

# **RISK FACTORS ASSOCIATED WITH EARLY CHILDHOOD CARIES: AN EPIDEMIOLOGICAL SURVEY IN MARIENTAL, NAMIBIA**

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## Abstract

Early Childhood Caries (ECC) is a public health problem both in developing and developed countries. Its widespread prevalence among children makes it ideal for assessing the risk factors and identifying specific strategies that could be implemented to prevent the disease. The **aim** of the present study was to determine the risk factors associated with early childhood caries among 5 – 48 month children in Mariental, Namibia. The **objectives** were to determine (i) the prevalence and severity of early childhood caries in 5 – 48 months old children (ii) the risk of early childhood caries associated with feeding practices, social and cultural behaviour, sugar consumption, dental health awareness, fluoride and risk behaviour.

The study design used was cross-sectional and descriptive. A convenience sample was used as mothers visited the post-natal clinic or the hospital for treatment of other ailments or problems. The sample size comprised 230 mothers and their children and only mothers and their biological children in the age range 5- 48 months were included in the survey. Data was collected by using an open- and closed-ended questionnaire that included questions regarding the child's dietary and nutritional habits, oral hygiene habits, socio-economic status and beliefs. Mothers and their biological children were examined for presence or absence of dental caries and the findings were recorded on a modified WHO data sheet.

The mean age of the children was 24 months, the mean deft 1.5 and the Significant Caries Index (SiC) was 4.5. There was an increase in caries prevalence (add caries prevalence) with increasing age both among girls and boys. The mean DMFT of the mothers was 7.1, their SiC was 17.11 and more than three quarters had at least one tooth missing which was extracted due to caries and just under a quarter had one or more decayed teeth. Despite the fact that most of the mothers reported knowing the importance of good oral hygiene, brush their own teeth and cleaning their children's mouth both mothers and their children had high DMFT or deft indices. This is due to a multiplicity of factors – the majority of the mothers were both uneducated and unemployed and have difficulty in making or taking appropriate choices conducive to healthy lifestyles in turn affecting their behaviours and oral hygiene practices.

## Declaration

I, Alex Thopil, the undersigned, hereby declare that the work contained in this dissertation – Risk Factors Associated with Early Childhood Caries: An Epidemiological Survey in Mariental, Namibia, is my original work and that it has not been previously in its entirety or in part submitted at any university for a degree. I also declare that all sources or information used in the writing of this thesis has been appropriately referenced.



.....  
Alex Thopil

# DEDICATION

My beloved parents and brother for their constant love, support and prayers

I dedicate this work to my Creator, the One who gives wisdom and direction in serving and helping those in need of care.



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## LIST OF ABBREVIATIONS

AAPD	American Academy of Paediatric Dentistry
ADA	American Dental Association
Ad lib	On demand
AIDS	Acquired Immune Deficiency Syndrome
ANC	Ante-natal clinic
CAST	Children's Aid Society of Toronto
DCC	District Co-ordinating Committee
Deft	decayed extracted filled tooth
DMFT	decayed missing filled tooth
ECC	Early Childhood Caries
GDP	Gross Domestic Product
HIV	Human Immune-deficiency Virus
IgA	Immunoglobulin A
LDL	Low density lipoprotein
MoHSS	Ministry of Health and Social Services
PHC	Primary Health Care
PNC	Post-natal clinic
QoL	Quality of Life
RMT	Regional Management Team
SADC	Southern African Development Community
S.mutans	Streptococcus mutans
SiC	Significant Caries Index
TB	Tuberculosis
US	United States
UWC	University of the Western Cape
WHO	World Health Organisation

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## CHAPTER 1: INTRODUCTION

Namibia is the second largest country on the Southern African sub-continent with an area of 852 000 sq.km. The country is sparsely populated (1.8 million inhabitants) and the majority of the population is rural but with strong urbanisation trends (Schier, 1993). The population is characterised by a large young population with a growth rate of 2.6% and according to data available 942 572 (52%) are females and 887 721 (48%) are males (Road Map for Accelerating the Reduction of Maternal and New Born Morbidity and Mortality, November 2007). Women of child bearing age (15-49 years) constitute about 24% of the total population, while adolescents (10-19 years) make up just under a quarter (22.6%). The national literacy rate for 15-19 year olds is estimated at 90.6%. The overall literacy rate has increased from 76% (1991 census) to 81% (2001 census) (Road Map for Accelerating the Reduction Maternal and New Born Morbidity and Mortality, November 2007). Malaria, tuberculosis and HIV/Aids infections are serious and common public health disease. Life expectancy at birth is 49 years (Road Map for Accelerating the Reduction of Maternal and New Born Morbidity and Mortality, November 2007). The dentist to population ratio is 1: 29 000 inhabitants but the distribution is unequal and varies from a dentist inhabitant's ratio of 1: 200,000 in the north-east region (Draft National Oral Health Programme for Namibia, 1996 - 2010).

Communities, even in some rural areas in Namibia, due to inter-migration, influence from commercials on television and billboards and economic developments have changed their life styles with increasingly poor dietary and oral health habits leading to an increase in the prevalence and severity of dental caries (National Oral Health Programme for Namibia, 1996-2010). Furthermore, the per capita sugar consumption in Namibia was 30.2 in 2005 which was fourth among the SADC countries with an average annual GDP of 12.95% between 1986-2005 (SADC Sugar Consumers, Facts and Opportunities, 2005).

Hofstedth et al. (1999) reported that the oral health status, knowledge and dietary habits among urban and rural 6-7 year old children in the Windhoek area, had a caries frequency much higher than the goals set by World Health Organisation (WHO) for the year 2000 (Hofstedth et al. 1999). One of the global goals is that 80% of the 5-6year old will be caries free (National Oral Health Promotion Programme, Policy and Guidelines for Namibia, 1997).

However, this survey showed that only 20% of urban children and 35% of rural children were caries free (Hofstedth et al. 1999). A more recent survey (National Oral Health Survey, 2011) reported the overall prevalence of dental decay among 5-6 year olds in Namibia as 42.95% and that nearly two thirds (57%) of the primary dentition of the 5-6-year-olds were caries-free. However, there was a wide variation in the caries-free-status between the regions, with Kunene having the highest (90%) and Caprivi the lowest (20%). All the regions in the country, except Caprivi, Kavango, Hardap and Oshikoto have more than half of the 5-6-year-olds caries-free.

There have been no studies or surveys reporting the prevalence and severity of early childhood caries in Namibia.



## **CHAPTER 2: LITERATURE REVIEW**

### **2.1 Definition**

Early childhood caries (ECC) is a rampant caries that affects the primary dentition of infants and toddlers (Misra et al. 2007). The American Dental Association (ADA) defines ECC as “the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries) or filled tooth surfaces in any primary tooth in a preschool age child between birth and 71 months of age.” Overall, defining ECC is problematic, since the true nature of the syndrome is not clear. It has become an alarming public health problem because the disease is so common and widespread among young children, especially in the developing world. The prevalence of the disease in the developing world is reported to be as high as 70% (Tinanoff and O’Sullivan, 1997).

### **2.2 ECC - A Public Health Problem**

Dental caries has been a major oral health problem in many industrialized countries affecting 60 – 90% of school children (Petersen, 2004) and with the rapid urbanization and economic growth taking place in the less developed countries, the incidence of dental caries is predicted to increase (Petersen, 2004; Watt 2005). Given their prevalence worldwide, oral diseases including dental caries especially among primary teeth is considered to be a public health problem with many of these children being untreated (Watt, 2005) and the treatment of dental caries in children alone is expected to exceed the total child health care budget, especially in the developing countries (Petersen, 2004). In addition, to the burden of treating these diseases, pain, discomfort, sleepless nights, and limitation in eating function leads to poor nutrition and together with time taken off school for the children and work for parents, it can be detrimental to the physical and social health of both the children and their parents (Watt, 2005; Sheiham, 2006; Filstrup et al. 2003).

Although there have been improvements in the oral health provision in developed countries, oral health inequalities still remains both in the developed and developing countries and is a major public health challenge because it is often lower income and socially disadvantaged sections within these societies that are affected (Watt, 2005). Early childhood caries is prevalent among the disadvantaged sections in all societies of the world (Zhou et al. 2011; Borutta, Wagner and Kneist, 2010; Postma, Ayo-Yusuf and Van-Wyk, 2008; Harris et al.

2004; Mouradian, Wehr and Crall, 2000) with 90% of pre-school children being affected (Sheiham, 2006) and with the disease threatening to affect the well-being of millions of children, the WHO has recommended the common risk factor approach to deal with the problem. Non-communicable diseases like – diabetes, cardiovascular diseases, oral cancer and chronic obstructive pulmonary disorders share the common risk factors with oral diseases which are life-style related and preventable (Petersen, 2004). Countries, organizations and institutions have been advised to re-orient their health care policy within the frame work of the Ottawa Charter in bridging the gap between the inequalities in health (Petersen, 2004; Watt, 2005).

### **2.3 Common Risk Factors**

The World Health Organization (WHO) defined health as a state of complete physical, mental and social well-being and not merely the absence of disease and infirmity. In medical science “risk” may be defined as the probability that a particular outcome will occur due to the presence of specific risk factors or after exposure to a particular action or event (Vadiakas, 2008). Health risk may encompass disease precursor associated with a higher than average morbidity or mortality. The disease precursors may include demographic variables, certain individual behaviours, familial and individual histories, and certain physiologic changes.

Dental caries is a chronic, cumulative, moderately prevalent oral disease that shares similar risk factors with other chronic diseases (Zhou et al. 2011; Kelishadi et al. 2010; Valencia-Rojas 2008; Rozenblatt and Zarzar, 2004; Pine et al. 2004; Hallet and Rourke, 2003). The variables or determinants’ of the disease can be based on socio-economic and demographic factors which includes – level of education (schooling), occupation, income, locality of habitation and access to amenities like health care. For example, the parents’ socio-economic background determines the child’s socio-economic status and this reflects on the parents’ level of schooling, education and income (Zhou et al. 2011). Other factors or variables of significance could be feeding habits and practices- with regard to frequency and methods used; nutritional status- with regard to height and weight; oral health behaviour- with regard to tooth brushing and dental check-ups (Zhou et al. 2011). In addition, in the development of early child hood caries could be oral hygiene status and the types and counts of bacteria involved in causing the disease (Zhou et al. 2011).



## 2.4 Early Childhood Caries

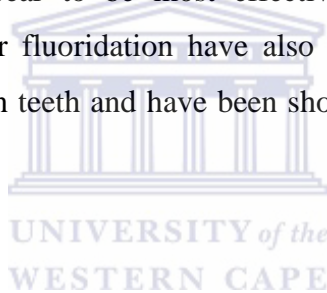
Early childhood caries (ECC) is rampant type of caries that affects the primary dentition of infants and toddlers (Misra et al. 2007) as is defined as the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger (American Academy of Paediatric Dentistry, 2010). For the past fifty years, dentists and researchers have struggled to clearly define ECC. It has been variously referred to as “baby bottle tooth decay,” “nursing bottle syndrome” and “rampant caries lesions” (Huntington, Kim, & Hughes, 2002). Other terms include labial caries (LC), caries of incisors, rampant caries (RC), nursing bottle caries (NBC), nursing caries, bottle mouth, bottle caries and Fass (1962) who published the first comprehensive description of caries in infants, termed it “nursing bottle mouth” (Early Childhood Oral Health, 2009). The name for this type of caries comes from the fact that the decay usually is a result of allowing children to fall asleep with sweetened liquids in their bottles or feeding children sweetened liquids multiple times during the day. The preferred and most commonly used term today is early childhood caries (ECC) proposed by the Centres for Disease Control and Prevention (CDC). According to Davis (1998), the definition of this pathology has always been complex and “difficult to describe, but when it is seen, you know what it’s about”.

The onset of ECC requires all the necessary components: susceptible teeth, bacteria and presence of carbohydrates over a period of time. The key bacteria implicated are *Streptococcus mutans*, and a large body of scientific evidence indicates that ECC is an infectious and transmissible disease, with the transmission of the bacteria to the child, usually from the primary caretaker, the mother. The bacteria also appear when the first tooth erupts, usually at 6 months. The carbohydrates are found in the milk formula and fruit juices that are fed to babies and young children in bottles and come into contact with tooth surface often when a child is habitually put to sleep with the bottle in the mouth. The longer the child is exposed to the contact of sugary fluids around the tooth surface, the more likely it is for the bacteria to act on the sugars and cause demineralisation.

ECC typically develops in the tooth surfaces of the primary upper anterior teeth, upper and lower primary first molars and lower canines (Naidoo and Myburgh, 2007). The lower anterior teeth are usually not affected because the tongue protects these teeth during bottle

feeding. Initially it appears as a band of white decalcification along the gingival line or the occlusal surface in the presence of plaque, indicating that the lesion is sub-surface (pre-cavitation stage). Because the enamel of primary teeth is immature and porous, it is highly susceptible to dissolution by bacterial acids, resulting in cavitated lesions. As the demineralisation process continues, it extends around the circumference of the tooth, forming a black collar with gross tissue destruction which can easily lead to crown fracture which as described by Misra et al. (2007).

ECC is a preventable dental disease and much research has been done to support the success of the various preventive strategies that can be utilized. Preventive measures include oral health education and promotion to the mother, diet counselling, use of prenatal fluoride, topical application of fluoride such as fluoride toothpastes, rinses and varnishes aids in remineralisation. A systematic review by Ammari, Baqain, Ashley (2007) concluded that the fluoride based interventions appear to be most effective in protecting deciduous teeth. Population approaches like water fluoridation have also proven to be effective. Optimum fluoride levels in water strengthen teeth and have been shown to reduce tooth decay by 60% (Pizzo et al. 2007).



## 2.5 Measurement of ECC

ECC can be measured according to the different stages of development and a simple method of categorising ECC into 3 types has been proposed (Postma et al. 2008):

Type	Description
Type 1	Mild to moderate ECC which involves 1 or 2 molars and /or incisors
Type 2	Moderate to severe ECC which involves labial-lingual caries on max. Incisors, where the molars are either affected or not.
Type 3	Severe ECC which involves virtually all teeth, including mandibular incisors (Postma et al. 2008)

In order to explain the clinical course of ECC, Begzati et al. (2010) proposed the following stages in the occurrence and progression of carious lesions in ECC:

Stage	Description
ECC <sub>i</sub> (initial stage)	White spot lesion or initial defect in enamel of cervix
ECC <sub>c</sub> (circular stage)	Lesion in the dentin and circular distribution of this lesion proximally
ECC <sub>d</sub> (destructive stage)	Destruction of > than half the crown without affecting the incisal edge
ECC <sub>r</sub> ( <i>radix relicta</i> stage)	Total destruction of the crown (Begzati et al. 2010).

In epidemiology surveys, researchers use the decayed, missing filled teeth (DMFT) index to determine the prevalence and incidence of dental caries in a given population. To arrive at a DMFT score for an individual patient's mouth, an addition of the 3 values is determined: the number of teeth with carious lesions, the number of extracted teeth, and the number of teeth with fillings or crowns. It is also possible to determine more detailed DMFS (decayed, missing, or filled surface) scores. As anterior teeth have four surfaces and posterior teeth have five, a full dentition of 32 teeth includes 128 surfaces. For primary dentition, scoring is referred to as "deft" or "defs" (decayed, extracted, or filled). In 2000, the World Health Organization developed the significant caries index (SiC) to be used for studying DMFT scores on a global basis. A single population may include a number of individuals with very low DMFT scores, as well as those with very high scores. A mean DMFT value would not accurately reflect the status of the population. Individuals are sorted according to DMFT values. The third of the population with highest caries scores is isolated, and a mean DMFT for this subgroup is calculated resulting in a value which is the SiC Index.

**2.6 National and Global prevalence of ECC:** The prevalence rate of ECC varies in developed and developing countries. Although developed countries display relatively low rates of ECC (1%-12%), disadvantaged populations (immigrants and ethnic minorities) in developed countries and in developing countries, the prevalence rate in as high as 70% (Milnes, 1996).

**2.6.1 NATIONAL:** The 2010/2011 Namibia National Oral Health Survey recorded 43% caries prevalence amongst 4-5 year -olds as seen in Table 1.

**Table 1: Prevalence of dental caries and untreated caries in primary teeth of 5-6-year-olds**

Age group (years)	% Caries	% Untreated caries	% UTN
<b>National weighted</b>	<b>42.95</b>	<b>38.51</b>	<b>89.66</b>
Caprivi	80.00	41.67	52.09
Erongo	48.33	31.67	65.53
Hardap	56.67	56.67	100.00
Karas	43.33	41.67	96.17
Kavango	70.00	70.00	100.00
Khomas	41.67	38.33	91.98
Kunene	10.00	8.33	83.30
Ohangwena	40.00	38.33	95.83
Omaheke	21.67	11.67	53.85
Omusati	51.67	51.67	100.00
Oshana	21.67	15.00	69.22
Oshikoto	51.67	50.00	96.77
Otjozonjupa	40.00	32.73	81.83

Just over half (57%) of the primary dentition of the 5-6-year-olds are caries-free. However, there is a wide variation in the caries-free-status between the regions, with Kunene having the highest (90%) and Caprivi the lowest (20%). All the regions, except Caprivi, Kavango, Hardap and Oshikoto have more than half caries-free 5-6-year-olds. According to the Unmet Treatment Need (UTN), nationally nearly 90% of all caries in 5-6-year-olds go untreated.

**Table 2: Prevalence of dental caries & untreated caries in permanent teeth of 5-6-year-olds**

<b>Age group (years)</b>	<b>% Caries</b>	<b>% Untreated caries</b>	<b>% UTN</b>
<b>National weighted</b>	<b>6.36</b>	<b>4.57</b>	<b>71.86</b>
Caprivi	16.67	15.00	89.98
Erongo	5.00	0.00	0.00
Hardap	23.33	21.67	92.88
Karas	3.33	0.00	0.00
Kavango	3.33	0.00	0.00
Khomas	0.00	0.00	-
Kunene	1.67	1.67	100.00
Ohangwena	3.33	3.33	100.00
Omaheke	23.33	15.00	64.29
Omusati	1.67	1.67	100.00
Oshana	13.33	11.67	87.55
Oshikoto	6.67	0.00	0.00
Otjozonjupa	5.45	1.82	33.39

93.6% the permanent dentition of this age group is caries-free. However, in Caprivi, Hardap and Omaheke over 15% already have caries in their permanent dentition. Although this is low for permanent teeth, 71.9% will be untreated. Oshikoto fared best with regards to the treatment of caries of the permanent teeth of their 5-6 year olds.

The severity of dental caries is shown in Table 4. Dental caries is more severe in the primary than the permanent dentition. Untreated caries (decayed component) are the highest with low levels of missing teeth and negligible levels of filled teeth. Nationally the weighted dmft mean is 1.4 with Caprivi having the highest (4.4) and Kunene the lowest (0.2). The high d component for Karas may be due to the fact that the sample consisted of mainly 5 year olds with very few erupted permanent teeth. The low levels in Kunene may be related to the remoteness of this region live in consisting mainly of the Himba and Herero people. From a very early age, children are taught by their parents to use chewing sticks to clean their mouth and teeth. Furthermore, there is a very active school-based oral health programme throughout the Opuwo district in the Kunene Region. The severity of dental caries expressed as the mean

DMFT and the components of the DMFT of the permanent teeth is shown in Table 5. Nationally the DMFT is 0.16, with Khomas the lowest (0.00) and Omaheke the highest (1.12).

**Table 3: Distribution of the mean dmft and components of the dmft in primary teeth of 5-6-year-olds**

Region	dmft	d	m	f
<b>National weighted</b>	<b>1.44</b>	<b>1.17</b>	<b>0.26</b>	<b>0.01</b>
Caprivi	4.40	1.85	2.50	0.05
Erongo	1.60	0.97	0.55	0.08
Hardap	2.45	2.38	0.07	0.00
Karas	2.08	1.77	0.23	0.08
Kavango	2.83	2.73	0.10	0.00
Khomas	1.23	1.12	0.12	0.00
Kunene	0.22	0.18	0.03	0.00
Ohangwena	0.95	0.90	0.05	0.00
Omaheke	0.68	0.32	0.32	0.05
Omusati	1.73	1.45	0.28	0.00
Oshana	0.68	0.28	0.37	0.03
Oshikoto	1.50	1.48	0.02	0.00
Otjozonjupa	1.13	0.84	0.22	0.07

**Table 4: Distribution of the mean DMFT and the components of the DMFT in permanent teeth of 5-6-year-olds**

Region	DMFT	D	M	F
<b>National weighted</b>	<b>0.16</b>	<b>0.11</b>	<b>0.04</b>	<b>0.00</b>
Caprivi	0.32	0.28	0.02	0.02
Erongo	0.07	0.00	0.07	0.00
Hardap	0.67	0.63	0.03	0.00
Karas	0.03	0.00	0.03	0.00
Kavango	0.05	0.00	0.05	0.00
Khomas	0.00	0.00	0.00	0.00
Kunene	0.02	0.02	0.00	0.00
Ohangwena	0.03	0.03	0.00	0.00
Omaheke	1.12	0.72	0.40	0.00
Omusati	0.02	0.02	0.00	0.00
Oshana	0.35	0.33	0.02	0.00
Oshikoto	0.10	0.00	0.10	0.00
Otjozonjupa	0.05	0.02	0.04	0.00

The percentage of 5-6-year-old children in Namibia who need treatment for dental caries is 41.9%, with the regions ranging from 10.0% in Kunene to 70.0% in Kavango (Table 6). In seven of the regions less than 50% are in need for treatment. Nationally, the mean number of teeth needing care per child is 1.3, while in the regions it ranges between 0.2 and 3.0.

**Table 5: Percentage distribution of care needed and the mean number of teeth needing care in 5-6-year-olds**

Region	% Needing care	Mean number of teeth
<b>National weighted</b>	<b>41.92</b>	<b>1.28</b>
Caprivi	53.33	2.13
Erongo	31.67	0.97
Hardap	60.00	3.02
Karas	41.67	1.77
Kavango	70.00	2.73
Khomas	38.33	1.12
Kunene	10.00	0.20
Ohangwena	40.00	0.93
Omaheke	26.67	1.03
Omusati	53.33	1.47
Oshana	26.67	0.62
Oshikoto	50.00	1.48
Otjozonjupa	34.55	0.85

**Table 6: Type of care needed for the treatment of dental caries expressed as the mean number of teeth needing care in 5-6-year-olds**

Region	Preventive	Fillings	Crown + Veneer	Pulp care	Extractions	Other care	Not recorded
<b>National weighted</b>	<b>0.13</b>	<b>0.34</b>	<b>0.00</b>	<b>0.00</b>	<b>0.58</b>	<b>0.00</b>	<b>0.05</b>
Caprivi	0.72	0.22	0.00	0.00	0.95	0.00	0.25
Erongo	0.17	0.22	0.00	0.00	0.45	0.00	0.02
Hardap	0.00	0.57	0.00	0.00	1.22	0.00	0.92
Karas	0.02	1.20	0.00	0.00	0.42	0.00	0.05
Kavango	0.03	0.00	0.00	0.00	2.25	0.00	0.00
Khomas	0.00	0.20	0.00	0.00	0.63	0.00	0.00
Kunene	0.00	0.03	0.00	0.00	0.17	0.00	0.00
Ohangwena	0.40	0.38	0.00	0.00	0.07	0.08	0.00
Omaheke	0.00	0.05	0.00	0.00	0.22	0.00	0.00
Omusati	0.22	1.07	0.00	0.00	0.17	0.00	0.02
Oshana	0.22	0.10	0.00	0.00	0.27	0.00	0.03
Oshikoto	0.03	1.02	0.00	0.00	0.38	0.00	0.02
Otjozonjupa	0.00	0.78	0.00	0.00	0.05	0.00	0.00

The type of care needed for the treatment of dental caries expressed as the mean number of teeth needing care is shown Table 7. Extractions were the most common need in all the regions, followed by fillings and then preventive treatment. Kavango recorded the highest need for extractions (2.3), Karas for fillings (1.2) and Caprivi for preventive treatment (0.7).

## 2.6.2 GLOBAL

The prevalence of ECC in children, aged three to five years, in US Head Start programme has been found to be as high as 90% (Tinanoff & O’Sullivan, 1997). In Brazil the prevalence rate is 28.5%. In 1993-1994, the California Oral Health Needs Assessment of Children in the Head Start Program demonstrated that 30%-33% of Asian and Latino/Hispanic children had ECC, with 49% to 54% of who presented with untreated caries (Ramos-Gomez et al. 2002). Epidemiological studies of Aboriginal communities in Canada and Native American populations in the United States have reported that early childhood caries (ECC) is highly prevalent (52%). Table 7 shows the prevalence of ECC in various countries.

**Table 7: Prevalence of ECC in different countries**

Authors	Country/Year	Sample (n)	Age	Prevalence	Comments
Azevedo et al.	Brazil, 2005	369	3-6	36%	Severe ECC in Brazilian Preschool children
Luca et al.	Romania, 2008	673	<6	24.8%	Prevalence of S-ECC over period of 2 years
Finlayson et al.	Detroit, 2007	719	1-5	20%	Low income African –American children
De Grauwe et al.	Belgium, 2004	385	2-3	12,2%	Inner city children
	Australia, 2006	125	<4	94%	Paediatric hospital in Brisbane
Douglas et al.	China, 1994		3	67%	Dental caries in preschool in Beijing
Ministry of Health and Welfare	Japan, 1993		3	60%	Report on survey of dental diseases
WHO	Thailand		3	62%	WHO Oral Health country/area profile
Virdi et al.	India, 2010	709	3	42%	S-ECC in preschool children in Bahadurgarh

The prevalence of ECC in developing countries ranges from 20% to 67%. Namibia regarded as a developing country fall within this range.

## **2.7 Risk factors for ECC**

There is strong scientific evidence to indicate that the primary infection of *S. Mutans* is the first step in the development of ECC. The vertical transmission of bacteria from mother to child has been well established (Berkowitz, 2003). Oral streptococci, generally acquired from the mother, were elevated in children with ECC (Tinanoff and O'Sullivan, 1997). The lactose found in cow's milk, breast milk and milk formulas can cause dental decay of when acted upon by bacteria, therefore, babies as young as 6 months (when the first deciduous teeth erupt) and older are prone to ECC. According to a study by Olmez et al. (2003) infants had a higher risk of ECC when fed by both bottle and breast than infants who were only breast-fed.

Children who are bottled-fed at night and fall asleep with the bottle still in the mouths are also prone to ECC (Dukic et al. 2001) reported that feeding children with sweet beverages at night and the lack of introduction of tooth brushing habit after the first 24 months were significant risk factors in ECC. Nocturnal breastfeeding after 12 months of age, linear hypoplasia of deciduous teeth associated with malnutrition and the prolonged use of a pacifier covered with honey, sugar or other sweetened food are also prone to ECC (Tinanoff and O'Sullivan, 1997; van Palenstein, Helderma and Soe, 2006). A systematic review by Harris et al. (2004) concluded that a young child is most likely to develop caries if he/she acquires *Streptococcus mutans* at a young age, practice less than daily tooth brushing and consuming a highly cariogenic diet. Enamel hypoplasia is also another risk factor.

Other factors include the parents' attitude towards the child's oral hygiene practices. Parents who are non-compliant and lack ownership of responsibility of their child's oral hygiene have children who are at high risk of ECC. An association has been found between children with high caries experience and the number of missing teeth of the mother, her dental attendance pattern and her level of education (Misra et al. 2007). Other factors relate to socioeconomic issues - that is, children with ECC tend to come from low-income or lower socioeconomic backgrounds (Weinstein, 1998).

## **2.8 Micro-biological Factors**

The micro-biological factors involved in the disease or cariogenic process of ECC may be initiated by prolonged and frequent exposure of the child's tooth surfaces to substance such as



sugar contained within drinks such as milk, baby formulas, fruit juices or sweetened drinks (Chu, 2009). The ongoing practice of putting a child to sleep using methods such as bottle or breast feeding (nocturnal feeding), exposes the child's teeth to the sugar contained in the milk or liquid which pools around the teeth for hours (Petti, 2010; Galarneau, Brodeur, Gauvin, 2006; Helderman, Soe and Hof, 2006). Sugars combine with bacteria such as *Streptococcus mutans* and *Lactobacillus acidophilus* which appears in the mouth and the longer the milk or sugary fluids come into contact with the newly erupted teeth the more the chances are of demineralization of the tooth's enamel and dentin which can be caused by the acids that these bacteria produce (Zhou et al. 2011; Kanasi et al. 2010; Parrisotto et al. 2010; Petti, 2010; Harris et al. 2004).

For the cariogenic process to start, the bacteria, acid, food debris, and saliva combine to form the plaque that adheres to the teeth surface. The bacteria and plaque nourish from the sugars, producing lactic acid which in turn cause demineralization or tooth decay. If plaque is not removed thoroughly and regularly, tooth decay will continue to spread. This finding is supported by Parisotto et al. (2010) who reported that plaque accumulation on maxillary incisors was strongly associated with the development of early cavitated lesions with a drop in the pH at the tooth dental plaque interface caused by bacterial metabolism. Another study by Kanasi et al. (2010) evaluated the microbial risk biomarkers for caries and found that children, especially from the disadvantaged group, showed high levels of *Streptococcus* and *Lactobacillus* sp. Bacteria that is implicated in the cause of dental caries and the authors advocated for the routine use of microbiologic examinations in children who were considered to be at risk of developing the disease (Kanasi et al. 2010).

Besides the influence that sugar or diet has on dental decay, there are other biological factors that are needed to initiate the process of dental caries including the presence of a living host, bacteria (plaque), substrate (tooth) and time (relation between frequencies of diet or sugar intake). When there is an imbalance in between the host, bacteria, substrate or time, the normal oral micro flora is disturbed along with a change in the composition of saliva leading to excessive production of acid by the bacteria which renders the tooth susceptible to decay or the carious process (Borutta, Wagner and Kneist, 2010). Apart from the role that free sugars in diet play in the initiation of caries, fermentable carbohydrates, starchy staple foods and some fruits have also been implicated in causing low levels of dental decay (Moynihan and Petersen, 2004; Konig, 2000).

The use of the bottle feeding in children has been shown to first affect their primary maxillary anterior teeth, followed by the involvement of the primary molar teeth. (Tinanoff and O’Sullivan, 1997), thus it is not uncommon to observe children with ECC having decay predominantly around the maxillary centrals, laterals and canines. The tongue usually acts as a barrier protecting the bottom teeth from sugars and bacteria, where subsequently, the lower teeth are less affected and suffer less decay.

## **2.9 Disparities within the Professional Context and Access to Health Care**

Mouradian et al. (2000) have shown that some of the problems associated with in the dental care could be largely due to the difference between how the fields of medical and dental professions are practiced. Medical professionals have an important role to play in ECC prevention as they are the ones who are usually in regular contact with pregnant mothers and their children as opposed to dentists who usually only see a child when they present with a problem. There is therefore a need for medical and other health professionals to be trained in the prevention and identification of ECC (Weinstein, 1998).

The American Academy of Paediatrics formulated a policy in 2003 which recommends that every child should be given an oral health assessment (including caries risk assessment) by 6 months of age administered by a qualified paediatrician or paediatric health care professional (Hallett and Rourke, 2003). Along with identifying general health problems and screening for oral health disease, paediatricians can advise patients on risk factors related to caries formation even before a child’s teeth begin to erupt and include anticipatory guidance on oral health related topics during child care visits (Nunn et al. 2009).

Even in developed countries like the United States, where dental care is considered to be the one of the most prevalent unmet health need in children only a minority of poor children have proper access to dental care and children who belong to the low-income and minority group are seen to be at the highest risk for poor oral health (Mouradian, Wehr and Crall, 2000). Children from the less privileged background tend to have fewer dental visits and are less frequently brought in for dental treatment or care compared to their affluent counterparts. Besides, most public health clinics, where the majority of disadvantaged people are treated, only offer “episodic, impersonal, emergency services” (Weinstein, 2006).

## 2.10 Caries and Fluoride

The scientific literature has shown that diet (sugar) consumption alone does not contribute to ECC but race/ethnicity based on social disparities, economic status/poverty can be associated with an increase in ECC prevalence (Postma, Ayo Yusuf and van Wyk, 2008). Fluoridated drinking water has also been shown to have a significant caries protective effect in the deciduous dentition which is supported by a survey from South Africa which shows that caries was more prevalent among those who lived along the coastal Western Cape Province and urban areas compared to the rural areas where the ground water supply contained more fluoride (Postma, Ayo Yusuf and van Wyk, 2008). There has been much advocacy for the introduction of fluoridated toothpaste in children from the age of 12 months as part of preventive intervention in Brazil especially in areas where there is no fluoridated water supplies (Rozenblatt and Zarzar, 2004). In Namibia, the fluoride concentration in at least 50% of the Namibian water varies from 0.1 – 0.4 mg/l (Namibia Water Corporation Ltd, 1998), which is below the optimal concentration for the prevention of dental caries.

## 2.11 Feeding habits and ECC

Feeding children sweetened beverages together with poor oral hygiene practices have detrimental effects on the children's teeth. By-products of sugar such as sucrose, fructose, and glucose found in fruit juices, baby cereals and vitamin supplements are associated with infant caries (Seow, 1998; Hallet and Rourke, 2003). These sugars cause a drop in pH of the oral environment and initiate the process of tooth demineralization. A study by Seow (1998) reported that when sugar in the form sucrose is consumed in large quantities, plaque acidity increases and enhances the establishment and dominance of *S. mutans* bacteria. When sugar is consumed before sleep or in-between a child's naptime the ability of saliva to clear foods is reduced. During sleep, the low salivary flow decreases the oral clearance of sugars and increases the contact time between plaque and substrate (teeth), which can in turn increase the cariogenic potential of the substrates present (Seow, 1998; Hallet and Rourke, 2003). The disproportionate use of bottle feeding up to 36 months of age as compared to breast feeding up to 12 months of age and less bottle feeding has been shown to decrease caries severity (Hallet and Rourke, 2003). Breast feeding has shown to have a less significant effect on the development of early childhood caries (Hallet and Rourke, 2003; Rozenblatt and Zarzar, 2004) when compared to other forms of feeding like bottle feeding and cup feeding, but the

use of prolonged and breast feeding *ad lib* was shown to have an impact on the increased prevalence and severity of caries (Zhou et al. 2011).

Weaning from the breast soon after the child's first birthday is recommended by dental professionals (AAPD, 2006), partly based on the fact that breast milk is more cariogenic than other types of milk and prolonged breast feeding allows the colonization of *S.mutans* (Zhou et al. 2011). There is a significant relationship between the number of sugary meals and caries as shown in a study by Rozenblatt and Zarzar (2004) where dental caries was more prevalent among children who had more than five sugary meals per day compared to those children who had five or fewer. Since many of the habits and attitudes concerning food and health are acquired in early childhood, it is essential that basic oral health practises are introduced as early as possible preferably during the eruption of deciduous dentition. Interventions that can bring about a change in behaviour at an early phase would be easy to apply and the probabilities of it benefiting dental health are greater than at a later phase (Baric et al. 1974).

## **2.12 Social, Cultural or Behavioural factors and ECC**

The determinants of ECC disease include many socio-economic and demographic factors such as level of education, occupation, income, locality of habitation and access to amenities like health care. For example, parents' socio-economic background determines the child's socio-economic status and this is often a reflection of the parents' level of schooling, education and income (Zhou et al. 2011). Studies shows that children of parents with university education had less than half the average number mean Decayed, Missing, Filled Teeth (dmft) scores compared to children whose parents had only elementary school education (Ismail, 2003; Hallet and Rourke, 2003). Bedos et al. (2005) found that edentulousness in mothers was a risk factor for increased caries prevalence in their children independent of factors like socio-economic status, age, gender and the children's oral health related behaviours. There may also be a genetic predisposition related to saliva transfer of *S.mutans* from the mother's mouth to the child's mouth along with poor enamel density of the child's teeth (Harris et al.2004) while the behavioural/ lifestyle factors are linked to type and nature of diet involved and tooth brushing habits. Based on Bandura's social learning theory, children may acquire dental behaviors by direct observation and modelling of their mothers' behaviors (Bedos et al. 2005). Nutritional tastes and habits are transmitted from mother to child.

Feeding children sweetened beverages coupled with poor hygiene habits are detrimental to the health of the children's teeth; sucrose, fructose, and glucose found in fruit juices and Vitamin C beverages are the main sugars associated with infant caries (Seow, 1998; Hallet and Rourke, 2003). Children whose parents had an education background of at least an understanding of "how to access and use information, especially about the benefits of changing parenting practices and the norms of behaviour, could help some parents to be open to the possibility of changing their behaviour" (Weinstein, 1998).

### **2.13 ECC and Quality of Life (QoL)**

The aetiology of early childhood caries is multi-factorial and it is prevalent among the disadvantaged communities of the world irrespective whether they are living in a developed or developing country and these disadvantaged communities are the most prone to being at risk of the disease. To be at risk of the disease means that there is reduction or disruption in the quality of life (QoL) due to dental or oral pain, irritability and disturbed sleep habits that affects the overall general health of the child (Sheiham, 2006). Sheiham (2006) reported that children who had a low weight for age and untreated dental decay experienced a catch up in weight after they were treated for the problem. This is evident from another study (Filstrup et al. 2003) which showed that children who underwent dental rehabilitation had significant levels of improved quality in life compared to the period before their treatment with decreased pain, better ability to eat and sleep.

The adult (secondary dentition) can be susceptible to defects in eruption due to premature loss of deciduous (primary dentition) as a result of untreated caries. In extreme cases, symptoms such as infection and pain can lead to chewing problems, malnutrition, gastrointestinal disorders and psychological disturbances (Schroth and Cheba, 2007). Oral health related quality of life (OHQoL) studies (Sheiham, 2006; Filstrup, 2003) also report improved psychosocial related-quality of life in children and their parents after undergoing dental rehabilitation or treatment in terms of improved school performance along with social interaction and the reduced amounts of time parents have to take leave from their work which could affect their incomes.

## **2.14 Maternal Smoking and Caries**

It has been reported that nicotine present in tobacco can encourage the growth of cariogenic bacteria in vitro, thus, mothers who smoke are more likely to transmit these bacteria to their children compared to non-smokers (Alaine et al. 2003). Colonization of the mouth with the cariogenic *Streptococcus mutans* is thought to occur during the age of one year particularly during a period when the children are vulnerable to infections that may render the primary teeth susceptible to caries formation soon after their eruption. Maternal smoking is considered to be a major risk issue predisposing to premature and low birth weight among new-borns and as these children have been found to be more prone to chronic illnesses it may result in malformation of the enamel in the primary dentition (Alaine et al. 2003). Moreover the immune system is considered to be less mature compared to that of adults during infancy, and the saliva has less defensive properties than that of the adult with respect to IgA concentrations. In addition, children have a lower rate of salivary flow making them biologically susceptible to passive smoking and may result in dental caries, particularly in their early childhood (Hanioka et al. 2011).

## **2.15 Malnutrition and Dental Caries**

Maternal nutrition plays an important role in the general nutrition and development of the child. The quality, mineral composition and structure of the deciduous teeth depend on the appropriate development during the intra-uterine period. Hypoplasia of the deciduous teeth has been recognised as a biomarker for a range of systemic disturbances including intra-uterine malnourishment and infectious diseases during the first year of life (Pine et al. 2004). Rosenblatt and Zarzar (2004) are of the opinion that changes within the food industry from 1920 to date, has brought about the trend of decreased breast-feeding among the Brazilian mothers and with baby formulae becoming available to low-income families from 1960, malnutrition and premature child mortality has been on the increase. The presence of gram negative periodontal pathogens among pregnant women is thought suspected to pose a risk for pre-mature labour and low birth weight children (Mouradian, Wehr and Crall, 2000).

## **2.16 Caries and Child Neglect**

Children who could have been neglected are less likely to visit a dentist and therefore are more likely to have untreated dental caries. Young children who are considered to have suffered maltreatment have common risk factors especially related to low socio-economic status, social deprivation, single parent households, family isolation and disintegration, low parental level of education, substance abuse and unemployment (Valencia-Rojas et al. 2008; Schroth and Cheba, 2007). One study reported a high prevalence of early childhood caries (decayed only) among abused/neglected children admitted for care to the Children's Aid Society of Toronto (CAST) as compared to a low prevalence of early childhood caries among the general child population within the same area (Valencia-Rojas et al. 2008).

## **2.17 Social Class and Dental Health**

There is an association between social class and health in general of which oral health is a component. Osler et al. (2009) found that a lower social status both in childhood and adulthood could be linked to poor health outcomes. They found that participants from lower social classes were more prone to have physical limitations in terms of movement, poor health and fatigue along with a poor oral health dental status when compared to those in the high social class group. The physical limitations were considered to be due exposure to adverse social circumstances in adult life while the poor dental status could be due to exposure to poor social conditions in early life. This is also evident in children born to mothers in socially deprived conditions who were found to be more prone to early childhood caries (Zhou et al. 2011; Valencia-Rojas et al. 2008, Schroth and Cheba, 2007; Pine et al. 2004). This in turn could have a negative impact on the development of the child during adolescence and later in adult life in terms of malocclusion and oro-facial development with poor dental function (Stahl et al. 2007; Robke, 2007).

## **2.18 Tooth Malocclusion Associated with Early Tooth Extraction**

One of the main focus areas in orthodontic treatment in the first half of the twentieth century was on prevention and increased prophylaxis, since caries-damaged deciduous dentitions increased the risk of tooth mal-alignments and malocclusions. Change in nutrition and drinking behaviour patterns of infants and babies have had an effect on oro-facial function

and dental development (Stahl et al. 2007). Robke (2007) sought to determine the effects of nursing bottle caries and discrepancies in the oro-facial development and found that malocclusions such as loss of vertical dimension, deep bites and open bites were very common clinical features in children with nursing bottle caries. It is crucial for clinicians to focus on the potential development of pathologic functional patterns of the oro-facial development in addition to performing routine cavity check-ups and monitoring the long term dental effects of early childhood caries on the permanent dentition.

### **2.19 Related Cost Implications**

Treatment under general anaesthesia for extensive dental repair is a costly and potentially risky consequence of ECC. A report from the state of Louisiana in the US suggests that of the 2100 Medicaid-covered children who received dental treatment over a one year period, 60% of the children were 3 years or younger and the costs of these services to families and the public were significant with the mean cost estimated to be at \$1,508 per admission (Griffin et al. 2000; Mouradian, Wehr and Crall, 2000). Another report from the United States estimated that about \$4.5 billion is spent annually in treating the disease and could cost between US\$1600-3500 per 1000 children which could exceed the total available public health budgets in resource poor countries (Boyce et al. 2010). Extrapolating these costs across tens of thousands of children who receive general anaesthetic services annually in the United States exposes an expenditure of millions of dollars for treatment of a largely preventable disease (Casamassimo et al. 2009). If for instance, the amount of money spent annually on orthodontic treatment in children aged up to 15 years is considered, the early loss of deciduous teeth can lead to tooth mal-alignments and malocclusions which in turn is an economic burden on families and the health care system (Robke, 2007).

### **2.20 Morbidity and Mortality**

The issue of serious morbidity and to a lesser extend of mortality cannot be excluded in the case of children experiencing caries. Although there are few instances of mortality associated with early childhood caries, the literature does point to an indirect link between risk factors contributing to conditions such as cardiovascular diseases which may cause morbidity and



mortality. Kelshadi et al. (2010) reported that children with an increased dmft also had very high biomarkers for cardiovascular diseases such as total cholesterol count, LDL cholesterol count and triglycerides as compared to the children in the other group with low dmft and low biomarkers for cardiovascular disease. There are also reports of mortality – resulting from local anaesthetic overdose, sedation or general anaesthesia mishap and choking while attempting to treat early childhood caries (Casamassimo et al. 2009).

### **2.21 Relationship between nutrition, sugar consumption and dental caries**

The most significant effect of nutrition on teeth is the local action of diet on the development of dental caries (Moynihan and Petersen, 2004). There is a vast amount of evidence that shows sugars (mono and disaccharides added to food by the manufacturer) are undoubtedly the most important dietary factor in the aetiology and development of dental caries. Oral bacteria, especially *Streptococcus mutans* and *Lactobacilli* ssp. have the ability to ferment sugar (sucrose, fructose and glucose) and produce lactic acid. This acid production reduces the pH of the oral cavity to 5.5 which is the critical pH at which demineralisation occurs. If this pH is maintained for a long period of time, it is capable of destroying tooth enamel and can eventually lead to tooth loss. *S.Mutans* also has the ability to convert sucrose to an extremely adhesive substance called dextran polysaccharide which allows it to adhere to biofilm on the tooth surface.

In addition, the frequency of sugar consumption is an important aetiological factor for caries development. Primary evidence comes from the infamous Vipeholm study which showed caries development was low when sugars were consumed up to four times a day at mealtimes (Gustafsson et al. 1954). A study by Holbrook in 1989 among 5 year old children in Iceland also came to the same conclusion - children who developed 3 or more carious lesions had a sugar intake of an average of 5.1 times per day as compared with 2.1 times to those who developed less than 3 carious lesions. The amount of sugar consumed is also an important aetiological factor. An increase in the amount of sugar consumed results in increase in dental caries (Woodward and Walker, 1994). There is also a strong correlation between the amount and frequency of sugars consumed (Rugg-Gunn, 1993; Cleaton-Jones et al. 1984). The cariogenicity of sugary food is also related to dental caries. The longer it takes a food to clear the mouth, the longer the drop in pH remains. The cariogenicity of food is related to its consistency - whether it is a liquid, solid, sticky, nutrient composition, sequence of food intake, combination of food and potential to stimulate saliva (Naidoo and Myburgh 2007).

Rugg-Gunn (1993) extensively reviewed the evidence relating starches to dental caries and concluded that cooked staple starchy foods such as rice, potatoes and bread are of low cariogenicity and very low for uncooked starches, however the addition of sugar to cooked starches will increase the cariogenicity ( as found in sweetened breakfast cereals). Fresh fruit also has low cariogenicity. He concluded that an increase in intake of starchy staple foods such as bread, potatoes and wholegrain foods should be encouraged. He also concluded that an increase in consumption of fresh fruit to replace free sugars is likely to decrease dental caries in a population.

The role of fluoride to protect teeth against dental caries has been well documented and accepted however the beneficial effects may vary with the amount of sugars consumed (Kunzel and Fischer 1997). In fact, the prevalence and severity of dental caries can increase drastically when sugar intake increases from around 15kg to 21kg per person per year (Sheiham, 1984).

## **2.22 What role do individual health/oral health practices play?**

At the individual level, bad practices can be detrimental to health and oral health, in particular to the development of ECC. These include nocturnal breast-feeding practices (allowing baby to nurse in bed with mother all night), bottle feeding at night and baby falls asleep with the bottle in the mouth, frequently bottle feeding the child with sweet juices, bottle feeding after one year, using pacifiers sweetened with honey and other sugary foods. The mother's knowledge, beliefs and attitude are also important. If the mother does not think that the primary dentition is important and primary tooth decay can impact childhood health, she would not care for them. Results from a study by Schroth et al. (2007) indicate that caregivers who believed that baby teeth were important were more likely to have children with better oral health (i.e., less decay) than those who thought otherwise. They also found that caregivers with children with ECC were more likely to disagree that dental decay could affect a child's overall health.

These bad practices can affect the overall quality of health and wellbeing of the child as ECC can affect the child's ability to eat, the choice of foods, how he/she looks (embarrassment at discoloured and damaged teeth), distraction from playing and learning and the way the child communicates. If the damage is severe it could lead to persistent pain, discomfort and infection resulting in loss of the front teeth which can further complicate the child's quality of

life as there may be developmental delays in speech, delays in physical growth and psychological trauma (American Academy of Paediatric Dentistry; U.S. Department of Health and Human Services, 2010).

On the other hand, at the individual level, good oral hygiene practices such as not allowing the child to sleep with bottle in the mouth and not giving a child juice whenever he/she requests, assisting or supervising the child's tooth brushing, brushing with a fluoride toothpaste, sealants, and regular dental checkups (with the first dental visit at 1 year) is of primary importance for good oral health. Avoidance of excessive amounts of sugar and sweets and fluoride applications can also help prevent tooth decay.

### **2.23 Concluding remarks**

This review of the literature serves to highlight an alarming situation for Namibian children where dental caries has been found to be severe (National Oral Health Survey, 2011) and the fact that many children will be confronted by caries even in their permanent dentition. This assumption has been proven by previous studies that have shown a high correlation between high caries frequency in deciduous dentition followed by high caries frequency in the permanent dentition (Birkeland et al. 1976; Poulsen and Holm, 1980). It was with this background that the present study sought to determine the risk factors leading to early childhood caries among children aged between 5-48 months in the peri-urban setting of Mariental in Namibia.

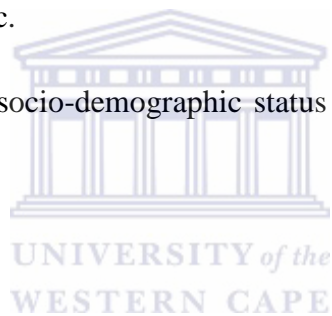
## **CHAPTER 3: AIM and OBJECTIVES**

### **3.1 AIM**

To determine risk factors associated with early childhood caries among 5 – 48 month old children in Mariental

### **3.2 OBJECTIVES**

- To determine the extent and severity of early childhood caries in 5 – 48 months old children in Mariental.
- To determine the risk factors associated with early childhood caries such as feeding practices, social and cultural behaviour, sugar consumption, dental health awareness, fluoride, risk behaviour etc.
- To compare the mothers socio-demographic status with the oral health status of her children.



## **CHAPTER 4: RESEARCH METHODOLOGY**

### **4.1 Study Design**

A descriptive, cross sectional survey was chosen for this study as it best suited the study aims and objectives.

### **4.2 Study Site and Study Population**

The study (site) was the ante-natal and post-natal clinic of the Mariental District Hospital. With the permission from the District Co-ordinating Committee (D.C.C) & Regional Management Team (R.M.T) a consultation room adjoining the Ante-natal clinic (A.N.C) & Post-natal Clinic (P.N.C) was allocated to carry out the clinical examination as well as the administering of questionnaires. The room had adequate lighting and hand washing facilities along with a table and chairs. The study population comprised of mothers and their biological children who visited the clinic for routine check-ups or screenings, counselling and treatment of other ailments.

### **4.3 Sampling and sample size**

A random sampling method was used to draw the samples from among the clients visiting the post natal clinic of the hospital and also from among those consulting for other ailments or problems. Only mothers and their children in the age range 5- 48 months were included in the survey. The study sample comprised 230, 5- 48 month-old children and their biological mothers.

### **4.4 Data Collection**

The data for the project was collected by means of clinical examination and structured interviews submitted to the mothers pertaining to their own personal health (Appendix 2 a) and pertaining to their children (Appendix 2 b). The team consisted of the calibrated examiner (dentist) and a recorder (nurse).The questionnaire was presented through an interview in the preferred language of the subject. The assistance of a translator was sought in the event of non-English-speaking individuals and the interview was conducted in privacy.

#### ***4.4.1 Clinical examination***

The clinical examinations were carried out on mothers and their children in the age group of (5- 48 months) and the dmft/DMFT index was used for the assessment of caries in both the mother and the child. The dentition of both the child and mother were checked for the presence or absence of caries, restorations and missing teeth due to caries or trauma as per the WHO criteria. After the intra-oral examination the findings were recorded on a modified WHO data sheet (Appendix 1). The examination was done using a mouth mirror and probe. The team began by explaining to the participant the reasons for the survey and the benefits thereof, checking and re-confirming the consent obtained that the participant was willing to participate in the survey. Oral examinations were carried out with a plain mirror and probe under daylight or, where necessary with a portable light source. No radiographs were taken.

#### ***4.4.2 Training and Calibration of the Examiner***

In order to obtain acceptable level of reliability during the data collection, training and calibration of the examiner took place prior to the survey. The team comprised of:

- i) A dentist who was trained by experts from the Department of Community Oral Health at the University of Western Cape; South Africa on clinical examination and data recording of the clinical findings.
- ii) Two Nurses – who were trained regarding interviewing of the mothers

#### ***4.4.3 Procedure***

Clinical examinations were carried out in a room in the post-natal clinic that had running water and electricity. Gauze or a cotton roll held with a pair of tweezers was used to clean and dry the teeth. The examiner adopted a systematic approach to the examination for dental caries, proceeding in an orderly manner from one tooth or tooth space to the adjacent tooth or tooth space. A tooth was considered present in the mouth when any part of it was visible or touchable with the tip of the probe without unduly displacement of the soft tissue.

Should a permanent and a primary tooth occupy the same tooth space, the status of the permanent tooth was recorded. The number of carious defects, fillings and missing teeth were recorded on the data capture sheets in accordance with the WHO criteria (Appendix 1). A

numerical coding system was used for recording the status of permanent teeth, while alphabets were used for primary teeth. Scores were calculated according to WHO guidelines. The SiC index was calculated as the mean dmft of one third of the population with the highest caries score (Nishi, 2002; Brathall, 2000). The following codes and criteria were used:

## **Codes and criteria**

### **0 Sound Crowns**

A crown was recorded as sound if it showed no evidence of treated or untreated clinical caries. In addition, a crown with the following defects were also coded as sound: white or chalky spots, discoloured or rough spots that were not soft to touch with the CPI probe, stained pits or fissures in the enamel that did not have visual signs of undermined enamel, or softening of the floor or walls detectable with the CPI probe, dark shiny, hard pitted areas of the enamel in a tooth showing signs of moderate to severe fluorosis, lesions that, on the basis of distribution or history, appeared to be due to abrasion.

### **1 Decayed Crown**

Caries was recorded as present when a lesion with a pit and fissure, or on a smooth tooth surface, had an unmistakable cavity, undermined enamel, or a detectable softened floor or wall. A tooth with a temporary filling, or one which is sealed (code 6) but also decayed was included in this category. The CPI probe was used to confirm visual evidence of caries on the occlusal, buccal and lingual surfaces. Where any doubt existed, caries was not recorded as being present.

### **2 Filled Crown, with decay**

A crown was considered filled, with decay, if it had one or more permanent restorations and one or more areas that were decayed.

### **3 Filled Crown, no decay**

A crown was considered filled, without decay, when one or more permanent restorations were present and there was no caries anywhere on the crown. A tooth that has been crowned because of the previous decay was recorded in this category. A tooth that had been crowned for other reasons (e.g. a bridge abutment), was coded as (7).

#### **4 Missing tooth, as a result of caries**

This code was used for teeth that had been extracted because of caries and was recorded under coronal status.

#### **5 Tooth missing, for any other reason**

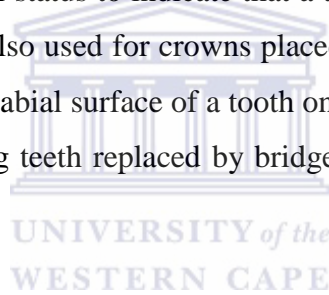
This code was used for teeth judged to be congenitally missing or absent, or extracted for orthodontic reasons, periodontal diseases, trauma, etc.

#### **6 Fissure sealant**

This code was used for teeth in which fissure sealant had been placed on the occlusal surface. If a tooth with a sealant had decay it was coded as (1).

#### **7 Bridge abutment, crown, and veneer**

This code was used under coronal status to indicate that a tooth formed part of a fixed bridge i.e. is a bridge abutment. It was also used for crowns placed for reasons other than caries, for veneers or laminate covering the labial surface of a tooth on which there has been no evidence of caries or a restoration. Missing teeth replaced by bridge pontics were coded 4 or 5 under coronal status.



#### **8 Unerupted crown**

This code was used for tooth space with an unerupted permanent tooth. Teeth scored as unerupted were excluded from all calculation concerning dental caries. This category does not include congenitally missing teeth, or teeth lost as result of trauma etc.

#### **9 Not recorded**

This code was used for any tooth that could not be examined for any reason.

#### ***4.4.4 Infection Control***

The advice of the Infection Control Committee of Mariental State Hospital was sought regarding various infection control measures and sterilization procedures to prevent cross-infection. Sterile gloves were used done by the examiner for intra-oral examination of both mother and child. Sterile mouth mirrors and probes were used for intra-oral examination. The gloves and used gauze were disposed in a red colour coded bag after use. Hand disinfection was done by the examiner after each examination.



## **4.5 Questionnaire**

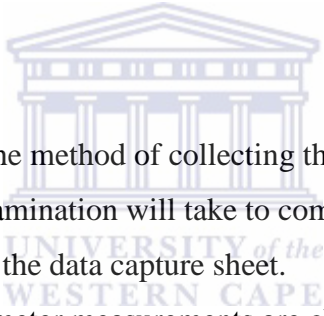
Structured administered questionnaires were used for collecting the data (Appendix 2a, 2b). This was written in English but administered in the language of the participant for ease of understanding to ensure that accurate information was obtained.

### **4.5.1 Development of questionnaire**

The first questionnaire consisted of 33 closed-ended questions that consisted of demographic details (age, gender, place of birth, occupation, level of education, living conditions) and the mother's oral health and dietary habits and the second questionnaire consisted of 33 closed-ended questions related to the child regarding feeding methods and frequency of feeding the child, type of diet fed to the child, oral hygiene and fluoride supplement use.

## **4.6 Pilot study**

A pilot study was carried out to:

- 
- (i) Test the suitability of the method of collecting the data.
  - (ii) Test how long each examination will take to complete.
  - (iii) Check the adequacy of the data capture sheet.
  - (iv) Check that all the parameter measurements are clear and unambiguous.
  - (v) Ensure that no major item has been omitted and
  - (vi) Remove any items that do not yield usable data.

The pilot study was carried out to test for the reliability and validity of the questionnaires and this was done on ten participants (mother's and the biological children who were within the age groups of 5 – 48 months). Participation was voluntary and informed consent was signed after information regarding the research aim and objectives were provided to the participants. After the pilot study, two ambiguous questions were revealed and reformulated. Following the pilot study, the questionnaire was found to be clearer and easy to understand, ensured minimum participants' error, efficient interpretation of the data and evaluated knowledge, attitude and behaviour of the participants. A final draft of the questionnaire was then printed and used for the final study.

#### **4.7 Data collection**

Interviews with the study participants took place at the clinics site and were conducted by a trained nurse. It was carried out in a private examination room in the post-natal clinic. To facilitate interviewing, respondents were interviewed in their own language.

#### **4.8 Data analysis**

The data that was gathered was categorized and coded then entered into the computer. The data was captured in Excel format. The EPIInfo statistical package was used to clean, collate and analyze the data. Statistical analysis consists mainly of frequencies, percentages and cross-tables as data is primarily categorical in nature. Bivariate analysis will make use of the chi-square or Fisher's exact test at the 0.05 level of significance. The main analysis will employ logistic regression and here tests will be done at the 0.05 level of significance.

#### **4.9 Ethical Considerations**

Permission to carry out the present study was obtained from the Senate Research Ethics Committee of the University of Western Cape (Appendix 3) and the Research Ethics Committee, Ministry of Health and Social Services, Namibia for permission to conduct the project in Mariental, Hardap Region (Appendix 5). Signed informed consent (Appendix 4) was obtained from each participant prior to interviews being conducted. Participation in this study was entirely voluntary and the participants were allowed to withdraw from the study at any time should they wish to do so without any penalties. It was emphasized that strict confidentiality would be maintained at all times and that none of their names or personal details will be mentioned in the write up of the study. Anonymity was achieved by not using the participant's names on the questionnaire and the questionnaire was recorded with serial numbers.

## CHAPTER 5: RESULTS

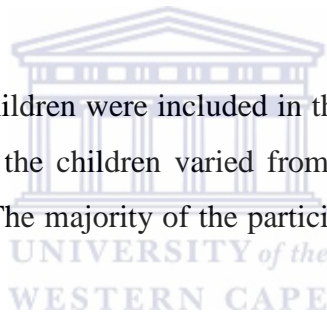
The results of the survey are described below. The results are descriptive in nature and findings divided into three parts: Part A reports of the findings from the children, Part B the findings of the mother and Part C compares the mother with their children's oral health status.

### 5.1 PART A: CHILDREN

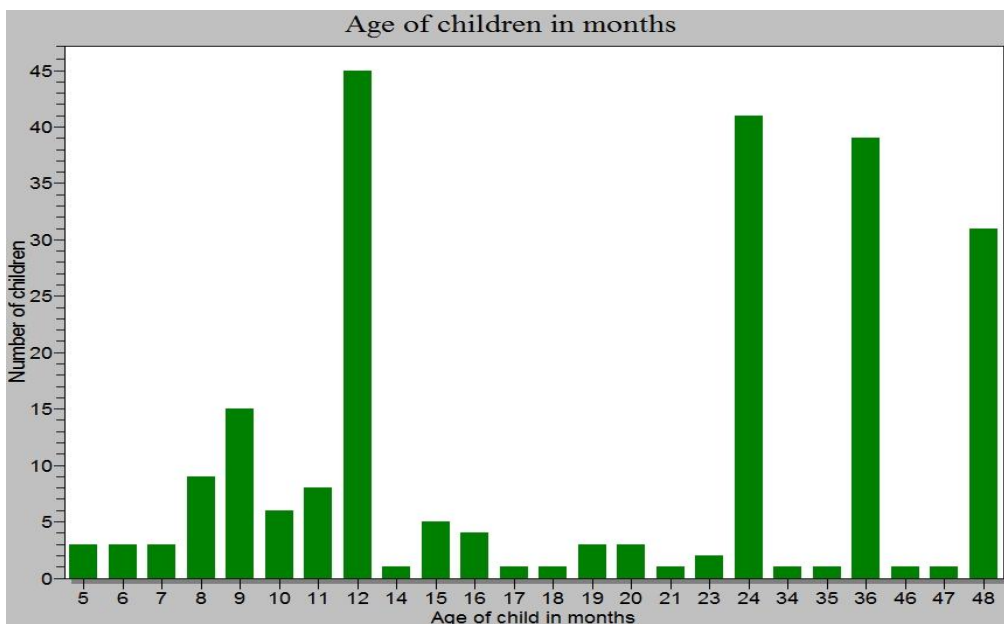
The results on the children's section will comprise of their demographic information, oral health status, feeding habits (methods used and frequencies), oral hygiene (methods used and frequencies of oral hygiene), and most common illness/es with those children on medications and those who are not on medications.

#### 5.1.1 Demography

Two hundred and twenty eight children were included in the survey and just over half (52%) survey were female. The age of the children varied from 5 months to 48 months, with the mean age of 24 months (Fig 1). The majority of the participants were between the 12 and 26 month age group (Table 1).



**Figure 1: Age (months)**



**Table 8: Age (months)**

Age	Frequency (n)	%
5 to 11 months	49	21.49
12 to 23 Months	64	28.07
24 to 35 Months	43	18.86
36 to 47 Months	41	17.98
48 months	31	13.59
<b>Total</b>	<b>228</b>	<b>100</b>

**5.1.2 Oral health status and dmft**

There was a steady increase in the mean deft for the children as the age groups increase (Table 8). Children in the higher age groups showed a higher deft but this was not statistically significant (Table 9 and 10).

**Table 9: Mean (average) deft for children by age groups**

Age groups	N frequency (%)	Total	Mean dmft	Variance	Std Dev(Standard Deviation)
5 to 11 months	49(21.6%)	6	0.1224	0.4014	0.6335
12 to 23 months	64(28.2%)	42	0.6563	2.9593	1.7203
24 to 35 months	43(18.9%)	90	2.093	8.4197	2.9017
36 to 47 months	41(18.1%)	130	3.1707	30.5451	5.5268
48 months	30(13.2%)	79	2.6333	19.8954	4.4604

**Table 10: Analysis of variance in the deft of the children.**

Variation	SS (sum of squares)	Df (degrees of freedom)	MS(mean of sum of squares)	F statistic	p value (calculated significance level)
Between	306.4616	4	76.6154	7.2128	0.0000
Within	2358.1023	222	10.6221		
<b>Total</b>	<b>2664.5639</b>	<b>226</b>			

Table 11a and 11b and Table 12a and 12b show an increase in the mean deft for the girls and boys as the age groups increase and that this finding was not significant.

**Table 11a: Girls deft by age-group**

Age groups	Observation	Total	Mean dmft	Variance	Std Dev(Standard Deviation)
5 to 11 months	25(21%)	2	0.08	0.16	0.4
12 to 23 months	34(28.6%)	9	0.2647	0.6248	0.7904
24 to 35 months	22(18.5%)	47	2.1364	7.2662	2.6956
36 to 47 months	20(16.8%)	102	5.1	52.2	7.225
48 months	18(15.1%)	26	1.4444	7.085	2.6618

**Table 11b: Girls deft test statistics**

Variation	SS(sum of squares)	Df(degrees of freedom)	MS(mean of sum of squares)	F statistic	p-value(calculated significance level)
Between	369.9843	4	92.4961	8.1786	0.0000
Within	1289.293	114	11.3096		
<b>Total</b>	<b>1659.277</b>	<b>118</b>			

**Table 12a: Boys deft by age-group**

Age	n(%)	Total	Mean dmft	Variance	Std Dev(Standard Deviation)
5 -11 months	24(22%)	4	0.166	0.6667	0.8165
12-23 months	30(28%)	33	1.1	5.3345	2.3096
24 -35 months	21(19%)	43	2.047	10.0476	3.1698
36-47 months	21(19%)	28	1.333	4.2333	2.0575
48 months	12(12%)	53	4.416	35.7197	5.9766

**Table 12b: Boys' deft test statistics.**

Variation	SS(sum of squares)	df(degrees of freedom)	MS(mean of sum of squares)	F statistic	p-value(calculated significance level)
Between	156.421	4	39.1054	4.7466	0.0015

Within	848.56	103	8.2385		
<b>Total</b>	<b>1004.99</b>	<b>107</b>			

More than two thirds of both the girls (Table 13) and boys (Table 14) were caries-free.

**Table 13: Caries free and caries affected by age groups in girls**

deft Girls				
Age (Months)	Caries n(%)	Caries- Free n(%)	TOTAL	Inference
5 to 11	1 (4%)	24(96%)	25	Chi-square = 77.2213
12 to 23	5(14.7%)	29(85.3%)	34	
24 to 35	11(50%)	11(50%)	22	DoF = 48
36 to 47	14(70%)	6(30%)	20	
48	7(38.89%)	11(61.11%)	18	p-value = 0.0047
<b>TOTAL</b>	<b>38(31.9%)</b>	<b>81(68.1%)</b>	<b>119</b>	

**Table 14: Caries free and caries affected by age groups in boys**

deft Boys				
Age (Months)	Caries n(%)	Caries- Free n(%)	TOTAL	Inference
5 to 11	1(4.17%)	23(95.83%)	24	Chi-square = 61.2572
12 to 23	9(30%)	21(70%)	30	
24 to 35	9(42.86%)	12(57.14%)	21	DoF = 44
36 to 47	7(33.33%)	14(66.67%)	21	
48	8(66.67%)	4(33.33%)	12	p-value = 0.0435
<b>TOTAL</b>	<b>34(31.48%)</b>	<b>74(68.52%)</b>	<b>108</b>	

The majority of the children were fed by a combination of methods (spoon, cup, bottle and breast feeding). Those children that were fed by only one or two methods had less caries compared to those being fed by a combination of methods (Table 15). Only about 10% of children were exclusively breast fed with one child being exclusively bottle fed.

**Table 15: Caries vs. Methods of Feeding**

Caries status	METHOD OF FEEDING							TOTAL	
	Bottle	Bottle & breast	Breast	Cup	Spoon	Spoon, Cup, Bottle & breast	Spoon Cup Breast		
<b>No caries</b>	1	16(10.2%)	17(11%)	3(2%)	3(2%)	54(34.6%)	62(39.7%)	156	Chi-square = 107.0677
<b>Caries</b>	0	3(4.1%)	6(8.3%)	3(4%)	3(4%)	29(40.2%)	28(39%)	72	DoF = 84
<b>TOTAL</b>	1	19(8.3%)	23(10%)	6(3%)	6(3%)	83(36.4%)	90(39%)	228	p-value = 0.0456

Table 16 shows that most of the children were breast fed during most of the day and night and these children had a high proportion of caries which was mostly feeding on demand (*ad lib*). Those children who were breast fed only during the day time only had less caries experience.

**Table 16: Caries vs. Frequency of Breastfeeding**

Caries status	FREQUENCY OF BREASTFEEDING						
	All day all night	All night	Baby cries in mid night	Before sleeping at night	During the day	During the day & before sleeping at night	During the day and when baby cries
<b>No caries</b>	69(47.9%)	4(2.78%)	6(4.16%)	20(13.9%)	10(7%)	27(18.75%)	8(5.56%)
<b>Caries</b>	30(51.7%)	3(5.17%)	2(3.45%)	7(12%)	3(5.17%)	9(15.6%)	4(6.90%)
<b>TOTAL</b>	99(49%)	7(3.45%)	8(3.96%)	27(13.37%)	13(6.44%)	36(17.82%)	12(5.94%)

Table 17 shows that children who had been bottle fed almost all the time during both day and night (on demand) had high proportion of caries. Those children being fed only during the day had less caries experience and no significant trend was observed ( $p = 0.383$ ).

**Table 17: Caries vs. Frequency of Bottle feeding**

FREQUENCY OF BOTTLEFEEDING								
Caries status	All day and night	During the day and before sleeping at night	Before sleeping at night	During the day	All night	When child cries at night	TOTAL	
<b>No caries</b>	15 (21%)	16 (23%)	3 (4.2%)	24 (34.2%)	10 (14%)	2 (3%)	70	Chi-square = 68.7902
<b>Caries</b>	14 (45%)	2 (6.4%)	0	6 (19.3%)	7 (22.5%)	2 (6.4%)	31	DoF = 66
<b>TOTAL</b>	29 (29%)	18 (17%)	3 (2.9%)	30 (29%)	17 (17%)	4 (4%)	101	p-value = 0.3831

Table 18 shows that majority of children (83.9%) had sugar added to their drink in a cup or bottle. Children who had sugar added to their drink in the bottle or cup had a higher caries proportion (90.3%).

**Table 18: Caries vs. Sugar Added to Bottle or Cup**

SUGAR ADDED TO BOTTLE OR CUP				
Caries status	No	Yes	TOTAL	
<b>No caries</b>	29(19.1%)	123(80.9%)	152	Chi-Square = 7.2692
<b>Caries</b>	7(9.7%)	65(90.3%)	72	DoF = 14
<b>TOTAL</b>	36(16.1%)	188(83.9%)	224	p-value = 0.9238

Table 19 shows that there were an almost equal proportion of children affected with caries (55%) in mothers who cleaned their child's mouth and those mothers who did not clean their child's mouth (44%).

**Table 19: Caries vs. Oral Hygiene**

CLEANING CHILD'S MOUTH				
Caries status	No	Yes	TOTAL	
<b>No caries</b>	82(52%)	74(47%)	156	Chi-square = 18.3658
<b>Affected Caries</b>	32(44%)	40(55%)	72	DoF = 14
<b>TOTAL</b>	114(50%)	114(50%)	228	P-value = 0.1906



Table 20 shows the oral hygiene methods used by mothers in cleaning their children's mouth. Most of the mothers used cloth to clean their children's mouth (71%) while a very few used a tooth brush and tooth paste (15%). Those children whose mouth were cleaned only with a cloth, showed a higher proportion of caries (67%) compared to those children whose mouth were cleaned with either tooth brush alone (8%) or with tooth brush and tooth paste (16%). Other methods like glycerine and water were also used by mothers to clean their children's mouth and teeth.

**Table 20: Caries vs. Different Oral Hygiene Aids**

Caries status	Methods used to Clean						TOTAL	
	Cloth	Finger	Other (Glycerine, Water)	Toothbrush	Toothbrush and toothpaste			
<b>No caries</b>	50(73%)	2(3%)	4(6%)	2(3%)	10(15%)	68	Chi-square = 42.6261	
<b>Caries</b>	24(67%)	0	3(8%)	3(8%)	6(16%)	36	DoF = 36	
<b>TOTAL</b>	74(71%)	2(2%)	7(6%)	5(5%)	16(15%)	104	p-value = 0.2075	

Table 21 shows that most mothers clean their children's mouth once in the morning and at night before sleep. Children whose mouth were cleaned twice (in the morning and at night before sleep) had less caries experience (23%) compared to those children whose mouth were cleaned only once (40%).

**Table 21: Caries vs. Frequency of Oral Hygiene**

FREQUENCY OF CLEANING	Caries status	No caries	Caries	TOTAL	Chi-square = 38.6213
	<b>After feeding</b>	18(56%)	14(43%)	32	
	<b>All the above</b>	1	0	1	
	<b>At night before sleep</b>	2(66%)	1(33%)	3	DoF = 63
	<b>Before and after feeding</b>	2(66%)	1(33%)	3	
	<b>Before feeding</b>	1(50%)	1(50%)	2	
	<b>In the morning</b>	21(60%)	14(40%)	35	p-value = 0.9934
	<b>In the morning and at night before sleep</b>	23(76%)	7(23%)	30	
	<b>Not at all</b>	1(50%)	1(50%)	2	
	<b>TOTAL</b>	69(64%)	39(36%)	108	

Table 22 shows that majority of the children were on treatment for respiratory tract infections/cough, fever and diarrhoea and these children had a high caries proportion. Nearly two thirds (64%) were on medications (suspensions and syrups) for various ailments. There was a high caries proportion (69%) in these children (Table 23).

**Table 22: Caries vs. Most common diseases the children being treated for**

	Allergy	ARV/PMT CT	Asthma	Fever	Diarrhoea	Respiratory Infection	Malnutrition	T.B
No Caries	6(7.79%)	2(2.60)	0(0%)	12(15.58%)	11(14.29%)	42(54.55%)	0(0%)	4(5.19%)
Caries	4(7.27%)	0(0%)	1(1.82%)	7(12.73%)	9(16.36%)	30(54.55%)	2(3.64%)	2(2.64%)
Total	10(7.58%)	2(1.52%)	1(1.82%)	19(14.3%)	20(15.15%)	72(54.55%)	2(1.52%)	6(4.55%)



**Table 23: Caries vs. Children on Medication**

CHILD ON MEDICATION				
Proportion of caries in children	No	Yes	TOTAL	
No caries	61(40%)	92(60%)	153	Chi-square = 10.2358
Caries Affected	22(31%)	48(69%)	70	DoF = 14
TOTAL	83(37%)	140(64%)	223	p-value = 0.7447

### Summary

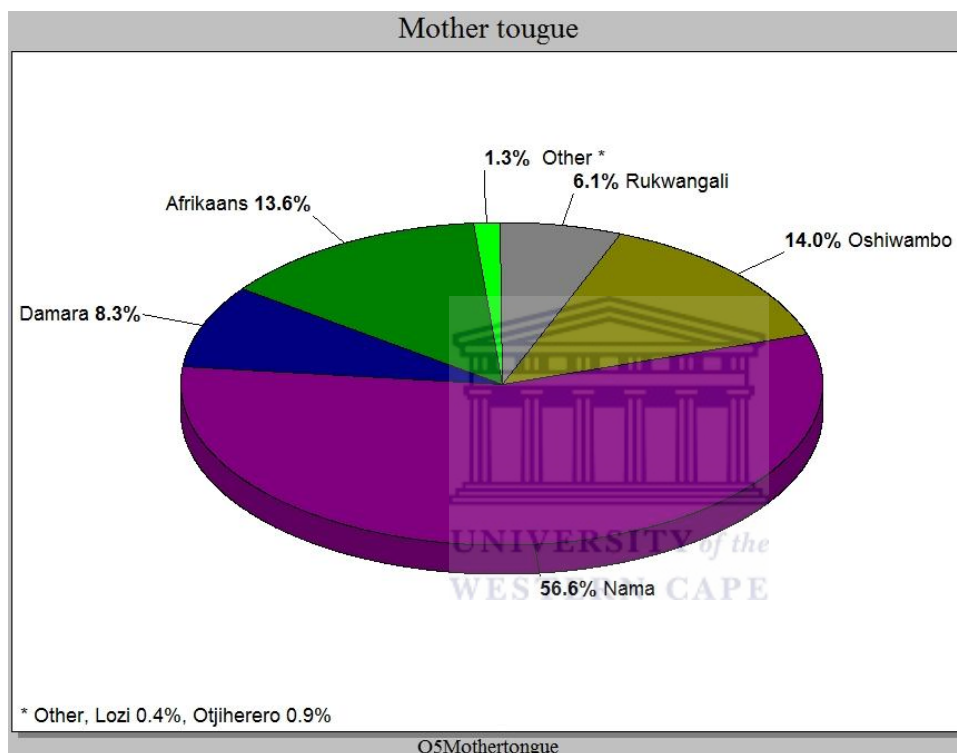
Out of the 228 children who took part in the survey, majority of them were between the age group of 12 and 26 months. The oral health status for both the girls and boys showed an increase in deft as they advanced in age, although this finding was not considered to be statistically significant. Also worth taking of the fact was that more than two-thirds of girls and boys being caries free. In terms of the risk factors that could have contributed to these children having a high deft could be that of a combination of deleterious feeding habits and patterns with improper oral hygiene methods or practices. Another interesting finding of the study was that more than 60% of the children who took part in the survey were on chronic medications for some kind of illness/es with these children having a high caries percentage.

## 5.2 PART B: MOTHERS

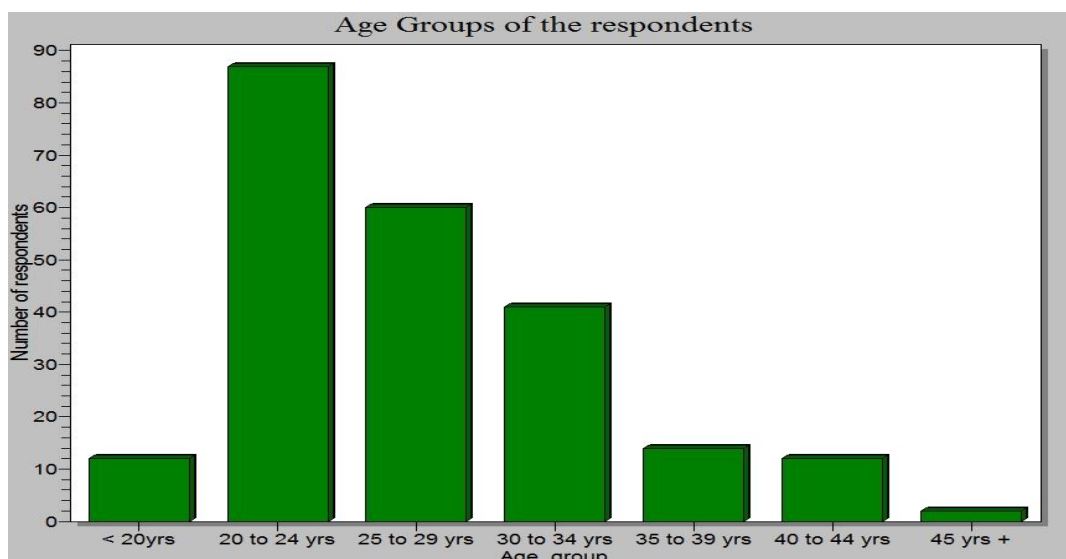
### 5.2.1 Demography

A total of 228 mothers participated in the survey with the majority from the Nama tribe, followed by Oshiwambo tribe (Figure 3). The majority were between the ages of 20 – 34 years.

**Figure 2: Distribution of respondents by mother tongue**

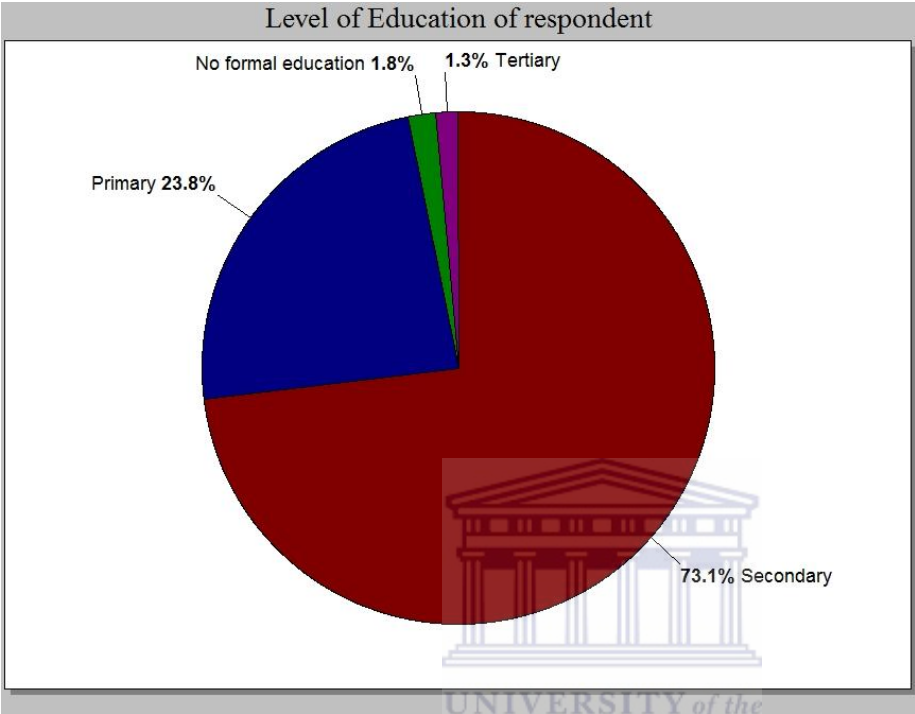


**Figure 3: Age in years**



The majority of the mother had a secondary school education up to grade 8, thereafter were not able to study further or dropped out of school (Fig 5). Nearly eight percent were unemployed (Table 18).

**Figure 4: Level of education of the respondents**



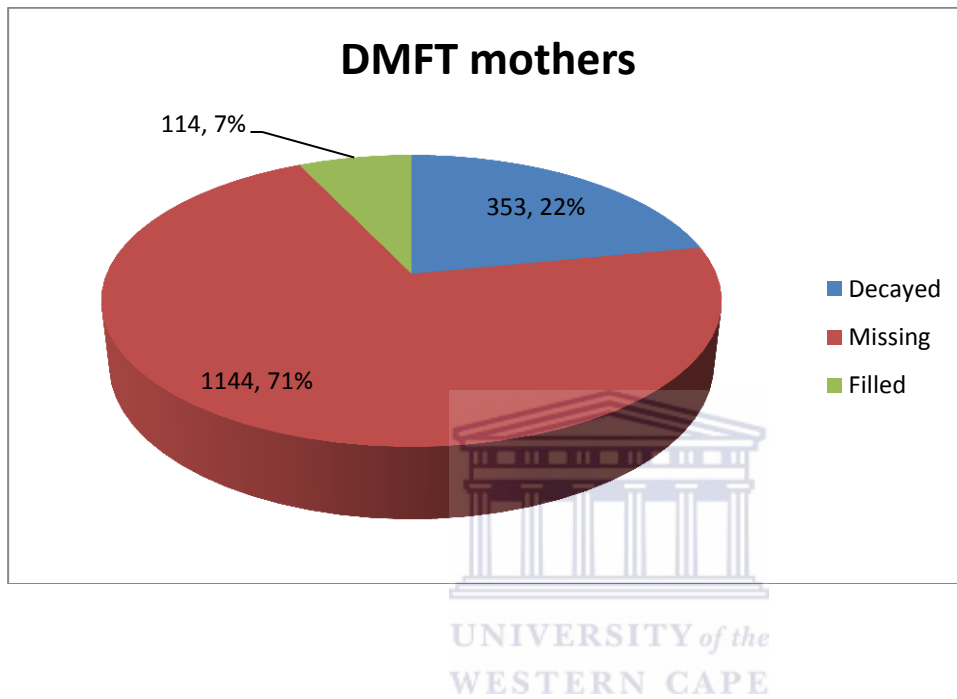
**Table 25: Occupation of mothers**

Occupation	Counts	%
Unemployed	179	78.50
Domestic worker	16	7.00
Cleaner	7	3.10
Armed forces	7	3.10
Till attendants	6	2.60
Educators	3	1.30
Health worker	3	1.30
Insurance/Bank employee	3	1.30
Farm worker	2	0.90
Tourism	1	0.40
Farmer	1	0.40
<b>Total</b>	<b>228</b>	<b>100.00%</b>

### 5.2.2 Oral Health Status and Dmft

More than two thirds (71%) had at least one tooth missing which was extracted due to caries, 22 % had one or more decayed teeth and 7 % filled teeth (Figure 6). The overall mean DMFT among the mothers was 7.1 with SiC index of 17.11.

**Figure 5: DMFT for mothers.**



### 5.3 PART C: MOTHER and CHILD'S ORAL HEALTH STATUS

#### 5.3.1 Mothers Educational Status In Comparison with Caries Proportion in Children.

Table 26 shows that more children were caries-free whose mothers had either a primary education or secondary education up to grade 8.

**Table 26: Caries and mother's education level**

Educational Status of Mother	Caries in children			Chi-square = 25.0196
	Caries n(%)	Caries-free n(%)	TOTAL	
No formal education	0(0%)	4(100%)	4	DoF = 42
Primary	17(32.1%)	36(67.9%)	53	
Secondary	53(32.5%)	110(67.5%)	163	
Tertiary	0(0%)	3(100%)	3	p-value = 0.9826
<b>TOTAL</b>	<b>70(31.4%)</b>	<b>153(68.6%)</b>	<b>223</b>	

Table 27 shows that 73% of children whose mothers were not working or unemployed had caries when compared to that of children whose mothers were employed or working.

#### 5.3.2 Mothers Occupation Status In Comparison with the Caries Proportion in Children

**Table 27: Caries and mothers' occupation**

Caries Status	Mother working			Chi-square = 14.1438
	No	Yes	TOTAL	
No Caries	117(79%)	31(21%)	148	DoF = 14
Caries	51(73%)	19(27%)	70	P-value = 0.4391
<b>TOTAL</b>	<b>168((77%)</b>	<b>50(23%)</b>	<b>218</b>	

#### 5.3.3 Mothers Perception on Oral Hygiene In Comparison with Caries Proportion in Children

Table 28 shows the mothers perception on the importance of oral hygiene in their children versus caries in their children. Although most mothers thought that it was important to clean their children's teeth, about 90% of children had at least or more carious teeth in their mouth.

**Table 28: Caries and Mothers perceptions on oral hygiene**

IMPORTANT TO CLEAN CHILD MOUTH				
Caries status	No	Yes	TOTAL	
No caries	18(11.6%)	137(88.4%)	155	Chi-square = 13.5503
Caries	5(7.4%)	63(92.6%)	68	DoF = 13
<b>TOTAL</b>	23(10.3%)	200(89.7%)	223	p-value = 0.4063

### 5.3.4 Type of Housing vs. Caries

Table 29 shows that irrespective of the type of housing used by the mothers, their children had high levels of caries. Nearly half of all children (49.2%) who lived with their mothers in concrete houses had caries, while 47.8% of those who stayed with their mothers in shacks had caries.

**Table 29: Type of housing vs. caries**

TYPE OF HOUSING				
Caries status	Formal Housing (Concrete house)	Informal Housing (Shacks, Huts)	TOTAL	
No caries	85 (54%)	71 (45.4%)	156	Chi-square = 41.1698
Caries	35 (49.2%)	36 (50.6%)	71	DoF = 28
<b>TOTAL</b>	120 (52.8%)	107 (47.1%)	227	p-value = 0.0518

### Summary

In terms of the mothers' educational levels and employment status, the study showed that children whose mothers had either a primary or secondary education upto Grade 8 were caries free. However, the study revealed that majority of these mothers was not working or unemployed with their children having a high caries percentage. Although majority of the mothers who participated in the survey were of the opinion that it was important to clean their children's teeth, about 90% of the children had at least one or more carious teeth in their mouth. The study also shows that irrespective of the type of housing used by mothers there was almost an equal proportion of children affected by caries who lived in concrete houses and shacks.

## **CHAPTER 6: DISCUSSION**

### **6.1 Introduction**

Mothers and their children attend public health clinics across Namibia for treatment of fevers, coughs and other respiratory illnesses. However, oral health is not given priority by the mothers as they do not realise that good oral health is part of good general health and vice-versa. Most mothers take their child to a dental clinic when the child is in extreme pain, usually due to grossly carious teeth or infection with swelling.

The present study was undertaken to determine the risk factors associated with early childhood caries and to the best of the authors knowledge is the first of its kind in Namibia. The sample consisted of two hundred and twenty-eight children (aged between five to forty eight months) and their biological mothers. Most of the mothers who participated in this study were between the age group of 20 and 34 years and most of their children were between the age group of 12 to 26 months.

### **6.2 Involved Risk Factors**

The relationship between early childhood caries and associated risk factors especially, in relation to oral hygiene habits, feeding habits and socio-economic conditions has been well established (Prakash et al. 2012; Zhou et al. 2011; Vaencia-Rojas et al. 2008). The common indicators used for assessing risk factors in most studies have been the child's feeding habits and patterns, oral hygiene habits and practices followed by the education and employment status of the mothers. In the present study, feeding and oral hygiene habits and practices along with the education and employment of mothers were determined.

### **6.3 Prevalence of ECC in comparison with Mothers Caries Prevalence**

The mothers who exhibited high caries levels in this study also had children presenting high caries levels. This concurs with studies conducted by Dye et al. (2011), Shearer et al. (2011) and Thitasomakul et al. (2009). Mother's oral hygiene status and practices act a predictive marker for their children's oral health as most of the habits followed by the mothers can significantly influence that of their children. In this study, the caries prevalence increased



with the child's age, both for boys and girls. Older children have been found to be more likely than younger children to have ECC which may be attributed to the longer time of exposure of the teeth to cariogenic microorganisms and fermentable carbohydrates (Warren et al. 2008; Schroth, Brothwell and Moffatt, 2007; Schroth, Moore and Brothwell, 2005).

#### **6.4 Mothers Educational & Employment Status and ECC**

This study also compared the mother's education and employment status to the oral health status of their children. Most of the mothers who participated in the survey had either a primary education or secondary education up to grade 8. There was high caries prevalence in children whose mothers had either primary education (32.1%) or secondary education (32.5%). Furthermore, children whose mothers who were not working or unemployed had significantly higher caries levels when compared to children whose mothers were employed or working. Unemployment coupled with a lack of education can influence life styles and access to health care information thereby contributing to increased susceptibility to dental caries (Prakash et al. 2012; Khan and Cleaton-Jones, 1998). However, there was insufficient evidence to prove an association between the lack of education in mothers with increased susceptibility of caries in their children.

#### **6.5 Feeding Practices and ECC**

Lack of information or education contributes to improper or detrimental feeding habits among mothers (Weinstein, 1998). This present study found that most of the mothers used a combination of methods in feeding their children mostly by breast, bottle and cup. Exclusive or a single method of feeding pattern was less commonly practiced. Those children who were either breast fed or bottle fed on demand had higher levels of caries. Studies have found that inappropriate breast and bottle feeding contributed to an increased risk of ECC in children but without any direct causal relationship (Prakash, 2012; Zhou, 2011; Seow et al. 2009). The WHO advises exclusive breast feeding in children up to six months of age and recommends continuation of breast feeding in addition to other nutritional supplements up to two years of age. A systematic review by White (2008) found that while breast feeding did pose a direct risk for ECC in children, none of the papers reviewed showed any direct causal relationship between breast feeding and ECC. Similarly a randomized control trial (RCT) showed that breast feeding in children did not pose any significant risk to the development of ECC (Kramer et al. 2007).

## **6.6 Oral Hygiene and ECC**

The association between diet, poor oral hygiene and the effect of plaque in contributing to ECC has been reported previously (Palmer et al. 2010; Saxena et al. 2008, Warren et al. 2008). The colonization of cariogenic bacteria mainly streptococcus mutans on the tooth surface leads to demineralization of these teeth in children at a much faster rate due to thin enamel matrix. In the present study, children had similar caries experiences irrespective of whether the mothers reported cleaning their children's teeth or not. This could however have been acquiescence bias on the part of mothers who were aware of the risk factors.

Despite the fact that nearly all the mothers thought that it was important to clean their children's mouth, this was not reflected in the oral health of their children. This could be due to fact that while the mothers had the basic knowledge that they needed to brush their children's teeth to have good oral hygiene, they may have had problems performing or reinforcing this habit on a regular or daily basis (Baginska and Rodakowska, 2012).

## **6.7 Common Childhood Ailments and ECC**

The present study found that there was high caries prevalence (69%) in children who were on chronic medication (suspensions and syrups) for conditions such as respiratory tract infections, fever and diarrhoea, but this was not statistically significant. However, studies conducted by (Olmez, Uzamis, Erdem, 2003, Holbrook et al. 1989 reports that children who consumed antibiotics and antihistamines frequently had a higher dmft compared to those children who were not on these medications.

## **6.8 Is ECC a Public Health problem in Namibia?**

The finding that nearly one in three children was affected by dental caries on the anterior primary teeth and with the population's SiC estimated at 7.6 highlights the need to recognise ECC as a serious public health problem in Namibia. The fact that 8 out of 9 provinces have a caries rate of over 40% among 4-5 year age group and the fact that the weighted national mean rate of caries in the same age group is over 50% is substantial evidence to prove that ECC is a major dental burden. The inequities that exist among different social classes are obvious factors to be considered as socially disadvantaged groups are particularly targeted.

Poverty, dental knowledge, personal habits, attitudes and beliefs among people are also important contributing factors that make ECC a serious dental health problem. Environmental issues like access to fluoridated water and access to dental services also compound the problem.

### **Limitations of the study**

This study has a few limitations. The sample size was too small to find significant relationships from the data and a convenient sampling method was utilised for data collection. This study was the first of its kind in Namibia, limiting the study in terms of predicting a trend in the caries indices and associated risk factors. However, despite these limitations this study provides important data with regard to the oral health status of mothers and their children in the Mariental township of Namibia.



## CHAPTER 7: RECOMMENDATIONS & CONCLUSIONS

### 7.1 Recommendations

ECC is highly prevalent within the communities in Namibia especially within this peri-urban setting where the study was conducted. The present survey reveals that children with caries experience had a high proportion of affected teeth. Consequences of this problem include a high risk of new carious lesions, risk of delayed physical growth and development, loss of school days with restricted activity, diminished ability to learn, diminished oral health related quality of life, hospitalization and emergency room visits with increased treatment costs and time. Since the problem is multi-factorial in nature and almost similar to that of occurrence both in the developed and developing countries, it would be feasible to look at strategies that could counter-act this problem and formulate a policy within a multi-sectoral and inter-sectoral collaboration.

Prevention should focus starting as early as the pre-natal and peri-natal periods. Mothers should be advised or given oral health education to optimize nutrition during their pregnancy and the infant's first year, when the enamel is undergoing maturation. This could prevent the risk of enamel hypoplasia or enamel defects which is presumed to be one of the risk factors to ECC (Lucey, 2009). An inter-sectoral collaboration involving the nurses, doctors, paediatricians and dentists should help in identifying those mothers and children with high caries risk so that appropriate counselling can be instituted at an early stage and where necessary referral and treatment done in terms of pre-natal fluoride administration, topical fluoride administration and preventive treatment like restorations.

The (AAPD, 2011) recommends and encourages professional and at-home preventive measures which includes –

- (i) Reducing the parent's/ sibling(s)' mutans streptococcus levels to decrease the transmission of cariogenic bacteria.
- (ii) Minimizing saliva sharing activities (e.g. sharing of utensils) to decrease the transmission of cariogenic bacteria.
- (iii) Implementing oral hygiene measures no later than the time of the eruption of the primary tooth. Tooth brushing should be performed for the children by the parent twice daily, using a soft tooth brush of age appropriate size. In children considered to be of moderate to high risk

under the age of 2 years, a 'smear' of fluoridated tooth paste should be used. In all children ages 2 to 5 years, a 'pea-size' amount should be used. Systematic review studies (Marinho et al. 2009; Twetman et al. 2009; Twetman et al. 2003), reports that fluoride toothpaste to be the most cost-effective home-care measure and semi-annual fluoride varnish applications as the best professional method for infants at risk.

(iv) Avoiding high frequency consumption of liquids and or solid foods containing sugar.

This should include:

- Sugar-containing beverages (eg, juices, soft drinks, sweetened tea, milk with sugar added) in a baby bottle or no-spill training cup should be avoided.
- Infants should not be put to sleep with a bottle filled with milk or liquids containing sugars.
- Ad libitum breast-feeding should be avoided after the first primary tooth begins to erupt and other dietary carbohydrates are introduced.
- Parents should be encouraged to have infants drink from a cup as they approach their first birthday. Infants should be weaned from the bottle between 12 to 18 months of age.

An inter-sectoral collaboration involving the major role players such as Ministry of Health, Education, Child Welfare, Food & Drug administration especially on diet & nutrition, Water and irrigation, Agriculture, Media (Ministry of Information & Broadcasting), Non-governmental organisations (health related and others) is of paramount importance in dealing with the problem. This is in line with the principles of the Ottawa declaration promulgated by the WHO in 1986 which encourages and recommends the reorientation of health services along with the participation of other stake holders whereby public health strategies are developed promoting oral health and reducing inequalities. Especially with escalating costs in tackling disease burdens such as ECC and with shrinking or limited resources, it would be prudent for both health authorities and the relevant stake holders in joining hands to develop country specific and community specific goals that could bring about a paradigm shift in putting plans or policies into action. The ministry of health as the custodian should take the lead role to ensure that mechanisms for inter-sectoral collaboration are considered which could include taxation and pricing, food labelling and advertising, school lunch policies and support to nutrition programmes.

## 7.2 CONCLUDING REMARKS

Oral diseases are considered to be a major public health problem and the W.H.O recommends the approach of common risk factor in dealing with the problem. A group of non-communicable diseases like – diabetes, cardiovascular diseases, oral cancer and chronic obstructive pulmonary disorders share the common risk factors with oral diseases which are life-style related and preventable (Petersen, 2004).

Health education usually encompasses any activity or group of activities that is educational in nature and which encourages individuals and communities to lead lifestyles conducive to health. Education of the general public and of the individual patients to develop sound oral health practices is of fundamental importance. There should be an education component of all preventive procedures, both at the community level and for the individual patient. Considerable public education is required to achieve acceptance of water fluoridation, school based prevention programmes and the use of non-cariogenic sweeteners (Schou and Blinkhorn, 1993). Motivation in some individuals may be enhanced by the encouragement of a dentist or a hygienist to the extent where these patients can prevent further oral disease largely by their own efforts. But with health education alone, targets in achieving the desired outcomes in oral disease reduction would be difficult (Sheiham and Watt, 2000; Locker and kay 1998; Olsen et al. 1986). It is therefore necessary that the concept of oral health promotion intervention based on integration with social and general health embracing the common risk factor approach be implemented.

Health inequalities still remains both in the developed and developing countries and is a major public health challenge because lower income and socially disadvantaged sections within these societies are affected (Watt, 2005). Countries, organizations and institutions have been advised world over to re-orient their health care policy within the frame work of the Ottawa Charter in bridging the gap between the inequalities in health (Petersen, 2004; Watt, 2005). This can be done by adopting a policy which empowers individuals and communities to increase control over the determinants of health thereby improving their health. For example, in a country like Namibia where field promoters are used in educating and screening of diseases like malaria, TB and HIV, these field promoters can be trained on providing dietary advice, screening and prevention of early childhood caries.

The development of an oral health component in the early identification and prevention of dental disorders should be included in the training curriculum for nurses. Both nurses and field promoters can be trained on applying fluoride varnish which can help in reversing the non- carious lesions such as white spot demineralization of the enamel. This should be cost-effective in terms of referring children to the dental personnel for treatment.

The WHO oral health programme (Petersen, 2003) has come up with a set of strategies or programmes for improved oral health globally through links with other technical programmes within the Department for Non-communicable Disease Prevention and Health Promotion. One such programme is the - Health promoting schools initiative which emphasizes on the concept of promoting health through creating an ideal environment for living, learning and working not only for the learners and teachers but also the community involved. This encourages and motivates the relevant stakeholders in joining hands and coming up with strategies or policies with a common goal i.e. well-being of the general health of the population and not just oral health care. The oral health sector can collaborate with policy makers on the delivery and accessibility of safe and clean drinking water across all sections of the public. Schools are an ideal setting whereby provision of clean and optimally fluoridated water will help and encourage children not only to have good oral health but general health.

Another method of preventing tooth loss as a consequence of dental decay among children would be the placement of dental sealants on tooth surfaces identified as high risk for caries. Schools provide an ideal setting whereby children can be screened and those grouped as medium to high risk for dental decay can be identified for dental sealant placement. To be cost effective, dental sealants should only be placed on children with current caries or previous caries or who are at high risk for ECC (Locker et al. 2003). Also of importance would be the development of a holistic nutrition programme which aims to improve the overall nutritional status of the children whereby, reduction in consumption of refined sugars and fats will not only contribute to oral health of the children but also decrease the vulnerability of these children other non-communicable diseases like hypertension, diabetes and oral cancer.

Any changes in behavior are usually easy to achieve at a younger age than later in life. Inclusion of healthy living and its benefits into the school curriculum should be a priority of all stake holders involved. This would help children not only in improving their awareness to

diseases but also on how to deal with social issues contribute to such problems. There should be a policy on the adverse effects of smoking and alcohol use, HIV/AIDS and bullying or violence among students (Sheiham and Watt, 2000).

In addition to Schools Health Promotion initiative, the WHO oral health care programme recommends (Petersen, 2003), the inclusion of programmes such as dietary and nutritional counselling along with promoting healthy lifestyles during patient clinic visits. This would also include encouraging mothers to breastfeed their children after pregnancy and the benefits attached to it. Oral Health Promotion focuses on working with people to remove barriers to health, barriers that are seen to be very much a part of people's social and physical environments (Schou and Blinkhorn, 1993). It is this multi-determinant, empowerment view of oral health promotion that is emerging in developing countries. It contests the current practise of promoting only personal life-style changes and advocates for healthy public policy and overall community development.





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# Appendix 1

## DATA CAPTURE SHEET

Name: \_\_\_\_\_

Year		Month		Day		Identification number				Examiner No.		

Sex 1=M,2=F	Date of Birth (YYMMDD)	Age in years	Region	Urban 1, Rural 2

### CARIES STATUS AND TREATMENT NEEDS

			55	54	53	52	51	61	62	63	64	65		
	17	16	15	14	13	12	11	21	22	23	24	25	26	27
Status														
Treatment														
Status														
Treatment														
	47	46	45	44	43	42	41	31	32	33	34	35	36	37
			85	84	83	82	81	71	72	73	74	75		

STATUS	Permanent tooth	Primary tooth
Sound	0	A
Decayed	1	B
Filled and decayed	2	C
Filled, no decay	3	D
Missing due to caries	4	E
Missing any other reason	5	
Fissure sealant	6	F
Bridge abutment/special crown or veneer/implant	7	G
Unerupted tooth	8	
Trauma (fracture)	T	T
Not recorded	9	

TREATMENT	
None	0
Preventive, caries arresting care	P
Fissure sealant	F
1 Surface filling	1
2 or more surface filling	2
Crown for any reason	3
Veneer or laminate	4
Pulp care and restoration	5
Extraction	6
Need for other care (specify)	8
Not recorded	9

### CODES FOR BOXES – 24 TO 30

#### GENDER CODE- BOX- 24

MALE = 1

FEMALE =2



**RACE GROUP CODE- BOX- 25**

- 1 = NAMA
- 2 = DAMARA
- 3 = BASTER/COLOURED
- 4 = OWAMBO
- 5 = HERERO
- 6 = TSWANA
- 7 = RUKWANGALI
- 8 = AFRIKANER
- 9 = GERMAN
- 10= LOZI

**OCCUPATION OF BREADWINNER CODE- BOX- 26**

- 0 = UNEMPLOYED
- 1 = FARMER
- 2 = FARM WORKER
- 3 = HEALTH WORKER
- 4 = EDUCATORS
- 5 = DRIVERS
- 6 = POLICE/MILITARY
- 7 = INSUARANCE/BANK EMPLOYEE
- 8 = HOTEL INDUSTRY/TOURISM
- 9 = PENSIONER
- 10= CLEANER
- 11= DOMESTIC WORKER
- 12= SUPERMARKET WORKER



**GEOGRAPHIC LOCATON CODE- BOXES- 27 TO 30**

- 00 = VILLAGE
- 01 = TOWN
- 02 = CITY
- 03 = SCHOOL (PRIMARY)
- 04 = SCHOOL (JUNIOR SECONDARY)
- 05 = SCHOOL (HIGHER SECONDARY)
- 06 = CLINIC
- 07 = HEALTHCENTER
- 08 = HOSPITAL (DISTRICT LEVEL)
- 09 = HOSPITAL (INTERMEDIATE LEVEL)
- 10 = HOSPITAL (TERTIARY/CENTRAL LEVEL)
- 11 = OLD AGE HOME
- 12 = HOME FOR MENTALLY RETARDED/HANDICAPPED
- 13 = ORPHANAGE

**Appendix 2 (a)**

**Early Childhood Caries Survey: Mariental, Namibia**

**QUESTIONNAIRE TO MOTHERS**

- 1) Identification no
- 2) Name \_\_\_\_\_
- 3) Age \_\_\_\_\_
- 4) Address \_\_\_\_\_
- 5) Mother Tongue \_\_\_\_\_
- 6) Occupation \_\_\_\_\_
- 7) Place of birth \_\_\_\_\_

- 8) How do you feel about your dental health?  
Poor  Fair  Good

- 9) Do you eat confectionary (sweets)?  
Yes  No

- 10) If your answer to the above question is yes, are the sweets homemade or bought from shops?

\_\_\_\_\_



- 11) Frequency of sweet intake?

Once a day

Twice a day

Thrice a day

If more, please specify the number of times \_\_\_\_\_.

- 12) Do you take sweetened drinks?

Yes  No

- 13) If your answer is yes, to question 12, please mention what type of sweetened drink/drinks do you take?

\_\_\_\_\_

14) Frequency of sweetened drink in a day?

Once a day

Twice a day

Thrice a day

If more, please specify number of times \_\_\_\_\_.

15) Do you clean your teeth and tongue?

Yes

No

16) Do you have your own toothbrush or do you share it with other family members?

Own

Shared

17) If your answer to question 15 is yes, what method do you use to clean your teeth and tongue?

Tooth Brush

Tooth Brush and toothpaste

Chewing Sticks

Other please specify \_\_\_\_\_.

18) If your answer to question 15 is no, what prompts you not to clean your teeth?

You feel it is not necessary

Not helpful

Does not know about brushing

Cannot afford to buy tooth brush and toothpaste

Other reasons, please specify \_\_\_\_\_

---

19) If your answer is yes to question 15, how often do you clean your teeth in a day?

Once a day

Twice a day

More specify \_\_\_\_\_.

20) Did you receive oral health information before?

Yes

No

21) If your answer to question 20 is yes, from where did you receive the information?

Radio  T.V  Magazines  Internet

Nurses  Dentists  Doctors  Pediatrician

School Education  Parents

Others \_\_\_\_\_.

22) Level of formal education?

Primary  Secondary  Tertiary  No formal education

23) Have you visited a dentist before?

Yes  No

24) If your answer is yes to question 23, was it state hospital or private clinic?

\_\_\_\_\_.

25) What was the purpose of the visit?

\_\_\_\_\_  
\_\_\_\_\_

26) If any treatments were done, please specify

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

27) In which type of house do you live?

Concrete House

Shacks

Huts

Tents

28) How many children do you have?

\_\_\_\_\_

29) Do you smoke or use smokeless tobacco (snuff)?

Smoke

Smokeless tobacco

Do not smoke

30) If you smoke (question 29), what do you smoke?

Cigarette

Tobacco

Other's, please mention \_\_\_\_\_



31) If you smoke or use smokeless tobacco (snuff), please mention the number of times you smoke or use smokeless tobacco (snuff) in a day?

1 – 5 times in a day

5 – 10 times in a day

more than 10 times in a day

32) If your answer to question 29 is yes, please mention for how many years have you been smoking or using smokeless tobacco?

Less than one year

One – five years

Five to Ten years

Ten years and more.

33) Did you smoke while being pregnant?

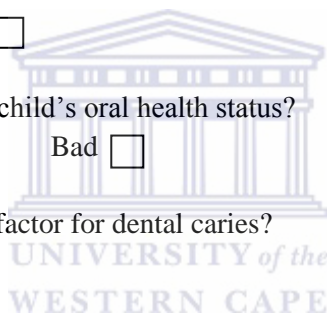
Yes

**Appendix 2 (b)**

**Early Childhood Caries Survey: Mariental, Namibia**

**QUESTIONNAIRE TO MOTHERS wrt the CHILD**

- 1) Identification no
- 2) Name of the child \_\_\_\_\_
- 3) Age of the child \_\_\_\_\_
- 4) Sex of the child \_\_\_\_\_
- 5) Mother Tongue of the child \_\_\_\_\_
- 6) Does your child live with you?  
Yes  No
- 7) If your answer is no to question 5, please specify with whom does the child stay?  
\_\_\_\_\_.
- 8) Do you like being a mother?  
Yes  No
- 9) How do you feel about your child's oral health status?  
Good  Fair  Bad
- 10) Do you think hereditary is a factor for dental caries?  
Yes  No
- 11) Do you think that your child should have good oral health?  
Yes  No
- 12) If your answer to question 11 is yes, why?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- 13) If your answer to question 11 is no, please state why?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- 14) How do you feed your child?  
Bottle  Breastfeed  Cup  All three
- 15) Frequency of bottle feeding in a day?  
Once  Twice  Thrice  More  On Demand



16) Time of bottle feeding?

During day time

Before sleeping at night

When the child cries in the middle of the night

17) Frequency of breast feeding in a day?

Once

Twice

Thrice

More

On Demand

18) Time of breast feeding?

During day time

Before sleeping at time

When the child cries in the middle of the night

19) What do you use if bottle feeding?

Milk

Juice

Tea

Water

Other \_\_\_\_\_.

20) Do you add sugar or other type of sweeteners' in the bottle or cup?

Yes

No

21) If your answer to question 19 is yes, please specify how many spoons of sugar do you add?

1-3 spoons

4-6 spoons

7-10 spoons

In case of more please specify how many spoons \_\_\_\_\_.

22) Does your child use sweetened dummies or pacifiers at night?

Yes

No

23) Does your child go to sleep while feeding at night?

Yes

No

24) If your answer is yes to question 23, what does the child use while going to sleep?

Bottle

Breastfeed

Cup

Pacifiers

25) Do you clean your child's mouth after feeding?

Yes

No

26) If your answer to question 24 is yes, what do you use?

Toothbrush

Tooth brush and toothpaste

Cloth

Finger

Other, please specify \_\_\_\_\_.

27) How often do you clean your child's oral cavity?

Before feeding

after feeding

once in the morning

At night just before the child sleeps

Not at all

28) Do you give your child any fluoride supplements?

Yes

No

29) If your answer to question 28 is yes, in what form?

Drops       Tablets       Topic

30) Name five types of foods commonly given to your child?

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31) Do you and your family/children have proper access to community tap water?

Yes       No

32) If your answer is yes to question 30, do you and family drink from tap water?

Yes       No

**Thank you so much for your time – it is much appreciated!**





## Appendix 3: Ethics Approval



**Office of the Deputy Dean**  
**Postgraduate Studies and Research**  
Faculty of Dentistry & WHO Collaborating Centre for Oral  
Health



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UNIVERSITY OF THE WESTERN CAPE  
Private Bag X1, Tygerberg 7505  
Cape Town  
SOUTH AFRICA

Date: 04<sup>th</sup> March 2011

**For Attention: Dr A Thopil**  
Department of Community Dentistry

Dear Dr Thopil

**STUDY PROJECT:** Risk factors associated with early childhood caries: an epidemiological survey in Namibia

**PROJECT REGISTRATION NUMBER: 11/1/57**

**ETHICS:       Approved**

At a meeting of the Senate Research Committee held on Friday 4<sup>th</sup> February 2011 the above project was approved. This project is therefore now registered and you can proceed with the work. Please quote the above-mentioned project title and registration number in all further correspondence. Please carefully read the Standards and Guidance for Researchers below before carrying out your study.

Patients participating in a research project at the Tygerberg and Mitchells Plain Oral Health Centres will not be treated free of charge as the Provincial Administration of the Western Cape does not support research financially.

Due to the heavy workload auxiliary staff of the Oral Health Centres cannot offer assistance with research projects.

Yours sincerely

Professor Sudeshni Naidoo

**Appendix 4: Informed consent form**

**MARIENTAL STATE HOSPITAL, MARIENTAL, HARDAP REGION,  
NAMIBIA.**

**Risk factors associated with early childhood caries: an epidemiological survey in  
Namibia**

Dear .....

My name is Dr Alex Thopil and I am a post-graduate student of University of Western Cape, South Africa.

We would like you to take part in a study to determine the risk factors associated with Early Childhood Caries. As there are a high number of children visiting the dental clinic presenting with the disease, the purpose of the study is to find out what the contributing factors are and to come up with strategies to prevent the problem. There has shown to be strong mother and child link in Early Childhood Caries, therefore it is important for us to interview mothers attending the Post-Natal Clinic with their children. If you agree to participate in the study, you will be asked some questions and your child's mouth will be examined for tooth decay.

There are no risks associated with the study. All information obtained will be treated with utmost confidentiality. Your participation in this research is completely voluntary, you may decline to participate in the study or withdraw from the study at any time without giving any reason and this will have no adverse effects or penalties. If you need any further information regarding the study, please do not hesitate to contact me (Tel: 0912386282).

If you agree to participate in the study and for your child's mouth to be examined, please sign and date it below to show that you have understood the information that has been given to you and that you had an opportunity to ask questions regarding the study.

Signature \_\_\_\_\_

Date \_\_\_\_\_

Signature of Witness \_\_\_\_\_  
(In case of verbal consent)

Date \_\_\_\_\_



REPUBLIC OF NAMIBIA

Ministry of Health and Social Services

Private Bag 13198	Ministerial Building	Tel: (061) 2032562
Windhoek	Harvey Street	Fax: (061) 272286
Namibia	Windhoek	E-mail: <a href="mailto:hilmanangombe@yahoo.com">hilmanangombe@yahoo.com</a>
Enquiries: Ms. H. Nangombe	Ref: 17/3/AP	Date: 15 October 2009

OFFICE OF THE PERMANENT SECRETARY

Dr. Alex Thopil  
P. O. Box 238  
Mariental  
Namibia

Dear Dr. Thopil,

Re: Risk/Contributing factors associated with early childhood caries; A cross-sectional Descriptive epidemiological survey among 5-48 month age group in Mariental Township.

1. Reference is made to your application to conduct the above-mentioned study
2. The proposal has been evaluated and found to have merit.
3. Kindly be informed that approval has been granted under the following conditions:
  - 3.1 The data collected is only to be used for research purpose;
  - 3.2 A quarterly progress report is to be submitted to the Ministry's Research Unit;
  - 3.3 Preliminary findings are to be submitted to the Ministry before the final report;
  - 3.4 Final report to be submitted upon completion of the study;
  - 3.5 Separate permission to be sought from the Ministry for the publication of the findings.

Yours sincerely,

  
MR. K. KAHUURE  
PERMANENT SECRETARY

