Oral health of Mauritanian children between 7 and 16 years old: a descriptive cross-sectional study

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Abstract

Introduction: Despite being preventable, dental caries (cavities) are one of the most predominant chronic diseases affecting children in Sub-Saharan Africa. Inequalities regarding access to care and other risk factors affect its prevalence. The objective of this study was to assess the incidence of dental caries and to verify the risk factors for dental caries according to the American Academy of Pediatric Dentistry (AAPD) table.

Methods: A descriptive cross-sectional study was conducted among children aged 7 to 16 who attended schools in two villages in Mauritania (Ouadane and Telaba). A questionnaire composed of three sections was provided to the included participants. The status of dental caries was assessed using the DMFT index and dental plaque was assessed using the Plaque Index.

Results: Our results showed a high occurrence rate of dental caries in our study population (only 10% had no carious lesions), a high plaque index (29.9%) as well as a high rate of pain among the children (48.7%). We found that 79.2% of children were at high risk of dental decay.

Discussion: Dental caries remain a real health problem for the African population today. This study provides more epidemiological elements concerning the pathology in Mauritania and shows that its commonness is much higher than that seen in developed countries. Risk factors such as diet and oral hygiene could play a key role in the onset of dental decay in this population.

Keywords:
Oral health
dental caries
children
prevalence
risk factors
Mauritania

Résumé

Etat de santé orale des enfants mauritaniens âgés de 7 à 16 ans : première étude transversale

Introduction : Bien qu'elles soient évitables, les caries dentaires sont l'une des maladies chroniques les plus répandues chez les enfants d'Afrique subsaharienne. Les inégalités d'accès aux soins et d'autres facteurs de risque affectent sa prévalence. L'objectif de cette étude était d'évaluer l'incidence des caries dentaires et de vérifier les facteurs de risque des caries dentaires selon le tableau de l'American Academy of Pediatric Dentistry (AAPD).

Méthodes : Une étude transversale descriptive a été menée auprès d'enfants âgés de 7 à 16 ans fréquentant les écoles de deux villages de Mauritanie (Ouadane et Télaba). Un questionnaire composé de trois sections a été fourni aux participants inclus. L'état des caries dentaires a été évalué à l'aide de l'indice DMFT et la plaque dentaire a été évaluée à l'aide de l'indice de Plaque.

Résultats : Nos résultats ont montré un taux élevé de caries dentaires dans notre population d'étude (seulement 10% n'avaient pas de lésions carieuses), un indice de plaque élevé (29,9%) ainsi qu'un taux élevé de douleur parmi les enfants (48,7%). Nous avons constaté que 79,2% des enfants présentaient un risque élevé de carie dentaire.

Mots-clés:
Santé orale,
caries
enfants
prévalence
facteurs de risque
Mauritanie

Discussion : La carie dentaire reste aujourd'hui un véritable problème de santé pour la population africaine. Cette étude apporte plus d'éléments épidémiologiques sur cette pathologie en Mauritanie et montre que sa fréquence est beaucoup plus élevée que celle observée dans les pays développés. Les facteurs de risque tels que l'alimentation et l'hygiène bucco-dentaire pourraient jouer un rôle-clé dans l'apparition de la carie dentaire dans cette population.

Introduction

Oral diseases such as dental caries (cavities), periodontopathies and cancer of the oral cavity and pharynx are an ongoing global public health concern [1]. The effects of oral diseases are costly and can cause pain, suffering, dysfunction and low quality of life to a population. Associated treatments represent between 5 and 10% of health expenses in industrialized countries, however they are not available to many patients from developing countries[1]. Most of these diseases are largely avoidable or can be treated at an early stage and oral healthcare practices oriented towards primary health care and prevention should be targeted, however, this is rarely the case in developing countries [2, 3].

Dental caries are the most common multifactorial disease in children and have a considerable negative impact on daily life. In 2004, the WHO (World Health Organization) estimated the number of people with dental WHO to be 5 million [1].

This phenomenon usually affects children from disadvantaged populations who have little to no access to care[4-6]. In Africa particularly, there is a strong social gradient leading to inequalities when it comes to access to care [5]. This is especially true since the number of dentists per capita is approximately 1 for 150,000 habitants compared to 1 for 2,000 residents in most industrialized countries [7]. Relating to children, little data is available on the link between dental caries and the social and family environment of African children.

In Mauritania, the growth of disadvantaged neighborhoods in urban areas and the existence of nomadic populations are big challenges for the healthcare system. The country has developed multiple health policies since its independence in 1958, however, despite these efforts, many problems have not been resolved. The main challenge that the health sector in the country faces is developing strategies that could maximize access to care, while also acknowledging that access to established structures will always be limited mainly because of the geographic distribution of the population and the existence of certain forms of nomadism [8].

Since the 1960s, Mauritania has implemented a public industrial and commercial system responsible for managing their Social Security Plan (CNSS); however, the majority of Mauritanians are not covered by any insurance [9]. Therefore, this general context and lack of national data led us to analyze the state of oral health of Mauritanian children between 7 and 16 years old.

The objective of this study was to assess the prevalence of dental caries and to confirm the already known risk factors for dental caries according to the table of the American Academy of Pediatric Dentistry (AAPD).

Methods

Study design

A cross-sectional survey was conducted between February 22nd and March 8th, 2020, in Mauritania.

Study setting and population

The target population was children aged 7 to 16 who attended schools in Ouadane and Telaba, in the desert region of central

Mauritania. The selection of subjects for the study was performed by random draw.

The selection of participating children was made on a voluntary basis under difficult examination conditions. The children were subsequently given oral health education, advice and referral instructions if indicated.

Variables

Variables included socio-demographic data. We based our questionnaire on the WHO format which collects information about sex, age, year of study and place of residence [urban, suburban or rural).

Concerning the oral examination, we evaluated three parameters: pain, the "Teeth that are decayed (D), missing due to decay (M) and filled (F)" (DMFT) index and the plaque index (PI). Pain was assessed as a standard "yes" or "no" response. The DMFT index and the PI were assessed via clinical examination. It is worth noting that the DMFT maximum score is 28 (when the third molars are not considered) and it reflects the severity of the carious lesion.

The index counts the number of decayed teeth absent due to decay and/or filled in primary dentition. The maximum score is 20 [10]. The PI measures the quantity of plaque near the marginal gingiva. The scores range from 0 to 3 for each individual tooth [11]. The examination of dental plaque is carried out on the four surfaces of teeth numbers 16-12-24-36-32-44.

The average score from all teeth therefore provided a general score that we calculated as follows: PI-0 = Excellent: (0); PI-1 = Good: (0.1-0.9), PI-2 = Bad: (1.0-1.9), and PI-3 = Poor: (2.0-3.0).

The examinations of caries risk factors associated with oral decay was carried out based on the risk classification from the AAPD [12].

We identified three categories of questions: biological, protective, and clinical factors.

Concerning the biological factors, we questioned the children on their living conditions, their parents' profession, and the number of meals they ate per day.

Regarding protective factors, the children answered questions about fluoridation of any water consumed, the frequency of tooth brushing, the use of individual prophylaxis accessories such as interdental brushes or dental floss, the use of fluoridated toothpaste, if they were taught any brushing techniques and by whom as well as questions about their visits to the dentist.

Lastly, we identified the clinical factors concerning interproximal lesions, white spot lesions and/or enamel defects (including amelogenesis and Molar Incisor Hypo-mineralization (MIH)) and defective restorations. Once these different factors were studied, we assigned a risk level to each child (high, medium, and low).

Data resource and measurement

Data collection tool

We designed a questionnaire with three sections: socio-demographic questions, oral examination and risk factors for dental caries (see Appendix 1).

Data collection

Demographic variables such sex, age, year of study and place of residence [urban, suburban or rural) were collected. Also, the data collection tool, collected caries risk factors: biological, protective and clinical factors. Responses were collected during an interview carried out by an investigator with the help of a resident of each of the villages who served as an interpreter.

Concerning the oral examination, we evaluated three parameters: pain, the 'Teeth that

are decayed (D), missing due to decay (M) and filled (F)' (DMFT) index and the Plaque Index (PI). The clinical examination necessary to calculate the various scores provided by the two examiners was carried out either standing in the schoolyard or on a classroom table.

Sample size

This is a preliminary study, we did not know how many children we would see in the desert of Mauritania. The sample size was not calculated.

Data analysis

Analysis was performed with the Stata® Software Version 16.1.

Qualitative variables were compared by a Chi-square test, while the qualitative variables were compared by a Mann-Whitney test. The significance threshold was set at 5% for all statistical tests. Variables with missing data were discarded from the analysis.

Ethical consideration

The study was approved by the Ministry of Health and regulatory agencies and were implemented in accordance with provisions of the Declaration of Helsinki.

No personally identifiable information was collected, and confidentiality was ensured. Written informed consent was obtained from the children's guardian/parents and assent was sought from the children. All information was treated confidentially.

Results

Participants and descriptive data

In total, 79 surveys were completed, composing of 33 girls [41.8%] and 46 boys [58.2%] living in the two rural areas of Mauritania which were eligible to be included in this study. The average age of the study population was 12 years old.

Main Results

Regarding dental pain, 48.7% of respondents had dental pain. There was no reported difference between genders (p = 0.79).

The PI distribution was significantly different by gender [p = 0.02]. Girls had a lower plaque index than boys. It was also noted that 14.3% of the population had PI-0 and 29.9% of the population had PI-3.

For PI-0, 72.7% brushed their teeth daily, while for PI-3, around 60% did not brush their teeth and around 35% brushed their teeth regularly. The PI was positively related to brushing frequency (p = 0.0001).

We found that 10% of children had no carious lesions, 22% had a maximum of four carious lesions (dmf+DMF) and 1% had 16 carious lesions as shown in Figure 1.

At 7 years old, the average dmf of the study population was 5.5 and gradually decreased until age 13 (dmf = 0) with the exception of children at 9 years old who presented a higher average score (dmf = 3) than those aged 8 years old (dmf = 2).

The type of drink consumed by the children was not different by gender either (p = 0.17). It should be noted that the preferred drink of respondents was camel milk. Only 6.9% of the study population drank only water between meals. The frequency of brushing was not different according to sex (p = 0.07) however, nearly half of the boys brushed their teeth "sometimes" and a third of the boys never brushed their teeth.

Of all the participants, 66% said they had received instruction about tooth brushing. The presence or lack of oral hygiene education was not different according to gender (p = 0.5). Visits to a dentist differed according to gender (p = 0.03). Indeed, 93.7% of boys had never had a visit to the dentist compared to 73.10% of girls. Children who had never had a dental consultation represented 84.5%

Figure 1:
Histogram of the mean temporary decayed missing or filled (dmf)/ permanent decayed missing or filled (DMF) index amongst children who attended schools in Ouadane and Telaba in Mauritania
DMFT: *Permanent Decayed, Missing due to decay or Filled Teeth,*
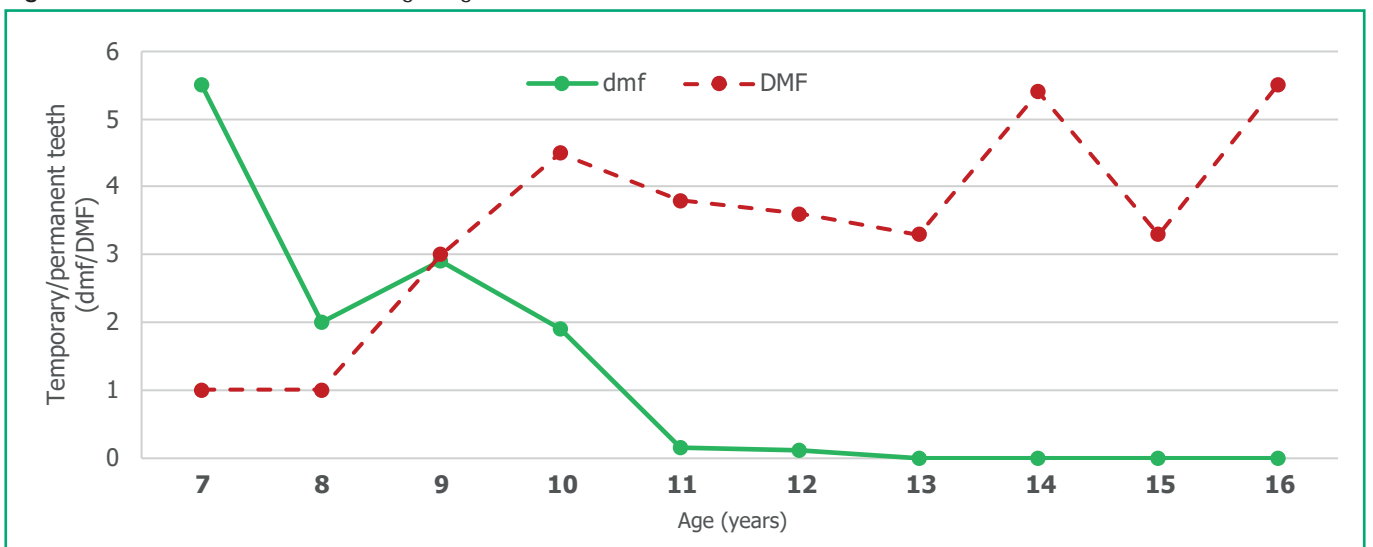**DMFT**: *Temporary Decayed, Missing due to decay or Filled Teeth*
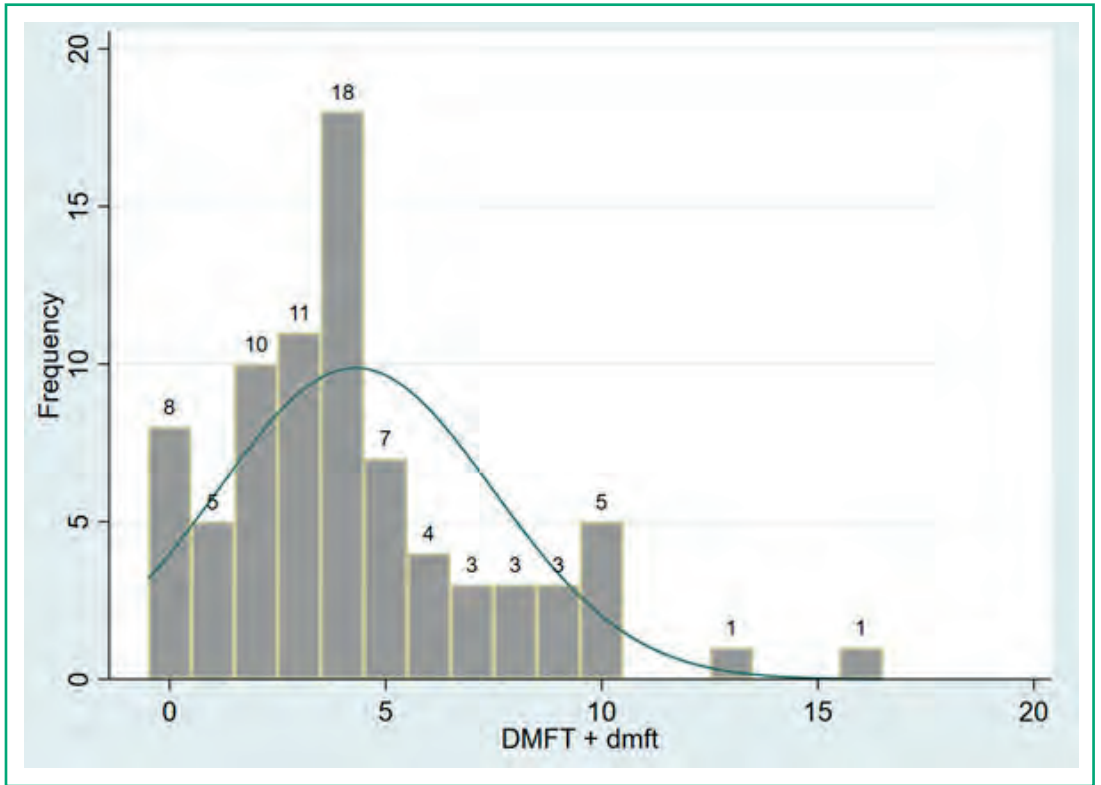
of the cohort. Lastly, we found that 79.2% (n = 61) in the study population had a high risk of caries (p = 0.32). There was no significant difference between the genders of the children. Only 7.8% of the population had a low risk of caries.

Other analyses

Conversely, the DMF was 1 from the age of 7 and reached a peak at 10 years with a DMF value between 4 and 5.

Between 14 and 16 years old, the DMF fluctuated between 4 and 6 (Figure 2).

Figure 2: The dmf/DMF curve according to age of children who went to schools in Ouadane and Telaba in Mauritania

DMF: *Permanent Decayed, Missing due to decay or Filled*, **DMF**: *Temporary Decayed, Missing due to decay or Filled*

We also found an increase in the DMF commensurate with the increase in the PI. The average DMF for a PI-0 was equal to 2.36, while for an PI-3, the DMF was equal to 5.17 (Figure 3).

Regarding risk factors, we noted that the parents of 61% of these children had professional work, whereas 16% were unemployed. Only 1.5% of the cohorts had a snack in the morning and 21.2% of them had lunch. Most children ate only one meal in the evening. There was no significant difference between the eating habits of the boys or girls in our study (p = 0.08) (Figure 4).

Discussion

In previous studies, poor oral hygiene behavior has been observed among people living in rural areas and the prevalence of early childhood caries is higher in rural areas than that of urban zones [13, 14].
Additionally, other studies, CHEN and GABER et al (2017) also confirm that the prevalence of poor oral health-related quality of life (OHRQoL) is statistically higher in rural areas than in urban areas [15, 16]. In this study, almost half the population had dental pain, which could clearly show the need for care in areas where dental surgeons are scarce.

Figure 3:
Average Permanent Decayed, Missing due to decay and Filled Teeth (DMFT) according to the plaque index (PI) of children who attended schools in Ouadane and Telaba in Mauritania
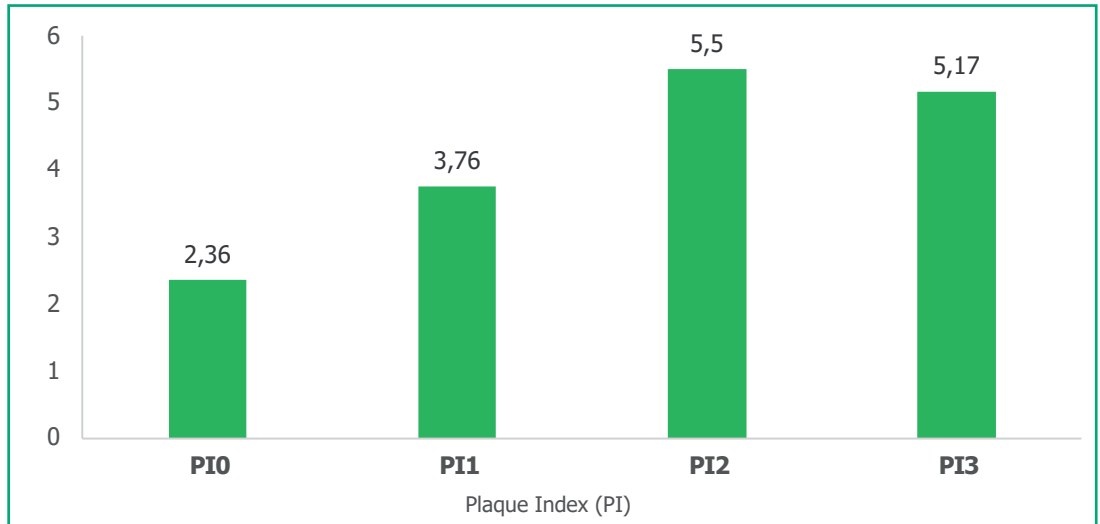
DMFT: *Permanent teeth that are Decayed, Missing due to Decay or Filled,*
PI: *Plaque Index*

Figure 4:
Meal frequency of children who attended schools in Ouadane and Telaba in Mauritania according to sex
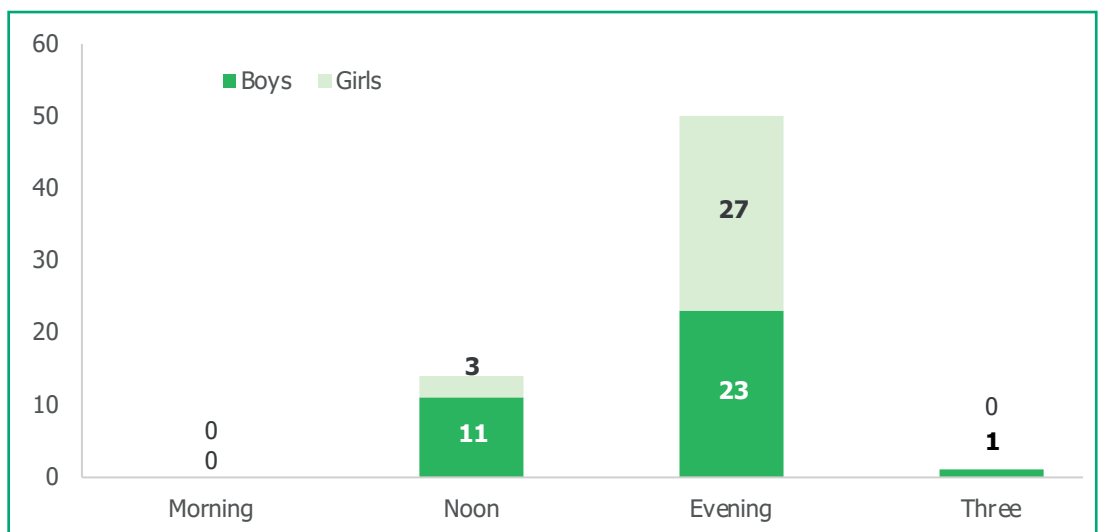
It may also show that respondents with dental pain could have been more interested in participating in the study to be examined and treated.

According to WHO data regarding cavity experience, Mauritania is located in a geographical area where the prevalence of caries should be low (between 1.2 and 2.6) [17]. These results differ from our findings where 10% of the children had no carious lesion, 22% had a maximum of four (dmf+DMF) and 1% had 16 carious lesions. Moreover, from the age of 10, the dmf+DMF was between 4 and 5. Therefore, it could be worth determining whether the data from the WHO underestimated the prevalence of cavities in Mauritania or in Africa in general.

The evaluation of the PI demonstrated a significant difference between the genders of the children. Similar findings in TRAMINI' study were found in developed countries that showed girls very often have a lower PI than boys [18]. On the contrary, the DMFT index was comparable for both girls and boys. This could have been due to the fact that the second molars appear at a younger age for the girls as they enter into puberty earlier and that earlier development including earlier tooth eruption are found in girls [19-21].

Girls often have better oral hygiene and earlier appearance of adult teeth compared to boys. The DMFT index could therefore be equally balanced between the two sexes [18].

In addition, we noted that in our study population, 85.7% had a PI different from 0 (PI-0 = 14.3%). This also could indicate the need for oral decay prevention in this region of Mauritania.

Only 6.9% of the children answered that the only drink they consume between meals is water. An explanation to this could be the daily consumption of camel milk among the nomads and the rural population, which is a tradition that has been rooted in sub-Saharan Africa for many generations. It is also worth noting that there is also a tendency to add a large amount of sugar to this milk for children to drink and consuming highly sweetened tea at any time of the day is also commonplace.

Tooth brushing in the Mauritanian desert is done with the help of the Siwak. It is a chewing stick obtained from the stem, twig, and root of the Arak tree (Salvadora persica) and is used for teeth and oral cavity cleaning. Studies have shown it is a useful tool against dental plaque, has antibacterial properties and possesses antifungal and antioxidant properties [22-26].

In our study, we observed a significant difference (p = 0.001) between the PI and the frequency of brushing with a Siwak. As a result, those using a Siwak had a lower PI although there is no fluoride input with the use of one. Our results also showed an increase of the DMF commensurate with an increase in the PI. Nevertheless, children with a PI-0 had an average DMFT of 2.36. This may be because the children used a Siwak on the vestibular surfaces of the teeth. Conversely, occlusal brushing was hardly ever performed. This could show that without fluoride intake (topical or systemic), simple mechanical brushing is not enough to fight against the decay process [27]. Indeed, the combination of education and promotion of oral health care, and the application of fluoride in the form of varnishes or the use of toothpaste containing fluoride are the most effective ways to fight against the appearance of dental caries [27].

Lastly, our study made it possible to analyze a juvenile population and to confirm the need for oral health care in a rural area of Mauritania. In fact, 79.2% of the population had a high risk of caries that could be explained by the data, namely few protective factors [such as brushing, fluoride and education) as well as a large number of triggering factors, particularly with food or drinks in which sugar content is high. Other studies suggest that the prevalence and appearance of dental

caries has increased over time as the sugar consumption by locals increased [28]. A clear relationship between the level of free sugar intake and the development of dental caries has already been demonstrated [29].

Limitations

A limitation of this study was that it was conducted in a rural setting where the local population spoke their own dialect. An interpreter was used; however, this could have influenced the children's answers or may have asked the questions incorrectly. Another limitation was that our findings may not have been representative of the general population of the country because the inclusion of the subjects was made on a voluntary basis that could have created a differential selection bias. Lastly, the lack of subjects and the large age range observed may have created a representativeness bias.

Conclusion

Despite the preventable nature of dental caries, they remain a public health concern for the African population today.
This study provides more epidemiological elements concerning this pathology in Mauritania and shows that its prevalence is much higher than in developed countries. Risk factors such as diet and tooth brushing could play a key role in the onset and prevalence of dental caries in this population.

Appendix 1

Partie 1

Numéro anonymat.......................... Date............... Sexe.............. Age.............. Année d'étude ....

Localisation (urbain, péri-urbain, rural) ....

Partie 2

1. Présence de douleurs dentaires :   Oui ☐   Non ☐

2. Evaluation de l'état de santé orale des enfants (OMS) :

Dentition status by tooth surface

Primary teeth	Permanent teeth
	Status
A	0=Sound
B	1=Caries
C	2=Filled w/caries
D	3=Filled, no caries
E	4=Missing due to caries
-	5=Missing for another reason
F	6=Fissure sealant
G	7=Fix dental prosthesis/crown, abutment, veneer
-	8=Unerupted
-	9=Not recorded

3. Indice de plaque :

The Plaque Index System
Excellent : 0   Good : 0.1-0.9   Fair : 1.0-1.9   Poor : 2.0-3.0
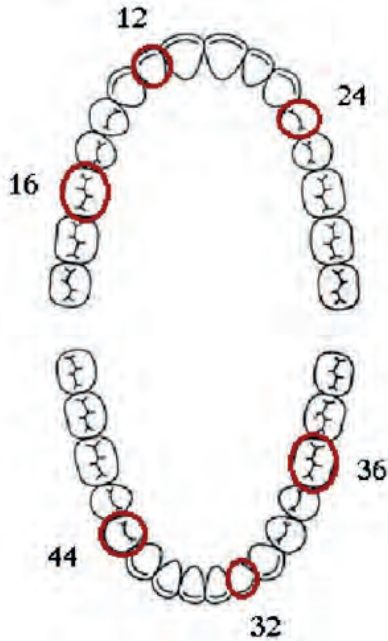
Silness-Loe Plaque Index	Criteria
0	Absence of microbial plaque
1	Thin film of microbial plaque along the free gingival margin
2	Moderate accumulation with plaque in the sulcus
3	Large amount of plaque in sulcus or pocket along the free gingiva margin

Partie 3
Facteurs de risque carieux

1. Les facteurs biologiques

Lieu d'habitation ....

Travail du père ....

Travail de la mère ....

Fréquence des repas et prises alimentaires par jour ....

2. Les facteurs protecteurs

Prise d'eau fluoré ....

Fréquence du brossage ....

Accessoires de brossage ....

Utilisation de dentifrice fluoré ....

Qui a enseigné à l'hygiène bucco-dentaire ....

Dernière visite chez un dentiste ....

3. Les facteurs cliniques

Présence de lésions interproximales ....

Présence de lésions "white spot" ou défauts amélaires (amélogénèse, MIH...) ....

Présence de restaurations défectueuses ....

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