ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

PREVALENCE AND DETERMINANTS OF DENTAL CARIES IN SHASHEMENE WOREDA

A THESIS SUBMITTED AS PARTIAL FULFILLMENT

FOR THE DEGREE OF MASTERS OF PUBLIC HEALTH (MPH)

ADDIS ABABA UNIVERSITY

BY:- GHIRMAY ANDEMICHAEL (MD)

MAY 1995

PREVALENCE AND DETERMINANTS
OF
DENTAL CARIES IN SHASHEMENE WOREDA
SOUTH EASTERN ETHIOPIA

A THESIS PRESENTED AS PARTIAL FULFILMENT

OF THE REQUIREMENTS FOR MPH

BY: GHIRMAY ANDEMICHAEL, MD

ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

Prevalence and Determinants of Dental Caries

By

Ghirmay Andemichael, MD

Department of Community Health
Faculty of Medicine, Addis Ababa University

Approved by the Examining Board

Dr. Derege Kebede
Chairman, Department
Graduate Committee

Dr. Tadesse Alemu
Advisor

Dr. Frew Lemma
Examiner

Dr. Melakeberhan Dagnew
Examiner

Dr. Negussie Taffa
Examiner

ACKNOWLEDGEMENT

I am grateful to the International Development and Research Centre (Canada) for funding the thesis research. I would also like to thank my thesis advisors Dr. Tadesse Alemu and Dr. Mesfin Kassaye for their invaluable assistance in reviewing the thesis draft and giving very useful suggestions. I am indebted to Dr. Derege Kebede for his help in the multivariate analysis and Dr. Yemane Berhane for his invaluable help in reviewing the thesis draft and giving very helpful suggestions.

My thanks also extends to those who cooperated with me in doing my thesis, the Shashemene woreda administrative bodies, various ministry offices and bureaus and the Shashemene hospital and health assistant training centre for their help from the start up to the end of the research.

Finally I would like to extend my thanks to the East Shoa Health Bureau for allowing me to do the training of the interviewers in Hailemariam Mamo and Kuyera hospitals. My thanks also extends to the community who participated in the study and to those who were involved in the training of the interviewers and those involved in performing the interview.

TABLE OF CONTENTS

List of Tables

LIST OF FIGURES

ABSTRACT

A cross sectional community based survey to determine the prevalence of dental caries in Shashemene woreda, 250 Km. South Eastern part of Ethiopia was conducted between November 1994 and December 1994.

A total of 1228 individuals, 630 (51.3%) males and 598 (48.7%) females participated in the study. The overall dental caries prevalence rate was found to be 51.4% 631 of the total 1228 people being affected, The prevalence of dental caries was found to be hgher among the rural resdents 53.7% of the total 821 people examined being affected as compared to 46.4% of the total 407 urban population studied respectively.

Females were affected more than males, 315 (52.7%) of the total 598 and 316 (50.2%) of the total 630 respectively. The difference was statistically significant OR= 1.81(1.32,2.49).The survey also elucidated that the disease prevalence increases with age old people being affected more, only 11.8% of those aged 60 years and above being caries free.

The risk factors for dental caries identified in this study were age (being old), sex (being a female), residence (being rural resident), low education, consumption of sweet food items, Khat chewing, presence of food remnants in the oral cavity, gingivitis, calculi and plaque.

The study has elucidated that dental caries prevalence is high, more than half of the studied population being affected by dental caries. It seems that the "excellent Ethiopian teeth" practically is becoming a legend this days.

Strengthening of health education in the health institutions and initiation of health education programme in schools, training of adequate health man power to deal with oral health problems and further studies to identify other risk factors and treatment requirement are recommended.

Introduction

Dental caries (tooth decay) is a chronic disease in which the active agent or agents are members of the indigenous oral flora. Carious lesions result primarily from the dissolution of mineral in enamel and dentin by acid produced during metabolism of food residues by microorganisms colonizing tooth surface (1). Teeth are very durable organs and remain in excellent condition for a considerable time after death (2). Numerous archeological reports indicate that carious lesions were infrequent during antiquity (3,4).

In industrialized countries now, few persons become adults without having had carious lesions in both their primary and permanent teeth. Since the early 1970's, however, because of the availability and use of various preventive procedures the prevalence of dental caries has substantially decreased in children of developed countries (5-7). The carious attack rate has been very low in developing nations as compared to industrialized countries, especially in the permanent teeth (8), unfortunately, with recent changes in food choices and life style, the prevalence of caries in developing nations has been increasing rapidly (9,10).

Unlike common infectious diseases, a carious lesion is not self-limiting, but once initiated, progresses until the pulp is infected and the crown destroyed. The

prevalence of dental caries varies from country to country and from region to region (11). In 1984, dental care in the United States of America cost $25.1 billion, about half of which was spent to restore or replace teeth damaged by dental caries(12). This figure represents 6.5% of all health expenditure. The projected cost for 1990 was $42 billion (13).

In Ethiopia the 1958 Littleton's national survey has shown low caries prevalence rate (23%), 77% being free of dental caries(14). All later studies, however, agreed that on an individual basis there was a low level of caries (that is, a low number of decayed, missed, or filled teeth per person). However, the prevalence of decay in the population as a whole has increased considerably (15-20).

The World Health Organization (WHO) recommends a dental caries survey be done at least every five years. There has never been done a community based dental caries research in the area where I did my health profile. Based on this and the increasing prevalence of dental caries in Ethiopia, there was a clear need for research in this area and a community based cross sectional survey was conducted in Shashemene woreda which is located 250 Km. South-east of Addis Ababa.

II. Literature review

A. Occurrence

Caries and inflammatory periodontal diseases are among the most prevalent diseases in the world (21). Dental disease accounts for more pain, suffering and loss of working hours than almost any other disease. Since tooth loss is still regarded incorrectly as a normal consequence of ageing there has been minimal emphasis on oral hygiene principles to prevent dental diseases and maintain good dental health (22).

For the first time ever, the frequency of dental caries in 1982 was greater among children in the Third World countries (23). Figures from the World Health Organization dental data bank showed that the average number of teeth with caries per 12-year-old child as assessed by the DMF index (D= decayed, M= missing, F= filled) was 4.1 for Third World countries in 1982 and 3.3 for industrialized countries . Twenty years ago the index was less than 1 DMF-teeth for most developing countries and as high as 10 DMF-teeth for developed countries (24). The decrease in dental caries in western countries are encouraging, but the prevalence of dental caries is still unacceptably high and in some countries little or no decline has occurred. For example, in England and Wales, where there has been a reduction of

about 50% in the proportion of children aged 6 and 7 years and a decrease in DMF of 1.5 per child between 1973 and 1983, 8 out of 10 children aged 10-13 and 9 out of 10 children aged 14-15 had experienced caries. The 15-year-old still had about six teeth attacked by caries about 20% of their teeth (25). Because caries is so common it tends to be regarded as an inevitable part of life. By the age of 15, 97% of children in Britain have had some caries and this proportion is 99% in Norway, where by the age of 21, only one person in a thousand is free of the condition (26).

In a study done in 8000 Finish people aged 30 years and above, the prevalence of dental caries (untreated) was 55% in women and 67% in men respectively. The mean number of decayed teeth was 2.5 per person. Men had more decayed teeth per person than women did. The study included only clearly detectable, untreated lesions. The use of x-ray probably would have given more decayed teeth per subject (27).

In a study done in 9 schools whose distances ranged from 2 to 17 miles away from Kasama town of Zambia in 1516 school children aged 7-16 years, the over all caries prevalence was 14.5% (28). Similarly in a study done in rural school children in Zambia, the percentage with dental caries DMF or df of 1 or more in 880 children aged 5-17 years was 17% (29). The study done in children

attending the pre-school and primary school in Mamre, South Africa, showed that with age both the severity and the prevalence of dental decay increase in the primary dentition, reaching a peak in the 6-year age group. But as the age advances there is an apparent reduction of dental caries in the primary dentition this is due to reduction of the number of primary teeth present in the mouth resulting from exfoliation of primary teeth and eruption of permanent teeth. The mean number of decayed primary teeth per child was 5.0, 6.6, and 3.2, in the age group under 6 years of age, 6 years of age, and 9 years of age respectively, and the mean number of decayed permanent teeth per child was 0.2, 0.5, 1.5 and 1.9 in the age group of 6, 9, 12 and 14 respectively (30).

Ethiopians had a very good teeth in the past. Madame Alexandra Dabbert, a Russian dentist who arrived in Dire Dawa in 1923 and later in Addis Ababa explained that she had an average of 6-10 patients a day. A large proportion of them were new clients. Ninety percent of her patients were Europeans, and only ten percent Ethiopians. She explained this primarily by the fact that the latter had "excellent teeth" (31). But also because her prices "though reasonable" were "too expensive for most of the population" (31).

Madame Dabbert, a pre-world war II Addis Ababa dentist who also practiced in Dire Dawa and Djibouti,

said that at the latter port she had many more patients than in the interior of Ethiopia. The inhabitants of the coast, she explained, ate many sweet things and drank sweetened tea and coffee, where as most Ethiopians scarcely consumed any sugar at all. Even the nobility drank coffee with salt rather than sugar. Sweet cakes which delighted the Arabs, Somalis and Indians were unknown to Ethiopians. The inhabitants of Djibouti, being much more involved in trade, purchased sweets for their children, while youngsters in Ethiopia made do with roasted grain which was much better for their health (32). In Ethiopia the 1958 Littleton's national survey has shown low caries prevalence rate (23%), 77% being free of dental caries (33). A survey of dental health condition among 232 participants(192 male and 40 female) in 6 campaign posts from three regions, Shoa, Keffa and Illubabor, in the development through cooperation, Ethiopia, 1976 showed that the Decayed, Missing, or Filled (DMF) rate was 53% (49%, 54%, and 65% in age groups of 15-19, 20-24, 25 years and over, respectively). Only 28% reported what could be considered acceptable oral hygiene practices, (regular daily brushing of the teeth after at least 2 meals), the majority using the mefakia, (local twig brush) 33% reported taking sweets and 41% took grilled cereals between meals. It is suggested that the era of the "high quality of the

Ethiopian teeth" might be over, and that the public health problem of dental health in Ethiopia should be reappraised (15). Dental caries and other diseases of teeth and gum was one of the 15 leading causes of out patient morbidity in Ethiopia, in 1984 (33).

The study done in Kimir Dingay, North-Western part of Ethiopia, showed an over all caries prevalence rate of 47.1%, the disease being higher in females than in males 49.6% and 41.8% respectively. The study also showed that the prevalence rate of dental caries increases with age, the age group 60 and above being highly affected. Molars were highly affected and the least affected teeth were the canines. Of those who used local tooth brush (mefakia) for cleaning their teeth only 23.1% were affected and a significant difference in caries prevalence were noted between those who used a mefakia and those who used no method of cleaning teeth. The gingivitis prevalence was 3.3% and out of these 77.8% were positive for dental caries, showing a strong relationship between gingivitis and caries (19). The study done in Ethiopian immigrants from rural Ethiopia to Israel revealed that caries levels were low, DMFT levels of 0.31 among 12-year-old, and 1.27 amongst adults. The 5-year-old were 86.8% caries free, while 12-year-old were 81.8% and adults 54% caries-free respectively (34).

B. Determinants

Although bacteria on the teeth are the direct causes of dental caries, a large number of microbiological, environmental, and host factors interact to determine whether or not an individual will be affected by this disease and, if affected, how and to what extent. For this reason, dental caries is considered to be a multifactorial disease. Caries is believed to be the same disease through out the world, yet the impact of various etiological factors can be quite different in different individuals and in different parts of the world. It is this interplay of factors that gives rise to the observed variations in prevalence and patterns of caries worldwide (35).

The factors conducive to tooth decay can be conveniently classified as (a) micro-organisms and (b) dietary substrate, both of which contribute to the formation of dental plaque and its maintenance on tooth surfaces (36).

1. Microorganisms

The etiological significance of all oral microflora has yet to be elucidated. Those that receive most attention so far are Streptococci and Lactobacilli. The former comprises not only S. mutans group, but also S. sanguis and other Streptococci (36). The mean total count

of salivary bacteria of S.viridans and S.mutans in Ethiopian Immigrants were not significantly different from the Israeli controls (34).

2. Diet

Dietary substrate implicated in cariogenesis include various forms of fermentable carbohydrates. Sucrose is considered to play a dominant part because it is not only fermentable to acid but also readily polymerized to insoluble glucan.

Finally, consideration must be given to the external or environmental factors that can modify both the resistance of teeth and the antagonistic forces. Geographic factors include the presence of fluoride and other trace elements in the soil, in water, and in food. Of major importance is the influence of socio-economic conditions which, in particular, may affect diet and health practice (36).

It should be clear that there is a dose response relation between sugar and caries. The relation holds for consumption level of up to about 35 Kg. sugar/year; beyond that level the curve flattens (37). In industrialized societies whose sucrose consumption was reduced because of the war time rationing the frequency of dental caries fell as expected then rose rapidly when rationing ended (38). In Japan before the war of 1939-45

sugar consumption was approximately 15 Kg./person/year. By 1945, consumption had fallen to about 0.2 Kg./person/year. Caries prevalence among children fell sharply during the war year and there was a strong correlation between annual caries incidence and the average sugar consumption in the same or the preceding year. Takeuchi showed that the rate of caries attack accelerated when sugar consumption rose above 10 Kg./year (38). Shimamura found that the attack was more intense at consumption level of 15-21 Kg./year (39). These findings are supported by data from Norway, where Schulerud found that children eating about 28 gm./day (10 Kg./year) had healthy teeth (40).

Additional evidence on the sucrose/caries relation came from an analysis of caries rates and national sugar consumption levels in 47 countries. Sreebny found a highly significant relation of r= 0.72 for 12-year-old children. He concluded that a sucrose consumption level of less than 50 gm./person/day is always associated with three or less attacked teeth and proposed that 50 gm./day (18 Kgm./year) should be taken as an upper limit of safe sucrose consumption (41).

3. Fluoride

Since the first half of this century, when scientists discovered that fluoride helps to protect teeth from dental decay, most of the work in caries prevention has been based on some types of fluoride use, and most of the success in reducing the prevalence of dental caries has been attributed to its use (36). The procedure of fluoridation was first carried out in Grand Rapids, Michigan, in 1945 and after 15 years of fluoridation, the DMF (Decayed, Missing or Filled) score of 15-year-old children had fallen from 12.5 to 6.2 teeth per mouth (42). Scientific researches has been successful in showing, for example, that addition of small amount of fluoride to drinking- water or other vehicles (e.g. salt, milk), plus reduction of sugar intake could dramatically decrease the prevalence and severity of dental caries. The increased use of fluoride from all sources, especially toothpastes, is undoubtedly the major factor in reducing dental caries in many parts of the world, but a variety of other factors also contribute to this (43).

Recent reports from both Australia and the United States of America have reconfirmed the safety and efficacy of fluoride in preventing dental caries (44,45). Fluoride in toothpaste has undoubtedly contributed significantly to the reduction in dental caries (46,47). The use of fluoride toothpaste from an early age ensures

the presence of high intra-oral fluoride level and the therapeutic effect of fluoride is greater. In addition, fluoride may interfere with the metabolism, transmission and implantation of cariogenic organisms (23).

4. Oral hygiene

There is no unequivocal evidence that tooth brushing and good oral cleanliness reduces caries experience (48). The weight of evidence is that improvement in oral hygiene, which has occurred in the past decade, is not a significant factor in the reduction of caries (47).

Efficient tooth-cleaning, irrespective of the methods used, has been demonstrated repeatedly to be important in maintaining periodontal health and reducing disease prevalence. In one study, once-a-day tooth-brushers had more disease than those brushing twice daily, but no significant difference in the severity of periodontal disease has been detected between those brushing their teeth twice a day and those brushing them three times a day. It would appear that the efficiency rather than the frequency of brushing is more important in removing plaque (49).

There is no consensus on what constitutes the best method of tooth cleaning, and no specific method of tooth brushing shows a clear advantage over others. The optimum frequency of cleaning may vary in individuals,

and emphasis should be placed on effectiveness of cleaning rather than frequency or method. Cleaning of only the buccal and lingual surfaces of teeth is insufficient. Cleaning of the interproximal surfaces of teeth is of paramount importance in the prevention of the periodontal diseases (49).

The study done by Kitaw et al, on the participants of the Development Through Cooperation Campaign in 1976, revealed that of the 157 students who filled in the part of the questionnaire dealing with oral hygiene practice only 37 (28.5%) reported regular oral hygiene practice after at least two meals. The mefakia, or local twig brush, was the means most regularly used (86%). Only 9 (5.7%) students used toothpaste. Only 17% of all students who participated in the survey had their oral cavity considered clean (15).

In the study done by Okubazghi et al in Kimir Dingay, North Western part of Ethiopia in 1985, revealed that out of the total of 384 participants who claim to use some methods of cleaning their tooth only 26 (6.8%) were using local tooth brush regularly and of these only 23.1% were caries positive, and the rest negative. Regular through cleaning of teeth even with simple local twig brush plainly gives some protection from dental caries (19).

5. Socio-economic status

The influence of social class in dental caries is strong (20,50). In Ethiopia, children from more affluent high social class families had four times more caries in primary teeth than poorer children and twice as many permanent teeth with caries (20).

6. Age

Many studies have proved that dental caries increases with age (14-16,19,20,30). A study done by Yayehyirad et al in 1976 have shown that the dental caries prevalence rate in those who are in the age group of 15-19 was 49% and in those aged 25 years and above 65% (16). Similarly the study done by Gebresselassie et al have shown a similar trend, in those aged 5-9 years the dental caries prevalence rate was 22.3% and in those aged 60 years and above 86.0% (19). The increase of dental caries with age indicates the chronic, progressive and irreversible nature of the disease.

7. Residency

Urbanized populations in underdeveloped countries are more likely to consume refined sugars than those in rural areas. Therefore it is not surprising that caries rates are higher in urban population (23). In the sudan, 15-19-years-old urban children had seven times more

caries than children in rural areas where the sugar consumption was below 5 lbs/person/year (51).

8. Gender

The prevalence of dental caries was found to be higher in females than in males in studies done in Ethiopia (16,20). The study done in Finland, however, showed higher prevalence in males than in females and the probable reasons proposed by the investigator were that women are likely to practice prevention and they are likely to have their teeth treated than men (27).

9. Khat

Khat is commonly used in Ethiopia for social and religious purposes. Also, certain occupational groups like long distance truck drivers and students during times of stress (examination periods) resort to the practice as a means of keeping themselves alert (52). Dental caries and psychosis are reported to be common among Khat chewers (53).

IV. Subjects and methods

A. Study design

The study was a community based cross-sectional with internal comparison.

B. Study area

Shashemene woreda is one of the fourteen woredas in Eastern shoa zone and has a total population of 229,217 in 77 rural and 11 urban kebeles. It has a total area of 7200 square Kilometres. About 70% of the population live in rural area. The average persons per house hold is 5.1 in rural and 5.0 in urban. The main staple foods in the area are teff, wheat, maize, sorghum and potato.

C. Population

1. Source population

The source population were all individuals residing in the 77 rural and 11 urban dwelling associations in Shashemene woreda. It has a total population of 229,927 out of which 76,116 (33.1%) are urban dwellers in 11 urban dwellers association and the rest 153,811 (66.9%) are residents in 77 rural kebeles. The male to female ratio is 1.02 to 1.00 and the predominant ethnic group in the woreda is Oromo and majority are Moslems. The economy of the people in the woreda, as in any other part of Ethiopia, is based on agriculture and the commonly

produced crops are wheat, maize, and teff. The source of water in the town is from a Dam, while the source of water in the rural is from rivers, springs and wells. Khat is frequently consumed in the towns and in the villages (personal observation). There is one hospital and one health centre which are owned by the ministry of health, and six clinics owned by missions and other institutions. There is a dental unit in the hospital which is run by one dentist and one dental assistant making the dentist and dental assistant to population ratio of 1:229,927.

2. Study population and sampling

The study population included all individuals above 5 years of age residing in the 292 systematically selected households (every fifth household) in the 30 clusters chosen by the Probability portionate to size (PPS) technique. A house to start with was selected randomly by rotating a bottle after identifying a land mark (Schools, Churches, Mosques etc...). The house to which the mouth of the bottle directs was chosen as the first house to start. All individuals above the age of 5-years-old in the selected households from whom a verbal consent to participate was found from the individual or their parents or guardians were examined and interviewed. (see fig.1 the sampling frame work).

3. Sample size

The required sample size was calculated based on the 90% power and 95% confidence limit to detect a prevalence rate of 50% among the urban population and 40% among the rural population based on the previous Ethiopian studies 53% among the Development Through Cooperation Campaighn by Kitw et al and 47.1% in rural North Western part of Ethiopia done by Okubagzhi et al. Assuming that 20% will be illigible the calculated sample size was found to be 650 from each group (urban and rural) which is 1300.

D. Measurements

1. Dental examination

Dental examination on all individuals was carried out by two nurses (principal examiners) and two health assistants (assistants), they were in two groups each group constituting one nurse and one health assistant. They can speak the local language (Oromifa) and Amharic fluently. They were trained (theoretically and practically) by a dentist for two weeks in physical examination and diagnosis of dental caries. To assess the consistency of the examination by the two groups 20 individuals with caries and with caries and without caries and its sequelae were chosen by the dentist and were examined by the two groups independently. The consistency of the examination was found to be within the

acceptable range recommended by WHO(54).

Each tooth of the individuals were examined for dental caries. Dental probes, dental mirrors, disposable tongue depressors, and flash lights were used to perform the physical examination. Teeth were inspected and probed for presence of Decay (D), Missing (M) and Filled (F). A cross examination by each groups was performed to check the consistency of the interview and physical examination done by the other group in every 10 to 15 questionnaires and the consistency was found to be with in the acceptable range recommended by WHO (54). Dental probes and dental mirrors were disinfected with savlon and socked in benzalkonium chloride (Zephiran, USA) for 30 minutes after every examination.

2. Interview

A questionnaire was developed in English and translated to Amharic and Oromifa and translated back to English to confirm its consistency.

Training on how to conduct the interview was given for one day to the interviewers, this was done by the principal investigator. The questionnaire was pretested in 30 households, 15 urban and 15 rural, which were not part of the study and appropriate revision done before the commencement of the actual interview. Interview was done after physical examination.

Ethical considerations

1. Permission from the woreda and kebele officials was obtained before the commencement of the study.

2. Verbal consent was obtained from the study subjects and for those who are not able to consent, parent's or guardian's consent was obtained before starting the physical examination and filling of the questionnaire.

3. Health education about oral health and diarrhoeal diseases (as there was a diarrhoeal disease epidemic at the time of our study period) was given after completion of the physical examination and interview to the study subjects, community leaders, and other members of the community which were available at the time of the study.

4. Those with serious oral and other health problems were referred to the hospital which has a dentist for further investigation and treatment.

5. There was no harm inflected on the study subject just by being part of it.

V. Results

A total of 1228 subjects, 630 (51.3%) males and 598 (48.7%) females participated in the study. The mean age for males was 29.9 and that of females was 32.4 years. Of the total studied subjects 407 (33.1%) were urban and 821 (66.9%) rural residents. The majority of the participants were in the age group 20-39 accounting for 465(37.9%) of the total subjects.

Most of the participants were house wives and farmers by occupation constituting 650(52.9%) of the total population. The rest were students, government employees, daily labourers and others.

The dominant ethnic group was Oromo constituting 839 (68.4%) of the total followed by Amharas 213 (17.3%) and the rest were Welaitas, Kembatas, Tigres and others.

Majority of the study subjects were married 616 (50.2%). The rest were single 571 (46.5) and divorced, widowed and separated constitute 41 (3.3%) of the total study subjects.

A total of 535 (43.6%) of the study subjects claimed that they can read and write, of these 328 (61.3%) were in elementary, 175 (32.7%) in secondary and 16 (3.0%) in higher education category. The rest 16(3.0%) were able to read and write but did not go to regular school. Majority of the study population were Moslems 724 (59%), followed by Orthodox Christians 461 (37.6%) table 1.

Table 1. Socio-demographic characteristics of study subjects in Shashemene woreda 1994/95.

Variable (N=1228)	Number	Percentage
Residence		
rural	821	66.9
urban	407	33.1
Sex		
Male	630	51.4
Female	598	48.6
Age		
5 - 9	123	10.0
10 - 14	202	16.4
15 - 19	179	14.6
20 - 29	254	20.7
30 - 39	211	17.2
40 - 49	124	10.1
50 - 59	59	4.8
60+	76	6.2
Religion		
Orthodox Christian	462	37.6
Moslems	724	59.0
Others	42	3.4
Ethnicity		
Oromo	839	68.3
Amhara	213	17.3
Others	176	14.4
Marital status		
Married	616	50.2
Single	571	46.5
Others	41	3.3
Educational status		
Illiterate	693	56.4
Read & write	16	1.3
Primary	328	26.7
Secondary (Jun&Hig)	175	14.3
Higher education	16	1.3
Occupation		
Farmers	361	29.4
House wives	289	23.5
Students	284	23.1
Merchants	54	4.4
Government employees	27	2.2
Daily labourers	180	14.7
Others	33	2.7

Dental caries was found to be high in the age group of 5-9 years affecting 32.5% of children in that age group, decreases in the age group of 10-14 years, and steadily increases with age to reach 88.2% in those aged 60 years and above the chi-square for linear trend was 238.88 (P-value < 0.001). (See table 2).

Table 2 The over all caries prevalence rate by age group among the study population in Shashemene woreda 1994/95.

Age group in years	Number examined	Number and percentage with dental caries
5-9	123	40 (32.5%)
10-14	202	34 (20.2%)
15-19	179	49 (27.4%)
20-29	254	152 (59.8%)
30-39	211	144 (68.2%)
40-49	124	95 (76.6%)
50-59	59	50 (84.7%)
60+	76	67 (88.2%)
TOTAL	1228	631 (51.4%)

X^2 for linear trend = 238.88 P-value < 0.001

The DMF index in those individuals with Decayed, Missing and Filled Permanent Teeth (DMF) was found to be 2.02/person and df index in children with decayed or filled teeth (df) was found to be 0.56/person.

The overall dental caries prevalence was 51.4%, 631 subjects being affected. The disease was more prevalent in rural residents than in urban residents 441 (53.7%) and 190 (46.7%) of the population being affected respectively. The difference between the urban and rural was maintained in all age groups and the magnitude of dental caries increases as age advances in both urban and rural residents (see table 3).

Table 3. Number and percentage (%) of caries positive subjects by age and area of residence in the study population Shashemene woreda 1994/95.

	Urban		Rural	
Age group in years	Number examined	Number & (%) DMF*/df**	Number examined	Number & (%) DMF*/df**
5-9	35	9 (25.7)	88	31 (35.2)
10-14	67	9 (13.4)	135	25 (18.5)
15-19	74	20 (27.0)	105	29 (27.6)
20-29	74	39 (52.7)	180	113 (62.8)
30-39	66	44 (66.7)	145	100 (68.9)
40-49	38	26 (68.4)	86	69 (80.2)
50-59	29	23 (79.3)	30	27 (90.0)
60+	24	20 (83.3)	52	47 (90.4)
TOTAL	407	190 (46.7)	821	441 (53.7)

* DMF = DECAYED, MISSING or FILLED PERMANENT TEETH

** df = decayed or filled primary teeth

The magnitude of dental caries was found to be highly associated with increment in age, the crude and adjusted OR have revealed significant association between age and dental caries.

There was a statistically significant difference between the rural and urban residents as to dental caries is concerned crude OR= 1.33(1.04,1.68). This was maintained when adjusted to other possible confounders, Adjusted OR= 4.76(2.76,8.23).

Females were more affected by dental caries than males 315(52.7%) out of the total 598 females and 316 (50.2%) out of the total 630 males respectively, the difference was statistically significant adjusted OR= 1.81(1.32,2.49).

Dental caries was found to be higher in those who are illiterate than in those who are not. The association was found to be statistically significant with crude OR= 2.17(1.73,2.74) this result was maintained when adjusted. Adjusted OR= 1.47(1.06,2.05).

The result of our study revealed that dental caries was high among Moslems. Out of the total 724 Moslems examined 397 (62.9%) were caries positive, 369 (92.9%) of these being a rural residents. A bivariate analysis revealed that there was significant difference OR= 1.39(1.10,1.76), but the adjusted odds ratio did not maintain this difference OR= 0.96(0.60,1.53).

There was no a statistically significant difference of dental caries prevalence between and among the different ethnic groups.

Out of the total study subjects 844 (68.7%) drink coffee. Most of these 594 (70.4%) were rural dwellers and 472 (79.5%) of these do not use sugar to sweeten their coffee. On the other hand only 121 (48.4%) of those urban dwellers who drink coffee do not use sugar to sweeten their coffee.

Most people in the rural area drink their coffee bare or use salt, butter or other ingredients to make their coffee tasty. Of the total coffee drinkers 441 (52.3%) were found to be caries positive. Our study revealed that there was strong association between coffee drinking and dental caries with adjusted odds ratio of 3.71(2.54,5.40) in the study population.

Our study revealed that out of the total 521 subjects (323 from urban and 198 from rural) who gave history of drinking at least one cup of tea per day, almost all that is 519(99.6%) use sugar to sweeten their tea and 322 of these were urban and 197 rural dwellers. There was no statistically significant association between tea consumption and dental caries in the population with adjusted OR= 0.74(0.51,1.06).

There were a total of 209 people (167 from urban and 42 from rural) who gave history of drinking soft drink at

There were 946 individuals who claimed that they brush their teeth at least once a week. Only 75 (7.9%) of those who claim to brush their teeth were practicing a regular daily brushing of their teeth after at least one meals. The other pertinent finding of our research was that 717 subjects (75.8%) of the 946 individuals who claim to brush their teeth had food remnants in their oral cavity at the time of examination.

There was no significant difference between those who brush their teeth and those who do not brush in the study population as far as risk of having dental caries is concerned; crude OR= 0.94(0.72,1.24). This result was maintained when adjusted OR= 0,60(0.20,1.01).

Gingivitis, calculi, plaque and the presence of food remnants in the oral cavity were found to be highly associated with dental caries. Of those 124 individuals who had gingivitis at the time of examination 86 (69.4%) had dental caries or its sequelae. There was a significant association between gingivitis and dental caries crude OR= 2.32(1.53,3.53) and adjusted OR= 1.68(1.12,2.21).

Of those who had an oral cavity food remnants at the time of examination more than half of them had dental caries, that is 520(56.3%) of the total 923. Majority of those who had dental caries in this category were rural residents 361 (69.4%). Of the total people whom food

remnants was found at the time of examination 717 were claimed to brush their teeth. The presence of food remnants in the oral cavity was found to be significantly associated with dental caries with crude OR= 2.26(1.71,2.97) and adjusted OR= 2.14(1.80,2.48).

Presence of calculi was detected in 798 individuals and of these 482 (60.4%) were found to be caries positive majority of these 322 (66.8%) were rural residents. Calculi was found to be highly associated with dental caries OR= 2.88(2.24,3.70). Adjusted odds ratio was not done on this factor.

Plaque which is one of the factors for developing dental caries was found in 535 individuals at the time of examination. Of these 335 (62.6%) were found to have dental caries or its sequelae. Majority of these were rural dwellers 229 (68.4%). Plaque was found to be greatly associated with dental caries crude being 2.35(1.77,2.85) and adjusted odds ratio of 1.39(1.09,1.69) (see tables 4, 5, and 6).

Table 4. Number and percentage of urban and rural population exposed to the determinant factors of dental caries Shashemene 1994/95.

Variable	Urban n= 407	Rural n= 821
Coffee drinkers	250(61.4)	594(72.4)
Tea drinkers	323(79.4)	198(24.1)
Soft drinkers	167(41.0)	42(5.1)
Sweet food item eaters	185(45.6)	8(1.0)
Khat chewers	82(20.1)	302(36.8)
Tooth brushers	328(80.6)	618(75.3)
Gingivitis	89(21.9)	35(4.3)
Food remnants	295(72.5)	628(75.5)
Calculi	282(69.3)	516(62.9)
Plaque	163(40.0)	372(45.3)

Table 5. Socio-demographic determinants of dental caries among the study population in Shashemene Woreda 1994/95.

Variables n = 1228	DMF/df yes n (%)	OR (95% C.I) Crude	Adjusted
Age			
5-12 (254)	61(24.0)	1.00	
13-19 (504)	214(42.5)	2.33(1.67,3.27)	2.96(1.84,4.75)
20-49 (335)	239(71.3)	7.9(5.4,11.5)	15.5(8.9,26.9)
50-59 (59)	50(84.7)	17.6(8.2,37.8)	62.6(23.9,164)
60+ (76)	67(88.2)	23.6(11.1,50.0)	82.5(31.8,214)
Sex			
Male (630)	316(50.2)	1.00	
Female(598)	315(52.7)	0.90(0.72,1.13)	1.81(1.32,2.49)
Address			
Urban(407)	190(46.7)	1.00	
Rural(821)	441(53.7)	1.33(1.04,1.68)	4.76(2.76,8.23)
Education			
Yes(535)	217(40.6)	1.00	
No(693)	414(59.7)	2.17(1.73,2.74)	1.47(1.06,2.05)
Religion			
Orthodox(462)	215(46.5)	1.00	
Moslems(724)	397(54.8)	1.39(1.10,1.76)	0.96(0.60,1.53)
Others (42)	19(45.2)	0.95(0.50,1.79)	1.53(0.69,3.40)
Ethnicity			
Oromos(839)	448(53.4)	1.00	
Amharas(213)	109(51.2)	0.91(0.68,1.24)	0.76(0.45,1.27)
Others(176)	74(42.0)	0.63(0.46,0.88)	0.61(0.36,1.04)

Table 6. Other determinant factors of dental caries among the study population in Shashemene Woreda, 1994/95.

Variables n = 1228	DMF YES	OR (95% C.I) Crude	Adjusted
Staple food			
Enjera(854)	428(50.1)	1.00	
Others(374)	203(54.3)	1.07(0.97,1.27)	0.99(0.83,1.19)
Coffee			
Yes(844)	441(52.3)	0.89(0.70,1.14)	3.71(2.54,5.40)
No (384)	190(49.5)	1.00	
Tea			
Yes(521)	267(51.2)	1.01(0.81,1.27)	0.74(0.51,1.06)
No(707)	364(51.5)	1.00	
Soft drinks			
Yes(209)	503(49.4)	1.62(1.18,2.22)	0.74(0.51,1.06)
No(1019)	128(61.2)	1.00	
Sweet food items			
Yes(193)	124(64.2)	1.87(1.34,2.61)	7.93(7.36,8.49)
No(1035)	307(29.7)		
Khat chewing			
Yes(384)	283(73.7)	3.99(3.04,5.25)	4.26(3.89,4.63)
No (844)	348(41.2)		
Tooth brushing			
Yes(946)	483(51.1)	0.94(0.72,1.24)	0.60(0.20,1.01)
No (282)	148(52.5)		
Gingivitis			
Yes(124)	86(69.4)	2.32(1.53,3.53)	1.68(1.12,2.21)
No(1104)	545(49.4)		
Food remnants (oral cavity)			
Yes(923)	520(56.3)	2.26(1.71,2.97)	2.14(1.80,2.48)
No (305)	111(36.4)		
Calculi			
Yes(798)	482(60.4)	2.88(2.24,3.70)	-
No (430)	149(34.7)		
Plaque			
Yes(535)	335(62.6)	2.35(1.77,2.85)	1.39(1.09,1.69)
No(693)	296(42.7)		

The prevalence of dental caries was also found to be increased with the frequency of Khat chewing. Those individuals who chew Khat four or more than four times per week were found to be 90.8% of them affected by dental caries the chi-square for linear trend was found to be 24.73 (P-value 0.00) see table 7 below.

Table 7. Frequency of Khat chewing and caries prevalence among the Khat chewers in Shashemene woreda 1994/95.

Frequency of Khat chewing per week	Number	No. & (%) with caries	No. & (%) caries free
One/week	114	65 (30.7%)	49 (69.3%)
Two/week	104	81 (77.9%)	23 (32.1%)
Three/week	79	58 (73.4%)	21 (36.6%)
Four and more	87	79 (90.8%)	8 (9.2%)
TOTAL	384	283 (73.7%)	101 (26.3%)

X^2 for linear trend = 24.73 P-value < 0.001

The prevalence of dental caries in children aged 5-19 years of age in our study was 24.4% which is higher than that reported from Zambian school children aged 5-17 which was 17% (29).

The higher prevalence rate in those age segments compared reveals that the prevalence of dental caries is increasing among Ethiopians in all age segments. This could probably be due to the increased consumption of refined carbohydrates (sugar) as a sweetener with coffee and tea in both urban and rural population. The increased consumption of Khat and inadequate oral hygiene practice could also be a reason for the increased prevalence of dental caries among the study population. The prevalence that we came up with might under estimate the real prevalence as we were detecting the clinical caries (caries that can be detected by physical examination only), otherwise the use of radiography and microscopic examinations might have revealed a prevalence rate of more than we reported here.

The higher prevalence rate in females was reported from Ethiopia and other countries (20,21,30). Our finding agrees with these findings, but the study done in Finland adult population showed a higher prevalence in males than in females (26). The reason for the increased prevalence could probably be due to the socio-cultural factors.

The other possible explanation could be the higher mean age in females could have influenced the dental caries prevalence. As described in this study dental caries increases as the age increases.

In the rural area of the woreda females have a culture of shaping their teeth, especially the upper incisors with sharp materials for they think that it increases their beauty. This culture could also be a contributory factor for the higher prevalence of dental caries in females.

Studies have shown that the prevalence of dental caries is higher in urban residents than in the rural residents (23,51), our finding however revealed a higher prevalence in rural dwellers than in the urban dwellers this could possibly be due to The high prevalence of Khat chewing and higher proportion of people with food remenants in the oral cavity among the rural dwellers. The other possible explanation for the higher prevalence of dental caries among the rural dwellers is that most of the rural dwellers are Moslems and the prevalence of dental caries was found to be high among Moslems and most Khat chewers were Moslems this could contribute to the higher prevalence in the rural dwellers.

Among the rural females there is a culture of shaping their teeth with sharp materials and dental caries was found to be higher among females this could

also have contributed to the higher prevalence of dental caries among the rural dwellers.

Even though the study area is in the rift valley area where there is abundant level of fluoride, fluoride in the rural water sources could be low as the people in the rural area use surface water from rivers and springs. Surface waters contain lower level of fluoride than the deep water sources. This was not included in our study.

Our finding on the association of age and dental caries was in agreement with other findings found by other investigators (14-16,19,20,30). This is due to the fact that the disease is chronic, progressive and irreversible unless it is promptly treated or there is a dramatic change in the feeding habit of the individual.

The higher prevalence rate of dental caries in those who are illiterate than in those who are not could possibly be due to the indirect effect of the education on dental caries. Those who are literate could possibly know the cause of dental caries and take appropriate measures to prevent it. They can read it from various sources of reading materials while those who are illiterate may not know the cause of dental caries and the measures that should be taken to prevent the dental caries.

Even though the prevalence of dental caries was found to be higher among Moslems than in the other

religions there was no strong association between religion and ethnicity and dental caries. This is due to the fact that it is not the religion or ethnicity that determines, what determines is the behaviour and practice of the individual even though there are some religious rituals that allow practices like Khat chewing.

The staple food among the study population was almost the same. There was a difference in the preparation only majority consume cereals. It is not surprising, therefore, not to find any association between the staple food that the population use and dental caries.

Tea and soft drinks were not associated with dental caries whereas sweet food items were found to be highly associated with dental caries. The reason for this could be due to the fact that as tea and soft drinks are fluids it less likely to stay in the oral cavity for longer period of time. But the sweet food items are likely to be retained in the oral cavity for longer period of time unless cleaned, this will give much time for the bacteria to ferment the substrate and produce acid which dissolves the teeth.

Tooth brushing was not protective according to our finding. This was also supported by the presence of food remnants in the oral cavity of those who claimed to brush their teeth. As mentioned earlier only 7.9% of all those

who claim to brush were regularly brushing their teeth every day. What we can conclude form this is that it is not the mere brushing that protects dental caries it is the regularity and technique and efficiency of brushing that could protect our teeth from dental caries.

Gingivitis, calculi, plaque which were associated with periodontal diseases were found to be associated with dental caries. This could possibly be due to the association that these determinants have with the general oral cleanliness in general. Further study to elucidate whether this is due to the direct effect of the above mentioned or indirectly by other mechanism need to be studied.

Limitations

1. The study was identifying subjects with clinical caries only (see annex c) and this may decrease the actual prevalence of dental caries in the community.
2. The study included those who are above five years of age only the under five children were not included. This may obscure the real prevalence in the community.

3. The monthly income of the family and the ownership of arable land were included in the questionnaire but only few responded and was difficult to analyze
4. The determinant factors were not exhaustive. There could be other determinant factors of dental caries which our study did not reveal.

VII. Conclusion and recommendations

Conclusion

The prevalence of dental caries was found to be very high in both urban and rural population of the woreda. The higher prevalence rate in the rural area indicates that the problem is no more confined to the urban community.

Khat which is commonly consumed in the woreda was found to be highly associated with dental caries. There is no documented evidence whether this is a direct effect of the Khat on the teeth or the behaviours associated with it that causes dental caries. The public should, therefore, be aware of the problem associated with chewing of Khat.

Tooth brushing which was thought to be preventive in previous studies was not confirmed in our study. This probabley is becouse of the inefficient tooth brushing technique and irregular tooth brushing time. As already mentioned only few brush their teeth regularly and the efficiency of the tooth brushing technique could be inefficient.

Recommendations

1. The prevalence of dental caries was found to be high in both rural and urban in the study area therefore immediate actions are required to establish and maintain dental care services in the woreda.

2. Public health education on oral hygiene and effective technique of tooth brushing should be started in schools and strengthened in the health institutions and via the community health workers to the rural population.

3. A further studies to elucidate other risk factors of dental caries and the treatment requirement of the caries affected people in order to plan for effective treatment programmes are recommended.

4. A training of health man power to deal with the oral health problem and equipping of the health institutions with trained man power and equipments should be done urgently.

REFERENCES

1. James H. Show. Causes and Control of Dental Caries. The new England journal of medicine 1987; 284: 235-237.
2. P.M.C James Epidemiology of Dental Caries. The British Scene Br. Med. Bull 1975;(231):67-9.
3. Sognnaes RF. Histologic evidence of Developmental Lesions in Teeth Originating from Poleolithic, Prehistoric, and Ancient men. Am. J. Pathol. 1956; 32: 547-77.
4. Keene HJ. History of Dental Caries in Human Population: the first million years. In: Tanzer Jm.ed. Animal models in cariology: Symposium proceedings. Washington, D.C.: IRL press 1981:23-40.
5. Glass RL, ed. The first international conference on the declining prevalence of dental caries. J. Dent. Res. 1982; 61: 1304-83.
6. Downer MC. Changing patterns of disease in the Western World. In: Guggenheim B, ed. Cariology today. Basel: S. Karger, 1984:1-12
7. Marthaler TM. Explanation for changing patterns of disease in the Western World. In: Guggenheim B, ed. Cariology today. Basel: S. Karger, 1984:13-23.

8. Russell AL. World epidemiology and oral health. In: Kreshover SJ, Mc-Clure FJ, eds. Environmental variables in oral disease. Washington, D.C.: American Association for the Advancement of Science, 1966: 21-39.

9. Barmes DE. Epidemiology of dental disease. J Clin Periodontol 1977; 4: Suppl: 80-93.

10. Sheiham A. Dental caries in underdeveloped countries. In: Guggenheim B, ed. Cariology today. Basel: S. Karger, 1984: 33-9.

11. Peter A. Leus. Wld Hlth. Org.Magazine June 1981; 10-13.

12. Levit KR, Lazenby H, Waldo DR, Davidoff LM. National health expenditure, 1984. Health Care Financ Rev 1985; 7(1):1-35.

13. Arnett RH iii, Mckusick DR, Sonnefeld ST, Cowell CS. Projection of health care spending to 1990. Health Care Financ Rev 1986; 7(3):1-36.

14. Littltone, N.W. Dental caries & periodontal diseases in Ethiopian civilians. Public health. Rep.. 1963;78:631-640.

15. Kitaw Y., Asmelash G., Bedru B. and Bekele A. Dental health conditions of students in Ethiopia : Findings from the development through co-operation campaign 1976-88 Community Dent. Oral epidemiol. 1979;7:37-41 and in Ethiop.Med.J. 1982; 20: 9-14.

16. Olsson , B. Dental caries and fluorosis in Arussi Province,Eethiopia. Community Dent. Oral Epidemiol. 1978; 6: 338-343.

17. Gordon, P.H.,C. Abate, J.H. Nunn et al. General dental data for children.J. Dent. Res. 1991; 70: 168-9.

18. Stretton-Downes, S. Infant school children, Kebele 41, Addis Ababa 1991. Unpublised data.

19. Okubagzhi G., Meaza T., Shibru G. et al. Epidemiology of dental cariesin a rural highland community, north western Ethiopia. Ethiop. Med. J. 1987; 25: 127-132.

20. Olsson, B. Dental health situation in previleged children in Addis Ababa, Ethiopia. Oral Epidemiol. 1979; 7: 37-41.

21. Stallard, R.E., A text book of preventive dentistry. W.B Saunders Company, Tokyo, 1982.

22. Oral hygiene and dental health [Editorial]. East African Medical Journal. February 1993; 70(2):65-66.

23. Aubrey Sheiham. Chenging trends in dental caries. International Journal of Epidemiology.1984; 13(2)142-7.

24. World Health Organization. 36th World Health Assembly- Press Release WHA/5, 9 May 1983, Geneva, World Health Organization, 1983.

25. Children's dental health 1983. London, office of population census and survey. Ref 5582/2, 8 Nov. 1983, 1-11.

26. World Health Organization Chronicle 1969, 23, 505.

27. Viljo Nyyssonen, Ilkka Paunio, Matti Rajala, and Miira Vehkalahti. Dental caries in the adult population in Finland. International Journal of Epidemiology 1984; 13(4): 86-90.

28. H.M. Desai. Dental caries in primary school children at Kasama. Medical Journal of Zambia 1973; 7(1): 7.

29. Peter Sims. Dental health of school children in the rural areas of Zambia. Medical Journal of Zambia 1973; 7(1): 7-10.

30. M.H. Moola, R,J. Vergotine. Prevalence of dental caries in preschool children and primary school children in Mamre. South African Medical Journal 1988; 74: 344-346.

31. Richard Pankhurst. An introduction to the medical history of Ethiopia. 1990, page 8.

32. Richard Pankhurst. The begining of modern medicine in Ethiopia. Ethiopian observer 1965; 9(2) 144-146.

33. Zein Ahmed Zein and Helmut Kloos. The ecology of health and disease in Ethiopia. Oxford Westview press 1988; 364-7.

34. Sgan Cohen HD; Steinberg D; Zusman SP; Sela MN.

Dental caries and its determinants among recent immigrants from rural Ethiopia. Community Dent Oral Epidemiology, 1992 Dec; 20 (6): 338-42.

35. World Health Organization expert committee.Recent Advances in Oral Health. WHO technical Report Series 1992;(826): 2-7.

36. World Health Organization, Technical Report Series, 1972, No.494.

37. Takeuchi M. On the epidemiological principles in dental caries attack. Bull Tokyo Dent Call 1962; 3:96-111.

38. Aubrei Sheiham. Sugars and dental decay. The Lancet, February 5, 1983; 1: 282-4.

39. Shimamura S. A cohort survey of caries attack in permanent teeth during a period of approximateley 20 Kg of annual sugar consumption per person in Japan. J. Dent Health 1974; 24: 46-52.

40. Shulerud A. Dental caries and nutrition during wartime in Norway. Oslo: Fabritius and Sonners trykkeri, 1950.

41. Sreebny LM. Sugar availability, Sugar consumption and dental caries. Commun Dent Oral Epidemiol 1982; 10: 1-7.

42. Fluoride, teeth and health, a report of the Royal College of Physicians, Pitman Medical Publishing Co. Ltd., 1976.

43. World Health Organization expert committee. Educational imperatives for oral health personnel: Change or Decay? World Health Organization Technical Report Series, Geneva 1990:(794):9-12.

44. National Health and Medical Research Council. The effectiveness of water fluoridation. Canberra, Australia Government Publishing Service, 1991.

45. Review of fluoride: Benefits and Risks. Report of the Ad Hoc subcommittee on fluoride of the committee to coordinate environmental health and related programs, Public health service. Washington,DC, Department of Health and Human Services, 1991.

46. Marthaler TM. Explanation for changing patterns of disease in the Western World. In: Cariology Today. B Guggeenheim (ed). Basel: S. Karger, 1984: 13-23.

47. British association for the study of community dentistry. Changes in dental caries levels. Report of BASCD. BASCD proceedings 1983, 5, No. 2, 17-23.

48. Sutcliffe P. Oral cleanliness and dental caries. In: The prevention of dental disease. JJ Murray(ed). Oxford, Oxford University Press, 1983, 159-74.

49. World Health Organization scientific group. Epidemiology, etiology, and prevention of periodontal diseases. WHO Technical report series 1978:(621):11-12.

50. Enwonwu C.O. Interface of nutrition and dentistry in preindustrial tropical countries. Odont Stom Trop 1978; 1: 19-42.

51. Emsile RD. A dental health survey in the Republic of Sudan. Br Dent J 1966; 120: 167-78.

52. Zein Ahmed Zein. Poly drug abuse among Ethiopian University students with particular reference to Khat (Catha edulis forsk). Am. J. Trop. Med Hyg 1988; 91: 1-5.

53. Ermias Dagne. Introductory remarks in proceeding of International symposium on Khat. Addis Ababa, 1984: 1-4.

54. World Health Organization. Oral Health Survey. Basic methods. WHO technical report series 1987:third edition, WHO Geneve, 1987.

55. F.A Ohito, G.N Opinya and J. Wang'Ombe. Dental caries, Gingivitis and dental plaque in handicapped children in Nairobi, Kenya. East African Medical Journal February 1993; 70(2): 71-4.

56. Manji, F. Gingivitis, dental fluorosis and dental caries in primary school children in Nairobi, Kenya. East African Medical Journal 1984; 61:524-7.

ANNEX:- A

QUESTIONNAIRE FORM

Serial number ☐☐☐☐ Date_____

A. SOCIO DEMOGRAPHIC INFORMATION

1. Name_____

2. Age in years_____

3. Sex 1. Male 2. Female

4. Address

1. Urban Higher_____ Kebele_____ House number_____

2. Rural Name of the village_____

5. Occupation

1. Government employee
2. Merchant
3. House wife
4. Farmer
5. Student
6. Others (Please specify)_____

6. Educational Back ground

6.1 Can you read a letter or a News paper

1. Yes 2. No (If no go to question number 7)

6.2 Last grade completed _____

7. Marital status

1. Married 4. Widowed

2. Single 5. Separated
3. Divorced

8. Religion
   1. Orthodox Christian
   2. Muslim
   3. Protestant
   4. Catholic
   5. Others (Please specify)_____

9. Ethnicity
   1. Oromo
   2. Amara
   3. Tigre
   4. Welaita
   5. Kembata
   6. Others (Please specify) _____

10. Monthly income of the family in Birr _____

11. Arable land owned by the family in hectare (Timad) _____

B. FEEDING HABIT OF THE INTERVIEWEE

12. What is the food that you usually eat?
   1. Enjera
   2. Kita
   3. Enjera and Kita
   4. Kocho or Bulla
   5. Others (Please specify) _____

13. Do you drink coffee?
   1. Yes 2. No (if no go to question No.14)

13.1.1 How many cups of coffee per day do you

drink?_____

13.1.2 What do you use to sweeten the coffee?

1. None 3. Salt
2. Sugar 4. Others (please specify)_____

14. Do you drink tea?

1. Yes 2. No (if no go to question No. 15)

14.1.1 How many cups of tea per day do you drink?_____

14.1.2 What do you use to sweeten your tea?

1. None
2. Sugar
3. Salt
4. Others (please specify) _____

15. Do you drink soft drinks?

1. Yes 2. No (if no go to question No. 16)

15.1.1 How many bottles of soft drinks per week do you drink?_____

16. Do you eat sweet food stuffs, like candy, cakes, cookies...etc?

1. Yes 2. No (if no go to question No.17)

16.1.1 Would you mention the sweet food staffs that you usually eat please?_____

17. Do you chew chat?

1. Yes 2. No (if no go to question No. 18)

17.1.1 How many days per week do you chew chat?_____

17.1.2 What of the following do you use to chew the chat?

1. None
2. Sugar
3. Tea
4. Coffee
5. Soft drink
6. Others (please specify) _____

C. KNOWLEDGE AND PRACTICE OF THE INTERVIEWEE.

18. Do you clean your teeth?

1. Yes 2. No (if no go to question No. 18.1.5)

18.1.1 How many days per week do you clean your teeth?_____

18.1.2 When do you clean your teeth?

1. Before meal
2. After meal
3. Before and after meal
4. At my convenience.
5. When I think my teeth is dirty
6. Others (please specify) _____

18.1.3 what do use to clean your teeth?

1. Mefakia (twig brush)
2. Tooth brush with tooth paste
3. Charcoal
4. Others (please specify)

18.1.4 Why do you clean your teeth?

1. To prevent decay
2. To make my teeth white
3. To feel healthy
4. Others (please specify) _____

18.1.5 If you do not clean your teeth what is the reason for not cleaning it?

1. It has no importance
2. I do not know its use
3. I have no time
4. I am old enough
5. Others (please specify) _____

19. Have ever had a tooth ache?

1. Yes 2. No (if no go to question No. 20)

19.1.1 If you had a tooth ache, where did you go for treatment?

1. To a Dentist
2. To traditional healer
3. To a pharmacy
4. Others (pleasespecify) _____

19.1.2 If you were to a dentist, what was the reason for visiting him/her?

1. For extraction
2. For teeth filling
3. For tooth cleaning
4. For replacing of broken teeth
5. Others (please specify) _____

20. What do you think is the cause of dental caries?

1. Eating sweet food staffs
2. Dirt on the teeth
3. Not cleaning the teeth
4. I don't know
5. Others (please specify) _____

Physical examination

1. Presence of food remnants in the oral cavity ?
   1. yes 2. no

2. Presence of gingivitis ?
   1. yes 2. no

3. Presence of calculi ?
   1. yes 2. no

4. Presence of plaque ?
   1. yes 2. no

5. Presence of fluorosis ?
   1. yes 2. no

6. Presence of other dental abnormalities ?
   1. yes 2. no

Dental caries assessment form (adopted from WHO oral health assessment form 1986).

Date_____ ID number ☐☐☐☐

Examiner_____

General information

Age in years ☐☐

Sex (M=1, F=2) ☐

Ethnic group ☐

Occupation ☐

Address_____

Geographic location 1. Urban ☐

2. Rural ☐

Dentition status

	STATUS	
	Permanent	Primary
0 =	Sound	A
1 =	Decayed	B
2 =	Filled & Decayed	C
3 =	Filled no decay	D
4 =	Missing due caries	E
5 =	Missing any other reason	F

	Primary	Permanent
Number of Sound teeth	_____	_____
Number of Decayed teeth	_____	_____
Number of Missing Teeth		
-due caries	_____	_____
- due to others	_____	_____
Number of Filled teeth	_____	_____
Total	_____	_____

ANNEX B:

Procedure followed to select sample population.

Population in the woreda = 229,927

Number of clusters needed = 30

Calculator derived random number = 0.904

Sampling Interval = $\frac{229,927}{30}$ = 7664

First Kebele = 7664 x 0.904 = 6928

The Kebele which include this number was chosen as the first Kebele to start with, and that Kebele was Higher 1 Kebele 02.

	NAME OF KEBELES	POPULATION	CUMULATIVE
1	HIGHER 1 KEBELE 01	4360	4360
2	HIGHER 1 KEBELE 02	6380	10740*
3	HIGHER 1 KEBELE 08	7736	18476*
4	HIGHER 1 KEBELE 09	7171	25647*
5	HIGHER 1 KEBELE 10	4681	30328*
6	HIGHER 2 KEBELE 03	4411	34739
7	HIGHER 2 KEBELE 04	4813	39552*
8	HIGHER 2 KEBELE 05	6678	46230*
9	HIGHER 2 KEBELE 06	3021	49251
10	HIGHER 2 KEBELE 07	8849	58100*
11	KUYERA LIYU KEBELE	18016	76116***
12	ALELU	4693	80809
13	ELLU	3710	84519*
14	GUBA	3381	87900
15	JELO DIDA	2168	90068
16	JELO MEDEDA	1003	91071
17	OBENSO	838	91909
18	KERARA ELALA	2547	94456*
19	AGUGETO JELO	1010	95466
20	KONI ANCHURA	2742	98208
21	EDOLA	3672	101880*
22	ABICHO	3394	105274
23	KERSA	3612	108886*
24	MEJA Ha	2034	110920

25	MEJA Le	2466	113386
26	UMBURE KETCHA	1871	115257*
27	OENI	1457	116714
28	TOGA	1653	118367
29	WERANSA	2801	121168
30	DENEBO	1840	123008*
31	MEJA BOLO	1576	124584
32	SHERIE FELEMA	1829	126413
33	BORERA	2675	129088
34	MEDO	2756	131844*
35	ABARO No.1	1251	133095
36	ALECHA KORE	2140	135235
37	BULCHANA	3698	138933*
38	HOLE BATI	2000	140933
39	KERARA KORKIE	3207	144140
40	WOTERA DENSHIE	2387	146527*
41	SHEGOLIE BOKI	3323	149850
42	KERARA BUTI	4406	154256*
43	KERARA KEFILCHA	3468	157724
44	TURTIE KETCHEMA	3674	161398*
45	ALICHO WORIERA	4141	165539
46	WOTERA SOKI	3103	168642*
47	BUTI MELKA ODDI	3787	172429
48	WEYO FELICHA	2959	175388
49	AWASHO	3798	179186*
50	AGOMSA DINKU	4133	183319*

51	SOLI	4445	187764
52	JEGISO KORKI	3666	191430*
53	KUBI No.1	715	192145
54	KUBI No.2	682	192827
55	CHELULIE No.1	1135	193962
56	CHELULIE No.2	649	194611
57	FUJI No.2	801	195412
58	FUJI KELEHO	1560	196972
59	FUGI No.1	1397	198369
60	SELMI GOLIE	1255	199624*
61	SINBO	801	200425
62	JENGELA	830	201255
63	WONDERA	1097	202352
64	HURSO	973	203325
65	FUJI MITI	883	204208
66	KORIE No.1	2153	206361*
67	KORIE No.2	2247	208608
68	ROGIECHA	2929	211537
69	DUBA CHEBI	1541	213078
70	UTIE BURA	785	213863*
71	UTIE DEDEGNATA	1141	215004
72	TATISA KOMBOLCHA	647	215651
73	CHECHIE SHOSHERA	735	216386
74	BOREMA SHOSHERA	1515	217901
75	TATISA	1150	219051
76	DEDISA	722	219773

77	TIKUR WEHA	1258	221031
78	DELETI BORGETA	731	221762*
79	DELETI CHELELEKA	751	222513
80	KORIE	740	223253
81	ABARO No.2	990	224243
82	GUNDIE	740	224983
83	KERSO	550	225533
84	HAMULU	1201	226734
85	CHELBISA	703	227437
86	DEGISA	808	228245
87	ARDANO BOKI	869	229114
88	SHOFA	813	229927*

* Selected Kebeles

ANNEX:- C

operational definitions

0 (A)- Sound tooth. A tooth is recorded as sound if it shows no evidence of treated or untreated clinical caries.

1 (B)- Decayed tooth. Caries is recorded as present when a lesion in a pit or fissure, or on a smooth tooth surface, has a detectable softened floor, undermined enamel or softened wall. A tooth with a temporary filling should also be included in this category. Where any doubt exists, caries should not be recorded as present.

2 (C)- Filled tooth with decay. A tooth is scored as filled with decay when it contains one or more permanent restorations and one or more areas that are decayed.

3 (D)- Filled tooth with no decay. Teeth are considered filled without decay when one or more permanent restorations are present and there is no secondary (recurrent) caries or other area of the tooth with primary caries.

4 (E)- Tooth missing due to caries. This score is used for permanent teeth that have been extracted because of caries.

5 - Permanent tooth missing for any other reason. This code is used for permanent teeth judged to be absent congenitally, or extracted for orthodontic reasons or because of trauma, etc.

Clinical caries:- clinical caries is defined as a cavity diagnosed by mouth mirror and probe examination.

Past caries:- past caries is manifested either by a filling or by loss of the tooth due to dental caries.

The DMF index is the average number of permanent teeth per person which are decayed (D), missing because of caries (M), or filled (F). It is a quantitative expression of the life-time caries experience of the permanent teeth. In the calculation of the DMF index, the numerator is the total number of DMF teeth and the denominator is the total number of persons examined.

The df index is a quantitative expression of primary teeth which are decayed (d) or filled (f). In calculation of the index the numerator is the total number of primary teeth which have clinical caries or which have been filled. The denominator is the total number of persons examined.

ANNEX:- D

3. Sample size

The required sample size was calculated based on the following assumptions and degree of confidence.

SAMPLE SIZE CALCULATION

$$n= \frac{(Z_B + Z_\alpha)^2 \quad [\ (P_1 \text{ X } 100-P_1) + (P_2 \text{ X } 100-P_2)\ ]}{(P_1 - P_2)^2}$$

n= sample size

Z_B= power 90%

Z_α= 0.05

P_1= Assumed Prevalence in urban area

P_2= Assumed Prevalence in rural area

$$n= \frac{(1.28 + 1.96)^2\ [(50x100-50)+(40x100-40)]}{(50-40)^2}$$

= 515/group

Assuming that 80% will respond the calculated sample size is multiplied by 1.25.

515 x 1.25 = 650 subjects

DECLARATION

I, the undersigned, declare that this thesis is my original work, has not been presented for a degree in any other university and that all resources of material used for this thesis have been fully acknowledged.

Name: Ghirmay Andemichael, MD

Signature: 

Place: Addis Ababa, Ethiopia

Date of submission: May 1995