



## **The Dental Caries Experience of Preschool Children in Harare**

**Cleopatra Matanhire<sup>1\*</sup>, Antonette Masiwa<sup>1</sup> and Mandy Sibanda<sup>1</sup>**

<sup>1</sup>*Department of Dentistry, College of Health Sciences, University of Zimbabwe, P.O.Box A178, Avondale, Harare, Zimbabwe.*

### **Authors' contributions**

*This work was carried out in collaboration among all authors. Author CM designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author AM managed the analyses of the study. Author MS managed the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Aims:** To describe the dental caries experience in preschool children in Harare and its contributing factors.

**Study Design:** Descriptive cross-sectional study.

**Place and Duration of Study:** Frank Johnson, Lochinvar, Southerton, Chembira and Chengu Primary Schools in High Glen District, Harare between May, and June 2014.

**Methodology:** The study participants were 178 preschool children. High Glen District in Harare was randomly selected. Using stratified sampling, schools from high, medium, and low-density suburbs were categorized and Purposive sampling was use low and medium density suburbs and Convenience sampling was used to identify the two schools from the two main high-density suburbs.

**Results:** A sample size of 220, 95% confidence level and precision of 5% was used, the response rate was 80.9%. The caries prevalence of 75.8% with a distribution of 51.3% in males and 48.7% in females was obtained. The mean dmft was 3.88 which is high as the implication is on average 20% of a preschool child's dentition is carious. Decayed teeth contributed 65.2%, missing teeth

\*Corresponding author: Email: [clairenyasha@gmail.com](mailto:clairenyasha@gmail.com);

34.8% to the dmft value and there were no filled teeth. An increase in dmft with age was noted, at 4 years dmft (25.1%), 5 years (29.9%) and at 6 years (45%). Only 12.7% of the participants had visited a dentist since birth. 93.9% of the study participants consumed sweets, and this occurred at an average of 4 times a week. 77.9% of parents and guardians had given their child something sweet to eat on the day data was collected.

**Conclusion:** The caries prevalence of preschool aged children in Harare is high and this requires attention. The early caries development seen in children from the all socio-economic classes reinforces the need for preventive programs through prenatal counselling to expectant mothers as early as prenatal counselling and implementation of Zimbabwe School Health Policy.

*Keywords: Early childhood caries; preschool children; dental caries; dmft.*

## 1. INTRODUCTION

### 1.1 Background

Early childhood caries (ECC) is an infectious disease that is characterised by the presence of 1 or more decayed, missing (due to caries) or filled tooth surfaces in any primary tooth in children 71 months (5 years 11 months) of age or younger [1]. Its aetiology comprises of interaction between pathogenic organisms, fermentable carbohydrate substrate, host susceptibility and time [2]. Tooth decay (caries) is the single most common chronic childhood disease. It is more common than asthma, four times more common than early childhood obesity and twenty times more common than diabetes [3].

Caries have been identified to develop in susceptible individuals. The factors influencing susceptibility to caries can be grouped into four categories which are saliva flow and composition, tooth morphology, enamel and dentine structure, dietary and taste preferences. Saliva is rich in calcium and phosphates which encourage enamel remineralisation in the tooth and has anti cariogenic properties. It also has a sweeping effect which helps in dislodging viruses, bacteria and yeast from teeth and mucosal surfaces; this significantly reduces the adherence of the pathogens for durations that promote caries formation [4].

Difficulties in carrying out important dental care such as tooth brushing, fluoride penetration and flossing can result from tooth malposition and deep grooves and fissures. These pose as great risk factors for the development of pit and fissure caries [5].

Enamel and dentine are the highly mineralized structures of teeth; poor development of these mineral structures weakens the tooth and

increases susceptibility to destruction by acids produced by cariogenic bacteria. In turn the tooth becomes soft and cavitation can also occur. Enamel and dentine structure thus significantly contribute to caries development [6].

Diet also influences caries susceptibility. The frequency of eating, type of food, its consistency and physical state contribute to the quantity and composition of plaque which accumulates on tooth surfaces. Choice of food is influenced by how food tastes, with time choices become habits. Children generally prefer sweet foods to bitter, savoury or plain foods [7]. An imbalance in any of the four elements mentioned above can result in caries development. The severity and outlook of the problem seems to vary with cultural, socioeconomic, and genetic differences in a community.

### 1.2 Problem Statement

In Zimbabwe, the end of the 2008 economic crisis marked the beginning of improved diets for the general population. From a period of lack of food supplies suddenly there was an abundance of food available on the market. The food was not only limited to healthy foods but to junk food as well. The dollarization era resulted in an increase of sweets, candy, biscuits, and other cariogenic foods being given as change in shops. This change meant more availability and exposure to cariogenic substances. This did not only affect adults but especially impacted on children as they are the chief recipients of these foods.

### 1.3 Solution to the Problem

The purpose of this study was to estimate the prevalence of dental caries experience in preschool children, the last national oral health survey was in 1995. The study provided an

opportunity to appreciate the dental caries experience for a vulnerable age group who for the above mentioned reasons and other risk factors are highly susceptible to caries development. The study would support the need for application of preventive oral health policies and programs for children in Zimbabwe.

#### 1.4 Brief Literature Survey

World Health Organisation states that of the 6,5 billion people that populate the world 5 billion are affected by dental caries [1]. In the developing and developed world, early childhood caries has been posing a great challenge over the past decades regardless of measures that have been taken to prevent and stop the problem. Particularly for nursing caries, Africa and South East Asia were recorded to have the highest prevalence of caries of maxillary anterior teeth. [8].

In Saudi Arabia, a study was done on 3 to 6-year olds and showed a 20% caries prevalence, however a more recent study in the same age group has showed an increase to 27,3%. This problem has been difficult to eradicate because regular schooling commences at 6 years in Saudi Arabia. If regular schooling commenced earlier, many affected children would receive adequate attention before the condition worsened. In India, 44% caries prevalence was recorded in children aged 8-48 months (0,75- 4 years) [8]. Whilst in Hong Kong, 50% of children suffer from caries at age of 5 years [1]. In China 97% of 5-year-old children diagnosed with caries between 1973 and 2003 were said to be left untreated [9].

In Africa, the dentist to population ratio is approximately 1:150 000 compared with about 1:2 000 in most industrialized countries. Few trained people are available who are able to carry out basic dental treatment especially for the preschool age group particularly in the rural areas where the need is greatest. Children and adults suffering from severe tooth decay are often left untreated or have their teeth extracted to relieve pain or discomfort. Public health problems related to tooth loss and weakened oral function are therefore expected to increase in many developing countries [10].

In United States, a developed country, a comparison study was done between 1988 and 1994 and for the period 1999 to 2004 to observe oral health trends. The results showed a general increase in caries prevalence for all groups studied. Of note the age group of 2 to 5-year olds

increased from 24% to 28% and the dmft index increased from 1, 39 to 1,58 [3]. Another study was done on 4 300 preschool children 2-5 years old which revealed that dental caries in preschool children is infrequently treated for this age group. This indicates how childhood caries are affecting both developing and developed worlds.

An increase in caries experience globally has been observed in lower socioeconomic groups, children and in new immigrants of certain countries. Children from low income families are almost twice as likely to experience decay compared to those from high income families. [11]. The cause of this increase cannot be clearly ascertained. However, there is strong evidence to point towards the theory that these groups of people have not been receiving the benefits of preventive dentistry education and practices that have been put in place. The increase in use of bottled water, borehole water and other non-fluoridated water sources as well as dietary changes have also been put forward as strong contributors of caries development, hence the experience [12].

With relevance to dietary changes, nutritional status has been found to be a reliable marker on early life stressors which contribute to poor tooth development. In malnourished or undernourished children, tooth development is often interfered due to insufficient nutrient availability which can result in weak or defective teeth such as in dental hypoplasia. These teeth are prone to easy and great damage by dental caries. Other manifestations of poor nutrition in saliva are poor calcium secretion and buffering capacity, low protein content and rate of saliva release, all of which are factors that promote caries development [13].

The World Health Organisation recommended that children be breastfed till 24 months but on the other hand prolonged exposure to breastfeeding, bottle feeding and feeding at night have been identified as risk factors for early childhood caries. Patterns of sugar consumption are established early in life and sugar consumption increases during the first 2 years as new food is introduced in the diet during the weaning process. Where sugar consumption is high, failure to implement proper oral health programs may well lead to higher rates of dental caries than elsewhere [14].

Dietary changes have been noted with relevance to beverage intake. Milk consumption has diminished whilst 100% juice and soda

consumption have increased over the years. The shift of beverage consumption accounts for the decrease in body calcium levels, increased childhood obesity and dental caries in children. Sugared beverages are high in energy and low in nutrients which influence caries presence [15].

Common results of dental caries are pain and discomfort from the untreated condition, difficulties in eating resulting in nutrition imbalances, difficulties in speaking, poor school attendance, disturbed sleeping habits hence altered growth and development as well as poor social interactions. The disease also has economic impacts as parents must take time off work to take children to seek dental care [16,17].

## 2. MATERIALS AND METHODS

A descriptive cross-sectional study was carried out amongst preschool aged children from primary schools in Harare. The study targeted scholars aged 4 to 6 and a half years enrolled in Early Childhood Development (ECD) classes of the primary education curriculum by the Ministry of Education, Sport and Culture. From all the districts in Harare, High Glen District was randomly selected as the district and 5 schools were selected through stratified sampling, schools from high, medium, and low-density suburbs in which the study would be conducted. The strata of high, medium and low density were based are based on Socioeconomic status and hence population density. Purposive sampling was used for selecting schools from low and medium density suburbs as there was only one school in the only low-density suburb of the district which was Waterfalls and two available medium density suburbs of the district Southerton and Lochinvar. The selected schools were Frank Johnson, Lochinvar and Southerton Primary Schools, respectively. Convenience sampling was used to select the two remaining schools from the two main high-density suburbs which were Chembira and Chengu Primary Schools from Glen Norah and High field High density suburbs. A total of 220 preschool aged students was sampled from 5 participating schools and a response rate of 80,9% was attained , 181 participants were included in this but only 178 had oral examinations done, 3 students were absent during the time examinations occurred.

### 2.1 Data Collection, Technique, and Tools

Questionnaires and consent forms were issued out to caregiver or guardian of child through

teachers at respective schools. The questionnaire had sections on demographic data, dental service utilization, oral health practices and habits of child and oral health knowledge of the guardian. The questionnaire was available in English and Shona, comprising of open ended and closed ended questions. A deadline was given when all questionnaires and consent forms were to be returned to the school.

### 2.2 Clinical Examination

On a specified date child whose parents had consented had individual oral examinations done by a calibrated examiner and research assistant who recorded data. Children aged 6 years of age were issued assent forms prior to examination and signed. Direct observation technique was used through intra-oral examinations which were carried out by the researcher using a disposable mouth mirror, portable light, and disposable probe on each of the participant.

The number of decayed, missing and filled teeth (dmft) was recorded on an examination sheet that was available for each patient. A tooth was considered decayed / carious when there was a filling, a carious lesion, a cavity, undermined enamel or a softened floor or wall on either the pit or fissure on one of the smooth surfaces.

### 2.3 Data Analysis

SPSS statistical package (version 17) was used to analyse data and generate frequencies, measures of central tendency and measures of spread.

## 3. RESULTS AND DISCUSSION

Table 1 and Fig. 1 show the frequency distribution of the study participants.

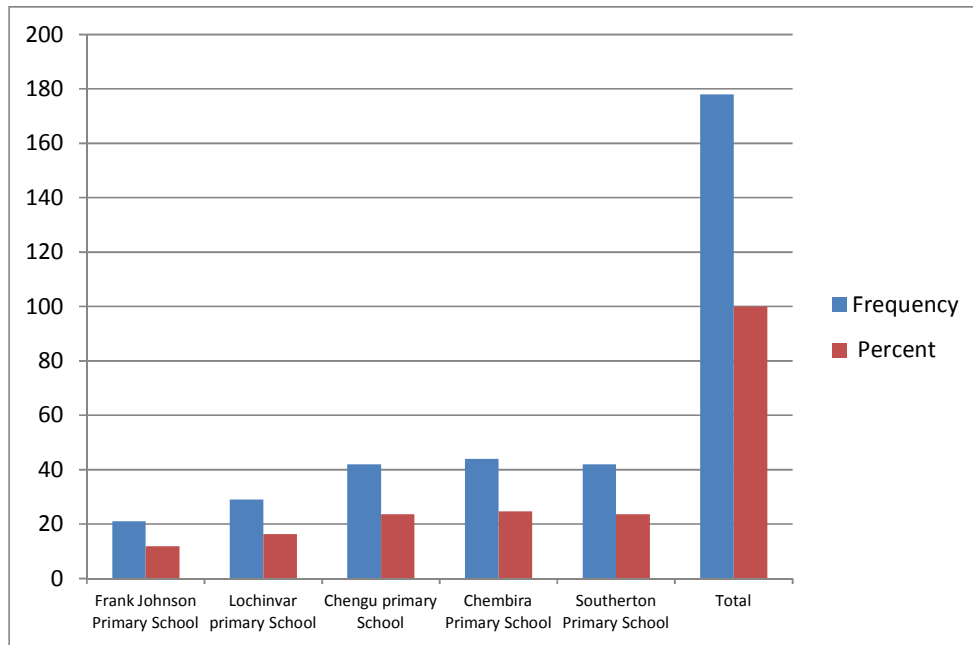
A total of 178 participants were included in this study. The mean age of the study participants was 5.1124 years.

The mean dmft of the study sample was 3.88, whilst the lowest dmft in an individual was 0 and the highest 17 out of 20. Mean dmft in boys was 3.99 whilst mean dmft in girls was 3.79. Table 2 shows the distribution of dental caries status and cumulative dmft whilst table 3 shows the status of dental caries in participants.

Fig. 2 is a line graph of dmft values and bar charts on frequency of decayed teeth and on frequency of missing teeth.

**Table 1. Frequency distribution of study participants**

School	Frequency	Percent %
Frank Johnson Primary School	21	11.8
Lochinvar Primary School	29	16.3
Chengu Primary School	42	23.6
Chembira Primary School	44	24.7
Southernton Primary School	42	23.6
<b>Total</b>	<b>178</b>	<b>100</b>



**Fig. 1. Bar chart on frequency distribution of participants**

**Table 2. Distribution of variables regarding dental caries status and cumulative dmft**

Variable	Frequency	Percent/%
dmft(cumulative)	3.88	100
Decayed	2.53	65.2
Missing	1.35	34.8
Filled	0	0
<b>dmft</b>		
<b>(gender wise distribution)</b>		
Male	3.99	51.3
Female	3.79	48.7
<b>dmft</b>		
<b>(age-wise distribution)</b>		
4yrs	2.91	25.1
5yrs	3.47	29.9
6yrs	5.21	45

**Table 3. Status of dental caries**

Variable	Frequency	Percent/%
<b>Dental caries status:</b>		
Caries positive	135	75.8
Caries negative	43	24.2

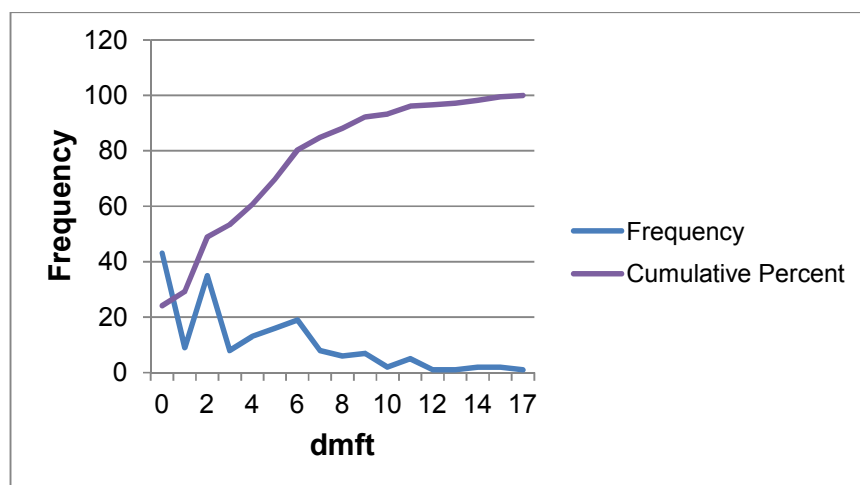


Fig. 2. Line graph of dmft

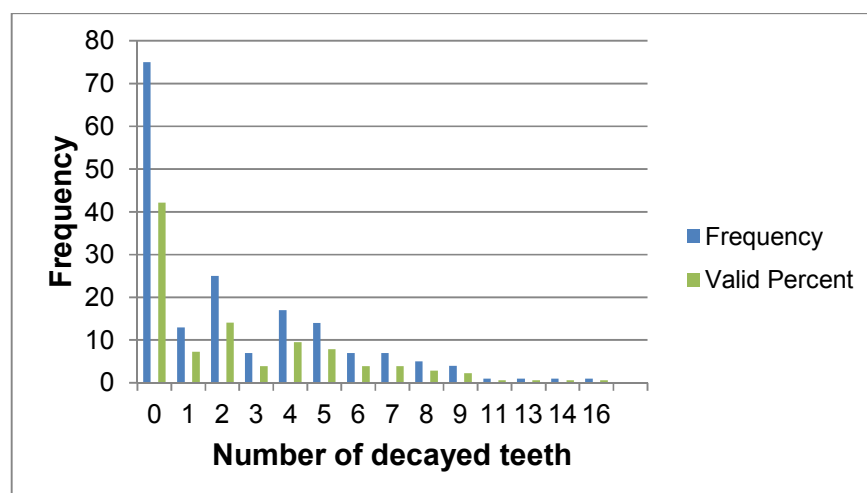


Fig. 3. Bar Chart on frequency distribution of decayed teeth

Table 4 is a tabulation showing responses and frequencies on oral health practices.

The Fig. 5 shows the percentage distribution of participants who have had dental visits since birth by according to residential area. Only 12.7%, that is 23 of the 181 participants had visited a dentist.

When asked how many times a person is supposed to brush their teeth a day, 9.9% said once whilst 35.4% said twice, 54.7% said thrice.

Mean weaning age was 17.5 months. The feeding bottle was used for an average of 4.2 months by participants. On average participants had 2 snacks a day, the participant who had the

highest number of snacks consumed snacks 7 times a day, whilst frequency of sweet consumption per week was at least 4 times.

## 4. DISCUSSION OF RESULTS

### 4.1 Prevalence of Caries

The sampling designs of the study were aimed at drawing samples from three different residential areas, high, low, and medium density suburbs. However, participants from high density suburbs were also highly enrolled in the medium density schools, at the same time there was a low response from the only available school in the low-density suburb. This negatively influenced the results as there is a clear misrepresentation

and insufficient evidence to denote the difference in caries prevalence in the three areas. The study had 178 participants, 84 males and 94 females. The caries prevalence of preschool children in High Glen District of Harare that was determined from this study was 75.8%. In comparison to a similar study in Australia, Jordan in which the prevalence of dental caries in the primary dentition was 41.6% whilst the mean number of decayed, missing and filled teeth (dmft) was 2.59 the prevalence and dmft in this particular study are significantly high. A similarity however is that the decayed component (d) constituted a higher component of the total number of decayed, missing and filled teeth followed by missing teeth [18].

In the Harare study 51.3% of the males had caries whilst in 48.7% of the female's caries were present. The mean dmft was 3.88 which is significantly high as the implication is on average 20% of a preschool child's dentition is carious. Decayed teeth contributed 65.2%, whilst missing teeth contributed 34.8% to the dmft value. There were no filled teeth in the study. Of note was that there was an increase in dmft with the increase of age, at 4years dmft was 25.1% of the total, whilst at 5 years it was 29.9% and at 6 years it was 45%.

#### **4.2 Oral Health Practices**

With regards to oral health practices, 5 out of 7 questions were satisfactorily answered. 97.2% of parents and guardians indicated that their children brushed their teeth and only 2.8% highlighted that their children did not brush their teeth. 70.7% of the participants brushed their teeth once whilst 26.5% brushed their teeth at least twice a day. 13.8% of participants who brushed their teeth had no supervision, whilst 43.1% were supervised by parents, 18.8% by older siblings, 18.8% by maids and 5.5% by grandparents. Of note was that only 12.7% of the participants had visited a dentist since birth. In a study done in urban Singapore 38% of the children brushed their teeth without supervision and 90% of the children brushed their teeth at least once a day [19].

#### **4.3 Oral health Knowledge in Guardians**

All the questions that were asked on the oral health knowledge and attitudes section were satisfactorily answered. When asked how many times a person should brush their teeth, 9.9% said once, 35.4% twice and 54.7 percent thrice.

89.5% were aware that it was necessary for a child to visit a dentist and 86.7% were aware that fluoride in toothpaste protected teeth from decay, 11.6% did not know the protective effect of fluoride. Only 5% were not aware of whether their child had caries or not. In a similar study in Singapore, most parents 83% agreed that baby teeth were important for their child's overall health and well-being. 71% parents strongly agreed that they made the effort to ensure that their child's teeth were brushed even when they were very busy [19].

#### **4.4 Sociodemographic Influences on Caries Occurrence**

Caries were present in 80% of children from low density areas, 80.5% from medium density and 72.9% from high density. Of the 12.7% participants who had visited a dentist, 17.6 were from medium density and 15% from low density whilst only 10% were from high density. It is evident that there is higher professional dental attention seeking behaviours in participants from medium and low density than from high density.

#### **4.5 Dietary Habits**

98.3% of participants were breastfed and were weaned off at the average age of 17.5 months. 29.8% had bottle feeding for an average duration of 4.2 months. In 11.6% of the participants the child slept on a feeding bottle at night. With regards to snacking, 82.9% of the participants had various in between meal snacks at an average of 2 times a day. There is an increased need for parents to be taught on the kind of food they wean their young ones on as there is an increase in nutritional imbalance and consumption of unhealthy food at the expense of healthy eating. It is encouraged that from 6 months onwards weaning can gradually take place but with introduction of healthy food into the diet [20]. The highest frequency of snacks that was observed in an individual during this study was 7 times. 93.9% of the study participants consumed sweets, and this occurred at an average of 4 times a week. When guardians were asked if they had given their child something sweet to eat that day, 77.9% agreed. The foodstuffs that had been given included juice, sweetened hot beverages, candy, cakes and biscuits. From these results it is evident that preschool aged children are having an increased exposure to sweet substances and most parents are the providers of these cariogenic food stuffs.

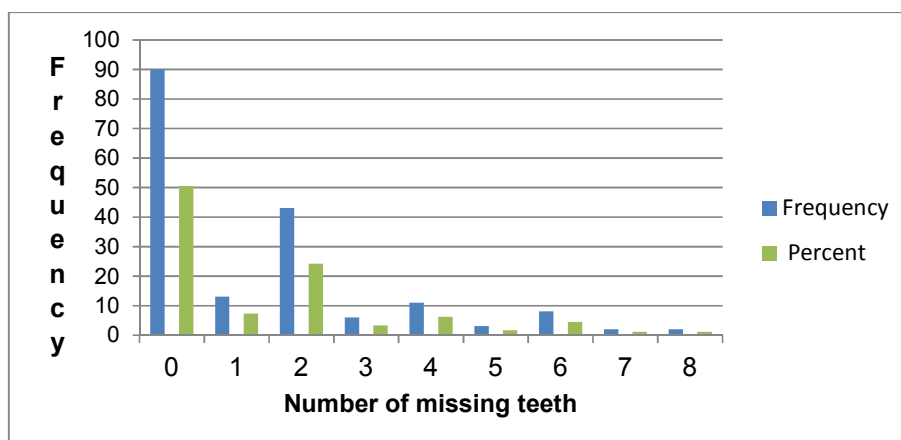


Fig. 4. Bar chart on frequency of missing teeth

Table 4. Oral health practices

Question	Responses and Frequencies		
1.Does your child brush their teeth	Yes- 97.2%	No- 2.8%	I do not know -0%
2.How many times does he or she brush their teeth in a day	Once-70.7%	Twice-26.5%	None-2.8%
3.What does he or she use for brushing Their teeth	Toothbrush-100%	Chewing stick 0%	
4.What kind of toothpaste does he /she use	Fluoridated-81.2%	Non fluoridated-7.2%	I do not know-8.8%
5.Who supervises your child when they brush their teeth	Grandparent-5.5%	Parent-43.1%	Sibling-18.8%
6.Has your child ever visited a dentist	Yes-12.7%	No -87.3%	I do not know-0%
7.If your child has visited a dentist when was the last visit	Never-86.7%	< 6 months ago-7.7%	6-12 months ago-3.3%
		>1 year ago-2.2%	

Table 5. Oral health knowledge and attitudes

Question	Yes %	No %	I do not know %
1.Toothbrushing prevents tooth decay	89	3.3	7.7
2.Fluoride in toothpaste protects teeth against decay	86.7	1.7	11.6
3.In your knowledge, can young children have teeth that decay	87.3	6.6	6.1
4.Is it necessary for your child to visit a Dentist	89.5	3.9	6.6
5.Does your child have a history of tooth Decay	32.6	62.4	5

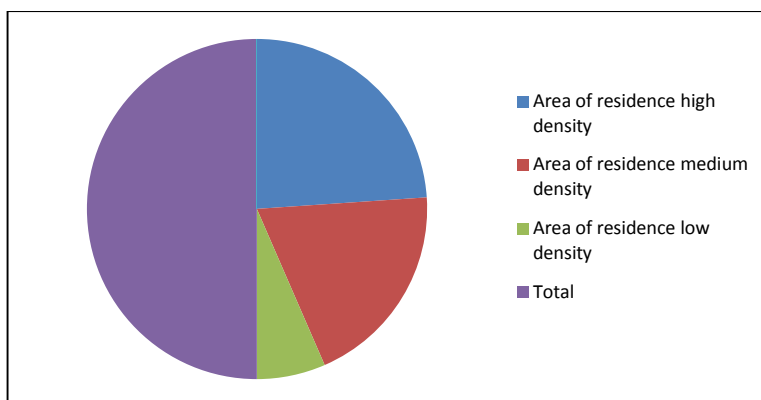


Fig. 5. Pie chart of dental visits according to residential area



**Table 6. Caries prevalence of children affected in specific residential areas**

Residential area	Total number of children	Caries present	Caries free	% caries present	dmft
High density	107	78	29	72.9	3.44
Medium density	51	41	10	80.4	4.22
Low density	20	16	4	80	5.4

**Table 7. Dietary habits**

Question	Yes %	No %	I do not know%
1.Was your child breastfed	98.3	1.7	0
2.Did they ever use the bottle for feeding	29.8	68	2.2
3.Did you ever use the feeding bottle as a means of making your child sleep at night	11.6	82.9	5.5
4.Does your child have in between meal snacks	82.9	13.8	3.3
5.Does your child eat sweets	93.9	4.4	1.7
6.Did you give your child something sweet to eat today	77.9	18.8	20.6

**5. CONCLUSION**

The caries prevalence of preschool aged children in Harare is high and this requires attention. The early caries development seen in children from the all socio-economic classes reinforces the need for preventive programs. Dental caries can be largely prevented or controlled in its early stages of development by simple and relatively cheap methods of personal care, involving attention to general nutrition, diet, and oral hygiene. Dental care information and oral hygiene instructions should be given early to the expectant mothers as early as prenatal counselling and close monitoring should occur during the transition from deciduous to permanent teeth.

**CONSENT**

Permission to carry out this study was sought from the Ministry of Education, Sport and Culture, Provincial Education Director, District Education Officer and School Heads. Informed consent was sought from parents or legal guardians of the children. Assent was sought from 6-year-old schoolchildren.

**ETHICAL APPROVAL**

Ethical assessment was done by the University of Zimbabwe Joint Ethics and Research Committee and the study number assigned was JREC/136/14.

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**COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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