

Hygiene, eating habits and oral health among children in three Nepalese Public High Schools

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– Essay –

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Abstract – Currently, many developing countries are experiencing rising prevalences of caries associated with changes in lifestyle and living conditions. *Objectives:* To describe the hygiene, eating habits, and oral health status of Nepalese children. *Materials and Methods:* A stratified sample of 231 children 5–7, 11–13, and 15–16 years of age (53% boys, 47% girls) who attended public high schools in the rural area of the Lalitpur District, Nepal was selected. The study was a field study combining a clinical examination (plaque, gingivitis, calculus, and caries) and a questionnaire. The questions concerned sanitary conditions, health support, personal hygiene, tooth cleaning, and eating habits. *Results:* During the school day, half of the children ate nothing at all. General personal hygiene was associated with tooth-cleaning frequency. Four out of five children in the entire sample cleaned their teeth once/day or more, using their own toothbrush. The use of fluoride toothpaste was rare. More frequent tooth cleaning and lower plaque indices were seen among girls and older children. More plaque was found on the occlusal surfaces of erupting permanent molars than on fully occluded permanent molars. Most children had a low prevalence of manifest caries in the primary and the permanent dentitions. However, every fifth 5–7-yr-old had manifest caries in three or more primary teeth. The occlusal surfaces of molars accounted for almost all registered caries in both dentitions. *Conclusion:* Although the prevalence of manifest caries was low, the low level of preventive activities may cause an increase in the prevalence of caries, as in other developing countries. The presumed risk scenario needs to be met by comprehensive and systematic health promotion and preventive measures.

Key words Nepal, eating habits, personal hygiene, tooth cleaning frequency, eruption stage, dental plaque, occlusal caries

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Sammanfattning: I många utvecklingsländer sker förändringar av livsstil och levnadsförhållanden med samtidig ökad förekomst av karies. *Mål:* Att beskriva hygien, matvanor och munhälsa hos nepalesiska barn. *Material och Metod:* Ett stratifierat urval av 231 barn, som i åldrarna 5-7, 11-13 och 15-16 år (53% pojkar, 47% flickor), elever i statliga grundskolor på landsbygden, Lalitpur distriktet Nepal, användes. Studien utformades som en fältstudie med klinisk undersökning (plack, gingivit, tandsten och karies) kombinerad med en enkätstudie. Frågorna rörde sanitära förhållanden, hälsostöd från hemmet, personlig hygien, tandrengörings- och matvanor. *Resultat:* Under skoldagen åt hälften av barnen ingenting alls. Allmän personlig hygien var associerad med tandrengörings frekvens. Av alla barn, som användande sin egen tandborste, borstade fyra av fem, en gång om dagen eller mer. Äldre barn och flickor rengjorde tänderna oftare och hade ett lägre plackindex. Mer plack fanns på erupterande molarers occlusalytor jämfört med molarer i full ocklusion. De flesta barnen hade en låg frekvens manifest karies i primära och permanenta bettet. Dock hade en femtedel av 5-7 åringarna tre eller fler manifesta kariesangrepp i primära bettet. Ocklusal karies på molarerna utgjorde nästan all registrerad karies i båda dentitionerna. *Slutsats:* Låg frekvens av manifest karies, men en låg grad av förebyggande aktiviteter, kan medföra en ökad kariesfrekvens liknande den i andra utvecklingsländer. Den förmodande risken måste bemötas med behovsriktade och systematiska hälsobefrämjande och preventiva åtgärder.

Nyckelord

Nepal, matvanor, personlig hygien, tandrengörings frekvens, eruptionsstadier, dentalt plack, ocklusal karies

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Abbreviations

CDHP	Community Development Health Program
CMA	Community Medical Auxiliary
HA	Health Assistant
High school	A school consisting of classes from grades one to ten
HMG	His Majesty's Government
HP	Health Post - usually a government clinic in a village, which provides basic preventive and curative health services. Service is provided by a variety of auxiliary health staff, e.g. CMAs and HAs
INGOs	International Non-Governmental Organizations
NGOs	Non-Governmental Organizations
PHC	Primary Health Care
Primary school	A school consisting of classes from grade one to three or one to five
UMN	United Mission to Nepal

Definition of terms

The different teeth and their numbers

The mouth is divided into four quadrants, with five teeth per quadrant in the primary and eight teeth in the permanent dentition.

Incisors – the four front teeth, known as the biting edge of the anterior teeth.

Cuspids – the teeth next to the incisors; one tooth per quadrant primarily used in tearing/ripping food.

Premolars (only in the permanent dentition) – the teeth in between the cuspids and molars, two teeth per quadrant, used for chewing.

Molars – the posterior teeth, used for chewing; two molars per quadrant in primary and three in permanent dentition.

The **20 primary teeth** are numbered in the following manner:

upper right; **55, 54, 53, 52, 51 – 61, 62, 63, 64, 65**; upper left

lower right; **85, 84, 83, 82, 81 – 71, 72, 73, 74, 75**; lower left

The **32 permanent teeth** are numbered in the following manner:

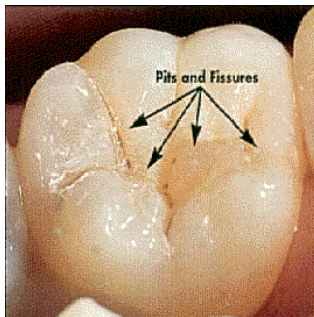
upper right; **18, 17, 16, 15, 14, 13, 12, 11 – 21, 22, 23, 24, 25, 26, 27, 28**; upper left

lower right; **48, 47, 46, 45, 44, 43, 42, 41 – 31, 32, 33, 34, 35, 36, 37, 38**; lower left

Stage of eruption

The stage, when the small tooth bud breaks through the gum until the whole crown of the tooth has completely erupted and is in occlusal contact with the molar in the opposite jaw. For a permanent first molar it takes about one year and for a second permanent molar about one and half years. The first permanent molars erupt behind the primary molars at about the age of 6 years. The second permanent molars erupt behind the first permanent molars at about the age of 12 years.

Surfaces of the tooth



Buccal – the surface of the tooth facing the cheek.

Occlusal – The biting surface of a molar (and a premolar). The pits and fissures are retention places for plaque and at risk for developing caries, particularly on molars.

Lingual – the surface of the tooth facing the tongue.

Tooth diseases and the cause

Caries (decay): an oral infection disease of the teeth in which organic acid metabolites produced by the plaque and the diet lead to demineralization and destruction of tooth structure.

Calculus: mineralized plaque, which will be a retention place for plaque and new gingivitis.

Gingivitis: inflammation of the gingiva (gum) is reversible, which means that the gingiva heals after removal of plaque by toothbrushing.

Periodontitis: loss of the surrounding bone, which is irreversible, may develop as a result of chronic gingivitis, meaning no proper removal of plaque and calculus for years.

Plaque is the bacterial-containing deposit that adheres to the surfaces of teeth.

PREAMBLE

From my graduation in 1972 up to 1984, I worked as a general dental practitioner at the Public Dental Service, Älvsborg County, Sweden. My work involved performing different clinical procedures on patients in all age groups. Even so, the main emphasis was children and preventive dentistry. For a long time I have been interested in working in a developing country. After a few months of training in living and working in a foreign country, I went to Nepal. The first five months in Nepal involved learning the Nepalese language, learning about the Nepalese culture, and living for three weeks in a village in a mud house with no electricity but with a loving, chatty Nepalese family.

I worked as a dentist in Nepal for more than 12 years, between 1984-99. Half of the working-hours I spent in a modern dental clinic and the other half with teaching and the development of community oral health. My place of work was Patan Hospital, technically a governmental hospital, but financed and operated run by the UMN (United Mission to Nepal), an international Christian development organization. UMN operated hospitals, community health programs, schools, and industrial and village development programs all over Nepal. These programs often begin as small projects, develop into mature programs, and are often later taken over by HMG or another Nepalese NGO counterpart. UMN had several hospitals with associated development and community health programs. Patan Hospital was one of them. It was situated in Patan, a twin city to the capital Kathmandu. Patan is in the neighboring Lalitpur District. While it was quite accessible for those living in the city of Patan, it was less accessible for those who lived in the rural, mountainous, southern part of the district. It took a journey of two days by vehicle and foot from the center to reach most remote villages.

In 1986, in the rural part of Lalitpur, there were five well working HPs (Health Posts) in Lalitpur. That year we dentists at Patan Hospital; one Nepalese and three expatriates (there were about 30 dentists in the whole country), discussed that instead of pulling teeth ourselves on patients, who often come from remote areas, health workers should be taught to do that. The outcome of this discussion was the establishment of the Lalitpur community oral health program in 1987.

In order to improve the program, I realized needed further training. On a furlough I went to courses in public health. An interesting course was Community Dentistry, and one of the tutors was associate professor Arne Halling. He became my supervisor. We talked about how to find simple methods to promote oral health among children in a country with limited resources. Therefore for my master thesis I choose to study hygiene, eating habits and oral health. Colleges had done fluoride mapping all over Nepal and successfully lobbied to toothpaste manufacturers to make fluoride toothpaste. My study could contribute to direct an intensive toothbrushing program, at a time when the permanent molars are erupting as well as to support an integrated teaching approach regarding general hygiene and toothbrushing. Also to be stressed was a locally made nutritious snack/meal at lunchtime for schoolchildren.



INTRODUCTION

Nepal, which was a closed country up to the early 1950s, has a geographical area of one third the size of Sweden. Nepal is divided into four regions: the Kathmandu Valley, east Nepal, central Nepal, and the west and far west Nepal (1). In 2004 the population was estimated to be approximately 24 millions (2). About half the population is under the age of 20 and a redoubling of the population is estimated to occur in the next 25 years (2). For the Nepalese, life expectancy at birth is 59 years with a high infant and maternity mortality (2). The infrastructure, service and economics in the country have improved during the last decade, but still many Nepalese live under the poverty line and there is widespread illiteracy. Most of the population subsists on small farms with limited access to roads, health and educational systems (3). The inhabitants of Nepal can be classified culturally into three general groups: Hindu castes (Brahmin/Chettri 53.2%), ethnic groups of the hills (for example Newar 3.4% and Tamang 4.7%) and Northern border people of the population (1). Often a group/cast live concentrated in a particular part of the country having their own language, culture and traditions (1).

Lalitpur, one of Nepal's 75 districts, consisting of both urban and rural areas, is situated south of the capital Kathmandu. Most of the inhabitants in the district are farmers and belong to three castes/ethnic groups: 1) the traditional Hindu castes (Brahmin/Chettri), who believe that body and oral cleanliness is a necessity before early morning worship (1,4). 2) Newars, who practice both Hinduism and Buddhism and who are characterized by having the most traditional and nutritious diet. 3) Tamangs, who practice Buddhism and who work as day laborers. In the rural area of the Lalitpur District there are 10 public high schools, one private high school and several dozen of public and private primary schools. Hygiene is a priority to Nepalese and traditionally it is a general custom to bathe regularly, as well as to clean hands prior to the rice meal. However, it is still rare to have water supplies close to the homes; forcing people to spend hours collecting water for their daily

needs. In the rural part of the Lalitpur District, most people have enough water and even access to a tap in their own yard or nearby. The outdoor tap is a place for bathing, hair washing, washing of clothes and collecting water for the kitchen. A special brass jug with a pipe is used for cleaning the hands as well as for drinking clean water. Generally, the drinking water in Nepal (5) has a low fluoride content ($p < 0.1 \text{ ppm F}$), resulting in a low protecting and preventive effect against caries. Traditionally, the Nepalese, after waking up in the morning, clean their teeth with their fingers or with a brush with or without ash, charcoal or toothpaste (4). Over the last ten years, inexpensive, good quality, locally produced toothbrushes for adults have become available. However, toothbrushes for children are hard to find, except in the fancy stores of the capital. Up until 2002, the supply of fluoride toothpaste was almost non-existent (6).

Traditionally, rice, lentils and a vegetable curry is the basic food for most Nepalese, including the population in the rural area of the Lalitpur District. In Lalitpur in general, most children, as well as the rest of the family, begin the day with a cup of sweet milk tea. Every day in the late morning and evening, a big plate of rice or corn, vegetables and often lentils or beans are served. Water is the drink. The food/tea is prepared over an open fire, a time-consuming process. However, some people eat snacks in the afternoon, like beaten rice, corn, white bread or biscuits with or without a cup of sweet milk tea. School children often get something to eat after coming home from school in the late afternoon. The supply of modern snacks, such as biscuits, white bread and sweets, in shops/tea shops in the villages in Lalitpur has recently increased remarkably, while "bean salads", "somasas" (potatoes and pea bread) "chapattis" (traditional bread) and other traditional nutritious snacks are selected about the same or slightly less often. Presumably, these changes in supply have a negative impact on both general and oral health in children and adolescents (7).

In a developing country with many competing demands in the society, oral health generally has a low political priority (8). In the beginning of the twenty-first century there were more than 200 dentists in Nepal (one dentist per 120,000 inhabitants), of which less than 50 worked outside the capital Kathmandu. Most dentists are educated abroad, but dentists are now starting to graduate from the college of dentistry in the city Dharan in eastern Nepal. The dentists either work at hospitals and/or in their private clinics and the services are generally oriented towards adult emergency and curative dentistry. Also included in the dental care service providers are approximately 400 health workers, who are stationed at the health posts and smaller hospitals, mainly doing emergency dental care, e.g. extracting teeth.

There is very little organized dental care for children. However, non-governmental organizations (NGOs), such as Oral Health Care Nepal, as well as some government health posts (HPs) are promoting oral health in schools in some areas. A few minor dental examinations made in Nepal 1980 and onward show a low, but increasing prevalence of caries in children and adolescents, and periodontal problems in many adults (9-19). This is a trend that also has been observed in several other developing countries in Southeast Asia (20-22).

Dental care should be part of the health care system but it is affected by economy, social and welfare systems in the country. The dental care need is dependent on the prevalence of the underlining main oral diseases (caries and periodontal diseases), its accessibility and the potential for prevention and treatment of the diseases. What is crucial in this context is the understanding of the natural history of the diseases and what can be done to prevent them. Recognition in the early stages of the conditions is of special importance in order to interfere and stop the progress of the disease. Dentists have traditionally worked symptomatically by relieving pain (tooth extraction, endodontic treatment and conservative treatment, e.g. filling therapy) with limited and uncertain effects on oral health. Oral health and people's behavior are largely determined by the socio-economic milieu and the conditions in which they live (23).

An increase of caries prevalence in children and adolescents, mostly in the primary dentition (20-22), has been attributed to increased sugar consumption (24). There is a dose-response between the quantity of sugar consumed and the severity of caries (25), as well as the frequency of consumption of sugar and caries (26). To treat caries with drilling and filling is beyond the financial capabilities of low income nations like Nepal (27). Furthermore, it has been shown in rich industrial countries that this practice does not contribute substantially to oral health (28). Therefore, emphasis has to be put on cost-effective oral health promotion, which has to meet the western life style and food habits coming into Nepal (29).

Three decades ago, primary health care (PHC) was developed, but the implementation of oral health was not included (30). The Primary Health Care in Nepal is organized by His Majesty's Government (HMG) and it is rare to have oral health integrated in the HPs or rural hospitals. When the oral health is integrated, the care is predominately based on curative measures, like pulling out teeth by the staff (31,32) rather than on oral health promotion and prevention, such as screening and oral hygiene advice. In 1987 a community-based oral health program (31) was initiated in the Lalitpur District, where the emergency oral health services substantially work with the integrated HPs but under varied conditions related to quantity and quality of preventive oral health (7). The Health Assistants (HA) and Community Medical Auxiliaries (CMA) were found to be capable of performing dental examination, extraction therapy and oral health teaching at HPs and schools and the program was well received by the villagers.

However, recently an integrated approach oral health/primary health has been approved in the National Oral Health Plan (2004) by the Health Authorities in Kathmandu. Basic epidemiological research was mentioned as an important tool and basis for future community interventions. The intention is to carry out studies on oral health related to environmental and sociological factors, as well as evaluating implementations of health promoting effects in the local community, schools and local HPs.

Sanitary conditions and body hygiene habits in general have been reported to be strongly associated with toothbrushing habits (33). Toothbrushing habits are also linked with the

pattern and prevalence of plaque and the progress of caries and periodontal diseases (34). However, the habit of brushing their teeth every day is not self-evident for children in developing countries (8,35,36). Diet is another important determinant of caries risk and at a population level, explaining the differences between the virtual absence of caries in certain developing populations versus the pandemic disease observed until recently in developing countries taking over western food habits (37). Studies have shown that the risk of having caries is at its peak when the teeth are erupting. Molars and their occlusal surfaces are at risk, because of an increased accumulation of plaque (38-41). As no data was found in the scientific literature on the natural history of occlusal caries for the first permanent molars in a group of children with low caries prevalence (42), I found it of special interest to study oral health in a cultural, demographic and general hygiene perspective.

AIM

The overarching aim was to describe hygiene and eating habits and oral health in Nepalese children.

Questions of special concern

- Are sanitary conditions and hygiene habits related to gender and age?
- Is there a correlation between personal hygiene and oral hygiene?
- Are eating habits related to gender and age?
- Is the status of plaque, gingivitis and calculus related to gender and age?
- Is the prevalence of plaque associated with stages of eruption on the occlusal surfaces on first and second permanent molars?
- Is the primary dentition more affected by caries than the permanent dentition?
- Are certain types of teeth and tooth surfaces more affected by caries than others?

MATERIALS AND METHODS

Study population

A questionnaire and clinical study took place from May to June in 1999 in two public high schools in the valley (School A, B) and one high school in the mid-hill area (School C) of the rural Lalitpur district. An inclusion criteria was that the high schools had to be situated less than one hour's walk from a road or/and a HP, which meant out of 11 schools, four was eligible. Finally three out of these schools were willing to let their pupils participate in

the present study. All children aged 5-7, 11-13 and 15-16 years of age were selected by their teachers according to their class lists at the time of the examination. The children included in the study were:

- 5-7-yr-olds with erupting first permanent molars (children with all first permanent molars in full occlusion were excluded).
- 6-7-yr-olds with no erupting first permanent molars and
- 11-13-yr-olds with erupting permanent second molars (no eligible children had all their second molars in full occlusion).

The age group 15-16-yr-olds were selected as a reference group if all their teeth (except wisdom teeth) were erupted and in full occlusion. In the three high schools, all children fulfilled the requirements and were included in the study. For the 15-16 yr-olds in School C the samplings were made in two steps: 1) stratified sampling 2) random sampling. In total 232 children participated in the study. However one questionnaire was lost, making 231 children available for the analyses (Table 1). The distribution of castes were Brahmins/Chetris (n=114), Newars (n=76), Tamangs (n=25) and others (n=16).



Table 1. The number of participating children related to age group and grade.

	5-7-yr-olds grade 1	11-13-yr-olds grade 2-5	15-16-yr-olds grade 6-9	Total
Boys	41	41	41	123
Girls	25	39	44	108
Total	66	80	85	231

Clinical examination

The clinical examination was carried out by two trained dentists, one Nepalese dentist (RS) and one expatriate dentist (KW), who understood and spoke Nepalese. Teachers and CMAs worked as facilitators for the project - being organizers, flashlight-holders, recorders etc. Training and calibration of the examiners and recorders were done prior to the start of the study. The examiners were instructed to follow a survey form, letting the procedures be conducted in a systematic consecutive order. The form was pretested and evaluated by the participating examiners before the clinical examination on school children of corresponding ages, but who were not involved in the study. The children were examined lying down on a bench in a class room, in daylight (plus a flash light), close to the window, based on the setting recommended by WHO for field studies (43). Stage of eruption was assessed on permanent molars. The status of each tooth related to plaque, gingivitis, calculus and caries were recorded.

Status of molars and stage of eruption

The tooth eruption was registered by means of a dental mirror and assessed. Every single molar got one score (Table 2)(44). In borderline cases regarding permanent molars and score 6 and 7, the children also had to bite with a piece of paper at the particular teeth, in order to find out if the teeth were in occlusion or not.

Table 2. Dental status and stage of eruption.
Modified classification (Kuzmina, Ekstrand, 1992, 44).

Score	
	Primary molar
1	Erupted
2	Extracted due to caries
	Permanent molar
3	Not erupted
4	Less than half of occlusal surface visible
5	More than half of the occlusal surface visible
6	The whole occlusal surface but not in full occlusion
7	In full occlusion
8	Extracted due to caries

Plaque, gingival and calculus status

Plaque status

The presence of visible plaque was recorded by gentle probing on the tooth surface by a Community Periodontal Index (CPI) dental probe. (Table 3)(43,45)

For 5-7-yr-olds (with/without erupting first molars) on: (44)

- 16, 12 or 55, 52; buccal surfaces
- 16, 36 or 55, 75; occlusal surfaces
- 31, 36 or 75; lingual surfaces

Mean plaque score index including six surfaces was calculated for each child.

For the 11-13-yr-olds and 15-16-yr-olds on the: (44)

- 17, 16, 12; buccal surfaces
- 17, 16, 36, 37; occlusal surfaces
- 31, 36, 37; lingual surfaces

Mean plaque score index was calculated for each child; 7-10 surfaces were calculated for 11-13-yr-olds, depending on stage of eruption of their second molars, and 10 surfaces for 15-16 yr-olds.

Plaque index occlusal on 17, 16, 36 and 37 were calculated related to the stage of eruption; score 4-7. (Table 2)(44)

Gingival status

The occurrence of gingivitis was assessed when bleeding occurred following gentle probing on: (Table 3)(44)

- Primary dentition: 55, 52; buccal marginal gingiva
71, 75; lingual marginal gingiva
- Permanent dentition: 16, 12; buccal marginal gingiva
31, 36; lingual marginal gingiva

Calculus

The occurrence of calculus was measured by visual inspection on: (Table 3)

- Primary dentition: 55, 52; buccal surfaces
71, 75; lingual surfaces
- Permanent dentition: 16, 12; buccal surfaces
31, 36; lingual surfaces

Table 3. Modified classification of plaque and gingival status (Kuzmina, Ekstrand 1992).
Calculus status.

Plaque:	0 = No visible plaque;	1 = Visible plaque;	2 = Thick plaque
Gingival:	0 = Sound;	1 = Light bleeding;	2 = Heavy bleeding
Calculus:	0 = No calculus;	1 = Visible calculus;	2 = Heavy amount of calculus

Classification of Caries

In order to enable optimal visible conditions of the tooth surfaces prior to the caries registration, all participating children had their teeth colored with a red erythrosine solution® facilitating a careful cleaning. Before that the children were given the opportunity to see their "plaque status" by means of mirrors in their own and each other's mouths. The Nepalese dentist and a CMA taught the children in groups (about 10 in each) about toothbrushing in general and about how to brush on erupting permanent molars in particular (39-41). Before recording, by gentle probing by a CBI probe, the children's mouths were drained with gauze fabric and the presence of caries was scored as shown in table 4. This modified classification index (44,45) means, compared to the WHO criteria (43); sound, opacity/brownish discoloration/no cavitation and initial caries are sound; manifest caries and pulp involvement are decayed; extracted is missed and filled is filled. According to the WHO criteria, the caries prevalence is measured by DMFT, DMFS, dmft, dmfs - decayed, missed, filled teeth or surfaces; refers to permanent dentition when written in upper-case letters; and to primary dentition when written in lower-case letters.

Table 4. Modified Classification Index of Caries (Kuzmina, Ekstrand 1992 and Alinder Lundman, Bolin 1996).

Score	
0	Sound
1	Opacity/brownish discoloration/no cavitation
2	Initial caries, the surface of the enamel has lost its normal translucence and exhibits a white and chalky appearance
3	Manifest caries
4	Pulp involvement
5	Extracted teeth due to caries
6	Filled surface

Questionnaire

The questionnaire was created with fixed questions and answers, specially designed for this study. The questionnaire consisted of a total of 26 questions: regarding the children's social environment, access to water, latrine, their own toothbrush, their mothers' education and tooth-brushing habits, the family's support of the child's oral health and questions about the children's personal hygiene and eating habits. The questionnaire was tested and evaluated on about 15 children belonging to corresponding age groups in a school, which was not involved in the study. Based on minor comments from this test the questionnaire was changed and used in the study.

In the study either prior to or after the clinical examination, the child answered the questionnaire assisted by a local CMA or teacher. The CMAs and teachers had in advance received detailed instructions from the two dentists how to conduct the questioning. The questioner read each question and the different predetermined answers to the child and recorded the reply on the form.

ETHICS

The study was included in a comprehensive integrated health project in Nepal - Community Development and Health Project (CDHP), which provides a part of the HMG health service in the Lalitpur District. Earlier, the head of the HMG health service in Lalitpur had given permission for an integrated project on dental health and dental care. In the Nepalese culture, relationships and having time for talks are important. Prior to the initiation of the study, the schools were therefore visited by the CDHP health inspector, two CMAs from the closest health post and the two dentists (RS, KW) who later conducted the study. They informed the principals and teachers of the schools about the study and asked if they were willing to let the children participate. All the participants in the study were Nepalese, except for one dentist (KW) who speaks Nepalese and knows the culture well. This meant that the teachers could feel free to express their opinions directly or indirectly. Four schools were eligible; three of these were willing to let their pupils participate in the present study. Those schools that showed an interest in the study were visited by the two dentists (RS, KW) a second time. At the first occasion, the manager of the school was also informed that the study was planned to be followed by a three-year tooth-brushing program in some of the schools and probably in other schools later on. To follow up with an intervention program is important in Nepal, particularly close to the capital Kathmandu, since it is quite common that aid organizations conduct surveys without following them up. No studies had been made in these schools before. The teachers and CMA live in the village close to each school and were in contact with the children's parents and could inform them.

All the children who fulfilled the criteria and had the opportunity to be involved in the study wanted to participate. The two dentists (RS, KW) performed the clinical examination using a survey form in English. The questionnaire was in Nepalese. A local teacher or CMA asked about the habits and so on of each child in the same classroom and on the same occasion as when the clinical examination was performed. The name of the child was written down, but each child was also assigned an ID number. If the child needed emergency oral health care, he or she was referred to the nearest HP. After data collection, the results were coded by ID numbers only. The results were presented at the group level, i.e. not individually.

When the data collection took place, I was not aware of the fact that there was a newly established ethics committee in Nepal. This ethics committee mainly aims at research in independent projects. My research project does not apply to this, since it is a project within the CDHP, its co-operation with the head of the Lalitpur HMG health service and its various village committees. The performance of the study went smoothly, the children happily participated, and the teachers were helpful and co-operative. The study did not result in any disturbing elements or complications either during the study or after the study was completed.

Statistics

Descriptive analysis was used for prevalence figures. The Mann-Whitney test was used when testing hygiene habits, eating habits, plaque, gingivitis and calculus related to gender and age. If no gender difference was found, the children were pooled and tested for age. If gender differences were found, the age differences were tested for each sex by using the Mann-Whitney or Kruskal-Wallis Test. $P < 0.05$ was considered as statistically significant. When calculating the distribution of plaque, gingivitis and calculus the Epi-Info, version 2002 was used. The other statistical analyses were conducted using SPSS standard package version 10.0 for Windows.

RESULTS

Hygiene

Tap and latrine

The majority of the children (58%) had a water tap in their own yard, 39% within 5 minutes' walk and 3% of the children 15-30 minutes' away. 73% had a latrine in their yard. Differences between gender or age groups regarding sanitary conditions (availability of tap and latrine) were nonsignificant.

Oral hygiene

82% (n=186) of the children had their own toothbrushes - older children had more frequently than younger ones. (Figure 1)

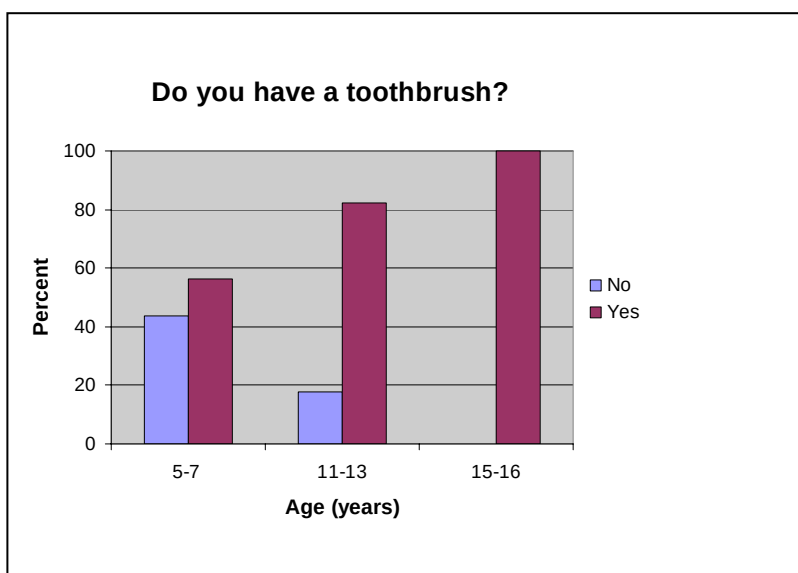


Figure 1. Distribution of children having their own toothbrush, 5-7 years (n=65), 11-13 years (n=79), 15-16 years (n=85).

Bathing

Half (47%) of all children had a bath two or more times a week and the rest once a week or less (5-7 years, 18%; 11-13 years, 46%; 15-16 years, 72%).

Washing hair and hands

Two-thirds (63%) of all children washed their hair twice a week or more and the rest once a week or less. 86% washed their hands before the rice meals/principal meals.

Toilet habits

73% of the children always passed stool in an outdoor latrine (5-7 years, 56%; 11-13 years, 67%; 15-16 years, 88%).

There were significant statistical differences between age groups regarding the frequency of bathing and washing hair, washing the hands before a rice meal and passing stool in a latrine. Older children more frequently had a bath, washed their hair, washed their hands and passed stool in a latrine.

Tooth cleaning methods

Of all children (n=230), 9% used a toothbrush with fluoride toothpaste, 66% with non-fluoride toothpaste, 7% only used a toothbrush, 7% used hand and ash, and < 1% sometimes used hand and ash and sometimes a toothbrush and paste and 10% did not clean their teeth at all.

Tooth cleaning frequency

Of all children (n=230) 22% cleaned their teeth twice a day, 59% once a day, 9% less than once a day, and 10% not at all. The corresponding figures for those who cleaned their teeth and used a toothbrush were 96%, 93%, and 75% respectively. Tooth cleaning frequency related to age is depicted in figure 2.

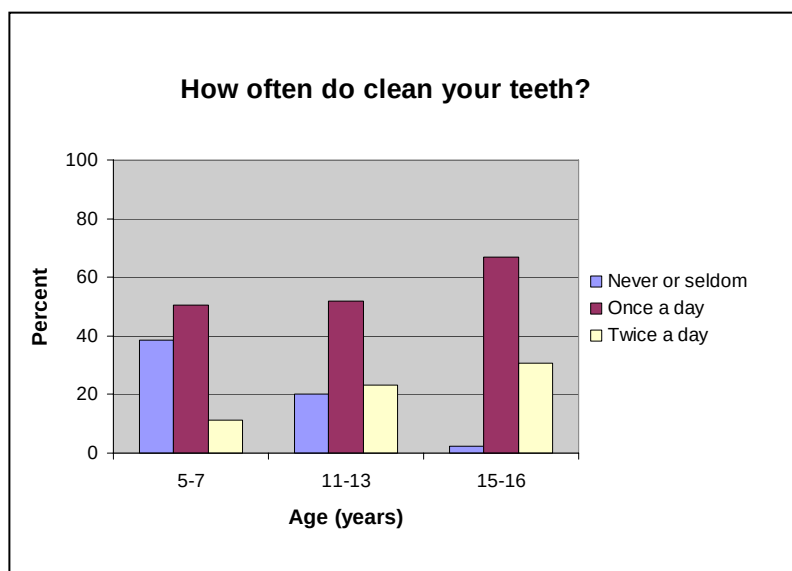


Figure 2. Tooth cleaning frequency of the children in age groups 5-7 years (n=66), 11-13 years (n=80), 15-16 years (n=84).



Among all girls (n=108) 28% cleaned their teeth twice a day, 58% once a day, and 14% never or seldom, compared with 17%, 59% and 24% respectively for boys (n=122), a significant difference. Older children cleaned their teeth more often than younger children. For toothbrushing the result showed similar tendency. Girls and older children brush their teeth more often than boys and younger ones.

Tooth cleaning - time of the day

For those children, who cleaned their teeth; 63% of them did so just after waking up, 35% after morning tea or morning meal and 20% in the evening. Among those cleaning once per day; 4% of the children cleaned in the evening, compared to 63 % of the children, who cleaned twice per day.

Tooth cleaning support/assistance for young children

Of the 41 children aged 5-7 years, who cleaned their teeth, 71% did it by themselves and the remaining got help from their mother (n=9); father (n=1); brother (n=1); and from mother/father/brother (n=1).

If and where have you learnt to clean your teeth?

Twenty-eight children answered that they had not learned to clean their teeth. Of the remaining 203 children, 45% had learnt it by themselves, 34% from home, 9% from school by health workers, 8% from school by teacher, and 4% from others e.g. radio, HP or friends.

Mothers' education and tooth cleaning habits

Twenty percent of the children's mothers had gone to school, most of them up to class three. 74% of the mothers used a brush and paste when cleaning their teeth; less than 1% used only a brush; 2% sometimes used hand and ash and sometimes brush and paste; 4% used hand and paste; and 5% used hand and ash. Fourteen percent of the mothers did not clean their teeth at all.

Personal hygiene and tooth cleaning frequency

The distribution of the reported tooth cleaning, bathing, washing the hair, and washing the hands before principal meals/rice meals are shown in tables 5-8. The frequency of toothcleaning increased whenever bathing, washing the hair and "always passing stool in a latrine" also increased. Of the 50 or 51 who cleaned their teeth twice a day or more, 62% took a bath twice a week or more and 90% passed always stool on a latrine. Of the 44 children who never or seldom cleaned their teeth, 75% bathed once or less often per week, and 43% never or seldom used a latrine to pass their stool. No significant association was found between frequency of tooth cleaning and washing the hands before principal meals/rice meals.

Table 5. Distribution of reported bathing frequency per week related to tooth cleaning frequency. Percentage.

Tooth cleaning frequency per day	Bathing frequency per week	
	Twice or more	Once or less
Twice or more (n=50)	62	38
Once a day (n=136)	49	51
Never or seldom (n=44)	25	75

Table 6. Distribution of reported hair washing frequency per week related to tooth cleaning frequency. Percentage.

Tooth cleaning frequency per day	Hair washing frequency per week	
	Twice or more	Once or less
Twice or more (n=51)	80	20
Once a day (n=135)	64	36
Never or seldom (n=44)	39	61

Table 7. Distribution of reported stool passing places related to tooth cleaning frequency. Percentage.

Tooth cleaning frequency per day	Place where stool is passed	
	Always latrine	Sometimes latrine and sometimes field/road
Twice or more (n=51)	90	10
Once a day (n=133)	71	29
Never or seldom (n=44)	57	43

Table 8. Distribution of reported washing of hands before principal meals related to tooth cleaning frequency. Percentage.

Tooth cleaning frequency per day	Cleaning hands before meal	
	Cleaning hands before meal	Not cleaning hands before meal
Once a day or more (n=185)	88	12
Never or seldom (n=44)	77	23

Eating habits

The eating habits during school time (“Yesterday what did you eat at school?”) are shown in table 9. More than half of the children did not eat anything at school. A significantly higher percent of children among the 5-7-yr-olds ate something at school compared to 15-16-yr-olds.

Table 9. Eating habits during school time related to age groups. Percentage.

Type of food	5-7 years (n=65)	11-13 years (n=76)	15-16 years (n=85)
Nutritious	29	26	23
White bread	9	2	1
Sweet snack/beverage	16	13	12
Nothing	46	59	64

Of in total 229 children, 3% did not eat after returning from school. Most of the them (80%) had eaten some nutritious food like rice, lentils and vegetables, beaten rice, popcorn or soy beans. 4% ate white bread and 13% had a sweet snack or/and a beverage like sweet tea.

Snacks

The children showed higher consumption of sweet snacks, compared to non sweet snack. (“How often do you eat “mitai”, biscuits and popcorn, roasted soybeans?”) (Table 10)
The daily and weekly intake of modern snack, biscuits was twice as much as traditional snack, “mitai”.

Table 10. Consumption of common snacks, sweet respective non sweet. Percentage.

Type of food	Never or monthly	Weekly	Every day
“Mitai” a sweet traditional pastry (n=229)	69	25	6
Biscuit, a sweet modern snack (n=231)	33	51	16
Popcorn, roasted soybeans, non-sweet traditional snack (n=231)	28	50	22

Plaque, gingivitis and calculus

Plaque

Two children (2.4%) of the 15-16-yr-olds were recorded as being plaque-free.

56%, 65%, 37% of 5-7 yr-olds, 11-13-yr-olds and 15-16 yr-olds, respectively, had evidence of thick plaque (score 2) covering one or more surfaces. (Table 11) There were no differences between the genders, but between the age groups.

The mean plaque score index were; 0.8 for 5-7-yr-olds, 0.7 for 11-13-yr-olds and 0.5 for 15-16-yr-olds. Girls had significantly less plaque than boys and older children less plaque than the younger ones.

Gingivitis

13% of the children had no gingivitis (score=0). 17% of the children showed evidence of heavy bleeding (score=2) in one or more sites (9%; 24%; 18% of the 5-7-yr-olds; 11-13-yr-olds and 15-16-yr-olds respectively). (Table 11) There were statistical significant differences between gingival status related to age but not to gender.

Table 11. Distribution of Plaque and Gingivitis by age group. Percentage.
(Mean values and 95% Confidence Intervals CI).

Age (years)	Plaque			Gingivitis		
	No visible	Visible	Thick	Sound	Light bleeding	Heavy bleeding
5-7 (n=65)	0 (0-5)	44 (32-57)	56 (43-68)	21 (12-33)	70 (57-80)	9 (3-19)
11-13 (n=80)	0 (0-5)	35 (25-47)	65 (54-75)	4 (1-11)	72 (61-82)	24 (15-35)
15-16 (n=85)	2 (0-8)	61 (50-72)	37 (26-48)	15 (8-25)	67 (56-77)	18 (10-27)

Calculus

37% of the children had no calculus (score =0), 10% had a heavy amount of calculus on one or more surfaces, score 2 (6%, 7%, 15% of 5-7-yr-olds, 11-13-yr-olds, and 15-16-yr-olds respectively). Girls and older children had significantly less calculus than boys and younger children.

Plaque on occlusal surfaces of molars and stage of eruption

No significant differences were found between plaque on occlusal surfaces for the eruption groups under eruption (Figure 3). Therefore, all molars not in occlusion were pooled into one group (n=143 molars), showing that 22% had no plaque (score=0), 69% thin plaque (score=1) and 9% thick plaque (score 2) on the occlusal surfaces (Figure 4).

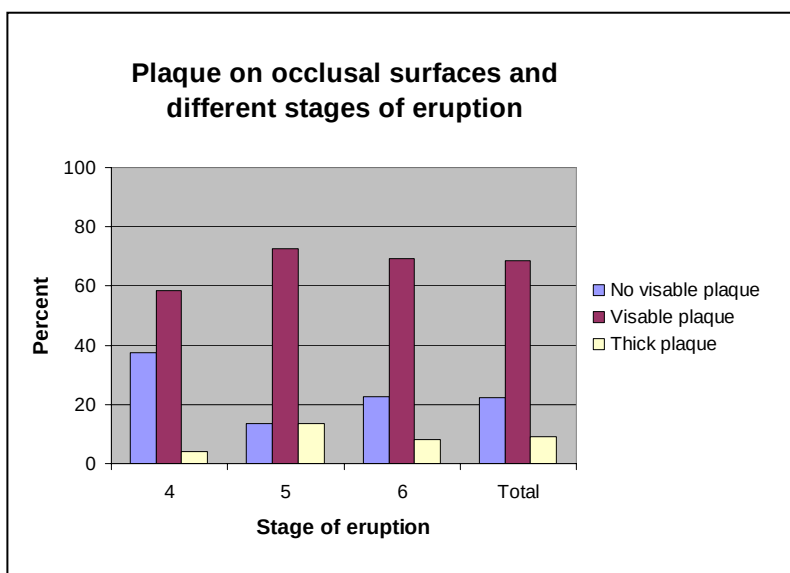


Figure 3. Plaque on occlusal surfaces and different stages of partial eruption.

Related to molar surfaces in full occlusion (n=496 molars, representing 168 children), showed that 87% had no plaque on occlusal surfaces, 12% thin and 1% thick plaque (Figure 4). Significantly more plaque on occlusal surfaces of molars was found for molars not in occlusion compared to molars in occlusion.

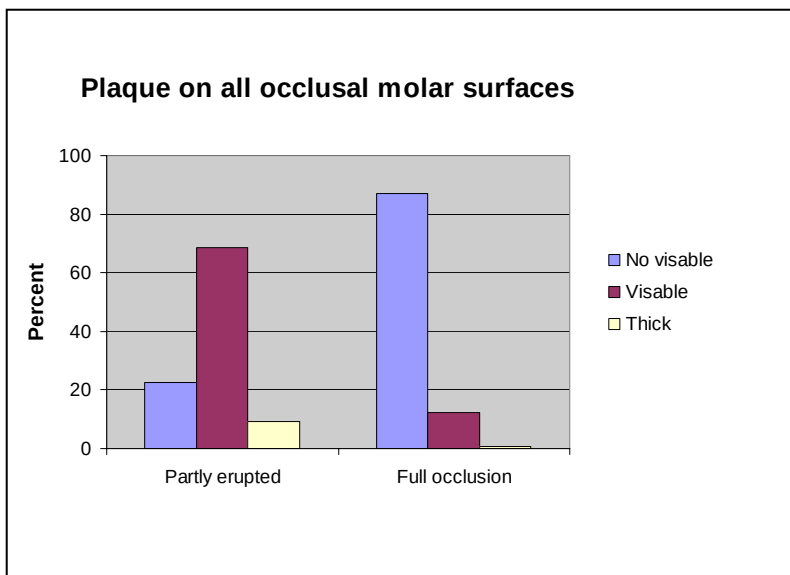


Figure 4. Distribution of plaque for the teeth 16, 17, 36, 37 (pooled) partly erupted (not in occlusion) and in full occlusion (erupted).

The amount of plaque on occlusal surfaces of molars in different parts of the mouth in partial eruption and in full occlusion shown in figure 5 and 6. Regarding partly erupted molars: upper molars (n=61), lower molars (n=82), first molars (n=57), second molars (n=86).

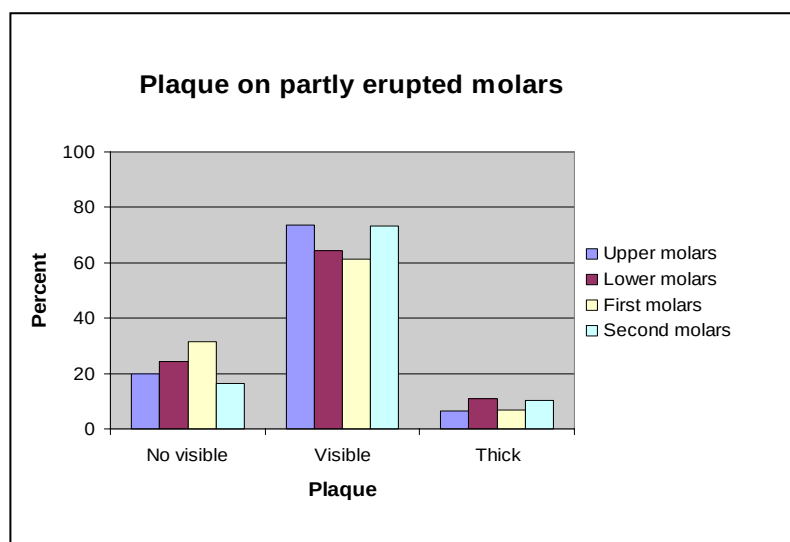


Figure 5. Distribution of plaque on occlusal surfaces on upper molars (16,17), lower molars (36,37), first molars (16,36) and second molars (17,37) partly erupted (not in occlusion).

Regarding molars in full occlusion: upper molars (n=249), lower molars (n=247), first molars (n=331), second molars (n=165).

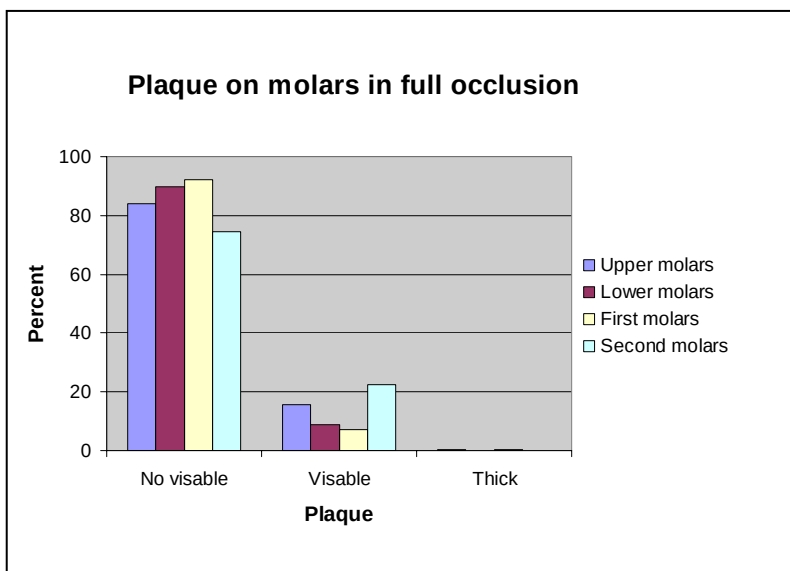


Figure 6. Distribution of plaque on occlusal surfaces on upper molars (16,17), lower molars (36,37), first molars (16,36) and second molars (17,37) in full occlusion (erupted).

Caries

Primary dentition

Sixty-five percent of 5-7-yr-olds were caries free in the primary dentition, but 21% had manifest caries in three or more primary teeth (table 12). Two primary teeth were extracted and no teeth had fillings (table 13). The mean caries index defs and deft were 2.2 and 1.2 respectively.

Among the 5-7-yr-olds, 79 primary teeth were affected by manifest caries. Molars accounted for 75% of the caries, maxillary incisors 22% and the maxillary canines for 2%. The occlusal surfaces on the primary second molars were the most prone to caries (defs=0.4), followed by the occlusal surface of first primary molar (defs=0.3) and distal surface of primary molars (defs=0.3).

Permanent dentition

Over 90% of the children 5-7 years and 11-13 years and over 80% of 15-16 years of age had no caries resulting in very low caries indexes (DMFS and DMFT) in permanent teeth. No one has fillings and only one tooth had been extracted. (Table 13) Of all permanent teeth, 34 were affected by manifest caries. 31 of these caries occurred in molars. The remaining three occurred in two upper incisors and one premolar of different individuals among 15-16-yr-olds.

Regarding surfaces, five teeth were excluded because of pulp involvement and many surfaces decayed, which make 29 teeth and 31 surfaces. The occlusal surfaces of molars accounted 24 of these caries, the buccal surface of molars for 3 and the distal surface of a molar, the occlusal surface of a premolar, the lingual surface respective mesial surface of two different incisors for the remaining 4.

Table 12. Distribution of deft and DMFT related to age. Percentage.

	Age (years)	(n)	deft/DMF			
			0	1-2	3-4	5-12
Primary Dentition	5-7	66	65	14	11	10
Permanent Dentition	5-7	46	98	2	0	0
	11-13	80	91	9	0	0
	15-16	85	82	15	3	0

Table 13. Mean number of Sound, Decayed, Missed and Filled Surfaces and defs/deft and DMFS/DMFT related to age.

Age (years)	(n)	Sound		Decayed	Missed	Filled	DMFS	DMFT
		Arrested	Initial	Manifest+ Pulp inv.	Extracted	Filled		
* 5-7	66	1.0	0.6	2.0	0.2	0	2.2	1.2
5-7	66	<0.1	0.2	<0.1	0	0	<0.1	<0.1
11-13	80	1.1	0.2	0.2	0	0	0.2	0.1
15-16	85	1.6	0.4	0.4	<0.1	0	0.4	0.3

*dmfs/dmft

Arrested, initial and manifest caries on the occlusal surfaces of first and second permanent molars

On first and second permanent molars (212 children and 1318 surfaces); 82% of the occlusal surfaces were sound, 13% had arrested caries, 3% initial caries and 2% manifest caries.

Arrested caries on occlusal surfaces of first molars were found among the two oldest age groups, 21% of 11-13 yr-olds (85 children and 339 surfaces), and 11% of 15-16 yr-olds (80 children and 320 surfaces) (Figure 7).

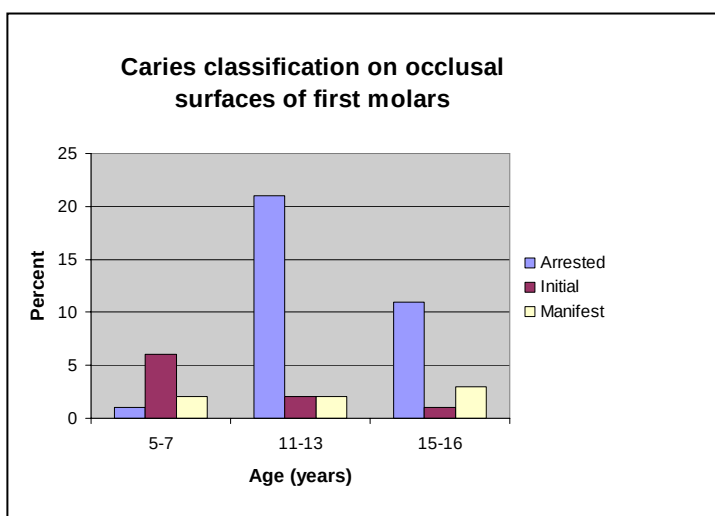


Figure 7. Distribution of arrested, initial and manifest caries on occlusal surfaces of the first permanent molars related to age.

Arrested caries on occlusal surfaces of second permanent molars was found among the oldest age group, 19% of 15-16-yr-olds (85 children and 340 surfaces)(Figure 8).

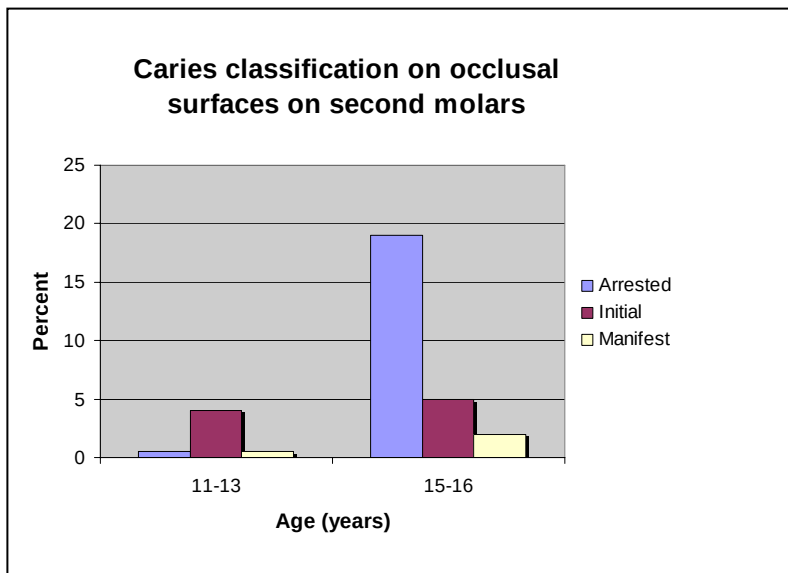


Figure 8. Distribution of arrested, initial and manifest caries on occlusal surfaces of the second permanent molars, related to age.

DISCUSSION

Tooth cleaning was associated with general personal hygiene among Nepalese children. Four out of five cleaned their teeth once/day or more using their own toothbrush. Girls and older children had lower plaque indices and cleaned their teeth more often than boys and younger children. Occlusal surfaces on erupting permanent molars had more plaque than occlusal surfaces on fully occluded permanent molars. Eating habits still seemed to be traditional because more than half of the children did not eat anything at all during school. Manifest caries was found to be low in the primary dentition and very low in the permanent dentition and mainly affected the occlusal surfaces of molars in both dentitions. However, one out of five of the 5–7-yr-olds had manifest caries in three or more primary teeth.

In developing countries, sampling in epidemiological studies is particularly difficult due to the lack of census lists or valid population databases. Of special concern for Nepal and in this study is that only four-fifths of all 5–7-yr-olds begin school, half continue after class 5 (about 11–13 yrs old), and one-third continue to the higher classes (about 15–16 yrs old). Approximately 90% of the boys begin school compared to less than 80% of the girls (46). The participants of the study were therefore chosen based on convenience sampling from three public high schools: two in the Kathmandu valley and one in the middle mountain area of the rural part of Lalitpur District. The sampling method must be regarded as relevant for the purpose of study in connection with future planning and oral health-

promoting activities in Nepal. Because the study was conducted as a cross-sectional survey, conclusions about issues related to cause cannot be made.

In the process of caries progression and regression, plaque has been reported to play an important role (39-41). According to Carvalho (39), the transition from eruption to when the teeth are fully occluded and in contact is an especially crucial period of high risk for the initiation and progression of caries. So plaque was recorded both on the buccal/lingual and on the occlusal surfaces of permanent molars in different stages of eruption. The WHO setting for field studies, e.g., use of the visual-tactile method and the CPI probe for examination, were followed. Tooth brushing before caries registration was added, which made a reliable recording of noncavitated and initial caries possible (47).

Based on the intention stated in the 1986 Ottawa charter (48), to take into consideration the structures of the community and the environment for the people, we included data on the availability of facilities like access to water; ownership of a toothbrush; help from parents; and habits regarding personal hygiene, tooth cleaning, and eating.

A higher prevalence of gingivitis in children is generally found in developing countries compared to industrialized countries (49). Older epidemiological data from Nepal showed that about 40% of the 6-yr-olds (14) and 68%–97% of 12–19-yr-olds (14, 18) had calculus. To get a rough estimation of periodontal conditions, gingivitis and calculus on four tooth surfaces were measured. But, there are difficulties in comparing periodontal conditions between studies due to a lack of consensus on how to measure periodontal disease and differences in study design, age groups, and so on.

Nearly all children had access to a tap in their own yard or close to their home and about three-fourths had access to a latrine. This can be compared to the mean of about 75% with access to a tap and about 35% to latrines in other parts of Nepal (50), which might reflect the success of a decade-long water and sanitation program in the mountainous part of the Lalitpur area (51). That may also account for the fact that about three-fourths of the children always use the latrine when passing stool. Most children clean their hands before eating, probably because of the cultural habit of eating with one's hands. About half of the children bathed once a week—the day off “Saturday bath” like most Nepalese—while the other half bathed twice a week or more. The study was done during the warm season, and the bathing frequency may have been lower than it would have been during the cold season of the year. The bathing frequency of the 15–16-yr-old Nepalese was similar to the bathing frequencies of adolescents in England (52) and Kenya (53).

No statistical differences were found between the genders regarding bathing frequency and other hygiene practices. This is in agreement with similar studies in other countries (52,53). However, age differences were found regarding hygiene practices. The higher frequency of hygiene habits for older children in this study may be a reflection of socioeconomic and cultural factors—only half of the Nepalese children continue school after grade 5.

Most children in all ages use toothbrushes, which now-a-days are cheap, of good quality, and available in shops in Lalitpur. However, few were using fluoride toothpaste at the time of the study. Since 2002, more than 90% of all toothpaste contains fluoride. Most of the children cleaned their teeth just after waking up, which is the old Nepalese tradition, and if the teeth were cleaned again, it was done in the evening. Girls brushed their teeth more frequently than boys, which concurs with studies from Europe (54,55), Kenya (53), and India (23).

The cleaning frequency for 5–7-yr-olds and 11–13-yr-olds in this study were the same as for children in the Wuhan province in China (8), and the 15–16-yr-olds cleaned as often as Swedes in similar ages (54). In this study, the tooth cleaning/brushing frequency increased with age, which is in agreement with a study from China (8). A late start with oral hygiene, at the age of 7 years in Saudi Arabia, may explain the age differences (56). Another reason may be that older children have their own toothbrush and are more concerned about hygiene in general. In the Nepalese joint-families, the grandmother or older daughters often look after the younger siblings while the young wives work in the fields. So, it was surprising to find that none of these children got help cleaning their teeth from their grandmother or older sisters. Home, however, seems to be an important place for learning how to clean teeth, because most children in all age groups answered that they either learnt by themselves or from home how to clean their teeth.

Tooth cleaning was associated with personal cleanliness like bathing and other hygiene practices. This is in concordance with reports from England and Kenya (33,52,53). Tooth cleaning, therefore, needs to be linked with personal hygiene practices. It is not a matter of course that stool must be passed in a latrine in Nepal, and many development programs focus on latrine building and the importance of using it. So it was not surprising to find an association between tooth-cleaning frequency and the habit of passing stool in a latrine. These are habits important in avoiding caries and periodontal disease, diarrhea, and so on.

Notable was that half of the children reported that they did not eat anything at all at school. This was a remarkable finding because the school day is long, beginning at ten o'clock and finishing at about three o'clock. Besides, many children in Lalitpur have as much as a 1-hour walk to get to school. The children were probably practicing the traditional eating habits in Lalitpur—a big rice meal in the late morning and evening. Only some people have snacks during the day. Significantly more 5–7-yr-olds ate at school compared to 15–16-yr-olds. Of those eating at school, the 5–7-yr-olds consumed slightly more of both nutritious and sweet snacks and more white bread than the two oldest age groups. These habits, together with less frequent toothbrushing, may indicate why one-fifth of the 5–7-yr-olds had a high prevalence of caries in the primary dentition.

The majority of the subjects ate after returning home from school, and most of them ate something nutritious. Differences in intake of food after school and snack habits in general in relation to sex and age were nonsignificant. The explanation for the nonsignificance may be that too few individuals were involved in the study (lack of statistical power).

Biscuits, the modern sweet sticky snack foods, were consumed twice as often as traditional sweet snacks and as often as traditional nutritious foods like popcorn and roasted soybeans. These new habits will be hazardous for their oral health. Biscuits are cheap and have been available everywhere in recent years, so consumption may be even higher than reported. The rather high consumption of biscuits may indicate a new growing habit in rural Lalitpur and is in line with what was found among schoolchildren in urban Nepal (29).

In caries prevention, a good and balanced diet is a key factor in keeping snacking frequencies at moderate levels (57,58). In the present study, most of the children brushed only once a day. Therefore, the importance of toothbrushing and a balanced diet in school, with a special emphasis on the formation of good food habits, should form an integral part of nutrition and oral health education in developing countries (59). Children in all ages should be encouraged to continue taking local traditional snacks—like roasted wheat, soybeans, and beaten rice—to school to eat at the break in the middle of the day. In the future, oral health surveillance should be an integral part of growth and nutrition surveillance in schools.

Plaque indices were lower among older children and girls. The lower plaque index among older children and girls may be due to more frequent toothbrushing. However, when using the highest score as a measurement of plaque, there were no gender differences. The occlusal surfaces of erupting first and second molars accumulated significantly more plaque than did the occlusal surfaces in full occlusion, which is in concordance with Carvalho et al. (39) and Kuzmina, Ekstrand (44) who showed that the amount of plaque was greatest on the occlusal surfaces of erupting first molars. As a consequence, a preventive program with a focus on the eruption period of primary and permanent molars should be implemented. Long-term intervention studies from Nexö, Denmark (40,41) and Moscow (60) have confirmed that an individualized, non-operative treatment program is able to reduce plaque and caries on molars.

Matsson reported in 1978 (61) that preschool children have a lower tendency to develop plaque than adults. The same trend was found in the present study, where the most gingivitis was seen among the 11–13-yr-olds. The oldest age group, the 15–16-year-olds, had the most calculus, probably because, like the majority of Nepalese, calculus is never removed. Girls had a lower plaque index and less calculus than boys, which may be due to the higher toothbrushing frequency among girls. It is not possible to compare the level of gingivitis and calculus in the present study with what was found in a previous study (14) in Lalitpur in 1986 due to differences in investigative design and methods. But, it seems clear that periodontal conditions among children have improved substantially. This may be because hygiene consciousness is higher today and the availability of good quality toothbrushes in many local shops in Lalitpur has improved in the last decade.

The caries prevalence was low in the present study and lower compared to studies in Central and Western Nepal in 1999–2000 (62) and in Eastern Nepal in 2001 (63). The present study in Lalitpur was smaller and carried out in governmental schools in a limited

area—mainly among Brahmins and Newars and among 5-7-yr-olds and 11–13-yr-olds only children with erupting first respective second molars were included, which may explain the differences in prevalence of manifest caries between the studies. All three Nepalese studies performed in schools found a caries prevalence below the WHO goals for 12-yr-olds of no more than 3 DMFT by the year 2000 (64) or < 1.5 DMFT for European 12-yr-olds by 1998 (65).

The prevalence of caries is higher in the primary teeth than in the permanent teeth. In this respect there is a difference between industrial and developing countries (8). Changed eating habits combined with less frequent toothbrushing may explain the high rate of manifest caries in the primary dentition. Only the 5–7-yr-olds in this study (65%) were above the WHO goal of 50% children caries-free in the primary dentition (64) compared to children in similar ages in the Western and Central Nepal study (33%) and the Eastern Nepal study (48%). But all three studies were below the WHO goal in Europe, 80% caries free (65). The finding that 21% of the 5–7-yr-olds in the present study had manifest caries in three or more of their primary teeth is alarming. This is in line with CDHP annual reports, which have reported increasing numbers of extractions of primary teeth at Lalitpur HPs in recent years (7). Several studies have also shown that children with manifest caries in their primary dentition are more likely to develop manifest caries in their permanent teeth (66-69).

The manifest caries in permanent teeth found in the present study were almost exclusively located in molar fissures or in extensions of the buccal or lingual fissures. Very few were found on buccal surfaces only, which is in agreement with other studies (38,39). The high rate of arrested caries for this study may be part of the explanation of the low prevalence of manifest caries in the two oldest age groups. Arrested caries were with few exceptions found on permanent first molars of 11–13-yr-olds and 15–16-yr-olds and on second molars of 15–16-yr-olds, thus on molars which had been in full occlusion for at least one year (39-41). Carvalho et al. (39-41) concluded that the majority of the fissures on the occlusal surfaces of recently erupted first molars show early signs of caries and these early lesions have the potential to be remineralized.

CONCLUSIONS and RECOMMENDATIONS

The prevalence of manifest caries for most children was low or very low. However, every fifth 5–7-year-old had manifest caries in three or more primary teeth. The prevalence of caries will probably increase in the future due to the low level of preventive activities, in particular toothbrushing among the younger children and food habits that are supposedly changing. The presumed risk scenario needs to be met by comprehensive and systematic health promotion and preventive measures.

The data from the present study suggest that the preventive program to be implemented should focus on molar teeth in both dentitions and should be implemented during the initial eruption period on primary and permanent molars. Supervised toothbrushing for children with erupting permanent molars are to be recommended in schools. Children in all classes should be encouraged to have a break with local nutritious snack/meal in the middle of the school day. In order to reach younger children and mothers, the school-based approach should be integrated with family- and community oriented oral health education programs.

When planning and implementing oral health care in developing countries, the common custom is to—simply—request additional resources. In the future, it will be necessary to consider how to use the resources at hand; to encourage the continuation of beneficial older traditions in order to develop new good habits. For example, the traditional homemade bean salad or roasted whole wheat/soy beans are both cheaper and healthier. The challenge is to encourage people to be proud of their wise traditions and to continue to follow them. Another challenge is to discourage buying non-nutritious, pre-prepared foods and instead buy the modern cleaning tools: toothbrush and fluoride toothpaste. Therefore begin by supporting good health behavior, and use what is already available in the country. Make good choices – easy choices!

The focus should be on oral health promotion and primary health care, since the dental services reported by Nadonovsky and Sheiham account for only a small part of the decreasing level of caries in industrial countries (27). Health promotion should be strategic, with a common risk factor approach (23). And comprehensive, systematic dental care for children that focuses on oral hygiene, nutrition, and the use of fluorides should be organized (70). Finally, research is urgently needed in preventive and curative dentistry for children in Nepal, in order to meet the negative effects of Westerns lifestyles. Research should focus on the nature of dental caries and periodontal diseases and studying the effects of the different key persons involved (teachers, HP staff, parents and so on), while taking cultural aspects in account.

These suggestions should be presented and discussed with Nepalese Health authorities, the many INGOs and NGOs, local health committees, schoolteachers, and shopkeepers, but the suggestions should be placed in a Nepalese context.



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