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## Characteristics of children under 6 years of age treated for Early Childhood Caries at Tygerberg Oral Health Centre, South Africa

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**Abstract Objective:** This retrospective survey highlighted the characteristics of children under six years of age presenting with nursing caries who had two or more teeth extracted under intravenous sedation at the Tygerberg Oral Health Centre in Cape Town, South Africa. This survey was carried out in order to plan a community-appropriate intervention strategy. **Methods:** Records of 140 patients kept by the Paediatric Dentistry Division met the inclusion criteria and were included in this survey as from January 2004 to February 2005. Most of the patients originate from economically disadvantaged areas. **Results:** Diet, feeding and oral hygiene habits were shown to be the most significant factors which contributed to the development of nursing caries in these patients. All the children were either breast- or bottle-fed past one year of age. 93.6% of the children went to sleep with the bottle or while on the breast and 90% of them were fed on demand during the night. On average, breastfeeding was stopped at 9 months of age compared to bottle-feeding which, on average, was stopped at a much later mean age of 23 months. Where oral hygiene practices were concerned, 52.6% of children brushed their own teeth without supervision. Frequency of brushing varied between subjects. **Conclusion:** The results of this study have demonstrated that there is a need for culturally appropriate education campaigns to inform parents (especially those in disadvantaged communities) about the importance of oral health and the prevention of oral disease.

**Keywords:** nursing caries, dental, children, bottle-feeding, breastfeeding

### Introduction

Dental caries has shown an overall decline worldwide, yet it remains a problem for a large number of children, especially those living in the developing world (Bowen et al 1997, Van Wyk et al 2004).

According to the 1999--2002 South African National Children's Oral Health Survey, the prevalence of dental caries in 4-to-5 year-old children in the Western Cape was 77.1% (Van Wyk et al 2004). From this survey, it was evident that in this population the primary dentition is more severely affected by dental caries than permanent teeth. The huge number of children affected by caries so early in life, results in hugely increased case loads at hospitals and clinics. As most of these children are under five years of age, general anaesthesia usually has to be considered. This is the most expensive treatment option (Tsubouchi et al 1995; Kelly & Bruerd 1987; Winter 1990).

Nursing caries is defined as a rampant form of caries often found in young children (Dilley et al 1980; Ripa 1988). This infectious disease process in young children was previously referred to as “baby bottle syndrome” as this clinical picture is seen most often in children older than 12 months who sleep with a bottle containing sweetened substances. Since a bottle is not always necessary to obtain this clinical picture, Ripa (1988) suggested that the term “nursing caries” be used, as on demand nocturnal breastfeeding has also been shown to have the same effect (Bowen et al 1997; Milnes 1996). A high prevalence of nursing caries was also found in children who used pacifiers dipped in sweetened substances (Peters 1994).

Teeth are usually affected “in the sequence in which they erupt” (Peters 1994; Derksen & Ponti 1982). This means that the four upper anterior teeth are usually the most severely affected as they erupt first. The tongue protects the mandibular incisors during feeding. This, together with the spacing of the mandibular incisors and the proximity of the sublingual and submandibular salivary glands, make these teeth less susceptible to caries formation and characteristically they remain unaffected (Milnes 1996; Cameron & Widmer 2003; Kennedy et al 1996; Ripa 1988). This characteristic distinguishes this pattern of decay from classical rampant caries (Ripa 1988).

Poor oral hygiene and reduced saliva flow, increased metabolism of fermentable carbohydrates and acid production, result in the development of nursing caries. Without intervention, nursing caries can have a destructive effect on the primary dentition (Peters 1994; Kelly & Bruerd 1987; Ripa 1988). Invasive treatment is usually required. Extraction of decayed teeth can leave children with emotional after-effects and can also later lead to the development of orthodontic problems (Phillips & Stubbs 1987; Lee et al 1994).

The prevalence of nursing caries differs between different populations but the incidence is reported to be as high as 60% to 65% in developing countries (Albert et al 1988). The American Academy of Pediatric Dentistry (2002) has recognized nursing caries as a “significant public health problem”.

Differences in ethnic and cultural circumstances (Milnes 1996) and biological, environmental and behavioural factors (Vanobbergen et al 2001), can also have an effect.

### **Aim of the study**

Our long term objective is to design a community-based and culturally appropriate intervention strategy to decrease the high incidence of nursing caries. In order to plan our future investigations in this regard, we needed to determine the following baseline information:

1. The epidemiologic profile of children under six years of age presenting with nursing caries who had two or more teeth extracted under intravenous sedation at the Tygerberg Oral Health Centre.

2. How many of the known risk factors for nursing caries (behavioural, social and environmental) could be identified in the group of parents seeking treatment for their children at the Tygerberg Oral Health Centre which contributed to the development of nursing caries in their children.
3. The specific habits, usages, beliefs and cultural factors in this group that may play a role in nursing caries.

Presently, there is no research-based information on these aspects relating to this particular cultural group and thus there is a need for establishing reliable data to use in future planning to address the urgent need to reduce the prevalence of nursing caries.

### **Method and study subjects**

A survey was carried out using records of patients kept by the Paediatric Dentistry Division at the Tygerberg Oral Health Centre. A data sheet was filled in to obtain specific information from the patient files. Questions relating to feeding, oral hygiene habits and social and medical history were noted on the data sheet. Gathering the original information from the parents was overseen by the senior author, who conducted most of the original clinical interviews and completed the record entries herself.

Records of patients (as specified in the inclusion criteria below) who had undergone sedation for the extraction of two or more primary anterior teeth were included as from January 2004 to February 2005.

#### **Inclusion criteria**

1. Children 6 years of age and under, seeking dental treatment at the Paediatric Dentistry Division at the Tygerberg Oral Health Centre
2. History of extraction of two or more primary anterior teeth (under sedation)

#### **Exclusion criteria**

1. Presence of any medical or dental condition that would have a direct impact on oral health status
2. Children who did not meet the above-mentioned inclusion criteria

### **Results**

All children who met the inclusion criteria during the period January 2004 to February 2005 (140 subjects in total) were included in the study.

*Age distribution:* The youngest child was 1.42 years of age and the oldest was 5.25 years. The mean age was 3.02 years.

*Age of first visit:* Only two of the children had received previous dental treatment which included extractions at a clinic. For the rest of the children (138), it was their first visit to the dentist.

*Residence:* The majority of patients came from the poverty-stricken peri-urban areas of Cape Town called Ravensmead, Belhar, Elsies River, and Eerste River.

#### *Social factors*

Of the 140 children surveyed, a total of 55 children (39.2%) came from single-parent families. The number of single mothers (34.2%) far exceeded the number of single fathers (5%).

The unemployment rate was very high (See Figure 1). A total of 86 parents out of 189 (45.5%) for whom information was available, were unemployed. Sixty-seven mothers and 19 fathers reported that they were unemployed. Very few parents had jobs that required a tertiary qualification. Most occupations listed were those of blue-collar workers which included jobs such as drivers, general workers and builders among the fathers. Four of the fathers were self-employed. The majority of the employed mothers listed jobs such as assistants, packers and cleaners. These findings indicate that the cases in our study originate from a very vulnerable or economically disadvantaged group.

In four instances, the primary caregiver was either the grandmother (3 cases) or the aunt (1 case). Two of the 140 children were adopted and the rest lived with one or both of their parents.

#### *General health of children*

None of the children received vitamin supplements. Only 4.3% (6/ 140) were reported as suffering from allergies. These included three cases of allergy to penicillin. The other three presented with eczema and/ or hay fever.

Thirty-three children (23.6%) presented with some kind of illness or congenital condition. The most common illnesses were some form of respiratory or chest problem (39.4%), ear infections (15%), gastrointestinal problems including diarrhoea and gastroenteritis (12.12%) as well as tonsillitis (15%). The other 18.48% comprised bladder infections, HIV and mumps as well as congenital conditions such as haemophilia, Down's syndrome and polycystic dysplastic kidney disease.

A total of 20 children were on medication. Eight (40%) received some form of antibiotic and 6 (30%) were using some form of bronchodilator. One child was on TB medication and 1 received antiretroviral drugs.

#### *Diet*

In this survey, all the children except one had highly cariogenic diets. Only eleven children (7.85%) were exclusively breast-fed. Breast-feeding was stopped at 9 months of age on average, as opposed to 2.3 years (28 months) for bottle-feeding (See Figures 2 & 3). 18.57% of children were exclusively bottle-fed.

73.6% received both breast- and bottle-feeding. One-hundred-and-thirty-one (93.6%) children went to sleep while bottle- or breastfeeding and 90% (126) were fed on demand throughout the night.

### *Contents of bottle*

The majority of children (86%) drank cow's milk out of the bottle. Of these, 96% of the parents claimed to have added nothing to the milk. A sweetened flavourant (Nesquick ®) was added to the bottles of 10.8% of the children while 8.1% had sugar added to the bottle. Honey was added in only one instance.

None of the children received breast milk in the bottle and only one child drank soya milk. Only 15 children consumed milk formula. Of the 129 children in this study, 62% drank fruit juice from the baby bottle (information unavailable for 11 children).

Other beverages of interest consumed from the baby bottle were:

- Cola drinks or other soft drinks= 8.5%
- Tea with sugar= 36.9%. Of this group, 31.2 % favoured an indigenous herbal tea (rooibos tea) and the rest (68.7%) drank Ceylon tea.
- Sugar water= 3.8%

The data for bottle contents is depicted in Figure 4.

*Fluoride:* Only one child received fluoride supplements but all 135 children who practised some form of oral hygiene used fluoridated toothpaste.

*Oral hygiene practices:* The majority of the children (62.1%) brushed once a day, 27.1% brushed twice a day while 2.8% of children brushed thrice a day.

Eleven children (7.8%) either did not brush their teeth at all or brushed infrequently (less than once a day). This included brushing once or twice a week, now and then, sometimes, on weekends or never. Five children never had their teeth brushed.

Seventy-three children (52.6%) brushed their own teeth without supervision. In 44.4% of cases, the parent or caregiver was in some way actively involved in the process of brushing the child's teeth. The rest of the time, the parent or caregiver watched the child brush his/ or her teeth without actively lending a helping hand.

### *Medical history of mother during pregnancy*

Only 11 mothers reported experiencing some kind of problem during pregnancy. These included two cases of hypertension and two mothers with low iron levels. The rest were isolated incidences of diabetes, asthma, epilepsy and low blood sugar levels. One mother was HIV positive.

Only one mother followed a diabetic diet during pregnancy. For the rest of the mothers, their diets were within the bounds of normal. Four mothers took iron supplements, one mother took folic acid and three took vitamins. The rest did not take any prenatal supplements.

*Perinatal complications:* Four mothers had Caesarian sections and eight of the 140 babies were born prematurely. Three babies had serious complications at birth which included breathing problems, no foetal heartbeat and the umbilical cord around the baby's neck. Only one child was reported as having neonatal jaundice.

## **Discussion**

Overall, this large group of children highlighted the serious problem with nursing caries (with extensive destruction of teeth) in this particular part of our patient population. This study also indicated a socio-economic link which seems to exacerbate the problem. According to the profile of the patient drainage area, the majority of patients making use of the oral health facilities at Tygerberg belongs to the lower income group and resides in the poorer areas surrounding Tygerberg Hospital.

Breastfeeding was stopped at a much earlier age than bottle-feeding. If one takes into consideration that more than a third of the children came from single-parent families and that nearly half of the parents in the survey were unemployed, it is clear that economic stress is a contributing factor. This often means that parents are not able to provide the best possible care for their children. Nutrition is also likely to be compromised.

The results of this study have also shown that most parents wait too long before the child is brought for their first dental check-up, usually only when there is pain. Children from lower socio-economic groups are more likely to receive treatment at public community health clinics or teaching hospitals (such as Tygerberg) which have long waiting lists. This means that access to care is delayed, exacerbating the problem by allowing the child's oral health to deteriorate further. This situation is certainly reflected in the clinical picture of persons making use of the Tygerberg Oral Health Centre.

It emerged from interviews with parents that bottle-feeding is used as a means of behaviour control. This is the easiest way to pacify a crying child, especially for single mothers who have more than one child to take care of. Parents, especially single mothers, often do not have the time to pacify their children by some other means. The convenience of this method of behaviour control makes it difficult to change this pattern of behaviour. For this reason, children as old as 5 years of age were sometimes still being bottle-fed. These child-rearing practices and lack of familial support when it comes to caring for these children, contributes to the extreme dental "neglect" which was observed in this group of patients surveyed.

The findings of this study are in agreement with the literature (Derksen & Ponti 1982; Holt 1990; Peters 1994; Verrips et al 1993; Freeman et al 1989; Winter 1990; Johnsen et al 1984) where many of the patients surveyed also had other factors in common.

Parents interviewed in this survey were found to be generally unaware of the link between caries and dietary habits. They are also generally ill-informed about caring for their children's teeth and there is a general misconception amongst them as to the causes of decay and the importance of caring for and preserving the primary dentition. The fact that very few parents in this study had high levels of formal

education could be a contributing factor. All the children surveyed except one, had diets high in sugar content. There was also no limit to the amount of sweet snacks the children consumed during the day. Mealtimes (where balanced meals were consumed) were also unscheduled and irregular. Excessive in-between-meal snacking increases the caries risk.

The time children spend feeding and frequency of feeds plays an important role in the progression of nursing caries. The longer these deleterious feeding habits continue, the more teeth are likely to be affected. Parents found it easier to give in to their children's demands for a night-time bottle as opposed to finding alternative methods to pacify them. This is particularly noticeable in children of single parents or children from families with a large number of children.

The parents of these high-risk children were also less likely to put water into the bottle and usually did not implement any form of oral hygiene after removal of the bottle and before the child falls asleep. Thus, the teeth were subjected to acid attacks, increasing the risk of caries development. Most of the children were still on the bottle when they initially presented for dental treatment. Parents seeking treatment at the Tygerberg Oral Health Centre have also been found to neglect their own oral health. They often only seek treatment when there is a problem.

Premature babies and babies with episodes of fever, gastroenteritis and respiratory infections were found amongst the children surveyed. Respiratory infections were among the most common illnesses. Chronically ill children especially, received sweetened liquid medication up to 3 to 4 times a day and this can exacerbate the problem. Parental overindulgence is especially common in very sick children as the parents of these children try to comfort them in this way.

The majority of children in this study were however healthy. This suggests that the child's medical condition may play less of a role in the development of nursing caries than parental behaviour and lack of knowledge regarding the causes of nursing caries.

#### Contents of the bottle

The majority of children in this survey received cow's milk in the bottle. The fact that only a small percentage of children were exclusively bottle-fed suggests that the majority of parents realize the importance of breast-feeding. However, the lactose content of human milk is twice that of bovine milk which means that human milk could be more cariogenic than bovine milk (Ripa 1988).

Information should also be made available to the public regarding the cariogenic potential of certain infant formulas so that informed choices can be made (Bowen et al 1997). Formulas that are the least likely to induce caries should be selected.

Fruit juices and carbonated drinks were popular choices of beverages in this study. These substances are acidic and more often than not, they contain sweeteners.

Phillips and Stubbs (1987) suggested that the contents of the bottle gradually be diluted until it is entirely replaced with water. Parents should be encouraged to wean their children from 6 months of age (Ripa 1988). *Streptococcus mutans* has been shown to be one of the aetiological factors responsible for the initiation of carious lesions. Since it is usually not detectable in the oral cavity before one year of age, Berkowitz (1996) recommended that the child be weaned by this time in order to prevent the development of nursing caries. The use of sweetened pacifiers should also be discouraged.

### Oral hygiene practices

Fluoride has been shown to be an important component in the prevention of caries (Vanobbergen et al 2001; Winter 1990). The use of fluoridated toothpaste was the only exposure these children had to fluoride as none of them received fluoride supplements and the fluoride levels in the reticulated water in Cape Town are too low (< 0.05ppm) to have a beneficial effect on tooth development.

Oral hygiene practices were generally poor in the group of children surveyed. The majority of children were responsible for their own oral hygiene, without parental supervision or assistance. Even though the oldest child was only 5 years old, most of the parents felt that their children were old enough to brush their own teeth. In single-parent families with more than one child, oral hygiene practices were often neglected by the parents in favour of “more important tasks”.

As was found in this study, parents of high caries risk children generally found it more difficult to enforce oral hygiene in their children. They reported that in these instances, children refused to sit still or open their mouths. This daily battle often results in the caregiver or parent neglecting this task.

Parents should be encouraged to clean their child's teeth after each feeding. Proper instructions must be given and the parent should be taught to brush the child's teeth with fluoridated toothpaste as soon as the teeth erupt. Freeman et al (1989) stressed the importance of active parental participation in the oral hygiene practices of preschool children at least up to the age of five. Care must also be taken to prevent the child from swallowing excess fluoride. The quality of brushing should also be emphasized more than the frequency of brushing. This study showed that even though some children brushed their teeth more than once a day, they did not have the necessary dexterity to perform the task adequately.

### **Conclusion**

This retrospective study of the records has highlighted that this problem has reached epidemic proportions in the study population making use of the Tygerberg Oral Health Centre. This problem would not have been quantified or the seriousness



realized without the availability of good records from the general anaesthesia and sedation services.

The results of this study demonstrate that, as there is currently no information based on research pertaining to this particular community, reliable data regarding the risk factors for nursing caries should be obtained so that it can be utilized to design “culturally appropriate” education campaigns. South Africa is a melting pot of different cultures. These cultural beliefs, lack of parental knowledge and behaviour which contributed to the development of nursing caries in this population group need to be explored in greater detail. In this way, specific campaigns which are tailored to the needs of each community and which target pregnant women, parents, babysitters and grandparents as well as professionals outside of dentistry can then be designed and implemented. This campaign should be widespread and would serve to educate parents about the importance of oral health and the prevention of oral disease.

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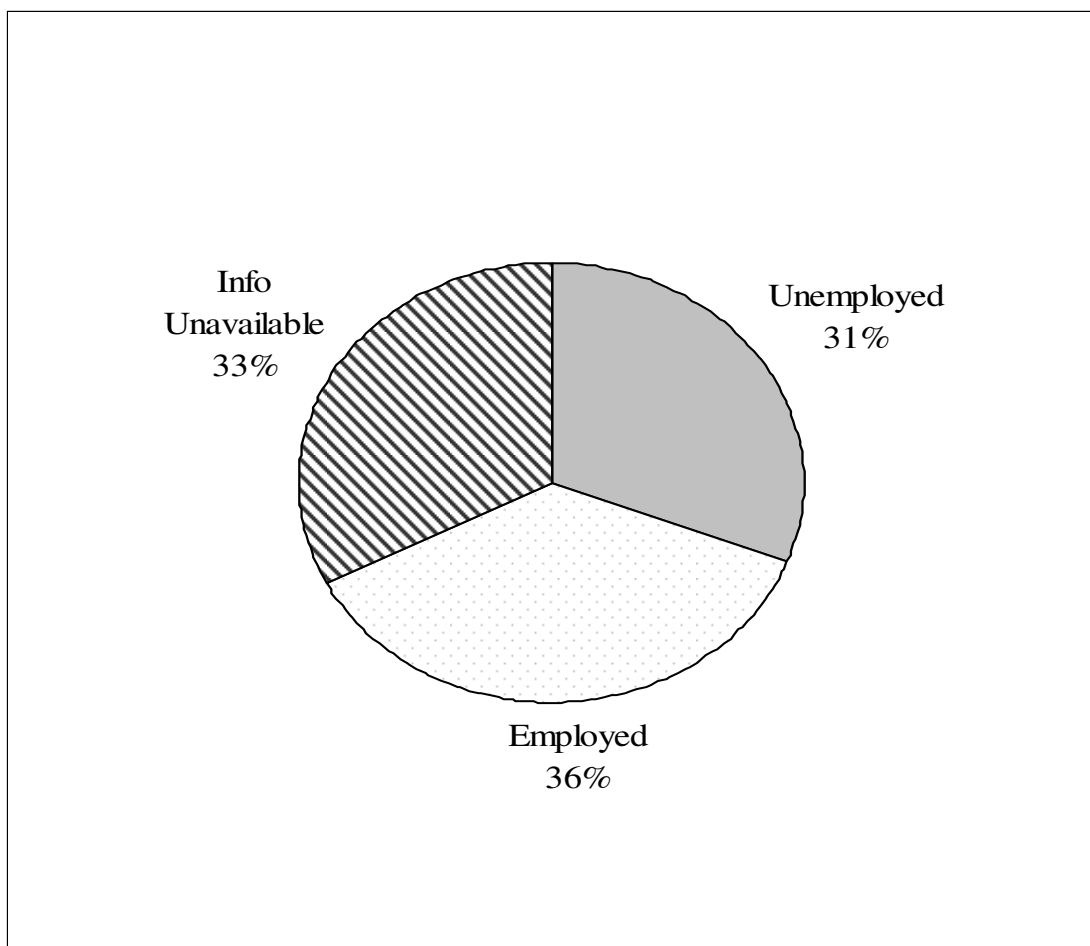


Figure 1: Employment history of caregivers in survey (total = 280 parents or caregivers)

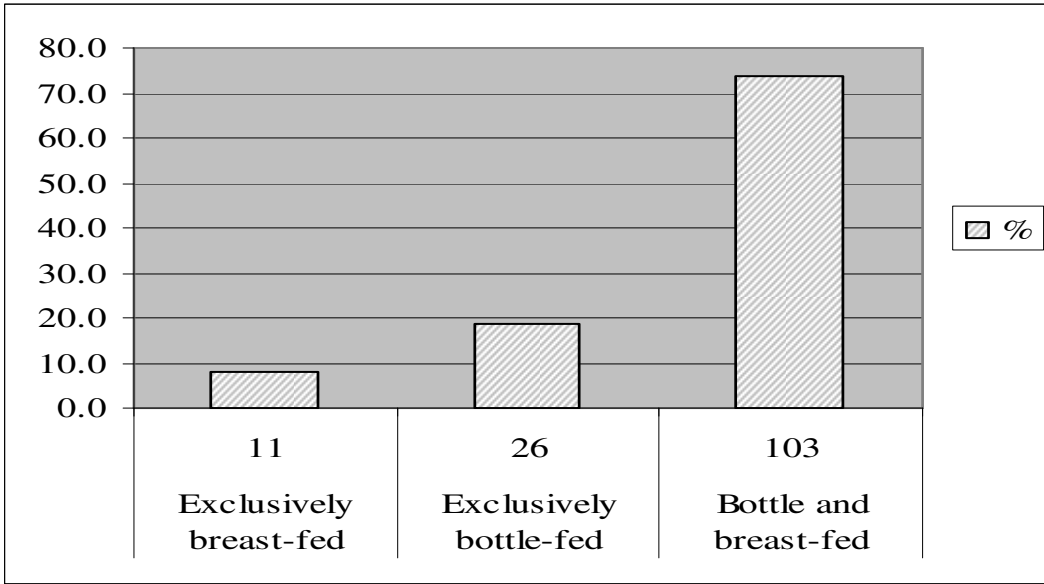


Figure 2: Feeding patterns of patients in survey (total = 140)

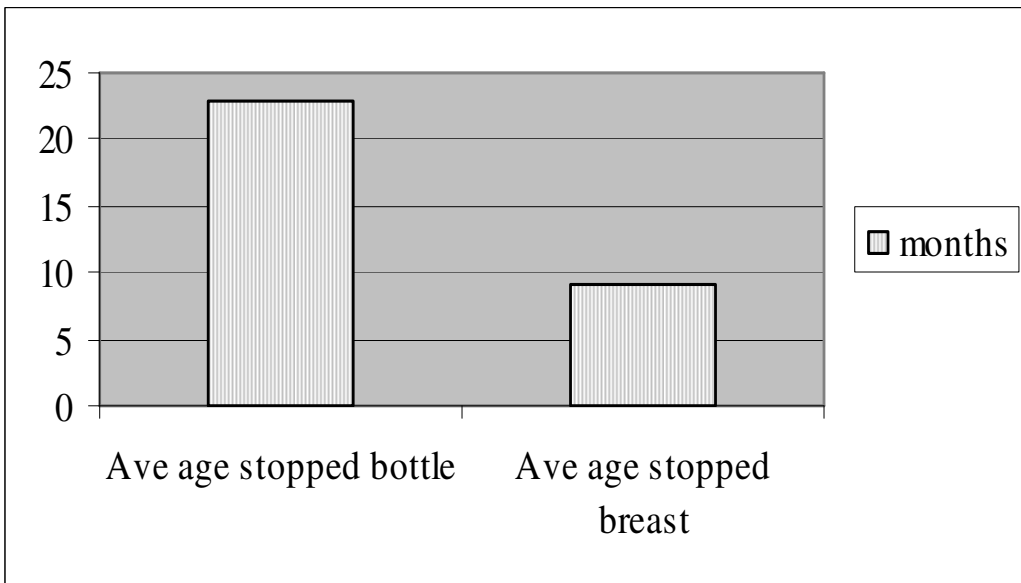


Figure 3: Average age at which bottle and breast-feeding was stopped (total = 140)

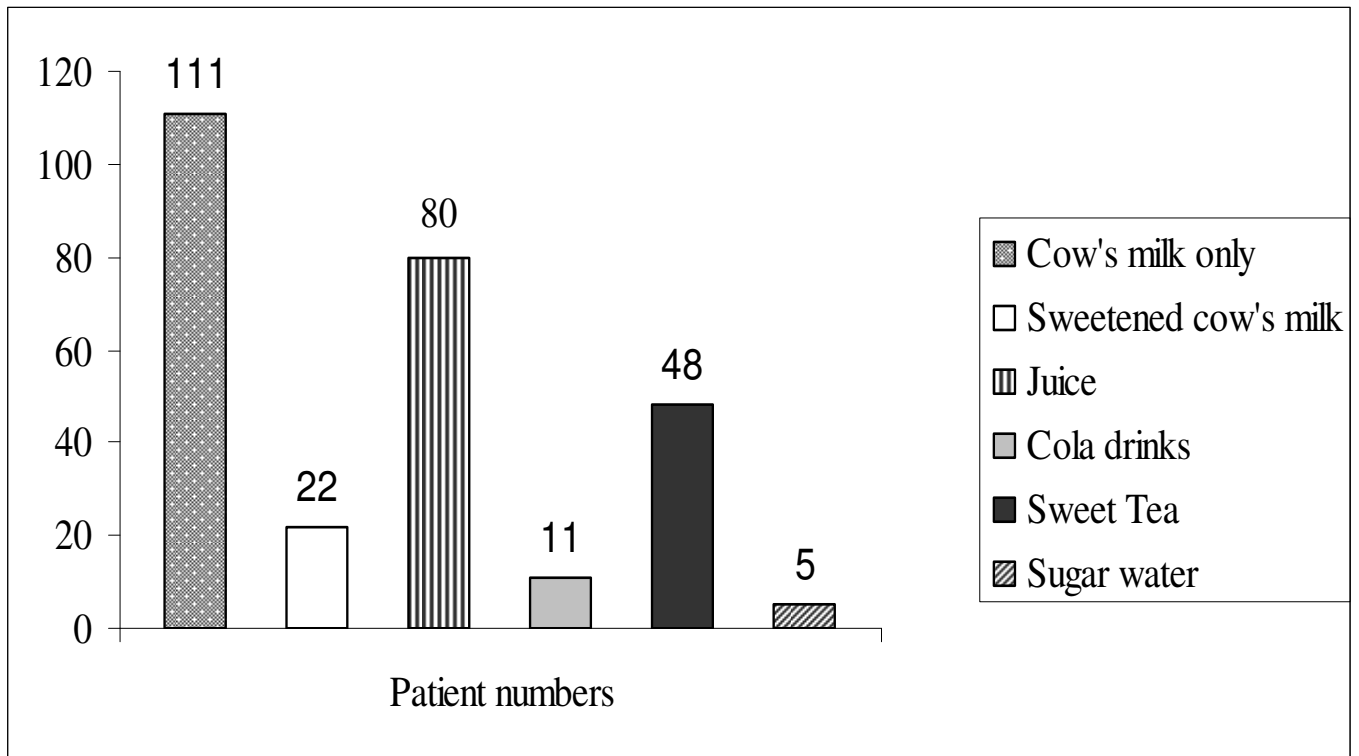


Figure 4: Bottle contents as reported by caregivers in survey. Some patients received more than one substance in their bottles.