0.110] |
| | 3 | -0.228 | 0.178 | 0.203 | [-0.579;0.123] |
| | 4 | -0.252 | 0.177 | 0.157 | [-0.602;0.097] |
| | 5 | -0.229 | 0.177 | 0.197 | [-0.577;0.119] |
| | | | | | |

| | | | | | |
|--|---|--------|-------|-------|----------------|
| | 6 | -0.230 | 0.177 | 0.195 | [-0.577;0.118] |
| | 7 | -0.223 | 0.177 | 0.209 | [-0.572;0.126] |

(*): p-value <0.05

Table 19: Generalized Estimating Equation (GEE) analysis for clustering effect at school ID level for the DMFT index

| DMFT (GEE) | | Coef. | Std. Err. | P-value | 95% CI |
|---|------------------------|--------|-----------|---------|-----------------|
| <i>Educational level of the parents</i> | Intermediate/Secondary | -0.593 | 0.259 | 0.022* | [-1.102;-0.084] |
| | University | -0.708 | 0.413 | 0.087 | [-1.519;0.102] |
| <i>Monthly family income</i> | ≥1.000.000LL | -0.375 | 0.267 | 0.160 | [-0.898;0.148] |
| <i>Maternal cigarettes smoking</i> | No | 0.420 | 0.882 | 0.634 | [-1.310;2.150] |
| <i>Feeding mode</i> | Bottle feeding | -0.954 | 0.656 | 0.146 | [-2.240;0.331] |
| | Both | -0.503 | 0.141 | 0.000* | [-0.780;-0.225] |
| <i>Oral health perception</i> | Average | 1.283 | 0.666 | 0.054* | [-0.022;2.588] |
| | Bad | 2.675 | 0.520 | 0.000* | [1.655;3.696] |
| <i>Frequency of teeth brushing</i> | ≤once/day | 0.381 | 0.440 | 0.386 | [-0.481;1.243] |
| | Rarely | 0.760 | 0.717 | 0.290 | [-0.647;2.166] |
| <i>Frequency of soda intake</i> | >Once/week | -0.375 | 0.640 | 0.557 | [-1.631;0.879] |
| | Occasionally/never | -0.355 | 0.524 | 0.497 | [-1.383;0.671] |
| <i>Frequency of sweets consumption</i> | Once/day | 0.204 | 0.563 | 0.716 | [-0.899;1.308] |
| | >Once/day | 0.891 | 0.736 | 0.226 | [-0.552;2.336] |
| <i>School</i> | Private | -2.273 | 0.832 | 0.006* | [-3.904;-0.643] |

(*): p-value <0.05

Table 20: Generalized Estimating Equation (GEE) analysis for clustering effect at school ID level for the plaque index

| Plaque index (GEE) | | Coef. | Std. Err. | P-value | 95% CI |
|---|------------------------|--------------|------------------|----------------|-----------------|
| <i>Gender</i> | Male | 0.017 | 0.016 | 0.262 | [-0.013;0.048] |
| <i>Marital status of the parents</i> | Divorced/widowed | 0.012 | 0.042 | 0.769 | [-0.071;0.096] |
| <i>Educational level of the parents</i> | Intermediate/Secondary | -0.061 | 0.021 | 0.004* | [-0.103;-0.019] |
| | University | -0.048 | 0.021 | 0.019* | [-0.089;-0.008] |
| <i>Monthly family income</i> | ≥1.000.000LL | -0.036 | 0.023 | 0.123 | [-0.082;0.009] |
| <i>Maternal cigarettes smoking</i> | No | 0.051 | 0.047 | 0.279 | [-0.041;0.142] |
| <i>Breathing mode</i> | Mouth | 0.036 | 0.026 | 0.160 | [-0.014;0.087] |
| | Both | -0.018 | 0.020 | 0.382 | [-0.058;0.049] |
| <i>Feeding mode</i> | Bottle feeding | -0.006 | 0.020 | 0.730 | [-0.046;0.032] |
| | Both | -0.006 | 0.023 | 0.776 | [-0.052;0.038] |
| <i>Presence of chronic disease(s)</i> | No | 0.018 | 0.031 | 0.561 | [-0.043;0.078] |
| <i>Oral health perception</i> | Average | 0.027 | 0.026 | 0.291 | [-0.023;0.079] |
| | Bad | 0.069 | 0.062 | 0.264 | [-0.052;0.189] |
| <i>Previous dental consultation</i> | No | 0.022 | 0.034 | 0.517 | [-0.044;0.089] |
| <i>Fluoride intake</i> | No | 0.019 | 0.015 | 0.205 | [-0.010;0.049] |
| <i>Frequency of teeth brushing</i> | ≤once/day | 0.049 | 0.023 | 0.038* | [0.002;0.095] |
| | Rarely | 0.054 | 0.021 | 0.012* | [0.011;0.096] |
| <i>Frequency of soda intake</i> | >Once/week | -0.006 | 0.042 | 0.878 | [-0.088;0.076] |
| | Occasionally/never | -0.034 | 0.019 | 0.144 | [-0.801;0.012] |
| <i>Frequency of sweets consumption</i> | Once/day | -0.022 | 0.026 | 0.403 | [-0.075;0.030] |
| | >Once/day | -0.005 | 0.039 | 0.907 | [-0.081;0.072] |
| <i>School</i> | Private | -0.047 | 0.042 | 0.266 | [-0.130;0.036] |

(*): p-value <0.05

Table 21: General Linear Model (GLM) analysis for plaque and DMFT indices

| GLM: DMFT+Plaque indices | Wilk's Lambda | |
|---|----------------------|----------------|
| | Value | P-value |
| <i>Gender</i> | 0.995 | 0.434 |
| <i>Marital status of the parents</i> | 0.995 | 0.479 |
| <i>Educational level of the parents</i> | 0.994 | 0.394 |
| <i>Monthly family income</i> | 0.991 | 0.239 |
| <i>Maternal cigarettes smoking</i> | 0.992 | 0.265 |
| <i>Breathing mode</i> | 0.997 | 0.635 |
| <i>Feeding mode</i> | 0.998 | 0.719 |
| <i>Presence of chronic disease(s)</i> | 0.999 | 0.849 |
| <i>Oral health perception</i> | 0.953 | 0.000* |
| <i>Previous dental consultation</i> | 0.986 | 0.098 |
| <i>Fluoride intake</i> | 0.991 | 0.249 |
| <i>Frequency of teeth brushing</i> | 0.989 | 0.160 |
| <i>Frequency of soda intake</i> | 0.993 | 0.336 |
| <i>Frequency of sweets consumption</i> | 0.985 | 0.087 |
| <i>School</i> | 0.998 | 0.683 |
| <i>ID</i> | 0.986 | 0.103 |

(*): p-value <0.05

Table 22: Percent distribution of those who consented and those who did not in public schools for the DMFT index

| | | DMFT | | | |
|---------------------------|-----|------|------|------|---------|
| | | N | Mean | SD | P-value |
| Consented (public) | No | 204 | 7.88 | 7.43 | 0.239 |
| | Yes | 325 | 7.30 | 3.98 | |

(*): p-value <0.05

Table 23: Percent distribution of those who consented and those who did not in public schools for the plaque index

| | | Plaque Index Average | | | |
|---------------------------|-----|----------------------|------|------|---------|
| | | N | Mean | SD | P-value |
| Consented (public) | No | 192 | 1.35 | 0.21 | 0.758 |
| | Yes | 301 | 1.35 | 0.23 | |

(*): p-value <0.05

Table 24: Percent distribution of those who consented and those who did not in public schools for age

| | | Age | | | |
|---------------------------|-----|-----|------|------|---------|
| | | N | Mean | SD | P-value |
| Consented (public) | No | 204 | 9.15 | 6.50 | 0.083 |
| | Yes | 325 | 8.50 | 1.40 | |

(*): p-value <0.05

Table 25: Percent distribution of those who consented and those who did not in public schools for gender

| | | Gender | | | | P-value |
|--|--|--------|---|---------|---|---------|
| | | Males | | Females | | |
| | | N | % | N | % | |
| | | | | | | |

| | | | | | | |
|---------------------------|-----|-----|------|-----|------|-------|
| Consented (public) | No | 204 | 40.4 | 204 | 36.4 | 0.304 |
| | Yes | 325 | 59.6 | 325 | 63.6 | |

(*): p-value <0.05

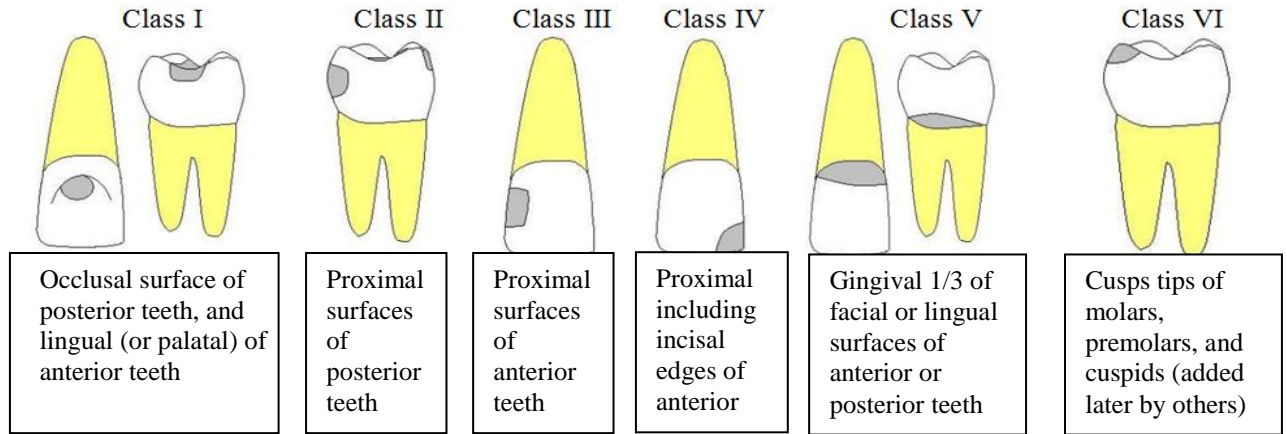


Figure1: Black's classification of dental caries (Wikipedia)

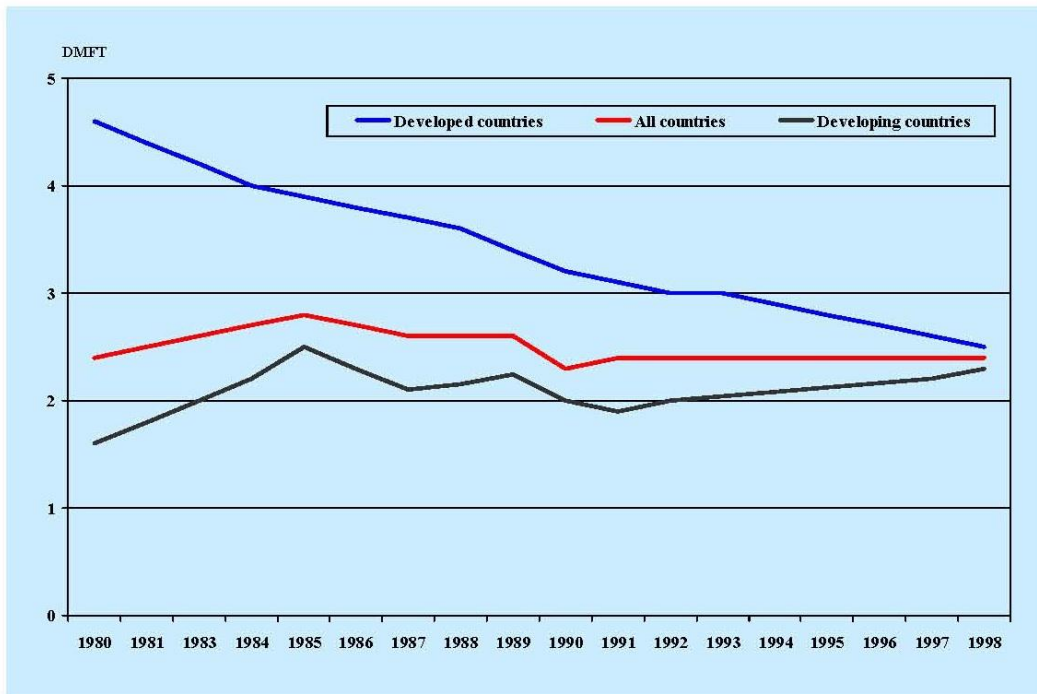


Figure 2: Changing levels of dental caries experience (DMFT) among 12-year-olds in developed and developing countries (World Health Organization, 2003)

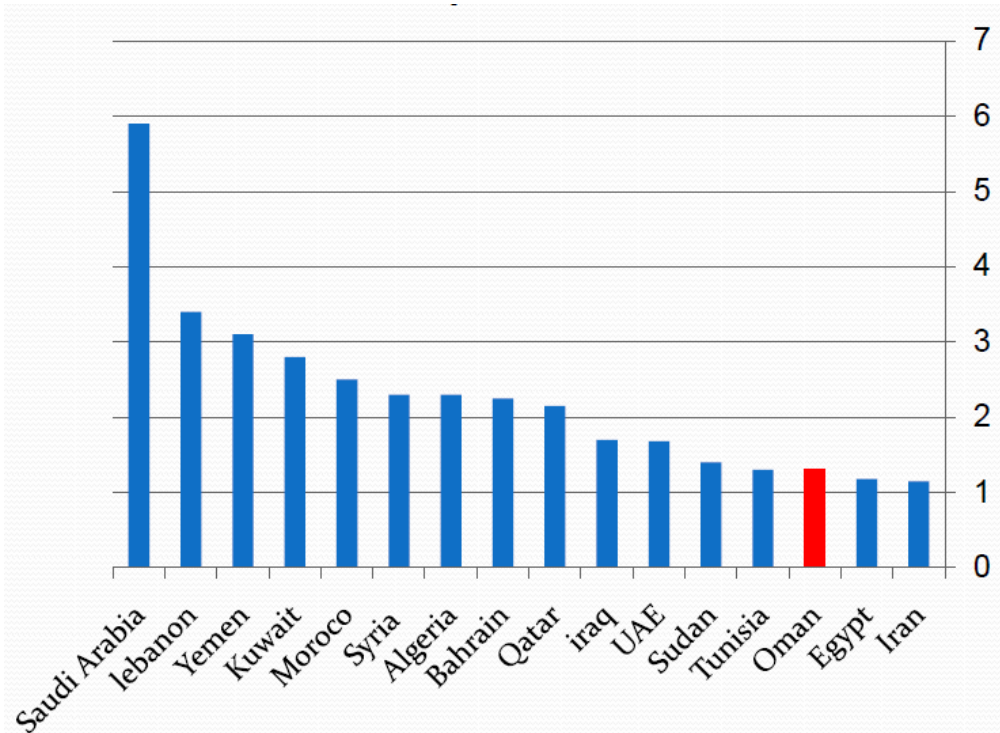


Figure 3: DMFT for 12 years old children. (World Health Organization, 2003)

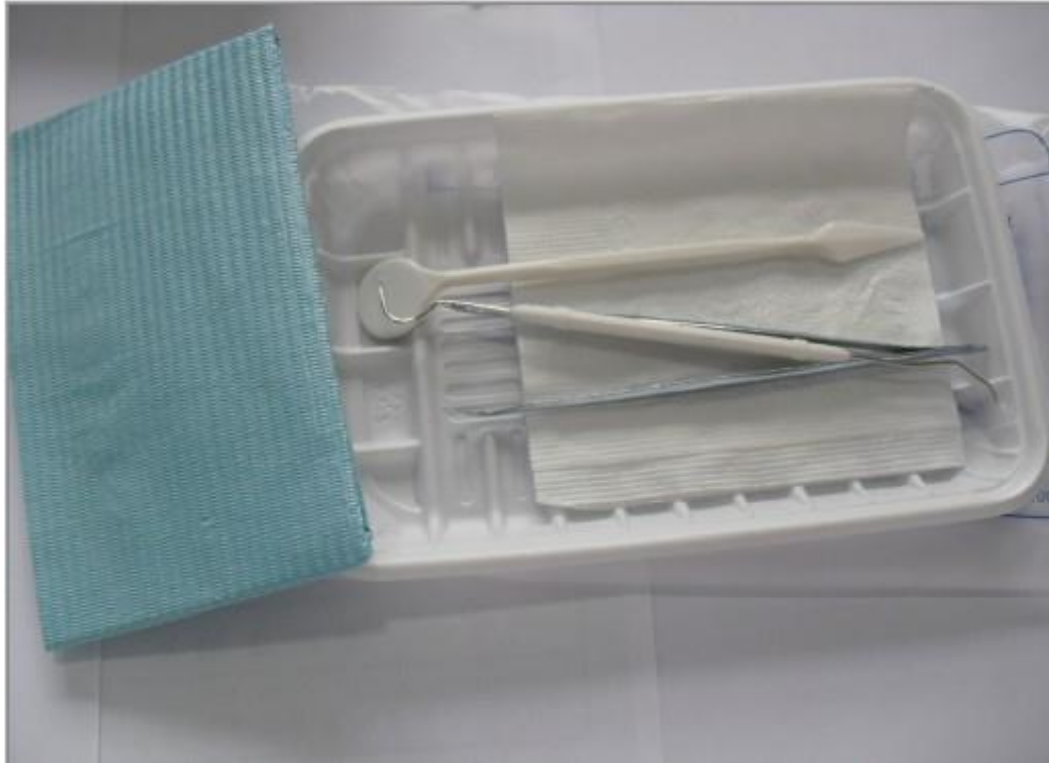


Figure 4: Examining kit

REFERENCES

- Acs, G., Shulmann, R., Ng, M., W., et al. (1999). The effect of dental rehabilitation on the body weight of children with early childhood caries. *Pediatric Dentistry*, 21(2), 109–113.
- Al Khateeb TL, Darwih SK, Balsawi AE, O Mullane DM (1999). Caries prevalence and treatment need amongst children in Saudi Arabian community. *Comm. Dent Oral Epid.* 19(5):227-280.
- Allensworth, Diane D., and Kolbe, Lloyd J. (1987). "The Comprehensive School Health Program: Exploring an Expanded Concept." *Journal of School Health* 57(10):409–412.
- Anderson H K, Drummond, B K, Thomson W M. (2004). Changes in aspects of children's oral-healthrelated quality of life following dental treatment under general anaesthetic. *Int J Paediatr Dent*; 14: 317-325.
- Ayhan H, Suskan E, Yildirim S. (1996) The effect of nursing or rampant caries on height, body weight and head circumference. *J Clin Pediatr Dent*; 20: 209-212.
- Botvin, G., Baker, E., Dusenbury, L., Tortu, S. & Botvin, E. (1990). Preventing adolescent drug abuse through a multimodal cognitive-behavioural approach: Results of a 3-year study. *Journal of Consulting and Clinical Psychology*, 58, 437-446.
- Brosky, M., E. (2007). The role of saliva in oral health: strategies for prevention and management of xerostomia. *The Journal of Supportive Oncology*, 5, 215-225.
- Burt, B. (2002). Fluoridation and social equity. *Journal of Public Health Dentistry*, 62:195-200.
- Burton L. Edelstein, Courtney H. Chinn. Update on Disparities in Oral Health and Access to Dental Care for America's Children. *Academic Pediatrics*. Volume 9, Issue 6, November–December 2009, Pages 415–419.
- Chedid NR *et al.* (2011). Caries prevalence and caries risk in a sample of Lebanese preschool children. *Odontostomatol Trop*; 34(134):31-45.
- Cleaton-Jones, P., Richardson, B.D., Winter, G.B., Sinwel, R.E., Rantsho, J.M. and Jodaikin, A. (1984) Dental caries and sucrose intake in five South African preschool groups. *Community Dental and Oral Epidemiology* 12, 381– 385.
- Cottrell, Randal R.; Girvan, James T.; and McKenzie, James F., eds. (2002). *Principles and Foundations of Health Promotion and Education*, 2nd edition. San Francisco: Benjamin Cummings.

- Dawes, C. (1989). An analysis of factors influencing diffusion from dental plaque into a moving film of saliva and the implications for caries. *Journal of Dental Research* 68, 1483-1488.
- Demakakos, P., Nazroo, J., Breeze, E., & Marmot, M. (2008). Socioeconomic status and health among the aged in the United States and Germany, a comparative cross-sectional study. *Social Science and Medicine*, 67, 330-340.
- Doughan B. *et al.* La santé bucco-dentaire des écoliers au Liban (2002). *Cahiers d'études et de recherches francophones / Santé .Volume 12, Numéro 2, 223-8, Etudes originales.*
- Doughan, B., & Doumit, M. (1995). Oral health in Lebanon: a situation analysis. Lebanese University, Beirut.
- Doughan, B., Doumit, M., & Hussein, S. (1996). Oral health pathfinder: survey in Lebanon. *Revue Dentaire Libanaise*, 2(2), Retrieved from :<http://www.emro.who.int/Publications/EMHJ/0202/16.html>
- Edelstein BL. (2002). Disparities in oral health and access to care: findings of national surveys. *Ambul Pediatr.*;2(2 Suppl):141-7.
- Edgar, W., Bowen, W., Cole, M. (1981). Development of rampant dental caries, and composition of plaque fluid and saliva in irradiated primates. *Journal of Oral Pathology & Medicine* 10(4), 284-295.
- Featherstone, J. (2000). The science and practice of caries prevention. *Journal of the American Dental Association*, 131, 887-99.
- Featherstone, J., & O'reilly, M. (1986). Enhancement of remineralisation in vitro and in vivo. In Factors relating to demineralisation and remineralisation of the teeth. *IRL Press. Oxford and Washington.*
- Filstrup SL, Briskie D, da Fonseca M, Lawrence L, Wandera A, Inglehart MR. (2003). Early childhood caries and quality of life: child and parent perspectives. *Pediatr Dent*; 25: 431-40.
- Freire Mdo C, Reis SC, Gonçalves MM, et al. (2010). Oral health in 12 year-old students from public and private schools in the city of Goiânia, Brazil. *Rev Panam Salud Publica*; 28(2) :86-91.
- Gift H C, Reisine S T, Larach D C. (1992). The social impact of dental problems and visits. *Am J Public Health*; 82: 1663-1668.
- Griffin SO, Jones K, Tomar SL. (2001). An economic evaluation of community water fluoridation. *Journal of Public Health Dentistry*; 61:78-86.
- Griffin, S., Griffin, P., Swann, J., Zlobin, N. (2005). New coronal caries in older adults: implications for prevention. *Journal of Dental Research*, 84, (8), 715-20.

- Hallonsten AL, Wendt LK, Mejàre I, Birkhed D, Håkansson C, Lindvall AM, Edwardsson S, Koch G. (1995). Dental caries and prolonged breast-feeding in 18-month-old Swedish children. *Int J Paediatr Dent.*;5(3):149-55.
- Hayes C. (2006). Nutrient intake of children with severe early childhood caries (S-ECC). *American Association for Dental Research*.
- Hefferenn, J. (1986). Proceedings: scientific consensus conference on methods for assessment of the cariogenic potential of foods, San Antonio. *Journal of Dental Research*, 65.
- Hussein, S., A., Doumit, M., Doughan, B., El Nadeef, M. (1996). Oral health in Lebanon: a pilot pathfinder survey. *Eastern Mediterranean Health Journal*, 2, (2).
- Huysmans, M., Longbottom, C., Pitts, N. (1998) . Electrical methods in occlusal caries diagnosis: an in vitro comparison with visual inspection and bite-wing radiography. *Caries Research*, 32, 324–32.
- Juan J. Villalobos-Rodelo, Carlo E. Medina-Solís,† Gerardo Maupome, Ana A. Vallejos-Sánchez, Laura Lau-Rojjo, and Marco V. Ponce de León-Viedas (2007). Socioeconomic and Sociodemographic Variables Associated With Oral Hygiene Status in Mexican Schoolchildren Aged 6 to 12 Years. *J. Periodontology*, Volume 78, Number 5, pages 816-822.
- Kaste, L., Selwitz, R., Oldakowski, R., Brunelle, J., Winn, D., Brown, L. (1996). Coronal caries in the primary and permanent dentition of children and adolescents 1-17 years of age: United States, 1988--1991. *Journal of Dental Research*, 75 Spec No, 631-641.
- Kay, E., & Locker, D. (1996). Is dental health education effective? A systematic review of current evidence. *Community Dentistry and Oral Epidemiology*, 24: 231-235.
- Kelder, S., Perry, C. & Klepp, K. (1993). Community-wide youth exercise education: Longterm outcomes of the Minnesota Heart Health Program. *Journal of School Health*, 63(4), 218-223.
- Lindhe, J. (2003). *Clinical Periodontology and Implant Dentistry*. Oxford: Blackwell Munksgaard, a Blackwell Publishing Company.
- Locker, D. (2009). Self-esteem and socioeconomic disparities in self-perceived oral health. *Journal of Public Health Dentistry*, 69(1), 1-8.
- Low W, Tan S, Schwartz S. (1999). The effect of severe caries on the quality of life in young children. *Pediatric Dent*; 21: 325–26.
- Luepker, R.V., Perry, C., McKinlay, S., Nader, P., Parcel, G., Stone, E., Webber, L., Elder, J., Feldman, H., Johnson, C., Kelder, S. & Wu, M. (1996). Outcomes of a field trial to improve children's dietary patterns and physical activity: The Child and

Adolescent Trial for Cardiovascular Health (CATCH). *Journal of the American Medical Association*, 275, 768-776.

- Majewski, R., Snyder, C., Bernat, J. (1988). Dental emergencies presenting to a children's hospital. *ASDC Journal of Dentistry for Children*, 55, 339-342.
- Mansbridge, J.N. (1959). Sex differences in the prevalence of dental caries. *British Dental Journal* 106, 303-308.
- Marinho, V., Higgins, J., Logan, S., Sheiham, A. (2003). Topical fluoride (toothpastes, mouthrinses, gels or varnishes) for preventing dental caries in children and adolescents. *Cochrane database of systematic reviews*, (4), CD002782.
- Means R T, Krantz S B. (1992). Progress in understanding the pathogenesis of the anemia of chronic disease. *Blood*; **80**: 1639-1647.
- Means, R. T. (2003). Recent developments in the anemia of chronic disease. *Current Hematology Reports*, 2(2), 116-121.
- Mohebbi SZ, Virtanen JI, Vahid-Golpayegani M, Vehkalahti MM. (2008). Feeding habits as determinants of early childhood caries in a population where prolonged breastfeeding is the norm. *Community Dent Oral Epidemiol.*;36(4):363-9.
- Moreira PVL, Rosenblatt A, Passos IA. (2007). Prevalence of cavities among adolescents in public and private schools in João Pessoa, Paraíba State, Brazil. *CiêncSaúde Coletiva*;12(5):1229-36.
- Neville, B.W *et al.* (2002). "Oral & Maxillofacial Pathology." 2nd edition, 247, 398.
- Nithila, A., Bourgeois, D., Barmes, D., Murtomaa H. (1998). WHO Global Oral Data Bank, 1986-96: an overview of oral health surveys at 12 years of age. *Bulletin of the World Health Organization* 76: 237-244.
- Perry, C., Kelder, S., Murray, D. & Klepp, K. (1992). Community-wide smoking prevention: Long-term outcomes of the Minnesota Heart Health Program and the Class of 1989 Study. *American Journal of Public Health*, 9, 1210-1216.
- Petersen PE. (2003). The World Health Report 2003: continuous improvement of oral health in the 21st century __ the approach of the WHO Global Oral Health Programme. *Community Dentistry and Oral Epidemiology*; 31 Suppl 1:3-24.
- Piovesan C. *et al* (2010). Impact of socioeconomic and clinical factors on child oral health-related quality of life (COHRQoL). *Qual Life Res.*;19(9):1359-66.
- Pitts, N. (2004). Are we ready to move from operative to non-operative/preventive treatment of dental caries in clinical practice? *Caries Research*, 38, 294-304.
- Ratnayake N, Ekanayake L. (2005). Prevalence and impact of oral pain in 8-year-old children in Sri Lanka. *Int J Paediatr Dent*; 15: 105-112.

- Reich, E., Lussi, A., & Newbrun, E. (1999). Caries-risk assessment. *International Dental Journal*, 49(1), 15-26.
- Reisine S T. (1985). Dental health and public policy: the social impact of disease. *Am J Public Health*; 75: 27-30.
- Rima T Nakkash, Joanna Khalil, Monique Chaaya and Rema A. Afifi (2010): Building research evidence for policy advocacy: a qualitative evaluation of existing smoke-free policies in Lebanon. *Asia Pac J Public Health*; 22: 168S
- Rishi Tyagiet al. (2008). Genetic basis of dental disorders: a review. *Journal of oral health and community dentistry*; 2(3).
- Roberts GJ, Cleaton-Jones PE, Fatti LP, Richardson BD, Sinwel RE, Hargreaves JA, Williams S. (1993). Patterns of breast and bottle feeding and their association with dental caries in 1- to 4-year-old South African children. 1. Dental caries prevalence and experience. *Community Dent Health*; 10(4):405-13.
- Rogers, A. (2008). *Molecular Oral Microbiology*. Caister Academic Press. ISBN 978-1-904455-24-0. Retrieved May 15 from <http://www.horizonpress.com/oral2>
- Rolla, G., Saxegaard, E. (1990). Critical evaluation of the composition and use of topical fluorides, with emphasis on the role of calcium fluoride in caries inhibition. *Journal of Dental Research* 69, 780-785.
- Rosenblatt A, Zarzar P. (2004). Breast-feeding and early childhood caries: an assessment among Brazilian infants. *Int J Paediatr Dent.*; 14(6):439-45.
- Sabbah, W., Tsakos, G., Sheiham, A., & Watt, R.G. (2009). The Role of health-related behaviors in the socioeconomic disparities in oral health. *Social Science and Medicine*, 68, 298-303.
- Shepherd M A, Nadanovsky P, Sheiham A. (1999). The prevalence and impact of dental pain in eight year old school children in Harrow, England. *Br Dent J*; 187: 38-41.
- Sprod, A., Anderson, R., & Treasure, E. (1996). *Effective oral health promotion*. Literature Review. Health Promotion Wales.
- Susan G. Reed (2006). The epidemiology of dental caries in older adults. *Medical University of South Carolina/SC-Geriatric Education Center*.
- Takashi Hanioka, Miki Ojima, Keiko Tanaka 3 and Mito Yamamoto. (2011). Does Secondhand Smoke Affect the Development of Dental Caries in Children? A Systematic Review. *Int. J. Environ. Res. Public Health*, 8, 1503-1519
- Tamari J. An Assessment of oral disease among primary school children in Lebanon; 1. Assessment of dental caries (1973). *International Dental journal*, Volume 24, Issue 3. Pages 407-415.

- Tanaka, Keiko; Miyake, Yoshihiro; Sasaki, Satoshi. (2010). The Effect of Maternal Smoking During Pregnancy and Postnatal Household Smoking on Dental Caries in Young Children. *Obstetrical & Gynecological Survey: Volume 65 - Issue 1 - pp 15-17*.
- Thomas C W, Primosch R E. (2002). Changes in incremental weight and well-being of children with rampant caries following complete dental rehabilitation. *Pediatr Dent; 24: 109–113*.
- Ur Rehman, M. M., Mahmood, N., & Rehman, B. (2008). The relationship of caries with oral hygiene status and extra-oral risk factors. *Journal of Ayub Medical College, Abbottabad :JAMC, 20(1), 103-108*.
- US Department of Health. Health care financing administration (1998). National health expenditures. *Washington, DC: Health Care Financing Administration*.
- Varenne B. *et al.* (2011). Family environment and dental health disparities among urban children in Burkina Faso. *Rev Epidemiol Sante Publique*.
- Wang NJ, Kallestaal C, Pertersen PE, Arnadottir IB. (1998). Caries preventive services for children and adolescents in Denmark, Iceland, Norway and Sweden: strategies and resource allocation. *Community Dentistry and Oral Epidemiology; 26:263-71*.
- White H, Lee J Y, Vann W F Jr. (2003). Parental evaluation of quality of life measures following pediatric dental treatment using general anesthesia. *Anesth Prog; 50: 105-110*.
- Williams, S.A., Kwan, S.Y.L., and Parsons, S. (2000): Parental smoking practices and caries experience in pre-school children. *Caries Research 34, 117–122*
- Windstrom E, Eaton KA. (2004). Oral health care systems in the extended European Union. *Oral Health and Preventive Dentistry; 2:155-94*.
- Winn, D., Brunelle, J., Selwitz, R., et al. (1996). Coronal and root caries in the dentition of adults in the United States, 1988--1991. *Journal of Dental Research, 75, Spec No, 642--51*.
- World Health Organization. (1982). Retrieved from http://www.esbhhealth.nhs.uk/publications/public_health/oral.asp
- World Health Organization. (2003). The World Oral Health Report 2003. Continuous improvement of oral health in the 21st century– the approach of the WHO Global Oral Health Programme. Retrieved from www.who.int/oral_health/media/en/orh_report03_en.pdf
- World Health Organization. (2009). Oral Health. Retrieved from http://www.who.int/topics/oral_health/en/

Yee R, Sheiham A. (2002).the burden of restorative dental treatment for children in third world countries. *International Dental Journal*; 52:1-9.

التربية الصحية
وزارة التربية والتعليم العالي، المديرية العامة للتربية، الإرشاد والتوجيه
-
نتائج الكشف الطبي بالمدرسي على أسنان
2005 - 2006 إحصاء

Appendices

الرقم المتسلسل: _____

تقييم صحة الفم في المدارس الابتدائية في لبنان: مقارنة بين المدارس العامة والخاصة

الجامعة الامريكية في بيروت
الاسئلة الخاصة بالاهل

كجزء من التقييم الصحي السنوي الذي تنظمه Ajjalouna، جرت تقييم صحة فم وأسنان طفلك من قبل أطباء أسنان مخططين. لم يتلق طفلك أي علاج، وأرسلت ورقة معه لإعلامك ما إذا كان بحاجة إلى أي علاج. نود استخدام البيانات التي تم جمعها من فحص فم وأسنان طفلك في بحث يهدف إلى تقييم صحة طفلك عن طريق الفم، وربط العوامل السلوكية والخلفية على حد سواء من الأطفال والاهل وستعرض البيانات على شكل بيانات. ان مشاركتكم الطوعية، والمشكورة هي جد مطلوبة، لتجميع المعلومات المتعلقة باولادكم، وبحالة، وسلامة اسنانهم، بحيث يمكن ربطها بعوامل تتعلق بسلوكية وعادات الاولاد والاهل معا. ترمي الدراسة الى متابعة الأطفال لسنوات خمسة لمتابعة صحة أسنانهم.

نرجو ان تأخذوا وقتكم بقراءة هذه المعلومات بدقّة وروية، قبل قرار المشاركة في الاستطلاع او عدمه:

1. سوف لن يأخذ الاستطلاع من وقتكم اكثر من 5 دقائق، كما ان الاسم والاجوبة سوف تكون مجهولة المصدر، ولن تنشر مُطلقاً.

2. يمكن لكم عدم الاجابة عن كلّ الاسئلة، حتى بعد توقيع القبول بالمشاركة

بعد قراءة وفهم كل ابعاد هذا البحث، وتم اخذ القرار بالمشاركة من قبلكم وتعبئة الاستطلاع، الرجاء توقيع القسم الأول.

إذا وافقتم على امكانية الاتصال بكم بعد سنوات قادمة لتحديث مضمون هذا الاستطلاع، الرجاء توقيع القسم الثاني. سيتم الكشف وفحص الاطفال من قبل أطباء اسنان متخصصين، ليُصار بعدها الى تدوين المعلومات عن كلّ حالة. إذا كان الولد بحاجة الى علاج معين، سوف يتم ابلاغ الاهل عبر رسالة خطية تُرسل مع ولدهم. إذا كنت توافق على ان المعلومات التي تم جمعها من فحص طفلك عن طريق الفم ان تستخدم في دراستنا التي تتم في كلية العلوم الصحية وبالتعاون مع قسم تقويم الاسنان في الجامعة الامريكية في بيروت، الرجاء توقيع القسم الثالث.

القسم - 3 -
الموافقة على
استخدام المعلومات الواردة في الدراسة

.....
توقيع المشارك

.....
التاريخ

القسم -2-
الموافقة على تحديث المعلومات

.....
توقيع المشارك

.....
التاريخ

القسم -1-
الموافقة على تعبئة الاستمارة

.....
توقيع المشارك

.....
التاريخ

شكرا سلفا

لمساهمتكم.

فريق البحث، يستطيع المساعدة في حال تعذر عليكم تعبئة الاستمارة.
رجاء الاتصال عند الحاجة ب:

• الدكتور انطوان حنا، قسم تقويم الاسنان، الجامعة الامريكية في بيروت، خلوي:

03-325163، بريد الكتروني: ah111@aub.edu.lb

• الدكتور سيلين مكرزل، قسم تقويم الاسنان في الجامعة الامريكية في بيروت، خلوي:

03-968168، بريد الكتروني: cm27@aub.edu.lb

تقييم صحة الفم في المدارس الابتدائية في لبنان: مقارنة بين المدارس العامة والخاصة

الجامعة الاميركية في بيروت
الاسئلة الخاصة بالاهل

تقوم كلية العلوم الصحية والعلوم بالتعاون مع قسم تقويم الاسنان في الجامعة الاميركية في بيروت باستطلاع يتعلّق بصحة الفم (الاسنان) لالف -1000- طفل تتراوح أعمارهم بين 6 و 11 سنين منتسبين الى المدارس الخاصة والعامة. ان مشاركتكم الطوعية، والمشكورة هي جد مطلوبة، لتجميع المعلومات المتعلقة باولادكم، وبحالة، وسلامة اسنانهم، بحيث يمكن ربطها بعوامل تتعلّق بسلوكية وعادات الاولاد والاهل معا. ترمي الدراسة الى متابعة الأطفال لسنوات خمسة لمتابعة صحة أسنانهم

نرجو ان تأخذوا وقتكم بقراءة هذه المعلومات بدقّة وروية، قبل قرار المشاركة في الاستطلاع او عدمه:

3. سوف لن يأخذ الاستطلاع من وقتكم اكثر من 5 دقائق، كما ان الاسم والاجوبية سوف تكون مجهولة المصدر، ولن تنشر مُطلقاً.

4. يمكن لكم عدم الاجابة عن كلّ الاسئلة، حتى بعد توقيع القبول بالمشاركة.

بعد قراءة وفهم كل ابعاد هذا البحث، وتم اخذ القرار بالمشاركة من قبلكم وتعبئة الاستطلاع، الرجاء توقيع القسم الأول.

إذا وافقتم على امكانية الاتصال بكم بعد سنوات قادمة لتحديث مضمون هذا الاستطلاع، الرجاء توقيع القسم الثاني. سيتمّ الكشف وفحص الاطفال من قبل أطباء اسنان متخصصين، ليُصار بعدها الى تدوين المعلومات عن كلّ حالة. إذا كان الولد بحاجة الى علاج معيّن، سوف يتمّ ابلاغ الاهل عبر رسالة خطية تُرسل مع ولدكم. إذا وافقتم على ان يُشارك ولدكم في هذه الدراسة، الرجاء توقيع القسم الثالث.

شكرا سلفا لمساهمتمكم.

| |
|--|
| <p>القسم - 3 -</p> <p>الموافقة على مشاركة التلميذ</p> <p>.....</p> <p>توقيع المشارك</p> <p>.....</p> <p>التاريخ</p> |
|--|

البحث،

| |
|---|
| <p>القسم -2-</p> <p>الموافقة على تحديث المعلومات</p> <p>.....</p> <p>توقيع المشارك</p> <p>.....</p> <p>التاريخ</p> |
|---|

فريق

| |
|---|
| <p>القسم -1-</p> <p>الموافقة على تعبئة الاستمارة</p> <p>.....</p> <p>توقيع المشارك</p> <p>.....</p> <p>التاريخ</p> |
|---|

يستطيع المساعدة في حال تعذّر عليكم تعبئة الاستمارة.
رجاء الاتصال عند الحاجة ب:

- الدكتور انطوان حنا، قسم تقويم الاسنان، الجامعة الاميركية في بيروت، خلوي: 03-325163، بريد الكتروني: ah111@aub.edu.lb
- الدكتور سيلين مكرزل، قسم تقويم الاسنان في الجامعة الاميركية في بيروت، خلوي: 03-968168، بريد الكتروني: cm27@aub.edu.lb

القسم الأول: التعريف

اسم الولد _____
اسم المدرسة _____
الصف _____

11. علاقتك بالولد

1. الوالدة
2. الاب
3. الجدّ الجدة
4. أخ أخت
5. عمّ عمّة
6. علاقة اخرى اما هي

القسم الثاني: معلومات ديموغرافية اجتماعية

SD1. تاريخ الولادة: اشهر | سنة [] [] []
SD2. العمر في آخر عيد ميلاد [] سنة
SD3. الجنس

1. ذكر
2. انثى

SD4. الوضع العائلي

1. متاهل متاهلة
2. مُطلق مُطّقة
3. أرمل أرملة

SD5. أعلى مستوى علمي

1. أمّي
2. كتابة اقرائة
3. ابتدائي
4. متوسط
5. ثانوي
6. كئيّة جامعة

SD6. الدخل الاجمالي الشهري للعائلة

1. ما دون ال 500,000 ل.ل
2. بين 500,000 و 999,999 ل.ل
3. بين 1000,000 و 3000,000 ل.ل
4. ما فوق ال 3000,000 ل.ل

SD7. ترتيب ولادة الولد؟

1. البكر
2. الاخير الاصغر
3. آخر (حدّد).....

H1. هل طفلك عاناً ولا يزيح اليه عانى من مرض من؟

1. نعم
2. كلاً (انتقل الى السؤال H5)

H2. إذا كانت الإجابة بنعم، من أي الأمراض التالية؟

1. مرض السكري
2. أمراض القلب
3. مشاكل رئوية
4. أمراض الجهاز الهضمي
5. سرطان
6. آخر (حدّد) _____

H3. هل لدى احد افراد العائلة حالياً، او عانى سابقاً من نفس المرض؟

1. نعم
2. كلاً (انتقل الى السؤال H5)

H4. إذا كانت الإجابة بنعم، من أي الأمراض التالية؟

1. مرض السكري
2. أمراض القلب
3. مشاكل رئوية
4. أمراض الجهاز الهضمي
5. سرطان
6. آخر (حدّد) _____

H5. إذا نعم، رجااء حدّد علاقة الشخص بالطفل؟

1. الأب
2. الأم
3. الجدة/الجد
4. آخر (حدّد) _____

H6. طفلك يتنفس في الغالب من

1. أنف (انتقل الى السؤال H8)
2. فم
3. من الأنف والفم
4. لا اعرف (انتقل الى السؤال H8)

H7. إذا كنت طفلك يتنفس من فمه، هل خضع للعلاج؟

1. نعم
2. كلاً (انتقل الى السؤال H8)

H8. إذا كانت الإجابة بنعم في أي عمر اتم علاج ذلك؟ [] سنة

H9. هل كانت الوالدة تُدخّن السجائر خلال فترة ملها بالولد المعني؟

1. نعم
2. كلاً

3. لا اعرف

H10. إذا نعم، خلال أي فصل من الحمل

1. الأول
2. الثاني
3. الثالث
4. كل فترة الحمل
5. لا اعرف

H11. تقريبا كم عدد السجائر يوميًا كانت تدخن الأم خلال فترة الحمل

1. 1-10
2. 11-20
3. أكثر من 20 سيجارة
4. لا اعرف

H12. هل كانت الوالدة تُدخنًا لرغيله خلال فترة ملها بالولد المعني؟

1. نعم
2. كلا
3. لا اعرف

القسم الرابع: عادات معينة لدى الولد

S1. هل كان الولد يمصّ اصبعه، شفّته، او أي شيء آخر خلال فترة الرضاعة؟

1. نعم
2. كلا (انتقل الى القسم الخامس)

S2. إذا نعم، ماذا كان يمصّ؟

1. ابهام الصبع
2. الشفّة
3. آخر (حدّد) _____

S3. في أي عمر بدأ بدأت هذه العادة؟

S4. في أي عمر، اوقف اوقفت هذه العادة؟ _____

S5. ما هي مدّة فترة ممارسة هذه العادة؟

1. ساعة او اقلّ
2. من ساعة الى 3
3. ساعات الى 6
4. ست ساعات وما فوق
5. لا أذكر

القسم الخامس: طريقة التغذية

F1. كيف تمّ اطعام الولد خلال أول ستة اشهر من طفولته؟

1. رضاعة
2. الفئينة
3. كلاهما
4. لا اعرف

F2. ما هي مدّة ارضاعه؟

1. 1-5 اشهر

2. أكثر من 6 اشهر، اقل من سنتين
3. أكثر من سنتين
4. لا اتذكّر

F3. ما هي مدّة ارضاعه من القنينة؟

1. 1-5 اشهر
2. أكثر من 6 اشهر، اقل من سنتين
3. أكثر من سنتين
4. لا اتذكّر

F4. كم مرة يتناول الولد الحلويات \ السكريات؟

1. أكثر من مرّة يوميًا، حدّد.....
2. مرّة يوميًا
3. مرّة في الاسبوع
4. مرّة في الشهر
5. بالمناسبات

F5. متى يتناول الحلويات\السكريات؟

- | | | | |
|----|-------------------|-----|-----|
| 1. | خلال وجبات الطعام | نعم | كلا |
| 2. | بعدها | نعم | كلا |
| 3. | بين وجبتين | نعم | كلا |
| 4. | قبل فترة النوم | نعم | كلا |

القسم السادس: نمط الاهتمام بصحة الفم\الاسنان

B1. كم مرة عادة ينظف الولد أسنانه ؟

1. مرّة يوميًا\أكثر
2. 2-3 مرّات يوميًا
3. اقل من مرّة
4. في المناسبات
5. ابدا
6. لا اعرف

B2. ما هي المواد المستعملة لتنظيف الاسنان؟

1. معجون اسنان
2. لاشيء
3. آخر، حدّد.....

B3. هل سبق أن عاين ولدكم اي طبيب اسنان ؟

1. نعم
2. كلا

B4. إذا نعم، متى كانت آخر مرّة؟

1. شهر أو أقل
2. 1 الى 3 اشهر
3. 3 الى 6 اشهر
4. أكثر من 6 اشهر

B5. إذا نعم، في آخر مرة عاين طبيب اسنان الولد لايّ سبب من الاسباب التالية؟

- | | | | |
|----|------------|-----|-----|
| 1. | كشف روتيني | نعم | كلا |
| 2. | تنظيف | نعم | كلا |

3. تسوّس نعم كلا
4. ألم حاد نعم كلا
5. شكل الاسنان نعم كلا
6. آخر، حدد نعم كلا

B6. هل تعرّضت اسنان الولد لمادة الفلوريد من غير معجون الأسنان؟

1. نعم
2. كلا

B7. إذا نعم، كيف تمّ اخذ الفلوريد؟

1. بواسطة الماء؟
2. غسل الفمّ
3. إضافات غذائية احبوب
4. خلال زيارات طبيب الاسنان

B8. كيف غالبا يستهلك الولد مادة الصودا؟ بببسي، كوكاكولا وغيرها

1. اكثر من مرّة يومياً
2. مرّة ايوم
3. اقل من المعدل اليومي. عدّة مرات اسبوعياً
4. في المناسبات
5. ابدا

B9. هل تعتقد ان حالة فم الولد الصحيّة هي؟:

1. ممتازة
2. جيّدة
3. عادية
4. سيّئة
5. سيّئة جدا

B10. هل تعتقد ان الولد بحاجة الى تقويم اسنان؟

4. نعم
5. كلا
6. لا اعرف

B11. إذا نعم لأية اسباب؟

1. اسنان متراكمة فوق بعضها البعض
2. اسنان ناتئة
3. وضع غير طبيعي لأي من الفكّين
4. آخر ، حدّد.....

جزيل الشكر لمشاركتكم

SBS Child Assent Form Template

AUB Social & Behavioral Sciences Assent to Participate in Research

Study Title: تقييم صحة الفم في المدارس الابتدائية في لبنان: مقارنة بين المدارس العامة والخاصة

Researcher: سيلين مكرزل, انطوان حنا

Sponsor: الأميركية في بيروت الجامعة

إننا نحاول درس كل ما يتعلق باسنانك و فمك. إذا توافق على أن يتم فحصك، فكل ما هو مطلوب منك هو فتح فمك كي نستطيع فحص اسنانك. إن مدة الفحص لن تتجاوز ال-10 دقائق. وقد سمح لنا والديك بفحصك يمكنك التوقف عن المشاركة في هذه الدراسة ساعة تشاء. لن يكون هناك أي ألم أو خطر خلال المعاينة، وفي حال الحاجة للمعالجة، فسوف يتم اعلام والديك. سوف تتمكن من معرفة حالة وصحة اسنانكم والتأكد إذا ما كنتم بحاجة لعلاج. أنك لن تحصل على أي مكافآت مقابل السماح لنا بفحصك.

للسؤال عن الدراسة يمكنك الاتصال ب:

انطوان حنا : 03325163

سيلين مكرزل : 03968168

Signing the assent form

لقد قرأت (أو شخص قد قرأ لي) هذه الورقة وفهمت مضمونها. أوافق يتم فحص فمي و أسناني.

AM/PM
التاريخ والوقت
التوقيع أو اسم الفرد.

Investigator/Research Staff

لقد أوضحت للمشاركة قبل طلب التوقيع أعلاه. لا توجد فراغات في هذه الوثيقة. وقد سلمت نسخة من هذا النموذج إلى المشاركين أو ممثله/ممثلها.

توقيع الشخص الحاصل على موافقة
اسم الشخص الحاصل على موافقة
AM/PM
التاريخ والوقت

This form must be accompanied by an IRB approved parental permission form signed by a parent/guardian.

Appendix 4: Assent form for school children

