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Assessment of current oral health knowledge attitude and oral hygiene practices among 12-year old school children and patients attending the dental facility at Vezo Hospital in the rural village of Andavadoaka, Madagascar

A pilot study.

Philipp Scaglia
Aryan Niknamdeh

Supervisor: Ryo Jimbo

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Malmö University
Faculty of Odontology
205 06

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Abstract

Aim: This pilot study aimed to evaluate oral health knowledge, perceptions and oral hygiene practices among 12- year old children from the local school of Andavadoaka and patients visiting the dental facility at Vezo Hospital, Andavadoaka, Madagascar.

Materials and Methods: Data was collected using a questionnaire consisting of 18 close-ended questions. The study population consisted of 12-year old schoolchildren from three sixth-grade classes (total n=70), and dental patients of all ages visiting Vezo Hospital (total n=76). Clinical registration of decayed and missing teeth were also done on the latter group. **Result:** Results showed favorable knowledge and attitude among both groups. Self-perceived oral health was also positive. Practices, such as frequency and time spent brushing teeth, were lacking and generally did not meet recommended standards. Very few participants had any knowledge about what fluoride is. In both groups, intake of sweets and soft drinks were low. The results of the clinical examinations showed a high incidence of caries. Hospital patients had often poor dental status and poor oral hygiene. **Conclusion:** Despite good self-perceived oral health and knowledge, the reported oral hygiene practices of the participants were insufficient. To improve the oral health care of the region a more efficient delivery of health care services must be made accessible, not only physically and practically but also through implementation of proper instructions and information regarding good oral health habits. This is especially important in rural areas where resources are not as readily available. Furthermore, to actually subside the issue, a prevention program should be put into place.

Background

General health is not defined only by the absence of disease. Health also extends to being physically, mentally and socially well (1). Majority of oral diseases are related to lifestyle, which means that a behavioral change is needed to reduce diseases. Such changes require expertise within health promotion. Alcohol and tobacco consumption is becoming much more common in recent years, people's' eating habits are changing to more "carb-heavy" diets means that we need more than manpower to subside the issue. Worth noting is that both causative and risk factors of major diseases are often the same as those in oral disease (2). This means that preventing oral diseases will also result in a general reduction in diseases outside of the oral spectrum (3).

Many factors are relevant when considering oral health status. Nutrition, oral hygiene, tobacco, alcohol and even general diet habits influence the development of caries and periodontal related problems. Signs of improvements in the oral health have been noted in industrialized countries where school based prevention programs are in place and where habits such as sugar consumption, use of fluoride, standards of living and lifestyle changes have been noted (2,4). There is evidence that supports the fact that proper oral health education presents better oral care practices. Alongside this, a positive attitude towards oral health practices encourages better oral health habits. To create a relevant and appropriate health education program, it is essential to know the target population's' knowledge, attitude and practice regarding oral health (5,6).

Oral diseases have a significant impact on an individual's social life. Chronic diseases like periodontitis lead to tooth loss, which in turn impacts the individual physically, emotionally and financially. Oral diseases often impact the physical appearance and functional aspects like chewing can be negatively affected and worsened. Aforementioned factors play a big part in affecting the individual's daily life and social relations, which in turn will affect the quality of life. With a proper health education program, knowledge about these diseases and proper ways to fight them can reduce harmful oral health habits and minimize the negative impact of chronic oral disease (7).

The relevant diseases concerning oral health problems are dental caries and periodontal disease. The idea is to raise awareness about the causal factors for these diseases, and adequately inform patients and others alike through measures that aim to reduce said diseases' risk factors. Most relevant target group to inform about preventive measures are parents, teachers and health care personnel. Greater knowledge has been noted to be associated with better hygiene (i.e. lower plaque score) and also with a more positive attitude towards oral health (7).

In line with this, a study performed in Sweden has shown that socioeconomic factors and country of birth are determinants of dental attendance habits and failure to seek dental care even when treatment is needed. Over 80 percent of adults in Sweden visit a dentist within a two-year period. The findings have also shown that regular dental attendance is associated with better health and that if such behavior is established early it will persist throughout life (8).

Madagascar

Madagascar is a country known for its nature and unique flora and fauna that is 90% endemic to the island. Located east of Mozambique, it has a population just above 24 million people consisting of eighteen different tribes and of very mixed heritage, such as Australian, south-east Asian, Arabic and even European ancestry (9). Madagascar is one of the world's poorest countries. The gross national income per capita is \$440 with 91 percent of the country's population living on less than \$2 per day. The country is suffering from a socio-economic decline as a result the recent political crisis combined to the lacking provision of social services. The island has 22 regions and is poorly urbanized. Only 17 percent of the population lives in urbanized areas. The rest live on the countryside. Living conditions have been steadily declining in recent years, in particular in terms of transport, health, education and market access. 76.6 percent of the population in these rural areas is affected by poverty, in comparison to 52.1 percent in the urbanized areas. The urbanized regions are unevenly distributed and because of socio-economic inequalities, the country's population is fragmented. The differences are most significant between the highlands and the coastal areas. The country being very prone to natural disasters is also a factor that affects the country's infrastructure especially considering its already limited ability to recuperate from damage. According to WaterAid (10) over 50% of the country's population lacks access to safe water, Madagascar has the fourth worst clean water-access in Africa.

Many villages are isolated and the socio-economic decline affects the rural areas the most. In particular the declining access to health care, education and transportation result in harsh living conditions.(11,12)

According to data from the international fund of agricultural development (IFAD), almost 80 percent of the country's inhabitants live on the countryside. Here, the living conditions have been steadily declining in recent years, particularly in terms of transport, health, education and market access. When people are very ill, travelling is sometimes the only option. The country suffers from lacking infrastructures and poor oral and general health (13).

Many rural health centers lack trained staff and a number have been closed in recent years due to a shortage in government funding. Poverty is also more prevalent in these areas: 76.7 per cent of rural inhabitants are poor, as compared with 52.1 per cent of urban inhabitants. The isolation of rural inhabitants also helps to make living conditions particularly hard (14).

National oral health policy and plans

There is a need of implementation plans that emphasize prevention and early detection of disease in the African region. The management of oral diseases is lackluster in most countries in the WHO African region: only 32 percent of these have a national oral health policy plan and Madagascar is not included in this number. This presents a major barrier to the improvement of oral health. However, the aforementioned plans have not been well implemented, if at all. What has been done has not necessarily been evaluated. For this reason, a manual has been prepared by WHO regional office for Africa, which introduces a systematic approach for national health policies. The manual provides priorities of oral health problems and selection of effective, evidence-based interventions that are compatible with the socio-economic development of the relevant communities (15).

35 percent of the rural population lives more than 10 km from a health facility. While there are many faith-based NGOs and civil society organizations present that offer treatment facilities, these nonprofit organizations do not coordinate their practices with the public sector. The country's health-services are underutilized with only 31.2 percent of the population attending these facilities as outpatients for basic health care. These private non-profit organizations bring some advantages.

They offer some services that the public sector does not, such as immunization services and antenatal check-ups. However, since these private organizations focus directly on a particular community or communities, they all work independently from both each other and the public sector. The result is a lacking health care coverage, which do not provide proper healthcare for everybody at its current state. The lack of developed infrastructure and trained personnel in many developing countries limits the applicability of many strategies. Improving health services is highly dependent on mainly two factors: better technical competency to provide higher quality health care and more efficient medical equipment. The country suffered a decline in health-care coverage during the years between 2008 and 2012 as a result of the closure of several health care facilities. While the financing for health services from the public sector itself has declined, donations from other sources have risen. However, from the \$160 million that was donated during 2008-2010 (a rise from 2008's \$92 million), only 10% was at the public authorities disposal (16).

Regarding dental health care, it is privatized and practices are often only concentrated to the urban areas. Rural areas are practically excluded in this regard since they are isolated and the lacking infrastructure contributes to poor access to the health facilities. The country has in total 3,150 doctors, approximately 1.6 doctors for every 10,000 people. The number of dentists are even fewer, for every 100,000 people there are two dentists in Madagascar (17). Furthermore, rural inhabitants have to travel long distances to receive care and for some it is impossible to receive care because of isolation, lack of transport, or unaffordable care (18). The status of health care in Madagascar is underdeveloped and there is an imbalance between personnel types and population needs (16). Only 60–70% of Madagascar's inhabitants have ready access to primary health care. Many people still have to walk long distances or more to receive treatment (13). The majority of them are located in major cities (19). Dentistry is limited to the private sector and the clinics are located mainly in urban areas while rural areas are cut out. It is in fact expensive for a Malagasy person to visit a private dentist.

Caries prevalence and sugar consumption

Dental caries and periodontal diseases are generally considered to be the major oral health problems around the world. However in African countries these do not appear to be on the same order of severity as in the developed world (15). (Oral Health Issues in the African Region: Current Situation and Future Perspectives)

According to the WHO's Global Data on DMFT Index from 2003, the dental caries level in Africa is low. The urbanization process is at an explosive pace in Africa (20). The latter is a factor that increases access to sugar products. This increase of exposure to cariogenic food can lead to the development of dental caries. There are studies that show an increasing prevalence of caries in a slow but steady rise in many African countries (21). In many conducted studies of dental caries in African populations, a close correlation between caries level and dietary habits, as well as socioeconomic status and education has been reported (20-22).

African countries are in a phase of rapid industrialization. Associated with the changes in socio-economic outlook of the nations is marked alteration of the dietary habits of the people (20). The susceptibility of communities to oral diseases is heightened in some areas by the specific risks of worsening nutritional patterns like increasing the intake of food containing fermentable sugars and tobacco use. In more rural and isolated areas in which low incomes lead to low consumption, the availability of refined sugars has been shown to be lower (22). Despite difficulties and inaccuracies in determining the sugar intake, it was estimated that in 1993, 25 out of 41 examined African countries, including Madagascar, had intakes of less than 15 kg/person/year. A dramatic increase in prevalence and severity of caries is reported as sugar intake increases from about 15 kg to 35 kg/person/year (23). It is often left out in such estimates with regards to the widespread consumption of sugar cane and other sugar-containing products like sweetened soft drinks.

According to a study performed in Africa the main barrier to provide good quality oral health care services in African countries are often related to:

- Few oral care personnel and imbalance of personnel type and population needs
- Service and resource availability such as clean water and electricity
- Logistic problems and lacking infrastructures

It can be said that low priority given to oral health care due to the presence of several general health problems (15).

Oral health in Madagascar

Studies regarding oral health conducted in Madagascar are scarce. There are not enough studies that accurately map the periodontal health of the population in Madagascar. The main coverage of oral health concerns DMFT. The most relevant studies have been conducted by Petersen 1988-1999 (24-27). In his first publication from 1988, he studied the caries prevalence among urban schoolchildren in Madagascar. Caries experience in both primary and permanent dentition was high. 82% of 6-year old children had their primary dentition affected by caries. In the 12-year old group 75% had caries in permanent teeth. He concluded that the founding of almost all untreated decay was an indicator of a lacking availability and shortage of dental manpower. The second study aimed to assess not only the oral health status of 6 and 12-year-old schoolchildren but also the dental health knowledge and attitude among the mothers and the children as well as the knowledge and attitude to dental health education among schoolteachers (24).

The resulting data showed a frequent consumption of sugar and poor oral hygiene habits among the children. Most of the mothers had positive attitudes to the prevention of dental disease among children but their knowledge level was lacking. For example only 50% of the mothers held the opinion that tooth cleaning prevents gingival bleeding and solely 38% were aware of the preventive effect of fluoride.

The teachers had a higher level of knowledge compared to the mothers and were aware of the importance of proper oral hygiene. Almost all of them held the opinion that children were in great need for dental treatment. In this and the former study, only schoolchildren of Antananarivo were taken into account. In order to obtain a more representative sample and different age group, a study was accomplished in 1996 using the WHO pathfinder sampling procedure. DMFT data was collected and divided according to: ethnic group, urbanization, age, sex. The findings of the study revealed that the level of dental caries of the child population surveyed was substantially higher than reported recently for Eastern African countries and the caries experience was found to be relatively high for the Malagasy adult population.

In the early 1980s, many epidemiological studies had shown the number of industrialized countries that had achieved the oral health goals set by WHO/FDI for the year 2000(28). In contrast to this data, some developing countries had shown an opposite trend that means an increase in the DMF values. This trend according to Petersen's previous study seems especially to be of concern in Madagascar, where the caries prevalence has risen above the global target figures within a short space of time (25).

The voluntary hospital

The Vezo Hospital is a voluntary hospital located in the village of Andavadoaka. It is driven by the humanitarian, non-profit, non-governmental organization "Amici di Ampasilava" based in Bologna, Italy. The hospital is entirely financed by donations and was built in 2006. It has a sickroom with 9 beds for the patients that need hospitalization, one operating room, two ambulatories for general medicine, one dental surgery equipped with a dental unit and also two laboratories for radiographs

and analysis. There are also some enlargement projects ongoing to make the structure more capacious.

Andavadoaka is a small fishing village located on the southwest coast of Madagascar in the Toliara Province. It has been financed predominantly by donations. Andavadoaka is located in a rural area, it is 180 km away from the city of Tulear. Reaching the hospital is not easy; no proper roads exist, and only few dirt roads which are in poor conditions.

Nevertheless, the Vezo hospital has a catchment area of approximately 20000 patients per year that travel long distances by walk or animal transport to seek health care. This health care facility has become important for Andavadoaka and all the surrounding villages that are not served by proper medical and dental care. Its services are expected to cover a radius of approximately 200 km². The organization provides board and lodging for the volunteers in exchange of a small donation to the organization. During the last 8 years of activity, there have been over 600 volunteers that have offered service at the hospital. The organization ensures that there is always staff available at the hospital during different times of the year.

Besides providing health care, the organization is engaged in projects that aim to increase life standard of the inhabitants of the village. For example an aqueduct has been built that will give water supply to ensure basic hygiene needs and basic food hygiene.(29)

Achievements

During the two months July-August 2016, 316 dental patients were examined including children and adults. Common treatment involved extractions of carious teeth and scaling. Oral health education was given at the local school to three sixth grade classes with a total of 120 school children.

Dental care was provided for all the patients attending the hospital. This mainly included extractions, restoration, scaling and oral health education.

Hypothesis

In isolated villages there is scarce knowledge regarding good oral health habits, which are not seen as a priority. Due to the lack of information and preventive programs, we hypothesize that oral health knowledge, attitude and practice are expected to be unsatisfactory.

Aim of the study

To get an understanding of oral health habits, in particular knowledge level, attitude and practices among the rural population of Andavadoaka and patients attending Vezo Hospital. Moreover, to see whether there is a correlation between bad oral hygiene (OH) and oral health knowledge (OHK) among hospital patients.

Material and methods

Area and Population

The survey was carried out on a local level and the data was collected in the village of Andavadoaka in the Atsimo Andrefana Region. Two different study groups were included. The first is composed by 76 patients aged 12 to 69 (male=35, female=41) that visited the hospital. The second group included 70 sixth grade students from the local school of Andavadoaka from three different classes. This group was relevant because according to the WHO oral health survey guide, it is likely that by this age all the permanent teeth except the third molars will have erupted. 12

years has been chosen as the global indicator age group for international comparisons and surveillance of disease trends (30). In both groups the oral health knowledge=OHK, oral health attitude=OHA, oral health practice=OHP, self-perceived oral health and dietary habits was studied.

Kap survey

Knowledge, attitude and practice (KAP) surveys are based on predefined questions formatted in standardized questionnaires that can provide quantitative and qualitative information. The aim of a KAP survey is to collect information on a specific population regarding on what is known, believed and done in relation to a particular topic.

A KAP survey can potentially identify knowledge gaps, cultural beliefs, or behavioral patterns that may facilitate understanding. They can identify why people practice certain health behaviors and factors influencing reasons for their attitudes. KAP surveys can also assess communication processes and sources that are important to defining effective methods for oral disease prevention. KAP survey can be used to orient resource allocation and project design, and to establish a baseline for comparison with subsequent, post-intervention KAP surveys (6).

Nature of information and methods used

The data collection was carried out in a period of 8 weeks during July-August 2016. A close-ended questionnaire was designed for collecting the data. Clinical examinations were carried out at the Vezo hospital. The survey was administered in person and took approximately fifteen minutes for the patients to complete. The clinical registration of dental status took roughly five minutes.

The Clinical examinations

All the examinations were carried out by a single examiner: using dental probe, dental mirror and tooth air-drying. All the dental tools were disinfected and sterilized with an autoclave.

Before submitting the questionnaire we carried out clinical examinations where we registered number of missing teeth, number of carious teeth and presence of calculus in the lower jaw incisors. We did not register any DMFT data but rather utilized a simplified method of registration that will be explained in the next paragraph. This approach was adopted because of the limited time and resources available.

Caries registration using the following criteria:

- Caries should be registered only if it is a manifest lesion, regardless of the number of affected surfaces.
- Root residues should be registered as a carious lesion.
- Third molars are excluded.

Calculus registration using the following criteria:

- Presence of supragingival calculus covering more than one third of the lingual surface of the lower jaw incisors will be registered as a positive (present) result.

Missing teeth counting criteria:

- Missing third molars are excluded.
- Root remains should not be registered as missing.

The questionnaire

The WHO survey guide and guide to developing knowledge, attitude and practice survey were consulted to get a better understanding of the design of the questionnaire and to understand which type of survey would give the most reliable results in more rural condition (6,30).

We consulted premade questionnaires used in other KAP studies (4,5,24,31-35) and tailor-made our own that would best help us achieve our aim. This was translated and back-translated in the standard method from English to Malagasy. The questions were initially written in English and later translated by a local interpreter on the field. To ensure the validity of the questionnaire and in order to avoid misinterpretation, it was successively translated back to English by a second interpreter in order to avoid interpretational mistakes.

The self-administered questionnaire used for data collection consisted of 18 close-ended questions that would provide an understanding of the oral health knowledge, attitude and practice of the patients. The respondents were asked elementary questions on oral health knowledge, attitude and oral hygiene practices. The questions on oral health were for example: causes of tooth decay, reasons for cleaning teeth, what fluoride is, etc. Questions were asked on brushing habits along with tools used for brushing and brushing frequency in order to assess oral hygiene practices. The respondents were also given questionnaires on experience of dental pain and prior information received on oral health. The questions were divided in five parts:

1. Questions regarding self-perceived oral health.
2. Oral health knowledge (OHK).
3. Attitude towards oral health.
4. Hygiene practices.
5. Dietary habits.

Concerning the 12-year old schoolchildren, students from three local classes were gathered in one bigger classroom. With the help of the teacher, all the questions were written on a blackboard while the interpreter would read the questionnaire out aloud to the entire class. All the students were informed the day before to have materials ready to write down the answers (paper and pencil). These papers would then be collected by the team and later be processed in an SPSS sheet with the collected data.

Sampling method

Consecutive sampling was used to conduct the survey and the clinical examination at the hospital. For the 316 dental visits, no exclusion criteria were applied. However, the high number of patients we were not able to hand out the questionnaire to every single one due to time limitation. This technique was used because of the limited time and resources that were available on the field. Participants at the school were selected using the following inclusion criteria: 1. must be 12 years old, 2. must be a student at the local school of Andavadoaka.

Personnel and physical arrangements:

We initially prepared a protocol where we decided the purpose and main objectives of the study. The protocol was made in order to simplify the collection of clinical data and to make the interpretation more time-efficient. We decided the type of information to be collected and the method to be used. Calibration was not performed between the examiners. It was deemed not necessary because a single operator was going to register the clinical data while the other inserted the registered data in an excel data sheet. By doing this, the inconsistency in scoring different levels of an oral disease would be reduced. The diagnostic variability of one examiner could still be large however. During the pretest phase, eight examinations were conducted on different patients and were recalled after two days to be reexamined in order to ensure the intra-observatory variation was kept low.

Examinations were performed in a room with dental equipment. This created an environment devoid of crowding and noises that could inconvenience the examiner during the registration. This setup allows the diagnostic variability to be further minimized. We pretested our first translated questionnaire on ten patients to see if any questions were hard to understand or not sufficiently clear. After this phase some questions were adjusted to cover all the possible choices so that they would be relevant for the population.

For the group of school children, we gathered a sample group of three classes with the help of the local school teacher and nun, even though they had finished their semester. However, a pretest could not be made because of limited time and difficulties in gathering a pretest group.

Statistical analysis and computational procedure

We inserted the raw data into an excel sheet for later analysis. In order to make statistical analysis possible we transferred the data to SPSS 22 and conducted statistical analysis. Data registered were:

- Age
- Gender
- Residency
- Clinical data (only hospital patients)
- Questionnaire results

With the use of SPSS, data was analyzed to see how the questionnaire results and clinical data compared to each other. Structured tables of the answers were made in order to simplify the reading and interpretation of the data.

Ethical consideration

The project plan and its execution, including ethical consideration, were approved by the Vezo Hospital, Andavadoaka. We explained to all the participants the scope and aim of the study. Every participant was free to withdraw from the survey. All study participants gave verbal consent and were assured that their privacy would be maintained.

Results – hospital patients

	Total [n(%)]	Male [n(%)]	Female [n(%)]
Perceived oral health status			
<i>Health of gum and teeth</i>			
Excellent	10(13.2)	4(9.8)	6(17.1)
Very good	14(18.4)	7(17.1)	7(20.0)
Good	23(30.3)	12(29.3)	11(31.4)
Average	22(28.9)	12(29.3)	10(28.6)
Poor	3(3.9)	3(7.3)	0(0.0)
Very poor	3(3.9)	2(4.9)	1(2.9)
Don't know	1(1.3)	1(2.4)	0(0.0)
<i>Satisfaction with appearance of teeth</i>			
Very satisfied	21(27.6)	11(26.8)	10(28.6)
Adequately satisfied	20(26.3)	8(19.5)	12(34.3)
Barely satisfied	13(17.1)	7(17.1)	6(17.1)
Not satisfied	22(28.9)	15(36.6)	7(20.0)
Knowledge			
<i>Source of information</i>			
Friends	9(11.8)	7(17.1)	2(5.7)
Relatives	17(22.4)	12(29.3)	5(14.3)
Teachers/school	36(47.4)	16(39.0)	20(57.1)
TV/radio	4(5.3)	1(2.4)	3(8.6)
Dentists/hospital staff	10(13.2)	5(12.2)	5(14.3)
<i>Cleaning teeth can prevent tooth decay</i>			
Agree	64(84.2)	35(85.4)	29(82.9)
Disagree	3(3.9)	2(4.9)	1(2.9)
Don't know	9(11.8)	4(9.8)	5(14.3)
<i>Cleaning teeth can prevent gum bleeding and tooth loss</i>			
Agree	55(72.4)	31(75.6)	24(68.6)
Disagree	5(6.6)	1(2.4)	4(11.4)
Don't know	16(21.1)	9(22.0)	7(20.0)
<i>Eating and drinking sweets can cause tooth decay</i>			
Agree	64(84.2)	37(90.2)	27(77.1)
Disagree	5(6.6)	1(2.4)	4(11.4)
Don't know	7(9.2)	3(7.3)	4(11.4)
<i>Knowledge of fluoride</i>			
Yes	4(5.3)	1(2.4)	3(8.6)
No	72(94.7)	40(97.6)	32(91.4)
<i>Regular visits to the dentist prevent dental problems</i>			
Agree	62(81.6)	33(80.5)	29(82.9)
Disagree	6(7.9)	3(7.3)	3(8.6)
Don't know	8(10.5)	5(12.2)	3(8.6)
Attitude			
<i>Importance of oral hygiene</i>			
Very important	38(50.0)	17(41.5)	21(60.0)
Important	30(39.5)	19(46.3)	11(31.4)
Less important	3(3.9)	2(4.9)	1(2.9)
Not important	5(6.6)	3(7.3)	2(5.7)
<i>I avoid going to the dentist because of</i>			
Possible pain	21(27.6)	11(26.8)	10(28.6)
Distance	31(40.8)	17(41.5)	14(40.0)
Not prioritized	5(6.6)	1(2.4)	4(11.4)
Too expensive	8(10.5)	5(12.2)	3(8.6)
I don't avoid it	11(14.5)	7(17.1)	4(11.4)
<i>I only go to the dentist when I am in pain</i>			
Agree	56(73.7)	31(75.6)	25(71.4)
Disagree	16(21.1)	9(22.0)	7(20.0)
Don't know	4(5.3)	1(2.4)	3(8.6)
<i>Frequency of oral discomfort last 12 months</i>			
Often	20(26.7)	14(35.0)	6(17.1)
Occasionally	27(36.0)	17(42.5)	10(28.6)
Rarely	9(12.0)	3(7.5)	6(17.1)
Never	19(25.3)	6(15.0)	13(37.1)
Don't know	0(0.0)	0(0.0)	0(0.0)

	Total [n(%)]	Male [n(%)]	Female [n(%)]
Practice			
<i>Frequency of teeth cleaning</i>			
Once per day	21(27.6)	14(34.1)	7(20.0)
Twice per day	23(30.3)	12(29.3)	11(31.4)
More than twice per day	0(0.0)	0(0.0)	0(0.0)
Less than once per day	32(42.1)	15(36.6)	17(48.6)
<i>Time spent cleaning teeth</i>			
Less than 2 minutes	48(64.0)	31(77.5)	17(48.6)
2 minutes	11(14.7)	4(10.0)	7(20.0)
More than 2 minutes	12(16.0)	4(10.0)	8(22.9)
Do not clean my teeth	4(5.3)	1(2.5)	3(8.6)
<i>Tools for cleaning</i>			
Tooth brush	54(71.1)	29(70.7)	25(71.4)
Fingers	8(10.5)	4(9.8)	4(11.4)
Miswak	5(6.6)	2(4.9)	3(8.6)
Charcoal	6(7.9)	4(9.8)	2(5.7)
Other	3(3.9)	2(4.9)	1(2.9)
<i>Use of tooth paste</i>			
Yes	50(66.7)	26(65.0)	24(68.6)
No	25(33.3)	14(35.0)	11(31.4)
Dietary habits			
<i>Frequency of soft drink intake</i>			
Never	46(61.3)	26(65.0)	20(57.1)
One time/week	10(13.3)	7(17.5)	3(8.6)
Two-three times/week	12(16.0)	3(7.5)	9(25.7)
Four-five times/week	4(5.3)	4(10.0)	0(0.0)
Every day	3(4.0)	0(0.0)	3(8.6)
<i>Frequency of sweet food intake</i>			
Never	6(8.0)	5(12.5)	1(2.9)
Less than one time/day	20(26.7)	7(17.5)	13(37.1)
One time/day	37(49.3)	22(55.0)	15(42.9)
Two-three times/day	12(16.0)	6(15.0)	6(17.1)

Table 1. Results from the questionnaire of the Hospital patient group.

	Mean	Present [n(%)]	Not present [n(%)]	
Calculus	-	49(64.5)	27(35.5)	
	Mean	None	< 3	≥ 3
Caries	3.04	8(10.5)	33(44.0)	34(45.3)
	Mean	None	< 3	≥ 3
Missing teeth	3.18	21(27.6)	21(27.6)	33(44.0)

Table 2. Data from the clinical examination.

Perceived oral health

The majority of the respondents perceived their oral health as good. Out of the respondents, only 7.8% reported to have a poor to very poor perceived oral health. 46% of the total respondents were barely satisfied or not satisfied at all with the appearance of their teeth. Of those not satisfied the majority (68.1%) were male.

Knowledge

Almost half of the hospital patients (47.4%) reported to have received information regarding oral health i.e. brushing teeth in schools. The second most common source was relatives (22.4%) followed by dentist/hospital (13.2%). A vast majority had good knowledge about the preventive effect of teeth cleaning, 84.2% agreed with the fact that brushing teeth can prevent tooth decay. 81.6% answered that regular visit can keep away dental problems. Even though 27.7% of the patients weren't aware of the fact that tooth brushing can prevent periodontal diseases, the majority (72.3%) knew that tooth brushing had a preventive effect against it. Many patients were aware of the risks of consuming foods and drinks containing sugar and their detrimental effect on oral health, 84.2% knew that eating and drinking sweet things can cause tooth decay. Nearly all the participants (94.7%) didn't know what fluoride is.

Attitude

Only 8 participants found it less important or not important at all to take care of their teeth. In total, 68 patients answered important to very important (50.0% very important, 39.5% important). The most frequent reason (40.8%) for avoiding dental visits was the long distance to the clinic. The second most common answer was the fear of possible pain, 27.6%. The majority 73.6% of the patients sought dental help only when they experienced pain. Occasionally and often (62.7%) were the two most common answers regarding oral discomfort while rare occasions of oral discomfort in the last year was an infrequent answer (12.0%).

Practice

57.9% of the respondents cleaned their teeth at least once a day. One third of the participants did it twice per day. The time spent cleaning teeth was in 64.0% of the cases less than 2 minutes. Regarding the tools used for cleaning, the most common was toothbrush, 71.1%. The second most common method was fingers (10.5%). Among patients that reported "Other" as answer there were three more tools used: grass, sand with water and soap. 66.7% reported to use toothpaste while brushing.

Dietary habits

The intake of soft drinks is generally low. 61.3% reported to never consume soft drinks. 13.3% consumed soft drinks once a week and 21.3% more than two times a week. In total, only 4.0% of the respondents reported to consume sugar containing drinks daily. Regarding the consumption of sweets almost half of the patients (49.3%) consumed sweets one time a day. 16.0% consumed two-three times a day. 26.7% less than once a day and 8.0% never.

Results – school children

	Total [n(%)]	Male [n(%)]	Female [n(%)]
Perceived oral health status			
<i>Health of gum and teeth</i>			
Excellent	20(29.0)	9(32.1)	11(26.8)
Very good	8(11.6)	3(10.7)	5(12.2)
Good	7(10.1)	2(7.1)	5(12.2)
Average	25(36.2)	10(35.7)	15(36.6)
Poor	2(2.9)	1(3.6)	1(2.4)
Very poor	4(5.8)	1(3.6)	3(7.3)
Don't know	3(4.3)	2(7.1)	1(2.4)
<i>Satisfaction with appearance of teeth</i>			
Very satisfied	23(32.9)	9(31.0)	14(34.1)
Adequately satisfied	22(31.4)	9(31.0)	13(31.7)
Barely satisfied	19(27.1)	6(20.7)	13(31.7)
Not satisfied	6(8.6)	5(17.2)	1(2.4)
Knowledge			
<i>Source of information</i>			
Friends	3(4.3)	1(3.4)	2(4.9)
Relatives	1(1.4)	1(3.4)	0(0.0)
Teachers/school	20(28.6)	10(34.5)	10(28.6)
TV/radio	6(8.6)	1(3.4)	5(12.2)
Dentists/hospital staff	40(57.1)	16(55.2)	24(58.5)
<i>Cleaning teeth can prevent tooth decay</i>			
Agree	37(53.6)	18(62.1)	19(47.5)
Disagree	16(23.2)	5(17.2)	11(27.5)
Don't know	16(23.2)	6(20.7)	10(25.0)
<i>Cleaning teeth can prevent gum bleeding and tooth loss</i>			
Agree	36(51.4)	17(58.6)	19(46.3)
Disagree	11(15.7)	3(10.3)	8(19.5)
Don't know	23(32.9)	9(31.0)	14(34.1)
<i>Eating and drinking sweets can cause tooth decay</i>			
Agree	29(42.0)	11(37.9)	18(45.0)
Disagree	29(42.0)	12(41.4)	17(42.5)
Don't know	11(15.9)	6(20.7)	5(12.5)
<i>Knowledge of fluoride</i>			
Yes	0(0.0)	0(0.0)	0(0.0)
No	70(100.0)	29(100.0)	41(100.0)
<i>Regular visits to the dentist prevent dental problems</i>			
Agree	61(88.4)	26(89.7)	35(87.5)
Disagree	1(1.4)	1(3.4)	0(0.0)
Don't know	7(10.1)	2(6.9)	5(12.5)
Attitude			
<i>Importance of oral hygiene</i>			
Very important	55(79.7)	22(75.9)	33(82.5)
Important	5(10.1)	5(17.2)	2(5.0)
Less important	6(8.7)	2(6.9)	4(10.0)
Not important	1(1.4)	0(0.0)	1(2.5)
<i>I avoid going to the dentist because of</i>			
Possible pain	48(68.6)	17(58.6)	31(75.6)
Distance	10(14.3)	6(20.7)	4(9.8)
Not prioritized	5(7.1)	1(3.4)	4(9.8)
Too expensive	5(7.1)	4(13.8)	1(2.4)
I don't avoid it	2(2.9)	1(3.4)	1(2.4)
<i>I only go to the dentist when I am in pain</i>			
Agree	33(47.1)	14(48.3)	19(46.3)
Disagree	32(45.7)	11(37.9)	21(51.2)
Don't know	5(7.1)	4(13.8)	1(2.4)
<i>Frequency of oral discomfort last 12 months</i>			
Often	6(8.6)	1(3.4)	5(12.2)
Occasionally	22(31.4)	10(34.5)	12(29.3)
Rarely	6(8.6)	5(17.2)	1(2.4)
Never	24(34.3)	7(24.1)	17(41.5)
Don't know	12(17.1)	6(20.7)	6(14.6)

	Total [n(%)]	Male [n(%)]	Female [n(%)]
Practice			
<i>Frequency of teeth cleaning</i>			
Once per day	38(55.1)	12(42.9)	26(63.4)
Twice per day	3(4.3)	1(3.6)	2(4.9)
More than twice per day	3(4.3)	2(7.1)	1(2.4)
Less than once per day	25(36.2)	13(46.4)	12(29.3)
<i>Time spent cleaning teeth</i>			
Less than 2 minutes	38(54.3)	15(51.7)	23(56.1)
2 minutes	27(38.6)	10(34.5)	17(41.5)
More than 2 minutes	4(5.7)	3(10.3)	1(2.4)
Do not clean my teeth	1(1.4)	1(3.4)	0(0.0)
<i>Tools for cleaning</i>			
Tooth brush	46(65.7)	16(55.2)	30(73.2)
Fingers	10(14.3)	5(17.2)	5(12.2)
Miswak	6(8.6)	3(10.3)	3(7.3)
Charcoal	4(5.7)	4(13.8)	0(0.0)
Other	4(5.7)	1(3.4)	3(7.3)
<i>Use of tooth paste</i>			
Yes	48(68.6)	15(51.7)	33(80.5)
No	22(31.4)	14(48.3)	8(19.5)
Dietary habits			
<i>Frequency of soft drink intake</i>			
Never	31(44.9)	15(51.7)	16(40.0)
One time/week	18(26.1)	7(24.1)	11(27.5)
Two-three times/week	9(13.0)	3(10.3)	6(15.0)
Four-five times/week	8(11.6)	2(6.9)	6(15.0)
Every day	3(4.3)	2(6.9)	1(2.5)
<i>Frequency of sweet food intake</i>			
Never	12(17.6)	8(27.6)	4(10.3)
Less than one time/day	37(54.4)	18(62.1)	19(48.7)
One time/day	8(11.8)	2(6.9)	6(15.4)
Two-three times/day	11(16.2)	1(3.4)	10(25.6)

Table 3. Results from the questionnaire of 12-year old schoolchildren group.

Perceived oral health

The majority of the respondents perceived their oral health as average 36.2%. Poor or very poor was not a frequent answer, 2.9% and 5.8% respectively. Among the schoolchildren only 8.6% reported to be not satisfied with the appearance of their teeth while the most frequent answers were very satisfied (32.9%) and adequately satisfied (31.4%).

Knowledge

Out of the 70 surveyed children it was revealed that 40 reported that the most common source of information regarding oral health was the local dentist/hospital (57.1). The second most common source of information regarding oral health was teacher/school and 20 respondents picked this option (28.6). A little more than half of the respondents (53.6%) agreed with the fact that brushing teeth can prevent tooth decay. The remaining either did not agree (23.2%) with the fact or did not know (23.2%). 51.4% were aware that cleaning teeth can prevent periodontal diseases, yet one third of the respondents (32.9%) were unaware of the fact. The respondents agreed and disagreed in equal amount (42.0%) to the fact that eating sweets can cause tooth decay. None of the schoolchildren knew what fluoride was.

Attitude

The awareness of importance of oral hygiene was reported to be high; the majority of the students (79.7%) rated oral hygiene as very important. The most common reason for not visiting the dentist was the fear of possible pain (68.6%). There were slightly less school children that agreed with the fact that they visit the dentist only when in pain (47.1%) compared to the ones who disagreed (45.7%).

It was not common among the children to experience frequent dental pain in the past 12 months. Only 6 students responded 'often'. The most common answer was never (34.3%) followed by occasionally (31.4%)

Practice

Few school children reported to brush their teeth twice per day only (4.3%). The majority of the respondents (55.1%) brushed once per day while 36.2% cleaned their teeth less than once per day. Time spent brushing was for 54.3% of the school children less than 2 minutes, while 38.6% reported to brush for 2 minutes. The most common (65.7%) tool used for tooth cleaning was toothbrush, second most used method was fingers: 14.3% of the class used their fingers for cleaning. The use of toothpaste was fairly common, 48 school children (68.6%) reported to use toothpaste.

Dietary habits

The consumption of sweet food among schoolchildren was not high. 54.4% reported to consume sweet foods less than one time per day and 17.6% answered never. The percentage of children who consumed sweets every day or more was 28.0%. Soft drinks were not so common. Only 3 students (4.3%) consumed it on a daily basis while almost half of the respondent reported to never consume soft drinks. 26.1% reported once a week while 24.6% two or more times a week.

Discussion

The majority of the hospitals in Madagascar are located in major cities according to the list of Medical Facilities/Practitioners in Madagascar, prepared by the British Embassy (19). Dentistry is limited to the private sector and the clinics are located mainly in urban areas while rural areas are cut out. It is in fact expensive for a Malagasy person to visit a private dentist. There are some voluntary dental missions that have been carried out during the last 10 years, such as mercy ships with dental staff and for example the so called Ankizy fund.

Socioeconomic status and the lack of oral health care facilities throughout the country are factors that contribute to the poor oral health of many people. Beside those, other factors exist that can have a detrimental effect on the oral health, for example poor oral hygiene practices or lacking knowledge regarding the risks of cariogenic food. Knowledge of the risks related to tobacco use are also of importance to the oral health of the population. Even though this was not documented with the current survey, the prevalence of smoking among teenage pupils in Madagascar is a significant issue and studies conducted in Madagascar have shown a high incidence in tobacco use among teenagers. It has been reported to be higher than the average compared to other African regions (36,37).

In this study we focused on the oral health knowledge, attitudes and hygiene practices of the rural population in the village of Andavadoaka. We observed and studied behaviors in a completely rural surrounding. One of the study groups was the population seeking dental treatment at the Vezo Hospital dental facility. It is of interest to analyze a group characterized by dental problems in order to see if there are any specific weak spots in knowledge, attitude and/or practices.

Dentists on site have previously reported the need of dental treatment for the vast majority of the patients that visited the dental clinic. It was therefore hypothesized that the patients that would be examined, would show a bad dental status. In fact, the mean carious teeth for each patient was 3.04 and mean missing teeth were 3.18 (table 2). An interesting finding is the data of the perception of good oral health status of teeth and gums in relation to the clinical data. 61.9% reported good to excellent oral health. Among them almost half of the respondents (42.5%) showed 3 or more decayed teeth and 3 or more missing teeth (44.6%). Dental caries experience and missing teeth appeared therefore to not have a strong impact on their perception of good/excellent oral health.

Good to excellent oral health perception (n=47)

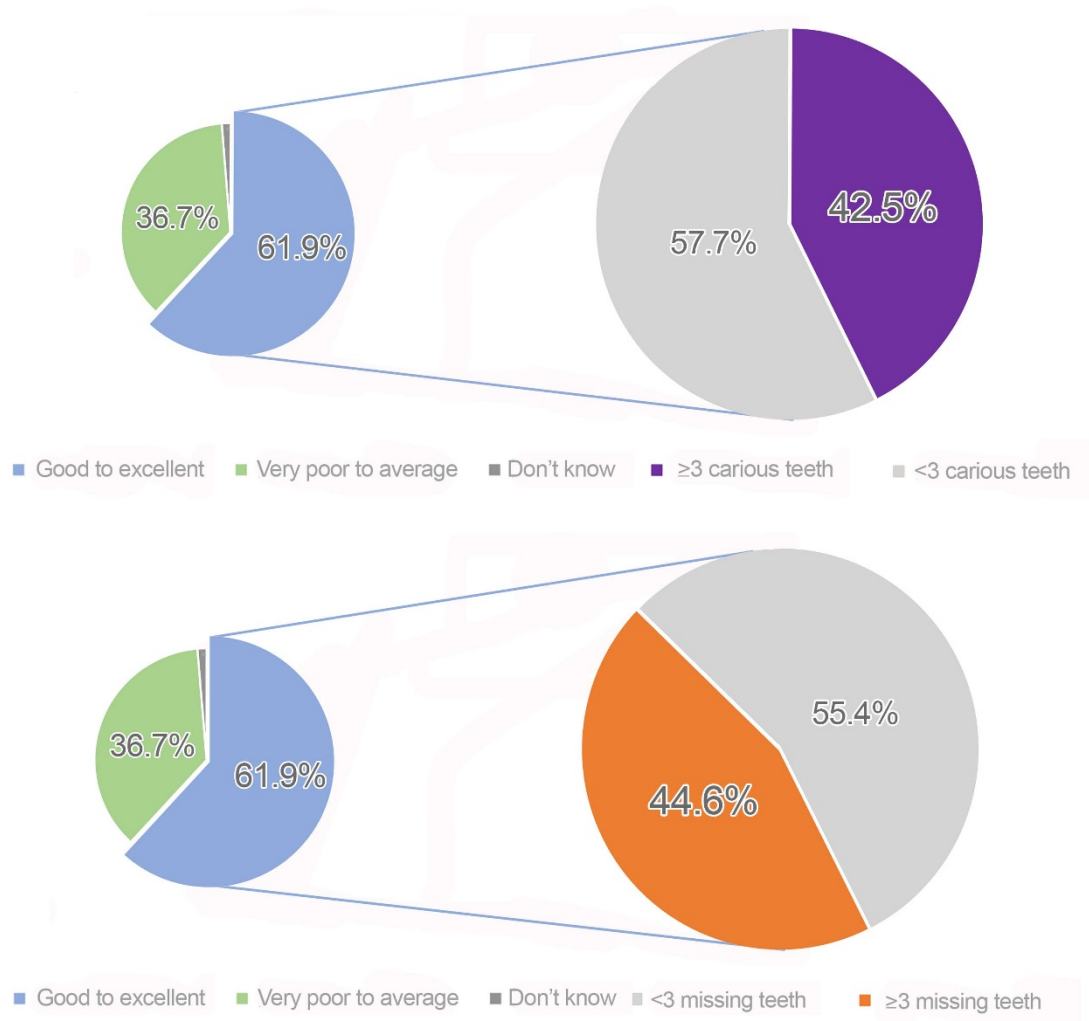


Table 4. Correlation between the patient's perception of good oral health of teeth and gums and actual dental status.

88% of the examined patients had at least one manifest carious lesion. In accordance to Petersen's previous findings (25), a high prevalence in untreated carious lesions among the visited patients was encountered during our clinical examinations. It's hard to tell the exact cause for the high prevalence but could probably be related to the difficult access to affordable health care services combined with detrimental oral habits. Similar findings of high prevalence of untreated dental caries was reported in studies performed in Madagascar on patients who had limited access to dental care due to the lack of dental manpower (25,27).

Oral hygiene is generally poor in many African countries (22). The oral hygiene of the majority of the patients was unsatisfactory. Gingivitis was a frequent finding combined to high amounts of plaque, calculus was also fairly common (Table 2.). The majority of the patients had tartar and it was often covering more than one third of the crown which could give an indication regarding the oral hygiene status of the individual. This finding can be related not only to low dental knowledge and low education but also the scarce availability and high pricing of toothbrushes and fluoridated toothpaste. In Andavadoaka three different toothpaste types were found, whereof two did not contain fluoride. The fluoride-containing one cost three times more than the fluoride-free.

Toothbrushes have a fairly high price compared to general living cost and was only available in some of the small shops. This is a major barrier for regular use. Furthermore, it has been reported that in low and middle income countries the fluoride toothpaste is not always of good quality. Some middle-income countries manufacture their own toothpaste but the level of fluoride is sometimes too low to be effective and national regulations or even international quality standards are not met (13).

Although this study did not aim to report the occurrence of fluorosis, there was a severe presence of fluorosis in front teeth and molars among many patients both young and old. This could be related to the fluoride concentration from the ground water which in small concentrations has a positive effect but can be detrimental if it's found in excessive concentrations. Even malnutrition in early life stages can be a causative factor of fluorosis. The composition and structure of enamel is drastically compromised as a result of excess fluoride during development. In this manner, the tooth become less resistant to demineralization which can lead to tooth decay (38,39).

According to the data from table 1, in line with another study (24) there was a clear discrepancy between knowledge and practice. Table 5 underlines how the respondents in the hospital group had good oral health knowledge but less promising results regarding brushing habits. Of our total sampling population, 30.3% answered they brush their teeth twice a day. Out of these, only 13% had three or more caries lesions and 26% had three or more missing teeth. In comparison to this, among the participants who brushed only once a day (27.6%) two thirds of them had three or more caries lesions (66.6%) and three or more missing teeth (71.4%). 84.2% agree to the question that a good oral hygiene can prevent tooth decay, yet the previous figures regarding caries lesions and missing teeth are in contrast. This number is the same (84.2%) for patients that agree to the fact that sweet things can cause tooth decay (see table 1). Among the schoolchildren the brushing frequency and duration was not satisfactory, as hypothesized. Almost the entire study group (91,3%) reported to brush less than twice per day, which is not the recommended frequency and less than half (44.3%) of the respondents had followed the correct duration for tooth brushing, i.e. 2 minutes or more (see table 3). Similar pattern was encountered for the hospital group where the majority of them (69.7%) brushed less than twice per day and 69.3% less than 2 minutes (see table 1).

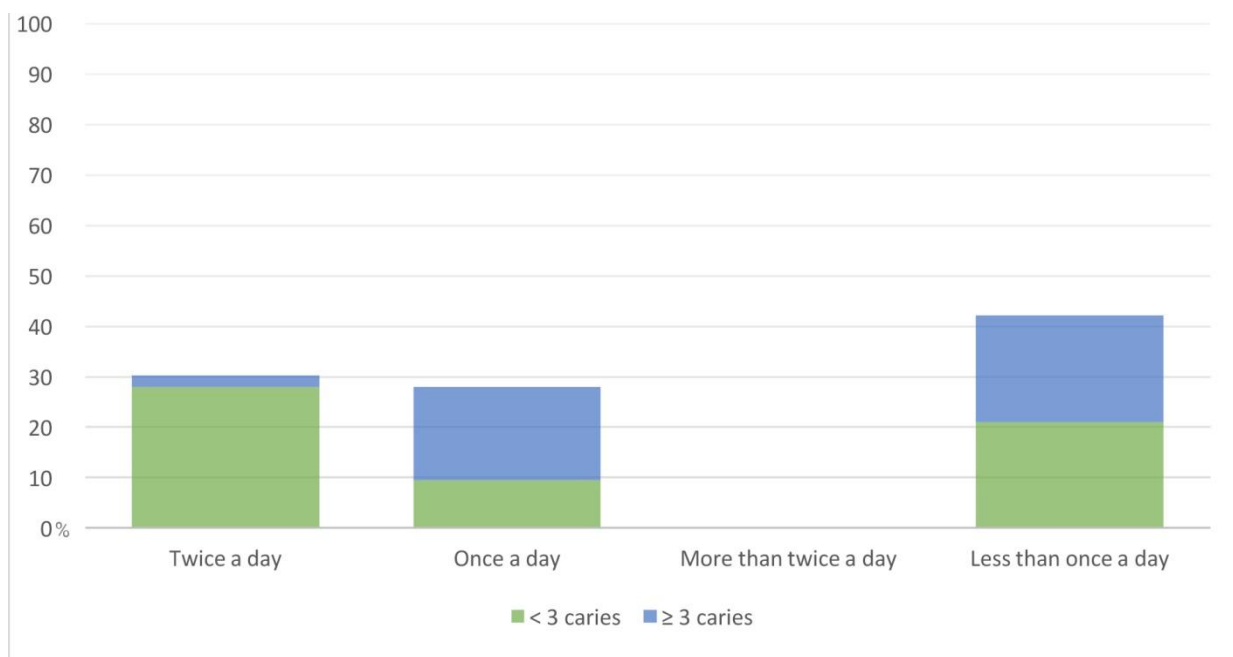


Table 5. Caries count in relation to tooth brushing frequency among hospital patients.

Compared to the hospital group the 12-year old children had lower knowledge regarding oral health, in particular regarding the risks correlated to the consumption of sweets. More than half of the respondents disagreed or were not aware of the fact that the consumption of sweets can cause tooth decay. In addition, more than one fourth of the class reported a daily intake of sweets. Together with urbanization and economic growth, the sugar availability is increasing constantly (23). Even though Andavadoaka is an isolated village, the availability of sugars is high. Sweets and candies had a very low price and were available in almost every stand/shop. The consumption of sugar canes is a common practice by many inhabitants in Andavadoaka. This is a source of sugar that is not regarded as a sugar-containing food, and could possibly go unnoticed in the findings of our questionnaire since people do not see it as sweets. It could be an ulterior factor that can influence the caries incidence of the locals (40).

It emerges from a previous study that in developed countries where the average sugar consumption is higher than the “safe” levels and where preventive programs are in place, sugar consumption is not associated with high or increasing caries prevalence. In developing societies, however, where sugar consumption is higher than the so-called “safe” levels and where there are no well-organized preventive programs, the caries prevalence is already high or increasing (23). In rural villages like Andavadoaka, there exist no active oral health prevention program and the increase of availability of sugars can affect the dental health of the population drastically, especially if the knowledge regarding the risks of consuming sugar-containing foods is low.

Good knowledge is important for prevention of oral disease (5), especially in a rural environment where the lack of the latter can lead to an increase in detrimental habits, like eating sweets, tobacco use and insufficient oral hygiene. These are factors that can worsen the oral health status of an individual and in some cases lead to more severe oral infections. Nevertheless, not only is education of importance, but also correct and proper hygiene habits. Oral health knowledge is a factor that contributes to good oral health but unless attitudes and habits are developed and put into practice, little can be improved as shown in a previous study (35).

Evidence has shown that strong knowledge of oral health demonstrates better oral care practices (5). It is therefore important to improve both knowledge and habits of the people, in particular of the younger generations. The question regarding source of information gives an understanding of the most effective communication channel for teaching proper oral health habits and knowledge. From our findings, it emerged that the most common source of information regarding oral health were the school and the hospital/dentist. The weight of primary schools in influencing children’s oral health behavior has previously been observed by Petersen (24). Schoolchildren spend plenty of time in school and can be reached in a state when their health habits are being formed. It is therefore important to instruct school personnel in teaching correct habits and practices. They are of fundamental importance in health communication and have the possibility to form many student’s behaviors in a cost effective way. The lackluster oral health of the children, both from a cariogenic perspective and for the gingival health, could be restored with correct oral hygiene practices and frequency. Individuals who hold favorable oral health related beliefs over time have better oral health in their later years than those who do not. This implies that changing beliefs should result in changes in behavior (35). There is a bilateral correlation between parents and children, it is important to instruct parents so that they can provide good oral habits to the children (41). At the same time, as previously reported in a recent Swedish study, children are also of particular importance having the potential to influence the behavior, attitude and knowledge of their parents (42).

It needs to be taken into account that the sample was not large and thus this is considered a pilot study. The results from this study may not reflect the actual status of other areas of Madagascar. However, it should be noted that the oral health data of rural areas in Madagascar is scarce and has

not been updated recently. For this reason this study provides useful and updated data of a specific region that has great influence on the surrounding population. This because the hospital, together with the dental staff, can further influence patients and local teachers thanks to the constant availability of trained personnel in the area. This could distribute the information more readily and make it more accessible.

High response rate was obtained among both the hospital group and the school children group. There was a low response loss among the total answers; 0.37% and 0.88% respectively. As reported in a previous study, this data collection method has certain limits. Over-reporting of dental knowledge, oral hygiene habits and the dental visiting pattern has to be assumed while under-reporting has to be considered for consumption of sweets (24). The hospital patients may have given answers that tend to overestimate their positive practices and underestimate their negative habits. Possibly, the environmental factors could lead to bias since the patients answered the questionnaire in the chair at the dental clinic. This could put pressure on the patient and influence their answers. The same is possible for the school children; despite being instructed of it not being so, they might have interpreted the questionnaire as a test and answered what they thought might be the correct answer rather than being objective in their judgment.

Conclusion

The rapid social development that is taking place in third world countries can lead to a tendency for the urban and the rural population to be exposed to more cariogenic foods. Products with fermentable sugars are also reaching rural populations and there are changes in the dietary habits of the locals. These changes are happening without having a major improvement of the knowledge regarding risks for the oral health and proper oral hygiene habits. In this study a lack of knowledge was observed regarding risks of consuming sweets among 12-years old schoolchildren and unsatisfactory brushing habits both in duration and frequency.

For a more efficient delivery of oral health care services a bigger focus has to be given on prevention of oral disease rather than only trying to improve the treatment of its consequences. Motivation to implement the instructions given regarding oral health and regular repetition over time are essential to promote oral health. This is of peculiar importance in rural areas where there are scarce resources and it is not always easy to get oral health care. Despite having some limitations the present study fills an epidemiological information void that can provide a basis for subsequent surveys or even be useful in planning a prevention plan at a local level that can be more specific for the rural population.

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