Dental Caries as a Predictive Factor for Childhood Obesity

Rhea Colvin [a], Patrick Bontems [b], Emmanuel Lenga [c], Amir Shayegan [d]

[a] CHU Marie Curie, Department of Emergency Medicine, Lodelinsart, Belgium
[b] Queen Fabiola Children's University Hospital, department of Paediatric Gastroenterology, Brussels, Belgium
[c] Chirec site Braine l'Alleud, Department of Paediatrics, Braine l'Alleud, Belgium
[d] Queen Fabiola Children's University Hospital, department of Paediatric Dentistry and Orthodontics, Brussels, Belgium

rhea.colvin@gmail.com

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Abstract

Introduction
The objective of this study is to investigate the relation between dental caries and childhood obesity, with sugar intake suspected as a common risk factor.

Methods
We developed a cohort prospective study, of 5-18 year olds with a dental consultation at the HUDERF in Brussels, Belgium between January 2018-March 2018.

We collected data regarding BMI, diet, dental scores, exercise, parents' BMI and education, socioeconomic status. These were considered potential confounding factors related to dental caries and childhood obesity.

Results
216 children were asked to participate in this study and 200 participated. 116 participants were female and 84 were male. According to children's BMI, 2% were underweight, 57% had a normal weight, 25% were overweight and 16% were obese. Mean dfm-t and DFM-t were 4 and 1.46 respectively.

Conclusion
We did not find a statistically significant association between dental caries and BMI. However, we did find a higher prevalence of overweight and obesity amongst children with a dental appointment compared to the general population. A school based longitudinal study should be performed to further investigate these findings.

Introduction

The primary objective of this study is to investigate the potential association between childhood obesity and dental caries, with the hypothesis that identifying a link between these two conditions may facilitate earlier diagnosis and intervention.

Currently there is not a clear consensus on the relationship between dental caries and a child's BMI (1). This study is based in Belgium and while other European and North American studies have shown inconclusive findings, there are no Belgian publications including younger children (2,3).

The prevalence of obesity has increased significantly over the past three decades, both in adults and children (4). Obesity is associated with an elevated risk of numerous comorbidities, including cardiovascular diseases, metabolic disorders, musculoskeletal conditions, cancer, respiratory diseases, and infectious diseases. Approximately 79% of obese adolescents remain obese in adulthood, and between 62% and 90% of obese adolescents were obese during childhood (5). To date, no country has reversed its obesity epidemic (6).

In adults, obesity is defined as a Body Mass Index (BMI) above 30 kg/m^2 and overweight as a BMI between 25 and 30 kg/m2. In children, BMI varies according to age, and childhood obesity is defined using age and sex specific BMI-for-age percentiles (or z-scores), typically derived from growth reference tables such as those from the World Health Organization (WHO), the Centres for Disease Control and Prevention (CDC), or the International Obesity Task Force (IOTF)

Since 1975 the global prevalence of obesity has tripled (7). In Belgium 3.9-4.9% of school-aged children are obese according to the European Childhood Obesity Group (ECOG) (8). Furthermore up to 10% of children 7-9 years old are obese in Europe according to the European Childhood Obesity Surveillance Initiative (COSI) in 2024.

Risk factors for childhood obesity are currently a lower socio-economic status, obese parents, parents' ethnicity, a high-sugar diet in particular sugary beverages, the amount of physical exercise, the number of hours spent watching TV (9,10,11,12,13,14).

A high-sugar diet is not only a significant contributor to childhood obesity but also plays a crucial role in the development of dental caries. Dental caries were the most prevalent condition included in the Global Burden of Disease Study in 2015 (15). Moreover, dental procedures remain the leading cause of school absenteeism (16). The risk factors for dental caries include poor oral hygiene, reduced salivary flow, genetic predisposition, inadequate fluoride exposure, and low salivary immunoglobulin levels (17,18).

Since 1990, there has been a notable improvement in dental health among children, as evidenced by a decline in the prevalence

of dental caries and an increase in the proportion of caries-free children (19). However dental decay still represents the main cause of hospital admissions for children 5-9 years old in England and the number of tooth extractions under general anaesthesia has increased (20). In Europe, the average number of decayed teeth among 12-year-olds decreased from 3.0 in 1990 to 1.8 in 2015 (21).

Methods

Study design & setting

This was a prospective, cohort study taking place between January 2018 – April 2018.

All participants were recruited during their dental appointment at Queen Fabiola Children University Hospital (HUDERF). HUDERF's Ethics Committee approved this study in January 2018, under the number CEH nº07/18.

Participants

The criteria for participation were any child born between 2000-2012, female or male, with a dental appointment between January 2018 and April 2018, if both parents and child consented. All children meeting these criteria, were asked to participate in this study, after the aim of this study was briefly explained to both parent and child by the author conducting this project. The parents were then asked to sign an informed consent form.

All children from the dental office were asked to participate. During the dental consult, the author would complete a questionnaire with the parent or guardian.

The exclusion criteria for the study were, any child with a specific diet related to medical problems. Any child having had or who currently had orthodontics was excluded, due to of the increased risk of dental caries amongst orthodontics wearers and the specific diet they are required to follow. Any patients with buccodental malformations were also excluded. No children undergoing general anaesthesia for dental treatment were included in this study.

When a language barrier existed, if it was possible to ask via a translator, the child was accepted into the study, but when there was no translator available, that child was excluded from the study.

Variables

Through a questionnaire completed by the author of this paper the following information was obtained: number of toothbrushes per day, age of first toothbrush, number of sweet snacks of food consumed per day, number of savoury snacks consumed per week, hours of physical exercise per week, drinks consumed, child's country of birth, child's postcode, mother's height, weight, country of birth, ethnicity, highest diploma, father's height, weight, country of birth, ethnicity, highest diploma. In order to determine socioeconomic status, the patients' postcodes were classed into their respective clusters using Belfius' socioeconomic communes typology 2017, based on 150 socioeconomic indicators.

Dental examination

Through a dental examination dfm-t scores (decayed, filled, missing deciduous teeth) and DFM-T scores (decayed, filled, missing permanent teeth) were calculated for each participant at the time of visit, by dentists, using a blunt probe. The dentist would give the number of teeth that currently had decay, the number of teeth with a filling (filled), the number of teeth missing, for both lacteal and permanent teeth. In order to assess if the missing teeth were absent through decay or by naturally falling out, the child's medical record was consulted. If the information was missing the parent would be asked.

BMI Calculation

The participants' weight and height were measured by the author. The child's weight was given in kilograms, using a Seca digital, 0.1kg precision scale. The child wore light clothing without shoes. The child's height was measured in centimetres, using a Seca non-digital, 0.1cm precision tape measure. The author measured and weighed all participants in this study, with the same set of scales and tape measure. With the weight and height, the child's BMI was calculated (weight (kg)/(height (m)^2), and according to WHO's z-score BMI charts for age, the participant was put into one of the following categories : thinness (standard deviation, SD, -2), normal weight (SD 0), overweight (SD 1), obese (SD 2). A standard deviation of +2 is approximately equivalent to a BMI of 30 kg/m2 at the age of 18.

Data sources

All data was obtained during the participant's dental appointment, by the author directly asking the parents in agreement with the child. Emphasis was put on the child accepting to participate and whether the child agreed with his or her parent's answer.

Bias

In order to limit bias, the author did not pre-assess possible participants with dental appointments, i.e. guess the child's BMI based on their appearance. Nor were the participants chosen because of their dental scores. All of this information was obtained immediately after obtaining parental consent during the child's dental appointment.

All participants were asked the same questions regarding the consumption habits, in the same order, by the same investigator, as an open question. In order to clarify what a portion was, the author, would quantify how many, and what size or each food category was eaten.

Study size

The study size was originally calculated using G*power 3.1.9.3 software (Institut für Experimentelle Psychologie, Heinrich-Heine-Universität, Düsseldorf, Germany). The number of participants needed for significance was calculated, with alpha = 0.05.

Statistical methods

Data was obtained via questionnaire and by consulting the participants' electronical medical file (bDoc), entered into RedCap, a secure, internet-based, data collection program, with its domain at HUDERF.

From RedCap, participants data was exported into SPSS 25 (IBM, Armonk, USA) for analytical statistics. Statistical tests were performed using chi-squared tests and one-way ANOVA. The significance level was set at $P<0.05$.

Results

Two hundred children accepted to participate in this study. Out of the 216 that were asked, 10 children did not fit inclusion criteria because of their specific dietary needs, 6 refused - 2 teenage girls refused because they did not want to be weighed, 4 sets of parents refused.

116 participants were female (58%), and 84 were male (42%).

2% of participants classed as underweight. 57% had a normal BMI. 25% were overweight and 16% were obese, according to WHO's z-score BMI-for-age classification tables.

TABLE 1: Relationship of different characteristics with BMI.

	BMI
Dental scores deciduous teeth	No significant difference (p>0.05)
Dental scores permanent teeth	No significant difference (p>0.05)
Age of first dental caries	No significant difference (p>0.05)
Sweet snacking	No significant difference (p>0.05)
Savoury snacking	Significant difference (p=0.043)
Drinking habits	No significant difference (p>0.05)
Physical exercise	No significant difference (p>0.05)
Mother's BMI	Significant difference (p=0.026)
Father's BMI	Significant difference (p=0.002)
Mother's education	No significant difference (p>0.05)
Father's education	No significant difference (p>0.05)
Socioeconomic cluster	No significant difference (p>0.05)

There was no significant difference for the number of caries between male and female participants - neither for lacteal teeth (p = 0.158) nor for permanent teeth (p = 0.065), nor was there a significant difference in BMIs (p = 0.696).

The youngest participants were 5 years old. The eldest were 16 years old. The mean was 9.4.

Child's BMI and dental scores for deciduous teeth (dfm-t)

46 participants were excluded, 45 participants did not have any lacteal teeth left, and 1 participant was considered an outlier, with 17 dental caries (baby bottle tooth decay). There was no significant difference in deciduous dental scores between BMI groups (p>0.05) (Table 1).

Child's BMI and dental scores for permanent teeth (DFM-t)

There was no significant difference in definitive dental scores between BMI groups (p>0.05).

Child's BMI and age of first dental caries

There was no significant difference between BMI groups, and age of first dental caries. (p>0.05).

Child's BMI and sweet snacking (biscuits, cake, candy, chocolate, cookies, waffles) (Table 2).

There was found to be no significant difference between BMI groups for the number of sweet snacks eaten per day (p>0.05).

21.5% ate sweet snacks less than once a day.

18% ate sweet snacks once a day.

33% ate sweet snacks twice a day.

27.5% ate sweet snacks more than twice a day.

Child's BMI and savoury snacking (Table 3)

There was found to be a significant difference in savoury snacking between BMI groups (p=0.043).

36% of participants ate savoury snacks once a week or less.

29.5% of participants ate savoury snacks once a week

31% ate savoury snacks twice a week

3.5% ate savoury snacks more than twice a week.

Child's BMI and drinking habits (Table 4)

There is not a statistically significant difference of the consumption of any drink between BMI classes (p>0.05). These numbers represent the number of participants answering yes to the consumption of each of these drinks on a regular basis, defined as more than twice a week.

99% of participants drink water on a daily basis.

73% drink fresh unsweetened juice regularly

57.5% drink sweetened fruit juice (Oasis, Caprisun, cordials)

50.5% drink non-diet soda regularly

7% drink diet soda regularly

77% drink plain milk regularly

54.5% drink milk regularly.

Child's BMI and physical exercise (Table 5)

We only had information for 174 participants.

There was not found to be a significant difference in hours of physical exercise (PE) reported between BMI groups. Amongst all participants 54% did not do any PE regularly.

22.4% did 1-2 hours/week.

14.4% did 3-4 hours/week.

9.2% did 5 or more hours of PE/week.

These values exclude the number of hours of PE during school, we chose to exclude school PE hours because of variability in the number of hours and the quality of PE classes between schools. There was not found to be a significant difference between BMI groups (p>0.05).

Mother's BMI (Table 6)

There was found to be a significant difference between child's BMI groups and mothers' BMI (p=0.026).

1.5% of the mother's BMI were unknown.

33% of the mothers had a normal BMI.

34.5% of the mothers were overweight.

31% of the mothers were obese.

Amongst overweight children, 28% had overweight mothers and 38% had obese mothers. 66% had overweight or obese mothers.

Amongst obese children, 40.6% had overweight mothers, 43.8% had obese mothers and 84.4% had overweight or obese mothers.

Father's BMI (Table 7)

There was found to be a statistically significant difference in father's BMIs between child's BMI groups (p=0.002).

Amongst overweight children, 42% had an overweight father, 19.5% had an obese father, 61.5% had an overweight or obese father.

Amongst obese children, 43.8% had an overweight father, 37.5% had an obese father, 81.3% had an overweight or obese father.

TABLE 2: Child's BMI and sweet snacking.

		Sweet Snacking habits (biscuits, cake, candy, chocolate, cookies, waffles)				
		Less than once/day	Once/day	Twice/day	More than twice/day	TOTAL
Child's BMI	Thinness	0	0	2 (50%)	2 (50%)	4 (100%)
	Normal weight	27 (23.7%)	17 (14.9%)	40 (35%)	30 (26.3%)	114 (100%)
	Overweight	6 (12%)	11 (22%)	19 (38%)	14 (28%)	50 (100%)
	Obese	10 (31.3%)	8 (25%)	5 (15.6%)	9 (28%)	32 (100%)
	TOTAL	**43 (21.5%)**	**36 (18%)**	**66 (33%)**	**55 (27.5%)**	**200 (100%)**

TABLE 3: Child's BMI and savoury snacking.

		Savory snacking (chips, savoury biscuits, crackers, peanuts, nuts)/week				
		Never or <once/week	Once/week	Twice/week	>Twice/week	TOTAL
Child's BMI	Thinness	2 (50%)	1 (25%)	1 (25%)	0	4 (100%)
	Normal weight	38 (33.3%)	37 (32.5%)	38 (33.3%)	1 (0.9%)	114 (100%)
	Overweight	20 (40%)	17 (34%)	10 (20%)	3 (6%)	50 (100%)
	Obese	12 (37.5%)	4 (12.5%)	13 (40.6%)	3 (9.4%)	32 (100%)
	TOTAL	**72 (36%)**	**59 (29.5%)**	**62 (31%)**	**7 (3.5%)**	**200 (100%)**

TABLE 4: Child's BMI and drinking habits. A: numbers, B: percentages.

A

		Water	Juice	Sweetened juice	Soda	Diet soda	Milk	Sweetened milk
Child's BMI	Thinness	4	3	3	3	0	3	2
	Normal weight	113	86	65	55	6	88	64
	Overweight	49	32	29	25	6	36	27
	Obese	32	25	18	18	2	27	16
	TOTAL	**198 (99%)**	**146 (73%)**	**115 (57.5%)**	**101 (50.5%)**	**14 (7%)**	**154 (77%)**	**109 (54.5%)**

B

		Water	Juice	Sweetened juice	Soda	Diet soda	Milk	Sweetened milk
Child's BMI	Thinness	100%	75%	75%	75%	0%	75%	50%
	Normal weight	99.1%	75.4%	57%	48.2%	0%	77.2%	56.1%
	Overweight	98%	64%	58%	50%	12%	72%	54%
	Obese	100%	78.1%	56.3%	56.3%	6.3%	84.4%	50%

TABLE 5: Child's BMI and physical exercise.

		Hours of exercise/week				
		0 hours	1-2 hours	3-4 hours	≥5hours	**MEAN**
Child's BMI	Thinness	2	2	0	0	**0.75**
	Normal weight	52	23	18	5	**1.33**
	Overweight	26	7	4	6	**1.69**
	Obese	14	7	3	5	**1.75**
	TOTAL	**94 (54%)**	**39 (22.4%)**	**25 (14.4%)**	**16 (9.2%)**	**174 (100%)**

TABLE 6: Child's BMI and sweet snacking.

		Mother's BMI			
		Unknown	Normal	Overweight	Obese
Child's BMI	Thinness	0	2 (50%)	2 (50%)	0
	Normal weight	1 (0.9%)	44 (38.6%)	40 (35.1%)	29 (25.4%)
	Overweight	1 (2%)	16 (32%)	14 (28%)	19 (38%)
	Obese	1 (3.1%)	4 (12.5%)	13 (40.6%)	14 (43.8%)
	TOTAL	**3 (1.5%)**	**66 (33%)**	**69 (34.5%)**	**62 (31%)**

TABLE 7: Child's BMI and father's BMI.

		Father's BMI				
		Unknown	Underweight	Normal	Overweight	Obese
Child's BMI	Thinness	2 (50%)	0	2 (50%)	0	0
	Normal	6 (5.3%)	2 (1.8%)	43 (37.7%)	46 (40.4%)	17 (14.9%)
	Overweight	3 (6%)	0	13 (26%)	24 (48%)	10 (20%)
	Obese	2 (6.3%)	0	4 (12.5%)	14 (43.8%)	12 (37.5%)
	TOTAL	**13 (6.5%)**	**2 (1%)**	**62 (31%)**	**84 (42%)**	**39 (19.5%)**

TABLE 8: Relationship of different characteristics and dental scores.

	Dental scores deciduous teeth	Dental scores permanent teeth
Toothbrushes/day	No significant difference (p>0.05)	No significant difference (p>0.05)
Sweet snacking	No significant difference (p>0.05)	No significant difference (p>0.05)
Savoury snacking	No significant difference (p>0.05)	No significant difference (p>0.05)
Drinking habits	No significant difference (p>0.05)	No significant difference (p>0.05)
Mother's education	No significant difference (p>0.05)	No significant difference (p>0.05)
Father's education	No significant difference (p>0.05)	No significant difference (p>0.05)
Socio-economic cluster	Significant difference	No significant difference (p>0.05)

TABLE 5: dfm-t score and socioeconomic cluster.

		Socioeconomic cluster				
Frequency		I	II	III	IV	V
dfm-t	NA	13	11	1	12	1
	No caries	8	6	4	4	1
	1-2	7	6	0	7	0
	3-4	11	8	0	8	0
	5-6	4	8	0	6	0
	≥7	9	17	0	8	0
TOTAL		**52**	**56**	**5**	**45**	**2**

Mother's education

10.5% of mothers interviewed had never been to school.

14% of mothers had attended primary school, as their highest level of education.

37% of mothers had obtained a secondary school diploma, as their highest diploma.

8.5% of mothers had obtained a professional diploma as their highest diploma.

23.5% had a Bachelor's degree

5.5% had a Master's degree.

1% had an unknown education level (mother was absent during the appointment and the spouse did not know)

There was not a statistical difference found between child's BMI class and mother's education (p>0.05).

Father's education

10.5% of fathers interviewed had never been to school.

0.5% of fathers had attended primary school, as their highest level of education.

14% of fathers had obtained a lower secondary school diploma, as their highest diploma.

36.5% of fathers had obtained a higher secondary school diploma, as their highest diploma.

8% of fathers had obtained a professional diploma as their highest diploma.

22% had a Bachelor's degree

7.5% had a Master's degree.

1% had an unknown education level (father was absent during the appointment and the spouse did not know)

There was not a statistical difference found between child's BMI class and father's education (p>0.05).

Socioeconomic cluster

There was not a statistically significant difference found between child's BMI and their socioeconomic cluster (p>0.05).

Dental scores (Table 8)

The mean number of caries in lacteal teeth in this study was 4 caries. The mean number of caries in definitive teeth in this study was 1.46 caries. These values are dependent on the participants' age.

There was no significant difference found between boys and girls for dental caries (p>0.05).

Dental scores and toothbrushes/day

5% of children in this study brush their teeth once every other day. 27.5% brush their teeth once a day. 14% brush their teeth between once and twice a day 48.5% brush their teeth twice a day. 5% brush their teeth more than twice a day.

There was not found to be a significant difference between dfm-t scores and the number of toothbrushes per day (p>0.05)

There was not found to be a significant difference between DFM-t scores and the number of toothbrushes per day (p>0.05).

Dental scores and sweet snacking

There was no statistically significant difference found between groups (p>0.05).

Because of the large age spectrum of participants, not all children still had lacteal teeth, in fact 47 children participating only had permanent teeth. 43 participants were 12 years old (the age at which participants no longer have mixed dentition).

There was no statistically significant difference found between DFM-t scores and snacking habits (p>0.05).

Dental scores and savoury snacking

There was no significant difference between groups, (p>0.05), for dental caries in lacteal teeth and savoury snacking habits. There was no significant difference between groups (p>0.05), for savory snacking habits and caries in adult teeth.

Dental scores and drinking habits

There was no statistical difference found in beverages consumed regularly between groups for dental scores in deciduous teeth (p>0.05).

There was no statistical difference found in beverages consumed regularly between groups for dental scores in permanent teeth (p>0.05).

Dental scores and socio-economic factors

There was no statistically significant difference found between child's dfm-t score and mother's education (p>0.05). There was no statistically significant difference found between child's DFM-t score and mother's education (p>0.05).

There was no statistically significant difference found between child's dfm-t score and father's education (p>0.05).

There was no statistically significant difference found between child's DFM-t score and father's education (p>0.05).

The 40 participants from outside of Brussels were not considered for this test.

There was a statistical difference found between socioeconomic clusters and dfm-t scores (p<0.05), as defined by the Belfius socioeconomic cluster score.

There was no statistical difference found between postcodes and DFM-t scores (p>0.05).

We found no variables that significantly influenced both BMI and dental scores. For this reason, we believe we've eliminated the possible confounding factors that had been thought of prior to this study.

To further analyse our results, we performed a multivariate analysis based on all variables that were found to have a significant effect on either BMI or dental scores (parents' BMI, savoury snacks and socioeconomic cluster). There was still not a significant difference found between dental scores and BMI classes.

Discussion

According to the European Childhood Obesity Group (ECOG), 3.9-4.9% of school-aged children in Belgium are obese although current data is not available, international workgroups like COSI are still using the statistics from 2017 (8). In this study 16% of children were obese. It should be noted that the hospital chosen to perform the study has a paediatric obesity program, which could explain the higher prevalence. It is possible that due to the small number of participants in some of the age groups, some of these values are overestimated. All children with a dentistry appointment were asked to participate, according to their birth year.

In Belgium, 49.3% of adults are overweight and 15.9 % are obese according to the Health Initiative Study (HIS) and values reported by Sciensano dating from 2018. In this study, 34.5% of mothers were overweight, 31% were obese. 42% of fathers were overweight and 19.5% of fathers were obese. These values exceed the data reported by Belgian Health authorities. The hospital is located within a lower socio-economic area, and all the dentists working in this paediatric hospital are non-private, it is possible that there was a selection bias towards families of lower socio-economic status, thus partly explaining the higher levels of obesity in both parents and children.

As studied there is a statistically significant difference between mother's BMI depending on their children's BMI, and the same for father's BMI. The higher number of obese children participating could be partly explained by the presence of a paediatric obesity clinic. This could partly explain the higher levels of obesity found within the parent's group too.

Parents were not weighed in this study, both parents rarely accompanied their child to their dental appointment, so to limit collection bias, we decided to only take reported height and weight. In the case where parents were separated, if the present spouse knew the other parent's weight, that weight would be recorded, however if they no longer knew, then the other parent's weight was recorded as unknown. This could partially explain why there is such an important difference between our values and national statistics. The higher prevalence of obesity and overweight amongst the participant's parents, may also explain why the percentage of overweight and obese children is higher than recorded by WHO, ECOG and HBSC (Health Behaviour in School-aged Children). It is a known fact that parents' BMI is correlated to childhood obesity (10).

We chose not to perform bitewing x-rays, or localized x-rays because of unnecessary radiation and the cost of these radiographs. Identification of dental caries was performed by dental probe.

The consensus recommendation is to brush teeth for 2 minutes, twice a day. In this study we found that 46.5% of children participating did not brush their teeth the recommended twice a day. This plays an important part in the higher mean of dental caries found in our population and represents an interesting pillar to focus our public health efforts on.

Most European countries advise that sugar represents <10% of daily energy intake, however it is often not specified the precise quantity of sweet snacks allowed (22). Belgium advocates in its food pyramid, to eat less sugar, without quantifying the maximum amount. 60.5% of participants eat 2 or more sweet snacks per day.

Many of the participants reported that they were in sugar-free schools, often with the school supplying fruit. In other cases, the school provided all snacks, but fruit only once a week, the rest of the snacks provided were processed goods.

Although in this study, the BMI group that ate the least amount of sweet snacks was the obese group with 31.3% of obese children eating sweet snacks less than once a day, compared with 23.7% of children with a healthy weight. This is not a statistically significant difference however.

This could partly be because in some cases parents were conscious of their child's BMI and made an active effort to reduce the number of "unhealthy snacks" that were available. Some of the children in the obese or overweight group were already part of the paediatric obesity program present in this hospital. This could also explain their lower consumption of sweet snacks as active measures were being taken to tackle this disease.

Savoury snacking recommendations seem to be respected. 65.5% of participants ate savoury snack once a week or less, often seen as a treat to be enjoyed on the weekend, an example being a bag of chips for the family on a Friday evening.

If we take WHO's recommendations of 30 mins of activity/day, 76.4% of participants did not reach it. 10.5% of mothers had never gone to school, 14 % had only completed primary school. 10.5 % of fathers had never gone to school. 14.5% had never finished high school. About 25% of parents had not finished high school. It's important to take this into account, especially in future health and nutrition campaigns. Again these numbers do not represent the national level of education amongst adults in Belgium which are at 10 % of adults in Belgium only have a primary school diploma (23). For the same reasons as cited above, this could be due to the location of the paediatric hospital, and the ease at getting a dentistry appointment with a non-private dentist.

This study was conducted as a one-off face-to-face questionnaire. Depending on the parents' own diets, the answers given were radically different. Some parents would say that their child snacks all the time, but when quantified as portions, in actual fact their child snacked once a day. For other parents their child had a very healthy diet, rarely snacked, but when asked to quantify, their child ate 2 portions of sweet snacks per day. The same answer was perceived differently depending on the parent's own habits.

There was one participant with baby bottle tooth decay. This did not reflect their current dietary habits, but their dietary habits as a toddler.

Although information regarding snacking was collected, no information regarding a "normal meal" was obtained.

In this study, the percentage of parents never having gone to school, or only with a primary school education was high. This could have influenced the answers given.

As a child passes from mixed dentition to permanent dentition, the information relative to their lacteal teeth was lost. We decided not to include what information we could have found in their medical file because too few children had only ever been seen at this dental clinic.

In order to find a correlation and possibly causality between obesity and dental caries, a longitudinal study would have been ideal, similar to the one conducted by Gerdin and al in Sweden (24).

Current studies have not reached a consensus regarding a possible correlation. A recent meta-analysis seems to identify a correlation, however individual studies such as this one, tend to find no correlation between the two (25,26). Realistically obesity and dental caries are both multi-factorial.

To further improve parents' report on snacking sizes, a picture scheme would have been useful to better quantify the participants eating habits. This could also have been used for the participants normal meals, and the glasses of beverages consumed throughout the day.

In order to increase the participants' diversity, backgrounds, and ages, it would have been interesting to base this study out of other hospitals, private clinics or in schools. As children become older, less and less continue to have paediatric dental appointments such as the one at HUDERF.

Conclusion

We did not find a statistically significant relationship between dental caries and childhood obesity. Children with a higher BMI did not have their first dental caries diagnosed at a younger age nor did they have a larger number of teeth affected by tooth decay. Dentistry does not appear to be able to predict obesity or at risk of overweight. Overweight and obese children probably should not be sent more frequently to the dentist than their non-obese/ overweight peers.

A multi-centric or school based, longitudinal study should be performed in order to confirm this.

We did find however, that overweight and obesity is higher amongst children with a dental appointment in our hospital.

We also found that guidelines regarding sugar intake and exercise were not met in this particular population. Dental hygiene recommendations were not met either. These represent interesting pillars towards which further efforts should be concentrated in order to fulfill the objectives outlined by the WHO. Furthermore, parents in this population also had a higher BMI than in the general Belgian population, and 25 % of them had not finished high school. Parents' education level need to be taken into account when delivering information regarding their child's health, and perhaps a more targeted effort should be made to make the information given more accessible to a population that perhaps has poorer reading skills than assumed.

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