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Early Childhood Caries in children 12-24 months old in Mitchell's Plain, South Africa

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Keywords

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Intensity of Early childhood caries index

SUMMARY

Introduction

The American Academy of Pediatric Dentistry (2005/06) defines Early Childhood Caries (ECC) as the presence of 1 or more decayed (noncavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger. ECC can cause significant problems in preschool children and is a source of considerable societal costs.

The South African national oral health survey conducted between the year 1999 and 2002 reported on the caries prevalence in young children. The caries prevalence was 50% in 4-5 year old children with a mean dmft of 2.4 (van Wyk and van Wyk, 2004).

Aim

To assess early childhood caries in children 12-24 months in the Mitchell's Plain district of the Western Cape.

Objectives

To determine:

a) The prevalence and pattern of early childhood caries.
b) The relation between early childhood caries and infant feeding practices.
c) The relation between early childhood caries and oral hygiene practices of the child.

Materials and Methods

This study is a cross sectional study of ECC of children 12-24 months of age. Parent/child pair attending the Well Baby Clinic at Eastridge/ Mitchell's Plain were informed about the study and invited to participate on a voluntary basis.

The data collected consisted of a dental examination of 120 children (stratified by age: 60 in 12-18 months age group and 60 in 19-24 months age group) and a questionnaire completed by the accompanying parent/guardian.

The dental examination was conducted using the WHO guidelines (Geneva 1997). Child age, tooth status (sound, decayed, filled, extracted, unerupted), and visible dental plaque on maxillary incisors (Spitz et al, 2006) were recorded.

Results

The prevalence of ECC for the sample was 23.3% (dmft =0.88). The maxillary incisors had the highest prevalence of decay (14%) followed by the maxillary molars (4%).

There was a significant association (p=.006) between duration (12 months and more) of bottle use and presence of caries (40% caries prevalence).

There is no significant difference between the different feeding practices (breast, bottle or both) and the presence of caries.

Conclusion

- There is a high prevalence of Early Childhood Caries (23.3%) in the 12-24 month age group.
- Early Childhood Caries was related to prolonged (>12 months) bottle feeding.
- The association between the presence of dental plaque and ECC was the most significant factor (p= .000).

DECLARATION

I hereby declare that "Early Childhood Caries in children 12-24 months old in Mitchell's Plain" is my own work that it has not been submitted before for any degree or examination in any university, and that all the sources. I have used or quoted have been indicated and acknowledged by complete references.

Mahmoud Mustafa Ali

February 2008

Signed:..

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DEDICATION

To my mother and father. Despite the distance between us you still the ones in my heart….

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF PHOTOGRAPHS

LIST OF TABLES

CHAPTER 1

INTRODUCTION

A workshop, convened by the National Institutes of Health (NIH) in 1999, proposed the term early childhood caries (ECC) to describe the presence of one or more decayed (noncavitated or cavitated lesions), missing (because of caries), or filled tooth surfaces on any primary tooth in children up to 71 months of age (Drury et al, 1999; Kaste et al, 1999).

Early childhood caries results in functional, esthetic and psychological disturbances for the child accompanied by a great concern from the parents and the dentist. Pain, infection, loss of function, and poor esthetic may be early consequences of early childhood caries. The late consequences may continue long after its initial treatment as malnutrition, low self esteem, decay in permanent teeth and malocclusion.

Mitchell's Plain is a district of Cape Town with 30% unemployment rate and 41% of those employed earn less than R1600 per month and is considered a low to middle income urban district (Census, 2001). The information about the oral health status of preschool children between the ages 12-24 months in Mitchell's Plain is very limited. In order to formulate a preventive oral health program for these children, a baseline study is needed to gather the information about their oral health status.

The present study is designed to determine the prevalence of early childhood caries, and oral health practices of children 12-24 months old in Mitchell's Plain.

CHAPTER 2

LITERATURE REVIEW

2.1-Introduction

The first to describe a particular pattern of dental caries in a young child was Fass in 1962 as "nursing bottle mouth". The caries took the form of severe and rampant caries involving the maxillary incisors followed by the maxillary and mandibular first molars. This followed the eruption sequence, except for the mandibular incisors which are rarely affected. Subsequently other terms such as "baby bottle tooth decay", "night bottle mouth" and "nursing caries" have also been used to describe this condition (Ripa, 1988).

2.2- Definition of Early Childhood Caries:

In 1994 the Centers for Disease Control and Prevention recommended the use of the term. "Early Childhood Caries" (ECC), because the link between bottle practices and caries was considered not to be absolute (CDCP 1994). However, currently there is no universally accepted definition for the term ECC.

A workshop, convened by the National Institutes of Health (NIH) in 1999, proposed that the term early childhood caries (ECC) be used to describe the presence of one or more decayed (noncavitated or cavitated lesions), missing (because of caries), or filled tooth surfaces on any primary tooth in children up to 71 months of age (Drury et al, 1999; Kaste et al, 1999).

Furthermore the expression severe ECC (S-ECC) was adopted in lieu of rampant caries, in the presence of at least one of the following criteria:

a) Any sign of caries on a smooth surface in children younger than three years.

b) Any smooth surface of an anteroposterior deciduous tooth that is decayed, missing (due to caries) or filled, in children between three and five years old.

c) Decayed, missing, and filled teeth index (dmft) equal to or greater than 4 at the age of 3, 5 at the age of 4 and 6 at the age of 5 years (American Academy of Pediatric Dentistry "AAPD", 2005).

However, the World Health Organization (WHO) does not consider the presence of non-cavitated lesions for the dmft (WHO, 1997).

2.2.1- Classification of ECC:

Wyne in 1999 proposed the following classification of ECC:

Type I (mild to moderate) ECC:

The existence of isolated carious lesion(s) involving Molars and /or incisors. The cause is usually a combination of cariogenic semi solid or solid food and lack of oral hygiene. The number of affected teeth usually increases as the cariogenic challenge persists. This type of ECC is usually found in children who are 2 to 5 years old.

Type II (moderate to severe) ECC:

Labiolingual carious lesions affecting maxillary incisors, with or without molar caries depending on the age of the child and stage of the disease, and unaffected mandibular incisors. The cause is associated with inappropriate use of feeding bottle or at will breast feeding or combination of both, with or without poor oral hygiene. Poor oral hygiene most probably compounds the cariogenic challenge. This type of ECC could be found soon after the first teeth erupt. Unless controlled, it may proceed to become type III ECC.

Type III (severe) ECC:

Carious lesions affecting almost all teeth including the lower incisors. This condition is found between ages 3 to 5 years. The condition is rampant and involves tooth surface/s generally that are unaffected by caries e.g. mandibular incisors.

2.3- Prevalence of Early Childhood Caries:

Differences in the prevalence of ECC among racial and ethnic groups have been reported (Ripa, 1988; Milnes, 1996). The discrepancies within and between studies have occurred because of the use of different ECC definitions, diagnostic criteria and the age of the children.

A number of studies have shown that ECC is more prevalent in native Americans (Cook et al, 1994); African Americans (Reisine and Litt, 1993; Vargas et al, 1998); and Hispanics (Vargas et al, 1998; Ramos Gomez et al, 1999; Watson et al, 1999); and children from immigrant families (Verrips et al, 1992; Stecksen-Blicks and Borssen, 1999).

2.3.1- Early Childhood Caries in South Africa:

Cleaton Jones et al, (1978) studied 120 black children from rural Tlaseng and Motlatla villages and found that 77.5% were caries free with mean dmft values ranging from 0.6-1.5 and 68 black children in urban Soweto 79.4% were caries free with mean dmft values ranging from 1-1.3.

Gordon and Reddy (1985) in a study of 100 infants between 1 to 2 years of age in 10 baby clinics in Cape Town found that the prevalence of caries was 72% and the mean dmft value was 2.37. The majority of the sample was from low socioeconomic background and 72% did not clean their child mouth which may explain the high caries prevalence.

In 2000 MacKeown et al studied dental caries prevalence among urban black South African children (Johannesburg/Soweto) at the ages of 1 and 5 years and found that dental caries prevalence at age 1 was 1.5%. By age 5 the prevalence reached 62.2%. The median dmfs score at age 1 was 0 and at 5 years 5.

Table 2.1: Epidemiological Studies of caries in children in South Africa

Author	Year N=	Age (year)	dmft	dmfs	Prevalence of caries
Cleaton Jones et al	1978 n=631	1 year 5 year overall	1-2 4.5-5.1 3.7-4.1		
Gordon and Reddy	1985 n=100	1-2 year old infant	2.37		
Moola and Vergotine	1988 n=375	Under 5.5year 6 year			26.4% 41%
Booyens et al	1991 n=670	5 year old Caucasian nursery school	1.97		49.1%
Khan and Cleaton Jones	1998 n=426	3 year 4 year 5 year		2.2 3.0 3.7	47% 58% 63%
MacKeown et al	2000 n=1639	1 year 5 year urban black children	0 5		1.5% 62.2%
Van Wyk and Van Wyk	2004 n=30876	4-5 year 6 year	2.4 2.9		50.6% 60.3%
Wanjau and Du Plessis	2006 n=269	3 year 4 year 5 year	0.93 2.69 2.18		25.4% 54.8% 53.4%

2.3.2-Early Childhood Caries in children below 2 years:

Thitasomakul et al (2006) in a longitudinal study examined 599 children at the age of 9 months with re-examination at 12 and 18 months. The study location was in Thepa district in Thailand which is categorized as a rural area. High rate of caries was found and buccal surfaces of the maxillary incisors were the most affected.

Table 2.2: Epidemiological Studies of caries in children younger than 24 months.

	Country	Age in Months	Prevalence of ECC (%)	Mean Number of Teeth Present	Mean dmft
Thitasomakul et al (2006)	Rural Thailand	9 12 18	2 22.8 68.1	2.2 5.5 10.4	0.05 0.73 2.82
Vachirarojpisan et al, 2004	Rural Thailand	6-8 9-10 11-14 15-19	0 20.8 58 83	2.3 3.2 5.6 9	0 .048 0.26 1.27
Carino et al ,2003	Urban Philippines	24	59		4.18
Milgrom et al , 2000	Island of Saipan (USA)	6-12 13-24	3.4 31.4		
Douglass et al, 2001	Arizona (USA)	13-24	4-13		

Rosenblatt and Zarzar, 2004	Brazil	9-18 19-24	9 28		
Scavuzzi et al, 2007	Brazil	12-30	6.4		
Mohebbi et al, 2006	Iran	12-15 16-19 20-25	3 9 14		

In a cross sectional study of 520 children, 6-19 months, in Suphan Buri province, rural Thailand, Vachirarojpisan et al (2004) defined ECC as both cavitated and non cavivtated lesions which explains the high prevalence.The intensity of early childhood caries index was introduced to investigate the severity of early childhood caries. The intensity of ECC was computed by dividing the number of affected teeth by the number erupted teeth. The mean of intensity of ECC for the age group 9-10 months was 0.11, 11-14 months 0.27 and for 15-19 months age group it was 0.45.

A cross sectional study of preschool children in the Philippines found the caries prevalence was 59% (dmft =4.2) for the 2 year old and 85% (dmft =7.4) for the 3 year old. This study included only 34 children in the 2 year old group and 78 in the 3 year old group (Carino et al, 2003).

Milgrom and coworkers (2000) in a cross sectional study found the prevalence of enamel cavitations in 6-12 months old children on the island of Saipan (USA) to be 3.4% which rose dramatically in the 13-24 months old children to 31.4%.

Douglass et al (2001) reported a lower caries prevalence of 4-13% in 13-24 months old children in Arizona recruited from Head Start programs, Women, Infants and Children (WIC) programs and health fairs serving primarily low income families and private day care centers serving primarily middle income families.

The prevalence of caries in (149) socio-economically disadvantaged, age group 9-18 months old, Brazilian children was 9% and in the age group 19-24 months was 28 % (Rosenblatt and Zarzar, 2004)

A prospective longitudinal study of dental caries was carried out on a sample of 186 children aged from 12 to 30 months in Feira de Santana, Brazil, where the water supply is optimally fluoridated**;** the prevalence of dental caries was 6.4 %(Scavuzzi et al, 2007).

Mohebbi and coworkers (2006) reported the prevalence of ECC in 483 children in Tehran. The prevalence of ECC among the youngest age group (12-15 months) was 3%, 9% for 16-19 months, and 14% for 20- 25 month olds.

2.4-Etiology of Early Childhood Caries

2.4.1-Introduction

Dental caries is the localized destruction of susceptible dental hard tissues by acidic by-products from bacterial fermentation of dietary carbohydrates (Selwitz et al, 2007).

Caries is regarded as an infectious, contagious and multifactorial disease produced by three primary individual factors: cariogenic microorganisms, cariogenic substrate and susceptible host (AAPD, 2005). Dental caries results from interactions over time between bacteria that produce acid, a substrate that the bacteria can metabolise, and many host factors that include teeth and saliva. Dental caries results from an imbalance in the demineralization and remineralization between tooth minerals and oral microbial biofilms (Seow, 1998; Harris et al, 2004).

The signs of the carious demineralisation are seen on the hard dental tissues, but the disease process is initiated within the bacterial biofilm (dental plaque) that covers a tooth surface. Dental caries is a multifactorial disease that starts with microbiological shifts within the complex biofilm and is affected by salivary flow and composition, exposure to fluoride, consumption of dietary sugars, and by preventive behaviors (cleaning teeth). The disease is initially reversible and can be halted at any stage, even when some dentine or enamel is destroyed (cavitations), provided that enough biofilm can be removed (Selwitz et al, 2007).

Early Childhood Caries is a virulent form of dental caries, and is initiated when acidogenic bacteria and fermentable carbohydrate in plaque produce end products which react with a susceptible tooth surface to eventually cause caries. ECC begins on tooth surfaces which are usually not affected by decay, such as labial surfaces of maxillary incisors while dental caries usually involves plaque retentive areas, and ECC starts soon after teeth erupts (Davies, 1998). Thus it is thought that there may be unique risk factors for Early Childhood Caries (Seow, 1998).

The associated risk factors have also been found to vary from population to population (Ripa, 1988). Infant feeding practices are influenced by cultural, ethnic, and socioeconomic factors which make the comparison of different studies difficult (Milnes, 1996).

2.4.2-Substrate:

There is overwhelming evidence that sugars (such as sucrose, fructose and glucose) and other fermentable carbohydrates (such as highly refined flour) play a role in the initiation and development of dental caries (Douglass, 2000; Paes Leme et al, 2006).

Sucrose promotes an increase in the proportions of mutans streptococci and lactobacilli and, simultaneously, a decrease in *S. sanguinis* levels as a result of the pH fall caused during the fermentation of this carbohydrate. This observation suggests that acid production from sucrose metabolism disrupts the balance of the microbial community, favoring the growth of cariogenic species. Thereby converting a healthy biofilm to a diseased one, and consequently enhancing demineralization. This suggests that sucrose may act as a typical fermentable carbohydrate source; however, in comparison with other carbohydrates, sucrose shows enhanced cariogenicity (Paes Leme et al, 2006).

Studies have demonstrated that a high frequency of sugar consumption/snacking (Mattila et al, 2000; Rodrigues and Sheiham, 2000; Maciel et al, 2001), at an early age (Mattila et al, 2000; Milgrom et al, 2000; Rodrigues and Sheiham, 2000; Karjalainen et al, 2001) are related to the occurrence of caries.
The lack of consistent findings between dietary factors and caries is probably due to the difficulty of assessing diet and the multifactorial nature of the disease process (Douglass, 2000).

2.4.2.1-Cariogenic role of human milk and cow's milk in infant feeding

Milk is synthesized in mammary secretory epithelial cells and contains 2 major protein groups: caseins (insoluble) and whey proteins (soluble). Caseins (~80% of total milk protein) are a heterogeneous family of proteins predominated by As1, As2, B, and k caseins. Individual casein proteins are small molecules .Whey proteins (~20% of total milk protein) are also a heterogeneous, polymorphic group of proteins composed of lactalbumin , lactoglobulin, serum albumin , immunoglobulins (10%), and proteose peptones (10%). Unlike caseins, whey proteins have high levels of secondary, tertiary, and quaternary structures, and are typically heat-labile globular structures. Milk contains numerous minor proteins. The minor proteins include enzymes, metal-binding proteins, enzyme inhibitors, vitamin binding proteins, and numerous growth factors (Aimutis, 2004).

The milk protein known as alpha-1 casein may be concentrated in the acquired pellicle and act as an inhibitor of Mutans streptococci adherence to saliva-coated hydroxyapatite (Thomson et al,1996; Aimutis, 2004).

Human milk might be more cariogenic than cow milk. Human milk contains 7% lactose compared with 5% in cow milk. The aqueous solutions of lactose clearly shows when present in cow milk, the additional constituents overcome the harmful effects of lactose. Human milk differs in composition from cow milk in several important ways; for example, cow’s milk contains significantly more calcium (114 vs 22.0 mg) and phosphorus (96 vs 9.8 mg/100 g) and human milk contains lower protein content (1.2 g/100 ml versus 3.3 g/100 ml). Addition of Ca2 and PO4 to human milk prevented the demineralization to some degree. Raising the lactose concentration in cow milk to 7% did not enhance its ability to demineralize plaque-covered enamel. It seems, therefore, that the difference in the cariogenicity of the milk resides for the most part in the mineral content. Clearly, other factors such as casein content cannot be discounted (Seow, 1998; Bowen and Lawrence, 2005).

Breast milk contains a mix of oligosaccharides that is complex and exclusive to the human species, found in tiny amounts in very few mammals, which may act at the initial infectious stage by inhibiting bacterial adhesion to epithelial surfaces. For example the oligosaccharide-bound sialic acid (OBSA), content of bovine milk is between 4.4 and 18 times lower than that of human milk, depending on the stage of lactation. Infant formulas have an OBSA content similar to that of transitional or mature bovine milk and consequently lower than that of human milk (between 10 and 27 times) (Martı´n-Sosa et al,2003) .

Human milk is characterized by a complex defense system (including Lactoferrin, Lactoperoxidase, lysozyme and IgA) that inhibits the growth of several microorganisms, including mutans streptococci. Human milk is a better source of lysozyme (2.5 mg/100 mL) than bovine milk (0.025 mg/100 mL). The mechanism of action for lysozyme is to hydrolyze glucosidic linkages in bacterial cell wall peptidoglycan (Aimutis, 2004).

Experimentally, Erickson and Mazhari,(1999) showed that human milk is not cariogenic because it does not decrease the plaque pH significantly in breastfed infants, aged between 12 and 24 months. The drop in ph after 1 hour of rinsing with human milk was 0.6 while for bovine milk was 0.5.

Human milk allows moderate growth of Streptococcus sobrinus; bovine milk provides optimal growth); human milk promotes enamel remineralization by way of calcium and phosphate deposition on the enamel surface (bovine milk promotes demineralization); human milk has a poor buffering capacity; (bovine milk higher buffering capacity); and human milk does not cause in vitro enamel decalcification after twelve weeks (bovine milk caused decalcification after 14 weeks) [Erickson and Mazhari 1999].

Thomson et al (1996) found that incubation of saliva for 7.5 hours with human milk resulted in a greater decline in pH value than when cow milk was used as substrate. The ph declined from 6.44 to 4.57 with human milk where as in cow milk the decline in ph was from 6.52 to 5.01. Furthermore, exposure of enamel covered by dental plaque to human milk led to enhanced demineralization compared with that observed with cow milk.

The cariogenic role of human milk and cow's milk is complex and depend not only on the mineral and carbohydrate content of the milk but extend into protein and enzymes interaction with saliva and plaque itself.

2.4.2.2-Bottle feeding

Baby bottle feeding predispose to ECC because their nipple blocks the access of saliva to the upper incisors, whereas lower incisors are close to the main salivary glands and are protected from liquid contents by the bottle nipple and the tongue (Davies, 1998). The use of baby bottles during the night is associated with the reduction in salivary flow and in the capacity of salivary neutralization, which would cause food stagnation in the teeth and prolonged exposure to fermentable carbohydrates (Seow, 1998).

Prolonged bottle feeding, taking a bottle at night time, and falling asleep with a bottle have been reported to be factors associated with ECC (Van Everdingen et al, 1996; Ollila et al, 1998; Hallett and O'Rourke, 2003; Hallett and O'Rourke, 2006). However there has been evidence that prolonged milk bottle feeding at night time is not the sole cause of ECC (O'Sullivan and Tinanoff, 1993).

The studies by Roberts et al, (1993; 1994) could not find any relationship between ECC and the type of feeding (bottle or breast), or the period of feeding. They also could not relate early childhood caries to the length of time of breast or bottle feeding in 1 to 4 years old South African children.

Prolonged bottle use in children (>12 months) was significantly associated with enamel cavitations while night time bottle use/sleeping with bottle were not significant predictors of caries (Milgrom et al, 2000).

Du and co-workers (2000) found that children who had been bottle-fed had a five times greater risk of having rampant caries compared to children who were breast-fed. Furthermore Shulman (2005) and Saraiva et al, (2007) found that bottle feeding after 19 months was associated with higher caries risk while having been breast-fed was associated with lower caries risk.

However, several studies could not find any relationship between ECC and the type of feeding (bottle or breast), or the period of feeding (Roberts et al 1993, Roberts et al 1994). Tsai and coworkers (2006) found no relationship between night-time bottle use and caries, nor was a bottle containing a sugary drink identified as a risk factor for caries.

2.4.2.3-Breastfeeding

Breast-feeding has many advantages: it provides optimal infant nutrition, immunological protection and minimizes the economic impact to the family. Despite good practice, there is conflicting evidence regarding breast-feeding in terms of dental health. Prolonged breast-feeding apparently carries a risk of developing dental caries or nursing caries (Davenport et al, 2004).

The relationship between breast feeding and early childhood caries could not be established in many studies (Ramos-Gomez et al, 1999; Carino et al, 2003; Rosenblatt and Zarzar, 2004).

The duration of breast-feeding and frequency of breast-feeding during the day has been reported to have no association with dental caries in a study conducted by Matee et al (1994).A strong association was found, however, between caries development and the habit of allowing children to sleep with the breast nipple in their mouths (Matte et al, 1994).

The period of breast feeding is also controversial. Mattos-Graner and coworkers (1998) found that children who were either never breast-fed or only until three months of age exhibited significantly higher caries prevalence than those who were breast-fed for a longer time. Ollila and co-workers (1998) considered that it may be favourable to breast-feed children for more than six months but not longer than 12 months from a dental perspective. This is supported by a study which demonstrated there was a higher prevalence of disease (expressed as caries as a whole, extensive patterns of caries, rampant caries and incisor caries) amongst children who had either never been breast-fed or breast-fed for 24 months or longer (Dini et al 2000). Hallett and O'Rourke (2003) found that breast feeding up to 12 months of age is associated with significantly lower ECC experience compared to not breast feeding at all.

A recent study by Helderman and co workers (2006) indicates that, nocturnal breastfeeding after the age of 12 months pose a risk for the child's developing ECC. Daytime breastfeeding practices also showed no significant associations with ECC, in contrast to nocturnal breastfeeding practices and to sleeping with breast nipple in the child mouths. Children who were breastfed at night more than twice had a significant Odds Ratio for ECC of 35, and those who were exposed to > 15 min *per* feeding at night had a significant Odds Ratio for ECC of 100 (Helderman et al, 2006).

According to the American Academy of Pediatrics (AAP), "*A woman's guide to breastfeeding,* mothers can breast feed children on demand, and that there is no right time to wean and that a baby benefits longer from drinking human milk". Weerheijm and co-workers (1998) stated that there was no need to discourage breast-feeding for a prolonged period of time, as long as preventive measures, such as, toothbrushing with fluoridated toothpaste and reducing the frequency of feedings are incorporated.

Mamabolo et al (2004) studied the feeding pattern of infants in central region of the Limpopo Province over the first 12 months of life and found 44% of these were exclusively breastfed. Formula milk alone was given to 2.2% of the infants, and 38.1% were given a combination of breast milk and formula milk.

Weber-Gasparoni and coworkers (2007), in a study of children who developed caries before 3 years old found a greater frequency of breast-feeding and the presence of night-time breast-feeding to be associated with presence of caries. Children with caries on their maxillary incisors were more likely to have been breast-fed at night and more frequently during the night.

Ribeiro and Ribeiro (2004) in a systematic review of the literature concluded that there is no scientific evidence to confirm that breast milk is associated with caries development. This relationship is complex and contains several confounding variables, mainly infection caused by mutans streptococci, enamel hypoplasia, intake of sugars in varied forms and social conditions represented by parental educational and socioeconomic level.

In another systematic review involving 73 studies, Harris et al (2004) identified 106 risk factors significantly associated with the prevalence or incidence of ECC. Among these, only three factors are related to breastfeeding (duration, frequency and breastfeeding at night) and three to both breastfeeding and/or bottle-feeding (when used to feed or to stop the infant from crying at night, to put him/her to sleep, and duration of breastfeeding/bottle feeding longer than 18 months).

2.4.3-Oral bacteria:

The basic reasons for tooth demineralization in children are extensive exposure to a cariogenic diet and early infection with cariogenic bacteria. Children who consume beverages containing sucrose in their baby bottle had levels of Mutans streptococci four times the level of those who consumed milk from a baby bottle (Mohan et al, 1998).

The main cariogenic microorganisms are the so-called mutans streptococci, (especially Streptococcus mutans and Streptococcus sobrinus) and Lactobacillus .These pathogens can colonize the tooth surface and produce acids at a faster speed than the capacity of neutralization of the biofilm in an environment below the critical pH value (less than 5.5), which results in the destruction of the tooth enamel (Seow, 1998, Selwitz et al, 2007).

Poor feeding practice alone will not cause early childhood caries: A child must be infected and have colonization by S mutans. Studies indicate that S mutans can colonize the oral cavity of predentate children as young as 6 months of age (Milgrom et al, 2000; Wan et al, 2001; Tinanoff et al, 2002).The risk of S mutans colonization appears to be higher in infants who consume sweetened beverages rather than milk from a bottle (Mohan et al, 1998).

Early colonization of S mutans and high levels of S mutans (Milgrom et al, 2000; Maciel et al, 2001, Fabı´ola et al, 2006) are considered to be significant factors in the development of caries in very young children.

The presence of S mutans and lactobacilli are considered etiological agents of dental caries in children. Bacterial infection is a necessary but not a sufficient factor for developing clinical disease (Harris et al, 2004), as S mutans and lactobacilli are also present in caries free children (Toi et al, 1999).

2.4.4- Oral hygiene:

It is generally accepted that the presence of dental plaque is a high risk factor for developing caries in young children (Mattos Graner et al, 1998; Seow et al, 1998). Some studies have reported that a child's brushing habit, the age of starting to brush, frequency of brushing, and/or use of fluoride toothpaste are associated with the occurrence and development of dental caries (Watson et al, 1999; Rodrigues and Sheiham, 2000, Vanobbergen et al,2001; Hallett and O'Rourke, 2003). It was found that children who did not have their teeth cleaned at bedtime had a higher risk of developing ECC (Tsai et al, 2001).

By contrast, Milgrom and co workers (2000) have found no correlation between caries risk and oral hygiene practices. In their study the child usually cleaned his/her own teeth when old enough to hold the toothbrush and this finding suggests that the quality of brushing may be poor.

Oral hygiene practices in terms of the age at which the child started brushing their teeth and the frequency of brushing their teeth did not show statistically significant relation with early childhood caries (Dini et al, 2000).

Helderman and co workers (2006) also found no correlation between tooth brushing before the age of 18 months and early childhood caries probably because fluoridated toothpaste had not been used.

Karjalainen et al (2001) in longitudinal study of 135 children at 3 and 6 years old found no significant correlation between visible plaque at 3 years old and caries at 6 years. However when combined with sweet intake of more than once a week visible plaque may be used to predict dental health 3 years later.

2.4.5-Susceptible tooth / host

Several factors can predispose an individual or indeed a particular tooth to dental caries. These may include immunological factors, reduced saliva, immature enamel and defects of the tooth tissues.

Saliva is the major defense system of the host against caries, removing foods and bacteria, and providing buffering against the acids produced. It functions as a mineral reservoir for calcium and phosphate, necessary for enamel remineralization, containing antibacterial substances. Individual situations that decrease salivary flow and, consequently, its buffering capacity, as occurs while infants are sleeping, increase tooth susceptibility to caries (Seow, 1998; Berkowitz, 2003).

Because enamel is immunologically inactive, the main immune defence against S mutans is provided largely by salivary secretory immunoglobulin A (IgA) or serum and gingival crevicular fluid. As children become infected with oral microorganisms, they develop salivary IgA antibodies (Seow, 1998).

Teeth erupt into the mouth with immature enamel. The process of enamel maturation continues following tooth eruption, so that teeth become less susceptible to decay over time. The enamel matures incorporating orally available ions including fluoride. Therefore, a tooth is most susceptible to caries immediately after eruption until final maturation. Furthermore, enamel hypoplasia in young children has been proposed as another predisposing factor to caries in infancy (Milgrom et al, 2000).

2.4.6- Fluoride

A number of studies have shown that five year old children living in a fluoridated area have approximately 50% less caries than those in a non-fluoridated area. The constant maintenance of fluorine in the oral cavity is important for enamel resistance, interfering with the dynamics of caries development, reducing the amount of minerals lost during demineralization and activating the response during remineralization (Davies, 1998).

2.4.7-Low birth weight and caries

Birth weight is a function of duration of gestation and intrauterine growth rate. Either a short gestation or a retarded intrauterine growth rate could produce an infant small for gestational age, commonly defined as having a birth weight below the 10th percentile (Hediger et al, 1998). More generally, low birth weight and very low birth weight infants weigh less than 2,500 and 1,500 g, respectively (Hediger et al, 1998).

Mamabolo et al (2004) studied the growth pattern of infants in a central region of the Limpopo Province over the first 12 months of life and found that at birth 8.8% of infants had a low birth weight, and 9.6% were stunted.

If low birth weight is associated with caries, the link could either be a direct biological one through low immunocompetence, hypoplasia, and other enamel defects, or it could be because low birth weight is so often a marker for deprived social circumstances and all the caries risks that come with it (Burt and Pai, 2001).

In a systematic literature review, Burt and Pai (2001) found no direct evidence that low birth weight was a risk factor for caries.
In a cross sectional study by Davenport and co workers (2004) there were no differences between the pre-term and low birth weight and normal birth weight children's decay experience. Normal birth weight children had a higher dmft (dmft=3.00) over pre-term and low birth weight children (dmft=2.95).

In a cross sectional study of 400 six year old Brazilian children low birth weight was not a risk factor for caries while height by age deficit at 12 months, represented the main risk factor for high levels of dental caries (Peres et al, 2005).

A recent study, conducted as part of the Third National Health and Nutritional Examination Survey in USA (NHANES III, 1988–1994), addressed the relationship between low birth weight and dental caries among 2- to 6-year-old children (Shulman, 2005). The author evaluated data of 4,205 subjects and concluded that neither low birth weight nor preterm birth was associated with dental caries (Shulman, 2005).

Saraiva et al, (2007) used the data from the Third National Health and Nutritional Examination Survey (1988–1994), to look at 2- to 5.9-year-old singletons (n = 3189). Preterm birth was statistically significantly associated with dental caries, low birth weight although positively associated did not reach statistical significance.

Although the studies of Shulman 2005 and Saraiva et al 2007 extracted data from NHANES III there is some difference in the sample while the Saraiva sample consisted 46% of lower income the Shulman sample consisted of 38% from the lower income group. Each study used different statistical tests.

2.4.8- Education of the parents:

The education level of parents has been shown to be correlated with the occurrence and severity of ECC in their children (Al Hosani and Rugg Gunn, 1998; Khan and Cleaton Jones, 1998; Dini et al, 2000).

Lower prevalence of dental caries and lower mean dmft scores have been associated with higher levels of education either of both parents or of the mother or father alone. (Al Hosani and Rugg Gunn, 1998; Szatko et al, 2004; Mohebbi SZ et al, 2006).

Children whose mothers had a lower level of education had a higher sugar consumption rate found among, compared to children of those highly educated counterparts in a study among pre-school children in Uganda (Kiwanuka et al, 2004).

In addition, when the parental education is low, but the income is high, the risk of having ECC in children is higher than when both the parental education level and income are low (Al Hosani and Rugg Gunn, 1998).

Milgrom (1998), showed that the mother is not only the reservoir of cariogenic bacteria, but also her dental knowledge, behavior, as well as the general care of her child are also factors that contribute to caries risk.

2.4.9-Socioeconomic factors:

The socioeconomic status may well have a significant effect on dental caries experience and treatment patterns in children (Reisine and Litt, 1993; Tickle et al, 1999).

Children from low income families tend to make their first visit to the dentist at an older age, less frequently (Nurko et al, 1998) and only when there are dental problems (Eckersley and Blinkhorn, 2001). In addition, toothbrusing by deprived children usually starts later in life and is practiced less frequently (Eckersley and Blinkhorn, 2001).

Children from single parent families are more likely to have ECC (Maciel et al, 2001). Tsai and co-workers (2001) found that in Taiwan mothers who were without full-time jobs were more likely to have children with ECC than those with full-time jobs.

2.5-Multifactorial nature of ECC

The lack of consistency in the published literature on the specific cause, or causes, of ECC suggests that there may well be multiple factors that interact to produce dental caries. For example, some studies did not find any relationship between the use of fruit syrups, type of feeding (bottle or breast), or time of weaning and the occurrence of caries on the labial surfaces of the teeth of children (O'Sullivan and Tinanoff 1993). This could suggest that beside infant feeding practices, other factors are playing a role in the etiology of ECC. In fact, a number of studies, which attempted to isolate specific etiological factors which cause ECC, have not been able to show a direct relationship with ECC, so supporting the multifactorial nature concept in the etiology of this disease

(Douglass et al 2001). Hence, the rationale for using the term ECC rather than "nursing caries" serves to reflect the multifactorial etiologic nature of this disease.

The multifactorial nature of ECC has, to some extend, been supported by work that showed that even if a dietary habit, with a high risk factor, is established at one year of age, the chance of remaining caries-free until three years of age is highest if good oral hygiene practices, including the use of fluoride toothpaste are established by two years of age (Wendt et al 1996).

2.6-Consequences of early childhood caries

Early childhood caries is a unique childhood disease. It is the most common disease of childhood that is not self-limiting. Given that untreated caries is very prevalent and significant barriers exist to obtaining treatment, an unfortunate pattern occurs. As treatment for ECC is delayed, the child's condition worsens and becomes more difficult to treat, the costs of treatment increases and the number of clinicians who can perform the more complicated procedures diminishes (Vargas et al, 2002).

The most common immediate consequence of untreated dental caries is dental pain. Even though dental pain is a serious and common problem, very limited research about the epidemiology of children's dental pain has been conducted. Dental pain is usually endured for several weeks and affects children's regular activities, such as eating, sleeping, and playing (Vargas et al, 2002).

Children who had caries early in the life of their primary dentitions are at greater risk from developing additional carious lesions in their primary and permanent dentitions (Kaste et al, 1992; O'Sullivan and Tinanoff, 1996; Skeie et al, 2006).

Children with ECC are shown to weigh less than 80 % of their ideal weight and to be in the lowest 10th percentile for weight (Acs et al, 1992). The oral infection and pain associated with ECC make eating difficult. Alternatively poor nutritional practice may be responsible for both dental caries and reduced weight (Tinanoff and O'Sullivan, 1997).

2.7-Conclusion

Early childhood caries (ECC) is defined as the presence of one or more decayed, missing, or filled tooth surfaces on any primary tooth in children up to 71 months of age. Literature shows that early childhood caries have high prevalence among children younger than 24 months.

The etiology of ECC is multi-factorial, but the exact interplay of risk factors in different communities remains controversial. The ECC development in children less than 2 years of age could lead to long-term risk of dental caries.

The purpose of this study is to assess the prevalence of ECC in the early stages of development and to investigate the association between risk factors and ECC in a South African population.

CHAPTER 3

AIMS AND OBJECTIVES

3.1-Aim of the study

The aim of this study is to assess early childhood caries in children 12-24 months in the Mitchell's Plain district of the Western Cape.

3.2-The Objectives

The objectives of this study are to determine:

- Prevalence of early childhood caries in children 12-24 months.
- Pattern of early childhood caries.
- The association between visible dental plaque on labial surface of maxillary incisors and early childhood caries.
- The association between early childhood caries and oral health care practices.
- The relation between early childhood caries and nursing practices of the child.

CHAPTER 4

MATERIALS & METHODS

4.1-Study Design

This study is a cross sectional study of Early Childhood Caries of children 12-24 months of age. The data was collected through dental examination of children and a parent/guardian questionnaire.

The dental company of Colgate Palmolive South Africa was approached as sponsor for tooth brushes and tooth paste for the survey and each child participated in the survey was given a tooth brush and tooth paste.

4.2-The Sample

The study population included children who attended the well baby clinic at Eastridge in Mitchell's Plain. Their age had to be 12-24 months on the day of the examination.

The Eastridge Well Baby Clinic was visited and information about the approximate number of children present in the clinic and time that the dental examination could be carried out, was gathered.

It was estimated that 5000 children visit the Mitchell's Plain baby clinic for vaccination each year. Using the Epi Info (V 3.2) with confidence level 99% and an estimated prevalence of ECC of 20%

and worst acceptable prevalence of ECC 6% a convenient sample size was determined to be 120 patients.

Participation in this study was on a voluntary basis. Consent forms were signed by accompanying parents/ guardian. All child /parent pairs where approached in the clinic and those who met the criteria where asked to participate in the study. There was a high participation rate with only six parents refusing to participate in the study when approached.

4.2.1-Exclusion criteria

- Patients with special health care needs.
- Children without accompanying parents/guardian from whom consent could not be obtained.
- Children showing uncooperative behavior on whom the examination could not be done properly.

4.2.2-Inclusion criteria

- The patient 12-24 months old on day of examination.
- Patient/parent from whom consent could be obtained.

4.3-Procedures

4.3.1-Questionnaire

A structured questionnaire (Appendix 1) was completed by interviewing the parent or caregiver. The questionnaire collected information on the oral hygiene practices of the children, breast and bottle nursing patterns.

The questionnaire was piloted prior to the main study on 10 parents and their children attending the Oral Health Center to check the easiness and clearness of the questionnaire. Some of the questions were reformulated accordingly to make them clearer and easier.

The questionnaire consisted of closed end questions in which the parent choose one of the answers except for the question about the age of starting and terminating breast feeding and bottle feeding in which the age was recorded in months and any period below 2 weeks was considered as 0 months while any period above 2 weeks was considered as a full month. The weight of the child at birth and at the day of examination was recorded from the road to health chart (Appendix 2).

4.3.2-Clinical Examination

The clinical examination was performed on the child after the interview with the parent/caregiver (Photo 4.1).

Photo 4.1- The clinical examination for one of the child.

The examination for dental caries was conducted with a mouth mirror under natural light at the well baby clinic at Mitchell's Plain. No radiographs were taken.

4.3.2.1-Diagnostic Criteria

Dental plaque visually inspected on the labial surfaces of maxillary incisors and recorded as (0) no plaque, or (1) plaque present on any of these teeth (Kiwanuka et al, 2004; Spitz et al, 2006).

The dental data collected was coded using WHO coding system 1997 to enable comparison with other studies (Thitasomaku et al, 2006; Carino et al, 2003; Vachirarojpisan et al, 2004).

Dentition Coding:

1) Sound tooth.

A tooth was recorded as sound if it showed no evidence of treated or untreated clinical caries.
The stages of caries that precede cavitation, as well as other conditions similar to the early stages of caries, are excluded because they cannot be reliably diagnosed. Thus, teeth with the following defects, in the absence of other positive criteria, was coded as sound:

1. White or chalky spots
2. Discoloured or rough spots
3. Stained pits or fissures in the enamel that catch the explorer but do not have a detectably softened floor, undermined enamel, or softening of the walls

4. Dark, shiny, hard, pitted areas of enamel in a tooth showing signs of moderate to severe fluorosis.

All questionable lesions were coded as sound.

2) Decayed tooth.

Caries was recorded as present when a lesion in a pit or fissure, or on a smooth tooth surface, has a detectably softened floor, undermined enamel or softened wall. A tooth with a temporary filling was also included in this category. A tooth with one or more permanent restorations and one or more areas that are decayed (secondary caries) was included in this category. Where any doubt exist caries was not recorded as present.

3) Filled tooth.

Teeth were considered filled without decay when one or more permanent restorations were present and there was no secondary (recurrent) caries or other area of the tooth with primary caries. A tooth with a crown placed because of previous decay was recorded in this category.

4) Tooth extracted due to caries.

This score is used for primary teeth that have been extracted because of caries. For missing primary teeth, this score should be used only if the subject is at an age when normal exfoliation was not a sufficient explanation for absence.

5) Tooth unerupted.

Any tooth which has not erupted either for pathological or physiological cause.

4.3.2.2-Calibration

For the clinical dental examinations, the examiner was calibrated by an experienced paediatric dentist (Appendix 3). The calibration was a double examination of 25 children and the Cohen's Kappa coefficient was 0.88 for the plaque presence and for the dmft it was 0.89.

Table 4.1: The labels assigned to the corresponding ranges of Kappa values

Cohen's Kappa coefficient	Strength of Agreement
<0.00	Poor
0.00 – 0.20	Slight
0.21 – 0.40	Fair
0.41 – 0.60	Moderate
0.61 – 0.80	Substantial
0.81 – 1.00	Almost perfect

Table 4.2: Kappa values for the calibration.

Tooth	Cohen's Kappa coefficient
55	.833
53	.781
64	.92
75	.802
73	1.00
84	1.00
Mean for Teeth	.89
Plaque Presence	.884

Dental examination was carried out under natural light with the aid of a dental mouth mirror with the mother and examiner sitting in a knee-to-knee position, the child on their laps and the mother controlling the child's feet and hands (Photo 4.1).

4.3.2.3-Intra-examiner calibration:

To ensure reliability of the results the examiner reexamined 20 children of the sample after 1/2 hour of their first examination. The Cohen's Kappa coefficient for the dmft was 1.00 and for the plaque was 0.89 as shown in the Table 4.3.

Table 4.3: The kappa coefficient for intra-examiner calibration.

Tooth	**Cohen's Kappa coefficient**
55	1.00
53	1.00
64	1.00
75	1.00
73	1.00
84	1.00
Mean for Teeth	1.00
Plaque Presence	.886

4.4 -Data processing and analysis

All the data collected from the dental examination and from the questionnaire were entered and tabulated using an excel spreadsheet, and the data where analyzed using a commercially available statistical software package (SPSS 15.0 (May 2007), SPSS Inc.).

When entering the age and duration of breast/bottle feeding any period less than 2 weeks was considered as zero months and any period more than 2 weeks was considered as one full month.

The association between dental caries and the factors being investigated was analyzed by the Chi-square test. Kruskal Wallis test, Mann Whitney test, Spearman's Rho correlation test where applicable.

The sample was sub-grouped according to age (12-18 months, 19-24 months), feeding practices (breast, bottle, breast and bottle), and according to the presence of caries (caries, caries free).

The whole data was subjected to statistical tests.

An index called the 'Significant Caries Index' (SiC) was proposed by Bratthall (2000), in order to bring attention to those individuals with the highest caries scores in each population. The SiC Index is the mean dmft of the one third of the study group with the highest caries score. The index is used as a complement to the mean dmft value.

To calculate Significant Caries Index:

• Sort the individuals according to their dmft

• Select the one third of the population with the highest caries values

• Calculate the Mean dmft for this subgroup.

The SIC index frequency were calculated in this study as it gives better understanding of the extent of ECC than the dmft.

4.4.1-Measurement of severity of ECC

In a number of studies the numbers of dmft, dmfs, and noncavitated and / or cavitated teeth/surfaces have been used to measure the severity of ECC. However an early lesion in 1 year old is more severe than the same lesion in 5 years old. Therefore those indices did not discriminate between degrees of severity especially in children whose teeth had not erupted fully.

Vachirarojpisan et al, 2004 used the ratio of affected teeth (cavitated/noncavitated) to erupted teeth and called this index the Intensity of ECC index. The Intensity of ECC index can be computed by dividing the number of carious teeth by the number of erupted teeth.

In this study we used I-ECC (Poisson rate) in calculating the Intensity of ECC (I-ECC) rather than the ratio.

The I-ECC (Poisson rate) was calculated according to this formula:

The Rate = (affected teeth +0.5) / (number of erupted teeth+0.5)

The 0.5 was added as a continuity correction. This will decrease the fluctuation of the rate especially when the number of teeth

present is low. The addition of the continuity correction will make the rate more sensitive in reflecting the severity of ECC.
Intensity of ECC which represents the affected teeth related to teeth erupted demonstrates the severity of carious attack in the individual. For example: children with one carious tooth may have the I-ECC of 0.18 (8 teeth erupted) while I-ECC of 0.09 (16 teeth erupted). The I-ECC score therefore can discriminate the degree of intensity of the disease, i.e. the higher the value of I-ECC the higher the severity of ECC.

The I-ECC (Poisson rate) between affected teeth and number of teeth present was used instead of using dmft in the statistical test of correlation or significance. The Poisson distribution can be used to determine the probability of rare events; it gives the probability that an outcome occurs a specified number of times when the number of trials is large and the probability of any one occurrence is small.

CHAPTER 5

ETHICAL CONSDERATIONS

The proposal was submitted to the ethical and research committee of the University of The Western Cape for discussion and approval. Child/parent pair in this study were invited to participate on a voluntary fees-free basis. Child/parent pair is free to withdraw from the study at any time. An informed consent (Appendix 4) was signed by the caregiver/parent. The examination of the study population did not include any radiographic examination. Caregivers where informed about any necessary dental treatments.

Patients were referred for the necessary treatments on with an appointment to the dental clinic of their choice.

The dental company of Colgate Palmolive South Africa was approached as a sponsor for tooth brushes and tooth paste for the survey and each child participating in the survey was given a tooth brush and tooth paste.

All information gathered from the study would be strictly confidential.

No one would have access to this information except the researcher, the supervisor, and the statistician will have access to the excel data sheet only; neither the name nor surname nor file number will be reported in any reports of this study.

All information collected would be maintained and stored in such a way as to keep it as confidential as possible.

CHAPTER 6

RESULTS

6.1-Description of the sample:

Table 6.1- The description of the sample according to age, gender and birth weight.

	The sample N=120	12-18 months n=60	19-24 months n=60
Mean age months ±SD	18.8±3.86	15.5±1.97	22.2±1.88
Male (%) Female (%)	64(53) 56(47)	30(50) 30(50)	34(57) 26(43)
Mean weight kg ± SD	2.95±0.65	2.96±0.63	2.92±0.67
Low birth weight <2.5kg (%)	22(18.3)	10(16.7)	12(20)

Table 6.2- The distribution of birth weight according to gender

	Birth Weight (Kg)				
	Mean	Median	Standard Deviation	Mean – 2SD	Mean +2SD
Female	2,86	2.90	0.66	1.54	4.18
Male	3,02	3.10	0.64	1.74	4.3

There were 10 females under 2.4 kg (low birth weight), 12 males under 2.5 kg (low birth weight) and 2 male above 4.4 kg (over weighted at birth) according to WHO child growth charts (Appendix 5).

6.2-Prevalence of ECC:

For the 120 children 28 (23.3%) had ECC. Of these 22 between the age of 19-24 months and 6 between the age of 12-18 months. The dmft index was not used in this study because no teeth had been restored or had been extracted due to caries.

The minimum age of the ECC to appear was 17 months. Fig 6.1

Figure 6.1: The caries prevalence according to the age of the infant

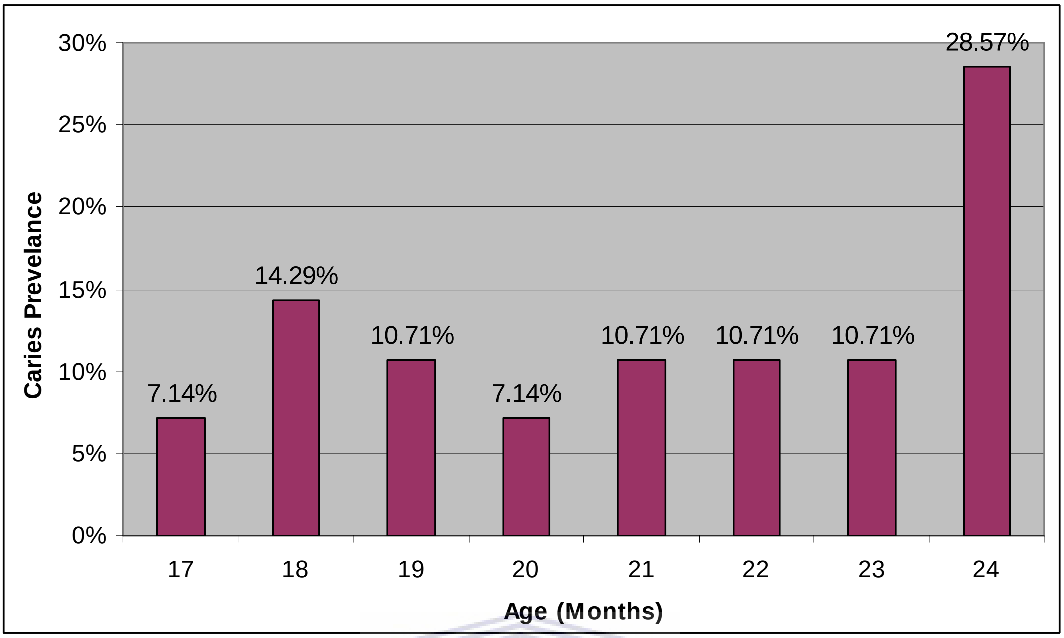


Table 6.3- The dental status according to age group

Age group	**Prevalence of ECC (%)**	**SiC**	**Mean Decayed**	**Mean Intensity of ECC**	**Mean No. of teeth present**
12-18 (n=60)	10	0.8	0.27	0.07	10.08
19-24 (n=60)	37	4.3	1.48	0.12	16.13
Total (N=120)	23.3	2.63	0.88	0.09	13.11

For the age group 12-18 months there were 6 patients with caries their mean dmft was 2.67 with one patient with dmft of 8 which markedly skewed the distribution

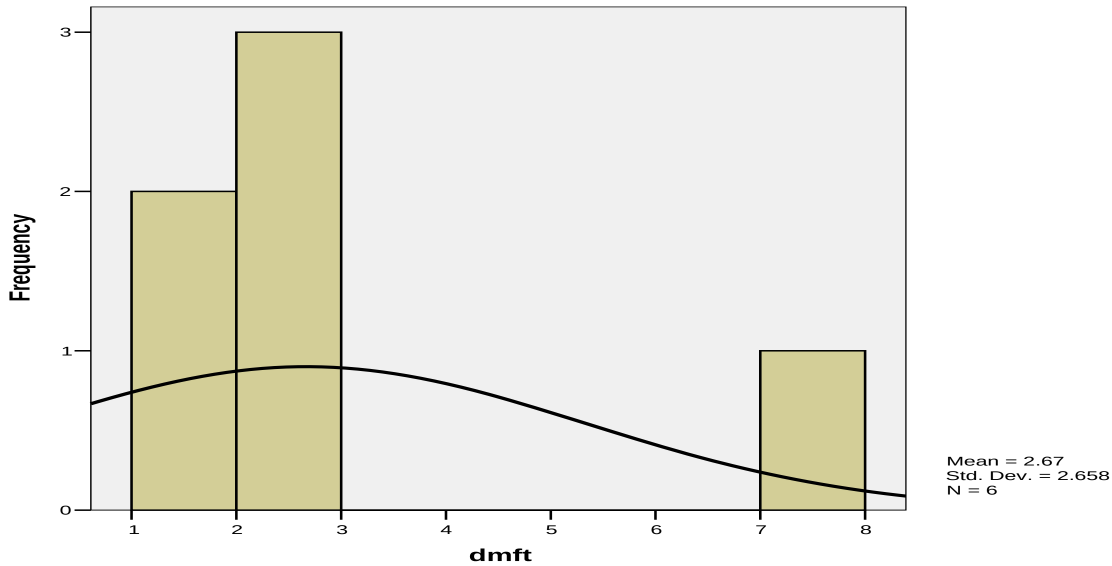


Figure 6.2-The decay frequency distribution for the 12-18 month group

For the age group 19-24 months there were 22 patients with caries. The mean dmft of the 22 caries group children was 4.05. Three patients in this group had a high dmft of 8, 10, and 12 respectively which skewed the distribution to the left.

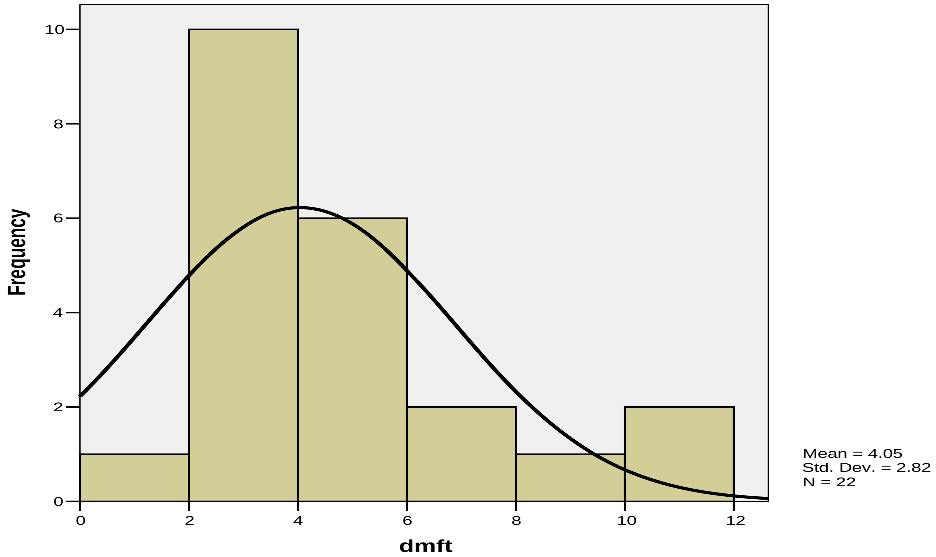


Figure 6.3- The decay frequency distribution for the 19-24 month group.

Table 6.4- The ECC character by age, gender, birth weight, plaque, feeding practices for caries and caries free groups.

	The sample N= 120	Caries free group n=92	Caries group n=28
Age(months)			
Mean ±SD	18.8±3.9	18.1±3.9	21.2±2.5
Gender			
Male (%)	64(53)	48(52)	16(57.1)
Female (%)	56(47)	44(48)	12(42.9)
Weight At Birth(Kg)			
Mean ±SD	2.96±0.63	2.91±0.65	3.01±0.62
Visible Plaque On Maxillary Incisors			
Present (%)	81(67.5)	54(58.7)	27(96.4)
Absent (%)	39(32.5)	38(41.3)	1(3.6)
Feeding Practices			
Breast (%)	28(23.3)	23(25)	5(17.9)
Bottle (%)	16(13.3)	9(9.8)	7(25)
Breast and Bottle (%)	76(63.3)	60(65.2)	16(57.1)

There was no significant difference in the number of teeth present in the mouth between male and female although it was slightly higher in the females (p=0.188) (Table 6.5).

Table 6.5-The mean number of teeth found in the mouth according to the age:

Age Groups (Months)		**Number of teeth present** (Mean ±SD)	**dt** (Mean± SD)	**dmft** (Mean± SD)
12-15	Female	6.79± 1.76	0±0	0±0
	Male	8.06± 3.25	0±0	0±0
16-18	Female	13.62± 3.36	0.25± 0.58	0.25± 0.58
	Male	11.92± 3.93	0.92± 2.25	0.92± 2.25
19-21	Female	16.6± 2.32	2.4± 3.86	2.4± 3.86
	Male	14.44± 2.51	1.22± 1.86	1.22±1.86
22-24	Female	16.75± 3.42	1.31± 2.89	1.31± 2.89
	Male	16.16± 2.97	1.32± 2.01	1.32± 2.01

6.3-Pattern of ECC:

Twenty six children of the sample (120) had caries on theirs maxillary incisors and 3 children had caries on their mandibular incisors (Table 6.6).

Table 6.6- The pattern of decayed and eruption according to tooth type*.*

	Caries tooth	Sound tooth	Unerupted tooth	Number of patient with decay
Maxillary Incisors	66	402	12	**26**
Mandibular Incisors	10	441	29	**3**
Maxillary Canine	2	134	104	**1**
Mandibular Canine	2	126	112	**1**
Maxillary Molar	18	173	289	**9**
Mandibular Molar	7	201	279	**3**
Total	105	1,477	825	**28**

The maxillary incisors were most susceptible to ECC (14.1%) followed by maxillary molars (9.4%) whereas the canines where the least susceptible to tooth decay (1.5%).

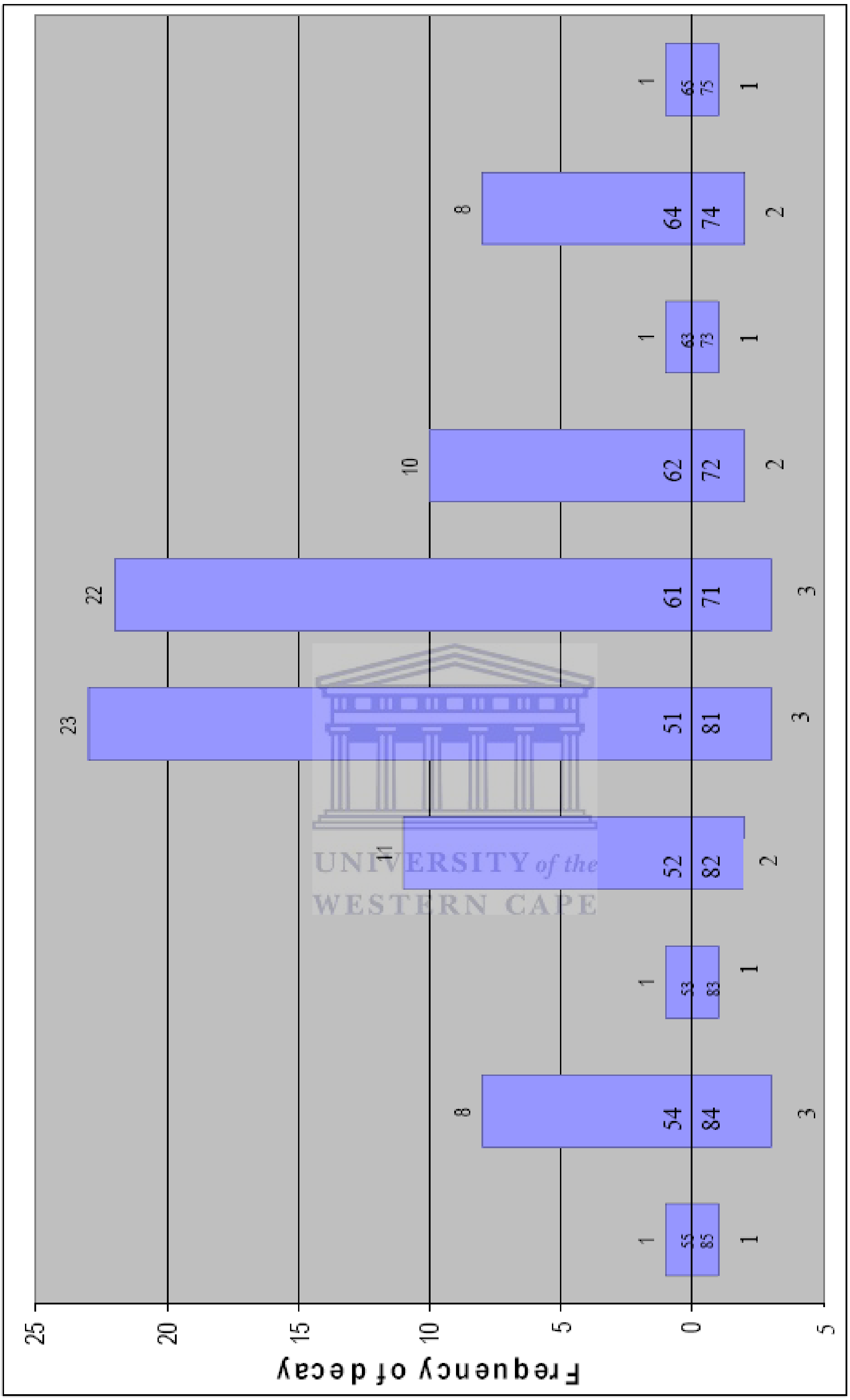


Figure 6.4- The pattern of early childhood caries

6.4-Dental Plaque and ECC:

Visible dental plaque on the maxillary incisors was recorded as present in 81(67.5%) of the sample. Thirty three (55%) for the group 12-18 months and in 48 (80%) for the group 19-24 months.

In the caries group (n=28) 96.4% (sample with Caries>1) had plaque present on their maxillary incisors, while in the caries free group (n=92) 58.7% had plaque present. Plaque presence was the single most significant risk factor in presence of caries prevalence where the p=.000 (Fisher's Exact test).

Furthermore, the relationship between dental plaque and different tooth type groups affected by caries was studied and the following table shows the association between dental plaque and caries (Table 6.7).

Table 6.7- The association between dental plaque and caries

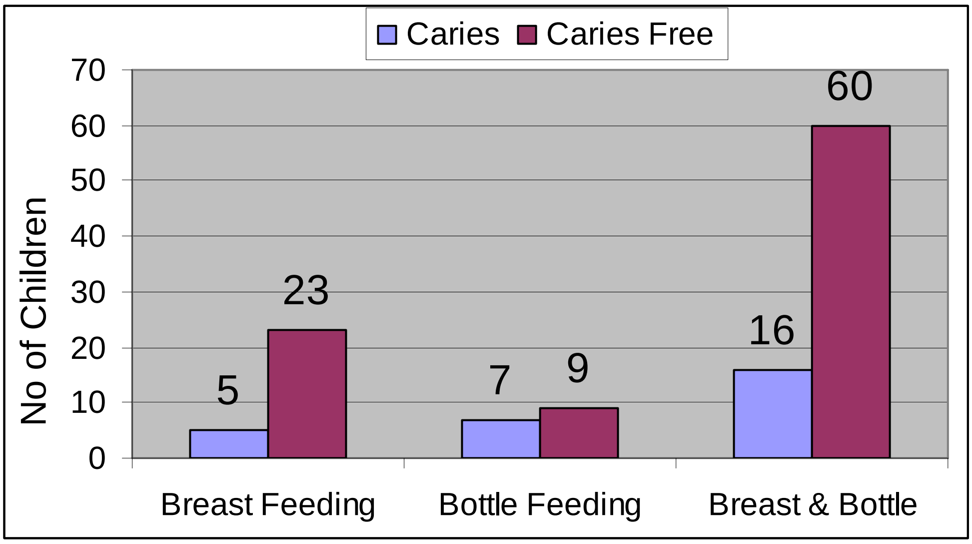
Tooth	Dental plaque Present (%)	P (Fisher's Exact Test)
Maxillary Incisors		
Caries	96.2	0.000
Caries Free	59.6	
Mandibular Incisors		
Caries	100	0.55
Caries Free	66.7	
Maxillary Canine		
Caries	100	1.000
Caries Free	67.2	
Mandibular Canine		
Caries	0	0.33
Caries Free	68.1	
Maxillary Molar		
Caries	44.4	0.15
Caries Free	69.4	
Mandibular Molar		
Caries	66.7	1.000
Caries Free	67.5	

6.5- Feeding Practices

Of the 120 child, 28 were (23.3%) breast fed only, 16 bottle fed only (13.3%), and 76 breast and bottle fed (63.3%).

There was no significant difference between the three groups in caries presence (p=0.11) or plaque presence (p=.19).

Figure 6.5- Feeding practices in relation to caries /caries free groups



6.6 Breast Feeding Practices

104 (86.7%) of the 120 child had been breast fed. All of them started breast feeding at birth with 12.6 (sd±7.5) months as average of the duration of breast feeding.

There was a relationship between breast feeding and presence of caries but it was not statistically significant {p=.055 (Chi Square test)}.

Of the remaining 16 (13.3%) of the sample who were not breast fed the prevalence of ECC was 43% compared to 20% in children breast fed (Table 6.8).

Table 6.8-The association between breast feeding and caries presence

Breast Feeding	Caries	Caries Free
Yes	21 (20.2%)	83 (79.8%)
No	7 (43.8%)	9 (56.3%)

There was significant correlation between the I-ECC (Poisson rate) (decayed/ teeth present) and the frequency of breast feeding during the night using Spearman's Rho test where n=28, r =0.41 and p=0.029 in the exclusively breast fed group.

There was significant relation between plaque presence and breast feeding during the night in the caries group p=.043 (Chi square test).

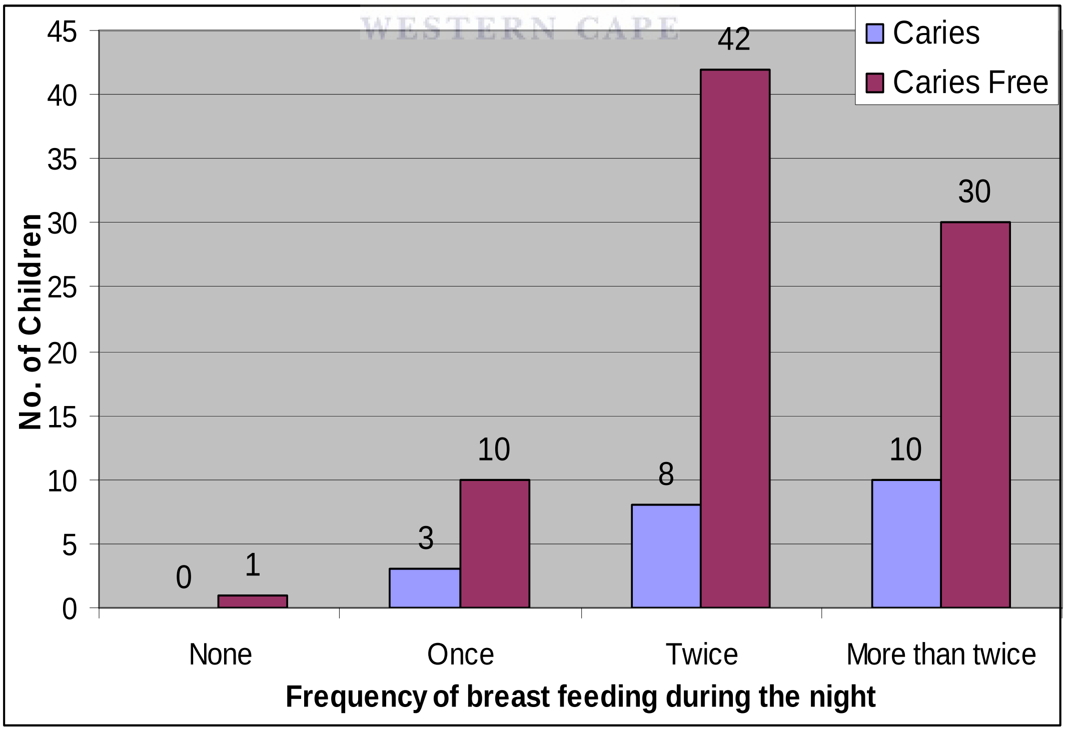


Figure 6.6-Breast feeding during the night and caries status

6.6-Bottle Feeding Practices

76.7% (n=92) children had been bottle fed. The mean age of the infant for starting bottle feeding was 4.8 (sd±5.1) months whilst 18.3 months (sd±4) was the mean for stopping bottle feeding. 13.5 months (sd±6.3) was the average duration of bottle feeding. The bottle fed children where subdivided into 4 groups according to the duration of the bottle feeding group: 1 (1-6months), group 2 (7-12 months), group 3 (13-18 months) and group 4 (19-24 months).

There was a significant relation between caries presence and the duration of the bottle groups p= 0.006 (Chi Square). Children being bottle fed for 13-24 months had significantly higher caries prevalence of 40% compared to 10.6% for 1-12 months bottle feeding duration.

Table 6.9: The relation between the duration of the bottle feeding and caries.

Duration of the Bottle	Caries	Caries Free
Never	5 (17.9%)	23 (82.1%)
1-6 months	1 (7.7%)	12 (92.3%)
7-12 months	4 (11.8 %)	30 (88.2 %)
13-18 months	6 (30%)	14 (70 %)
19-24 months	12 (48 %)	13 (52 %)

There was a significant relationship between bottle feeding during the night and the plaque presence p=.05 Figure 6.7 (in only bottle fed p=.022) {Chi Square test}.

There was no significant relationship between bottle feeding during the night and the caries presence (p=.781) or I-ECC (p=.321).

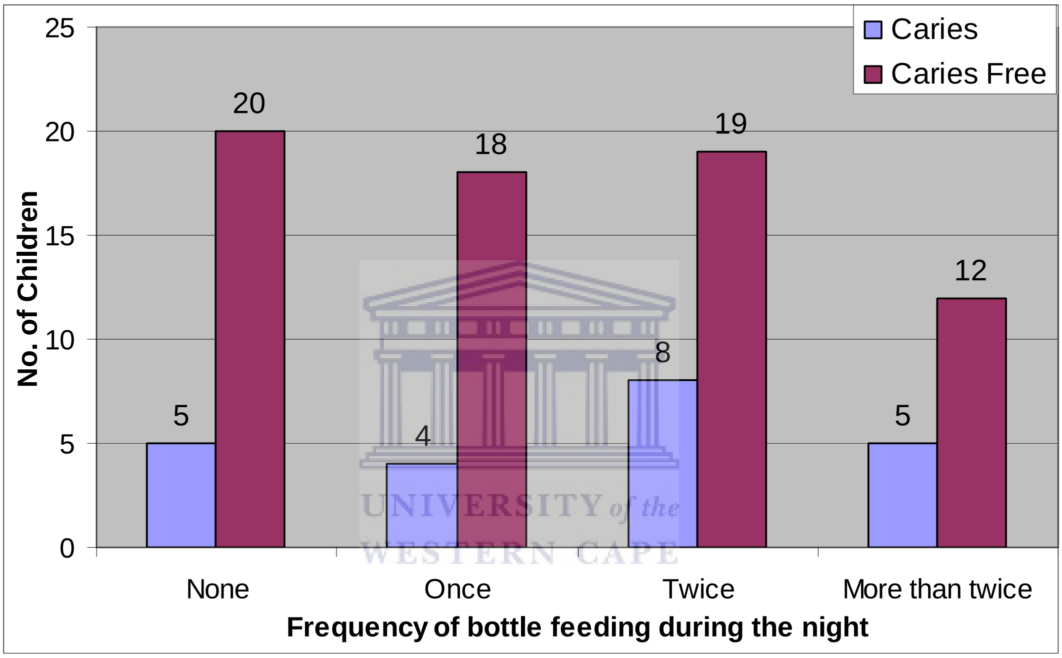


Figure 6.7: The frequency of bottle feeding during the night and caries status.

6.7-Oral Hygiene practices:

In this sample 107 (85.8%) mothers reported that they cleaned their mouth and 56 (46.7%) clean the child's teeth using a tooth brush and toothpaste. 10% used other methods of cleaning teeth (e.g. cloth).

There was no significant difference in caries (p=.542), I-ECC (p= 0.166) or plaque presence (p=.263) between children whose teeth were cleaned and those whose teeth were not cleaned.

CHAPTER 7

DISCUSSION

7.1- Introduction:

It is difficult to compare the prevalence of early childhood caries between different populations in different studies because of the lack of agreed reproducible diagnostic criteria. Furthermore the available data on the prevalence of early childhood caries in pre school children varies widely throughout the world.

Using the WHO criteria in defining dental caries generally allows for reliable diagnoses, on the other hand, however such a rough criterion could result in slightly under-estimated prevalence figures due to excluding the white spot lesion.

The relative inaccessibility of preschool age children especially below 24 months old in comparison to older children is a practical reason why dental health of preschool children have not been extensively studied.

The infant feeding and oral hygiene practices data was only collected from parents through the questionnaire. As with any questionnaire, the validity of parental responses must be considered when interpreting the results. It may show some personal bias.

In this study the Intensity of ECC (I-ECC) (Poisson Rate) between affected teeth and number of teeth present was used in the statistical test instead of the dmft because it reflects the caries status more accurately than the dmft in the young children.

The I-ECC (Poisson rate) showed a skewed distribution to the left among the sample. Therefore, non parametric tests where used through out the statistical part of the study. The histogram in figure 7.1 shows the skewed distribution of the Intensity of ECC (Poisson rate).

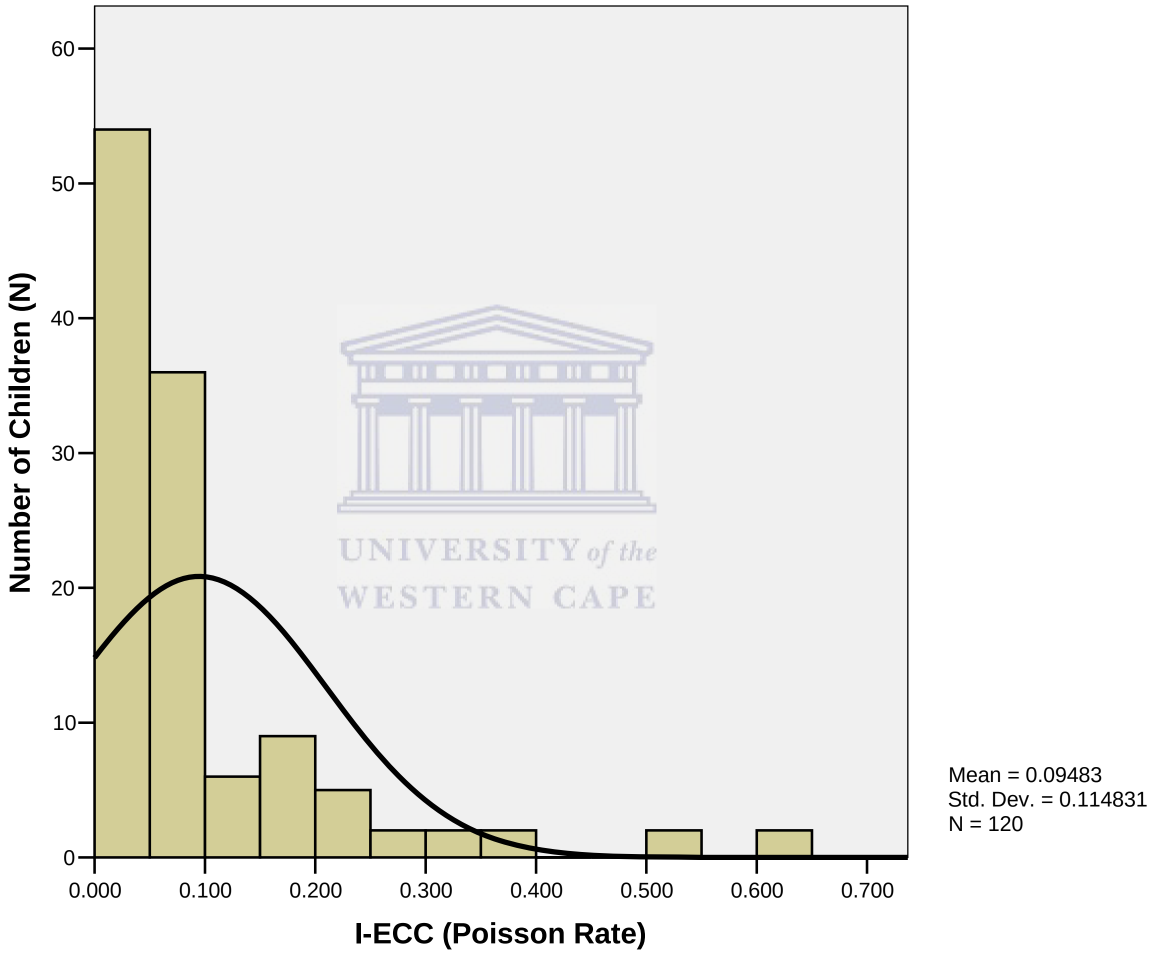


Figure 7.1: The frequency distribution of the Intensity of ECC (Poisson rate)

Figure 7.1 shows 76.7% (n=92) with no caries (I-ECC ranges from 0.024-0.111) with a skewed distribution to the left. The I-ECC rate is not comparable with dmft or dmfs index. For example a child with one decayed tooth in complement of full primary dentition of 20 teeth the rate would be 0.073.But in a child with only 4 erupted teeth (8 months old) with one decayed tooth the I-ECC rate would be 0.333. The rate of intensity shows an increase in the fraction differential. i.e. the higher proportion the greater the fraction.

However the Intensity of ECC (Poisson rate) used still poses some points for consideration. The same Intensity of ECC (Poisson rate) may not represent the same intensity of the disease. For example a child with 16 teeth and one decayed tooth has the rate of 0.09 while a child with 5 teeth and no decay have the same rate of 0.09. It however gives a better idea about caries per tooth present as caries at an early age is considered more problematic than at a later age. For example the rate of 2 decayed teeth of 20 erupted teeth is 0.122 while the rate of 2 decayed teeth out of 12 erupted is 0.200. There is less fluctuation of the rate with addition of 0.5 compared to the rate without the addition.

The I-ECC in this study was calculated according to both formulas (affected teeth/erupted teeth, affected teeth + 0.5/erupted teeth +0.5) and the correlation with number of affected teeth and with number of erupted teeth was investigated.

The r value for the number of affected teeth for I-ECC (affected /erupted) is higher than for I-ECC (affected+.05 /erupted+0.5) which means that there is less fluctuation with minor changes in affected teeth while the r value for Poisson rate in 0.737 which mean that it is sensitive to changes in affected teeth.

The r value for the number of erupted teeth is more important as it is clearly differentiate between the I-ECC (affected/erupted) and

I-ECC (affected+.05/erupted+0.5). It is of positive value for the I-ECC (affected/erupted) which means it increase with the increase of the number of erupted teeth which mean it fails to reflect the severity of ECC as concept. While the r value for I-ECC (affected teeth+0.5/erupted teeth +0.5) was negative and the rate decreases as number of erupted teeth increase which make the proposed rate capable of reflecting the severity of ECC.

The risk factors under investigation in this study were very difficult to measure precisely by the questionnaire survey. Therefore, there may be a degree of uncertainty in the strength of associations between the various potential risk factors and ECC. Consequently, it is important to note that as this study was a cross sectional study, the risk factors that have been identified can only be considered as potential etiological factor and not causal factors.

In this study I-ECC was used as indicator of ECC severity and in all the statistical tests instead of dmft. While in most of other studies dmft/dmfs index was used, which makes the comparison with them more complicated. The question remains wither dmft/dmfs indexes where capable of picking up the significant risk factors correctly or not.

7.2-The Prevalence of Early Childhood Caries

The prevalence of early childhood caries for 12-18 month old children was 10%, with a dmft 0.27 and mean number of teeth present were 10. This is lower than that reported by Thitasomakul et al, 2006 in Thailand, which was 68.1%, dmft 0.73 and mean number of teeth present 10 among 18 month old.

Table 7.1 - The difference in the dental status between the two studies.

Study	Prevalence of ECC (%)	Mean dmft	Mean number of teeth present	I-ECC
Mitchell's Plain				
12 months	0	0	6.0	0.08
18 months	30.8	0.92	12.8	0.11
(n=120)				
Thitasomakul				
12 months	22.8	0.73	5.5	0.21
18 months	68.1	2.82	10.4	0.30
(n=599)				

ECC expressed in prevalence and severity was higher in the Thai population.

In the Thai sample there is about a three fold increase in ECC prevalence between age 12 and 18 months that was associated with similar increase in dmft and severity. While in this study although an alarming increase in ECC prevalence and severity, it was lower than that of the Thai population.

This might be explained by the fact that the Mitchell's Plain sample is an urban and low to middle class population with access to first world conditions. Whereas, the Thai study population is a rural agricultural society with low fluoride concentration in drinking water. The increase of ECC severity expressed as prevalence and dmft between the 12 to 18 months is higher in the Thai population and this increase can't be explained by the increase in the number of teeth present in the mouth.

The high increase in ECC expressed as prevalence and severity between ages 12-18 months shows high susceptibility of this age group, and successful preventive program must target this age group to obtain greatest benefit.

Table 7.2- The comparison with Vachirarojpisan et al, 2004

Study	Prevalence of ECC (%)	Mean dmft	Mean number of teeth present	I-ECC dmft /erupted teeth	I-ECC dmft+0.5/erupted teeth+0.5
Mitchell's Plain					
11-14 months	0	0	6.8	0	0.068
15-19 months	18.7	0.5	12.6	0.04	0.076
Vachirarojpisan					
11-14 months	10.8	0.26	5.6	0.046	0.12
15-19 months	40	1.27	9.0	0.14	0.186

The data included in the previous table were extracted from the study by Vachirarojpisan et al (2004) and ECC was defined such to include only cavitated teeth to compare it with this study.
There is a higher ECC expressed as prevalence and severity in the study by Vachirarojpisan. There is higher ECC prevalence and severity in Thai sample compared to this study.

The ECC prevalence and severity increase dramatically between the 2 age groups (11-14 , 15-19 months). This increase was higher in the Thai sample, which indicate that the ECC attack in this study was less severe than in Thai study and caries progression took longer time in Mitchell’s Plain.

The I-ECC as proposed by Vachirarojpisan fails to reflect the ratio between affected teeth and erupted teeth especially when the number of affected teeth is low as it will be zero. The mean I- ECC will be skewed and it will affect associations strength obtained. This might have been camouflaged in Vachirarojpisan et al 2004 as ECC is relatively high in Southeast Asia. And the caries free group constitutes only 48.5% for 11-14 months and 17.2% for the 15-19 months old.

The higher prevalence and severity of ECC might be attributed to nocturnal nursing practices which were more prevalent in the Thai sample than in this study (fall asleep with bottle 71% Vs 57%, night time bottle feeding 86.5% Vs 72%). 35% reported that they don't clean their mouth in the Thai sample compared to 14% in our study and tooth brushing was practiced by only 17% in the Thai sample compared to 47% in this study.

Combining the data from the three studies the transitional age between 11-14 months might the most suitable age targeted by preventive program in South Africa as progression of ECC is fast. In this age group children will have the white spot lesion that will progress to cavitation within next 5 months and those white spot lesions can be arrested using topical fluoride, dietary advice and oral hygiene instruction.

Table 7.3-Comparison with Rosenblatt and Zarzar, 2004

Study	Prevalence of ECC (%)	Mean dmft
Mitchell's Plain		
12-18 months	10	0.3
19-24 months	37	1.48
Rosenblatt and Zarzar		
12-18 months	8.7	0.4
19-24 months	27.7	1.47

The prevalence of ECC was higher in this study compared with Rosenblatt and Zarzar while dmft in this study was less. As the mean number of teeth present was not provided in the Brazilian study the severity of ECC can be assumed to be higher in Brazilian sample depending on dmft only.

The Brazilian sample included low socioeconomic urban children. While in this study the population was low to middle socioeconomic urban children for whom the access to better dental and medical services which might be a possible explanation for lower severity in ECC (dmft). Another possible explanation for the lower dmft is the lower prevalence of breast feeding in Brazil (21%) compared to our study (86.7%) bearing in mind the protective action breast milk has against dental caries.

The prevalence of early childhood caries was 23.3%, dmft 0.88 and mean number of teeth present 13 in the 12-24 month old infants which is lower than Philippines 59% dmft =4.2 for the 2 year old (Carino et al, 2003), the island of Saipan (USA) 31.4% in the 13-24 months old children (Milgrom et al, 2000).

The prevalence of caries rose from 10% (12-18 months) to 37% (19-24) compared to the national survey among 4-5 years in South Africa reported 50.6% (van Wyk and van Wyk, 2004).

The great jump of the caries prevalence between the two groups can be explained by the increased number of teeth present (10 to 16), increased exposure to the cariogenic diet as no significant differences were found in the feeding practices and oral hygiene practices between the two groups, and due to white spot lesion which is an initial stage of caries which presents as demineralization was not classified as caries according to the diagnostic criteria used in this study.

The prevalence of early childhood caries was 37% (dmft=1.48) among 19-24 months old. It was higher than 25.4% (dmft=0.93) as reported by Wanjau and du Plessis (2006) among 3 years old in Mpumalanga province. This may be explained by different feeding practices between the two provinces and different fluoride levels in the drinking water between the provinces as fluoride occur naturally in the water in Mpumalanga (van Wyk and van Wyk ,2004).

All the caries in 12-24 months children in this community is left untreated while 92% remain untreated at age 4-5 (van Wyk and van Wyk, 2004). This is a serious situation, because despite the fact that early childhood caries is not a life threatening disease the consequences of untreated decay includes pain, poor child nutrition, damage to permanent teeth, and potential risk to overall child health.

The high rate of untreated caries has been attributed to lack of community awareness and understanding that prevention and treatment of caries begin in early childhood.

The majority of decay was located on the maxillary incisors (63%) followed by maxillary molars (17%). A similar pattern of decay was found by Vachirarojpisan et al, (2004), and Thitasomakul et al, (2006). This pattern of decay was explained by the eruption pattern and that the mandibular teeth are partially protected by the tongue and saliva from the cariogenic challenge.

7.3-Birth Weight

The prevalence of low birth weight was double the prevalence found in Limpopo province as reported by Mamabolo and coworkers (2004).

Similar results found by Davenport and coworkers (2004) found no differences between the pre-term and low birth weight and normal birth weight children's decay experience. This is also supported by Peres and coworkers (2005) who found low birth weight was not a risk factor for caries but height by age deficit (Z score) at 12 months represented the main risk factor for high levels of dental caries.

The Third National Health and Nutritional Examination Survey in USA (NHANES III, 1988–1994) addressed the relationship between low birth weight and dental caries among 2- to 6-year-old children (Shulman, 2005). The author concluded that neither low birth weight nor preterm birth was associated with dental caries.

7.4-Dental Plaque

The presence of visible dental plaque on maxillary incisors recorded as present or absent was successful as a predictor of ECC in general. It was present in 96% of the caries group. However it might not be as successful in the prediction of caries in specific tooth groups (Table 6.7).

The high occurrence of visible dental plaque among these 12-24 month old children was similar to that found by Mohebbi et al 2006 (65% among 12-15 months; 69% among 16-19; 76% among 20-25) (Table 7.2).

Table 7.4-The comparison with the study by Mohebbi et al, 2006.

Study	**Plaque (%)**	**ECC (%)**	**dmft**	**Number of teeth present**	**I-ECC**
Mohebbi 2006					
12-15	65	3	0.1	6.2	0.09
16-19	69	9	0.2	12.7	0.05
20-25	76	14	0.4	15.8	0.06
Mitchell's Plain					
12-15	42	0	0	7.5	0.06
16-19	72	23	0.62	13.4	0.08
20-25	80	38	1.62	16.4	0.13

The increase in plaque presence is associated with increase in ECC prevalence and I-ECC. This can be partly attributed to an increase in the number of teeth present in the mouth. Tehran sample representing the whole socioeconomic spectrum (low, middle and high) while this study was conducted in a low to middle socioeconomic district of Cape Town.

The presence of caries was strongly associated with the presence of dental plaque and this association has been verified by other studies. (Mattos-Graner 1998; Mohebbi et al 2006).

Although the prevalence of ECC for the 12 to 18 month-olds was rather low, the high occurrence of dental plaque indicated their increased risk for future caries. It is necessary to control this risk factor. Mohebbi et al, 2006 suggested an imperative procedure should be put in place to improve oral health and decrease this risk factor for future caries.

In order to control the plaque an improvement in the oral hygiene and reduction of the fermentable carbohydrate exposure through oral health education and oral health promotion programs should be considered.

7.5-Nursing Practice

This study showed that breast feeding is commonly practiced in Mitchell's Plain (86.7%), which is similar to findings of Mamabolo et al (2004) 84.8%. This study, however reported higher breast feeding than Mackeown and Faber (2002) 57%.

Breast fed children had lower ECC (20% vs 43% in the non breast fed) though it was not statistically significant (p=.055, Chi square test) and lower plaque presence 66% compared to 75% in non breast fed children. This is supported by Hallett and O'Rourke (2003) who found breast feeding up to 12 months of age is associated with lower ECC compared to no breast feeding at all.

The children who were breast fed for a period less than 6 months and those more than 18 months have higher prevalence of caries than those breast feed between 7-18 months (p>.05). This is supported by Mattos-Graner and coworkers (1998) who found that children who were either never breast-fed or only until three months of age exhibited significantly higher caries prevalence than those who were breast-fed for a longer time.

A study by Dini et al (2000) demonstrated that children who were never breast-fed, or were breast-fed beyond the age of 24 months had a higher prevalence of caries affecting the incisors and molars.

Earlier weaning from the breast could also increase the likelihood of bottle feeding, which, in turn, is associated with early childhood caries. Human milk contains Ca and Po ions and it might play a role in the post eruption maturation of the primary teeth. As the most affected teeth are maxillary incisors and they usually erupt around 8-12 months of age. Therefore children who are breast fed for a short period are more at risk of developing decay.

There was a significant correlation between the I-ECC (Poisson rate) (decayed/ teeth present) and the frequency of breast feeding during the night (in the breast only group). This is supported by Helderman et al (2006) where children who were breastfed at night more than twice and those who were exposed to > 15 min *per* feeding at night had a statistically significant greater Odds ratio for early childhood caries. Similar results by Weber-Gasparoni and coworkers (2007) showed that a greater frequency of breast-feeding and the presence of night-time breast-feeding are associated with the presence of caries.

Increased frequency of breast feeding during the night was significant risk factor for the presence of dental plaque. Frequent breast feedings during the night, resulting in accumulation of milk on the teeth, which, combined with reduced salivary flow and lack of oral hygiene, may produce tooth decay.

Human breast milk causes greater decline in pH compared to cow's milk and has a poor buffering capacity. During the night there is a reduced salivary flow and when combined with breast feeding the buffering capacity will be poor. Fermentable carbohydrate from sources other than breast milk taken by the child will be transformed to acids. Smaller amounts of acids will cause greater drop in the pH, in a shorter period and pH increase back to normal will take more time. Hence prolonged breast feeding and nocturnal breast feeding can contribute to early childhood caries.

Prolonged bottle feeding (>12months) was significantly associated with caries presence (40% compared to 10% bottle fed for 12 months or less) this is supported by Milgrom et al, 2000; Hallett and O'Rourke, 2003; Shulman, 2005; Hallett and O'Rourke, 2006; Saraiva et al, 2007.

7.6-Oral hygiene practices:

Forty seven % brushed the teeth though no relationship between oral hygiene and caries or plaque presence was found. The veracity of 47% brushing is doubtful as the social desirability bias was inevitable as parent tend to lie about brushing child teeth.
Also no question where asked about who brushes the child's teeth which may indicate that poor quality of tooth brushing practices may resulted in camouflaging the relationship between oral hygiene and dental caries and the presence of dental plaque.

However some studies have reported that a child's brushing habit, the age of starting to brush, frequency of brushing, and/or use of fluoride toothpaste are associated with the occurrence and development of dental caries (Watson et al, 1999; Rodrigues and Sheiham, 2000, Vanobbergen et al,2001; Hallett and O'Rourke, 2003). It was found that children who did not have their teeth cleaned at bedtime had a higher risk of developing ECC (Tsai et al, 2001).

By contrast, Milgrom and co workers (2000) have found no correlation between caries risk and oral hygiene practices. In their study the child usually cleaned his/her own teeth when old enough to hold the toothbrush and this finding suggests that the quality of brushing may be poor.

Helderman and co workers (2006) also found no correlation between tooth brushing before the age of 18 months and early childhood caries probably because fluoridated toothpaste had not been used. Karjalainen et al (2001) in a longitudinal study of 135 children of 3 and 6 years old found no significant correlation between visible plaque and caries while when combined with sweet intake more than once a week might be used to predict dental health at 3 years.

7.7-Profile of patients with severe caries

There were 8 patients with I-ECC more than 0.3 those patients were identified as a severe caries group. Those with high I-ECC skewed the frequency distribution of the I-ECC of the sample to the right. We will refer to them as severe caries group while the 20 patients with I-ECC (<0.3) we will refer to them as moderate caries group. Their demographic profile and dental status is shown in Table 7.3

Table 7.5- The demographic and dental status of the severe caries group.

Patient	Age (months)	Gender	Birth weight (Kg)	Number of teeth present	dmft	I-ECC
1	18	Male	2.3	16	8	0.515
2	19	Male	3.1	12	4	0.36
3	20	Female	3.2	20	12	0.610
4	21	Male	2.6	14	4	0.31
5	21	Female	3.4	18	6	0.351
6	22	Female	2.7	20	6	0.317
7	23	Male	2.9	16	8	0.515
8	24	Female	2.8	16	10	0.636

The severe group patients have plaque on their maxillary incisors and the plaque presence is indeed a risk factor for caries.

In the severe caries group only 62,5% were breast fed. However in the moderate caries 80% were breast fed and in the caries free group 90.2% were breast fed. The severe caries group did not benefit from the protective effect of the breast milk.

And of those breast fed in the severe caries group 80% used both breast and bottle in which bottle may serve as the fermentable carbohydrate source and the poor buffering capacity of the breast milk caused their high dmft.

Sixty % of severe caries group were breast fed for a period of 19-24 months and children breast fed for such long period usually do not depend on breast feeding as sole source of nutrition and they have other snacks (like the bottle) which may be the fermentable carbohydrate source.

In the severe caries group 87.5% bottle fed their children which is higher than moderate caries (80%) and caries free (75%) . Of the severe caries group 37.5% had exclusively bottle feeding. 87% bottle fed for period more than 12 months. 87% bottle fed for more than 3 times daily, and 87% bottle fed for 2 time or more during the night.

Cow's milk and infant formulas lack the protective mechanism of the breast milk as the breast milk contain less of the oligosaccharide and the protective enzymes and proteins. Of the severe caries group 71.4% adds sugar to the content of the bottle. This sugar is most likely to be sucrose one of the most cariogenic carbohydrates. This extrinsic source of fermentable carbohydrate with the intrinsic carbohydrate, lack of the protective mechanism, high frequency of cariogenic challenge may explain why these children have high dmft.

All of the 8 children of the severe caries group had dental plaque on their maxillary incisors compared by 67.5% of the caries free group. Although all children of the severe caries group reported that they do clean their teeth using a tooth brush once or twice daily. The social desirability bias may have played a role (over report) as all of them had visible dental plaque. The quality of tooth brushing might be poor as no question was asked about who brushes the teeth of the child or if they received professional advice about the brushing technique. More over the question asked about the current oral hygiene and not about the past as no questions were asked about the age of starting cleaning practice. And those might have started after the development of decay.

CHAPTER 8

CONCLUSIONS

It is possible to draw the following conclusions from the results of the present study:

- The prevalence of early childhood caries in 19–24 -month-old children is high (37%) to other data around the world.

- Maxillary incisors are the most prone teeth to early childhood caries.

- Low birth weight was not identified as risk factor for early childhood caries.

- Early childhood caries was not related to the type of feeding in this sample of children. Breast feeding seemed to have a protective effect against caries development (caries prevalence was 20% Vs 40% in non breast fed). However improper feeding practices especially prolonged breast feeding (25% fed >18 months Vs 14% fed 7-18) is considered a potential risk factor for ECC.

- Prolonged bottle feeding (>12months) was identified as risk factor for ECC (11% fed ≤12 Vs 40%>12months). While bottle feeding during the night for 2 times and more was a risk factor for plaque presence (60% plaque presence in <2 times Vs 84% plaque in ≥ 2 times).

- Dental plaque was prevalent in 67.5% of the sample which is relatively high. Dental plaque was strongly associated with in ECC. High prevalence of dental plaque among these young children was found. The high occurrence of dental plaque indicates their increased risk for future caries calling for imperative procedures to reduce that risk factor.

- Oral hygiene practice was common in this sample (85.8%) and 47% used tooth brush and tooth paste. No statistically significant correlation found between oral hygiene practices and caries prevalence or plaque presence.

- In this study I-ECC (affected teeth +0.5/erupted teeth+0.5) was used as indicator of ECC severity and in all the statistical tests instead of dmft. More studies are needed to evaluate the validity of I-ECC.

- I-ECC (affected teeth +0.5/erupted teeth+0.5) was more sensitive in reflecting the severity of ECC compared to I-ECC as proposed by Vachirarojpisan et al,2004 (affected teeth/erupted teeth).

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Appendix 1

DATA RECORD SHEET

Dental examination

Subject No:

Date of examination:

Date of birth:

Gender:

Male **1**

Female **2**

	Weight(kg)
At birth	
Today	

Plaque presence:

Yes **1**

No **2**

55	54	53	52	51

61	62	63	64	65

85	84	83	82	81

71	72	73	74	75

Condition	Code
Sound	1
Decayed	2
Filled	3
Extracted due to decay	4
Unerupted	5

Questionnaire

Subject number:

Interviewee:

Father:	1	Mother:	2
Others:	3		

Number of children in the family:________.

<u>Child's dietary habits</u>

<u>Please answer the following questions about the present dietary habits of your infant / child</u>

1. Did you breast feed the child after birth?

Yes	1
No	2 **(go to question 7)**

2. How old was your child when you started breast feeding (months)?

3. How long was child being breast fed (months)?

Still Breast fed

4. How many times do you breast feed your child during the day?

Less than 3	1
3 to 6 times	2
More than 6	3

5. Does your child fall asleep with the breast nipple in his mouth?

Yes	1
NO	2

6. How many time do you breast feed your child during night?

None 1

Once 2

Twice 3

More than Twice 4

7. Did you bottle feed the child after birth?

Yes 1

No 2

8. How old was your child when you started bottle feeding (months)?

9. How long was child being bottle fed (months)?

Still Bottle fed

10. How many times do you bottle feed your child during the day?

Less than 3 1

3 to 6 times 2

More than 6 3

11. Does your child fall asleep with the bottle in his mouth?

Yes 1

NO 2

12. How many time do you bottle feed your child during night?

None 1

Once 2

Twice 3

More than Twice 4

13. Do you add Sugar to your child's bottle?

Yes 1

No 2

14. Does your child use a pacifier/dummy/comforter?

No	1
Yes without addition of sweetener	2
Yes with addition of sweetener	3

Child's oral hygiene habits

Please answer the following questions about the oral hygiene habit of the child

1. Do you clean your child's mouth?

Yes	1**(go to question 2)**
No	2

2. How do you clean the child teeth?

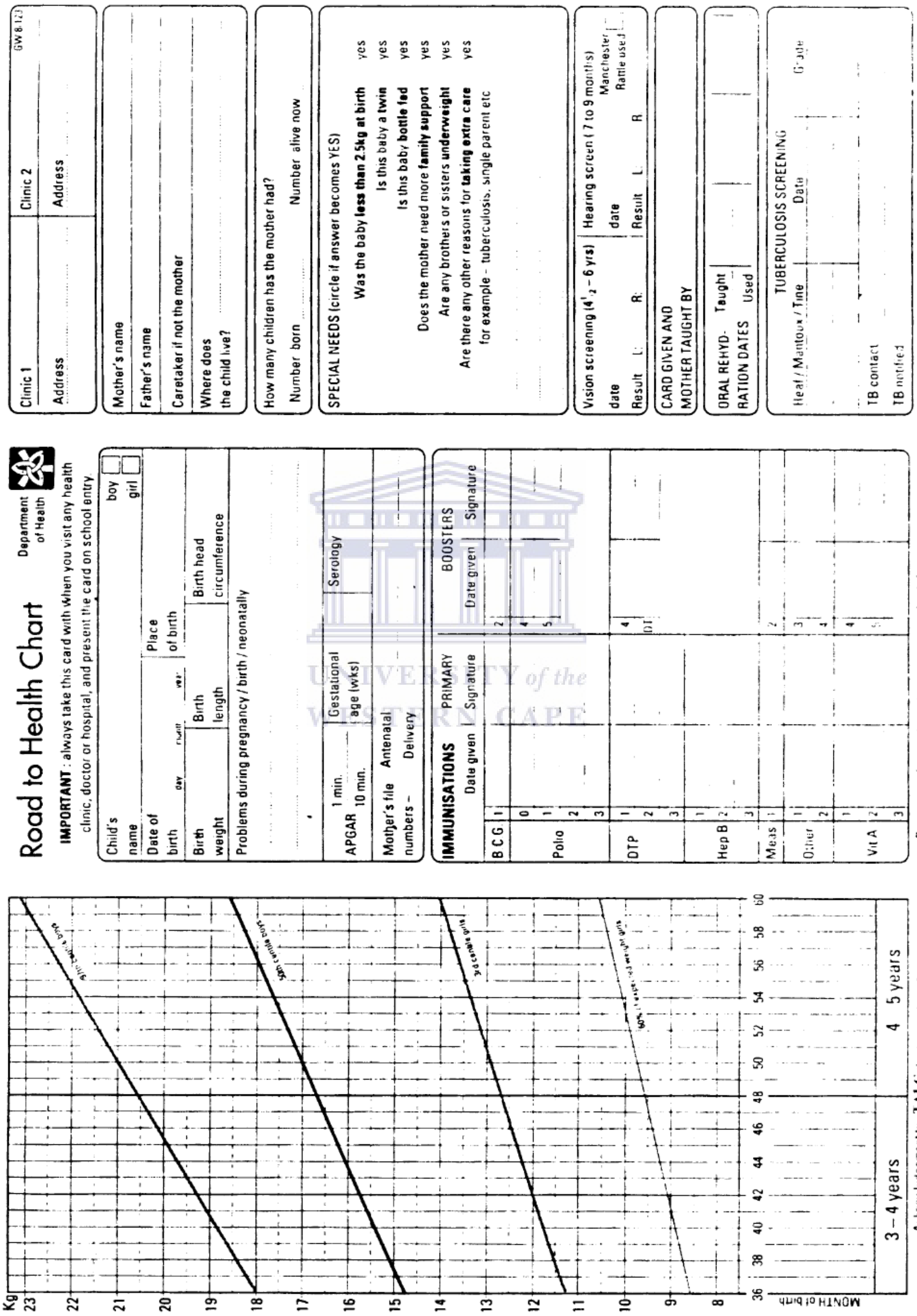
Don't clean	1
Gauze /handkerchief	2
Rinse/drink some water	3
Toothbrush alone	4
Toothbrush with tooth paste	5
Other	6

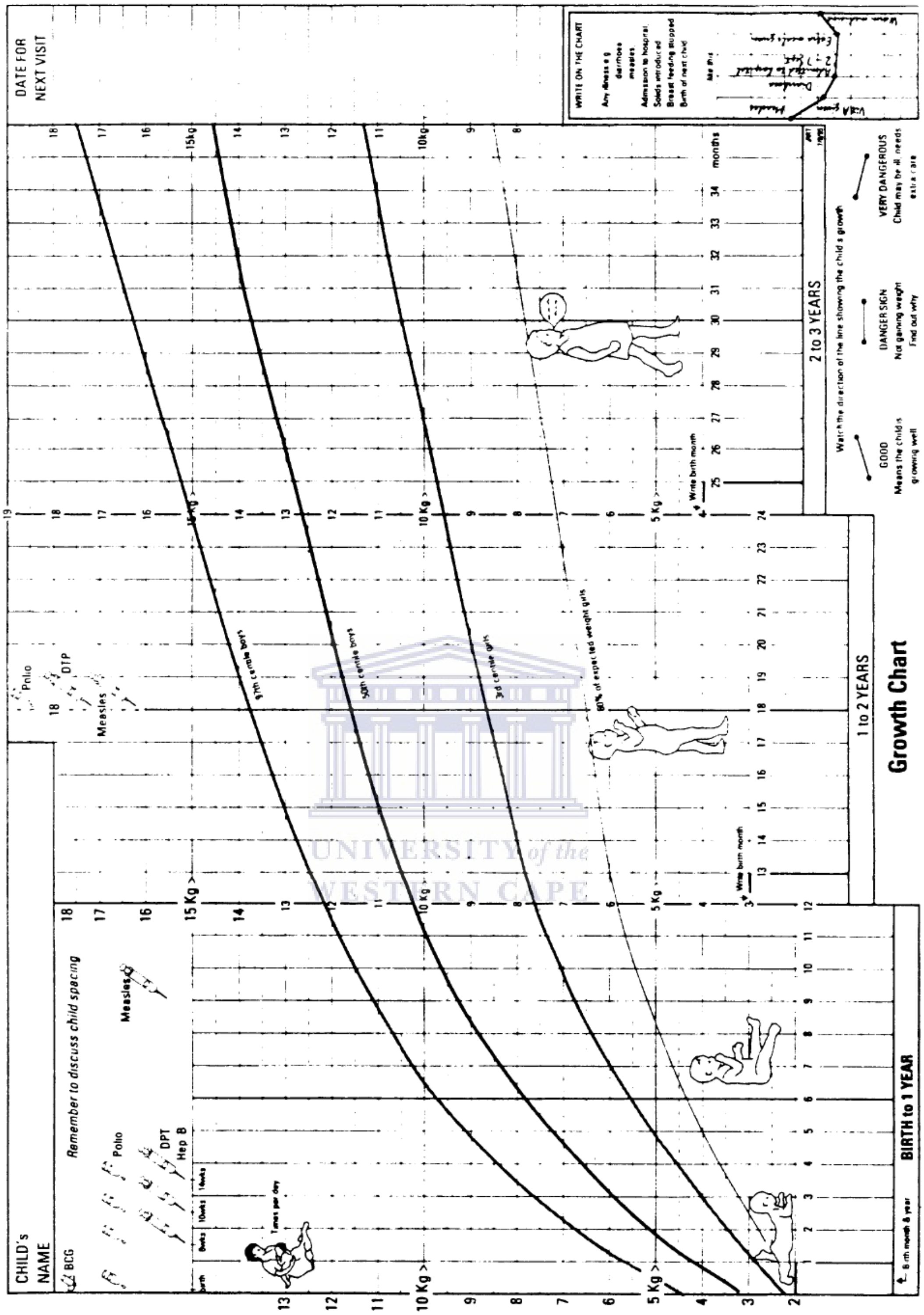
3. When do you clean the child mouth?

Don't clean	1
Once daily	2
Twice daily	3
After every meal	4
Not regular	5

Appendix 2

Road to Health Chart





Growth Chart
CHILD's NAME
BIRTH to 1 YEAR
1 to 2 YEARS
2 to 3 YEARS
DATE FOR NEXT VISIT
Remember to discuss child spacing
BCG
Polio
DPT
Hep B
Measles
DTP
97th centile boys
50th centile boys
3rd centile girls
80% of expected weight girls
Write birth month
months
Watch the direction of the line showing the child's growth
GOOD
Means the child is growing well
DANGER SIGN
Not gaining weight
Find out why
VERY DANGEROUS
Child may be ill needs extra care
WRITE ON THE CHART

Appendix 3

Calibration form

Dental examination

Subject No:

Date of examination:

Examiner:

SYH 1
MMA 2

Date of birth:

Gender:

Male 1

Female 2

Plaque presence:

Yes 1

No 2

55	54	53	52	51

61	62	63	64	65

85	84	83	82	81

71	72	73	74	75

Condition	Code
Sound	1
Decayed	2
Filled	3
Extracted due to decay	4
Unerupted	5

Appendix 4

Consent form

UNIVERSITY OF THE WESTERN CAPE
Faculty of Dentistry & WHO Collaborating
Centre

For Oral Health

Department of Paediatric Dentistry

Consent Form

I have read (or been informed verbally)and understand the information concerning this study and I willingly agree that my child will be examined and participate in this study. I understand that further treatments will be arranged for my child if needed according to the treatment protocols of the Oral Health Centre, Faculty of Dentistry, University of The Western Cape.

______________________	___________	_______
Caregiver name (Print)	**Signature**	**Date**

______________________	___________
Examiner name (Print)	**Signature**

Appendix 5

WHO child growth standards

Weight-for-age GIRLS

Birth to 5 years (z-scores)

World Health Organization

Year: Month	Month	L	M	S	Z-scores (weight in kg) -3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
0: 0	0	0.3809	3.2322	0.14171	2.0	2.4	2.8	3.2	3.7	4.2	4.8
0: 1	1	0.1714	4.1873	0.13724	2.7	3.2	3.6	4.2	4.8	5.5	6.2
0: 2	2	0.0962	5.1282	0.13000	3.4	3.9	4.5	5.1	5.8	6.6	7.5
0: 3	3	0.0402	5.8458	0.12619	4.0	4.5	5.2	5.8	6.6	7.5	8.5
0: 4	4	-0.0050	6.4237	0.12402	4.4	5.0	5.7	6.4	7.3	8.2	9.3
0: 5	5	-0.0430	6.8985	0.12274	4.8	5.4	6.1	6.9	7.8	8.8	10.0
0: 6	6	-0.0756	7.2970	0.12204	5.1	5.7	6.5	7.3	8.2	9.3	10.6
0: 7	7	-0.1039	7.6422	0.12178	5.3	6.0	6.8	7.6	8.6	9.8	11.1
0: 8	8	-0.1288	7.9487	0.12181	5.6	6.3	7.0	7.9	9.0	10.2	11.6
0: 9	9	-0.1507	8.2254	0.12199	5.8	6.5	7.3	8.2	9.3	10.5	12.0
0:10	10	-0.1700	8.4800	0.12223	5.9	6.7	7.5	8.5	9.6	10.9	12.4
0:11	11	-0.1872	8.7192	0.12247	6.1	6.9	7.7	8.7	9.9	11.2	12.8
1: 0	12	-0.2024	8.9481	0.12268	6.3	7.0	7.9	8.9	10.1	11.5	13.1
1: 1	13	-0.2158	9.1699	0.12283	6.4	7.2	8.1	9.2	10.4	11.8	13.5
1: 2	14	-0.2278	9.3870	0.12294	6.6	7.4	8.3	9.4	10.6	12.1	13.8
1: 3	15	-0.2384	9.6008	0.12299	6.7	7.6	8.5	9.6	10.9	12.4	14.1
1: 4	16	-0.2478	9.8124	0.12303	6.9	7.7	8.7	9.8	11.1	12.6	14.5
1: 5	17	-0.2562	10.0226	0.12306	7.0	7.9	8.9	10.0	11.4	12.9	14.8
1: 6	18	-0.2637	10.2315	0.12309	7.2	8.1	9.1	10.2	11.6	13.2	15.1
1: 7	19	-0.2703	10.4393	0.12315	7.3	8.2	9.2	10.4	11.8	13.5	15.4
1: 8	20	-0.2762	10.6464	0.12323	7.5	8.4	9.4	10.6	12.1	13.7	15.7
1: 9	21	-0.2815	10.8534	0.12335	7.6	8.6	9.6	10.9	12.3	14.0	16.0
1:10	22	-0.2862	11.0608	0.12350	7.8	8.7	9.8	11.1	12.5	14.3	16.4
1:11	23	-0.2903	11.2688	0.12369	7.9	8.9	10.0	11.3	12.8	14.6	16.7
2: 0	24	-0.2941	11.4775	0.12390	8.1	9.0	10.2	11.5	13.0	14.8	17.0

WHO Child Growth Standards

Weight-for-age BOYS

Birth to 5 years (z-scores)

World Health Organization

Year: Month	Month	L	M	S	Z-scores (weight in kg) -3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
0: 0	0	0.3487	3.3464	0.14602	2.1	2.5	2.9	3.3	3.9	4.4	5.0
0: 1	1	0.2297	4.4709	0.13395	2.9	3.4	3.9	4.5	5.1	5.8	6.6
0: 2	2	0.1970	5.5675	0.12385	3.8	4.3	4.9	5.6	6.3	7.1	8.0
0: 3	3	0.1738	6.3762	0.11727	4.4	5.0	5.7	6.4	7.2	8.0	9.0
0: 4	4	0.1553	7.0023	0.11316	4.9	5.6	6.2	7.0	7.8	8.7	9.7
0: 5	5	0.1395	7.5105	0.11080	5.3	6.0	6.7	7.5	8.4	9.3	10.4
0: 6	6	0.1257	7.9340	0.10958	5.7	6.4	7.1	7.9	8.8	9.8	10.9
0: 7	7	0.1134	8.2970	0.10902	5.9	6.7	7.4	8.3	9.2	10.3	11.4
0: 8	8	0.1021	8.6151	0.10882	6.2	6.9	7.7	8.6	9.6	10.7	11.9
0: 9	9	0.0917	8.9014	0.10881	6.4	7.1	8.0	8.9	9.9	11.0	12.3
0:10	10	0.0820	9.1649	0.10891	6.6	7.4	8.2	9.2	10.2	11.4	12.7
0:11	11	0.0730	9.4122	0.10906	6.8	7.6	8.4	9.4	10.5	11.7	13.0
1: 0	12	0.0644	9.6479	0.10925	6.9	7.7	8.6	9.6	10.8	12.0	13.3
1: 1	13	0.0563	9.8749	0.10949	7.1	7.9	8.8	9.9	11.0	12.3	13.7
1: 2	14	0.0487	10.0953	0.10976	7.2	8.1	9.0	10.1	11.3	12.6	14.0
1: 3	15	0.0413	10.3108	0.11007	7.4	8.3	9.2	10.3	11.5	12.8	14.3
1: 4	16	0.0343	10.5228	0.11041	7.5	8.4	9.4	10.5	11.7	13.1	14.6
1: 5	17	0.0275	10.7319	0.11079	7.7	8.6	9.6	10.7	12.0	13.4	14.9
1: 6	18	0.0211	10.9385	0.11119	7.8	8.8	9.8	10.9	12.2	13.7	15.3
1: 7	19	0.0148	11.1430	0.11164	8.0	8.9	10.0	11.1	12.5	13.9	15.6
1: 8	20	0.0087	11.3462	0.11211	8.1	9.1	10.1	11.3	12.7	14.2	15.9
1: 9	21	0.0029	11.5486	0.11261	8.2	9.2	10.3	11.5	12.9	14.5	16.2
1:10	22	-0.0028	11.7504	0.11314	8.4	9.4	10.5	11.8	13.2	14.7	16.5
1:11	23	-0.0083	11.9514	0.11369	8.5	9.5	10.7	12.0	13.4	15.0	16.8
2: 0	24	-0.0137	12.1515	0.11426	8.6	9.7	10.8	12.2	13.6	15.3	17.1

WHO Child Growth Standards

Appendix 6

Results (tables and graphs)

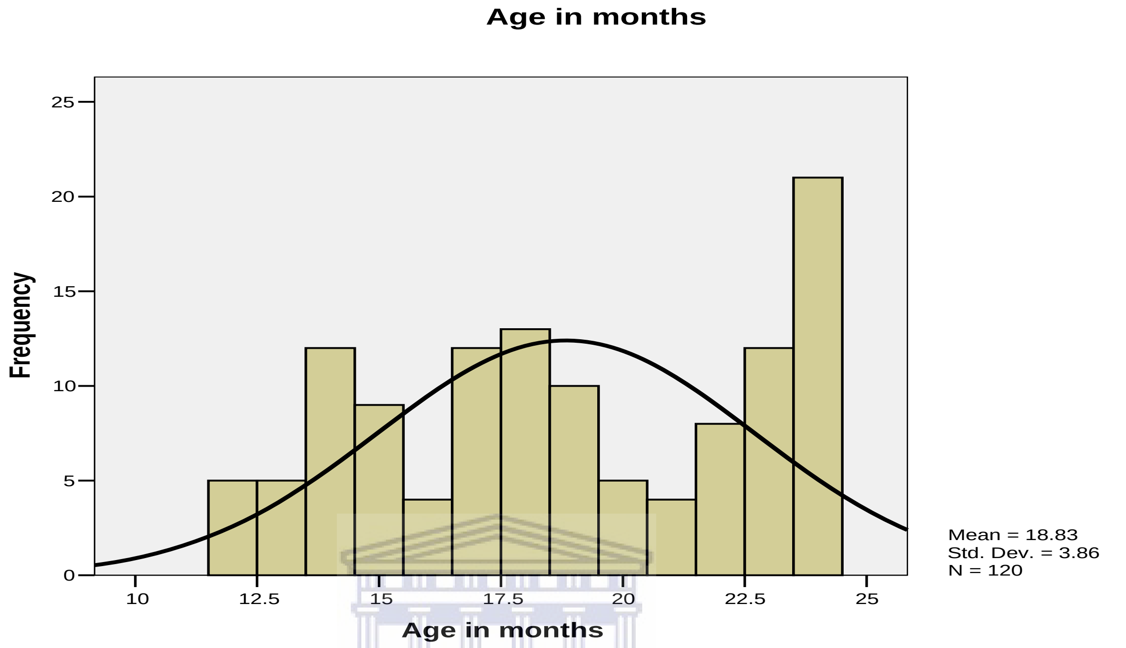


Figure A.1: Shows the frequency distribution of the sample according to the age:

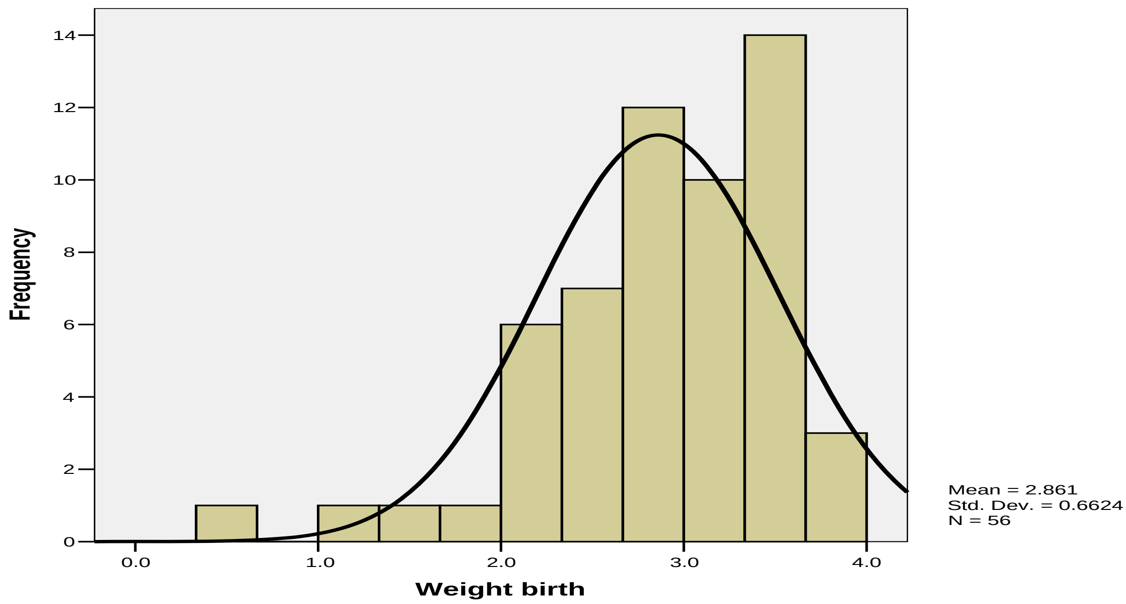


Figure A.2 shows the frequency distribution of the sample according the birth weight for females:

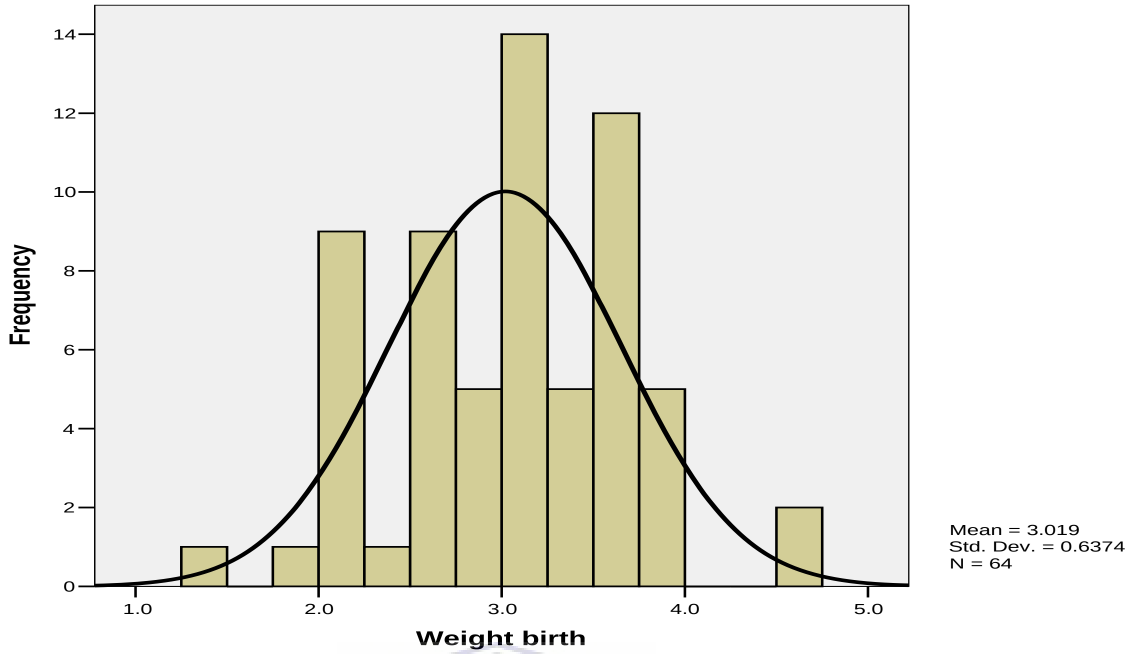


Figure A.3 The frequency distribution of the sample according the birth weight for male:

Table A.1: shows the relation between the duration of the breast and caries presence.

Duration of the Breast	Caries N (%)	Caries Free N (%)
Never	7 (43.8)	9 (56.2)
1-6 months	8 (23.5)	26 (76.5)
7-12 months	2 (13.3)	13 (86.7)
13-18 months	4 (14.3)	24 (85.7)
19-24 months	7 (25.9)	20 (74.1)

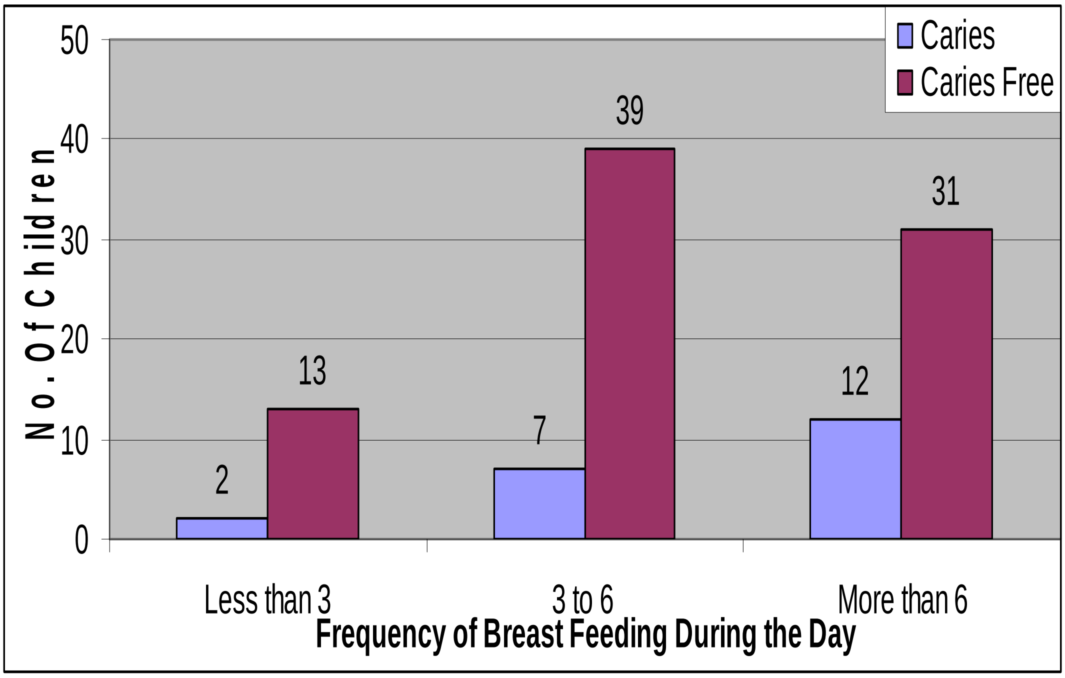


Figure A.4 The frequency of breast feeding during the day in the caries /caries free Group.

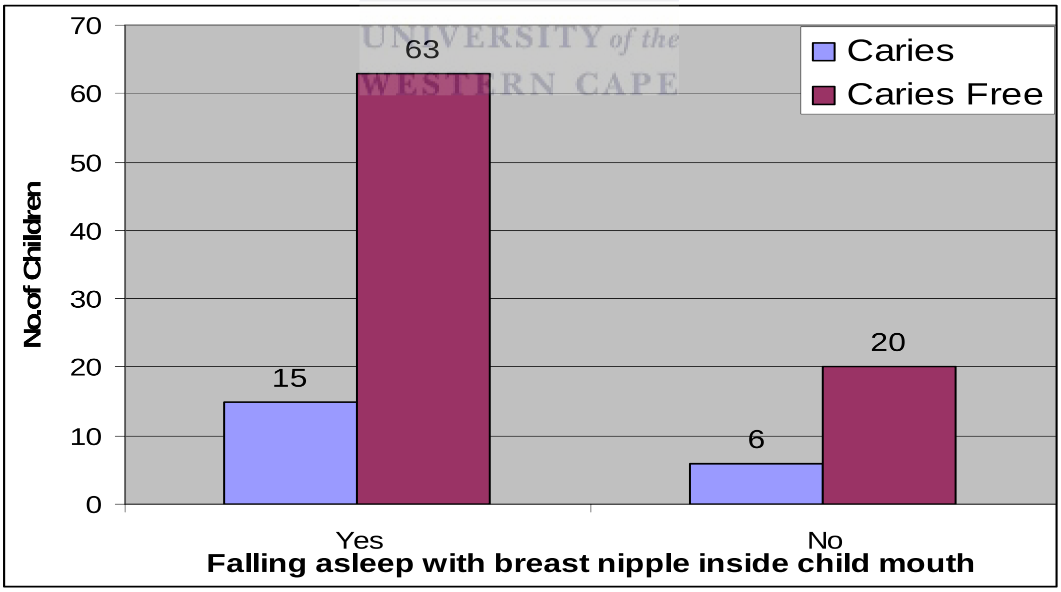


Figure A.5- Falling asleep with breast nipple in the child mouth in the caries /caries free Group

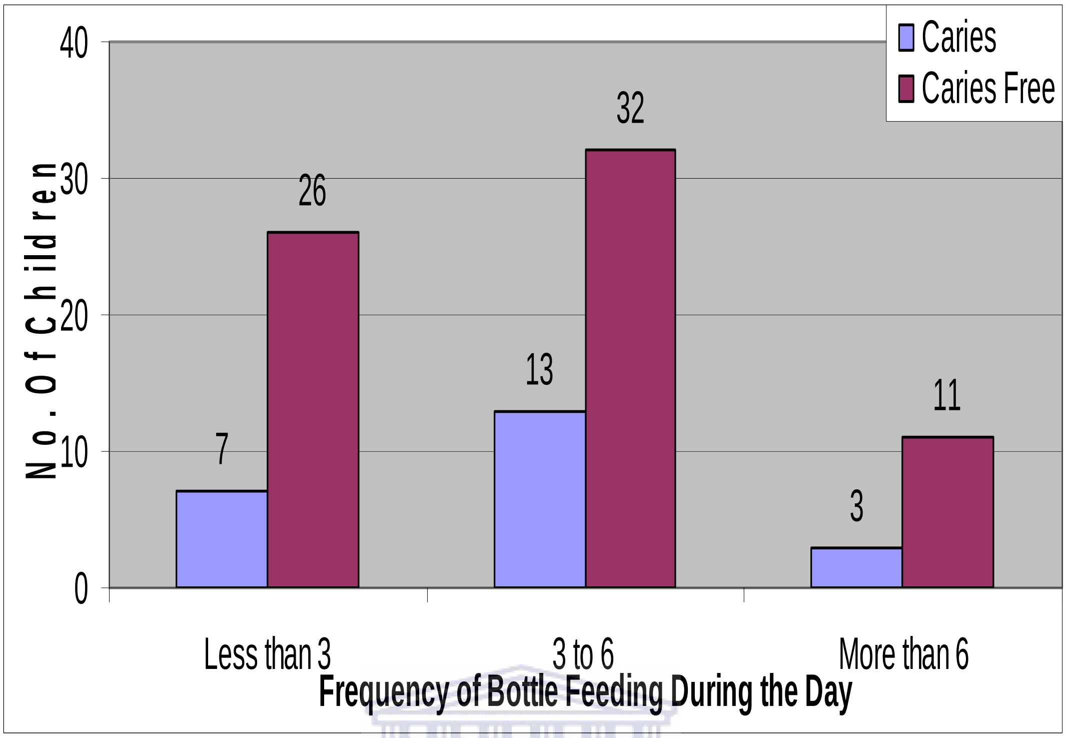


Figure A.6- The frequency of bottle feeding during the day in caries /caries free Group.

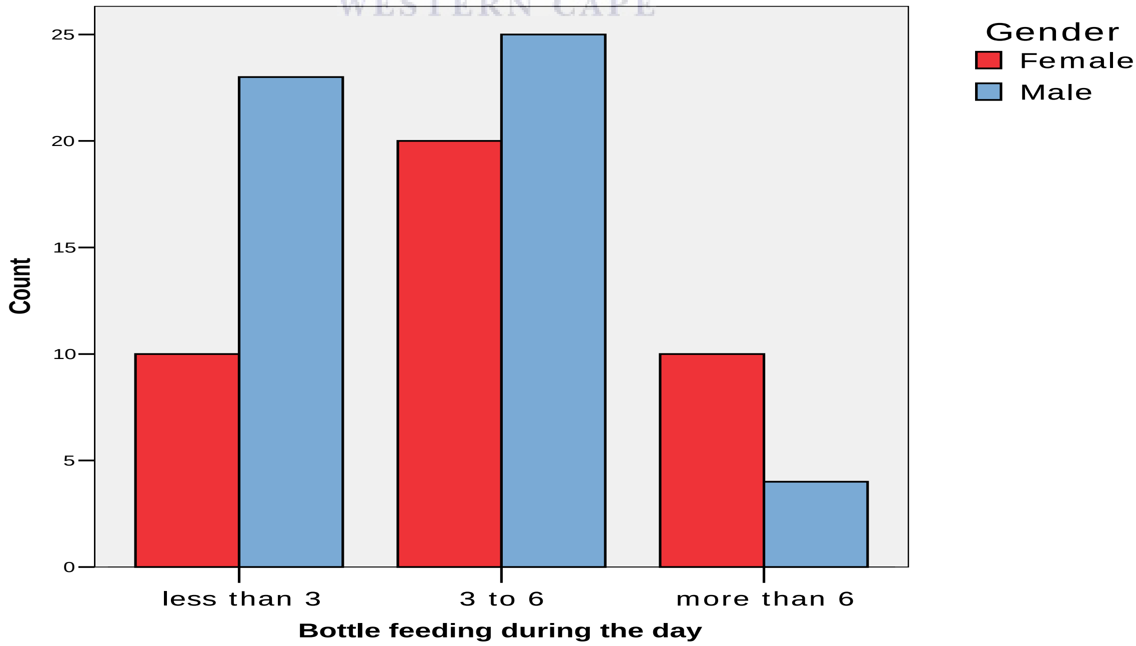


Figure A.7- Bottle feeding during the day gender relationship.

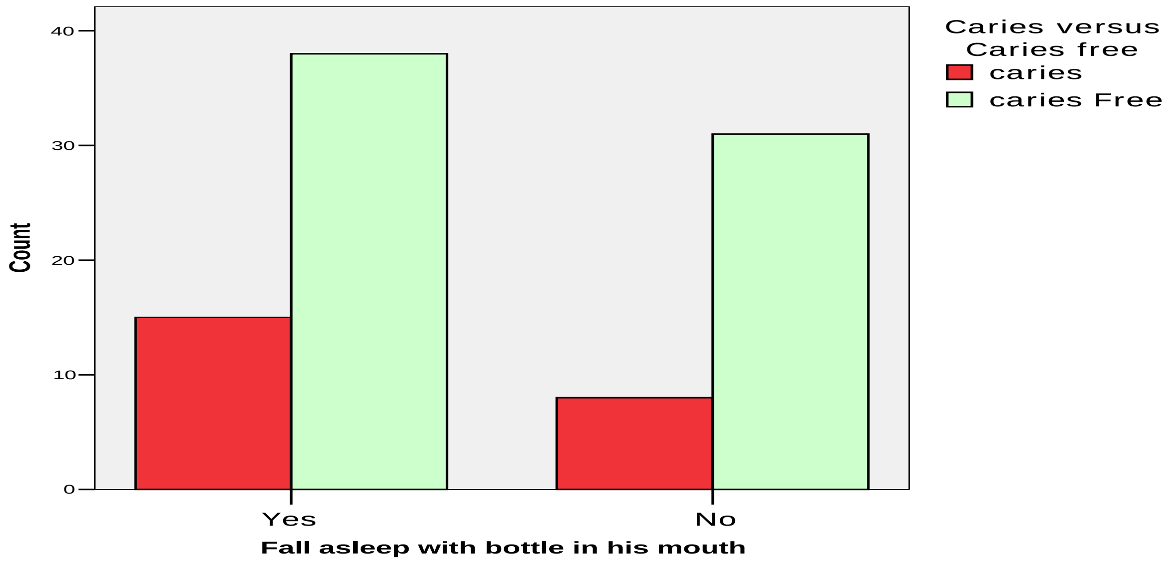


Figure A.8-Response to Q 11 does your child fall asleep with the bottle in the child mouth in caries /caries free Group.

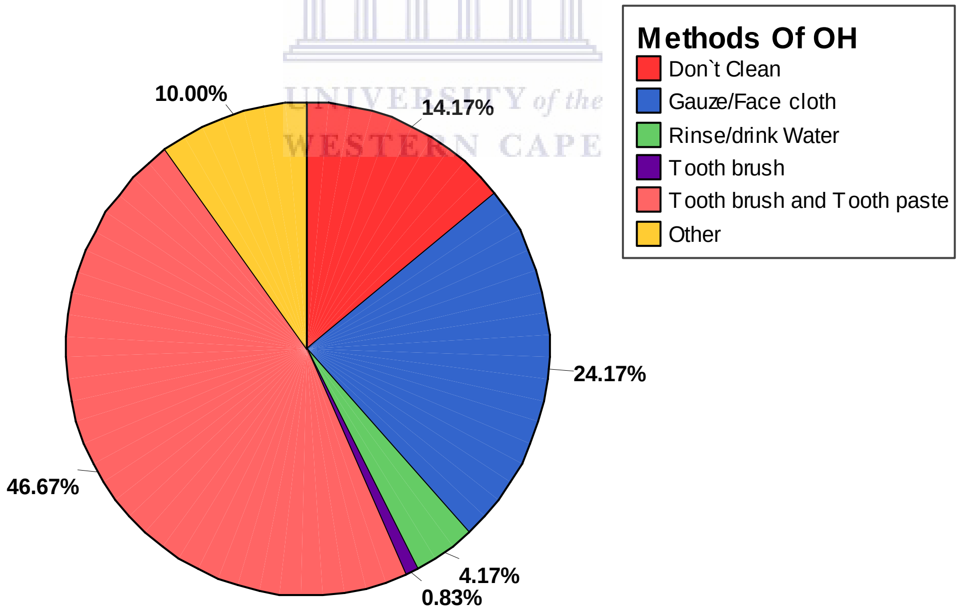


Figure A.9-Different methods used to clean the child mouth.

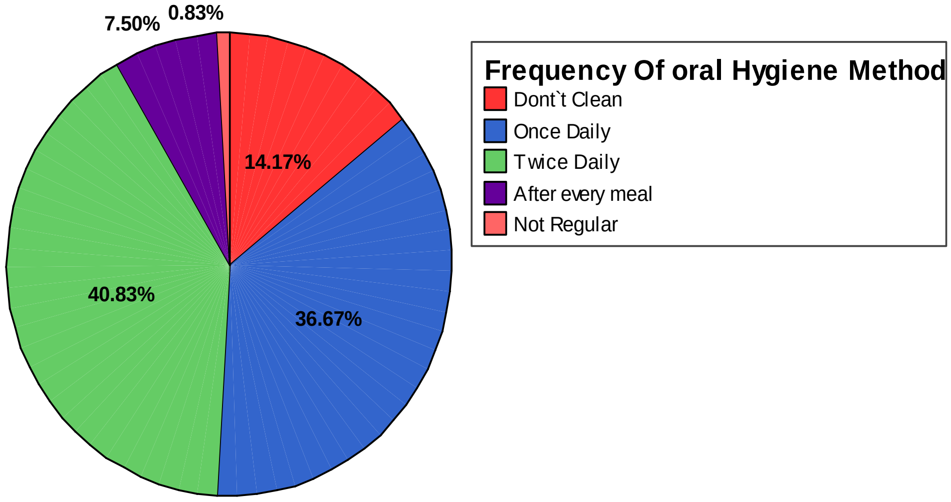


Figure A.10 –The frequency of oral hygiene methods

Table A.2-The frequency of Oral Hygiene and plaque

Frequency of OH (N)	Plaque (%)	ECC (%)
Don't Clean (17)	82.4	29.4
Once daily (44)	72.7	27.3
Twice daily (49)	63.3	16.4
After every meal (9)	44.4	22.2
Not Regular (1)	0	100