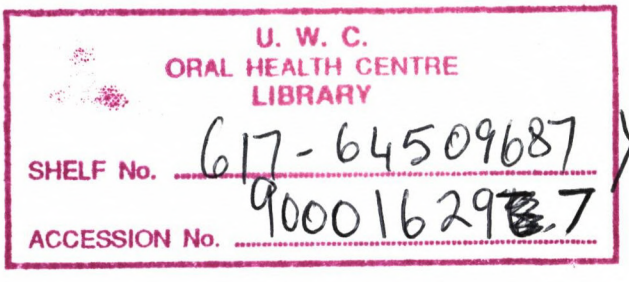


ORAL HEALTH OF A SELECTED GROUP OF PRESCHOOL CHILDREN

S. Yasin - Harnekar

AN INVESTIGATION OF THE ORAL HEALTH OF A SELECTED GROUP OF PRESCHOOL CHILDREN IN THE WESTERN CAPE

SORAYA YASIN-HARNEKAR

SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF M.SC.(DENT) IN THE FACULTY OF DENTISTRY OF THE UNIVERSITY OF THE WESTERN CAPE.

EXTERNAL EXAMINER: PROF. M. RUDOLF
FACULTY OF DENTISTRY
UNIVERSITY OF WITWATERSRAND

SUPERVISOR: PROF. J. REDDY
FACULTY OF DENTISTRY
UNIVERSITY OF DURBAN-WESTVILLE

CO-SUPERVISOR: DOCTOR C.P. OWEN
FACULTY OF DENTISTRY
UNIVERSITY OF THE WESTERN CAPE

DATE SUBMITTED: NOVEMBER 1987

DECLARATION

I declare "An investigation of the oral health of a selected group of preschool children in the Western Cape" is my own work and that all the sources I have used or quoted have been indicated and acknowledged by means of complete references.

Signed S. Y. Harnekar

Dr S. Yasin-Harnekar

ACKNOWLEDGEMENTS

I was very fortunate with this project to have had Professor J Reddy as my supervisor. He was the one to encourage me to do this investigation and also assisted me with the examination of the children. I appreciate the fact that he was never too busy to give me advice or help when I needed it.

My thanks to the principals and staff of the different créches for their co-operation and assistance during our visits. Particularly to all the children, most of whom had never been to a dentist previously and yet willingly submitted themselves for the dental examinations.

My sincere thanks to the assistants who accompanied us on these trips to the various créches to help with organizing the children and recording the data. They were Sister Pamela Peterson, Mrs Magdalena van der Horst and Miss Edna Delport. There may have been others who accompanied us from time to time who although not mentioned by name, I do wish to express my thanks to you too.

To the typists who made all this possible on paper, I want to express my sincere appreciation. Mrs D Isaacs spent hours putting the information on the wordprocessor. Mrs J D Ellis was always willing to type any part of the "pencil" script

that was needed in a hurry. Lastly to Miss E Solomon for typing the references and especially to Mrs E Petersen who efficiently helped me to finally put it all together.

I am most grateful to Matron Y Siebert and Mr R Koch for the well illustrated and neat graphs.

I also appreciate the help given to me by the statisticians at the Medical Research Council especially Miss Judy Cassidy. She unselfishly spent hours on the statistical analysis of the data.

During the writing of this thesis I often consulted with Dr C P Owen and Prof M H Moola. Their expert advice regarding the data and organization of the thesis was most valuable and much appreciated.

My acknowledgement would be incomplete without expressing my sincere appreciation of the support and encouragement my parents Mr and Mrs I Yasin, my family, friends and colleagues gave me. This was especially true of my husband, Dawood, who spent many patient hours waiting for me to complete my work. To all of you I say thank you.

CONTENTS

APPENDIX

6. **TABLES**

LIST OF FIGURES

LIST OF TABLES

FOREWORD: The Key to the abbreviations used in the text can be found in the appendix.

INTRODUCTION

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

The dental clinic of the University of the Western Cape provides oral health care for more than 30,000 patients annually. Most of the patients belong to the lower socio-economic groups. Among these patients many preschool children between the ages of 2-6 years are treated.

The clinical observation was that these children presented with rampant dental caries. Winter et al (1971) examining preschool children in the United Kingdom found more caries in the lower socio-economic group. Among other factors, poor dietary habits were implicated. However, in a follow-up study by Holt, Joels and Winter (1982) a marked reduction in the prevalence of decay in the primary teeth was noted.

In 1977 Barmes, reporting on the epidemiology of dental disease, stated that populations in highly developed countries almost always have high or very high prevalence of dental caries and developing countries have or have had low to extremely low prevalence of the disease, but that recent data indicated rapid and unmanageable increases in prevalence.

More recently, a report was compiled by an International Joint Working Group (FDI and WHO 1985) to identify the changes in oral health in children and factors associated with these changes during the past twenty years.

It was found that developed countries such as U.S.A., U.K. and Scandinavia showed substantial reductions in the prevalence of dental caries but developing countries (Nigeria, Thailand) appeared to have a considerable increase in dental caries.

In Nigeria (Adenubi 1982) and Sri Lanka (Amaratunge, Heidemann and Jayatilake 1986) the increase in caries occurred concurrently with a change in dietary habits.

Gordon and Newbrun (1986) found the decrease in caries trends observed in certain countries to be influenced largely by the extent of caries-preventive measures (particularly fluorides) and to a lesser degree by sugar utilization and the availability of dental personnel.

The reduction of caries in some industrialized countries may be relatively permanent as observed by Alanen, Tiekso and Paunio (1985). However, Mansbridge and Brown (1986) commenting on the decrease in caries concluded, "in common with other diseases, we are observing a cyclical effect."

The review of the relevant literature indicates that South Africa presents a unique opportunity to study the oral and dental health status of different ethnic and socio-economic groups. Cleaton-Jones et al (1978a, 1978b and 1981) reported on the caries prevalence of different ethnic preschool groups in the Transvaal area. Commenting on the anticipated changes in caries prevalence in South Africa, Cleaton-Jones, Richardson and Walker (1979) suggested that dental caries will increase in Indians, and remain at the same level or decrease in Blacks and Whites. They were cognisant of the lack of published data on which to base a firm prediction.

There is even less data on the oral health status of the preschool child in the Western Cape. Moola and Louw (1979) evaluated the needs and demands of the Coloured people in the Cape Peninsula. A mean dmft of 4.33 was recorded for 193 preschool children. The mean decayed score was 3.52 and the filling component was negligible. A comparison was made of the dental caries and periodontal disease in a low (Elim) and high (Garies) fluoride area in the South West Cape by Reddy, van Wyk and Grobler (1979). They found the dmft of children in Elim was 7.44 which was twice that of Garies (3.26). There were no fillings and very few missing teeth in these communities. Moola (1981) reported on the oral health of 6 year old children in the

Western Cape area. He found a low dental awareness among Coloured and Black children with the dmft 6.1 and 3.1, respectively. The White child had a dmft of 2.9 which was comparable to that of the Black child but the number of caries free teeth was more than twice (67%) in the former that in the latter group (30%). In the White child the decayed component was neglegible and the filled-component greatest. This was the opposite finding in the Black and Coloured children.

Gingivitis has been shown to develop more slowly in the preschool child (Mackler and Crawford 1973, Matsson 1978). However, it has been recorded in preschool children in developed countries (Holm 1975c, Gibson, Gelbier and Bhatia 1981) and especially, in developing countries (Manji and Sheiham 1986, Amaratunge et al 1986).

In South Africa, Moola (1981) found that intense gingivitis in the 6 year old child was highest in Blacks (72%) and much less in Coloureds (15%) and absent in Whites.

Interestingly, the caries experience of developed countries was still high about twenty years ago but with various improvements it has now declined. At present the developing countries are experiencing a rapid increase in caries. The manpower shortage to meet these increases especially in the preschool child is acute.

In order to describe the magnitude of the oral health problem and determine the need for oral treatment baseline data are essential. These data also provide a basis for the monitoring and evaluation of changes after the use of various preventive methods and the comparisons in deterioration or improvement of oral health.

1.2 OBJECTIVES

The oral health status of a selected group of preschool children aged 2-6 years was investigated in the Western Cape.

The specific objectives of the investigation were to study the prevalence of:

i) dental caries
ii) gingivitis
iii) soft deposits of tooth surfaces
iv) oral mucosal lesions
v) other hard tissue lesions.

REVIEW OF LITERATURE

CHAPTER 2

REVIEW OF LITERATURE

2.1 DENTAL CARIES

2.1.1 DEFINITION

Menaker (1980) defined dental caries as a "microbial disease which affects the calcified tissues of the teeth, beginning first with a localized dissolution of the inorganic structures of a given tooth surface by acids of bacterial origin, and leading to a disintegration of the organic matrix."

Dental caries is dependent upon the interrelationships of three main groups of factors viz. microbial, substrate and host factors. For the disease process to be initiated, all three factors must exist simultaneously over a period of time.

2.1.2 GENERAL ASPECTS OF EPIDEMIOLOGY

Epidemiology is the study of disease as it affect populations. It concerns the study of the processes which determine or influence the health of people. As an observational science it studies the distribution of diseases in populations and identifies and compares groups having differing ranges in disease levels or conditions (WHO 1979).

Prevalence is the occurrence of a condition assessed in a population at a particular point in time. If the occurrence is assessed at two separate points in time, the incidence can be determined. The incidence is the increase or decrease in the occurrence of a condition over a given period.

The presentation of such data vary from country to country, but are nevertheless invaluable for their intended purpose of providing a good approximation of disease prevalence and trends.

Specific indices have been developed to quantify dental data and describe their distribution.

2.1.3 INDICES FOR ASSESSMENT OF DENTAL CARIES

To assess the caries susceptibility of a community, regardless of the extent of dental treatment, past history must be considered. Jackson (1950) notes that Klein and Palmer in 1938 devised the DMF index for the permanent teeth - which means D = decayed, M = missing and F = filled teeth or surfaces. The decayed teeth are not differentiated into incipient and gross caries. Those missing are presumed to have at one time been carious. This assumption is considered to the younger age-groups, but in the older age groups when teeth are missing

because of other reasons such as periodontal disease, the DMF index loses its accuracy and cannot safely be used. The filled teeth are similarly assumed to have at one time been carious.

The def index for primary teeth was introduced where d = decayed teeth indicated for filling, e = decayed teeth indicated for extraction, and f = filled teeth. Missing teeth (extracted or exfoliated) are ignored. The def index has been used where "e" has meant "extracted" as in studies by Holm (1975).

Jackson (1950) modified the DMF index for use with primary teeth. The affected primary teeth are designated d, m or f, the initials having exactly the same meaning as in the permanent index. The index can be used for a full mouth primary dentition from age three to five years inclusive; and for deciduous molars from age three to eight years inclusive, but the canines are not included because they are prone to premature exfoliation in a sound condition.

Therefore, only those teeth which <u>should</u> be present according to the subject's age at the time of examination are assessed in the missing component because beyond a certain age it may be impossible to determine whether a given missing tooth has been extracted or has exfoliated.

Exfoliation in the primary dentition presents a problem and, therefore, modification of the indices has been proposed. An index used by Halikis (1965) was the defm(t) where d = decayed; e = indicated for extraction; f = filled and m = missing molars.

The World Health Organisation - Geneva (1977) in its basic survey techniques recommends the use of the df index, which is basically the same as that of the def index. The difference is that the d component of the df index is subdivided so that d = decayed (d) and indicated for extraction (e).

The dimf index where d = decayed, i = teeth indicated for extraction and f = filled was used in the study by Yassin and Low (1975).

To facilitate communication and comparison of results of epidemiologic research, authors should define the initials of the indices employed. In an attempt to encourage uniformity, the following definitions were proposed by Haugejorden (1978): d = decayed, e = decayed beyond repair ie. need to be extracted, m = missing because of caries, f = filled because of caries.

2.1.4 PREVALENCE AND INCIDENCE OF DENTAL CARIES IN THE PRIMARY DENTITION (PRESCHOOL CHILDREN)

Dental caries remains the major dental disease affecting children of all ages. Barmes (1977) highlighted the fact that the developed countries have a high prevalence of caries and the developing countries have a low level but with industrialization, caries in the developing countries is rapidly increasing.

With few notable exceptions, dentists in the early part of the twentieth century did not undertake epidemiological research or other community aspects of dentistry, and standardised epidemiological techniques were slow to develop (James 1975).

The lack of established criteria to ensure uniform assessment and the subjective classifications used did not allow meaningful comparisons between groups. The shortcomings of earlier works were realized, and modern techniques gradually developed. After the 2nd World War, research in this subject increased. The great social, economic and dietary upheaval after the war resulted in studies on its effects on the teeth of the populations involved.

2.1.4.1 **THE 5 YEAR OLD CHILD (Table 2.1)**

A report by Mellanby, Coumoulos and Kelley (1957) on 5 year old children in London showed an overall picture of the changes that took place in the incidence and severity of caries between 1943 and 1955. They found that in 1947 there was a smaller number of decayed teeth than in any other year, whereas in 1955 there was the largest total prevalence, with more severe caries than at any other time since 1943. The children who had some carious teeth in 1955 had a high average prevalence, 7.2 teeth per child being carious as compared with the next highest figure of 6.8 in 1943 and 1945, and with the lowest of 5.5 in 1947. The percentage of children free from visible caries followed a similar pattern with 14.9% caries-free in 1943 then rising to 28.1% caries-free in 1947, after which they declined to approximately the 1943 level and remained more or less at the same level with 15.5% in 1955.

Beal and James (1970) examined children in four areas of the West Midlands in England, each having a population with a different socio-economic status. A total of 1225, 5 year old children were examined. The mean deft for the sample was 4.5. The deft ranged from 5.2 and 15% caries-free in the district with a higher proportion of social classes III, IV and V to a deft of 3.1 and 39% caries-free in the district with a

higher proportion of social classes I and II. The d component ranged accordingly from 4.30 to 2.02 and f component 0.02 to 0.58 from the lower to higher social classes respectively.

Infante and Russell (1974) studied the prevalence of dental caries in 1155 White and Black preschool children in the United States. The mean deft for the 5 year old White children was 3.97 with 29.3% caries-free and for Black children 5.12 with 26% caries-free.

The caries prevalence in different racial groups of schoolchildren was studied in West Malaysia by Yassin and Low (1975). The caries experience in the permanent dentition of the three racial groups, namely Malay, Chinese and Indian/Pakistani, showed a distinct variation. In the primary dentition, however, the caries experience in the three groups was comparable. The dift for the 6 year old children were: Malay 6.4; Chinese 6.5 and Indian/Pakistani 5.8.

A survey of 177, 5 year old Swedish children by Holm (1975b) recorded the mean number of deft as 4.05; 25% were caries-free and 50% had a deft of < 3.

In 1977, Bruszt et al recorded the caries prevalence of preschool children in Baja, Hungary, and compared the data with that of preschool children of the same city in 1955. The mean dmft was 6.3 in 1975 compared to 4.5 in 1955. The percentage caries-free in the 1975 study was 11.4. A comparison of the data of 1975 with that of 1955 showed an increase of caries frequency (% of examinees with caries) at 5 years of 13.3% and caries intensity (dmft count per examinee) of 40%. The percentage distribution of the components of the dmf teeth was d = 92.4% and f = 1.5%.

A total of 965, 5 year old children in West Jerusalem were dentally assessed by Zadik (1978). A mean dift value of 4.7 was recorded and only 16% were caries free. The d(t) component was 3.6 and f(t) 0.2.

Gibson, Gelbier and Bhatia (1981) examined 865 children in the health areas of Lambeth, Southwark and Lewisham in England. They found 76% required treatment for dental caries and the mean dmft was 4.85. The mean number of decayed teeth was 3.29.

In Sri Lanka, Amaratunge et al (1986) reporting on 5 year olds recorded a dmft of 6.4 and 12.9% were caries-free.

DENTAL CARIES STATUS

TABLE 2.1: 5 YR OLD CHILD

AUTHOR	(YEAR)	COUNTRY	dmft/deft	CARIES FREE(%)
1) Mellanby et al	(1957)	London (U.K)	7.2	15.5
2) Beal & James	(1970)	England (U.K)		
		(Lower classes)	5.2	15.0
		(Higher classes)	3.1	39
3) Infante & Russel	(1974)	United States		
		(White)	3.97	29.3
		(Black)	5.12	26.0
4) Yassin & Low	(1975)	West Malaysia		
		(Malay)	6.4	-
		(Chinese)	6.5	-
		(Indian)	5.8	-
5) Holm	(1975b)	Sweden	4.05	25.0
6) Brustz et al	(1975)	Hungary	6.3	11.4
7) Zadik	(1978)	Israel	4.7	16.0
8) Gibson et al	(1981)	England (U.K)	4.85	24.0
9) Amaratunge et al	(1986)	Sri Lanka	6.4	12.9

2.1.4.2 **THE 4 YEAR CHILD (Table 2.2)**

In 1971, Winter and co-workers examined preschool children aged 12-50 months from all social groups in the London borough of Camden. Of the 110, 4 year old children examined 42% were caries-free with a mean deft of 3.07. In 1982, Holt et al did a follow-up study of the preschool children in the London borough of Camden to compare the data with that obtained in 1971. In the 4 year age groups 60% were caries free and a mean dmft of 1.34 was recorded.

Infante and Russell (1974) examined preschool children in the United States. The mean total number of def teeth for the 4 year age group was 2.57 and 46% caries-free for White preschool children and 3.85 and 24.4% caries-free for Black preschool children.

The oral health of 187, 4 year old Swedish children were examined by Holm (1975a). The mean deft was 2.23 and 33% were caries free.

Bruszt and co-workers (1977) compared data of preschool children in Baja, Hungary in 1955 and 1975. The caries frequency in the 4 year age group was 83.3% and caries intensity (mean dmft) was 5.2 in 1975. Carious teeth comprised 96.1% of the dmft index

and only 11 teeth were filled. The data recorded in 1955 was a dmft of 3.3. The increase during the last 20 years of caries frequency at 4 years of age was 14% and caries intensity was 58%.

Sutcliffe (1977) examined children from deprived and non-deprived areas in Edinburgh, Scotland. He found 37% of 4 year olds caries free and the mean total caries experience per child was 2.98. Those from the non-deprived area had a mean dmft of 2.38 and those from the deprived area 3.4. The difference in mean values was statistically significant.

Three hundred and fourteen 4 year old children in Mallow, Ireland, a non-fluoridated area, were examined by Holland and Crowley (1982). The number caries free was 30.6% and mean deft score was 3.87. In Sri Lanka, Amaratunge et al (1986) found a dmft of 6.4 and 11% caries free in the 4 year olds.

DENTAL CARIES STATUS

TABLE 2.2: 4 YR OLD CHILD

	AUTHOR	YEAR	COUNTRY	dmft/deft	CARIES-FREE(%)
1)	Winter et al	(1971)	London (U.K)	3.07	42.0
2)	Infante & Russel	(1974)	U.S.A. (White)	2.57	46.0
			(Black)	3.85	24.4
3)	Holm	(1975a)	Sweden	2.23	33.0
4)	Bruszt et al	(1977)	Hungary	5.2	16.7
5)	Sutcliffe	(1977)	Scotland	2.98	37.0
6)	Holland and Crowley	(1982)	Ireland	3.87	30.6
7)	Holt et al	(1982)	London (U.K)	1.34	60.0
8)	Amaratunge et al	(1986)	Sri Lanka	6.4	11.0

2.1.4.3 **THE 3 YEAR OLD CHILD (Table 2.3)**

In 1969 Hennon, Stookey & Muhler examined preschool children in the United States. They found that in the age group 36-39 months only 43% were caries-free with a mean deft of 2.66.

Winter and co-workers (1971) examined children in a London borough and found in the age group 36 to 47 months 64% caries-free and a mean deft of 1.41. In 1982 Holt et al did a follow up study on the preschool children from the same area and found in the 36 to 47 month age group 78% caries-free and the mean dmf(t) 0.71.

Infante and Russell (1974) studied American preschool children and found in the 3 year age group, White children had a mean deft of 1.62 and 59.5% caries-free; in the Black group a mean deft of 2.61 and 31.7% caries free.

Two hundred and sixty-three 3 year old children in South East England were examined by Silver in 1974. He found 67% caries-free and a mean deft of 1.37. After an interval of eight years Silver (1982) examined a similar sample in the same area. He found 83% caries-free and a mean deft of 0.52.

Holm (1975c) examined Swedish children and reported in the 3 year age group that 54% were caries-free with a mean deft of 2.01.

In Edinburgh, Scotland, Sutcliffe (1977) examined 574, 3 year old children and found 53% caries-free and an average of 1.9 dmft.

Bruszt et al (1977) examined 3 year old Hungarian children and reported 36% as caries-free and a mean dmft of 3.4. The examination they had done in 1955 showed 48% caries-free and a mean dmft of 2.5. The increase of caries frequency was 12.4% and caries intensity of 35% of the dmft count.

In Sri Lanka Amaratunge et al (1986) found a dmft of 5.5 and 6% caries free in 3 year old children.

DENTAL CARIES STATUS

TABLE 2.3: 3 YR OLD CHILD

	AUTHOR	YEAR	COUNTRY	dmft/deft	CARIES-FREE(%)
1)	Hennon et al	(1969)	U.S.A.	2.66	43
2)	Winter et al	(1971)	London (U.K)	1.41	64
3)	Infante & Russel	(1974)	U.S.A. (White)	1.62	59.5
			(Black)	2.61	31.7
4)	Silver	(1974)	England (U.K)	1.37	67
5)	Holm	(1975c)	Sweden	2.01	54
6)	Sutcliffe	(1977)	Scotland	1.9	53
7)	Bruszt et al	(1977)	Hungary	3.4	36
8)	Holt et al	(1982)	London (U.K)	0.71	78
9)	Silver	(1982)	England (U.K)	0.52	83
10)	Amaratunge et al	(1986)	Sri Lanka	5.5	6

2.1.4.4 **THE 2 YEAR OLD AND YOUNGER CHILD (Table 2.4)**

Hennon et al (1969) in their study of Amercian preschool children between 18-35 months, recorded a deft of 1.36 for the 2 year old child and 65% caries-free and the 1 year old group had an average deft of 0.13 and 92% caries-free.

Winter et al (1971) in the London study recorded children in the 24-35 month age group being 82% caries-free and a deft 0.76. The group 12-23 months were 98% caries-free and a mean deft of 0.04.

In the follow up study conducted in 1982 by Holt et al in the same London borough, they found in the 24-35 month age group 89% were caries-free and a mean dmft of 0.42. In the 12-23 month age group 97% were caries-free and a mean dmft of 0.11.

In 1974, Infante and Russell recorded the prevalence of dental caries in American preschool children. In the 2-year age group, White children had a mean deft 0.24 with 88.7% caries-free and Black children had a mean deft 1.50 with 65.6% caries-free. In the 1 year age group, White children had a mean deft of 0.13 with 98.5% caries-free and Black children had a mean deft of 0.03 with 98.4% caries-free.

DENTAL CARIES STATUS

TABLE 2.4: 2 YR OLD AND YOUNGER CHILD

AUTHOR	(YEAR)	COUNTRY	AGE(yrs)	dmft/deft	CARIES-FREE(%)
1) Hennon et al	(1969)	U.S.A.	(2)	1.36	65
			(1)	0.13	92
2) Winter et al	(1971)	Britain	(2)	0.76	82
			(1)	0.04	98
3) Infante & Russel	(1974)	U.S.A.	(White 2)	0.24	88.7
			(Black 2)	1.50	65.6
			(White 1)	0.13	98.5
			(Black 1)	0.03	98.4
4) Holt et al	(1982)	Britain	(2)	0.42	89
			(1)	0.11	97

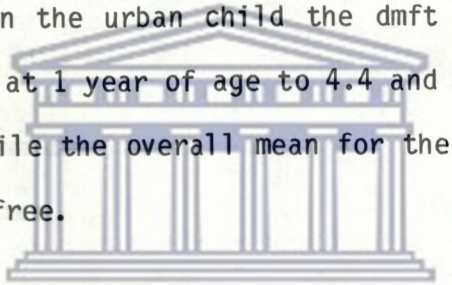
2.1.4.5 **THE SOUTH AFRICAN PRESCHOOL CHILD (Table 2.5)**

De Jager (1965) examined dental caries prevalence in the South African San people. The percentage of individuals with dental caries was calculated by taking the number of persons affected as a percentage of the total number examined. The percentage of diseased teeth was calculated by taking the number of such teeth as a percentage of the number of teeth which normally should have been present. He examined 25 individuals in the age group 1-6 years with a primary dentition only. He found 2 subjects with carious teeth and the total number of carious teeth and roots were 10 (2%).

In 1976 Van Wyk, Konviser and Dreyer examined a group of the Cape population belonging to the Muslim faith. Their survey revealed a high prevalence of dental caries, a lack of dental awareness and poor oral hygiene. In the 4 year age group (20 children were examined) the average dmft was 5.6 and the 5 year age group (16 children were examined) the average dmft was 7.9.

Cleaton-Jones et al (1978a) examined the dentitions of 499 White preschool children aged 1-5 years from a low fluoride urban area. The dmft ranged from 1.0 and 63% caries-free at 1 year of age to 5.1 and 26.6% caries-free at 5 years of age while the overall mean for the group was 3.7 and 32.4% caries-free.

Cleaton-Jones et al (1978b) examined the dentitions of 439 rural and 192 urban Black children aged 1-5 years. The percentage prevalence and dmft values were similar in children of 1-3 years in both groups. At 4 years there was a two-fold increase in dental caries in the urban children to reach a dmft score significantly greater than that in the rural children. In the rural child the dmft ranged from 0.6 and 88% caries-free at 1 year of age to 3.0 and 50% caries-free at 5 years of age while the overall mean for the rural group was 1.9 and 61% caries-free. In the urban child the dmft ranged from 1.0 and 83% caries-free at 1 year of age to 4.4 and 28% caries-free at 5 years of age while the overall mean for the urban group was 2.7 and 55% caries-free.



Moola and Louw (1979) evaluated the needs and demands of the Coloured people in the Cape Peninsula. In the 1-6 year age group 193 children were examined. A mean dmft of 4.33 was recorded with a total of 3 fillings. The mean decayed score was 3.52.

McInnes and Vieira (1979) determined the dental health status of a representative sample of Johannesburg Chinese school-children. In the 18 preschool children, 3-5 years old, 17% were caries-free and the mean dmft was 7.1.

Cleaton-Jones, Richardson and McInnes (1981) studied dental caries in 226 Coloured and 328 Indian children. There were significantly more caries in Coloured children at 1 year than in Indian children, but thereafter no significant differences were found. In the Coloured children the dmft ranged from 0.5 and 79% caries-free at 1 year of age to 5.2 and 20% caries-free at 5 years of age while the overall mean for the group was 3.1 and 44% caries-free. In the Indian children the dmft ranged from 0 and 99% caries-free at 1 year of age to 6.6 and 17% caries-free at 5 years of age while the overall mean for the group was 3.2 and 51% caries-free.

Moola (1981) compared the oral findings of Black, Coloured and White 6 year old children. The percentage children with active decay in the primary dentition ranged from 84% in Coloured children to 70% in Blacks and 33% in Whites. The mean dmft was 6.1 for Coloured, 3.1 in Blacks and 2.9 in Whites. The White group was the only one with any fillings present.

In a further study, McInnes, Richardson and Cleaton-Jones (1982) determined the caries patterns in groups of Coloured preschool children in high and low fluoride areas. A total of 331 children aged 1-5 years from the high fluoride area (2.2 - 4.1 ppm) were compared. In the high fluoride area the dmft ranged from 0 and 100% caries-free at 1 year of age to 1.4 and 72%

DENTAL CARIES STATUS

TABLE 2.5: THE SOUTH AFRICAN PRESCHOOL CHILD

	AUTHOR	YEAR	COMMUNITY	AGE(YRS)	dmft/deft	CARIES-FREE(%)
1)	De Jager	(1965)	San People		*10	92
2)	van Wyk et al	(1976)	Malays	(4)	5.6	
				(5)	7.9	
3)	Cleaton-Jones et al	(1978)	White	(1)	1.0	63
				(5)	5.1	26.6
				(mean)	3.7	32.4
4)	Cleaton Jones et al	(1978)	Urban Black	(1)	1.0	83
				(5)	4.4	28
				(mean)	2.7	55
			Rural Black	(1)	0.6	88
				(5)	3.0	50
				(mean)	1.9	61
5)	Moola & Louw	(1979)	Coloured	(1-6)	4.33	
6)	McInnes and Vieira	(1979)	Chinese	(3-5)	7.1	17
7)	Cleaton-Jones et al	(1981)	Coloured	(1)	0.5	79
				(5)	5.2	20
				(mean)	3.1	44
			Indian	(1)	0	99
				(5)	6.6	17
				(mean)	3.2	51
8)	Moola	(1981)	Coloured	(6)	6.1	16
			Black	(6)	3.1	30
			White	(6)	2.9	67
9)	McInnes et al	(1982)	Coloured (High F⁻)	(1)	0	100
				(5)	1.4	72
				(mean)	0.7	82
			Coloured (Low F⁻)	(1)	0.1	90
				(5)	8.4	8
				(mean)	5.4	32

*A total of 10 carious teeth recorded.

caries-free at 5 years of age. The mean dmft was 0.7 and 82% caries-free. In the low fluoride area the dmft ranged from 0.1 and 90% caries-free at 1 year of age to 8.4 and 8% caries-free at 5 years of age. The mean dmft was 5.4 and 32% caries-free.There were no filled teeth recorded in either group.

2.1.4.6 **NURSING AND RAMPANT CARIES (Table 2.6)**

The lack of a precise definition of labial and rampant caries has led to considerable confusion. These terms are often used synonomously. Winter, Hamilton and James (1966) described rampant caries as "a lesion of acute onset involving many or all of the erupted teeth, rapidly destroying coronal tissue, often on surfaces normally immune to decay, and leading to early involvement of the dental pulp. The acute onset of the disease in the deciduous dentition is a notable feature". They developed the criterion that rampant caries exists when at least two maxillary incisors are affected by lesions on the labial or palatal surfaces.

The frequent primary manifestation of the disease on the labial surface of the maxillary incisors gave rise to the descriptive title of "labial caries" by James, Parfitt and Falkner (1957) and the more developed circumferential cervical lesions to the term "circular caries" by Toth and Szabo (1959).

Baume (1973) found a high incidence of "circular hypoplasia", in the anterior primary teeth of Polynesians. The carious involvement of the hypoplastic enamel produced the condition called "odontoclasia". He claimed this to be the typical Polynesian caries pattern prevailing in the primary dentition.

Richardson et al (1978) described labial caries as carious lesions on the labial surface of one or more incisor or canine teeth and rampant caries as a dmft score of 5 or more. Timmis (1971) in England also described rampant caries as involving 5 or more teeth.

Other descriptive titles have been given to the caries of maxillary incisors, each determined by the author's concept of the principle aetiological agent.

These include the titles: "milk-bottle caries" (Kotlow 1977), "nursing bottle caries", and "nursing bottle syndrome" (Ripa 1978), "prolonged nursing-habit" (Dilley, Dilley and Machen 1980) and "nursing caries syndrome" (Derkson and Ponti 1982).

Hennon et al (1969) compared the total teeth at risk with the number of teeth decayed for the entire sample of 915 children studied and found 13% of maxillary central incisors were carious. This related the frequency of decay to the entire

sample rather than to only those who had dental caries. Of those who had dental caries 31% had d$\geqslant$5 but if calculated for the whole sample only 12% had d$\geqslant$5.

Goose, in 1967 reported on the prevalence of labial caries in the random child population in England. Of the 309 infants examined between the ages of one and two years he found 21 had caries on the labial surface of the incisors (6.8%). He showed that those who had bottles showed no more caries than those who did not. However, the ones who had infant feeders containing vitamin syrups had a significantly higher proportion of caries.

Beal and James (1970) recorded the percentage of 5 year old children with rampant caries as described by Winter et al (1966) in the four areas of the West Midlands. It ranged from 7% in the higher socio-economic group to 14% in the lower socio-economic group.

Winter et al (1971) examined 602 pre-school children aged 12 to 60 months from all social groups in a London borough. A prevalence of 8% of rampant caries for the total sample was noted (criterion - caries of 2 maxillary incisors). The important aetiological roles of prolonged bottle feeding and sweetened comforters contributing to all forms of caries in the primary dentition were established and found to be socially

related, a greater caries prevalence being noted in the lower social groups. Prematurity of birth and childhood illness were also shown to be related to the prevalence of caries in pre-school children.

Silver (1974) examining 3 year old children for dental caries in South East England found that a social gradient exists in the prevalence of dental caries brought about by differing parental attitudes to feeding and the use of sweetened bottles and pacifiers. He recorded an 8% prevalence of rampant caries of maxillary incisor teeth.

Enwonwu (1974) reported on Nigerian pre-school children in a village and found in the age group 0-4 years 1% had caries of the primary dentition. The maxillary incisors, more than other primary teeth, were more prone to dental decay and were also the teeth frequently found to show enamel hypoplastic defects. He supported the report concerning the association between structural defects of enamel and the high prevalence of caries in primary incisors in relatively remote underprivileged societies.

Holm (1975c) in a longitudinal investigation of 177 Swedish children at the ages of 3, 4 and 5 years, found that 16% of maxillary central incisors were carious at 3 years of age. There was no further caries increment from age 3 to 5 years in these teeth.

Cleaton-Jones et al (1978b) examined the dentitions of 439 rural and 192 urban Black children aged 1-5 years. In the rural group 14% had labial caries (caries on labial surface of one or more incisor or canine teeth) compared to 3% in the urban group. Rampant caries (dmft$\geqslant$5) recorded in the rural group was 15% and in the urban group 25%. They also examined the dentitions of 499 White preschool children aged 1-5 years. 12% had labial caries and 30% had rampant caries (dmft$\geqslant$5).

McInnes and Vieira (1978) determined the dental health of Chinese schoolchildren. In the 18 preschool children within the sample, labial caries was present in 6 (33%) and rampant caries (dmft$\geqslant$5) in 11 (61%).

Cleaton-Jones et al (1981) studied dental caries in 226 Coloured and 328 Indian children. The Coloured group had 8% labial caries compared to 10% in the Indian group. Rampant caries (dmft$\geqslant$5) was recorded as 25% in the Coloured group and 26% in the Indian group.

McInnes et al (1982) determined the caries pattern in groups of preschool children aged 1-5 years living in high and low fluoride areas. In the high fluoride area (331 children) only 2% had labial caries but in the low fluoride area (177 children) 27% had labial caries.

Silver (1982) examined a representative sample of 3 year old children in Hertfordshire, England after an interval of 8 years

and found a substantial reduction in caries experience. He found feeding habits had improved: more mothers were breast feeding and fewer were using sugared feeding bottles and comforters. He concluded that this change was probably responsible for the large reduction found in the prevalence of labial (rampant) caries from 8% to 1% of the children. The improvements had taken place in all social classes.

Holt et al (1982) examined 55 children aged between 12 and 60 months in the London borough of Camden where Winter et al (1971) previously reported on the oral status and feeding patterns of these preschool children. The investigation revealed only 3% had rampant (labial) caries. The previously observed association between the use of sweetened comforters and rampant caries still held true but the decline in the use of these pacifiers was mirrored by a similar decline in the prevalence of rampant caries. Of the children wholly breast fed 95% were caries-free and none had rampant caries.

Derkson and Ponti (1982) in Canada examined randomly selected children aged 1-6 years attending public health clinics and community centre activities in a non-fluoridated city, using the criterion of smooth surface caries on the labial and lingual surfaces of the maxillary incisors. Of the 594 subjects examined, 19 (3.2%) had labial caries. Factors found to affect the condition were the educational status of parents, prolonged day or night-time bottle or breast-feeding and fluoride supplementation of the diet.

NURSING RAMPANT CARIES

TABLE 2.6: THE PRESCHOOL CHILD

	AUTHOR	YEAR	COUNTRY	NURSING CARIES (%) MAX INCISORS	RAMPANT CARIES (%) (dmft ⩾5)
1)	Goose	(1967)	England (U.K.)	6.8	
2)	Hennon et al	(1969)	U.S.A.	13	12
3)	Beal & James	(1970)	United Kingdom		
			(higher classes)	7	
			(lower classes)	14	
4)	Winter et al	(1971)	London (U.K)	8	
5)	Silver	(1974)	England (U.K)	8	
6)	Holm	(1975)	Sweden	16	
7)	Cleaton-Jones et al	(1978)	South Africa		
			(Rural Black)	14	15
			(Urban Black)	3	25
			(White)	12	30
8)	McInnes and Vieira	(1979)	South Africa		
			(Chinese)	33	61
9)	Cleaton-Jones et al	(1981)	South Africa		
			(Coloured)	8	25
			(Indian)	10	26
10)	McInnes et al	(1982)	South Africa		
			(High F^-)	2	
			(Low F^-)	27	
11)	Silver	(1982)	England (U.K.)	1	
12)	Holt et al	(1982)	London (U.K)	3	
13)	Dirkson & Ponti	(1982)	Canada	3.2	

2.1.5 INFLUENCE OF DIET

The diet and prevalence of dental caries in a group of Alaskan Eskimos were studied on two occasions (Bang and Kristoffersen 1972). Considerable changes in living habits and diet were noted. The dietary change showed a 50% increase in carbohydrates and a corresponding decrease in proteins. There was a drastic increase in the prevalence of dental caries with the dmft rate for primary teeth showing an almost 90% increase.

Screebny (1982) indicated that for 12 year old children there was a significant positive correlation between the per capita availability of sugar and dental caries. It was also suggested that the availability, and presumably the ingestion, of 50g of sugar daily may represent an outer limit of "safe" or "acceptable" sugar consumption.

A study was conducted by Künzel (1983) comparing annual sugar consumption and caries prevalence in optimum fluoride areas. He found that in areas of low fluoride concentration in drinking water, caries prevalence at all times is in relative agreement with the level of the annual sugar consumption. In areas of optimum water fluoridation irrespective of an increasing sugar consumption there remained reduced caries activity.

Rugg-Gunn and Edgar (1984) reviewed the evidence for an association between sugar and dental caries. They concluded that in the development of dental caries, the influence of diet is much more important after a tooth has erupted into the mouth than any dietary influence on the forming tooth before its eruption. Sugar appeared to be the most important dietary item in caries aetiology. The frequency of sugar intake was a much more important dietary variable than either the concentration or total quantity of sugar eaten especially in "westernised" communities.

Jackson (1978) held the view that caries initiation and distribution cannot directly and quantitively be related to total sugar (sucrose) consumption or to the frequency of consumption. The genetic factor was more important than the environmental factors in determining whether or not a tooth is at risk to caries.

In an overview of sucrose intake and dental health, Richardson and Cleaton-Jones (1982) found little support for the sucrose-caries hypothesis. A limited relationship was found between increasing mean sucrose intake and increasing caries prevalence, comparing children from different ethnic communities living in low fluoride urban areas.

In another study by Cleaton-Jones et al (1984) on 5 year old South African Indian children, oral hygiene was a stronger

variable than either daily sucrose consumption or frequency of daily sucrose intake. Schröder and Granath (1983) showed that, irrespective of dietary habits, children with clean teeth, and children with suitable dietary habits, (provided they did not have gingivitis with bleeding) might be regarded as not at caries risk. But Richardson et al (1977) found no significant correlation between dietary variables and caries or oral hygiene indices and caries.

The caries prevalence, salivary Streptococcus mutans (S. mutans) and dietary scores of 13 year old Swedish schoolchildren were examined by Kristoffersson et al (1986). No differences were found between the DFS values of individuals with high, moderate or low dietary scores. There was also no statistically significant association between dietary scores and levels of S. mutans.

Lack of specific evidence certainly does not imply that the level of sugar intake has limited relevance to caries development. This lack of correlation between caries and carbohydrate consumptions may be explained (Richardson et al 1977) as follows:

(i) dietary surveys undertaken are over relatively short periods of time whereas dental caries indices are the product of years of disease-treament progressions.

(ii) there is a possibility that recorded diets which are considered low in carbohydrates and sugar, may still contain enough cariogenic foods to promote caries.

Walker (1984) was of the opinion that the factors responsible for the widespread improvements that have occurred in caries prevalence are uncertain. He states,"it would, therefore, seem over-sanguine to hope that children could be persuaded to seriously reduce their intakes of palatable sugar-containing foods, or to reduce or near-eliminate their in-between meal sugary, sticky confections, in return for an as yet uncertain measure of protection against caries".

In a review of studies with alternative sweeteners, Rugg-Gunn and Edgar (1985) found these to be non-cariogenic or virtually so. Therefore the substitution of dietary sugar by alternative sweeteners is desirable as a caries-preventive measure.
Sugar substitutes are still very expensive to use and not all of them have the bulk that sucrose provides in food processing (Green and Leach 1984).

2.1.5.1 **DIET AND NURSING CARIES**

Several workers have considered the aetiology of nursing caries. James et al (1957) found the occurrence of early labial caries of the deciduous incisors to be strongly associated with local factors involving the retention of sweet, sticky and acid substances on the labial enamel surfaces. These authors and

Winter et al (1966) found that the most important factor was the use of sweetened comforters. Goose (1967) also found that children who had infant feeders that contain vitamin syrups or dummies dipped in various sweeteners had a significantly higher prevalence of caries.

A social class difference in the use of sweetened comforters was confirmed by Goose (1967) and Winter et al (1977) in the United Kingdom. They were used more in the lower social classes. However, Silver (1974) failed to demonstrate conclusively a relationship between social class and the use of comforters. Dilley et al (1980) investigated a sample of children in North Carolina, U.S.A. The pattern of decay associated with prolonged nursing-habit had no association with the family background, with the exception of predominantly lower socio-economic conditions.

Adenubi (1982) reported on children with rampant caries in Nigeria. He found the parents of these children belonged to the higher income group and were mostly middle class. The more affluent Nigerian family is able to include refined carbohydrates in the dietary habits of these children who presented with rampant caries. The main aetiological factors implicated were the frequent intake of soft drinks, fruit juices, confectionaries and prolonged bottle feeding. The use

of a sugared dummy or sweetened comforters appears to be uncommon in Nigeria.

James et al (1957) and Goose (1967) found no relationship between the occurrence of labial caries and the incidence of bottle feeding. Derkson and Ponti (1982) reported the use of a nursing bottle as a pacifier to be at the root of the problem. The study did not note the bottle contents. They also observed that the parents of these children with nursing bottle syndrome were younger and had fewer years of formal schooling.

Prolonged (continued beyond approximately eighteen months) bottle feeding or nursing seemed to be a major contributing factor in labial caries as noted by Adenubi (1982), Dilley et al (1980) and Ripa (1978).

Studies of prolonged breast-feeding giving rise to a similar clinical picture of labial caries were noted by Dilley et al (1980), Derkson and Ponti (1982), Gardner, Norwood and Eisenson (1977) and Kotlow (1977). Rugg-Gunn, Roberts and Wright (1985) showed that human milk caused a greater fall in plaque pH in situ and enamel dissolution in vitro than bovine milk. However, it was concluded that the benefits of breast-feeding far outweighed any possible harmful effects which may occasionally be observed.

Richardson et al (1978) assessed the sucrose intake of preschool children in South Africa. It was observed that mean daily sucrose intakes were highest in White children (88g), lower in urban Black (62g) and least in rural Black children (52g). In rural and urban Black groups, those more affluent had higher sucrose intakes than those who were poorer but, in White children, poorer groups had higher intakes. A further observation was that rural Black children had a prevalence of labial caries not significantly different from Whites in spite of a much lower daily sucrose intake. Urban Black children who were generally more affluent than their rural counterparts, had a higher sucrose intake than rural children, but had a very low prevalence of labial caries.

Richardson et al (1981) after studying children in contrasting population groups found significant labial decay occurred in the absence of fruit syrup concentrates in rural Black children who were breastfed for prolonged periods. It was concluded that labial decay had little or no association with fruit syrups or the feeding bottle.

2.1.6 MICROBIOLOGY OF DENTAL CARIES

Many studies have investigated the relationship between caries and the microbial composition of dental plaque.

Van Houte (1980) concluded that organisms comprising the Streptococcus mutans group must be considered as important aetiologic agents based on their highly acid tolerant and acidogenic qualities, their cariogenicity in experimental animals, and their positive correlation with dental caries in humans.

Sutcliffe (1977) observed that an increased caries experience associated with poor oral cleanliness was more marked in the anterior than in the posterior teeth. A significant association between plaque levels of S. mutans and caries was found in children under 10 years of age by Loesche et al (1975). The strongest association was found when plaque was removed from single occlusal fissures. Seventy-one percent of the carious fissures had S. mutans, accounting for more than 10% of the viable flora whereas 70% of the fissures that were caries-free had no detectable S. mutans. Sixty-five percent of the pooled plaque samples from the children with rampant caries had S. mutans accounting for more than 10% of the viable flora, whereas 40% of the pooled samples from children that were caries-free had no detectable S. mutans.

Street, Goldner and Le Riche (1976) examined plaque from the tooth surfaces of the lower second deciduous molar in five year old children. A statistically significant association was found between the presence of S. mutans and caries on the occlusal and

mesial surfaces. S. mutans was found more frequently on carious than on sound surfaces but was present with equal frequency on all tooth surfaces (both carious and sound), thus indicating no significant localization.

The production of acids in rat dental plaque with or without S. mutans was investigated by van der Hoeven and Franken (1982). The lactic acid peak at five minutes after sucrose exposure was significantly higher in the S. mutans group than in the control group. More caries was also found in the rats harboring S. mutans. The results suggest that the rapid production of lactic acid following sucrose intake by the host is an important factor in the cariogenicity of S. mutans.

A longitudinal study was conducted by Mikkelsen and Poulsen (1976) on preschool children every six months during a period of one and a half years. They found that the only parameter which changed in connection with caries development was the ratio of aerobic to anaerobic micro-organisms. This ratio decreased in favour of the anaerobic micro-organisms. The author's interpretation of these results was that anaerobic micro-organisms are more caries conducive, and that dental plaque must have a certain quality to be able to produce carious lesions. There was a lack of correlation between caries initiation and the prevalence of S. mutans. It was also noted that the prevalence of S. mutans in plaque covering

initial carious lesions is low and increases as the carious lesions progress. Loesche et al (1975) confirmed that S. mutans is in some manner involved in human decay at the time when cavitation is present.

Kilian, Thylstrup and Fejerskov (1979) examined the plaque flora of caries-free Tanzanian children exposed to high and low fluoride concentrations. They found that bacteria such as Veillonellae and Neisseriae which potentially metabolize lactate comprised almost one half of the total flora. It was concluded that these bacteria which have the potential to metabolize the lactic acid produced by Streptoccoci and other members of the oral flora may be responsible for the lack of caries activity in these children by decreasing the available acid to the teeth. There were no detectable differences in the flora of plaque samples from children exposed to high or low water fluoride concentrations. Therefore, fluoride does not seem to exert an effect on the prevalence and plaque levels of S. mutans.

Van Houte, Gibbs and Butera (1982) examined plaque from carious and sound tooth surfaces of children with "nursing bottle caries". The findings provide support for the role of S.mutans in initiation of dental caries. Lactobacilli had a limited role in the initiation of caries but a more extensive role in its progression.

Boyar and Bowden (1985) found Lactobacilli, Actinomyces odontolyticus and S.mutans to be associated with progressive carious lesions. Lactobacillus was found to be a more useful indicator of carious progression than S.mutans. The finding of a significantly higher percentage of Veillonella in the plaque of progressive lesions seems to indicate that this genus may not modify the carious process in the plaque of man. This is opposite to the observation made by Kilian et al (1979).

The microbiology of susceptible tooth sites which developed a lesion or remained caries-free is very similar (Milnes and Bowden 1985). The organisms associated with developing lesions of nursing caries were S.mutans, Lactobacillus and Veillonella. Susceptible sites in a caries-active child which did not develop lesions supported a flora which was not different from that of the lesion sites. This suggests that other factors beyond those which allow the establishment of a 'pathogenic' flora are involved in the development of a lesion.

Carlsson, Olsson and Bratthall (1985) studied the relationship between S. mutans and dental caries in children in Mozambique. The distribution of S. mutans among the children varied but was not correlated with the differences in caries prevalence.

In individual children however, there was an association between high counts of S. mutans and the presence of dental caries. It was unexpected that S. mutans was widely distributed and occurred in high numbers in a population with a low prevalence of caries.

Loesche et al (1975) speculated as to the reasons why S. mutans may not always be an indication of clinically detectable cavitation:

1) S. mutans may not be a pathogen in each instance ie. one or more of the genetic groupings may be non-pathogenic in humans.
2) S. mutans may be one member of a mixed infection which is responsible for cavitation.
3) the ability of S. mutans to cause cavitation may be neutralized and/or modified by other members of the plaque flora.
4) the presence of S. mutans may indicate an early stage of infection that cannot be detected clinically (subsurface demineralization).

Although there is a strong association between dental caries and S. mutans, it has not been conclusively shown in humans that S. mutans causes dental caries or is essential for caries to occur. Therefore, "the caries vaccines have the fundamental defect of being directed at an organism which is not the specific cause of dental caries" (Sims 1985).

2.1.6.1 ORAL CLEANLINESS AND CARIES

Zadik (1978) found that 33% of five year olds with good oral hygiene were caries-free in Israel. Of those with fair and poor oral hygiene, 13.9% and 4.4% were caries-free respectively. However, a weak correlation was found between the degree of caries and oral hygiene.

Kleemola-Kujala and Räsänen (1982) in a study conducted on Finnish children showed that the association between the amount of plaque and dental caries was statistically significant at all levels of sugar consumption. It was also found that with increasing total sugar consumption the risk of caries increased significantly only when oral hygiene was simultaneously poor.

Evans et al (1982) in a study of five year old New Zealand children found that there was a consistent trend of a decrease in the Oral Hygiene Index (Green and Vermillion 1960), with increasing frequency of toothbrushing and a corresponding decrease in dmft.

Sutcliffe (1977) in a study of Scottish preschool children found that the children with poor oral cleanliness had a mean dmft of 3.6 compared to a dmft of 1.6 found in children with a good oral cleanliness. Winter and co-workers (1971) found children whose teeth were brushed had significantly less incisor caries than those whose teeth were never brushed.

Axelsson and Lindhe (1974) in a shool-based preventive programme in Sweden demonstrated that the maintenance of a high standard of oral hygiene combined with repeated applications of sodium monofluorophosphate practically inhibits the development of tooth decay in children.

The clinical assessment of the standard of oral cleanliness is highly subjective, as observed by Mansbridge and Brown (1985). These observations were noted in a study on the changes in dental caries prevalence in Edinburgh children over three decades. However, it was shown that there was a strong association between oral cleanliness and dental caries in primary teeth: as the standard of oral cleanliness declined the level of dental caries increased. The improvement in caries experience was greater in those children with good oral celanliness.

In the permanent teeth the association between oral cleanliness and caries was less consistent. The same observations were made in Ayr, another region in Scotland by Mansbridge and Brown (1985).

2.1.7 FLUORIDE AND DENTAL CARIES

In a review of fluoridation as a public health measure to combat dental caries Murray (1970) analysed data published throughout the world in different countries. He concluded that, "the efficacy of fluoridation has been proven beyond doubt".

Various studies have compared the caries prevalence between fluoridated and non-fluoridated communities in the primary dentition.

Jackson, Murray and Fairpo (1974) found the prevalence of rampant caries in 5 year old British children in a fluoride community to be 60% less than it was for a non-fluoride community. Also the number of affected teeth in those with rampant caries in the fluoridated community was 50% lower. Labial decay was also found to be less prevalent in a fluoridated area by McInnes et al (1982). A survey was done by Timmis (1971) in Essex, United Kingdom of 5 year old children in areas of varying fluoride concentrations. He found the caries experience in the fluoride areas (ranging from 0.7 to 5.0ppm F^-) to be 46% lower than that observed in the non-fluoride areas (ranging from 0.1 to 0.5ppm F^-).

McInnes et al (1982) compared the caries prevalence of preschool children in a high and low fluoride area in South Africa.
In the fluoride area, 82% of the children were caries free with a mean dmft of 0.8. In the non-fluoridated area, 28% of the children were caries free with a mean dmft of 5.4. The effect of fluoridation upon the relationship between caries experience and social class was investigated by Carmichael et al (1980) in Newcastle. It was shown that there was no social class trend in caries-free children in the fluoridated area. The difference in

caries experience between children living in the fluoridated and the low-fluoride areas was much greater in the lower social class groups.

It was concluded that adjustment of water fluoride to the optimum level appeared to benefit particularly lower social classes and remove inter-social class differences in dental caries experience. This is contrary to the view held by Hausen et al (1982) in Finland that the sole implementation of water fluoridation cannot remove differences between social classes in caries in the primary dentition. They found children in the highest social class had the lower caries experience in both high and low fluoride areas. Differences between middle and lower social class children were small.

Colquhoun (1985) showed after 15 years of fluoridation in Auckland, New Zealand, there was still a significant correlation between dental health of children and their social class than to fluoridation. The results suggested that fluoridation improved dental health but caries was still influenced by social class. The higher social classes consistently had better dental health in both areas.

Topical fluorides were claimed by Colquhoun (1985) to be just as effective as water fluoridation in preventing dental caries for all socio-economic groups. Tijmstra, Brinkman-Engels and Groeneveld (1978) compared fluoride users with non-users in the

Netherlands and found a 15% lower DFS score in fluoride users than in non-users. Fluoride users belonged to a relatively high socio-economic group.

Weatherell, Robinson and Strong (1984) speculated on the mechanism of action of fluoride so that its use clinically could be of maximum benefit.

The two possible ways in which fluoride increases tooth resistance to decay are as follows:-

1) Fluoride ion replaces the hydroxyl ion in the hydroxyapatite crystal structure to make the enamel mineral more stable and less reactive. This theoretical basis accords with the fact that fluoride is not distributed evenly throughout dental enamel but is concentrated in the outer enamel.

In primary teeth the concentrations are over 1,000ppm fluoride in the outer 30um of primary enamel depending on the concentration of drinking water (Iijima and Katayama 1985) but it is usually less than that of permanent teeth from the same area (Thylstrup 1981).

Topical fluoride treatment did not always notably increase the flouride content of the sound enamel although it did reduce caries incidence. Therefore the layer of high fluoride enamel at the tooth surface is clearly only part of the story (Weatherell et al 1984).

2) Fluoride acts primarily at the site of the carious lesion formation. At the time when the pH at the tooth surface is low and a lesion is about to form, the movement of ions between enamel and plaque will increase greatly. The direction of the dynamic equilibrium will be influenced by the presence of fluoride ions. The presence of fluoride in the fluid phase, either within the enamel or in the plaque fluid, can push the surface reaction towards mineral formation and away from mineral destruction. Presently it seems advantageous to have a fluoride concentration of not less than 0.5ppm in and around the lesion at the time of a carious attack (Weatherell et al 1984).

Fejerskov, Thylstrup and Larsen (1981) in a review also deduced that what appears to be important in reducing the solubility of enamel is the fluoride ion activity in the oral fluid rather than a high content of fluoride in the enamel only.

In the United States, Glenn (1981) strongly advised the administration of prenatal fluoride supplementation for caries immunity and maximum benefit in the primary dentition. The rationale was based on the clinical observation of children, whose mothers ingested fluoride during pregnancy and post-natally, who were totally caries-free as opposed to those children who only ingested fluoride post-natally and had a few carious teeth.

An alternate view is held by researchers who place less emphasis on the incorporation of fluoride into the dental enamel during formation. Among them are Thylstrup (1981), Fejerskov et al (1981) and Weatherell et al (1984). From a clinical point of view, they maintained, it is probably just as effective to fluoridate the enamel by topically applying fluoride to the tooth after eruption as by attempting to do the same by administering fluoride before tooth eruption.

It is presently concluded that the major cariostatic effect of water fluoridation, fluoride toothpaste and mouth rinses can probably be ascribed to regular increases in fluoride ion activity in the oral fluids. Therefore the frequent exposure to low concentrations fluoride rather than the infrequent use of high concentrations was advocated by Silverstone (1983).

2.1.8 LINEAR ENAMEL HYPOPLASIA OF THE PRIMARY INCISORS

"Linear hypoplasia of the deciduous maxillary incisors is characterized by a hypoplastic groove on the labial surface, the occurrence of which corresponds to the birth or neonatal period. Following eruption of these teeth the groove may become discoloured due to bacterial melanin-like deposits or food pigments and may decay to the extent that the clinical crown is destroyed". (Sweeney, Saffir and De Leon 1971).

Mellanby et al (1957) reporting on 5 year old London schoolchildren found the upper incisors, and especially the

centrals, to be much more hypoplastic than the lowers (68% compared to 16%) and the amount of caries increased with the severity of the hypoplasia. It was noted that 4% of non-hypoplastic teeth were carious, compared with 88% of those with severe defects and 38% of those with gross hypoplasia.

The lesion is found almost always in children of the lower socio-economic classes (Sweeney et al 1971) and in relatively remote, underprivileged societies (Enwonwu 1974).

Jelliffe and Jelliffe (1971) stated that linear hypoplasia invaded by caries, is very commonly seen in young children in malnourished communities. Infante (1975) reporting on a survey of Apache Indian preschool children found 19 to 39% had linear enamel hypoplasia of the anterior teeth in the different age groups which appeared to be associated with the high caries attack rate in these teeth.

Infante and Gillespie (1974) in an epidemiological study of four rural Guatamalan villages assessed the distribution and aetiology of linear enamel hypoplasia of primary anterior teeth. The prevalence ranged from 18 to 24% in three villages to 62% in the fourth. The prevalence did not increase with age and no sex differences were observed; siblings of children with the lesion had a prevalence significantly greater than the total study population. This suggested that factors such as infection and diarrhoeal disease operating at the family level enhanced the occurrence of the hypoplastic lesion in children.

Infante and Gillespie (1976) showed that in the Guatamalan preschool children 46% of the total number of carious teeth was observed in the anterior dentition. The anterior caries attack seemed to be associated with the occurrence of linear enamel hypoplasia of the primary maxillary anterior teeth and was prevalent in 31% of the children.

Enwonwu (1974) reporting on Nigerian preschool children up to the age of four found 1% with caries. The maxillary incisors, more than the other primary teeth, were prone to dental decay and were the teeth frequently found to show enamel hypoplastic defects.

Fraser and Nikiforuk (1982) proposed that the aetiology of linear enamel hypoplasia in children in Third World countries may be due to the hypocalcemia resulting from malnutrition caused by gastro-intestinal disorders. In the study of Guatamalan children by Sweeney et al (1971) 73% of children with severe malnutrition had linear hypoplasia of the primary maxillary incisors.

Naujoks, Schade and Zelinka (1967) investigated the chemical composition of enamel from the cervical region of primary teeth. Their findings showed that:

(a) the phosphorous content was significantly lower in this region.

(b) there was a significantly higher content of nitrogen than in the middle or incisal regions.

It was concluded that "the cervical regions of enamel in deciduous teeth show a lower degree of mineralization as well as alterations in structure, which may explain the frequency of the cervical caries of deciduous teeth".

Deciduous maxillary central incisors show a lower degree of crystallite arrangement as compared with samples from permanent incisors (Skaleric et al 1982). It was suggested that this fact could be the reason for high caries prevalence in the primary dentition as it afforded a greater porosity, a higher degree of disorder in the enamel structure, and hence the susceptibility to acid attacks.

Mellanby et al (1957) concluded that "the better the structure of a tooth - that is, the less hypoplasia - the greater its resistance to caries. It is, however, obvious than even a non-hypoplastic tooth may become carious if conditions for the initiation of the disease, whatever these may be, are strong and the resistance of the body (and so of the erupted tooth) is low, whereas a tooth with severe hypoplasia may remain free from the disease if the initiating factors are weak and the bodily resistance is high".

2.1.9 ETHNIC AND SOCIAL CLASS DIFFERENCES

Winter et al (1971) in the study of preschool children in the London borough of Camden found caries in the primary dentition to be socially related, a greater caries prevalence being noted in the lower social groups. The study reported by Holt et al (1982) on children of a similar age group in the same borough, showed slightly fewer children in the lower classes that were caries-free, than in the non-manual or upper class, but this was not statistically significant. Social class determination was based on father's occupation.

Beal and James (1970) found a lower prevalence of dental caries in children living in an area with a higher proportion of social classes I and II and a lower proportion of social classes IV and V. Children from the higher social classes had a greater number of fillings and fewer missing teeth.

Infante and Russell (1974) in the study on American children from urban and rural areas showed that Black children had a higher prevalence of dental caries at each age level than did White children. White children from the lower socio-economic level had a significantly greater prevalence of dental caries than White children from the middle socio-economic level but a lower prevalence than Black children (almost all from the lower socio-economic level).

Gibson et al (1981) examined five year old children in London and found that Negroid and Caucasian children exhibited a similar number of decayed teeth but Asian children had a higher mean value. The Caucasian group had a higher caries experience than the Negroid group but had received more restorative care than both the Negroid and Asian groups. They also found that children from higher socio-economic localities had fewer decayed teeth and a higher level of restorative care than children from lower socio-economic localities.

Silver (1974) demonstrated in three year old children a significant social gradient - the lower the social class, the more the caries. A correlation existed between illness and caries only in the lower social groups. Forty-two percent of the sample had already had a dental inspection previously and the results indicated that it was parents in the higher social groups who were more likely to seek dental treatment for their children. Silver (1982) repeated the study eight years later on three year olds and found that although a trend was still discernible, the difference between the classes in average deft and the proportion caries-free was no longer as marked and failed to reach statistical significance. The proportion of children who had previous dental examinations had risen to 58% and the difference between the social classes was much less marked.

Winter et al (1971) and Silver (1974) showed a higher prevalence of caries in children from overcrowded housing conditions, which was found in lower social groups. The family size however, was not socially related nor did it correlate with a higher prevalence of caries.

Yassin and Low (1975) studied three racial groups, (Malay, Chinese and Indian/Pakistani) in West Malaysia. A distinct variation was demonstrated in caries experience in the permanent teeth of the three groups but in the primary dentition the caries experience was similar. They observed that this was most probably due to the widespread occurrence of rampant caries in the primary dentition which would heavily weight the caries score of the children in all three groups.

Perkins and Sweetman (1986) reported on the ethnic differences in caries occurrence in 5 year olds in north-west London in the United Kingdom. It was found that caries prevalence in the primary dentition was significantly higher in the Asian group compared with the Whites and Afro-Caribbeans. No significant difference was found between the latter two groups.

Sutcliffe (1971) found that children living in areas of urban deprivation had a significantly higher total caries experience than children living in the non-deprived areas of the city and that this trend was independent of oral cleanliness.

Doyle (1977) found that children in the rural area had 44% fewer dmf teeth than those in the urban area and there was a larger portion in the rural area that belonged to the upper social classes.

Doyle (1977) and Zadik (1978) found an association between social class and mean dmf. Those in the higher class had a lower dmft. Doyle (1977) deduced that the rural and urban difference in mean dmf remained large in children with fair and poor standards of oral hygiene but was reduced to 1.5% in those children with good dental cleanliness.

Milen et al (1981) investigating the primary dentition of Finnish children, found that both past caries experience and need for restorative care increased continuously from the highest social class to the lowest. Children of the lowest social class had a dt value about twice that for children in the highest class. Children in both the middle and the lowest social class had received relatively less restorative care than those in the highest class. The most teeth missing due to caries were in the lowest social class.

Hausen et al (1982) found the effects of both naturally high fluoride content of drinking water and social class on caries experience were highly significant. The results showed a lower

caries prevalence in the fluoridated area and the higher social class had the lowest caries experience in both high and low fluoride areas.

Carmichael et al (1980) studied the effect of fluoridation upon social class and caries experience, and found a significantly stronger effect of water fluoridation on caries in the primary dentition in the lower social classes.

Richardson et al (1978) found caries prevalence in White and Black South African children was not related to socio-economic levels; in urban Black children the more affluent children had a higher prevalence of caries than the poorer children; in White children the poorer groups had the higher prevalences of caries; but in rural Black children prevalences did not show a consistent pattern.

Cleaton-Jones et al (1978b) found that labial caries was common in rural Black children but rare in urban Black children while rampant caries (dmft 5) exhibited the opposite pattern. However, for the first three years of life the caries experience was similar in both groups.

Enwonwu (1974) reporting on caries prevalence in Nigerians found a very low prevalence and intensity of dental caries among

impoverished, underprivileged peasants in the villages. In marked contrast to the findings in the village communities, educated Nigerians of high socio-economic background as well as the village children attending boarding schools located in the major cities had a high prevalence and intensity of dental caries. The sugar and sugar confectionery are luxuries which the village communities cannot readily afford but are being consumed with increasing frequency by the more affluent groups.

Louw and Moola (1979) in a study of residents in the Cape Flats, South Africa found no pattern of higher and lower caries prevalence in the different socio-economic groups.

2.1.10 **SERVICE UTILIZATION**

Beautrais, Fergusson and Shannon (1982) investigated the utilization of preschool dental services in New Zealand. There were highly significant associations between non-utilization of dental care services and measures of family social background and the quality of care provided to the child. Some of these factors included low gross family income; single parent family; and maternal attitudes to dental health which was one of the primary determinants of standards of child dental health.

Beal and Dickson (1974) studied parental awareness of the dental needs of their five year old children and found many of the mothers had an over-optimistic opinion of the child's dental condition and that the lack of knowledge about existing dental disease was a major factor in the gap between the dental need of the community and the demands made for treatment.

Fanning and Somerville (1974) found that city children were more likely than those from the country to have visited the dentist within a period of six months. City and country children who had taken fluoride tablets were also more likely to have visited the dentist previously or within six months than those who had not taken fluoride tablets.

Yassin and Low (1975) and Beal and James (1970) found a reluctance of those in the lower socio-economic group to accept or seek restorative care for the primary dentition.

Silver (1974) found that 42% of the sample investigated had already had a dental inspection and the results indicated that it was parents in the higher social groups who were more likely to seek dental treatment for their children.

2.1.11 SEX DIFFERENCES AND DENTAL CARIES

Infante and Gillespie (1976) found that in the Guatamalan study, boys had a slightly higher prevalence of dental decay. Holm (1975c) found no significant differences between the sexes except for the increase in deft between the age of three and four years, which was larger in the boys. Milen et al (1981) found no clear differences between the sexes in decayed and filled teeth but that boys had lost more teeth due to decay than girls.

Gibson et al (1981) found girls to have a slightly higher mean number of filled teeth but differences were not statistically significant. Beal and James (1970) found girls had a lower mean deft than the boys, but the differences were not statistically significant.

Toth and Szabo (1959), Winter et al (1971), Silver (1974), Sutcliffe (1977), Zadik (1978) and Cleaton-Jones et al (1978a, 1978b) found no sex difference in dental caries experience in the primary dentition.

The literature shows no evidence of significant sex differences in the prevalence of dental caries in the primary dentition.

2.1.12 DISTRIBUTION OF CARIES IN THE PRIMARY DENTITION

Toth and Szabo (1959) observed that caries was seen in children younger than two years of age, prior to the completion of the

primary dentition. The df count displayed a steady increase with advancing age up to six years, thereafter the df curve became somewhat flattened. After six years of age no new tooth units were attacked by caries, but rather there was a progress of decay in the carious teeth.

Caries attacks those primary teeth which erupt first. In children two years of age the anterior teeth were more heavily attacked than the posterior teeth (Toth and Szabo 1959, Infante et al 1975). Later a steady increase in the attack rate of the posterior teeth has been observed, so that children three to five years of age had caries increments located mainly in the posterior teeth. (Infante et al 1975, Holm 1975c).

Toth and Szabo (1959) showed that at three years of age, 75% of the total molar caries experience was contributed by the lower teeth and only 25% by the upper teeth. With increasing age there was a trend toward eliminating this difference. Mellanby et al (1957) found that the percentage of carious teeth in the upper and lower jaws was equal in five year olds.

Halikis (1965), Holland and Crowley (1982) and Gibson (1981) showed that the phenomenon of bilateral occurrence of dental caries in the primary dentition of both males and females was statistically significant. The phenomenon was demonstrated whether the caries experience was expressed as demf teeth or tooth surface.

The primary second molars were the more frequently decayed teeth (Holms 1975c, Holland and Crowley 1982). In the study by Toth and Szabo (1959) the second molars contributed 40% of the total caries experience of the primary dentition. This was followed in decreasing frequency by the first molars (28%), central incisors (17%), lateral incisors (11%) and cuspids (5%).

Gibson et al (1981) found the second molars contributed 52% to the total dmft and first molars 34%. Twice as many mandibular molars as maxillary molars were missing in five year olds.

Holland and Crowley (1982) found a similarity in the amount of caries present in the maxillary and mandibular molar teeth. A slightly higher prevalence occurred in the mandibular molars compared with their maxillary counterparts in four year old children.

Toth and Szabo (1959) found that there was no conspicuous difference in the caries attack rate of the lower first and second primary molars. Mandibular molars became carious earlier than the maxillary molars.

The upper anterior teeth have been found to be more carious than the lower anterior teeth and the lower posterior teeth more carious than the upper posterior teeth (Mellanby et al 1957, Toth and Szabo 1959, Hennon et al 1969).

The maxillary incisors have a high degree of attack rate with 22% of centrals affected and 13% of laterals (Holland and Crowley 1982).

The canines and mandibular incisors account for a relatively low proportion of the caries present (Holland and Crowley 1982, Toth and Szabo 1959, Hennon et al 1969, Mellanby et al 1957). The lower second molar was the most carious tooth. Mellanby et al (1957) found 70% of lower second molars carious in five year old children and Hennon et al (1969) found 57% carious in children younger than four years of age. The mandibular second molar had a higher caries prevalence than the maxillary second molars (Hennon et al 1969).

The occlusal surfaces were the first and the most affected tooth surfaces (Holm 1975a, Hennon et al 1969, Holland and Crowley 1982) in the age groups four years and younger. Holland and Crowley (1982) in a study of four year old children found that there was also a significant occurrence of caries on the other tooth surfaces. The distal surface of the first molars were more caries prone than the mesial of the second molars. The percentages recorded were as follows: distal of mandibular first molar (22%), mesial of mandibular second molar (16%), distal of maxillary first molar (18%), mesial of maxillary second molar (12%). Early involvement of posterior interproximal lesions could only be detected on radiographs as shown by Hennon et al (1969).

2.1.13 SITE SPECIFICITY AND GENETICS

Berman and Slack (1973) in a longitudinal study reported on the tooth surface susceptibility to caries attack of 353 school girls age 11-15 years in Britain. Only teeth that were caries free at the first examination and teeth that erupted between the first and second examination were observed. They found the occlusal surfaces of permanent teeth were the most susceptible to attack especially the first and second molars.

Approximal surfaces of posterior teeth showed varying degrees of susceptibility. Sites such as buccal and lingual surfaces of lower premolars and anterior teeth were hardly ever attacked by caries. Of the anterior teeth, the most susceptible surface was the palatal surface of the upper lateral incisor.

Akpata and Jackson (1978) studied the prevalence and distribution of caries in 820 Nigerians aged 15-21 years. They found that contrary to observations in most Western countries, approximately twice as many second permanent molars as first permanent molars were carious, at all ages. This distribution was observed mainly in subjects with a low caries experience (mean DMF $\leq$ 5). In subjects with higher caries experience, almost equal numbers of first and second permanent molars were affected.

Caries prevalence and distribution were studied in 761 South African high school pupils aged seventeen years in four ethnic groups by Cleaton-Jones and Walker (1980). They observed that among rural Black pupils, dental caries was approximately three times more common in the permanent second molars compared with permanent first molars. In urbanized Black, Coloured, Indian and White subjects, the molars were approximately equally affected.

Akpata and Jackson (1978) concluded that the increased vulnerability of the second molar to caries reported in African communities is difficult to explain in purely environmental terms and that genetic factors may be involved.

Bordoni et al (1973) reporting on the prevalence of dental caries in twins, found little variation in the def averages between twin groups and controls, and that the environment had a strong bearing on caries experience in primary teeth. The intra-pair differences in surface caries in controls were significantly greater than in twins and it was established that a similar environment for twin pairs reinforce phenotypic similarities. He concluded, "the genotype appears to be a determining factor in the caries rate of advance and in caries susceptibility or resistance. Although the environment played an important role as well. A genetic component appears to affect caries lesions in certain sites (proximal and occlusal)".

Jackson, Burch and Fairpo (1979) reported on the distribution of caries between the right/left homologous mesial and distal sites on permanent canines, premolars and molars. They found that the distribution of caries between right/left homologous sites was more commonly asymmetrical than symmetrical. Depending on the anatomical site, the ratio of asymmetrical to symmetrical attacks became effectively constant with age from about the age of twenty years and above. They concluded that genetic factors determine which teeth, and which sites of teeth, were at risk in a given environment with respect to attack by dental caries.
The study by Beck and Drake (1975) indicated that the caries pattern in a random sampling of occupied households in North Carolina was consistent with an infectious and nutritional model of causality. The genetic explanation, while represented in the data, was not as consistent with the findings as the infectious and nutritional explanations.

Jackson (1978) relating genetic predisposition to dental caries writes, "evidence is striking and can be explained only on the basis that each site on each tooth is genetically endowed with a characteristic that determines whether or not it is at risk to caries". He further states that the prevalence of mirror image patterns of tooth decay are in complete accord with the genetic hypothesis and cannot be explained on the basis of the acid theory or any other environmental theory.

Sofaer (1982) commented that a significantly greater accordance for pattern of site attack between identical as opposed to fraternal twins did not imply a pattern of caries vulnerability or resistance intrinsic to the dental hard tissues. It could presumably be imposed by a variety of inherited characteristics such as tooth morphology, tooth position and salivary constitution, as well as more indirectly through such environmental factors as diet and oral hygiene practices.

Jackson (1978) commented, "our studies do not rule out completely the role of environmental factors in the timing of distal caries although they do rule out environmental factors in the determination of the siting of caries".

Cole et al (1977) in a study of patients with immune dysfunction suggested that individuals suffering from immunoglobulin dysfunctions are, in general, more susceptible to dental caries and are found to harbour Streptococcus mutans with greater frequency than normal individuals.

The studies to date indicate that while genetic factors may play a role in the predisposition to dental caries, the dominant factors appear related to infectious and dietary states.

2.1.14 THE CHANGING PATTERN OF DENTAL CARIES

Lökken and Birkeland (1978) noted a reduction in dental caries and restorative needs in Norwegian children which was paralleled by the increased use of fluoride.

Although Norway has sub-optimal fluoride levels in the water, it was shown that alternative methods of fluoride prophylaxis efficiently improved community dental health.

Mansbridge and Brown (1986) also noted a decrease in caries experience in Scottish children over a 25 year period. A marked improvement in oral cleanliness and in the levels of dental care was observed. A social class difference in caries experience was still present with the upper classes showing the greatest improvement and the lower classes the least. However, it was noted that the decrease in caries experience had started before the increased emphasis on dental health education and other preventive methods (fluoride toothpaste, etc). They concluded that "in common with other diseases, we are observing a cyclical effect".

A comparison of trends in the prevalence of caries and restorations in young adult populations of several countries were investigated by Gordon and Newbrun (1986). The trends observed appeared to be influenced largely by the extent of

caries-preventive measures (particularly fluorides) and to a lesser degree by sugar utilization and the availability of dental personnel.

A report was compiled by an international Joint Working Group (FDI and WHO 1985) to identify the changes in oral health in children and factors associated with these changes during the past 20 years.

The nine developed countries (Australia, U.K., U.S.A., Denmark, etc.) showed apparent substantial reduction (30-50%) in the prevalence of dental caries in 5 and 12 year old children. Developing countries (Nigeria, Thailand) appear to have a considerable increase in dental caries.

It was observed that the decrease in caries was probably associated with the following common factors:

(i) availability of fluoride, especially the widespread use of fluoride dentifrices.

(ii) availability of dental services.

(iii) increased 'dental awareness' coupled with greater utilization of dental services

(iv) the preventive approach adopted by practitioners.

The changing trends emphasizes the need for regular monitoring of oral health status in all countries and better personnel planning (FDI and WHO 1985, Gordon and Newbrun 1986).

The future treatment needs of adults were queried by Katz (1986). He acknowledged the decline in caries experience in parts of the world but states, "we are most likely experiencing either a stable decline which has been achieved or a decline which will continue". At present there are only assumptions on which to work.

However, these changes in caries trends will change the treatment needs of patients including the periodic six-monthly examinations (Drug and Therapeutics Bulletin 1986). These periodic examinations may be needed less frequently.

Alanen, Tiekso and Paunio (1985) in Finland are of the opinion that teeth protected against dental caries during the first years after eruption have a good resistance against caries attack in later years. Therefore, the effect of the prophylaxis given today which resulted in caries reduction in some industrialized countries may be relatively permanent.

2.2 GINGIVITIS, SOFT DEPOSITS AND ORAL HYGIENE PRACTICE

A high to very high prevalence of periodontal disease persists in all populations throughout the world, although the problem seems to be greatest in the developing countries (Barmes 1977).

The World Health Organization Global Oral Data Bank shows "generally low or moderate levels of bleeding or calculus" in

industrialized countries and 'generally high levels' in developing countries (FDI and WHO 1985).

2.2.1 INDICES FOR ASSESSING THE PERIODONTAL STATUS

The World Health Organization in the book, Oral Health Surveys (1977) divides the mouth into six segments in applying the scoring methods for soft deposits, calculus, intense gingivitis and advanced periodontal involvement. Each assessment is made independently. In preschool children soft deposits and gingivitis are the more frequent assessments in surveys.

2.2.1.1 GINGIVITIS

The Oral Health Surveys (WHO 1977) assesses intense gingivitis by visual examination of the buccal and/or lingual aspects of each segment with the aid of a mouth mirror only. The categories are presence or absence of gingivitis with no indication of the degree of severity.

The Gingival Index (GI) system (Löe and Silness 1963) was introduced to distinguish between the quality of the gingiva (severity) and the location (quantity) as related to the four surfaces which make up the total circumference of the marginal gingiva of a tooth (Löe 1967). The examination is done with the aid of a periodontal probe.

A modification of the GI was introduced by Lobene et al (1986) to increase the sensitivity in the low-region of the scoring scale, and to eliminate the "bleeding on pressure" step in the assessment. Thus the Modified Gingival Index (MGI) provides a completely non-invasive scoring procedure as no periodontal probe is used.

2.2.1.2 **SOFT DEPOSITS**

The state of the oral hygiene can be evaluated by the amount of plaque present using several indices (WHO 1979). The Plaque Index (Pl) (Silness and Löe 1964) is based on the same principle as the GI, namely to distinguish between the severity and the location of the soft deposit aggregates (Loë 1967). This Pl matches the GI.

The Oral Hygiene Index (OHI) (Greene and Vermillion 1960) and subsequently the Simplified Oral Hygiene Index (OHI-S) (Greene and Vermillion 1964) were developed to serve as a systematic approach to quantitate the oral cleanliness variable in population studies (Greene 1967). The non-descript term "debris" was used for the soft deposits attached to the teeth. The OHI-S has two components, the Debris Index (DI) and the Calculus Index (CI). These indices are based on numerical determinants representing the amount of debris or calculus found on six preselected tooth surfaces.

The average individual or group debris and calculus scores are combined to obtain the OHI-S with values ranging from 0-6.

Tsamtsouris, White and Clark (1980) undertook a comparative study between the plaque indices of Silness and Löe (1964) and Greene and Vermillion (1960) and found strong agreement between the two indices and a prediction from one index to the other was excellent.

The World Health Organization (WHO 1977) outlines the criteria for the assessment of soft deposits as follows, "If soft deposits are clearly visible to the unaided eye at the gingival margin of one or more teeth within a segment, score 1 for the segment and if no soft deposit is detected visually within a segment, score 0. The only instrument used is a mouth mirror". This method divides the mouth into six segments: one anterior and two posterior segments in each jaw. The teeth are not dried before scoring and there is also no indication of the quantity of soft deposits, only the presence or absence.

2.2.1.3 **INDEX OF TREATMENT NEEDS**

The Periodontal Treatment Need System (PTNS) was developed to determine periodontal therapeutic needs of populations by estimating types of treatment needed and the time required for performing it (WHO 1979). Thus the calculation of manpower

requirements and costs could be calculated. Subjects are classified into three treatment classes on the basis of the presence or absence of plaque, calculus, or overhangs, gingival inflammation and periodontal pockets deeper than 5mm. All gingival areas on each tooth are probed. The lowest score of the tooth in a quadrant determines the treatment class of that quadrant.

In 1982, Ainamo et al reported on the development of the World Health Organization's Community Periodontal Index of Treatment Needs (CPITN). It was recognized that for population studies and field trials, having the objective of developing a method for the evaluation of treatment needs, recording of plaque was considered less important than the assessment of its consequences, gingival bleeding and pocket formation. Gingival recession and tooth mobility were also excluded from the recordings but calculus was included. To score these parameters a special probe was developed, the WHO periodontal examination probe.

Subjects are classified into different treatment need categories according to the highest score recorded during the examination. The categories range from 0 (no treatment) to III (complex treatment).

The CPITN is designed to assess periodontal treatment needs rather than periodontal status.

Manji and Sheiham (1986) used the CPITN in the examination of Kenyan children aged 6-15 years. The results were extrapolated to the child population of Kenya and used to calculate the amount of resources required to treat this population. The findings showed that, "the CPITN was easy to use, simple, quick and reproducible". However, calculations for manpower and resource planning by extrapolation lead to estimates that were quite out of proportion to the public health importance of the periodontal diseases in the population. It was concluded that using CPITN for planning purposes to provide care was excessive by any standards and a re-evaluation of the current thinking was needed.

Comparative data relating to periodontal disease is not available because of the various methods and criteria used to assess the condition. It is hoped the CPITN will be adopted by various countries to provide the basic information needed (FDI and WHO 1985). The CPITN is, however, not applicable to preschool children.

2.2.3 DEVELOPMENT AND BACTERIOLOGY OF GINGIVITIS

Loë et al (1978) in a longitudinal study compared the frequency pattern and rate of development of periodontal disease in two populations, viz, Sri Lankan teenagers and Norwegian students. The study shows that destruction of the periodontium and the

rate of progress was greater in the Sri Lankans. They concluded that without interference the destruction of the periodontium progresses at a relatively even pace and is continuous with age. Whether this was due to the cummulative effect of plaque and calculus or to an increase in susceptibility related to age was unclear.

Mackler and Crawford (1973) and Matsson (1978) found that although plaque development in preschool children is similar to that observed in adults, gingivitis develops much more slowly. The preschool children resemble the adults more in their cellular than in their vascular inflammatory response. The adult tissue has an approximately equal number of plasma cells and lymphocytes, while the child tissue has approximately seven times as many lymphocytes as plasma cells.

The majority of the lymphocytes (70%) were indicative of a T-cell population. The child tissue response resembled that of an early lesion of gingivitis in adults. (Longhurst, Johnson and Hopps 1977, Seymour, Crouch and Powel 1981).

Whether the host tissue response was due to the cummulative effect of plaque and calculus or to an innate resistance and presence or absence of host response in the young age group was unclear (Mackler and Crawford 1973, Bimstein, Lustmann and Soskolne 1985).

In a review of the periodontal conditions of young people, Cutress (1986) concluded that the epidemiological data implicated plaque as the primary aetiological agent in gingivitis. There was little evidence of the involvement of other factors except that host resistance or susceptibility in the young may modify the microbial effect.

The development of the oral microbiota from infancy to adulthood was reported on by Socransky and Manganiello (1971). It was shown that the microbiota of the oral cavity changes as the individual grows and the oral cavity undergoes physiologic changes (pre-eruption state to dentate to edentulous).
The bacterial populations were dependent upon the frequency of introduction of the organisms and conditions present in the oral cavity. The proportions of the predominant cultivable organisms from the gingival crevice area of the preschool child appear to generally resemble that of the adult with the exception that spirochaetes and Bacteroides melaninogenicus were not present in all children. Spirochaetes appear to increase in incidence with age.

Moore et al (1984) studied the bacteriology of experimental gingivitis in children and found children to be more resistant to gingivitis than adults. The floras of the children as a group were statistically significantly different from those of

the adults. Several of the anaerobic vibrios and Capnoacytophaga increased in frequency with increasing GI scores in children. This may indicate that floras with larger proportions of these gram-negative species are less potent agents of gingivitis production than are the more gram-positive floras associated with the more rapidly developing gingivitis in adults.

The incidence of some predominant species (Actinomyces, Fusobacterium nucleatum) correlate with increasing GI scores in both children and adults; therefore, host resistance still could play the greater role, or the causative agents could be different in the two populations

Socransky and Manganiello (1971) observed that the reason for the late establishment of some organisms was not clear, but that conditions for their growth may not be provided for by the gingival crevice in young children and that repeated transmission of the organisms were necessary.

A comparison of gingival inflammation at deciduous and permanent teeth of children in the mixed dentition was done by Matsson and Goldberg (1986). The results indicated that structural differences, if any, between the gingiva at deciduous teeth and that at permanent teeth had no impact of clinical significance on the gingivitis reaction.

It was concluded that the lower tendency to develop gingivitis in preschool children is explained by age-related bacteriologic differences and/or differences in the immune response rather than by morphologic differences between the gingiva at deciduous and permanent teeth.

2.2.4 PREVALENCE OF GINGIVITIS IN PRESCHOOL CHILDREN

Poulsen and Moller (1972) in a study of three year old Danish children found that 25% of all gingival units showed bleeding on slight pressure with a periodontal probe ie. G.I. of 2 according to the Loë and Silness index (1963).

Holm (1975c) reporting on the gingival state of Swedish children aged 3-5 years found the percentage of children with score 2 was as follows: 3 years - 35%, 4 years - 34% and 5 years - 23%. The percent of gingival units with score 2 was as follows: 3 years - 8%, 4 years - 4% and 5 years - 1%.

Hugoson et al (1981) reporting on Swedish children found 36% of three year olds and 64% of five year olds had gingivitis on one or more tooth surfaces: and 64% of three year olds and 36% of five year olds were free of gingivitis.

Gibson et al (1981) examined five year old children in London and found 47% had marginal gingivitis in one or more buccal segments.

Hugoson et al (1981) found the most common areas for the occurrence of gingivitis was on the lingual surface of the second molar in the lower jaw (25%) and the buccal surface of the second molar in the upper jaw (10%).

In a South African study, Moola (1981) examined 6 year old children of different communities. The findings recorded for intense gingivitis were 72% in Blacks, 15% in Coloured, and 0% in Whites.

Manji and Sheiham (1986) found 88.6% of 6 year old Kenyan children presented with gingival bleeding.

In Sri Lanka, Amaratunge et al (1986) examined preschool children aged 3-5 years old. The proportion with gingival bleeding was 34% in the 3 year olds, 53.8% in the 4 year olds and 62.4% in the 5 year olds. The mean number of segments with gingival bleeding was constant between the age groups.

2.2.5 PREVALENCE OF ORAL CLEANLINESS

Poulsen and Moller (1972) in a study of three year old Danish children found between 32.6 and 39.5 percent of all tooth surfaces examined showed a layer of plaque ie. PlI 2 (Silness and Löe 1964).

Hugoson et al (1981) reporting on Swedish children found 52% of three year olds had plaque on one or more tooth surfaces and 48% were plaque free; of the five year olds only 20% were plaque free. Zadik (1978) examined five year old Israeli children and found 17% had "good" oral hygiene, 69% "fair" and 14% "poor".

Evans et al (1982) in a study of five year old children in New Zealand found the OHI (Greene and Vermillion 1960) to range from 1.3 to 0.8. Gibson et al (1981) found plaque to be visible in 72.7% of five year old children in Britain.

In a report of three and four year old children in Scotland Sutcliffe (1977) found there was no group variation in the pattern of oral cleanliness and the average OHI-S (Greene and Vermillion 1964) was 1.0.

Moola (1981) examined 6 year old South African children from different communities. Soft deposits were found in 100% of Blacks, 90% Coloureds and 75% Whites. Calculus was recorded as 17.5% in Blacks, 25% in Coloureds and 11% in Whites.

The study by Manji and Sheiham (1986) of 6 year old Kenyan children used the CPITN which does not record plaque but expresses treatment needs. It was found 1.1% needed no treatment, 88.6% required oral hygiene instruction and 10.2% had calculus requiring a scaling.

Amarantunge et al (1986) examined 3-5 year old Sri Lankan children. Almost all children had soft deposits independent of age. The proportion with calculus was 18% among 3 year olds, 33.1% among 4 year olds and 51.8% among 5 year olds. The mean number of segments with soft deposits (4) was constant between the age groups, while the mean number of segments with calculus increased from 0.4 for 3 year old to 1.2 for 5 year old children.

2.2.6 RELATIONSHIP BETWEEN SOFT DEPOSITS AND GINGIVITIS

Although the plaque development is similar to that observed in adults, gingivitis develops much more slowly in children. Mackler and Crawford (1973), Matsson (1978) and Bimstein et al (1985) show no correlation between the amount of plaque and the degree of gingival inflammation in preschool children.

Zadik (1978) found a significant difference in the presence of gingivitis between five year old children with different levels of oral hygiene. Those with poor as opposed to those with good and fair oral hygiene were more likely to have gingivitis.

The studies by Axelsson and Lindhe (1974) and Lindhe, Axelsson and Tolskog (1975) demonstrated that regular professional oral prophylaxis of schoolchildren resulted in the establishment and maintenance of excellent oral hygiene standards. Low plaque index scores were associated with negligible signs of gingivitis in the test group, whereas in the control group higher plaque scores with signs of gingivitis were recorded.

Poulsen and co-workers (1976) studying the effect of professional toothcleansing in seven year old children after 1 year indicated that the improvement in oral hygiene was great enough to improve the gingival conditions.

Hugoson et al (1981) found 52% of three year olds and 80% of five year olds have plaque on one or more tooth surfaces, and 36% and 64% have gingivitis on one or more tooth surfaces, respectively.

Moola (1981) studied 6year old South African children from different communities. The observations showed soft deposits were present in 100% of Blacks, 90% of Coloured and 75% of Whites but the gingivitis was present in 72%, 15% and 0, respectively.

In Sri Lanka, Amaratunge et al (1986) in an examination of preschool children found soft deposits present in all children but gingivitis ranged from 34% in 3 year olds to 62.4% in 5 year olds.

This discrepancy in the amount of soft deposits and the amount of gingivitis recorded in studies led to the omission of the recording of soft deposits in the CPITN system. However, it takes into consideration the consequences of soft deposits namely gingival bleeding and pocket formation (Ainamo et al 1982).

2.2.7 ORAL CLEANLINESS AND SOCIAL CLASS

Beal and James (1970) in a study of five year old children of different social classes in Britain found that children in the higher social class had the highest proportion of "good" dental cleanliness. Those in the lower social class had "poor" dental cleanliness but the highest number of children with "good" gingival health.

Zadik (1978) found no association between oral hygiene and social class in five year old Israeli children.

Sutcliffe (1977) in a study of Scottish preschool children found that in the non-deprived areas 23% of children had good oral cleanliness and 11% had poor oral cleanliness. In the deprived areas the proportions were 14% and 20%, respectively.

An international joint working group (FDI and WHO 1985) reported on the changing patterns of oral health. It was shown that the major contrast related to 'generally low or moderate levels of bleeding or calculus' in industrialized countries and 'generally high levels' in developing countries. It would appear that periodontal disease was formerly high in all countries and has been reduced progressively in industrialized countries during the last 40 years, as toothbrushing and other oral hygiene procedures have been adopted as the social norm.

Mansbridge and Brown (1985) reported on changes in dental caries prevalence in Edinburgh children over three decades. It was found that oral cleanliness standards had improved in the social classes I - III but there was little change in the social classes IV and V.

2.2.8 **ORAL HYGIENE PRACTICE**

Winter et al (1971) and Silver (1974) found no difference between the social groups for the age at which parents commenced brushing their children's teeth. Winter et al (1971) found the teeth of children from the higher social groups were brushed significantly more frequently each day. Silver (1974) found no difference in the brushing habits between the social groups with regard to frequency of brushing.

He found that 80% of parents said their three year old children cleaned their teeth at least once a day and only 2% never cleaned their teeth. In a repeat study eight years later Silver (1982) found an improvement in oral hygiene practice, with 88% of children brushing their teeth daily and only 0.4% having never brushed their teeth.

Fanning and Somerville (1974) compared dental health factors in urban and country children in Australia. The findings were as follows:

1. the highest occurrence of tooth brushing was twice daily, after breakfast and at bedtime.
2. 11% of city and 19% of country children rarely or never used a toothbrush and between 3 - 7% of country children did not possess a toothbrush.
3. Children who had taken fluoride tablets received more regular toothbrushing assistance from parents.
4. 40% of city and country children aged 5-6 years and 30% aged 2½-5 years who had not taken fluoride tablets never received help with toothbrushing.

Holm (1975a) in the study of Swedish four year olds found that 51% brushed their teeth at least twice a day and 1% never or seldom brushed. 73% always received help from parents and 4% never. In 70% of children toothbrushing had been started between one and two years of age.

Blinkhorn (1978) found that 60% of a sample of preschool children in England had begun brushing at or before the age of two years. Forty-four percent of the mothers checked their children's mouths on a daily basis to assess the level of oral cleanliness.

MacGregor and Rugg-Gunn (1979) in a survey of toothbrushing sequence in children and young adults who were uninstructed found that 50% of subjects began brushing in the anterior labial areas. There was a strong tendency to move the brush from left to right. Occlusal surfaces were brushed consecutively and the lingual areas were rarely brushed (45% neglected to clean them at all).

A study was done to assess the factors influencing the transmission of the toothbrushing routine by mothers to their preschool children by Blinkhorn (1980). It was found that 62% of the mothers in the study considered their child capable of using a toothbrush without maternal assistance because toothbrushing was viewed as a simple skill requiring little manual dexterity. The transmission of the toothbrushing habit was best carried out by mothers with small families who themselves attend a dentist regularly. It was concluded that when giving advice to parents it should be noted that social class, educational attainment and employment are apparently not barriers to effective dental health education.

Kleber et al (1981) noted the duration and pattern of toothbrushing in unsupervised children using a gel or paste dentifrice. There was no preference in the use of dentifrice. The children had established toothbrushing habits which were quite consistent. The brushing sequence lasted for about one minute per brushing but 38% of the tooth surfaces were not brushed. The lingual surfaces were the areas most often missed, whereas the buccal, labial and mandibular occlusal surfaces were the areas brushed most thoroughly.

Mansbridge and Brown (1985) concluded that the improved standards of oral cleanliness noted in Edinbrugh over the last three decades would seem to indicate that dental health education is starting to achieve its objective.

2.2.9 PARENTAL INFLUENCE AND ASSESSMENT OF CHILD'S DENTAL HEALTH

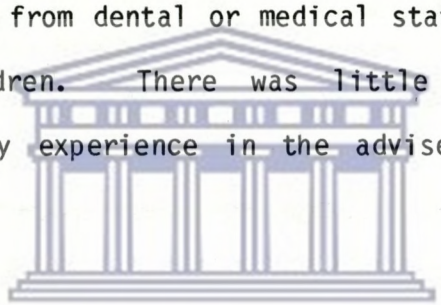
Blinkhorn (1978) studied the influence of social norms of toothbrushing behaviour of preschool children. He found that the practice of toothbrushing was widespread and mothers played the control role in teaching the brushing routine. The social norms concerning oral hygiene were imprecise. Thirty-six percent of mothers were unable to comment on the expected pattern of toothbrushing. This indicate that mothers had no social support for teaching their children to brush and no

information on how brushing should be carried out. Reasons given by mothers why their children were using a toothbrush were:

1. 46% - to maintain oral cleanliness
2. 25% - to prevent dental decay

Only 20% of the total sample of mothers had received any advice on how to look after their children's teeth.

Silver (1982) found only 18% of mothers could recall having received advice from dental or medical staff on how to prevent decay in children. There was little difference in the children's decay experience in the advised and "non-advised" groups.



Evans et al (1982) in a study in New Zealand found that there was a strong correlation between parents' qualitative assessment of their children's dental health and the dmft index. The mean dmft values of 0.57 to 9.08% corresponded to parental assessment of "very good" through to "very poor". Parents also appeared to be well informed regarding the treatment requirements of their children. It was also found that the frequency of parental checks on toothbrushing effectiveness had limited influence on the OHI (Greene and Vermillion 1960) and dmft.

King (1982) in a study in Britain of the influence of maternal age on dental health behaviour in infancy found that children of teenage mothers may be particularly at risk of developing dental disease. These mothers were also less likely to take advantage of treatment services if disease occurred. It was found that 64% of teenage mothers attend the dentist only if they have dental problems compared with 16% of older mothers. Teenage mothers also have less favourable infant feeding practices than the older mothers:

1. 58% compared with 23% added sugar to milk.
2. 20% compared with 7% used a sweetened dummy.
3. 24% compared with 4% had given their babies sweets under the age of three months.

King (1982) showed that 76% of children from non-manual social backgrounds were caries-free compared with only 28% of those from routine manual social backgrounds. Older mothers had more caries-free children (58%) when compared with teenage mothers (20%). Mothers who had continued with their full-time education beyond the age of sixteen had more caries-free children (74%) compared with mothers who had left school by the age of sixteen (41%).

Reporting on the sociological implications of dental preventive advice for mothers Blinkhorn (1981) stated, "Mothers often have the key role within the family when it comes to health matters, so that they will determine what health-related behaviour their children will adopt. The two important routines which will affect the dental health of preschool children are first their toothbrushing behaviour and secondly their pattern of sugar consumption".

2.3 ANTHROPOMETRY AND NUTRITION

2.3.1 GENERAL HEALTH

The state of nutrition has been widely recognized as having a major influence on communities in developing and industrialized countries alike. The health consequences of malnutrition go beyond the specific nutritional diseases themselves. Undernutrition lowers the production of workers, impairs the psychomotor development of infants and young children and increases the susceptibility of individuals to infectious diseases (Thomas 1984).

The effects of diet on growth and associated health is discussed by Walker and Stein (1985). The consumption of Western diets is more conducive to a more rapid growth in the young, increased height at maturity, but a high frequency of obesity and low rates of infections in the young. The consumption of an unrefined Third World diet often results in a converse of the

former characteristics. There are numerous other factors that influence this association. The conclusion reached was that, "apart from extreme deficits, slower growth associated with consumption of traditional high-fibre, low-fat intakes is not essentially deleterious".

In South Africa, malnutrition as measured in its various forms is more frequently recorded in the rural Black child. Pettifor and Ross (1983) observed a high prevalence of hypocalcaemia and elevated alkaline phosphatase values in rural paediatric populations. Calcium intakes are generally low in these children (less than 500mg per day) and well below the recommended dietary allowances (800mg/day). The majority of rural children show no clinical signs of calcium deficiency although they might manifest biochemical evidence. This observation was also made by Walker (1983), that clinical rickets of significance as regards public health is uncommon in these rural communities.

Nutritional anaemias are an important manifestation of malnutrition in preschool children. Van der Westhuyzen et al (1986) investigated the prevalence of anaemia and deficiencies of iron, folate and vitamin B_{12} in rural Black preschool children in the Transvaal. Anaemia was highly prevalent with 39% having haemaglobin levels below 11,1g/dl and about 10% were considered

iron deficient. It was also found that one in four children was folate-deficient. The results of the study provided a further indication for the implementation of fortification of the staple food of these children, viz maize meal.

Although studies have shown nutritional deficiencies in the preschool children, the clinical implications are not always clear. Pettifor and Ross (1983) and Walker (1983) on the subject of low dietary calcium intake are of the opinion that controlled studies of calcium supplementation should be conducted to rule out any effects of low-calcium diets on growth, dental caries and bone mineralization.

Apart from the nutritional parameters to assess the child's dietary intake, certain anthropometric measures are also used to assess a child's growth. Several growth standards have been compiled that are used throughout the world. Tanner and Whitehouse (1976) in the United Kingdom presented clinical standards based on longitudinal-type growth curves for clinical use as opposed to population survey use. In the United States the National Center for Health Statistics (NCHS) (Hamil et al 1979) prepared new percentile curves for assessing physical growth of children. These "may be used to improve identification of potential health and nutritional problems and to facilitate the epidemiological comparison of one group of children with others".

In the application of the growth standards, ethnicity has been deemed of minor importance compared with the role of environmental factors, chiefly diet. There are, therefore, limitations to the universal application of reference standards (Walker and Stein 1985).

In a study of the nutritional status of Black, Coloured and White preschool children in a section of Cape Town, Thomas (1984) found undernutrition had a significantly high prevalence amongst Black and Coloured children in the most deprived socio-economic zone. The Coloured children from the deprived zone, using the NCHS (1979) standards are as follows:

height for age - 47% below the 5th percentile

weight for age - 44% below the 5th percentile

weight for height - 12% below the 5th percentile

Household and Elliott (1987) reported on the nutritional status of Black preschool children. The findings indicated a 15-20% incidence of growth retardation based on NCHS (1979) values among healthy children from an urban area. They conclude that this growth retardation observed is the result of protein energy malnutrition.

From the literature it seem that the ramifications of differing rates of growth on subsequent as well as current health require

extensive investigation through retrospective and longitudinal studies. It would also appear that growth reference standards also have limitated universal application.

2.3.2 DENTAL HEALTH

Studies have implicated that malnutrition generally or specifically may affect tooth development and consequently, the dental caries status.

Linear enamel hypoplasia of deciduous incisor teeth was found in 73% of Guatamalan children recovering from third-degree malnutrition and in 43% of those treated for second-degree malnutrition (Sweeney et al 1971). These prevalences were significantly greater than reported for other Guatamalan children. It was concluded that the association of an event that occurs in the first month or so of life (linear enamel hypoplasia) and the subsequent evidence of malnutrition (kwashiorkor and marasmus) in later years may have epidemiologic significance in identifying segments of child populations for which food supplementation programs could have a major benefit.

It is believed that in most cases the factors in the child's familial and social environments leading to malnutrition have generally been present from birth. Jelliffe and Jelliffe (1971) agree that linear enamel hypoplasia is very commonly seen in young children in malnourished countries.

Miller et al (1980) in Cardiff made a clinical observation that weights of children who require extraction of 2 or more deciduous teeth were lower than the weights of control children. These trends were observed for both males and females. About 55% of the children that required general anaesthetic for extractions were below the second quartile of Tanner's Standard (1976) compared to the control who only had 40% below the second quartile. They proposed that extensive dental disease may be associated with a failure to thrive, and dental disease may thus be indicative of latent malnutrition.

Miller, Okoisor and Liddington (1986) correlated the criteria of physical measurement (weight and height) with the prevalence of oral disease in Nigerian children. They found 76% of the children are below the 50th centile in height and 83% are below the 50th centile in weight according the Tanner (1976) chart. It was concluded that dental disease may be associated with the family circumstances of the individual and that family economics or family customs may play a greater part in the development of serious dental disease than had previously been realised.

2.4 DEVELOPMENTAL DENTAL ANOMALIES

2.4.1 ENAMEL DEFECTS

Mellanby et al (1957) examining five year old London schoolchildren found the best enamel structure occurred in the

lower incisors (only 15.6% of centrals and 22% of laterals showing any degree of moderate-mild hypoplasia). The worst enamel structure occurred in the molars, particularly the upper second molars (89.7% with moderate-mild hypoplasia). The upper incisors were much more hypoplastic than the lower and there were a greater incidence of moderate-mild hypoplasia (59.1%) than of gross hypoplasia (3.1%).

Fisher et al (1968) examining children from the Island of Tristan da Cunha found four of the twenty-one children had one or more deciduous teeth affected by hypoplasia. Enamel opacities (mottling or white spots) occurred in the deciduous teeth of seven of the children.

Sweeney et al (1971) reported on data of children from three villages in Guatamala and found an overall prevalence of 22% of children with linear enamel hypoplasia of the deciduous incisor teeth.

Infante and Gillespie (1974) reported on linear enamel hypoplasia (of anterior teeth) in 429 Guatamalan children. The average prevalence was 31.2% (134 cases) and no sex difference was observed. The prevalence did not increase with age. This suggested caries was not an aetiological factor but that factors operating at the family level enhanced the occurrence of the hypoplastic lesion in the children.

Evans et al (1980) examined 923 children aged five years in New Zealand and found defects of enamel in 67 children, with 170 teeth being affected. 44 children had teeth with external defects (enamel missing) with 132 teeth affected. 23 children had internal enamel defects (53 teeth affected). The colour of the defects ranged between opaque-white to yellow-brown.

2.4.2 FUSED PRIMARY TEETH

The frequency of gemination and fusion of primary teeth was studied by Jarvinen, Lehtinen and Milen (1980) in a sample of 1141 Finnish children aged three to four years. The prevalence was 0.7%. All fused teeth were found in the anterior area of the mouth. In seven cases the diagnosis was a fusion of two separate teeth, and in one case it was a gemination of a single tooth.

Evans et al (1980) examined 923 children aged five years in New Zealand and found five children had fused crowns of the teeth, including either normal or supernumerary teeth.

2.4.3 SUPERNUMERARY TEETH

Evans et al (1980) examined 923 children aged five years in New Zealand and found three children had a supernumerary upper incisor.

2.4.4 INTRINSIC STAINS

Frankel (1970) in a clinical evaluation in 1724 public school children, ranging in age from five to ten years found thirty five cases (2.3%) of typical tooth discolouration. The medical history of each of these patients indicated the administration of one or more of the tetracycline antibiotics during developmental periods of the affected teeth. Frankel (1970) showed that administration of tetracyclines between -

1. birth and three months produced discolouration of the primary centrals and laterals.
2. three and ten months produced discolouration of the primary canines, 1st and 2nd primary molars.
3. ten and twenty four months produced discolouration of the permanent 1st molar, central and lateral incisors and canines.

Zadik and Eidelman (1975) studied 965 five year olds in West Jerusalem and found 8% with tetracycline-stained teeth. Males were affected twice as often as females. The prevalence of staining was significantly higher in children of lower socio-economic status. No significant association between staining and dental caries was established.

Evans et al (1980) in a study of 923 five year old children in New Zealand found five children had teeth stained dark brown in colour. Three of these were due to tetracycline stains and another due to an exchange blood transfusion at birth.

2.5 ORAL SOFT TISSUE LESIONS

2.5.1 GEOGRAPHIC TONGUE

Redman (1970) did a prevalence study among schoolchildren in Minnesota and found that of a total of 379 children aged five to six years, four presented with a geographic tongue. Sedano (1975) examined 6,180 Argentinian school-age children (6-15 years) and recorded a prevalence of 1.5% (106 cases) for the sample with a higher prevalence in males.

2.5.2 MEDIAN RHOMBOID GLOSSITIS

A review of the literature indicated the average incidence of median rhomboid glossitis to be about two affected persons per 1,000 population and the aetiology to be attributed to an embryologic fault (Baughman 1971).

Redman (1970) did a prevalence study among 3,611 schoolchildren aged five to eighteen years in Minnesota and recorded a total of five cases. In the age group five to six years only one case was found.

Baughman (1971) did a clinical examination of 10,010 patients which included schoolchildren and adults. No cases of median rhomboid glossitis were recored in his study. In the light of these findings he proposed, "median rhomboid glossitis is not a developmental disorder but an inflammatory, infectious, or degenerative process occurring in a specific region of the tongue in adults".

In a follow-up study of 28 cases Farman et al (1977) suggested that this condition of the tongue represents a clinical rather than a pathologic entity, and that the underlying disease process may not be identical in all cases. An alternate name for this condition was suggested viz, central papillary atropy of the tongue.

Sedano (1975) examined 6,180 Argentinian schoolchildren six to fifteen years and found only one case of median rhomboid glossitis in a female.

2.5.3 **OTHER**

Sedano (1975) in the study of 6,180 Argentinian children aged six to fifteen years recorded the following congenital findings:

1. Commissural lip pit (52 cases) prevalence of 7%.
2. Torus palatinus (2 cases)

2.6 ACQUIRED DENTAL AND ORAL LESIONS

2.6.1 TRAUMATIZED TEETH

Holm (1975a) in a study of 187 four year old Swedish children found that in 32% of children traumatic injury had resulted in a loss of one or more teeth, in a fracture of the crown or in discolouration of the crown as a sign of pulpal damage.

Zadik (1976) studied 965, five year old children in Jerusalem and found the prevalence of traumatized teeth was 11.1% with no difference between males and females. A total of one hundred and thirty one teeth were traumatized. The tooth most frequently affected was the maxillary central incisor (91.6%).

Evans et al (1980) examined 920 children aged five years in New Zealand and found evidence of dental trauma in 10.6% of the children (62 boys and 36 girls). A total of one hundred and thirty seven teeth being affected. In forty seven teeth a colour change was seen and thirty-seven teeth were physically damaged. The injury was caused by a blow to the tooth or a fall in 63 of the children. In 35 children the cause was not known by the parent.

2.6.2 EXTRINSIC STAINS

Mellanby et al (1957) reporting on the teeth of five year old London schoolchildren found that children who had black or

black-brown superficial stains on their teeth had, in general, a lower incidence of caries (20.2%) than children with no stains (29.1%) and much less than those with green stains (39.2%).

Theilade (1977) reported on the development of bacterial plaque in the oral cavity. The black stain appearing on the gingival third of teeth consists of bacteria of which a high proportion (89%) are gram-positive rods. The majority of these were Actinomycetes and only about 5% were gram-positive cocci. The latter organisms are predominant in supragingival plaque and usually result in oral disease. However, dental caries and gingivitis do not seem to follow the deposition of black stain.

Holm (1975a) in a study of 187 four year old Swedish children found only two children who showed extrinsic stains - one had yellow and one had green staining.

2.6.3 **ABSCESSED TEETH**

Evans et al (1980) examined 923 children aged five years in New Zealand and found four children had abscessed teeth, with a total of five teeth affected.

Slome et al (1980) in a study of children of Wuvulu Island, found a high caries experience in the primary dentition but apical infection, as evidenced by fistulae and swelling, was not observed.

From the literature it is evident that dental caries is a multifactorial infectious disease. There is at present a decrease in the caries prevalence in developed countries and an increase in developing countries. The developing countries seem to be going through the phase developed countries experienced about 20-30 years ago. Sugar is one of the first foods to respond to a rise in income in low-income countries. The percentage of sugar consumed in hidden forms rises progressively with rising income and increasing total sugar consumption (Sheiham 1984). In underdeveloped countries the first change in the pattern of caries with rising sugar consumption is an increase in the caries of primary teeth.
A good correlation between gingivitis and soft deposits is not always evident in the primary dentition with gingivitis tending to develop more slowly in children.

It is important to know which factors are prevalent and contributing to the dental disease pattern in a particular community so that appropriate and effective oral health programmes can be implemented.

There is generally little information available on the prevalence of common oral hard and soft tissue lesions in children.

METHODS and MATERIALS

CHAPTER 3

METHODS AND MATERIALS

3.1 SAMPLING

The target population for this study was the preschool child. The literature covering information about the preschool child includes children from approximately 2-6 years of age. A sampling frame of nursery schools and crèches was used for selecting the sample.

This sample is, therefore, not totally free of bias but was considered to be acceptable for the following reasons:

(1) It ensured a number of children present at a particular place and therefore, reduced transport costs.

(2) Many parents are working and in this way parental presence was not required.

(3) Other studies in the literature have used similar sampling strategies.

A list of crèches which included government subsidized and private organizations was obtained from the Department of Coloured Affairs in Cape Town. Of these, 46 crèches in the Cape Metropolitan (Appendix Map 1) low fluoride urban area was chosen. Twelve crèches were randomly selected for the study. Appendix Map 2 shows the location of crèches.

Permission to visit the crèches was granted by the Chief Inspector of Education in the administrative regions where the crèches were located.

A letter was then sent to each principal (Appendix Letter 1) to request permission to examine the children in their crèche. Subsequent to permission being granted another letter was sent to the principal to outline the procedure and requirements of the visit (Appendix Letter 2). The principals were then informed by telephone usually 1-2 weeks in advance of the day of the visit. The examination procedures were outlined again and they were advised to inform the children that we were, "only going to look at their teeth".

3.2 **PROCEDURE AT THE CRÈCHE**

Visits to the crèche were conducted during the week between 10h00 and 12h30. Usually only one visit to a crèche was needed. There were two examiners and three dental assistants present; two as recorders and one to take the weights and heights of the children. The one assistant obtained the names of the examinees and dates of birth from the crèche teacher. She also weighed the children fully dressed and measured their heights. Information was recorded on the survey forms. The examination rooms utilized were either the staff room at some crèches, an office, a spare room or the classroom. The children

were either English or Afrikaans speaking and questions that needed answering were asked by either the examiner or the recorder.

The examiners were usually seated in front of a window so as to obtain good natural light.

Examinees were seated on a chair in front of the examiner and then made to lie with their heads on the examiner's lap so that a clear vision was obtained into the examinee's oral cavity when the head was extended. The data was then systematically recorded on a revised World Health Organization Basic Oral Health Assessment form (Appendix Assessment Forms 1 and 2). The combined parental income was obtained from the créche supervisor.

3.3 EXAMINER VARIABILITY

Inter- and intra-examiner variability was assessed initially to standardize diagnostic criteria (Appendix Form 3: Examiner Calibration). A local créche was chosen for this exercise. A sample of 40 subjects was examined (approximately 10% of the proposed sample for the survey).

(a) Interexaminer variability: The two examiners alternately examined a child first or second at the same visit.

(b) Intraexaminer variability: Ten children at a time presented to the examiner. Each child was numbered and

presented for examination. After the sample had been seen for the first time they returned in a different order to be re-examined by the same examiner. The measurement of inter- and intra-examiner variability was calculated using kappa (k). Kappa is a measure of agreement with desirable properties. Different ranges of values for kappa with respect to the degree of agreement is suggested as follows by Fleiss (1981).

(1) Values greater than 0.75 represent excellent agreement beyond chance.

(2) Values below 0.40 represent poor agreement beyond chance.

(3) Values between 0.40 and 0.75 represent fair to good agreement.

3.4 DIAGNOSTIC CRITERIA

The oral examinations were conducted using a plain mouth mirror and a sharp sickle-shaped explorer. No radiographs were taken.

3.4.1 Dental Caries

The teeth were systematically examined from the upper right through to the upper left, then lower left and finally the lower right quadrant. All deciduous teeth visible in the oral cavity were charted. The coding was as follows:

(i) Sound Tooth (0) - A tooth that showed no evidence of treated or untreated clinical caries.

(ii) Decayed Tooth (1) - Caries was recorded with a sharp probe when a lesion in a pit or fissure or on a free smooth tooth surface had a detectably softened floor or undermined enamel or the tooth had a temporary or defective restoration. On approximal surfaces the explorer point had to enter a lesion with certainty.

(iii) Filled Tooth with decay (2) - Only a tooth with a permanent restoration without primary or secondary decay was considered.

(iv) Missing Tooth (3) - Any tooth not present in the mouth was recorded as missing. This included unerupted, extracted, exfoliated, or congenitally missing teeth.

(v) Enamel Hypoplasia and Opacities - These were recorded as present if there were white flecks present on teeth or if

there was loss of enamel and/or dentine with exposure of smooth tooth structure which may or may not be discoloured and no caries present. If one to four teeth were affected, it was scored as localized but if more than 4 teeth were affected it was noted as generalized.

4.3.2 Other Hard Tissue Lesions

These were recorded when they were observed clinically. If there was any doubt about the diagnosis of a lesion it was either not recorded or a consensus was reached between the two examiners. Staining of teeth was either intrinsic (could not be removed) or extrinsic (could be removed). Intrinsic stains affected either one tooth (localized) or affected bilateral symmetrical teeth. The latter usually reflected a systemic cause.

3.4.3 Oral Hygiene Practice

Questions were asked about the oral hygiene practice , the frequency of toothbrushing and by whom it was performed. Children were also asked the question, "What is the colour of your toothbrush at home?" before and again after the examination. This question was asked for two reasons:

(i) to enhance communication with the child and get their cooperation.

(ii) to check reliability of their answers to the oral hygiene questions.

3.4.4 Periodontal Status

The oral cavity was divided into six segments: anterior, from canine to canine, and left and right posterior segments which included the primary molars in each arch.

The assessment for soft deposits and gingivitis was made independently.

(i) Soft Deposits (Plaque) - was scored as being absent within a segment if none was present on the buccal and lingual aspects. It was scored as present within a segment if it was visible or detected with a probe on the buccal or lingual aspect of the tooth or teeth within that segment.

(ii) Gingivitis - was scored as being absent within a segment if none was observed on the buccal and lingual aspects. It was scored as present within a segment if there was a visible colour change from pink to red or bleeding on probing on the buccal or lingual aspect of the tooth or teeth within that segment.

3.4.5 Oral Mucosal Lesions

It was uncertain which oral mucosal lesions would be prevalent in this group of children. Therefore, any soft tissue lesions observed during the examination of children were recorded. If there was any doubt about the diagnosis of a lesion it was either not recorded or a consensus was reached between the two examiners.

3.5 ANTHROPOMETRY

The basic components for the measurement of physical growth involve measurements of height and weight. There is a wide variation amongst children in height and weight at any age. This variation within the normal range at a given age is expressed as percentiles. The children are grouped into the percentiles for weight and height for their given age.

The anthropometric indicators of height for age, weight for age and weight for height were used to assess the nutritional status of the children (Thomas 1984).

(i) Height-for-age : an index of the nutritional history of a child.

(ii) Weight-for-age : expresses a nutritional "wasting" but doesn't distinguish between acute and chronic malnutrition.

(iii) Weight-for-height : indicator of present or acute state of malnutrition.

The National Centre for Health Statistics (NCHS) (1979) charts were chosen in the present study as a suitable reference standard against which childrens' growth could be assessed (Appendix Graphs 1 & 2).

3.6 STATISTICAL ANALYSIS

The appropriate statistical tests were applied to the data and analysed using the Statistical Package BMDP Statistical Software (see results).

RESULTS

CHAPTER 4

RESULTS

4.1 EXAMINER VARIABILITY

4.1.1 INTRA-EXAMINER VARIABILITY

Table 4.1 Soft Deposits - Examiner 1

Variable	Kappa Value
SD1	0.576
SD2	0.462
SD3	Excellent
SD4	Excellent
SD5	0.474
SD6	Excellent

All the Kappa values were above 0.5 which represented a good to excellent agreement.

Table 4.2 Gingivitis - Examiner 1

Variable	Kappa Value
G1	0.614
G2	0.378
G3	0.684
G4	0.378
G5	0.576
G6	0.067

Five (83.3%) of the Kappa Values were 0.4 and above which represented a fair to good agreement.

Table 4.3 Dental Caries - Examiner 1

Variable	Kappa Value
T55	0.804
T54	0.942
T53	0.862
T52	0.852
T51	0.952
T61	0.952
T62	0.950
T63	0.862
T64	0.880
T65	0.783
T85	0.746
T84	0.768
T83	0.862
T82	0.737
T81	0.737
T71	0.737
T72	0.737
T73	0.737
T74	0.903
T75	0.746

Thirteen values (65%) of the Kappa Values were greater than 0.75 which represented an excellent agreement and the rest represented a good agreement.

Table 4.4 Soft Deposits - Examiner 2

Variable	Kappa Value
SD1	0.586
SD2	0.586
SD3	0.309
SD4	0.708
SD5	0.769
SD6	0.516

Five (83%) of the Kappa Values were above 0.5 which represented a good to excellent agreement.

Table 4.5 Gingivitis - Examiner 2

Variable	Kappa Value
G1	0.591
G2	0.705
G3	0.654
G4	0.646
G5	0.432
G6	0.521

All the Kappa Values were above 0.4 which denoted a fair to good agreement.

Table 4.6 Dental Caries - Examiner 2

Variable	Kappa Value
T55	0.757
T54	0.948
T53	0.923
T52	0.886
T51	0.857
T61	0.903
T62	0.833
T63	0.886
T64	0.891
T65	0.849
T85	0.857
T84	0.904
T83	0.751
T82	0.466
T81	0.588
T71	0.751
T72	0.576
T73	0.509
T74	0.741
T75	0.857

Fifteen values (75%) of the Kappa Values were greater than 0.75 which denoted an excellent agreement and the remainder represented a good agreement.

4.1.2 INTER-EXAMINER VARIABILITY

Table 4.7 Soft Deposits

	Kappa Value
Variable	**Combined**
SD1	0.462
SD2	0.474
SD3	1.000
SD4	1.000
SD5	0.611
SD6	1.000

The first inter-examiner variability calibration for soft deposits was done on 18 children and presented a poor agreement. (See Appendix table 1). The two examiners were re-calibrated and at the subsequent inter-examiner variability examinations the scoring was more favourable as shown in Table 4.7. All the values were 0.5 and above which represented a good to excellent agreement.

Table 4.8 Gingivitis

Variable	Kappa Value Combined
G1	0.680
G2	0.721
G3	0.639
G4	0.661
G5	0.168
G6	0.830

There was an overall good agreement on the scoring of gingivitis between the examiners. The lower anterior segment (G5) was the only one that showed poor agreement.

Table 4.9 Dental Caries

Variable	Kappa Value Combined
T55	0.840
T54	0.830
T53	0.557
T52	0.865
T51	0.862
T61	0.857
T62	0.835
T63	0.764
T64	0.935
T65	0.708
T85	0.739
T84	0.804
T83	0.868
T82	0.827
T81	0.811
T71	0.827
T72	0.868
T73	0.480
T74	0.889
T75	0.815

The Kappa Values showed an 80% excellent agreement between the two examiners in the scoring of dental caries.

4.2 PERSONAL

Five hundred and forty seven children were examined. There were slightly more males (51.3%) than females (48.7%). The sample was divided into four age groups.

TABLE 4.10

SAMPLE DISTRIBUTION BY AGE BY SEX

AGE	TOTAL		MALE		FEMALE	
(MNTHS)	N	%	n	%	n	%
24 - 35	49	9.0	22	4.0	27	5.0
36 - 47	123	22.5	69	12.6	54	9.9
48 - 59	193	35.3	97	17.7	96	17.6
60 - 75	182	33.2	93	17.0	89	16.2
ALL	547	100.0	281	51.3	266	48.7

From Table 4.10 it can be seen that the 2 - 3 year age group comprised 9% of the total sample.

The age ranged from twenty-four to seventy-five months. There were ten children over the age of seventy-five months that were included but their data did not affect the overall results.

TABLE 4.11

MEAN AGE OF AGE GROUPS

AGE (MNTHS)	AGE $\bar{x}$	s.d
24 - 35	31.6	2.9
36 - 47	42.2	3.6
48 - 59	53.5	3.5
60 - 75	64.9	4.7
ALL	52.8	11.4

Table 4.11 shows the mean age of the samples (52.8 months) and the mean age within each age group. There were 285 children below and 262 children above the mean age.

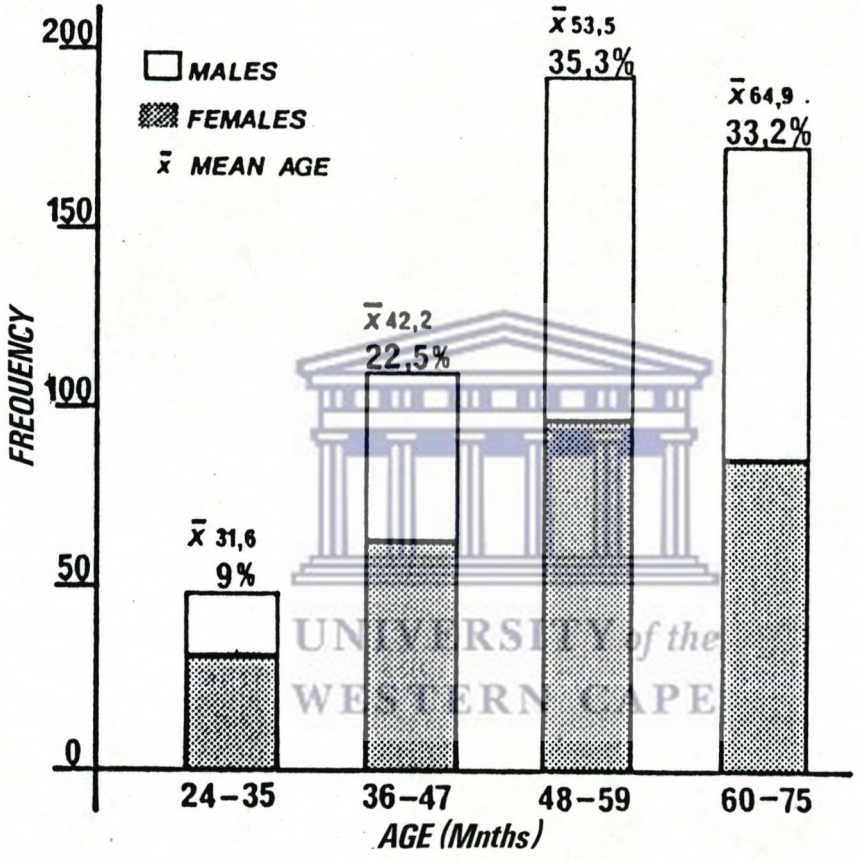


FIGURE 4.1: The sample distribution by age and sex.

TABLE 4.12

INCOME DISTRIBUTION

N = 235	
INCOME (RANDS) (PER MONTH)	%
≤ 250	52.8
251 - 500	36.8
501 - 750	7.2
751 - 1000	2.1
≥ 1000	1.7

The above table shows the income distribution of the sample. Of the 235 children whose combined parental income was recorded, 90% had an income of R500 or less per month.

4.3 DENTAL CARIES

TABLE 4.13

NUMBER AND PERCENTAGE OF CHILDREN WITH dmft = 0

AGE	SOUND DENTITION		MALES	FEMALES
	n	%	n	n
24 - 35	11	22.4	4	7
36 - 47	37	30.1	19	18
48 - 59	37	19.2	14	23
60 - 75	14	7.7	6	8
ALL	99	18.1	43	56

4.3.1 Complete Sound Dentition (dmft = 0)

Table 4.13 shows 18.1% of the sample had a complete sound primary dentition ie. dmft = 0. There was a gradual decrease in the percentage from age 36 months. In the sample 15.3% males and 21.1% females had a complete sound dentition. There was no statistically significant difference in the sex distribution ($p \geq 0.05$).

4.3.2 Decay-free (d = 0)

The mean percentage of decay-free children was 22.1%. This was 38.8% in the 2 year age group; 30.1% in the 3 year age group; 22.8% in the 4 year age group and 11.5% in the 5 year age group. For the sample 18.9% males and 25.6% females were decay-free but this difference in frequency was not statistically significant ($p \geqslant 0.05$).

4.3.3 The mean dmft

TABLE 4.14

THE MEAN dmft AND STANDARD DEVIATION FOR THE AGE GROUPS

AGE	dmft		decayed	missing	filled
(MNTHS)	$\bar{x}$	s.d	$\bar{x}$(dt)	$\bar{x}$(mt)	$\bar{x}$ (ft)
24 - 35	2.73	2.9	2.16	0.57	0.0
36 - 47	4.03	4.31	3.44	0.58	0.02
48 - 59	5.36	4.63	4.28	0.97	0.1
60 - 75	7.01	4.74	4.85	2.09	0.08

Table 4.14 shows the mean dmft for the age groups and table 4.15 for the whole sample. The mean dmft was 5.37 ± 4.67 for the sample. It ranged from 2.73 ± 2.9 for the 2 year age group to 7.01 ± 4.74 for the 5 year age group (see figure 4.2). There was a significant increase in the dmft with age ($p \leqslant 0.0001$).

The greatest increment (1.65) was between the ages four and five years. An analysis of variance test was done to see whether the dmft and the number of decayed teeth differed significantly among the age groups. The variances of the variables were not the same for the age groups and, therefore, the Welch test was used. Both dmft and the number of decayed teeth were significantly different ($p \leq 0.0001$) between the age groups. Due to the small number of missing and filled components, statistical tests were not undertaken.

TABLE 4.15

THE MEAN dmft AND STANDARD DEVIATION FOR THE WHOLE SAMPLE

ALL	dmft		decayed		missing		filled	
	$\bar{x}$	s.d	$\bar{x}$	s.d	$\bar{x}$	s.d	$\bar{x}$	s.d
547	5.37	4.67	4.09	3.73	1.22	2.55	0.06	0.5

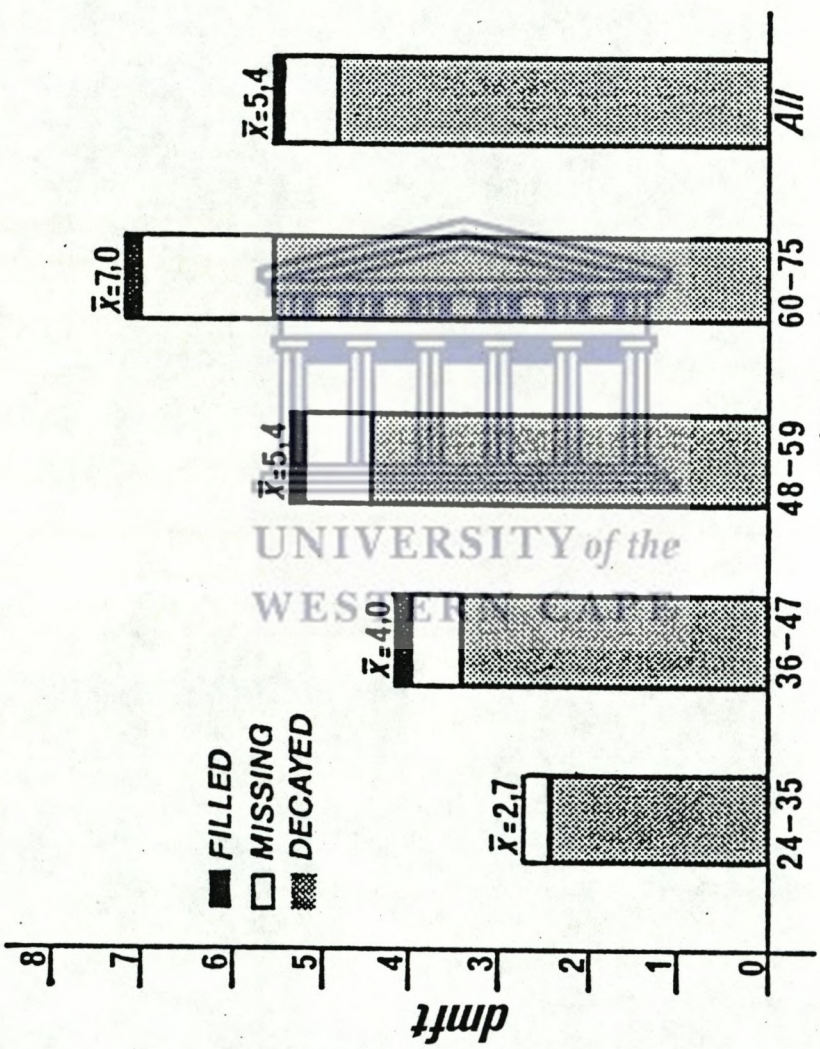


FIGURE 4.2: The mean dmft of the sample and for the various age groups.

TABLE 4.16

THE MEAN dmft AND STANDARD DEVIATION BY SEX

MALES		FEMALES	
dmft		dmft	
$\bar{x}$	s.d	$\bar{x}$	s.d
5.56	4.69	5.18	4.64

The mean dmft for males was 5.56 ± 4.69 and for females was 5.18 ± 4.65 (Table 4.16) but this was not statistically significant ($p \geqslant 0.05$).

4.3.4 % Components of the dmft

For the whole sample, the decayed component (76.2%) contributed the most to the dmft and the filling component (1.1%) the least (Table 4.17)

TABLE 4.17

PERCENTAGE OF THE COMPONENTS OF THE dmft BY AGE

(ROW PERCENTS)

AGE (MNTHS)	dmft $\bar{x}$	d%	m%	f%
24 - 35	2.73	79.1	20.9	0
36 - 47	4.03	85.4	14.4	0.5
48 - 59	5.36	80.0	18.1	1.9
60 - 75	7.01	69.2	30.0	1.1
ALL	5.37	76.2	22.7	1.1

The decayed tooth component decreased with age from 79.1% in the 2 year age group to 69.2% in the 5 year age group, but there was a concomitant increase in the missing tooth component from 20.9% to 30.0% respectively. The high missing tooth percentage in the 5 year old age group was partly due to the exfoliated mandibular incisors which were also recorded as missing.

4.3.5 Decay present

The mean percentage of children with decay present at time of examination was 77.9% (Table 4.18).

TABLE 4.18

DECAY PRESENT BY AGE

AGE (MNTHS)	DECAY PRESENT n	%
24 - 35	30	61.2
36 - 47	86	69.9
48 - 59	149	77.2
60 - 75	161	88.5
ALL	426	77.9

There was an increase in the percentage of children with caries present from 61.2% in the 2 year age group to 88.5% in the 5 year age group. The greatest percentage increase of 11.3% was between the age four and five years.

The difference in caries present between males and females (Table 4.19) was not statistically significant ($p \geq 0.05$).

TABLE 4.19

DECAY PRESENT BY SEX

ALL		MALES		FEMALES	
N	%	n	%	n	%
426	77.9	228	81.1	198	74.4

4.3.6 Fillings present

Only thirteen children (2.4%) had fillings present. There were no fillings in the 2 year age group.

4.3.7 Missing Teeth

28.2% of all children had missing teeth recorded (Table 4.20).

TABLE 4.20

FREQUENCY OF CHILDREN WITH MISSING TEETH BY AGE

AGE (MONTHS)	MISSING TEETH n	%
24 - 35	14	28.6
36 - 47	14	11.4
48 - 59	40	20.7
60 - 75	86	47.3
ALL	154	28.4

The 2 year age group demonstrated a high missing tooth component (28.6%). The possible reason for this was that no distinction was made between unerupted or teeth missing due to extraction. However, if the children in the 2 year age group with 2nd molars missing were omitted it did not affect the overall results of the whole sample. Conversely, the high missing tooth component in the 5 year age group was partly due to the exfoliation of the lower incisors.

4.3.8 The dmft distribution

The percentage of subjects with a dmft of 5 or more within the age groups is shown in Table 4.21. In the 2 year age group it was 16.3% and it increased steadily to 65.4% in the 5 year age group. The mean for the sample was 47.9%.

TABLE 4.21

THE PERCENTAGE SUBJECTS WITH dmft $\geqslant$ 5 BY AGE

AGE (MNTHS)	N	dmft $\geqslant$ 5 %
24 - 35	49	16.3
36 - 47	123	34.1
48 - 59	193	48.3
60 - 75	182	65.4
ALL	547	47.9

The distribution of the number of teeth that were decayed, missing or filled for the sample is shown in Table 4.22. 18% had a dmft = 0 and 20% had a dmft $\geqslant$ 10 (figure 4.3). There was no sifnificant difference between the percentage of males and females affected within the dmft distribution: ($p \geqslant 0.05$). A detailed dmft distribution by sex is shown in the Appendix Table 2.

TABLE 4.22

dmft DISTRIBUTION OF SAMPLE BY SEX

		MALES	FEMALES
dmft	n	%	%
0	99	18.0	15.3	21.1
1 - 5	211	38.7	40.2	36.8
6 - 10	151	27.6	28.1	27.1
11 - 15	67	12.2	12.8	11.7
16 - 20	19	3.5	3.6	3.4

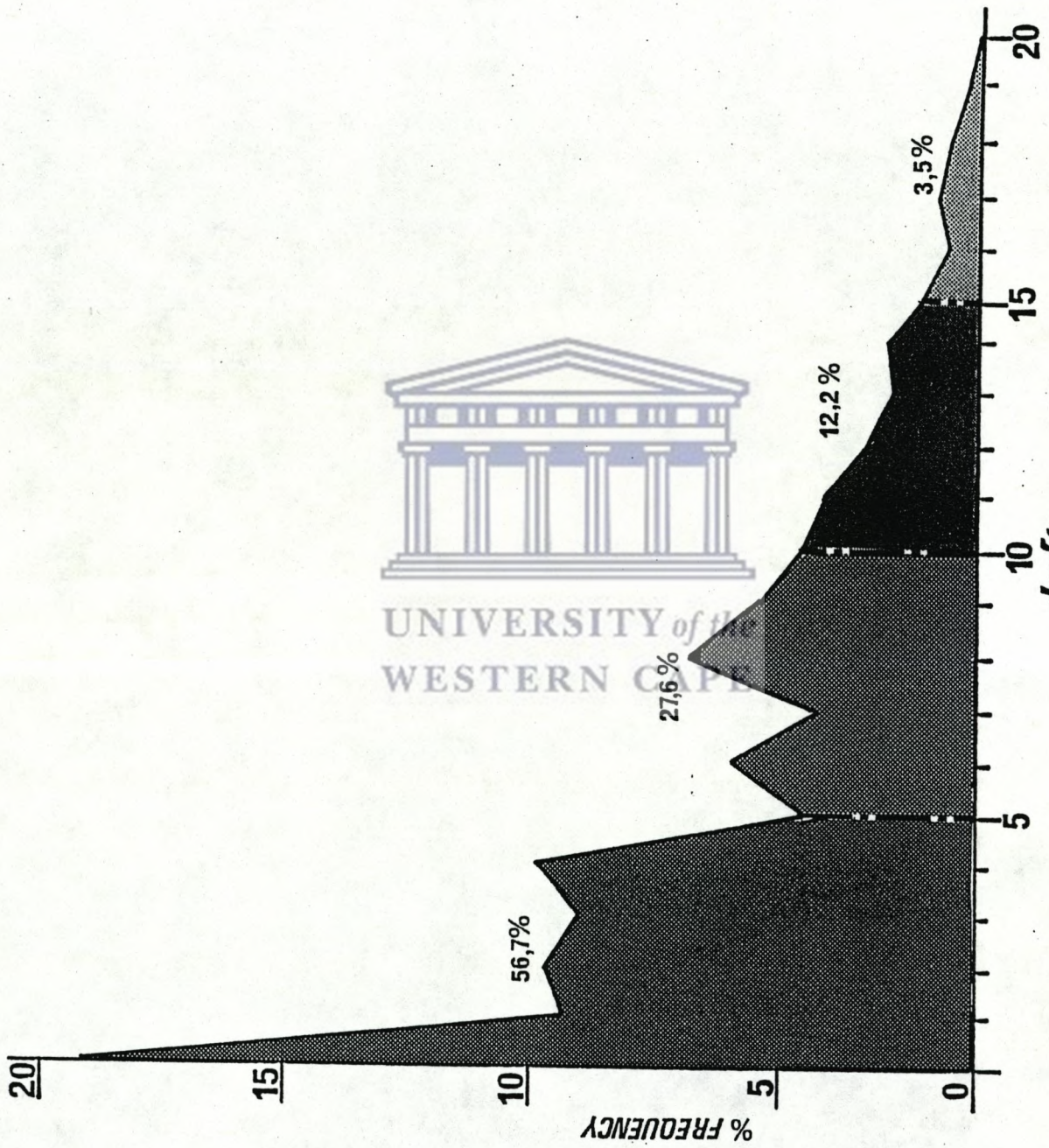


FIGURE 4.3: The dmft distribution of the sample

4.3.9 The dmf of Individual Teeth for the whole sample

The sound, decayed, missing and filled component of the individual tooth types were recorded for the whole sample.

Figure 4.4 clearly demonstrates the bilateral symmetry of caries distribution in the primary dentition. The sequence of the teeth affected by decay in order of most to least susceptible was as follows:

(i) Maxillary central incisors
(ii) Mandibular second molars
(iii) Maxillary second molars
(iv) Maxillary lateral incisors
(v) Mandibular first molars
(vi) Maxillary first molars
(vii) Maxillary canines
(viii) Mandibular central incisors, canines and lateral incisors.

The teeth with the highest dm component were the maxillary incisors followed by the mandibular second molars. (Appendix Table 3 details this information).

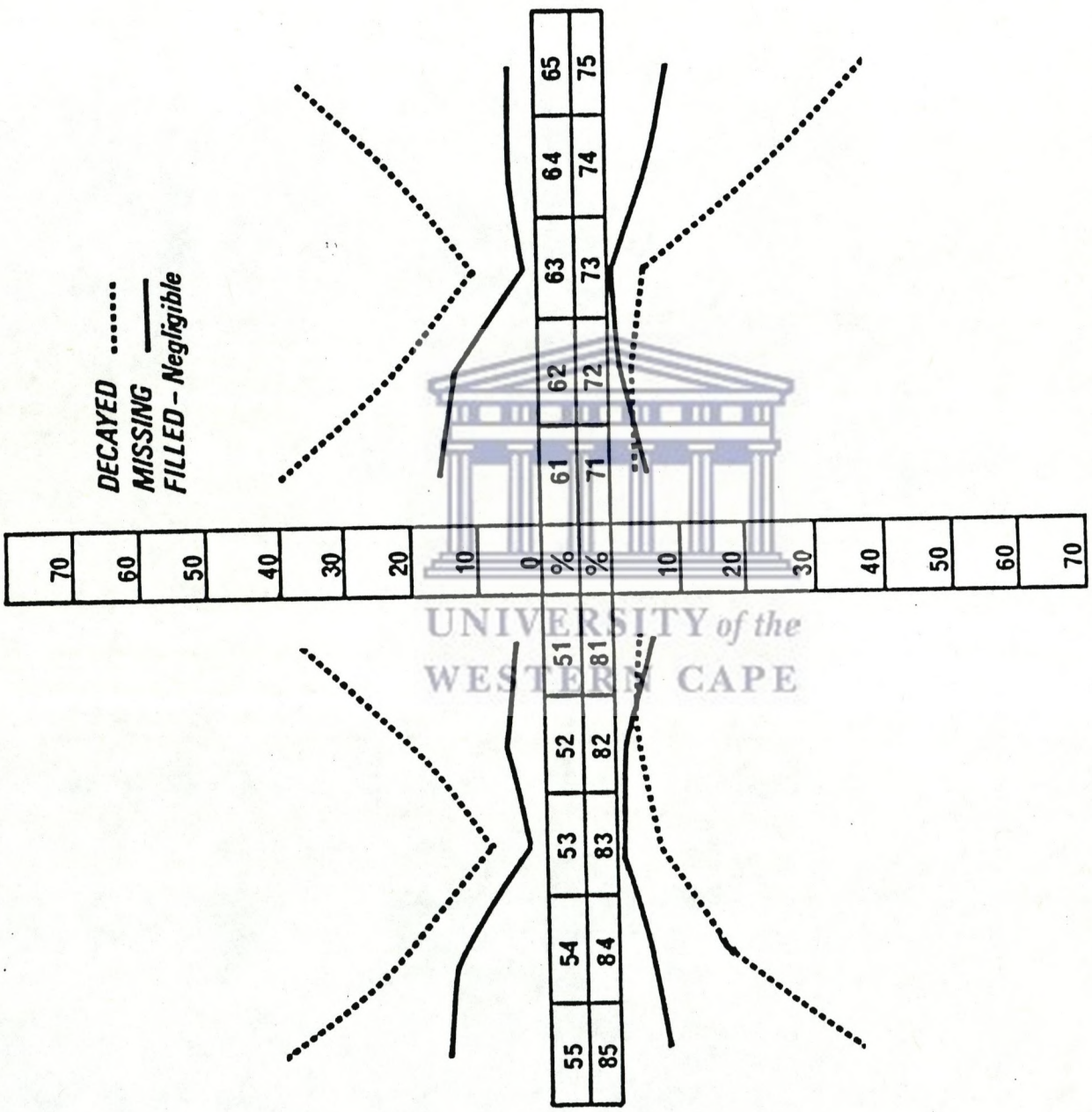


FIGURE 4.4: The percentage of decayed and missing components of individual teeth for the sample.

4.3.10 The dmf of Individual Teeth by Age

The percentages of the combined dmf-experience of individual teeth by by age were recorded (figure 4.5). The association between dmf-experience and age was tested. There was a statistical linear association between the dmft and age for all the tooth types except the canines. It was significant at the 1% level ($p \leq 0.01$) for all the incisors and molars except tooth 72 which was significant at the 5% level ($p \leq 0.05$).

Of the combined dmf-value of 20.9% and 19.8% for the 81 and 71, 14.8% and 14.3% were the values for the missing components, respectively. (Appendix Table 4 details this information).

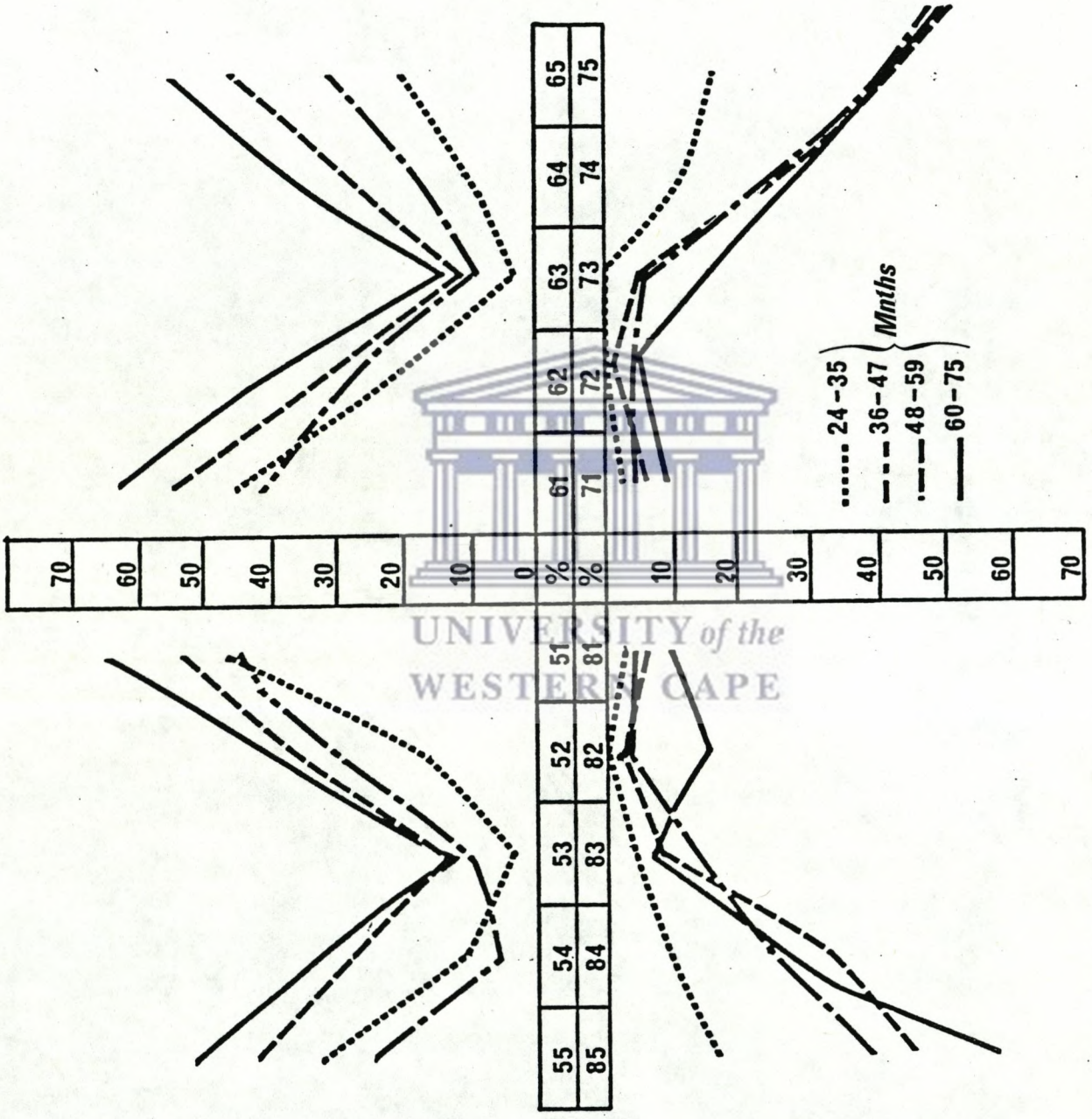


FIGURE 4.5: The percentage of dmf-experience for individual teeth by age in months.

4.3.11 **The mean dmft excluding subjects with dmft = 0**

The mean dmft was 6.56 for the sample excluding subjects with dmft = 0. It ranged from 3.52 for the 2 year age group to 7.59 for the 5 year age group as shown in Table 4.23. If those with dmft = 0 were excluded, the means for the age groups and the sample werehigher than the means in which the dmft = 0. The least difference was observed in the 5 year age group.

TABLE 4.23

THE MEAN dmft EXCLUDING THOSE WITH dmft=0

AGE (MNTHS)	EXCLUDING dmft=0 n	$\bar{x}$	INCLUDING dmft=0 $\bar{x}$
24 - 35	38	3.52	2.73
36 - 47	86	5.77	4.03
48 - 59	156	6.63	5.36
60 - 75	168	7.59	7.01
ALL	448	6.56	5.37

4.3.12 The mean number of decayed teeth in those children with decayed teeth present

If the decayed teeth of those with any decayed teeth present were calculated excluding those with no decayed teeth, then the values were as listed in Table 4.24. The mean dt was 5.25 for the whole sample. It ranged from 3.53 in the 2 year age group to 5.48 in the 5 year age group. These mean values were consistently higher than in the subjects with decayed teeth present.

TABLE 4.24

THE MEAN NUMBER OF DECAYED TEETH EXCLUDING THOSE WITH dt=0

AGE (MNTHS)	EXCLUDING dt=0 n	EXCLUDING dt=0 $\bar{x}$	INCLUDING dt=0 $\bar{x}$
24 - 35	30	3.53	2.16
36 - 47	86	4.92	3.44
48 - 59	149	5.55	4.28
60 - 75	161	5.48	4.85
ALL	426	5.25	4.09

4.3.13 The mean number of missing teeth in those children with missing teeth recorded

If the mean number of missing teeth of those with any missing teeth recorded was calculated then the mean for the sample was 4.33. It ranged from 2.0 in the 2 year age group to 4.42 in the 5 year age group (Table 4.25). The means of the number of missing teeth was much higher when the subjects with no missing teeth recorded were excluded.

TABLE 4.25

THE MEAN NUMBER OF MISSING TEETH EXCLUDING THOSE WITH mt=0

AGE (MNTHS)	EXCLUDING mt=0		INCLUDING mt=0
	n	$\bar{x}$	$\bar{x}$
24 - 35	14	2.0	0.57
36 - 47	14	5.07	0.58
48 - 59	40	4.70	0.97
60 - 75	86	4.42	2.09
ALL	154	4.33	1.22

Figure 4.6 depicts the percentage children with decayed and missing teeth by age and for the whole sample.

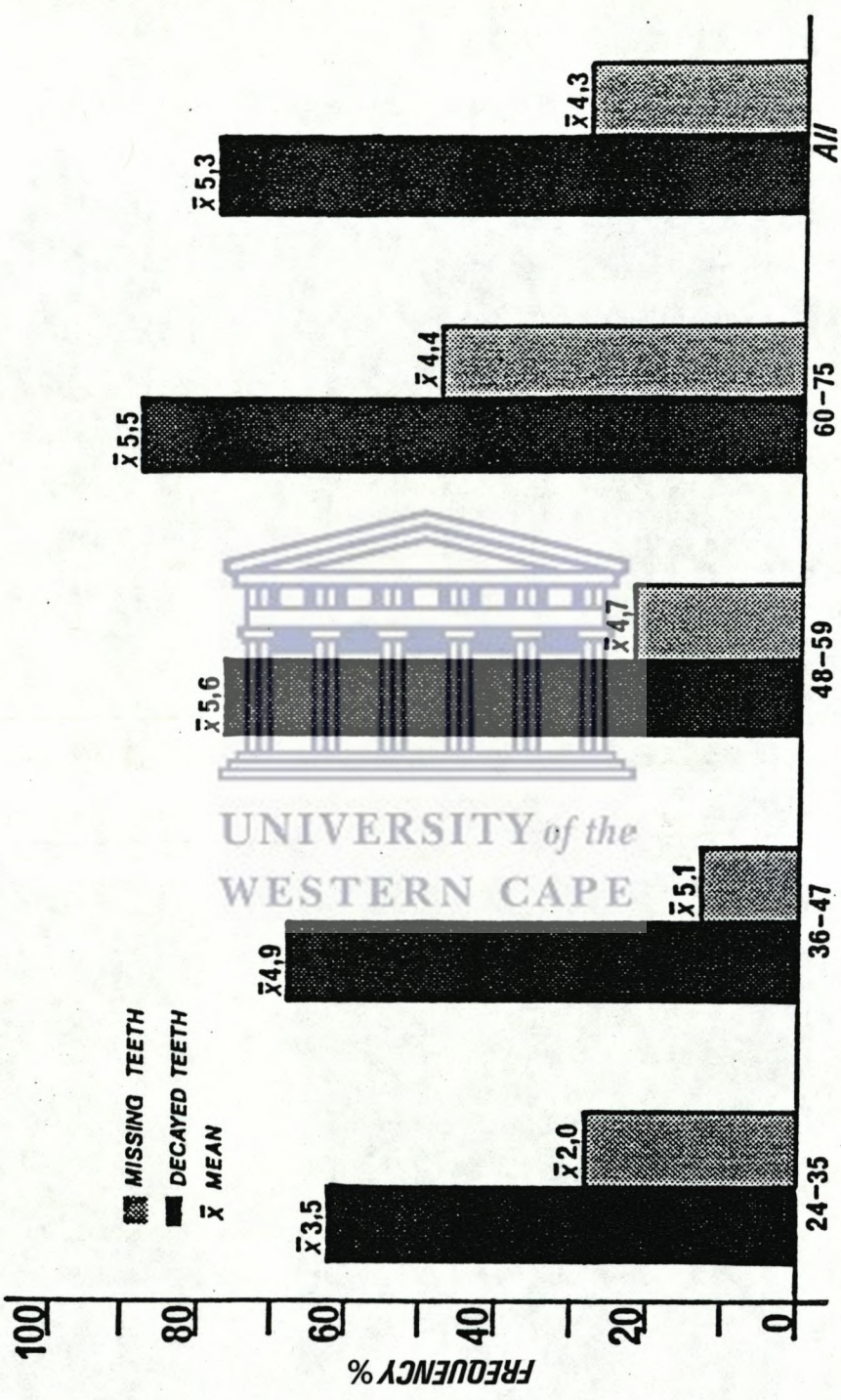


FIGURE 4.6: The percentage children with decayed and missing teeth in the sample and for the various age groups. The mean decayed and mean missing teeth within each group is shown.

4.3.14 The Percentage of Tooth Types at risk by Age

Only those teeth most susceptible to decay were considered viz. the maxillary incisors, the maxillary molars and the mandibular molars. The percentage sound component for each tooth type for the different age groups and for all is shown in Table 4.26. Because of the bilateral symmetry of caries in the primary dentition only the mean of each tooth type was given.

The maxillary central incisor was the least sound tooth at all the age levels. The decrease in sound tooth component between ages 2 and 5 years was gradual for maxillary teeth and ranged from a 17% difference for the central incisors to 27% for the second molars.

However, for the mandibular molars the decrease in sound tooth component from age 2 to 5 years showed a more rapid and greater difference with 37% for the first molars and 42% for the second molars.

In the 2 year age group the central incisors had the lowest percentage sound tooth component and the molars the highest. However, in the five year age group the difference is less marked and the molars have a similar low percentage sound component.

4.3.15 The percentage of total decayed teeth by tooth types

The maxillary incisors made up 30.8% of all the decayed teeth present in the sample as shown in figure 4.7. The second molars made up about 40%. Appendix Table 5 gives the details of percentages.

TABLE 4.26

THE PERCENTAGE OF TOOTH TYPES AT RISK BY AGE

TOOTH TYPE	ALL %	AGE (MONTHS) 24 - 35 %	36 - 47 %	48 - 59 %	60 - 75 %	Diff. % (2-5 yrs)
Mx CI	45.3	53.1	55.3	46.1	35.8	17.3
Mx LI	65.8	80.6	71.1	65.3	58.8	21.8
Mx 1st Ms	73.5	89.5	83.4	71.8	64.3	25.2
Mx 2nd Ms	58.2	73.5	72.4	56.2	46.5	27.0
Md 1st Ms	67.4	90.8	78.5	67.4	53.8	37.0
Md 2nd Ms	53.1	83.7	60.1	52.1	41.2	42.5

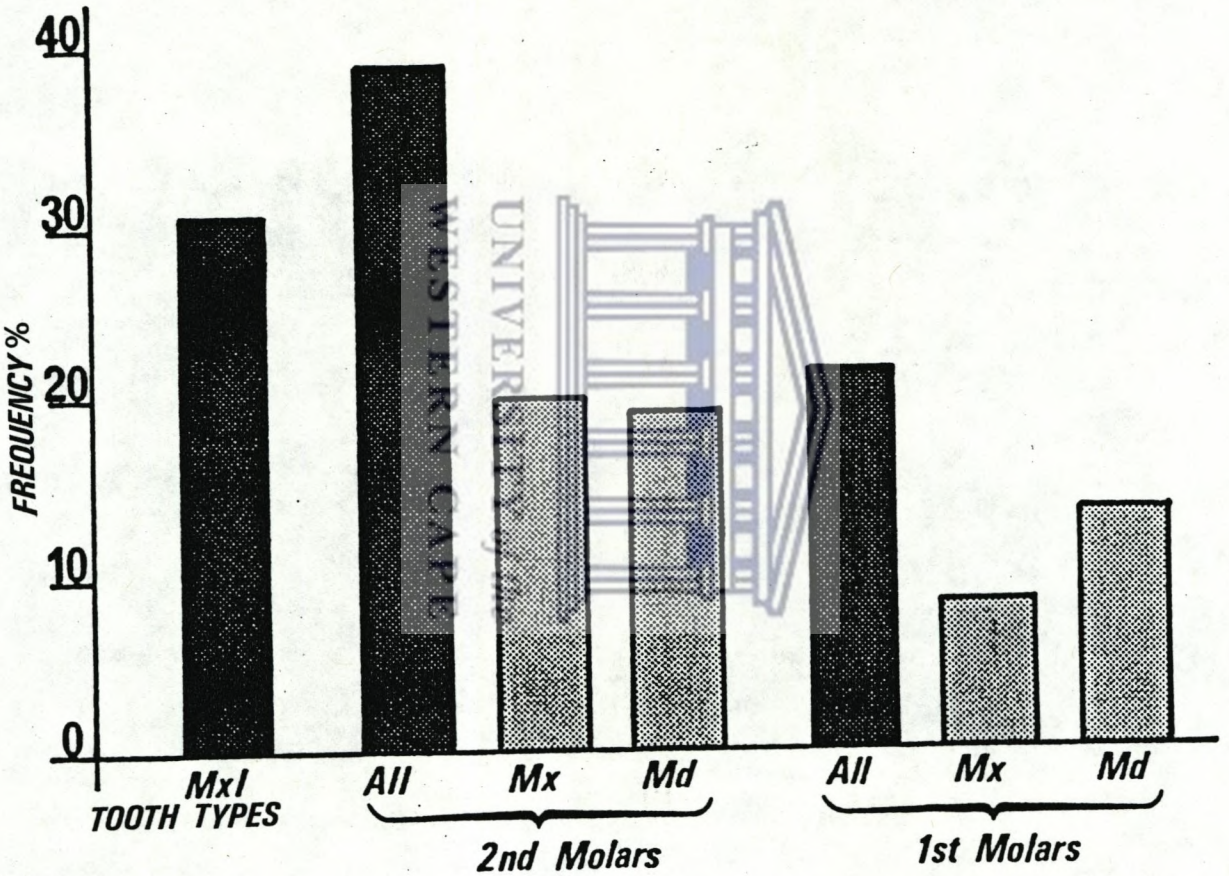


FIGURE 4.7: The number of children with decayed teeth was N = 426. The percentage of total decayed teeth that certain tooth types comprised is shown.

4.4 OTHER HARD TISSUE LESIONS

4.4.1 Localized Enamel Hypoplasia and Opacities

The prevalence of localized enamel hypoplasia ranged from 26.5% in the 2 year age group to 12.6% in the 5 year age group. The mean was 20.7%. The prevalence decreased significantly with age ($p = 0.0035$).

4.4.2 Generalized Enamel Hypoplasia

The prevalence recorded for the whole sample was 2.5% (13 cases).

4.4.3 Traumatized anterior teeth

The prevalence recorded for the whole sample was 3.7%.

4.4.4 Fluorosis

No cases of dental fluorosis were recorded.

4.4.5 Tetracycline Stained Teeth

Only 2 cases of tetracycline stained teeth were recorded (0.4%).

4.4.6 Miscellaneous Hard Tissue Anomalies

These anomalies were grouped together because they were less frequently observed clinically and it was unfavourable to list each separately for statistical analysis. There was no trend in the age or sex incidence. The following were observed:

	Anomaly	Number of cases
i)	Generalized attrition	21
ii)	Crowding of lower anterior teeth	3
iii)	Extrinsic Staining	
	Black stain (no decay)	2
	Black stain (with decay)	2
	Brown stain	1
	Green stain	3
	Other stain	4
iv)	Fusion	1
v)	Gemination	1

4.5 ORAL HYGIENE PRACTICE

4.5.1 Toothbrushing

The children were asked if their teeth were brushed or cleaned. For the whole sample 96.6% of the children claimed their teeth were being brushed. In the 2 year age group the response was slightly lower (86.4%).

4.5.2 Other Methods

No other method of oral hygiene besides toothbrushing was recorded.

4.5.3 Frequency of toothbrushing

In reply to the question of daily frequency of toothbrushing most of the children (68.8%) claimed their teeth were brushed once a day, 26.1% reported twice a day and 5.1% more than twice a day.

4.5.4 Supervised brushing at the crêche

Of the 12 crêches visited, 10 claimed that the children brushed their teeth at the crêche under supervision at least once a day.

4.5.5 Toothbrushing Responsibility

The children were asked who brushed their teeth. The answers to this question were recorded in Table 4.27. The data showed that the parent had the responsibility of brushing the child's teeth in 32.4% of the 2 year old group and 8.2% of the 5 year old group. For the whole sample 60% of the children had the sole responsibility of brushing their own teeth, 21.2% of cases the parent and in 18.5% of cases both parent and child.

TABLE 4.27

TOOTHBRUSHING RESPONSIBILITY

AGE (mnths)	BY WHOM: PARENT %	CHILD %	BOTH %
24 - 35	32.4	29.7	37.8
36 - 47	39.6	39.6	20.8
48 - 59	20.3	60.5	19.2
60 - 75	8.2	79.5	12.3
ALL	21.2	60.3	18.5

4.5.6 **Toothbrush Colour**

The response to the question regarding the colour of the child's toothbrush showed a distinct colour popularity as recorded in Table 4.28. The most popular colour was red (20%) followed by blue (17.3%), white (12.2%) and green (11%).

TABLE 4.28

TOOTHBRUSH COLOUR

N = 485

COLOUR	n	%
Red	97	20
Blue	84	17.3
White	59	12.2
Green	53	11
Yellow	31	6.4
Other	129	26.6
None	32	6.6

Of those children who responded 77% gave the same colour the first and second time the question was asked but 23% differed in their answers. 6.6% had no toothbrush at home.

4.6 SOFT DEPOSITS

4.6.1 Distribution of soft deposits by segment

The mean percentage distribution of soft deposits per segment for each age group and for all were calculated. There was no difference in the frequency distribution of the segments with soft deposits in the four age groups and, therefore, only the mean frequency by segment for the whole sample is shown in Table 4.29.

TABLE 4.29

MEAN PERCENTAGE SOFT DEPOSITS BY SEGMENTS FOR ALL

	N = 547		
	POST %	ANT. %	POST %
Upper	92.5	80.8	93.0
	(R)		(L)
Lower	93.6	73.7	89.9

Soft deposits were present in almost all segments in all the children. The posterior segments had more soft deposits (90-93%) than the anterior segments and the upper anterior segment more (80.8%) than the lower anterior segment (73.7%). The soft deposits were observed more often on the buccal of the upper posterior segments and on the lingual of the lower posterior segments although it was not detailed as such on the questionnaire.

4.6.2 Mean Number of segments with soft deposits

The mean number of segments with soft deposits in the four age groups ranged from 5.49 in the 2 year age group to 5.0 in the 5 year age group and a mean of 5.21 for the sample. There was a slight decrease in the mean number of segments with soft deposits with an increase in age but this was not significant.

4.6.3 The percentage distribution of children with soft deposits

The percentage of children with soft deposits present according to the number of segments involved is recorded in Table 4.30. There were 0.7% children with no soft deposits present and 60.1% with soft deposits present in all six segments.

TABLE 4.30

PERCENTAGE DISTRIBUTION WITH SOFT DEPOSITS

N = 547

No of Segments	n	%
0	4	0.7
1	6	1.1
2	11	2.0
3	35	6.4
4	66	12.1
5	96	17.6
6	329	60.1

4.7 GINGIVITIS

4.7.1 Distribution of gingivitis by segment

The mean distribution of the percentage of any gingivitis present by segment for each age group and for all was calculated. There was no difference in the frequency distribution of the segments with gingivitis in the age groups and, therefore, only the mean frequency by segment for the whole sample is given in Table 4.31.

TABLE 4.31

MEAN PERCENTAGE GINGIVITIS BY SEGMENT FOR ALL

N = 547

	POST%	ANT.%	POST%	
Upper	48.4	21.9	52.9	
(R)				(L)
Lower	72.4	10.8	69.4	

There was more gingivitis recorded on the lower posterior (69-72%) segments than on the upper posterior (48-53%) segments. Gingivitis was recorded more often on the buccal of the upper posterior segments and on the lingual of the lower

posterior segments although it was not detailed as such on the questionnaire. The upper anterior segments (21.9%) were affected by gingivitis twice as much as the lower anterior segments (10.8%).

4.7.2 Mean number of segments with gingivitis

The mean number of segments with gingivitis in the four age groups ranged from 2.45 in the 2 year age group to 2.89 for the 5 year age group, with a mean of 2.74 for the whole sample. There was a slight increase in the mean number of segments with gingivitis with an increase in age but this was not significant.

4.7.3 The percentage distribution of children with gingivitis

The percentage distribution of children with gingivitis present according to the number of segments involved is recorded in Table 4.32. There were 11.3% children with no gingivitis present and 4.2% with six segments of gingivitis present. 53.4% of children had one to three segments of gingivitis recorded.

TABLE 4.32

PERCENTAGE DISTRIBUTION WITH GINGIVITIS

N = 547

No of Segments	n	%
0	62	11.3
1	59	10.8
2	147	26.9
3	86	15.7
4	98	17.9
5	72	13.2
6	23	4.2

Figure 4.8 depicts the mean soft deposits and mean gingivitis percentage prevalence per segment for the sample. Figure 4.9 shows the percentage soft deposits as opposed to percentage of gingivitis per segment. Soft deposits did not correlate with the gingivitis prevalence.

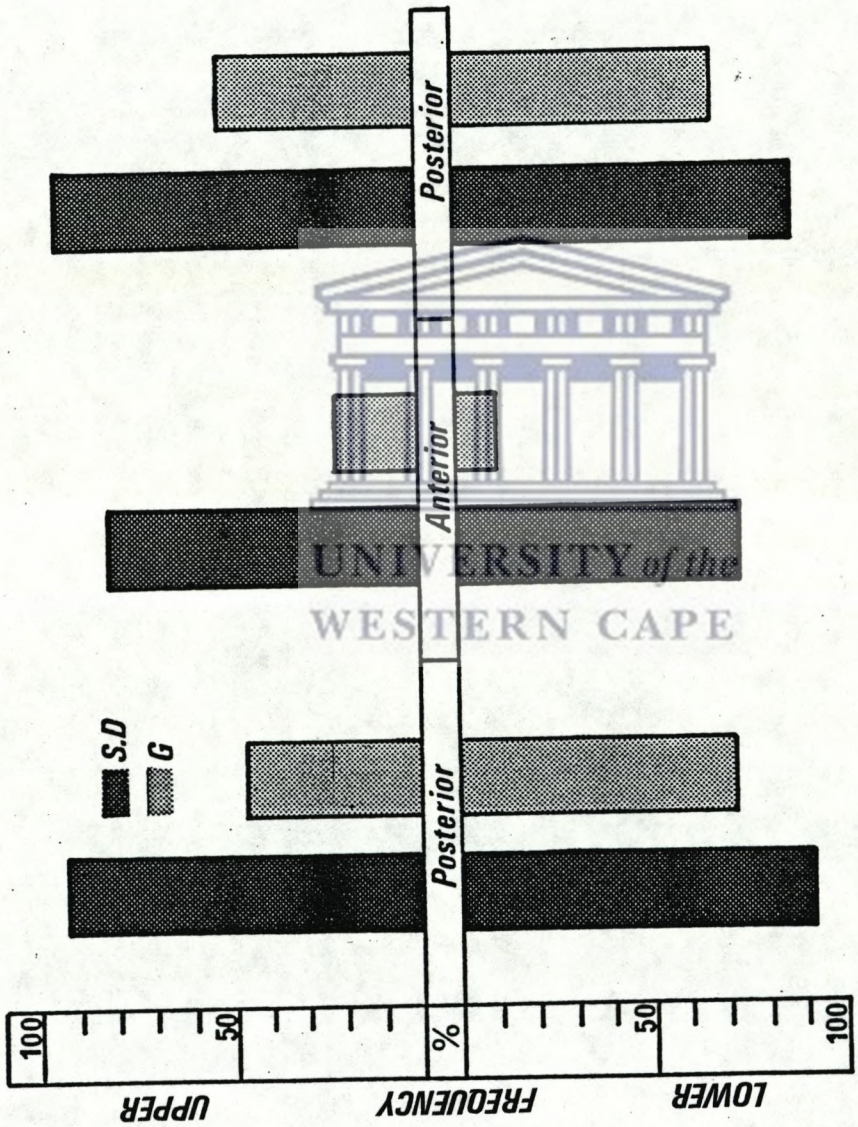


FIGURE 4.8: The percentage of soft deposits and gingivitis per segment for the sample.

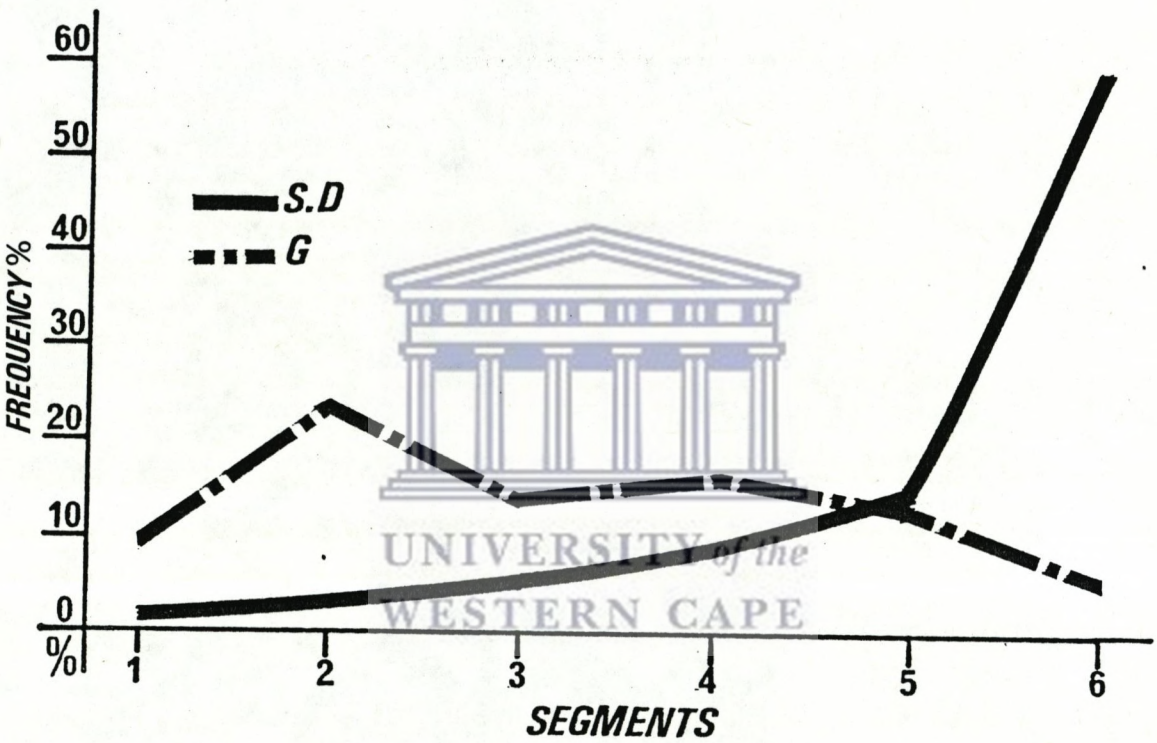


FIGURE 4.9: The percentage distribution of segments of soft deposits and gingivitis for the sample.

4.8 ORAL MUCOSAL LESIONS

4.8.1 Geographic Tongue

Six (1.1%) cases of geographic tongue were recorded.

4.8.2 Dento-Alveolar Abscess

The presence of dento-alveolar abscess was 8.0% for the whole sample. It was 2.0%, 4.9%, 6.2% and 13.7% for the 2, 3, 4 and 5 year age groups, respectively. The prevalence of dento-alveolar abscess increased significantly with age ($p = 0.0018$).

4.8.3 Erosions and Ulcerations

These were recorded in 17 children (3.1%) on the buccal and labial mucosa and on the tongue. The lesions were mostly of a traumatic nature and a few were aphthous ulcers.

4.8.4 Other Oral Mucosal Lesions

The following lesions were grouped together because it was uncertain which would be observed and it was unfavourable to list each separately for statistical analysis. There was no trend in the age or sex prevalence of the lesions recorded.

LESION		NO OF CASES
(1)	Gingival recession	2
(ii)	High labial frenal attachment with upper central diastema	15
(iii)	Congenital commissural pits	2
(iv)	Squamous papillomas	2
(v)	Angular cheilitis	2
(vi)	Oral petechiae	5
(vii)	Mole in palate	1
(viii)	Pigmentation of tongue	1
(ix)	Ankyloglossia	4
(x)	Secondary Herpes (Cold Sore)	1
(xi)	Mucocoele	1
(xii)	Fordyces granules	1

A total of 40 lesions (7.3%) were observed.

No cases of the following were recorded:

(i) Acute Necrotizing Ulcerative Gingivitis

(ii) Herpetic Gingivo-Stomatitis

(iii) Median Rhomboid Glossitis.

4.9 ANTHROPOMETRY

4.9.1 Weight

The percentage and mean weight of children less than or equal to the percentiles for weight for their given age are recorded in Table 4.33. There were 13% children below the 5th percentile with a mean weight of 14kg, and 3.2% were above the 95th percentile with a mean weight of 21.2kg recorded.

TABLE 4.33

WEIGHT FOR AGE (SEXES COMBINED)

	WEIGHT	
PERCENTILE	**%**	**MEAN (kg)**
< 5th	13.0	14.0
5-10th	7.7	14.7
11-25th	18.1	15.8
26-50th	21.9	17.1
51-75th	20.5	18.5
76-90th	10.8	20.0
91-95th	3.2	21.2

4.9.2 Height

The percentage and mean height of children less than or equal to the percentiles for height for their given age were recorded in Table 4.34. There were 28.3% children below the 5th percentile with a mean height of 97.8cm, and 2.0% of children above the 95th percentile with a mean height of 112.0cm.

TABLE 4.34

HEIGHT FOR AGE (SEXES COMBINED)

	HEIGHT	
PERCENTILE	%	MEAN (cm)
<5th	28.3	97.8
6-10th	10.5	99.4
11-25th	17.3	102.0
26-50th	19.6	105.0
51-75th	12.6	107.8
76-90th	5.5	110.2
91-95th	2.0	112.0

4.9.3 Mean Weight and Height

The mean weight and mean height for the age groups and for the whole sample are shown in Table 4.35. They ranged from 14.5kg to 18.6kg and 90.9cm to 107.6cm for the 2 year and 5 year age group respectively. For the whole sample the mean weight was 17kg and the mean height 101.5cm.

TABLE 4.35

MEAN WEIGHT AND MEAN HEIGHT BY AGE

AGE	WEIGHT(kg)		HEIGHT(cm)	
MONTHS	$\bar{x}$	sd	$\bar{x}$	sd
24 - 35	14.5	2.4	90.0	8.0
36 - 47	15.5	2.0	96.5	5.1
48 - 59	17.1	2.3	101.8	6.0
60 - 75	18.6	2.7	107.6	7.4
ALL	17.0	2.8	101.5	8.4

4.10 Correlations (Table 4.36)

There was a positive correlation between age and weight for all the age groups but for the 2 and 3 year age group it was not significant. This meant that the children in the younger age groups were generally underweight but those in the older age groups had weights more favourable in relation to their age.

There was an overall negative correlation between age and soft deposits which was significant. This indicated that older children had less soft deposits than the younger ones although the gingivitis increased with age.

The presence of soft deposits was significantly related to the amount of gingivitis and the number of decayed teeth present but was not related to the dmft or the presence of dento-alveolar abscesses.

However, the presence of gingivitis was significantly related to dmft, number of decayed teeth and the presence of dento-alveolar abscesses.

TABLE 4.36

CORRELATIONS

Variables	Spearman Correlation Coefficient	Significance
age, weight	0.5442	p 0.01
age, totsd	0.1164	p 0.01
age, totg	0.1420	p 0.01
totsd, totg	0.2325	p 0.01
totsd, dmft	0.0291	N/S
totsd, nodt	0.9124	p 0.01
totg, dmft	0.1650	p 0.01
totg, nodt	0.2501	p 0.01

totsd = total soft deposits

totg = total gingivitis

nodt = number of decayed teeth

CHAPTER 5

DISCUSSION

5.1 DENTAL CARIES

In the present study the mean dmft was 5.37 for the whole group and only 18.1% were caries-free. Other studies on the same ethnic age group in South Africa found values ranging from dmft 3.1 and 44% caries-free to 5.4 and 32% caries-free (Moola & Louw 1979, Cleaton-Jones et al 1981, McInnes et al 1982).

If these values are compared to values obtained for other ethnic groups in South Africa it is found that urbanized subjects have an average dmft of 3, but the number of caries-free subjects differs greatly among the communities, with Blacks having the highest number of caries-free subjects followed by Indians, Coloureds and Whites (Cleaton-Jones et al 1978a, 1978b, 1981).

Developing countries have a dmft which is often higher than their counterparts in developed countries (Infante and Gillespie 1976, Slome et al 1980). The dmft tends to increase as the country develops (Bruszt et al 1977). This trend is not observed in the permanent dentition.

Evidence in highly developed countries has shown a downward trend of caries experience (Naylor 1982). In England a study by Holt et al (1982) found preschool children to have a dmft of 0.65 and 81%

caries free whereas Winter et al (1971), who reported on the same community about 10 years previously, found the dmft to be 1.12 and 75% caries-free.

In the permanent dentition certain global trends of dental caries prevalence are emerging. In pre-industrialized countries caries is low. A gradual increase of caries is being reported in developing countries (Barmes 1977) while in highly industrialized countries there is a dramatic decrease in caries (Naylor 1982).

The increase in caries in developing countries has been attributed to an increase in sucrose-containing products (Bruszt et al 1977, Sheiham 1984). However, in pre-industrialized countries sucrose consumption is not so evident although the caries is higher in the primary than in the permanent teeth. In these countries poor nutrition as an aetiologic factor was suggested (Infante and Gillespie 1976, Slome et al 1980) but why it should affect the primary dentition more than the permanent dentition was not clear.

The decrease in caries in highly developed countries has been attributed to the wide spread use of systemic and topical fluorides, improved plaque control and a more enlightened attitude to the intake of sucrose-containing foods (Naylor 1982). The Danish Medical Research Council (1986) held a consensus conference on the decline in caries incidence in Denmark. The decline was

attributed to: collective prevention through better oral hygiene, use of fluoridated dentifrices, the public's general education level, better living conditions and the preventive methods used in public dental health services for children. It was interesting to note that changes in the diet were not included as a reason.

The group in the present study would be classified as being a developing community. The factors which contribute to the high dmft in this community are most likely to be:

i) low fluoride levels of the drinking water ($\leq$ 0.05 ppm)

(ii) high sucrose intake (Gordon and Reddy 1985)

(iii) poor oral hygiene as shown in the present study with almost all children having soft deposits.

(iv) the lack of preventive treatment.

Most of the children were from the lower socio-economic class as was evident from the parental income and area of residence. Of the children whose parental income could be obtained from the crèche teacher, 90% had an income of R500 or less per month. The parents were mostly employed as semi-skilled workers or labourers.

The mean dt of 4.09 made up 76% of the dmft; the mean mt of 1.22 made up 23% and the ft was negligible. The treatment provided for these subjects was mainly extractions. Observations of

extensively decayed teeth and the high prevalence of dento-alveolar abscesses suggested that this treatment was of an emergency nature. There was much unmet treatment in this group as only 22% of subjects were free of decay. Those with decay present had an average of 5 decayed teeth. Beal and James (1970), Milen et al (1981) and Gibson et al (1981) found a higher d component and a lower f component to be associated with the lower social classes.

Silver (1974) showed that parents in the higher social groups were more likely to seek dental treatment for their children. A major factor in the gap between dental needs of the community and the demands made for treatment is the lack of knowledge about existing dental disease (Beal and Dickson 1974). The mothers of the present community were found to have a limited knowledge about oral hygiene and oral hygiene practices (Gordon and Reddy 1985).

Although there is strong evidence to support this trend, Richardson et al (1978) in South Africa and Enwonwu (1974) in Nigeria found that caries prevalence was not related to socio-economic level. It was observed that in urban Blacks, the affluent children had higher caries prevalences than the poorer children. This discrepancy was due to the fact that the children from the higher social classes lived in cities and consumed a diet rich in sucrose. On the other hand both cost factors and the lack

of access to sucrose containing products precluded consumption among the poorer classes.

The present group of children are all urbanized. Sugar containing products are relativey cheap and readily available to them. This could be a contributory factor to the high dmft. However, Cleaton-Jones et al (1984) in a study on five year old South African Indian children found no significant change in mean dmft with increasing sucrose intake and frequency of sucrose intake. Richardson et al (1981) reporting on infant feeding practies found rural Black infants had a low intake of fruit syrups (0,6g/day) compared to urban White infants (15g/day) but the prevalence of labial decay in these two communities was the same (12%). These studies have found no significant relationship between dmft and sweetened foods. This implication is that other factors may be more important, such as oral hygiene, host and bacterial factors.

Besides the difference among the social classes a marked difference is also found between communities residing in high and low fluoride areas. McInnes et al (1982) found in the age group 1-5yrs, in the fluoridated community the mean dmft was 0.7 and 82% was caries-free but in the non-fluoridated community the dmft was 5.4 and 32% caries-free. On a much smaller sample Yasin-Harnekar and Reddy (1983) found those in the high fluoride area (2.5 ppm) to have a mean dmft of 2.84 and 44% caries-free and in the low fluoride area a mean dmft of 5.85 and only 10% caries-free.

Hausen et al (1982) showed that the higher social class had the lowest caries experience in both high and low fluoride areas but Carmicheal et al (1980) found a significantly stronger effect of water fluoridation on caries in the primary dentition in the lower social classes. On this basis the present community will benefit highly from water fluoridation.

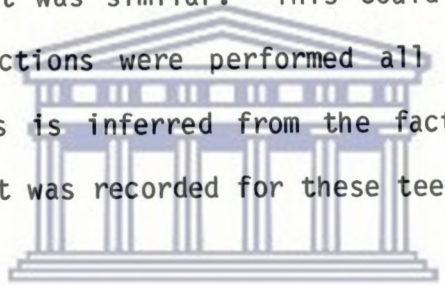
The present study found no significant difference in caries prevalence between males and females although the females had lower values for decayed teeth present and more of them were caries free. Most other studies have made similar observations (Sutcliffe 1977, Zadik 1978). Infante and Gillespie (1976) found males had a slightly higher prevalence of dental decay. There is no lucid explanation from the studies that have found a difference in the prevalence of dental caries between males and females.

Almost half of the subjects (48%) had rampant caries (dmft 5). This value was much higher than those obtained for other South African ethnic groups which ranged from 15% for rural Blacks to 30% for urban Whites (Cleaton-Jones et al 1978, 1978). However, for the Chinese group McInnes and Vieira (1979) recorded rampant caries in 61% of the children.

The phenomenon of bilateral symmetrical occurrence of dental caries in the primary dentition as recorded by Holland and Crowley (1982) was also demonstrated in the present study. The maxillary central incisors were the most frequently affected

teeth (55%), followed by the mandibular second molars (47%) and maxillary second molars (42%). Toth and Szabo (1959) and Holland and Crowley (1982) found the primary second molars most frequently decayed. This seem to indicate a difference in the susceptibility of tooth types amongst populations.

Labial or nursing caries denotes decay of the maxillary incisors (James et al 1957, Derkson and Ponti 1982). In the present study the maxillary central incisors were decayed almost twice (55%) as often as the maxillary lateral incisors (38%) but the missing component was similar. This could be due to the fact that when extractions were performed all four incisors were extracted. This is inferred from the fact that a negligible filling component was recorded for these teeth.



The decay of maxillary incisor teeth is often associated with poor early nursing habits (James et al 1957, Winter et al 1971, Dilley et al 1980). Although no dietary data was collected for the present study, the results suggest that poor, early and prolonged nursing habits played a role in the high prevalence of decay shown in the maxillary incisors from the age of two years. Gordon and Reddy (1985) studied feeding habits of infants in this community and found that infant feeding habits are influenced by the mother's dietary habits. In addition these children are introduced to sucrose containing products at a very early age.

Van Houte et al (1982) and Milnes and Bowden (1985) in studies of the microflora associated with nursing caries demonstrated a positive correlation between the plaque concentrations of S. mutans and the development of caries. Higher levels of S. mutans and Lactobacillus were found at the caries susceptible sites which were the maxillary incisors than at control sites which were mandibular incisors or the posterior teeth. However, the susceptible sites which did not develop caries in the caries active children had a microflora similar to the other susceptible sites. This suggests that factors other than the establishment of a "pathogenic" microflora are involved in the development of caries. One such factor may be the prolonged nursing habit so that the susceptible site may succumb because of the acidifying effect of dietary sucrose on the S.mutans colonization (van Houte 1980). The poor oral hygiene in the present study may explain the high prevalence of decay of the upper anterior teeth making these teeth more vulnerable.

The upper anterior teeth were more carious than the lower anterior teeth and the lower posterior teeth were more carious than the upper posterior teeth. Of the affected molars the second molars were more carious than the first molars. The decayed component for the maxillary and mandibular second molars was similar but the missing component was twice as high in the mandibular second molars. A similar trend was seen for the

first molars. The canines and mandibular incisors accounted for a relatively low proportion of the caries experience. Caries in the canines was observed at an early age, but its attack rate was maintained at the same low level in the different age groups. Of all the lower anterior teeth, the canines had the highest prevalence of decay. Similar observations were made by Toth and Szabo (1959). The present study showed that the second molars contributed 40% to the total caries experience of the primary dentition, the maxillary incisors 30.8% and the first molars 21.6%. Toth and Szabo (1959) recorded the sequence as second molars (40%) followed by first molars (27.5%) then central incisors (17%). The reason for the difference may be because Toth and Szabo (1959) separated the incisors into centrals and laterals but the present study combined them.

At age 2 years the maxillary incisors made up 62% of the total number of decayed teeth and the second molars 20% but at age 3 years the values were 31.5% and 42.8%, respectively. Thereafter, no conspicuous change occurred. This is in agreement with the observations of Toth and Szabo (1959). In England, Gibson et al (1981) found the second molars contributed 52.4% to the dmft and the maxillary incisors 8.2% in five year old children.

Numerous factors may contribute to the difference in susceptibility of the different tooth types in the primary dentition.

a) The eruption times of teeth. This may explain the higher prevalence of decay in the anterior teeth in the younger age groups but in the older age groups the posterior teeth have caught up in time (Toth and Szabo 1959).

b) Host factors such as salivary flow and its cleansing action may be playing a role in protecting the teeth. During nursing the liquid consumed bathes all of the teeth except the lower incisors which are physically protected by the tongue. The liquid can thus pool against the upper incisors and if the liquid contains a fermentable carbohydrate it will be acted upon by the oral bacteria (van Houte 1980) resulting in the production of acids that dissolve the teeth. The saliva which pools around the lower anterior teeth can buffer the acid production (Grobler and van der Horst 1982). The upper incisors are most ravaged while the lower incisors are protected (Ripa 1978).

c) The higher prevalence of decay in the posterior teeth compared to the anterior teeth may be explained on the basis of the morphology of the teeth. The posterior teeth have more pits and fissures and retentive areas for plaque accumulation (Loesche et al 1975). Occlusal surfaces are the most, and the lower anterior teeth the least susceptible to carious attack (Berman and Slack 1973).

In a laboratory study conducted by Hicks and Flaitz (1986) it was found that occlusal surfaces are not inherently more susceptible to a cariogenic challenge than smooth surfaces. The factors which contribute to the high susceptibility of occlusal surfaces to caries are: the provision of a retentive niche for microbial colonization, morphology makes it difficult to clean by toothbrushing, and fissure base is close to the amelodentinal junction (600um).

d) Mellanby et al (1957) found a high prevalence of hypoplasia of primary molars to be related to the high carious attack in these teeth. Infante et al (1975) also found linear enamel hypoplasia of the anterior teeth to be associated with a high caries attack rate. Both researchers attributed the hypoplasia to nutritional deficiencies during development of the appropriate teeth. In the present study a high prevalence of enamel hypoplasia (26.5%) was recorded but it decreased significantly with age. This may be because in the older child the hypoplasia became masked by caries or the affected teeth were extracted.

e) Akpata and Jackson (1978) in a study of Nigerian Blacks observed that in the permanent dentition the second molars were approximately twice as often carious as the first molars. Cleaton-Jones and Walker (1980) made the same

observation on South African rural Blacks but not on the urbanized Blacks where the molars were equally affected. Akpata and Jackson (1978) found this difficult to explain in purely environmental terms and stated that genetic factors may be involved. This is contrary to observations of molar caries in most western countries. However, no study has reported differences in site specificity in the primary dentition for different ethnic groups. Yassin and Low (1975) found racial differences in the caries prevalence of permanent teeth but not of the primary dentition. Bordoni et al (1973) reporting on the prevalence of dental caries in twins found little variation in the def averages between twin groups and controls. They found the environment to have strong bearing on caries experience in primary teeth.

In the present study the combined dmf experience of the individual teeth by age illustrated a statistically significant linear association between dmf and age for all the teeth except the canines. The maxillary central incisors were the most affected for all the age groups. For the posterior teeth the mandibular molars were affected more than the maxillary molars for all age groups.

This study has shown that for the two and three year age groups the anterior teeth contributed more to the dmf experience than the posterior teeth, but with increasing age there was a trend toward eliminating this difference. This agrees with the findings of Holm (1975c) and Infante et al (1975).

The mean dmf for the five year age group was 7.01 and only 7.7% caries-free which correlates well with the studies by Van Wyk et al (1976) and McInnes et al (1982) of the same ethnic group in South Africa. Most European studies (Holm 1975b, Gibson et al 1981) recorded lower scores of dmft. In the present study 88.5% of 5 year old subjects had decayed teeth present with a mean of 5.48 decayed teeth per subject and 65.4% had a dmft $\geqslant$5.

The mean dmft for the four year age group was 5.26 and only 19.2% caries-free which correlates with values by Bruszt et al (1977) but all other studies record a much lower dmft (Winter et al 1971, Holm 1975a, Holt et al 1982). Of the 4 year old subjects with any decayed teeth present (77.2%), the mean number of decayed teeth per subject was 5.55 and 48.3% had a dmft $\geqslant$5.

The mean dmft for the three year age group was 4.03 with 30.1% caries free. These values were much higher than those obtained by Hennon et al (1969), Infante and Russell (1974) and Sutcliffe (1977) for the same age group. In the 3 year age group 34.1% had a dmft $\geqslant$ 5 and of the subjects with decayed teeth present (69.9%), there was a mean of 4.92 decayed teeth per subject.

The mean dmft for the two year age group was 2.73 with 22.4% caries free. The values were higher than those obtained by Hennon et al (1969), Holt et al (1982) and Infante and Russell (1974). In the 2 year age group 16.3% had a dmft $\geqslant$5 and of the

subjects with decayed teeth present (61.2%), there was a mean of 3.53 decayed teeth per subject.

The percentage of caries free subjects was lower in the two year age group than in the three year age group. This could be due to the fact that the number of two year olds examined was very small. The number of subjects with a complete sound dentition decreased by almost half for every consecutive age group from 2-5 years. The values for those without decay present, that is, had carious teeth treated by extractions or restorations were still considerably low (38.8% for two year age group to 11.5% for 5 year age group).

The missing tooth component for those with any teeth missing showed that the two year age group had a mean of 2.0 teeth missing and the three, four and five year age groups had 5.07, 4.70 and 4.42 teeth missing, respectively.

The number of subjects with at least one tooth missing was high in the two year age group but this may be due to the small number of subjects examined in this age group. However, for the other age groups the percentage of subjects with missing teeth doubled for the consecutive age groups. It was 11.4%, 20.7% and 47.3% for the 3, 4 and 5 year age groups, respectively.
This reflected the predominant type of treatment that these children were receiving. The high number of untreated decayed

teeth present in the subjects indicated that treatment was only sought if there was discomfort and this may have resulted in an emergency extraction. This is borne out by Moola (1981), whose study of Black South African children recorded that 5.2% of the sample had received treatment in the past twelve months and went to the dentist only because they were in pain. Of the subjects wanting dental advice, about 64% wanted extractions. This was either due to their own or their parents past dental experience.

The other indicators of the lack of treatment sought were reflected in the high prevalence of dento-alveolar abscesses which doubled between the ages four (6.2%) and five (13.7%) and the filling component which made up 1.1% of the dmft.

Toth and Szabo (1959) observed a low count of fillings and no systemic treatment afforded to children of preschool age. Children were brought to the dentist by the parents only in the case of an emergency and the treatment undertaken by most dentists was the elimination of pain. Children of the lower social class receive relatively less restorative care than those in the higher class. The most teeth missing due to caries is in the lower social class (Milen et al 1981).

There is a reluctance of those in the lower socio-economic group to accept or seek restorative care for the primary dentition (Beal and James 1970, Yassin and Low 1975). This latter clinical observation has also been made by the author. Another factor which contributed to the low utilization of dental services in the present study was that these children's parents were all working and children were in the care of a crêche teacher.

Toth and Szabo (1959) regarded the fourth year of life as the critical one for the primary dentition. In the present study the greatest differences were observed between the ages four and five years which corresponds to the fifth year of life. It was between these two ages that the greatest increment in dmft was observed, the greatest decrease in the number of caries free subjects, more than twofold increase in rampant caries, and a twofold increase in the number of subjects with dento-alveolar abscesses.

5.2 SOFT DEPOSITS AND GINGIVITIS

Soft deposits were present almost universally in all age groups in all segments. 96.6% of the subjects claimed to brush their teeth at least once per day. The mean number of segments with soft deposits did not differ by age or for the whole group.

In the present study only 0.7% of subjects were plaque free. This is very low compared with values obtained in Sweden by Hugoson et al (1981). The reason for this low value could be the stringent measures used to record the presence of soft deposits which corresponded to Plaque Index 1 (Silness and Löe 1964) and higher. No differentiation was made in this study between the amount of soft deposits present per segment but only its presence or absence. If one assumes values of 0-2 segments of soft deposits to be good oral hygiene and 3-4 segments of soft deposits to be fair oral hygiene and 5-6 segments of soft deposits to be poor oral hygiene then it was found that the values correspondingly were 3.8%, 18.6% and 77.7%. These values were much higher than those by Zadik (1978) for Israeli preschool children but are comparable to those obtained by Gibson et al (1981) for five year old children in the United Kingdom.

Studies by Sutcliffe (1977) and Beal and James (1970) in the United Kingdom found a relationship between oral cleanliness and social class. They found that the lower social classes had the highest number of children with poor dental cleanliness. As most of the children in the present study were of the lower social class this may explain the poor oral cleanliness. However, Zadik (1978) failed to show any relationship between oral cleanliness and social class amongst Israeli children.

It was interesting to note that ten of the twelve crèches claimed that the children's teeth were brushed at the crèche under supervision at least once a day, but there was no difference in the plaque scores between the creches. When the responsibility for toothbrushing was investigated it was found that the parent helped with the younger child, but as the child became older the responsibility became the child's. 79.5% in the five year age group and 60.3% for the whole sample had the responsibility of brushing their own teeth. In the study by Gordon and Reddy (1985) of oral hygiene practices in infancy in the same community, it was found that 72% of mothers did not clean their children's teeth. There was a lack of knowledge of dental disease and how to control it. In the study by Holm (1975a) 73% of 4 year old Swedish subjects received help from parents.

Blinkhorn (1980) found that mothers view toothbrushing as a simple skill requiring little manual dexterity and 62% considered their preschool child as capable of using a toothbrush without maternal assistance.

Soft deposits and age were negatively related implying that older children had less soft deposits as they probably brushed more efficiently. The lower anterior segment followed by the upper anterior segment had less soft deposits than the posterior segments. Mackler and Crawford (1973) found anterior teeth

accumulate more plaque than the posterior teeth in the primary dentition although there are no differences regarding the rate and amount of plaque development. The reason the anterior segments had less plaque in this study may be due to children brushing more anteriorly than posteriorly when they do brush.

Kleber et al (1981) showed that children 10 years and older brushed their teeth for approximately one minute per brushing but failed to brush 38% of tooth surfaces eg. occlusal of maxillary teeth and the lingual surfaces. These areas are less accessible and require greater manipulative skill.

Soft deposits were usually observed with equal frequency on the buccal of the upper posterior segments and on the lingual of the lower posterior segments. The lingual surfaces of the mandibular teeth are protected by the lateral borders of the tongue and plaque may develop undisturbed. Mackler and Crawford (1973) found that mandibular teeth accumulated more plaque than maxillary teeth. They proposed that the morphology of the maxillary teeth and the action of the tongue may have a favourable effect in discouraging plaque accumulation of the maxillary teeth.

The segments of gingivitis distribution followed a similar pattern to that of the soft deposits. However, more gingivitis was recorded on the lower posterior segments lingually than on

the upper posterior segments buccally. This is in agreement with findings by Hugoson et al (1981).

The observation of MacGregor et al (1979) on the sequence of toothbrushing shows that lingual areas are rarely brushed. The fact that 45% of subjects neglected to brush this area could explain the high prevalence of gingivitis in this area.

The mean number of segments with gingivitis in the age groups showed a slight increase with age but this was not significant. It was interesting to note that the percentage distribution of children with gingivitis was similar for the age groups and, therefore, only the values for the whole sample are given. Although other studies also recorded the presence of gingivitis in preschool children, the values are much lower than those obtained in the present study (Holm 1975, Gibson et al 1981). This may be due to differences in scoring criteria used. Gibson et al (1981) only recorded gingivitis on the buccal segments and Poulsen and Moller (1972) used GI of 2 according the Silness and Loë Index (1964) to score the prevalence of gingivitis. In the present study more stringent measures were used which may account for the higher prevalence values obtained or the difference in prevalence from other studies may be real.

The prevalence was recorded for GI 1 or higher according the Silness and Loë Index (1964).

There was a weak correlation between the total soft deposits and total gingivitis. Although only 0.7% of subjects had no soft deposits, 11,3% had no gingivitis and 60% had six segments of soft deposits but only 4.2% had six segments of gingivitis. Mackler and Crawford (1973), Matsson (1978) and Bimstein et al (1985) showed no correlation between the amount of plaque and the degree of gingival inflammation. Gingivitis also developed much more slowly in preschool children. It was found that the higher the number of segments of soft deposits present the greater the tendency for the presence of gingivitis ($p<0.0001$). Zadik (1978) made similar observations.

Lindhe et al (1975) in the study of professional toothcleaning in schoolchildren found low Plaque Index scores were associated with low Gingival Index scores. It was also noted that in the test group the prophylactic programme was equally effective in the incisor and molar regions. In the controls the gingiva around molars were more often severely inflamed than that around incisors. In the present study it was also noted that there was more inflammation in the posterior molar segments than in the anterior segments. This may be due to the fact that most children did not clean the posterior segments effectively.

The microbiology of the soft deposits in the development of gingivitis is similar in preschool children to that observed in adults (Mackler and Crawford (1973) but gingivitis develops much

more slowly in children. The child tissue response resembles that of an early lesion of gingivitis in adults (Longhurst et al 1977). In a longitudinal study of periodontal disease, Loë et al (1978) concluded that without interference the destruction of the periodontium progressed at a relatively even pace and was continuous with age. However, it was unclear whether this was due to the cumulative effect of plaque and calculus or to an increase in susceptibility related to age (Loë et al 1978).

Recently, other data have become available which are inconsistent with the "continuous disease" hypothesis as proposed by Loë et al (1978). New concepts of destructive periodontal disease have been suggested by Socransky et al (1984). Data from longitudinal monitoring of periodontal changes indicate that periodontal disease progresses by recurrent acute episodes in individual sites of the mouth. An extension of the random disease model is also suggested in which bursts of destructive periodontal disease activity occur with higher frequency during certain periods of an individual's life.

A study was conducted by Reddy, Africa and Parker (1986) of the periodontal status of an urban adult South African Black population with poor oral hygiene. Although 90% of the tooth surfaces sampled were covered with plaque, the individuals appeared to be resistant to periodontitis as assessed clinically

by probing depths and loss of attachment measurements but there were widespread signs of gingivitis. They also noted that the increase in the percentage of spirochaetes recorded was more suggestive of a measure of inadequate oral hygiene than an indicator of periodontitis.

In the preschool child, Bimstein et al (1985) were unsure whether the tissue response may have been due to an innate resistance and the presence or absence of host response. It was noted in the present study that the mean number of segments with gingivitis (2.74) within the age groups did not differ significantly. This could mean that preschool children as a group show an innate resistance or that there was a certain susceptibility in some children which was independent of age but only responded to the presence of soft deposits.

The role that socio-economic factors play in the manifestation of gingivitis is not clear. Enwonwu (1981) in a review of oral disease in Africa stated that, "regardless of oral hygiene, which is universally poor in these countries, the lowest socio-economic underprivileged communities appear to suffer more severe periodontal destruction than the more affluent communities in the same country". The ill-defined contribution of malnutrition among other factors was not to be underestimated.

In the present study the children were predominantly from the lower socio-economic level and the poor oral hygiene and malnutrition may be contributing to the high prevalence of gingivitis compared to that obtained by Holm et al (1975) and Hugoson et al (1981) in Swedish children.

The association of dmft with soft deposits was not significant, but it was significant with gingivitis ($p < 0.0001$). The association of soft deposits and gingivitis with the number of decayed teeth were both very significant ($p < 0.0001$). Zadik (1978) found a weak correlation between the degree of caries and oral hygiene but Evans et al (1982) found a consistent trend of decreasing oral hygiene index with a corresponding decrease in dmft.

Some of the factors affecting the association between caries and soft deposits are:

(a) **Scoring criteria:**

Soft deposits are scored on buccal and lingual aspects but caries susceptible areas are occlusal and interproximal. The oral hygiene indices are a momentary measurement while caries indices represent a cumulative effect of several years (Richardson et al 1977).

(b) **Sugar consumption:**

Kleemola-Kujala and Räsänen (1982) found that with increasing total sugar consumption the risk of caries in Finnish children increased significantly only when oral hygiene was simultaneously poor. The increase in sugar consumption encouraged S. mutans colonization and the production of acids by S. mutans which is necessary for caries initiation (Van Houte 1980). The more soft deposits present the more favourable the environment for acid to stay in contact with the tooth and, therefore, enamel dissolution.

(c) **Microflora:**

Milnes and Bowden (1985) have shown that factors such as diet and feeding patterns, and not only a "pathogenic" microflora (one composed of S. mutans) are involved in the development of caries at various tooth sites and that local conditions at individual sites dictated the production of a lesion.

(d) **Fluoride:**

A study was conducted (Yasin-Harnekar and Reddy 1982) comparing children of the low socio-economic levels in a high fluoride (2.5ppm) area with those in a low fluoride (0.1 ppm) area. More subjects were caries-free and the dmft was lower in the high fluoride group although the soft deposit scores for the two groups were similar.

Fluoride has the ability to inhibit the synthesis of polysaccharides in dental plaque (Levine 1976) but this beneficial effect is dependent on a frequent supply of fluoride ions to the plaque. The plaque also takes up and stores fluoride and therefore at the enamel-plaque interface there may be a continuous availability of fluoride ions (Levine 1976).

Caries-like lesions were produced in vitro by Shellis (1984). The mean lesion depth was significantly greater in primary than in permanent enamel. The greater susceptibility of primary enamel appears to be due to the greater porosity. However, Shellis (1984) concludes that in the mouth factors such as tooth morphology and salivary flow are probably more important in determining the overall pattern of caries prevalence than the intrinsic susceptibilities of the teeth.

Iijima and Katayama (1985) in a study to assess the fluoride concentration in primary enamel in high and low fluoride areas confirmed that fluoride accumulates preferentially in the outermost layer of enamel. This would make the enamel surface more resistant to acid dissolution (Levine 1976).

(e) **Social class:**

Colquhoun (1985) in New Zealand concluded that levels of child dental health are more related to socio-economic factors than to water fluoridation. Hausen et al (1982) in Finland found that

differences between social classes in caries in the primary dentition cannot be removed solely by implementing water fluoridation. However, Carmichael et al (1980) suggested that the adjustment of water fluoride to the optimum level would appear to benefit particularly lower social classes and remove inter-social class differences in dental caries experience.

Evidence from developed countries indicates that the improvement in oral hygiene from the regimen of frequent professional mechanical cleansing is great enough to improve conditions such as gingival inflammation and plaque accummulation (Poulsen et al 1976) and is effective in reducing new carious lesions.

In Nigeria, 6 year old children from the lower socio-economic levels had higher percentages of poor oral cleanliness than those from the higher socio-economic levels but the dmft was lower in the former group than in the latter (Noah 1984). Children from the higher socio-economic group consumed more refined carbohydrates.

Schröder and Granath (1983) used gingival status as a measure of oral hygiene. They showed that 3 year old Swedish children with clean teeth, irrespective of dietary habits, and those with suitable dietary habits, provided they did not have generalized gingivitis with bleeding, might be regarded as at low caries

risk. Children with other combinations of oral hygiene and dietary habits were regarded as caries risks. Oral hygiene turned out to be more effective for preventing caries than dietary habits.

It can be concluded that there is a relationship between soft deposits and caries, and soft deposits and gingivitis. In a cross-sectional prevalence study this may not always be clearly demonstrated because of the diagnostic criteria used. Soft deposits are a momentory measure whereas gingivitis and caries are cumulative measures.

As gingivitis and caries are both cumulative measures, comparisons between these two variables may be more precise. In the present study it was noted that the association between dmft and soft deposits was not significant but it was significant with gingivitis ($p < 0.0001$).

In reply to the question regarding the colour of their toothbrush it was noted that 77% of the children who responded indicated the same colour the first and the second time the question was asked while 23% differed in their answers. It may be concluded that 77% of the answers were a truthful reflection of their possession of toothbrushes.

Red was the most popular colour followed by blue and 6.6% had no toothbrush at home. It was not known if red was really the most popular colour of the toothbrushes or merely a popular colour among children. It was observed that occassionally a child would indicate a colour that their friends have mentioned. For the younger child the different colour toothbrushes were displayed and they had to point out the colour of their toothbrush. A colour of the child's choice may have been chosen rather than an indication of the actual colour of the toothbrush owned.

5.3 ANTHROPOMETRY

In the present study 39.3% of the children were above the 50th percentile in weight and 24.3% above the 50th percentile for height. This meant that these children were generally lighter in weight and shorter in height. This would suggest that either the National Centre for Health Statistics (1979) standards for growth used were inappropriate for this South African population group or that these children were less developed physically.

Thomas (1984) did a study of South African preschool children weight- and height-for-age in the greater Cape Town area using the NCHS (1979) values. Coloured preschool children's weight-for-age ranged from 10-13.8% below the 5th percentile and the height-for-age 8.0-14.7% depending on the socioeconomic zone sampled.

In this preschool study the results of the weights (13% below the 5th percentile) correspond to that obtained by Thomas (1984) for Coloured preschool children but twice as many children (28%) were found to be below the 5th percentile for height.

The low weight in the present study correlated with that observed by Miller et al (1980) of children in Cardiff with extensive dental disease.

Miller et al (1986) in a study of children in Nigeria showed that those with oral disease have very low weights with only 17% above the 50% percentile and 24% above the 50th percentile in height. In the present study the weight was slightly better with almost twice (34.5%) as many children above the 50th percentile but the height values (20.1%) corresponded better.

It was noted in the present study that in the two and three year age groups the children were generally underweight and the weights did not correlate with their age. In the older age groups the correlation was more favourable. Weight-for-age expresses a nutritional "wasting" but does not distinguish between acute and chronic malnutrition (Thomas 1984). Although the children were receiving a substantial meal at the crēche, the results seem to indicate that the younger age groups may still be showing signs of chronic malnutrition from infancy.

If one accepts the views of Sweeney et al (1971) and Miller et al (1986) of an association between oral disease and malnutrition as evidenced by failure to thrive physically, then the high prevalence of dental disease in the present study may partly be due to malnutrition in early life of these children.

The study by Molteno et al (1980) shows that low birth weights in the present study population are still very common with 13.7% below 2500g. However, Richardson (1986) has shown that low birth weight did not play a meaningful detrimental role in growth in later years. It was found that subsequent growth patterns of rural Black children were not affected in spite of differences in birth weight. What may be more important is adequate nutrition postnatally to allow the children with low birth weight to catch up.

5.4 DEVELOPMENTAL DENTAL ANOMALIES

The prevalence of localized enamel hypoplasia and defects decreased significantly with age ($p < 0.05$). Most of the defects were observed in molars and upper anterior incisors although they were not recorded as such. This was in agreement with the findings of Mellanby et al (1957). They found the upper incisors and molars showed the most hypoplastic defects and the lower incisors and canines the least. The carious pattern followed a similar trend. In the present study the most carious teeth were the maxillary incisors and the molars and the

least carious the mandibular incisors and the canines. It may be that the hypoplasia was one of the factors that predisposed the teeth to decay. The decrease in prevalence of enamel hypoplasia with age could be due to these teeth becoming carious or being extracted. For generalized enamel hypoplasia defined as more than four teeth affected, a very low percentage was recorded for the study. Enamel hypoplasia is also associated with poor nutrition especially conditions of hypocalcaemia during tooth developmental stages. With the low anthropometric values obtained for these children and the high prevalence of decay of the maxillary anterior teeth, it may substantiate the findings of other researchers that nutritional factors affect the structure of the mineralized tissues (Fraser and Nikiforuk 1982) during development, and the resultant enamel hypoplasia predisposes the teeth to decay (Sweeney et al 1971).

The prevalence of traumatized teeth recorded was quite low compared to values obtained by Holm (1975c) and Evans et al (1980). The teeth affected most were the upper central incisors, which was observed clinically as being discoloured or fractured. The reason for the low prevalence recorded could be that teeth fractured subsequently became carious and were extracted.

Since all the children resided in a low fluoride area (< 0.05 ppm) no cases of fluorosis were recorded.

Two cases (0.4%) of tetracycline stained teeth were observed in this study. Evans et al (1980) also recorded a very low prevalence (three definite cases out of a total of 923) in New Zealand children. Zadik (1976) found 8% of the sample of Isreali children with tetracycline stained teeth. Males were affected twice as often as females. Stewart (1968) recorded a high prevalence of tetracycline stained teeth in children in Belfast. In the preschool age group, 72% showed clinical discolouration of teeth and the effect on the primary teeth was invariably greater than that observed on the permanent teeth.

Frankel (1970) observed that the medically recommended therapeutic dose will be associated with the discoloration of teeth forming at the times of administration of tetracycline. It was further noted that generally administration of the drug before ten months of age affected the primary teeth and after this time affected the permanent teeth.

Among the various factors that affect tooth discolouration is the type of tetracycline drug used. Bridges, Owen and Stewart (1969) in an experimental investigation of discolouration of 5 different types of tetracyclines in rats found oxytetracycline to result in the least unpleasant dental effects.

Subsequently, the WHO (1980) in a bulletin regarding drug

information recommended the use of doxycycline and minocycline as these have little tendency to chelate the calcium in teeth.

The low prevalence in the present study may be due to the greater awareness among practitioners about the dental effect of the drug and therefore they are less inclined to administer it or if they do, then they may be administering the types that have less effect on the teeth. It must also be remembered that administration of tetracycline after nine months of age will not have an effect on the primary teeth (Frankel 1970).

Bruxism refers to grinding or clenching the teeth. It is usually done subconsciously and may occur while the child is awake or asleep. The incidence of bruxism varies from 5 to 81 percent. This wide range results from differing definitions, diagnostic criteria, populations, and sampling techniques (Schneider and Peterson 1982). Clinical signs vary depending on the intensity with which the child bruxes. A moderate amount of occlusal wear on primary teeth is normal but in a few children bruxing will wear away most of the enamel and dentine. In the present study twenty one cases (3.8%) of generalized moderate to severe occlusal wear or attrition with dentine exposed was recorded.

Crowding in the lower anterior segment of the primary dentition was not common (0.5%). Similarly, other malocclusion traits in

the primary dentition were not observed with any frequency. Lavelle (1976) in a study of multi-racial malocclusions in adult skulls found crowding occurred more in the mandibular than the maxillary arches. Crowding in the mandibular arch was more prevalent in mongoloids (20%) than in negroids (5%). Laine and Hausen (1985) also observed more mandibular (32%) than maxillary (7%) crowding in Finnish students. The frequency of crowding recorded by De Muniz (1986) for the mandibular anterior segment in Argentine schoolchildren was much lower (7%).

The prevalence of high labial frenal attachment with central incisor diastema in the maxilla was recorded at 2.7% (15 cases) in the present study for the primary dentition. De Múniz (1986) in an epidemiological survey of malocclusion in Argentine schoolchildren, the frequency of incisor diastema in the maxilla was 2.0% for the permanent dentition. The Caucasian group had a greater frequency (2.6%) than the Amerindian group (1.0%).

Mellanby et al (1957) found that children with black or brown superficial stains on their teeth have a lower incidence of caries than those with no stains or other colour stains. In the present study the number of cases observed was too small to substantiate these findings. Three of the five children with brown or black stains had carious teeth. Other stains were usually associated with very poor oral hygiene.

5.5 ORAL SOFT TISSUE LESIONS

The prevalence of geographic tongue (1.1%) was in agreement with that obtained by Redman (1970) and Sedano (1975). The lack of any cases of median rhomboid glossitis substantiates Baughman's (1971) findings that it is an infectious process of the tongue that occurs in adults and is not a developmental defect. Farman et al (1977) proposed that it is a clinical rather than a pathologic entity.

In spite of the low anthropometric values for the children and poor oral hygiene as reflected by the presence of soft deposits, no cases of acute necrotizing ulcerative gingivitis (ANUG) were recorded.

Enwonwu (1972) did epidemiological and biochemical studies of acute necrotizing ulcerative gingivitis (ANUG) and noma in Nigerian children. He observed that ANUG was a disease of the lowersocioeconomic group and the severity of the malnutrition increased the incidence of the condition. Children with borderline malnutrition showed an incidence of 15% and those hospitalized for severe protein-calorie malnutrition had an incidence of 27%. Enwonwu (1981) found no cases in privileged Nigerian children of the same ethnic background and comparative age group as the rural community. The precise aetiology of the condition is not yet clearly defined but theories concerning its causation range from poor oral hygiene to conditions of stress.

The status of oral hygiene of these cases was not enough to explain the presence of these lesions in only the poor underprivileged communities. Enwonwu (1972) concluded that an adequate supply of dietary nutrients was important for the maintenance and functional integrity of oral tissues.

Sawyer et al (1986) observed the comparison of oral microflora between well-nourished and malnourished Nigerian children. Their findings showed that bacteria isolated from the malnourished subjects were strongly indicative of disease processes and could be explained by the malnourished state of the individuals. An improvement in nutrition, along with presumably better oral care, caused a shift in microbial flora to one indicative of oral health. Malnourished children had a significantly higher number of isolates containing anaerobic microflora including spirochaetes.

In the present study one can only surmise that although the oral hygiene was poor and the children were mostly from the lower socio-economic group, the crēches may have provided a favourable environment and an adequate nutrition. Although no dietary record was made, enquires were done regarding meals served at the crēches. These were usually a late morning snack of milk or tea and bread, and a hot meal at lunchtime.

The high prevalence of abscessed teeth recorded was much higher than that recorded by Evans et al (1980). The increase in prevalence with age was due to the accumulation and progression of the untreated decayed teeth.

Generally there was a low prevalence of oral mucosal lesions in these preschool children.

CONCLUSIONS and RECOMMENDATIONS

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

Within the limits of this study, which was restricted to a sample of children attending créches, the following conclusions and recommendations emerge:

CONCLUSIONS

1. The dental caries prevalence corresponded to that obtained for developing communities. ($\bar{x}$ = 5.37 It ranged from 2.73 at 2 years to 7.01 at 5 years).
2. The decayed component made up the greater part of the dmft irrespective of age. This showed the unmet treatment need and is supported by the following observations:
   (a) There was a high prevalence of dental abscesses increasing with age which indicated the advanced caries state of these children
   (b) The missing tooth component increased with age which may be indicative of the type of treatment obtained ie. of an emergency nature.
   (c) The filling tooth component was negligibile. This could reflect the lack of dental awareness or availability of dental services to this age group.
3. The composition of the dmft reflects the trend obtaining for preschool children in the lower socio-economic groups.
4. There was no significant difference in caries experience between males and females at any age as supported by other studies.

5. Almost half of the study sample (48%) had rampant caries dmft $\geqslant$5).
6. The phenomenon of bilateral symmetrical occurrence of dental caries was demonstrated for all the teeth at all age groups.
7. The maxillary central incisors were the teeth most affected by decay followed by the second molars. The canines and mandibular incisors were the least affected teeth. There was an increase in the decay experience of all the tooth types with age except for the canines and mandibular incisors.
8. The fifth year of life was the critial year for the primary dentition in terms of teeth affected by decay.
9. Soft deposits were present almost universally in all the children. The lower anterior segment displayed the lowest prevalence of soft deposits. There was a weak positive association between total soft deposits and total gingivitis.
10. Most pre-school children (60%) brushed their teeth independently with maternal help limited to the younger age group.
11. The presence of gingivitis was a better criterion to correlate dmft and decayed teeth than was soft deposits.
12. The children were generally lighter in weight and shorter in height according the NCHS (1979) standards. The younger children were underweight but the weight of older children was within normal limits.
13. Oral mucosal lesions were uncommon in this age group.
14. Hypoplastic lesions (20%) decreased with age.

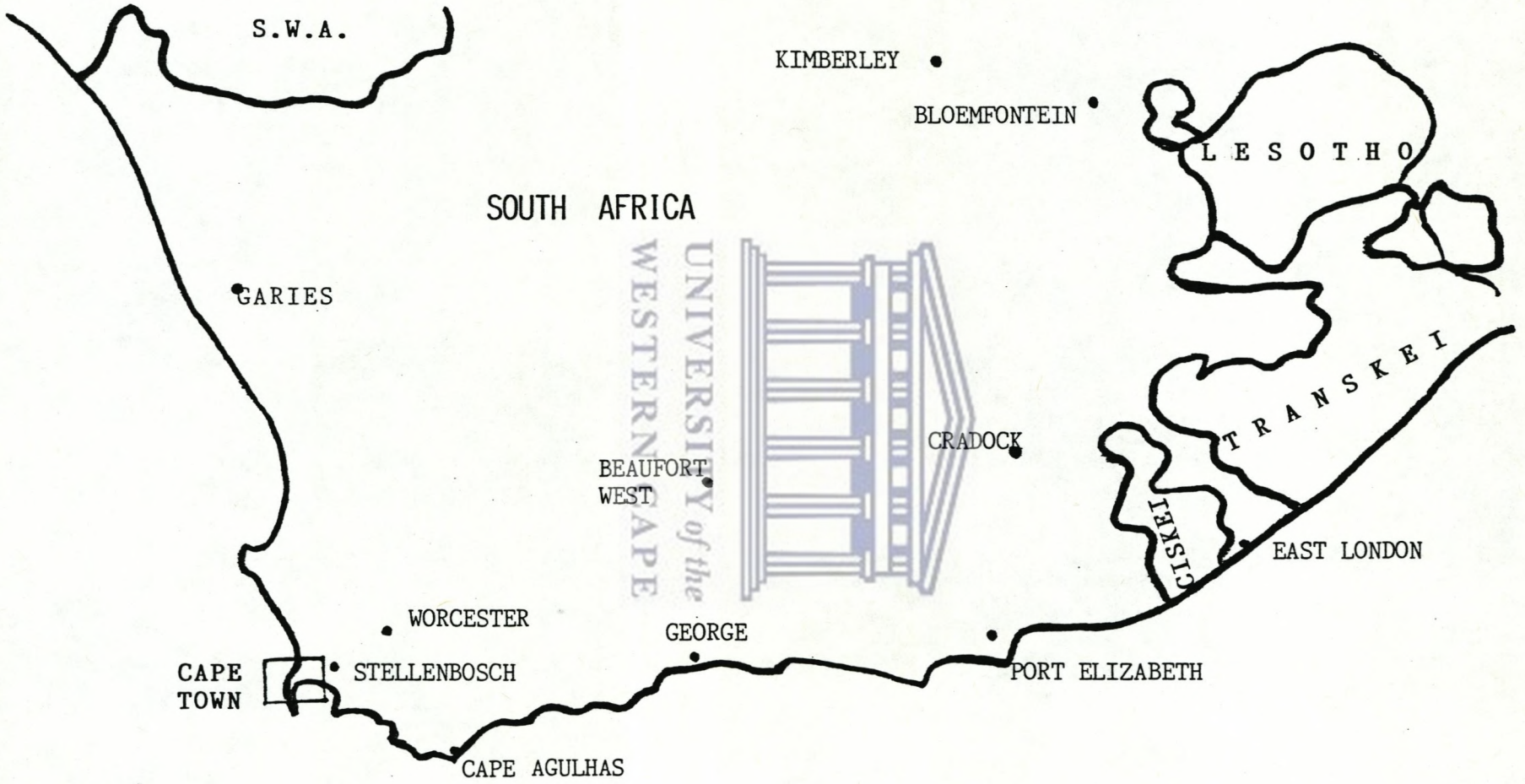
RECOMMENDATIONS

1. Increase the oral health awareness and knowledge of the parents, crêche teachers and subsequently, the children of this community.
2. Organize a crêche - based oral health programme to improve the oral health of these children. The programme should involve toothbrushing, dietary counselling and fluoride rinses or supplements.
3. The high decay rate of the maxillary anterior teeth and the high prevalence of decay in the younger age groups seem to reflect poor nursing habits during infancy. The effects of poor feeding habits during infancy should be stressed to pregnant and nursing mothers.
4. Provide optimal water fluoridation which would do much to alleviate this high caries rate as have been shown in numerous studies.
5. Provide and encourage utilization of a comprehensive dental service for this age group and not only an emergency service as is evident by the negligible filling component and the high missing component.
6. The low anthropometric values obtained may:
   a) reflect the smaller stature of these children and as such the NCHS (1979) standards are not applicable and a different set of values have to be devised.
   b) suggest the poor nutritional status of these children and therefore dietary supplementation should be instituted from an early age.

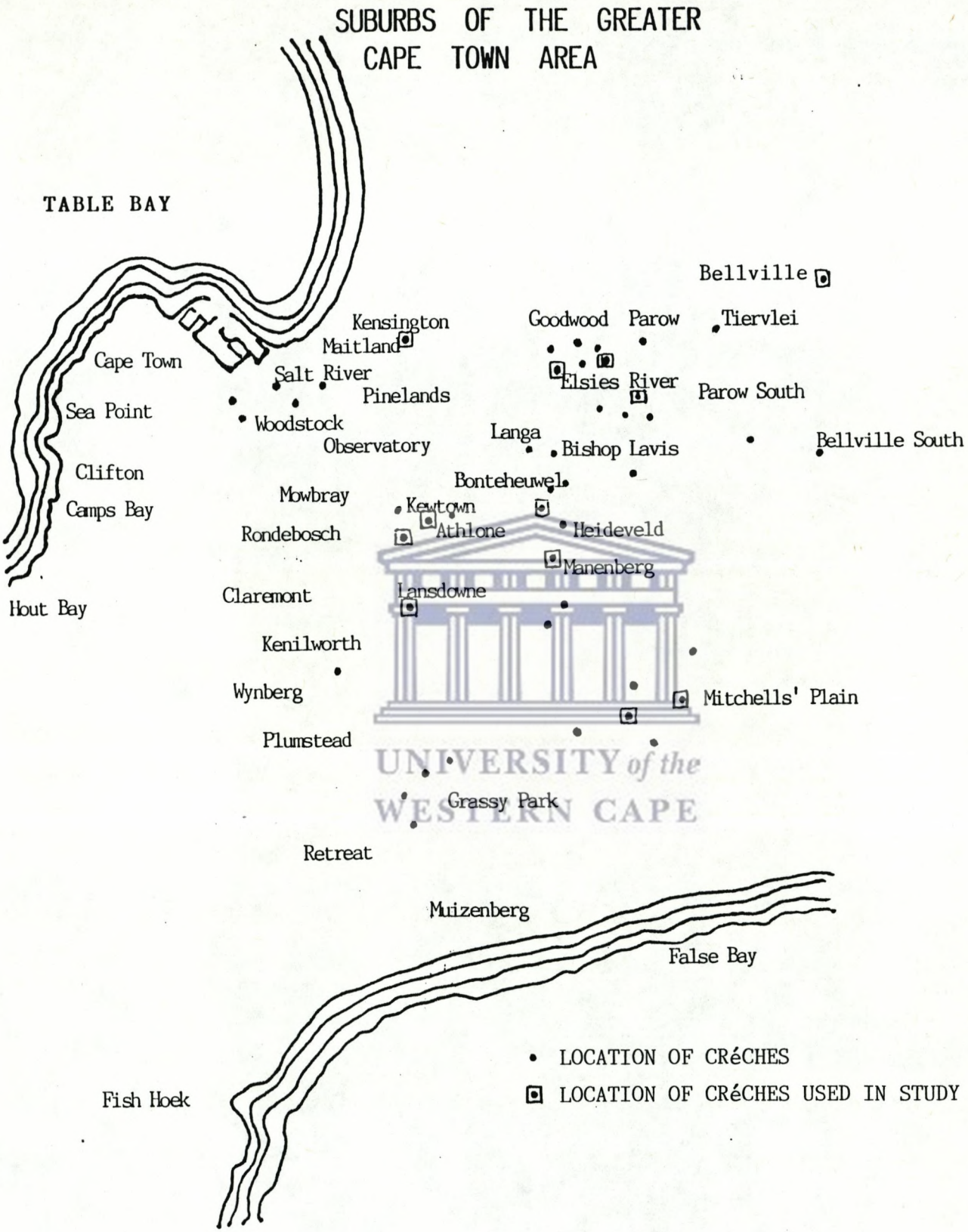
APPENDIX

APPENDIX: KEY TO ABBREVIATIONS

N	=	Total number in sample on which figures are based
n	=	Number in group on which figures are based
%	=	percentage
'd'	=	decayed
'm'	=	missing
'f'	=	filled
dmft/s	=	decayed, missing, filled teeth/surfaces
df	=	decayed, filled
s.d.	=	standard deviation
$\bar{x}$	=	mean
55,54 etc.	=	tooth type designated according to FDI two digit system
mnths	=	months
post	=	posterior
ant	=	anterior
R	=	Right side
L	=	Left side
Mx	=	Maxillary
Md	=	Mandibular
CI	=	Central Incisors
LI	=	Lateral Incisors
Ms	=	Molars



APPENDIX MAP 1: Map of South Africa. Blocked area depicts location where study was conducted.



APPENDIX MAP 2: Suburbs of the greater Cape Town areas where créches were located.

University of the Western Cape
Universiteit van Wes-Kaapland

Private Bag X12
Tygerberg, 7505
Tel.Add.: UNIBELL, S.A.
Tel. 931-4281

Privaatsak X12
Tygerberg, 7505
Tel.Ad.: UNIBELL, S.A.
Tel. 931-4281

DEPARTMENT OF CONSERVATIVE DENTISTRY

Faculty of Dentistry
Fakulteit Tandheelkunde

Dir. line/lyn .....

Ref./Verwys. .....

Date.....

Address.....

.....

.....

I am a post-graduate student at the University of the Western Cape Dental Faculty and intend doing a survey on the dental status of preschool children. A random selection of créches in the Cape Peninsula will be visited and a certain number of children from each créche will be examined. My selection of créches include the ..... créche.

I would appreciate it if you would grant me permission to examine the children from your créche.

Thanking you,

Yours sincerely,

S.Y. HARNEKAR (DR).

SYH/jde.

APPENDIX LETTER 1: Request permission.

University of the Western Cape
Universiteit van Wes-Kaapland
DEPARTMENT OF CONSERVATIVE DENTISTRY

Private Bag X12
Tygerberg, 7505
Tel.Add.: UNIBELL, S.A.
Tel. 931-4281

Privaatsak X12
Tygerberg, 7505
Tel.Ad.: UNIBELL, S.A.
Tel. 931-4281

Faculty of Dentistry
Fakulteit Tandheelkunde

Dir. line/lyn .....

Ref./Verwys. .....

Dear .....

Thank you for sending me the list of names of the children in your crêche.

I wish to outline to you what our research entails. Having, acquired permission to attend your crêche, we will select about 40 children to examine. Their dental status and other relevant data will be recorded.

We intend using the data as follows:

1. To find out prevalence of dental caries and other oral diseases in preschool children.
2. The specific treatment needs of this age group.

I will inform you telephonically prior to our visit and also advise you on how to prepare the children for our visit.

Thanking you,

Yours sincerely,

DR. S.Y. HARNEKAR.

APPENDIX LETTER 2: Procedure at crêche.

DENTAL HEALTH IN PRESCHOOL CHILDREN.

1. PERSONAL INFORMATION:

Patient's Name:..... Registration No: [ ][ ][ ] 3

Age: Months [ ][ ] 4 5

Creche: ..... [ ][ ] 6 7

Sex: Male 1
Female 2 [ ] 8

Weight: kg [ ][ ] 10 11

Height: cm [ ][ ][ ] 12 14

What is the colour of your toothbrush?

Red	1
Blue	2
Yellow	3
Green	4
White	5
Other	6
No toothbrush	7

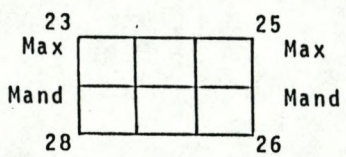
[ ] 15

2. ORAL MUCOSAL DISEASE: Absent = 0 Present = 1

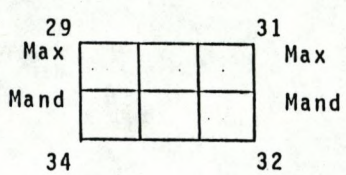
1.	Median Rhomboid Glossitis	[ ] 16
2.	Geographic Tongue	[ ] 17
3.	Acute Necrotizing Ulcerative Gingivitis	[ ] 18
4.	Herpetic Stomatitis	[ ] 19
5.	Abscess (gumboil/parulis)	[ ] 20
6.	Ulcers	[ ] 21
7.	Other: Specify	[ ] 22

3. PERIODONTAL STATUS: Absent = 0 Present = 1

Soft Deposits:



Gingivitis:

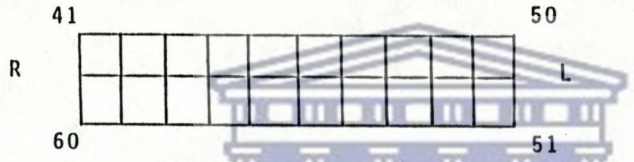


APPENDIX FORM 1: Oral Health Assessment.

4. DENTAL ABNOMALIES: Absent = 0 Present = 1

1.	Enamel Hypoplasia	Localized (1 to 4 teeth)	☐ 35
		Generalized (more than 4 teeth)	☐ 36
2..	Traumatized teeth		☐ 37
3.	Fluorosis		☐ 38
4.	Tetracycline Staining		☐ 39
5.	Other: Specify ..... (Fusion, Germination, Hypodontia, Supernumerary).		☐ 40

5. DENTAL CARIES STATUS:



Sound = 0

Decayed = 1

Filled = 2

Missing = 3

6. ORAL HYGIENE PRACTICE: No = 0 Yes = 1

Supervised brushing at creche ☐ 61

Brushing ☐ 62

Other ☐ 63

Daily frequency: once 1, twice 2, more than twice 3, never 4 ☐ 64

Specify:.....

Performed by parent 1
Performed by child 2
Performed by both 3 ☐ 65

What is the colour of your toothbrush?

Red = 1 Blue = 2 Yellow = 3
Green = 4 White = 5 Other = 6 No Toothbrush = 7

☐ 66

APPENDIX FORM 2: Oral Health Assessment.

DENTAL HEALTH IN PRESCHOOL CHILDREN

PATIENT'S NAME: ..... REGISTRATION NO: ☐☐

EXAMINER: ☐

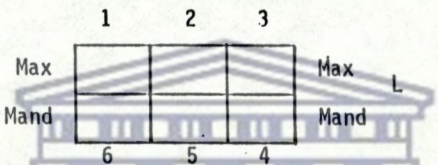
Examiner 1
Examiner 2

1st Examined = 1
2nd Examined = 2 ☐

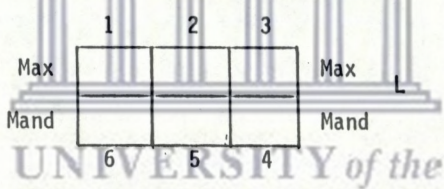
PERIODONTAL STATUS

Absent = 0 Present = 1

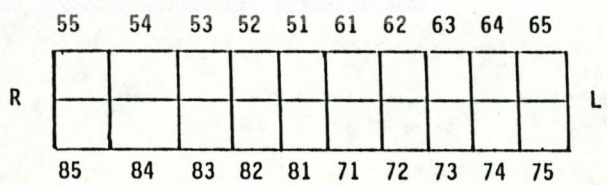
Soft deposits



Gingivitis



Dental Caries Status



SOUND = 0

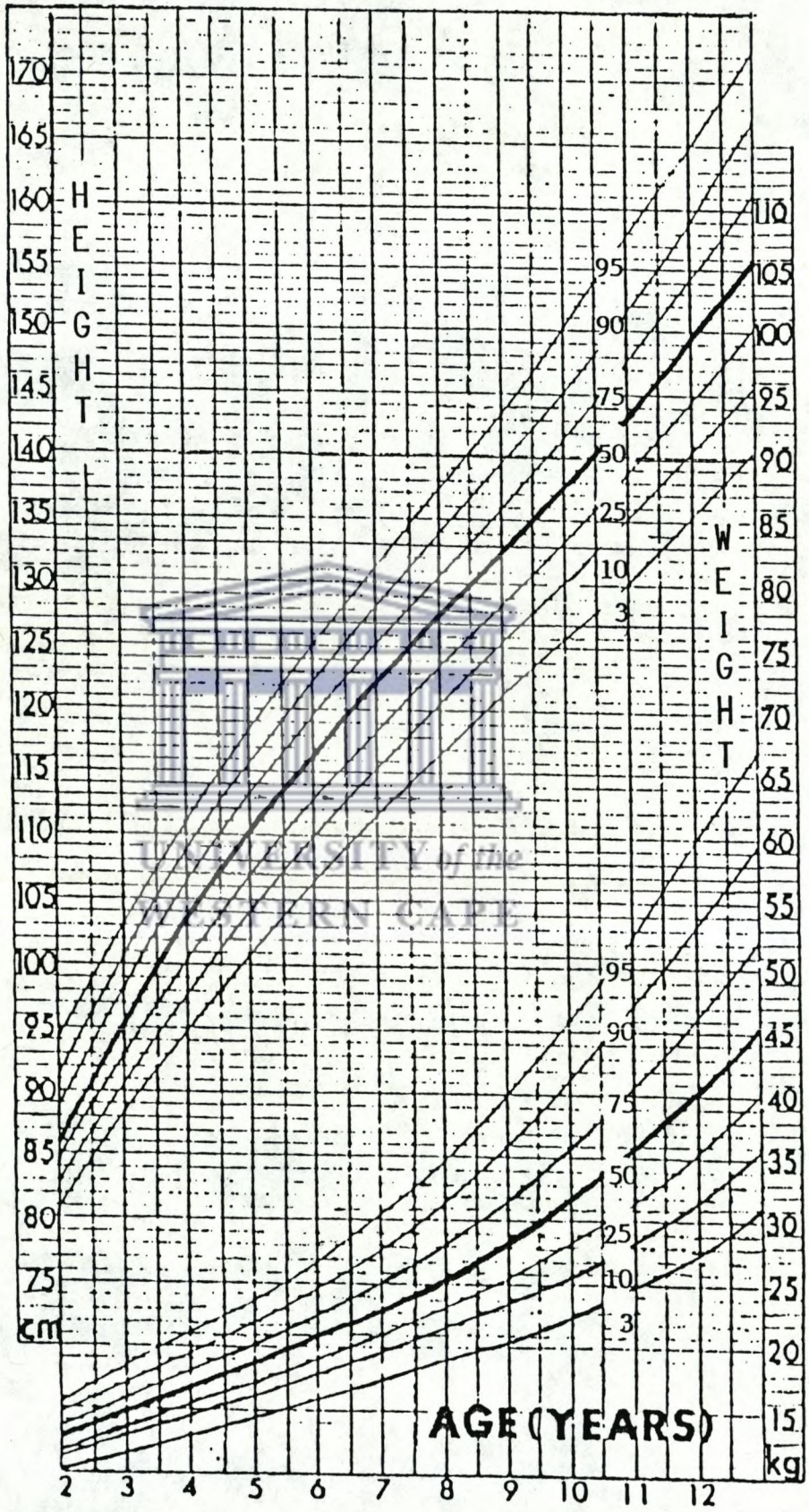
DECAYED = 1

FILLED = 2

MISSING = 3

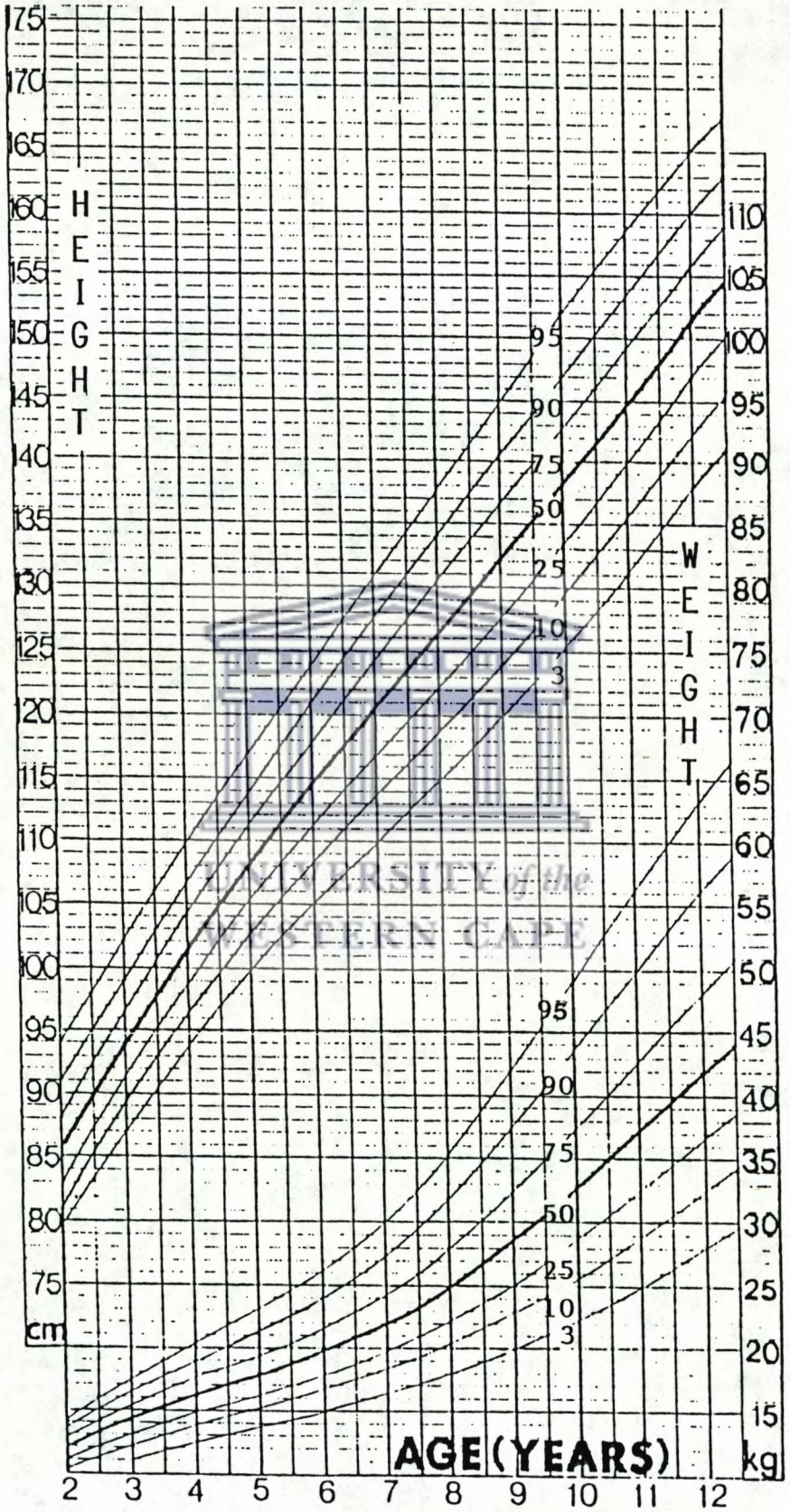
APPENDIX FORM 3: Examiner Calibration.

BOYS: ANTHROPOMETRIC MEASURES



APPENDIX GRAPH 1: National Centre for Health Statistics (1979). Percentile chart for boys 2-12 years.

GIRLS: ANTHROPOMETRIC MEASURES



APPENDIX GRAPH 2: National Centre for Health Statistics (1979). Percentile chart for girls 2-12 years.

APPENDIX TABLE 1

INTER-EXAMINER VARIABILITY: SOFT DEPOSITS (FIRST CALIBRATION)

Variable	Kappa Value Combined
SD1	0.019
SD2	- 0.110
SD3	0.211
SD4	0.177
SD5	- 0.017
SD6	0.031

APPENDIX TABLE 2

dmft DISTRIBUTION FOR THE SAMPLE BY SEX

dmft	n	%	MALES %	FEMALES %
0	99	18.0	15.3	21.1
1	46	8.4		
2	48	8.8		
3	43	7.9	40.2	36.8
4	49	9.0		
5	25	4.6		
6	32	5.9		
7	26	4.7		
8	39	7.1	28.1	27.1
9	30	5.5		
10	24	4.4		
11	25	4.6		
12	14	2.6		
13	15	2.7	12.8	11.7
14	9	1.6		
15	4	0.7		
16	7	1.3		
17	5	0.9		
18	3	0.5	3.6	3.4
19	3	0.5		
20	1	0.1		
	547	**100**	**100**	**100**

APPENDIX TABLE 3
THE dmf OF INDIVIDUAL TEETH FOR ALL AGES

U	55	54	53	52	51	61	62	63	64	65
%										
Sound	59.4	74.6	89.0	66.2	45.2	45.5	65.4	88.5	72.4	56.9
Decayed	36.0	19.6	8.4	20.7	39.5	39.5	21.6	9.1	22.3	38.2
Missing	3.8	5.7	2.6	13.2	15.0	15.0	13.0	2.2	4.8	4.0
Filled	0.7	0.2	0	0	0.4	0	0	0.2	0.5	0.9

L	85	84	83	82	81	71	72	73	74	75
%										
Sound	55.0	67.3	93.6	94.9	90.1	90.1	95.4	94.1	67.6	51.2
Decayed	36.7	26.5	6.2	3.8	4.2	4.4	3.1	5.7	24.9	38.8
Missing	7.1	5.5	0.2	1.3	5.7	5.5	1.5	0	6.9	9.1
Filled	1.1	0.7	0	0	0	0	0	0.2	0.5	0.9

APPENDIX TABLE 4

THE PERCENTAGE OF dmf-EXPERIENCE OF INDIVIDUAL TEETH BY AGE

U	55	54	53	52	51	61	62	63	64	65
AGE %										
24-35	32.7	10.2	4.1	16.3	46.9	46.9	22.4	4.1	10.2	20.4
36-47	24.4	15.4	9.8	29.3	45.5	43.9	28.5	10.6	17.9	30.9
48-59	42.0	28.0	14.0	36.3	53.4	54.4	33.2	11.9	28.5	45.6
60-75	52.0	33.5	10.4	39.0	64.8	63.7	43.4	13.7	37.9	54.9
ALL	40.6	25.4	11.0	33.8	54.8	54.5	34.6	11.5	27.6	43.1

L	85	84	83	82	81	71	72	73	74	75
AGE %										
24-35	16.3	8.2	4.1	0.0	2.0	2.0	0.0	0.0	10.2	16.3
36-47	38.2	23.6	2.4	3.3	4.1	4.9	4.1	5.7	19.5	41.5
48-59	44.6	32.6	7.3	2.6	5.2	5.7	2.1	4.7	32.6	51.5
60-75	57.7	45.6	8.8	10.4	20.9	19.8	8.8	8.8	46.7	59.9
ALL	45.0	32.7	6.4	5.1	9.9	9.9	4.6	5.9	32.4	48.8

APPENDIX TABLE 5

THE PERCENTAGE OF THE TOTAL NUMBER OF DECAYED TEETH CERTAIN TOOTH TYPES REPRESENT FOR ALL

	N = 426
Tooth Type	**% of total dt**
Mx Incisors	30.8
Mx 2nd Ms	20.0
Mx 2nd Ms	19.7
All 2nd Ms	39.7
Mx 1st M	8.5
Md 1st M	13.1
All 1st M	21.6

REFERENCES

REFERENCES

Adenubi, J.O. (1982). Rampant caries in Nigerian children: Preliminary Report. Journal of the International Association of Dentistry for Children, 13: 31-37.

Ainamo, J., Barmes, D.,Beagrie, G., Cutress, T., Martin, J. & Sardo-Infirri, J. (1982). Development of the World Health Organization (WHO) Community Periodontal Index of Treatment Needs (CPITN). International Dental Journal, 32: 281-291.

Akpata, E.S. & Jackson, D. (1978). Caries vulnerability of first and second permanent molars in urban Nigerians. Archives of Oral Biology, 23: 795-800.

Alanen, P., Tiekso, J. & Paunio, I. (1985). Effect of war-time dietary changes on dental health of Finns 40 years later. Community Dentistry and Oral Epidemiology, 13: 281-4.

Amaratunge, A., Heidemann, J. & Jayatilake, K. (1986). Oral health in a group of preschool children attending dental nurse clinics in the Kandy Area, Sri Lanka. Community Dental Health, 3: 169-173.

Axelsson, P. & Lindhe, J. (1974). The effect of a preventive programme on dental plaque, gingivitis and caries in schoolchildren. Results after one and two years. Journal of Clinical Periodontology, 1: 126-138.

Bang, G. & Kristoffersen, T. (1972). Dental caries and diet in an Alaskan Eskimo population. Scandanavian Journal of Dental Research, 80: 440-444.

Barmes, D.E. (1977). Epidemiology of dental disease. Journal of Clinical Periodontology, 4: 80-93.

Baughman, R.A. (1971). Median rhomboid glossitis: A developmental anomaly? Oral Surgery, 31: 56-65.

Baume, L.J. (1973). Pattern of dental disease in French Polynesia. International Dental Journal, 23: 579-584.

Beal, J.F. & Dickson, S. (1974). Parental awareness of the dental needs of 5 year old children in the West Midlands, England. Community Dentistry and Oral Epidemiology, 2: 91-94.

Beal, J.F. & James, P.M.C. (1970). Social differences in the dental conditions and dental needs of 5 year old children in four areas of the West Midlands. British Dental Journal, 129: 313-318.

Beautrais, A.L., Fergusson, D.N. & Shannon, F.T. (1982). Use of preschool dental services in a New Zealand birth cohort. Community Dentistry and Oral Epidemiology, 10: 249-252.

Beck, J., & Drake, C. (1975). Some epidemiologic evidence on the etiology of caries. Community Dentistry and Oral Epidemiology, 3: 223-227.

Berman, D.S. & Slack, G.L. (1973). Susceptibility of tooth surfaces to carious attack: a longitudinal study. British Dental Journal, 134: 135-139.

Bimstein, E., Lustmann, J., & Soskolne, W.A. (1985). A clinical and histometric study of gingivitis associated with the human deciduous dentition. Journal of Periodontology, 56: 293-296.

Blinkhorn, A.S. (1978). Influence of social norms on toothbrushing behaviour of preschool children. Community Dentistry and Oral Epidemiology, 6: 222-226.

Blinkhorn, A.S. (1980). Factors influencing the transmission of the toothbrushing routine by mothers to their preschool children. Journal of Dentistry, 8: 307-311.

Blinkhorn, A.S. (1981). Dental preventive advice for pregnant and nursing mothers - sociological implications. International Dental Journal, 31: 14-22.

Bordoni, N., Dono, R., Manfredi, C. & Allegrotti, I. (1973). Prevalence of dental caries in twins. Journal of Dentistry for Children, 40: 440-443.

Boyar, R.M., & Bowden, G.G.(1985). The microflora associated with the progression of incipient carious lesions in teeth of children living in a water-fluoridated area. Caries Research, 19: 298-306.

Bridges, J.B., Owens, P.D.A. and Stewart, D.J. (1969). Tetracyclines and teeth: An experimental investigation into five types in the rat. British Dental Journal, 126: 306-311.

Bruszt, P., Banoczy, J., Esztany, I., Hadas, E., Marosi, I., Nemes, J. & Albrecht, M. (1977). Caries prevalence of preschool children in Baja, Hungary 1955 and 1975. Community Dentistry and Oral Epidemiology, 5: 136-139.

Carlsson, P., Olsson, B. & Bratthall, D. (1985). The relationship between the bacterium Streptococcus mutans in the saliva and dental caries in children in Mozambique. Archives of Oral Biology, 30: 265-268.

Carmichael, C.L., Rugg-gunn, A.J., French, A.D. & Cranage, J.D. (1980). The effect of fluoridation upon the relationship between caries experience and social class in 5 year old children in Newcastle and Northumberland. British Dental Journal, 149: 163-167.

Cleaton-Jones, P., Richardson, B.D., McInnes, P.M. & Fatti, L.P. (1978a). Dental caries in South African White children aged 1-5 years. Community Dentistry and Oral Epidemiology, 6: 78-81.

Cleaton-Jones, P., Richardson, B.D. & Rantsho, J.M. (1978b). Dental caries in rural and urban Black preschool children. Community Dentistry and Oral Epidemiology, 6: 135-138.

Cleaton-Jones, P., Richardson, B.D. & Walker, A.R.P. (1979). Anticipated changes in caries prevalence in South Africa. Journal of the Dental Association of South Africa - Special Health Year Issue, 34: 723-727.

Cleaton-Jones, P. & Walker, A.R.P. (1980). Patterns of tooth vulnerability to caries in South African high school pupils. Community Dentistry and Oral Epidemiology, 8: 203-207.

Cleaton-Jones, P., Richardson, B.D. & McInnes, P.M. (1981). Dental caries in Coloured and Indian children aged 1-5 years. Journal of the Dental Association of South Africa, 36: 17-20.

Cleaton-Jones, P., Richardson, B.D., Sinwell, R., Rantsho, J. & Granath, L. (1984). Dental caries, sucrose intake and oral hygiene in 5 year old South African Indian children. Caries Research, 18: 472-477.

Cole, M.F., Arnold, R.R., Rhodes, M.J. & McGhee, J.R. (1977). Immune dysfunction and dental caries: A preliminary report. Journal of Dental Research, 56: 198-204.

Colquhoun, J. (1985). Influence of social class and fluoridation on child dental health. Community Dentistry and Oral Epidemiology, 13: 37-41.

Cutress, T.W. (1986). Periodontal health and periodontal disease in young people : global epidemiology. International Dental Journal, 36: 146-151.

Danish Medical Research Council in co-operation with Danish Hospital Institute. (1986). Prevention and treatment of dental caries. British Dental Journal, 161(3): 81-84.

De Jager, C.L. (1965). Dental caries incidence of the Okavango Bushmen. Journal of the Dental Association of South Africa, 20: 365-373.

De Múniz, B.R. (1986). Epidemiology of malocclusion in Argentine children. Community Dentistry and Oral Epidemiology, 14: 221-224.

Derkson, G.D. & Ponti, P. (1982). Nursing bottle syndrome; Prevalence and etiology in a non-fluoridated city. Journal of the Canadian Dental Association, 48: 389-393.

Dilley, G.J., Dilley, D.H. & Machen, J.B. (1980). Prolonged nursing habit: A profile of patients and their families. Journal of Dentistry for Children, 47: 102-108.

Doyle, A.J. (1977). A marked difference in caries prevalence between 5 year old children in two areas of Staffordshire, England. Community Dentistry and Oral Epidemiology, 5: 169-172.

Drug and Therapeutics Bulletin. (1986). Routine six-monthly checks for dental disease? British Dental Journal, 161: 78-79.

Enwonwu, C.O. (1972). Epidemiological and biochemical studies of necrotizing ulcerative gingivitis and noma (cancrum oris) in Nigerian children. Archives of Oral Biology, 17: 1357-1371.

Enwonwu, C.O. (1974). Socio-economic factors in dental caries prevalence and frequency in Nigerians. Caries Research, 8: 155-171.

Enwonwu, C.O. (1981). Review of oral disease in Africa and the influence of socio-economic factors. International Dental Journal, 31: 29-37.

Evans, R.W., Beck, D.J. & Brown, R.H. (1980). Dental health of 5 year old children: a report from the Dunedin Multi-disciplinary Child Development Study. New Zealand Dental Journal, 76: 179-186.

Evans, R.W., Beck, D.J., Silva, P.A. & Brown, R.H. (1982). Relationships between dental health behaviour and oral health status of 5 year old children: a report from the Dunedin Multi-disciplinary Child Development Study. New Zealand Dental Journal, 78: 11-16.

Fanning, E.A. & Somerville, C.M. (1974). South Australian kindergarten children: dental health factors in urban and country families. Australian Dental Journal, 19: 35-38.

Farman, A.G., van Wyk, C.W., Staz, J., Hugo, M. and Dreyer, W.P. (1977). Central papillary atrophy of the tongue. Oral Surgery, Oral Medicine, Oral Pathology, 43: 48-58.

FDI & WHO (1985): Report of Working Group convened jointly by the Federation Dentaire Internationale and the World Health Organization (1985). Changing

patterns of oral health and implications for oral health manpower: Part I. International Dental Journal, 35: 235-251.

Fejerskov, O., Thylstrup, A. & Larsen, M.J. (1981). Rational use of fluorides in caries prevention: A concept based on possible cariostatic mechanisms. Acta Odontologica Scandinavica, 39: 241-249.

Fisher, F.J. (1968). A field survey of dental caries, periodontal disease and enamel defects in Tristan da Cunha. Part 2: Methods and results. British Dental Journal, 124-125: 447-453.

Fleiss, J.L. (1981). In: Statistical Methods for Rates and Proportions. 2nd Edition. John Wiley & Sons U.S.A., pp. 212-219.

Frankel, M.A. (1970). Tetracycline antibiotics and tooth discoloration. Journal of Dentistry for Children, 37: 117-143.

Fraser, D. & Nikiforuk, G. (1982). The etiology of enamel hypoplasia in children - a unifying concept. Journal of the International Association of Dentistry for Children, 13: 1-11.

Gardner, D.E., Norwood, J.R. & Eisenson, J.E. (1977). At-will breast-feeding and dental caries: Four case reports. Journal of Dentistry for Children, 44: 18-23.

Gibson, A., Gelbier, S. & Bhatia, S. (1981). Dental health and treatment needs of 5 year old children in the health area of Lambeth, Southwark and Lewisham, England. Community Dentistry and Oral Epidemiology, 9: 5-9.

Glenn, F.B. (1981). The rationale for the administration of a NaF tablet supplement during pregnancy and postnatally in a private practice setting. Journal of Dentistry for Children, 48: 118-122.

Goose, D.H. (1967). Infant feeding and caries of the incisors: an epidemiological approach. Caries Research, 1: 167-173.

Gordon, M. & Newbrun, E. (1986). Comparison of trends in the prevalence of caries and restorations in young adult populations of several countries. Community Dentistry and Oral Epidemiology, 14: 104-109.

Gordon, Y. & Reddy, J. (1985). Prevalence of dental caries, patterns of sugar consumption and oral hygiene practices in infancy in South Africa. Community Dentistry and Oral Epidemiology, 13: 310-314.

Green, R.M. & Leach, S.A. (1984). Artifical sweeteners - a new dawn. British Dental Journal, 154: 161.

Greene, J.C. & Vermillion, J.R. (1960). The oral hygiene index: a method for classying oral hygiene status. The Journal of the American Dental Association, 61: 172-179.

Greene, J.C. & Vermillion J.R. (1964). The simplified oral hygiene index. The Journal of the American Dental Association, 68: 7-13.

Greene, J.C. (1967). The Oral Hygiene Index - Development and uses. Journal of Periodontology, 38: 625-635.

Grobler, S.R. & van der Horst, G. (1982). Biochemical analysis of various cooldrinks with regard to enamel erosion, de- and remineralization. Journal of the Dental Association of South Africa, 37: 681-684.

Halikis, S.E. (1965). A study of dental caries in a group of Western Australian children. Part IV: The bilaterality of dental caries. Australian Dental Journal, 10: 371-375.

Hamill, P.V.V., Drizd, T.A., Johnson C.L., Reed, R.B., Roche, A.F. & Moore, W.M. (1979). Physical growth: National Center for Health Statistics percentiles. The American Journal of Clinical Nutrition, 32: 607-629.

Haugejorden, O. (1978). Dental caries indices for primary teeth: the need to comply with international recommendations. Community Dentistry and Oral Epidemiology, 6: 126-128.

Hausen, H., Milen, A., Heinonen, O.P. & Paunio, I. (1982). Caries in primary dentition and social class in high and low fluoride areas. Commmunity Dentistry and Oral Epidemiology, 10: 33-36.

Hennon, D.K., Stookey, G.K.,& Muhler J.C. (1969). Prevalence and distribution of dental caries in preschool children. Journal of the American Dental Association, 79: 1405-1414.

Hicks, M.J. & Flaitz, C.M. (1986). Caries-like lesion formation in occlusal fissures - an in vitro study. Quintessence International, 17: 405-410.

Holland, T.J. & Crowley, M.J. (1982). Detailed examination of caries progression in 4 year old children in a non-fluoridated area in Ireland. Community Dentistry and Oral Epidemiology, 10: 144-147.

Holm, A.K. (1975a). Oral health in 4 year old Swedish children. Community Dentistry and Oral Epidemiology, 3: 25-33.

Holm, A.K. (1975b). Oral health in 5 year old Swedish children. Community Dentistry and Oral Epidemiology, 3: 184-189.

Holm, A.K. (1975c). A longitudinal study of dental health in Swedish children aged 3-5 years. Community Dentistry and Oral Epidemiology, 3: 228-236.

Holm, A.K, Blomquist, H., Grahnen, H., Crossner, C.G. & Samuelson, G. (1975). A comparative study of oral health as related to general health, food habits and socio-economic conditions of 4 year old Swedish children. Community Dentistry and Oral Epidemiology, 3: 34-9.

Holt, R.D., Joels, D. & Winter, G.B. (1982). Caries in preschool children: The Camden study. British Dental Journal, 153: 107-109.

Household, K.C., & Elliott, E. (1987). Nutritional status of black children under five years old attending a municipal clinic in Bloemfontein. South African Medical Journal, 71: 494.

Hugoson, A., Koch, G. & Rylander, H. (1981). Prevalence and distribution of gingivitis-periodontitis in children and adolescents. Swedish Dental Journal, 5: 91-103.

Iijima, Y. & Katayama, T. (1985). Fluoride concentration in deciduous enamel in high- and low-fluoride areas. Caries Research, 19: 262-265.

Infante, P.F., & Gillespie, G.M. (1974). An epidemiologic study of linear enamel hypoplasia of deciduous anterior teeth in Guatemalan children. Archives of Oral Biology, 19: 1055-1061.

Infante, P.F. & Russel, A.L. (1974). An epidemiologic study of dental caries in preschool children in the United States by race and socio-economic level. Journal of Dental Research, 53: 393-396.

Infante, P.F., Owen, G.M. & Russel, A.L. (1975). Dental caries in preschool Apache Indian children. Journal of Dental Research, 54: 915.

Infante, P.F. & Gillespie, G.M. (1976). Dental caries experience in the deciduous dentition of rural Guatamalan children ages 6 months to 7 years. Journal of Dental Research, 55: 951-957.

Jackson, D. (1950). The measurement of caries susceptibility. Journal of the British Dental Association, 89: 157-168.

Jackson, D., Murray, J.J. & Fairpo, C.G. (1974). Rampant dental caries in 5 year old children from a fluoride and from a non-fluoride community. British Dental Journal, 137: 317-318.

Jackson, D. (1978). Sugar and dental caries: Myth and Fact. The Probe, 20: 49-54.

Jackson, D., Burch, P.R.J. & Fairpo, C.G. (1979). Right/left asymmetry of caries at mesial and distal surfaces of permanent teeth. British Dental Journal, 147: 237-240.

James, P.M.C. (1975). Epidemiology of dental caries: The British scene. British Medical Bulletin, 31: 146-148.

James, P.M.C., Parfitt, G.J. & Falkner, F. (1957). A study of the aetiology of labial caries of the deciduous incisor teeth in small children. British Dental Journal, 102: 37-40.

Jarvinen, S., Lehtinen, L. & Milen, A. (1980) Epidemiologic study of joined primary teeth in Finnish children. Community Dentistry and Oral Epidemiology, 8: 201-202.

Jelliffe, D.B. & Jelliffe, E.F.P. (1971). Linear hypoplasia of deciduous incisor teeth in malnourished children. American Journal of Clinical Nutrition, 24: 893.

Katz, R.V. (1986). Dental caries: questions about future treatment needs of adults. Quintessence International, 17: 503-508.

Kilian, M., Thylstrup, A & Fejerskov, O. (1979). Predominant plaque flora of Tanzanian children exposed to high and low water fluoride concentrations. Caries Research, 13: 330-343.

King, J.M. (1982). The influence of maternal age on dental health behaviour. Journal of the International Association of Dentistry for Children 13: 27-30.

Kleber, C.J., Putt, M.S. & Muhler, J.C. (1981). Duration and pattern of toothbrushing in children using a gel or paste dentifrice. Journal of American Dental Association, 103: 723-726.

Kleemola-Kujala, E. & Rasanen, L. (1982). Relationship of oral hygiene and sugar consumption to risk of caries in children. Community Dentistry and Oral Epidemiology, 10: 224-233.

Kotlow, L.A. (1977). Breast-feeding: A cause of dental caries in children. Journal of Dentistry for Children, 44: 24-25.

Kristoffersson, K., Axelsson, P., Birkhed, D. & Bratthall, D. (1986). Caries prevalence, salivary Streptococcus mutans and dietary scores in 13 year old Swedish schoolchildren. Community Dentistry and Oral Epidemiology, 14: 202-205.

Kunzel, W. (1983). Annual sugar consumption and caries prevalence in optimum fluoride areas. Journal of the International Association of Dentistry for Children, 14: 15-19.

Laine, T., & Hausen, H. (1985). Space anomalies, missing permanent teeth and orthodontic treatment. The Angle Orthodontist, 55: 242-250.

Lavelle, C.L.C. (1976). A study of multiracial malocclusions. Community Dentistry and Oral Epidemiology, 4: 38-41.

Levine, R.S. (1976). The action of fluoride in caries prevention (A review of current concepts). British Dental Journal,140: 9-14.

Lindhe, J., Axelsson, P. & Tollskog, G. (1975). Effect of proper oral hygiene on gingivitis and dental caries in Swedish schoolchildren. Community Dentistry and Oral Epidemiology, 3: 150-155.

Lobene, R.R., Weatherford, T., Ross, N.M., Lamm, R.A. & Menaker, L. (1986). A modified gingival index for use in clinical trials. Clinical Preventive Dentistry, 8: 3-6.

Löe, H., & Silness, J. (1963). Periodontal disease in pregnancy. Acta Odontologica Scandinavica, 21: 533-551.

Löe, H. (1967). The gingival index, the plaque index and the retention index systems. Journal of Periodontology, 38: 610-616.

Löe, H., Anerud, A., Boysen, H. & Smith, M. (1978). The natural history of periodontal diseases in man: The rate of periodontal destruction before 40 years of age. Journal of Periodontology, 49: 607-620.

Loesche, W.J., Rawan, J., Straffon, L.H. & Loos, P.J. (1975). Association of Streptococcus mutans with human dental decay. Infection and Immunity, 11: 1252-1260.

Lokken, P. & Birkeland, J.M. (1978). Acceptance, caries reduction and reported adverse effects of fluoride prophylaxis in Norway. Community Dentistry and Oral Epidemiology, 6: 110-116.

Longhurst, P., Johnson, N.W. & Hopps, R.M. (1977). Differences in lymphocyte and plasma cell densities in inflamed gingiva from adults and young children. Journal of Periodontology, 48: 705-710.

Louw, N.P. & Moola, M.H. (1979). The dental needs and demands of the Cape Coloured people in the Cape Peninsula. Journal of the Dental Association of South Africa (Special Health Year Issue), 34: 715-718.

Macgregor, I.D.M. & Rugg-Gunn, A.J. (1979). A survey of toothbrushing sequence in children and young adults. Journal of Periodontal Research, 14: 225-230.

Mackler, S.B. & Crawford, J.J. (1973). Plaque development and gingivitis in the primary dentition. Journal of Periodontology, 44: 18-24.

Manji, F. & Sheiham, A. (1986). CPITN findings and the manpower implications of periodontal treatment needs for Kenyan children. Community Dental Health, 3: 143-151.

Mansbridge, J.N. & Brown, M.D. (1985). Changes in dental caries prevalence in Edinburgh children over three decades. Community Dental Health, 2: 3-13.

Mansbridge, J.N. & Brown, M.D. (1986). Changes in dental caries prevalence in Ayr children over 25 years and a comparison with Edinburgh children over the same period. Community Dental Health, 3: 41-52.

Matsson, L. (1978). Development of gingivitis in preschool children and young adults: a comparative experimental study. Journal of Clinical Periodontology, 5: 24-34.

Matsson, L. & Goldberg, P. (1986). Gingival inflammation at deciduous and permanent teeth: an intra-individual comparison. Journal of Clinical Periodotology, 13: 740-742.

McInnes, P.M., & Vieira, E. (1979). Dental caries status of Chinese children in Johannesburg, South Africa. Community Dentistry and Oral Epidemiology, 7: 170-173.

McInnes, P.M., Richardson, B.D. & Cleaton-Jones, P.E. (1982). Comparison of dental fluorosis and caries in primary teeth of preschool children living in arid high and low fluoride villages. Community Dentistry and Oral Epidemiology, 10: 182-186.

Mellanby, M., Coumoulos, H. & Kelley, M. (1957). Teeth of 5 year old London schoolchildren (1955): With comparison of results obtained from 1929-1955. British Medical Journal, 2: 318-322.

Menaker, L. (1980). In: The biologic basis of dental caries - an oral biology textbook. Hagerstown, Harper and Row Publishers, U.S.A. p 212.

Mikkelsen, L. & Poulsen, S. (1976). Microbiological studies on plaque in relation to development of dental caries in man. Caries Research, 10: 178-188.

Milen, A., Hausen, H., Heinonen, O.P. & Paunio, I . (1981). Caries in primary dentition related to age, sex, social status, and county of residence in Finland. Community Dentistry and Oral Epidemiology, 9: 83-86.

Miller, J., Okoisor, F.E. & Liddington, D.A. (1986). Dental disease as an indication of nutritional problems. Journal of Dentistry for Children, 53: 27-31.

Miller, J., Vaughan-Williams, E., Furlong, R. & Khosla, T. (1980). Dental caries and children's weight . The Lancet, 2: 853.

Milnes, A.R. & Bowden, G.H.W. (1985). The microflora associated with developing lesions of nursing caries. Caries Research, 19: 289-297.

Molteno, C.D., Hollingshead, J., Moodie, A.D., Willoughby, W., Bowie, M.D., Bradshaw, D. & Pretorius, J.P.G. (1980). A study on child development in Cape Town: The cohort and sample. South African Medical Journal, 58: 729-732.

Moola, M.H. (1981). A study of the oral health of schoolchildren in the Crossroads emergency camp, Cape Town. M.Sc. Thesis University of London.

Moola, M.H. & Louw, N.P. (1979). The essential dental needs for the Coloured population in the Peninsula. Journal of the Dental Association of South Africa, 34: 728-731.

Moore, W.E.C., Holderman, L.V., Smibert, R.M., Cato, E.P., Burmeister, J.A., Palcanis, K.G. & Ranney, R.R. (1984). Bacteriology of experimental gingivitis in children. Infection and Immunity, 46: 1-6.

Murray, J. (1970). Fluoridation studies and dental caries : a review. British Dental Journal, 129: 467-470.

Naujoks, R., Schade, H. & Zelinka, F. (1967). Chemical composition of different areas of the enamel of deciduous and permanent teeth. (The content of Ca, P, CO2,Na and N). Caries Research, 1: 137-143.

Naylor, M.N. (1982). The declining prevalence of dental caries (Report of an International Conference). British Dental Journal, 153: 127, 151-152.

Noah, M.O. (1984). Caries experience and oral cleanliness in the deciduous dentitions of Ibadan children from different social groups. Journal of the International Association of Dentistry for Children, 15: 43-49.

Perkins, P.C. & Sweetman, A.J.P. (1986). Ethnic differences in caries prevalence in 5 year olds in north-west London. British Dental Journal, 161: 215-216.

Pettifor, J.M., & Ross, F.P. (1983). Low dietary calcium intake and its role in the pathogenesis of rickets. South African Medical Journal, 63: 179.

Poulsen, S., Agerbaek, N., Melsen, B., Korts, D.C., Glavind, L. & Rolla, G. (1976). The effect of professional toothcleansing on gingivitis and dental caries in children after 1 year. Community Dentistry and Oral Epidemiology, 4: 195-199.

Poulsen, S. & Moller, I.J. (1972). The prevalence of dental caries, plaque and gingivitis in 3 year old Danish children. Scandinavian Journal of Dental Research, 80: 94-103.

Reddy, J., Africa, C.W., & Parker, J.R. (1986). Darkfield microscopy of subgingival plaque of an urban Black population with poor oral hygiene. Journal of Clinical Periodontology, 13: 578-582.

Reddy, J., van Wyk, C.W. & Grobler, S.R. (1979). Epidemiology of dental caries and periodontal disease in a low and high fluoride area in the South West Cape. Journal of the Dental Association of South Africa - Special Health Year Issue, 34: 703-705.

Redman, R.S. (1970). Prevalence of geographic tongue, fissured tongue, median rhomboid glossitis, and hairy tongue among 3,611 Minnesota schoolchildren. Oral Surgery, 30: 390-395.

Richardson, B.D. (1986). Low birth weight and health in the preschool years. South African Medical Journal, 69: 411.

Richardson, S., Boyd, M.A. & Conry, R.F. (1977). A correlation study of diet, oral hygiene and dental caries in 457 Canadian children. Community Dentistry and Oral Epidemiology, 5: 227-230.

Richardson, B.D., Cleaton-Jones, P.E., McInnes, P.M. & Rantsho, J.M. (1981). Infant feeding practices and nursing bottle caries. Journal of Dentistry for Children, 48: 423-429.

Richardson, B.D. & Cleaton-Jones, P. (1982). Dental caries and sucrose intake in preschool populations. Part II: An overview of sucrose intake and dental health. Proceedings of the Symposium on Sugar and Health, p 24-30.

Richardson, B.D., Rantsho, J.M., Pieters, L. & Cleaton-Jones, P. (1978). Total sucrose intake and dental caries in Black and in White South African children of 1-6 years. Part I: Sucrose intake. Journal of the Dental Association of South Africa, 33: 533-537.

Richardson, B.D., Cleaton-Jones, P., McInnes, P.M., Rantsho, J.M. & Pieters, L. (1978). Total sucrose intake and dental caries in Black and in White South African children of 1-6 years. Part II: Dental caries and sucrose intake. Journal of the Dental Association of South Africa, 33: 539-544.

Ripa, L.W. (1978). Nursing habits and dental decay in infants: "Nursing Bottle Caries". Journal of Dentistry for Children, 45: 18-19.

Rugg-Gunn, A.J. & Edgar, W.M. (1984). Sugar and dental caries : A review of the evidence. Community Dental Health, 1: 85-92.

Rugg-Gunn, A.J. & Edgar, W.M. (1985). Sweeteners and dental health. Community Dental Health, 2: 213:223.

Rugg-Gunn, A.J., Roberts, G.J. & Wright, W.G. (1985). Effect of human milk on plaque pH in situ and enamel dissolution in vitro compared with bovine milk, lactose and sucrose. Caries Research, 19: 327-334.

Sawyer, D.R., Nwoku, A.l., Rotimi, V.O., Hagen, J.C. (1986). Comparison of oral microflora between well-nourished and malnourished Nigerian children. Journal of Dentistry for Children, 53: 439-443.

Schneider, P.E., & Peterson, J. (1982). Oral habits: Considerations in management. Pediatric Clinics of North America, 29: 523-546.

Schroder, U. & Granath, L. (1983). Dietary habits and oral hygiene as predictors of caries in 3 year old children. Community Dentistry and Oral Epidemiology, 11: 308-311.

Sedano, H.O. (1975). Congenital oral anomalies in Argentinian children. Community Dentistry and Oral Epidemiology, 3: 61-63.

Seymour, G.J., Crouch, M.S. & Powel, R.N. (1981). The phenotypic characterization of lymphoid cell subpopulations in gingivitis in children. Journal of Periodontal Research, 16: 582-592.

Shellis, R.P. (1984). Relationship between human enamel structure and the formation of caries-like lesions in vitro. Archives of Oral Biology, 29: 975-981.

Sheiham, A. (1984). In: Cariology Today. Karger Publishers, Basel, Switzerland: 33-39.

Silness, J. & Löe, H. (1964). Periodontal disease in pregnancy: II. Correlation between oral hygiene and periodontal condition. Acta Odontologica Scandinavica, 22: 121-135.

Silver, D.H. (1974). The prevalence of dental caries in 3 year old children. British Dental Journal, 137: 123-28.

Silver, D.H. (1982). Improvements in the dental health of 3 year old Hertfordshire children after 8 years: The relationship to social class. British Dental Journal, 152: 179-183.

Silverstone, L.M., (1983). Remineralization and enamel caries: New concepts. Dental Update, 10(4): 261-273.

Sims, W. (1985). Streptococcus mutans and vaccines for dental caries: a personal commentary and critique. Community Dental Health, 2: 129-147.

Skaleric, U., Ravnik, C., Cevc, P. & Schara, M. (1982). Microcrystal arrangement in human deciduous dental enamel studied by electron paramagnetic resonance. Caries Research, 16: 47-50.

Slome, B.A., Rozier, R.G. & Seidel, J.S. (1980). A survey of dental disease in children of Wuvulu Island, Papua New Guinea. Community Dentistry and Oral Epidemiology, 8: 146-150.

Socransky, S.S., Haffajee, A.D., Goodson, J.M. & Lindhe, J. (1984).New concepts of destructive periodontal disease. Journal of Clinical Periodontology, 11: 21-32.

Socranksy, S.S. & Manganiello, S.D. (1971). The oral microbiota of man from birth to senility. Journal of Periodontology, 42(8): 485-494.

Sofaer, J.A. (1982). Genetics and site attack in dental caries: Comments on Jackson's theory. British Dental Journal, 152: 267-273.

Screebny, L.M. (1982). Sugar availability, sugar consumption and dental caries. Community Dentistry and Oral Epidemiology, 10: 1-7.

Stewart, D.J. (1968). Tetracyclines: Their prevalence in children's teeth. British Dental Journal, 124: 318-320.

Street, C.M., Goldner, M. & Le Riche, W.H. (1976). Epidemiology of dental caries in relation to Streptococcus mutans on tooth surfaces in 5 year old children. Archives of Oral Biology, 21: 273-275.

Sutcliffe, P. (1977). Caries experience and oral cleanliness of 3 and 4 year old children from deprived and non-deprived areas in Edinburgh, Scotland. Community Dentistry and Oral Epidemiology, 5: 213-219.

Sweeney, E.A., Saffir, A.J. & de Leon, R. (1971). Linear hypoplasia of deciduous incisor teeth in malnourished children. American Journal of Clinical Nutrition, 24: 29-31.

Tanner, J.M. & Whitehouse, R.H. (1976). Clinical longitudinal standards for height, weight, height velocity, weight velocity and stages of puberty. Archives of Disease in Childhood, 51: 170-179.

Theilade, J.(1977). Development of bacterial plaque in the oral cavity. Journal of Clinical Periodontology, 4: 1-12.

Thomas, A.G. (1984). The nutritional status of Black, Coloured and White preschool children in a section of Cape Town. Carnegie Conference Paper No. 210. pp 1-21.

Thylstrup, A. (1981). Is there a biological rationale for prenatal fluoride administration? Journal of Dentistry for Children, 48: 103-108.

Tijmstra, T., Brinkman-Engels, M. & Groeneveld, A. (1978). Effect of socio-economic factors on the observed caries reduction after fluoride tablet and fluoride toothpaste consumption. Community Dentistry and Oral Edpidemiology, 6: 227-230.

Timmis, J.C. (1971). Caries Experience of 5 year old children living in fluoride and non-fluoride areas of Essex. British Dental Journal, 130: 278-283.

Toth, K. & Szabo, I. (1959). Dental conditions of preschool children (one to six years of age) in Szerged, Hungary. Journal of Dental Research, 38: 451-463.

Tsamtsouris, A., White, G.E. & Clark, R.E. (1980). A comparison between the plaque indices of Silness-Löe and Greene-Vermillion. Journal of Pedodontics, 5: 51-61.

Van der Hoeven, J.S. & Franken, H.C.M. (1982). Production of acids in rat dental plaque with or without Streptococcus mutans. Caries Research, 16: 375-383.

Van der Westhuyzen,J., Van Tonder, S.V., Gilbertson, I., & Metz, J. (1986). Iron, folate and vitamin B12 nutrition and anaemia in Black preschool children in the Northern Transvaal. South African Medical Journal, 70: 143-145

Van Houte, J. (1980). Bacterial specificity in the etiology of dental caries. International Dental Journal, 30(4): 305-326.

Van Houte, J., Gibbs, G. & Butera, C. (1982). Oral flora of children with "Nursing bottle caries". Journal of Dental Research, 61: 382-385.

Van Wyk, C.W., Konviser, J.V. & Dreyer, W.P. (1976). The prevalence of dental caries in the Cape Malays. Journal of the Dental Association of South Africa, 31: 195-200.

Walker, A.R.P. (1983). Low dietary calcium intake and its role in the pathogenesis of rickets. South African Medical Journal, 63: 756.

Walker, A.R.P. (1984). How practicable are meaningful reductions in dental caries by dietary means? Nutrition Abstracts and Reviews in Clinical Nutrition - Series A, 54: 211-217.

Walker, A. & Stein, H. (1985). In: Dietary fibre, fibre-depleted foods and disease. Academic Press Incorporation (London) Limited, United Kingdom, p331-344.

Weatherell, J.A., Robinson, G. & Strong, M. (1984). Future possibilities for increased tooth resistance to dental caries. Journal of the Canadian Dental Association, 50: 149-156.

Winter, G.B., Hamilton, M.C. & James, P.M.C. (1966). Role of the comforter as an aetiological factor in rampant caries of the deciduous dentition. Archives of Disease in Childhood, 41: 207-212.

Winter, G.B., Rule, D.C., Mailer, G.P., James, P.M.C., & Gordon, P.H. (1971). The prevalence of dental caries in preschool children aged 1-4 years. Part 1:aetiological factors. British Dental Journal, 130: 271-277.

Winter, G.B., Rule, D.C., Mailer, G.P., James, P.M.C. & Gordon, P.H. (1971). The prevalence of dental caries in preschool children aged 1 to 4 years. Part 2: Additional aetiological factors. British Dental Journal, 130, 434-436.

WHO (1977): World Health Organisation - Geneva. Oral Health Surveys - Basic Methods 2nd Edition.

WHO (1979): World Health Organisation - Geneva. A Guide to Oral Health - Epidemiological Investigations. Oral Health Unit.

World Health Organization Bulletin. (1980). Tetracyclines and teeth discoloration. Drug Information, 80: 18.

Yasin-Harnekar, S. & Reddy, J. (1983). The pattern and prevalence of dental caries in preschool children in different population groups in the Western Cape. Journal of Dental Research, 62: 509, Abstract No. 105.

Yassin, I. & Low, T. (1975). Caries prevalence in different racial groups of schoolchildren in West Malaysia. Community Dentistry and Oral Epidemiology, 3: 179-183.

Zadik, D. (1976). A survey of traumatized primary anterior teeth in Jerusalem preschool children. Community Dentistry and Oral Epidemiology, 4: 149-151.

Zadik, D. (1978). Epidemiology of dental caries in 5 year old children in Israel. Community Dentistry and Oral Epidemiology, 6: 91-96.

Zadik, D. & Eidelman, E. (1975). Tetracycline-stained teeth in Jerusalem preschool children. Community Dentistry and Oral Epidemiology, 3: 69-71.

SUMMARY

SUMMARY

The dental clinic of the University of the Western Cape provides oral health care for many preschool children. The clinical observation was that these children presented with rampant dental caries. A recent report compiled by an international Joint Working Group of the Internationale Dental Federation and the World Health Organisation identified the changes in oral health in children and factors associated with these changes.

South Africa presents a unique opportunity to study the oral health status of different ethnic and socio-economic groups. A review of the relevant literature indicated that there was a lack of published data, especially on the oral health status of preschool children.

A study was designed to investigate the oral health status of a selected group of preschool children ages 2-6 years in the Western Cape. The examinations were conducted at twelve different crêches by two calibrated examiners. The examinees' weight and height were also measured. The data was recorded on a revised World Health Organization Basic Oral Health Assessment form.

A total of 547 children were examined with an almost equal distribution of males and females. Only 18% of the sample had a complete sound primary dentition, dmft = 0. The mean dmft was 5.37 which ranged from 2.73 for the 2 year age group to 7.01 for the 5 year age group.

The mean dt of 4.09 made up 76% of the dmft, the mean mt of 1.22 made up 23% and the ft was negligible. Seventy-eight percent of the sample had decayed teeth present and 28% had missing teeth recorded. The treatment chosen by or for these children appeared to be extractions. Observations of extensively decayed teeth and the high prevalence of dento-alveolar abscesses suggested that this treatment was of an emergency nature. There was much unmet treatment as only 22% of subjects were free of decay and those with decayed teeth present had an average of 5.

The dmft distribution showed 48% had a dmft $\geqslant$ 5. There was a statistically significant linear association between the dmf and age for all the tooth types except the canines. There was no significant difference in caries prevalence between males and females.

The phenomenon of bilateral symmetrical occurrence of dental caries in the primary dentition was demonstrated in the present study. The maxillary central incisors were the most frequently

affected teeth (55%), followed by the mandibular second molars (47%) and maxillary second molars (42%). This is contrary to the findings in European communities where the primary second molars are the most susceptible tooth types. The present study found the fifth year of life to be the critical one for the primary dentition. It was at this age that the greatest increment in dmft was observed, the greatest decrease in the number of caries-free subjects, more than a twofold increase in rampant caries, and a twofold increase in the number of subjects with dento-alveolar abscesses.

Few hard tissue anomalies were recorded. Localized enamel hypoplasia was quite common especially of the upper incisors and second molars.

Most children claimed their teeth were brushed at least once a day. But soft deposits were present in almost all age groups in all the segments. Sixty percent of the sample had the sole responsibility of brushing their own teeth with no assistance from their parents. Parental assistance with toothbrushing was limited to the younger age group.

In the present study soft deposits and gingivitis were recorded mostly on the buccal of the upper posterior segments and on the lingual of the lower posterior segments. The anterior segments

had less plaque than the posterior segments. This may be due to children finding it easier to brush anteriorly than posteriorly when they do brush. Also, the other areas are less accessible and require greater manipulative skill. There was a weak correlation between the total soft deposits and total gingivits. Although 60% of the sample had six segments of soft deposits present, only 4% had six segments of gingivitis present. However, it was found that the higher the number of segments of soft deposits present, the greater the tendency for the presence of gingivitis.

The association between dmft and soft deposits was not significant but between dmft and gingivitis was significant. This may be more precise as these two are both cumulative measures. Soft tissue lesions were generally uncommon in this age group.

The children in this community were generally lighter in weight and shorter in height compared to the NCHS (1979) percentiles.

Recommendations regarding ways of redressing the obviously inadequate general and oral health of this sample of children were made.