

Sugar snack consumption in Ugandan schoolchildren: validity and reliability of a food frequency questionnaire

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Running title: Validity and reliability of a food frequency questionnaire

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Objectives: This study assessed the reproducibility and relative validity of an 8-item self-administered food frequency questionnaire (FFQ) on intake of sugared snacks in Ugandan school children. A 5 day pre-coded food behaviour check-list (FBC) was used as validation criteria. Socio-demographic correlates of a sum frequency sugar score were explored. **Methods:** The study was conducted in Kampala, Uganda in 2004. Six hundred and fourteen school children (mean age 12.4 yr) completed FFQ on cakes/biscuits, chocolate, ice sticks, soft drinks, coffee, tea, sugared deserts and sweets/candies at school. They were examined clinically for dental caries. Forty students completed the FFQ twice, one week apart and 325 students completed the 5 day FBC at school. **Results:** The mean DMFT score was 0.98 (SD 1.6, range 0-15). Reproducibility scores (Cohen's kappa) for the sugar items ranged from 0.17 (ice-sticks) to 0.55 (biscuits). No differences were seen between the average intakes at test and retest. Higher intake was reported in FFQ than in FBC across all sugar items. Crude agreement between students reporting intake at least 3-5 times a week / less than 3 times a week ranged from 50-55% (e.g. biscuits, chocolate) to 87% (tea). Spearman's correlation coefficients ranged from 0.14 (dessert) to 0.27 (sweets). ANOVA revealed significant increase ($P=0.001$) in the mean FBC sum scores by increasing quartiles of the FFQ sum scores. The average sum FFQ sugar scores were higher in girls than in boys and higher in older than younger students. **Key words:** sugared snacks, Uganda, school children, reliability, validity

Introduction

Lifestyle related diseases, such as cancers and cardio-vascular disease, increase all over the world, particularly in the developing countries (1, 2). In the case of dental caries there is consensus about the relationship between frequency of intake of non-milk extrinsic sugars and incidence of tooth-decay (3, 4). The Nordic countries have recommended limiting added sugars to a maximum of 10% of children's total energy intake (5). Many developing countries, including Uganda, have experienced increases in the per capita sugar consumption (6,7). Evidence suggests that commercialised sugar products have become easily available and are highly preferred and frequently consumed, particularly among the higher socio-economic status groups and urban residents (6). Eating habits occurring during childhood tend to persist into adulthood (8,9). Policy to promote restricted sugar consumption needs information about the patterns of intake of sugared snacks at an early age and its significant influencing factors.

Assessment of dietary habits is recognised to be a challenging measurement issue (10). The study of dietary assessment in adults poses methodological problems relating particularly to the accuracy of assessment (10,11). Dietary studies in children have additional problems because children's cognitive ability to record and remember intake as well as their limited knowledge of food and food preparation must be addressed (11). Self-reported food frequency questionnaire, FFQ, 24-hour recalls, food diaries and direct observations have commonly been used to assess eating behaviours in both children and adults (12). The FFQ is appreciated for its ease of administration and relatively low cost. It correlates moderately well with information obtained by 24-hour recalls, diaries and direct observations, whereas recalls and

records show stronger agreement with other validation standards (12, 13). The validity of the FFQ methods has been investigated in a number of studies in adults. This method has been assumed to be suitable for collecting data in epidemiological studies from the age of 10 years and up-wards when the cognitive process of children become more similar to those of adults (10, 14-16). However, validation studies of questionnaires used in children and adolescents are limited. Few reproducibility and validation studies have been published that evaluate assessment methods for gathering self-reported food group intake among children without involving parents (12,13,15). No such study has evaluated self-reported intake of sugared snacks and drinks of primary school children in sub-Saharan Africa.

This study assessed sugar related eating habits among Ugandan primary school children using an eight-item FFQ. Its principle purpose was to rank the consumption of individuals into broad categories of intake rather than quantifying the individual consumption (17). The FFQ contained selected sugar items known to be commonly preferred and consumed among children and adolescents in East African countries (18-20). A study of its psychometric properties was deemed necessary and advantageous before further use. Thus, this study aimed to assess the reproducibility and relative validity of the eight-item FFQ on intake of sugared snacks and drinks among 10-14-year-old pupils attending primary schools in Kampala, Uganda. In the absence of an absolute gold standard for dietary assessment in free-living populations (10), a 5-day pre-coded food behaviour check-list, FBC, believed to provide greater accuracy than the questionnaire, was used as validation criterion. The socio-demographic and clinical dental status correlates of children's sugar intake were also examined.

Material and methods

Study population and sampling method

A cross-sectional study was conducted among children attending primary schools in Kampala (0.3mg fluoride/L), the capital city of Uganda, which covers an area of 197 km² and has a population of 1.2 million people (49% male, 18% below the age of 5 yr). The study was conducted during January-March 2004 using a FFQ, a clinical examination and a 5-day FBC to collect data. A list of all government primary schools (n=13) within the Kampala central division (area 14.7 km²) was obtained from the Division Headquarters. Two primary schools with less than 30 children were excluded due to limited size leaving 11 schools to constitute the sampling frame of 2589 standard seven pupils. A sample size of 650 children was calculated based on an assumed prevalence of dental caries (DMFT>0) of 50%, a standard error of 5% and a design effect of 2 (21). Lists of all students in grade 7 were obtained from the school authorities and every third student in each school was randomly selected to participate. This strategy provided a sample that was self-weighting, implying that each participating student had the same probability of being selected into the study. Allowing for refusal to give informed consent and exclusions of a few pupils in the age range 15-18 yr, 826 parents was contacted and 701 signed letters were returned. The help of teachers was elicited in reminding the children to return the signed forms and to set an appropriate date for the data collection. Twenty pupils who completed the questionnaire survey refused to be examined clinically and were thus excluded from the study. The final participation rate for the main questionnaire survey and clinical examination was 74% (n= 614, mean age 12.4, SD=0.8) (Table 1).

A test-retest of the whole FFQ was undertaken among 40 participants after one week to assess the extent to which the measurements are consistent across administrations (22). Participants were not told that they would complete identical questionnaires twice. For assessing relative validity of the FFQ, a follow-up study was conducted four weeks after completion of the main FFQ and clinical examination. A sub-group of participants from the FFQ survey consisting of 394 pupils attending 4 conveniently selected schools volunteered to keep FBC for 5 consecutive school days. A total of 325 completed (participation rate 82.5%) the records for the whole period (Table 1).

Ethical considerations

Ethical clearance was obtained from the ethical research committees in Norway and Uganda. Written permission to conduct the study was obtained from the Ministries of Health and Education in Uganda, local administration authorities and the school authorities. Written informed consent was obtained from the parent on behalf of their children.

FFQ questionnaire survey

The structured questionnaire comprised various socio-demographic and oral health related variables and sugar frequency questions. The questionnaire was constructed and administered in English, which is the language of instruction in all formal academic institutions in Uganda. Health professionals reviewed the survey instrument for semantic, experiential and conceptual equivalence. Sensitivity to culture and selection of appropriate words were considered. The FFQ was pilot tested and adjusted accordingly before being used in the field. It was administered by the main researcher (SK) and four trained assistants in schools as part of the classroom activity

to provide a standard administration with the adult assistance available. Questions were read out loud one at a time while the participants filled in the responses on their own.

Measurements

Socio-demographic characteristics

Age of the child was recorded as age at last birthday and categorised as (0) 10-12 yrs and (2) 13-14 yrs. *Gender* was coded as 0= male, 1= female. *Father's and mother's highest level of education* was assessed on scales ranging from (1) primary education to (4) university/ higher learning institutions. Two dummy variables were constructed yielding the categories (0) lower education (primary and secondary education) and (1) higher education (college or university or higher learning institutions). Household durable assets (e.g. bicycle, television, car, motor cycle) were assessed as (1) available/in working condition, (2) not available/nor in working condition. Aspects of the dwelling were assessed including number of rooms and main source of fuel. A household wealth index (asset) was constructed from 7 variables using Principle Component Analysis, PCA with factor scores ranked into quintiles from (1) poorest to (5) least poor (23).

Food frequency questionnaire (FFQ)

Sugar frequency intake was assessed using 8 items (biscuits, chocolate, ice sticks, soft drinks, tea with sugar, sugared coffee, sweetened deserts and sweets/candy), (4) several times a day, (3) once a day, (2) 3-5 days a week, (1) less than 3 days a week. Participants were asked to have their usual intake in mind when completing the questionnaire. No particular time frame was provided. A FFQ sum additive score

(FFQ ADD) was constructed from the 8 items as initially scored [range from 8 (low) to 32 (high)]. For cross tabulation analyses, each item was dichotomised into (1) at least 3 days a week and (0) less than 3 days a week.

Clinical examination

The clinical examination (n=614) was carried out by one dentist (SNK) whereas a trained assistant recorded the observations. Caries was assessed using the decayed, missing and filled tooth index (DMFT) as described by the World Health Organisation (24). Lesions were recorded as present when a carious cavity was apparent on visual inspection under field conditions (DMFT=0 and DMFT>0). Calibration exercise was carried out at the Institute for Paediatric Dentistry, Faculty of Dentistry, University of Bergen, Norway.

Follow-up study: 5 days food behaviour check list (FBC)

A 5-school day FBC was chosen as the reference method since three to seven days are normally adequate to assess food group intake (16, 25). Only students who completed records for the whole period were included in the analyses. On each day the FBC was completed anonymously in the class setting in the presence of the teacher and a research assistant responding to questions from students to help in completing the checklists. The FBC was constructed to assess adequate documentation of the 8 sugar items from the FFQ. The students were asked whether or not they had taken biscuits, chocolate, ice sticks, soda, tea, coffee, sugared deserts and candy the previous day. Answers were given as (1) yes and (0) no. All students were also asked about intake frequency (i.e. number of times an item was taken yesterday ranging from zero and up wards). The FBC is a simplification of the 24 hour recall. By focusing a recent and

defined time period (yesterday), the memory task is simplified by prompting specific sugared foods and drinks. An average score for the 5 days (range 0,0-1,00) was computed for each participant with respect to whether or not they had taken a sugar item yesterday. To enable comparison with FFQ sugar scores, each average FBC score was expressed as a proportion of the weekly use of that sugar item. Students in the score range 0.0-0.2 were weighted as "less than 3 days a week" (coded 0), whereas those having values ≥ 0.40 were weighted as "at least 3 days a week" (coded 1). A simple count FFQ sugar score (FFQ SC) and a simple count FBC sugar score (FBC SC) was constructed from the 8 dummy variables (0 = "less than 3 days a week" and 1 = "at least 3 days a week") yielding ranges of 1-8 and 0-8, respectively. In addition, the frequency of intake of sugared snacks and drinks taken the previous day was recorded and dummy variables were constructed yielding (1) \geq once yesterday and (0) not taken yesterday.

Statistical analysis

Data was entered using STAR OFFICE and transferred to SPSS version 11.5 for analyses. Univariate analyses were performed by use of chi-square statistics. Spearman's correlation, Wilcoxon signed rank test, and Mc Nemar's test were used for paired ordinal and dichotomous variables. Internal consistency and reproducibility was assessed using Cronbach's alpha and Cohen's kappa, respectively. Multiple variable analyses were conducted using GLM ANOVA and GLM Repeated Measures.

Results

Sample profiles

Table 2 gives the percentage distribution of participants' socio-demographic characteristics by gender for the FFQ survey. A total of 614 students, 45.1% boys, mean age 12.4, SD=1.0, 59.6% younger (10-12yr) participated in the FFQ and the clinical examination. Most of the younger students were girls. The mean DMFT was 0.98, SD=1.6, range 0-15. The corresponding scores in 10-12 and 13-14-year-old children were 0.77 (1.3) and 1.3 (2.0), respectively. A total of 59.8%, 61.7% and 1.1% had respectively, DMFT=0, DT=0 and FT>0. Forty students (50% boys, mean age 12.6, SD=1.0) completed the FFQ a second time after a period of one week. Three hundred and twenty five students participated in the follow up FBC study, 42.8% boys, mean age 12.3, sd=1.0, 62.5% younger (10-12 yr) students. To assess whether the participants of the follow up (n= 325), were representative of the study group as a whole, the follow-up group was compared on relevant characteristics with the pupils who completed the main FFQ study only (n= 289). There were no statistically significant differences between the two groups with respect to socio-demographics, DMFT status and frequency of intake of sugared snacks and drinks.

Internal consistency- and test-retest reliability

Internal consistency reliability (Cronbach's alpha) for the FFQ ADD and SC sugar scores obtained in the main survey (n= 614) were 0.70 and 0.69, respectively. The corresponding alpha score for the FBC SC scores among follow-up study participants (n= 325) was 0.70. Table 3 shows the mean and median sugar intake estimated from the FFQ at two time periods (n=40). Wilcoxon signed rank test showed no statistically significant difference at the group level between the intake assessed at time 1 and time

2. The weighted kappa values ranged from 0.16-0.17 (coffee, ice sticks) to 0.55 (biscuits). Intraclass correlation coefficient for the FFQ ADD scores at time a 1 and time 2 was 0.55 (95% CI 0.3-0.7). The examiner agreement for the clinical examination was found to be acceptable (Cohen's kappa= 0.75).

Relative validity

With few exceptions, no striking differences were found between boys and girls and younger and older students. Thus, results from the whole sample are presented (Table 4). McNemar test with dummy variables (cut off point at least 3-5 days a week) revealed statistically significant differences between the two methods with participants consistently reporting a higher intake in the FFQ as compared to the FBC. With respect to the single sugar items, Spearman's correlation coefficients ranged from 0.14 (sugared deserts) to 0.27 (sweets). Results from Wilcoxon signed rank tests revealed overestimation on the part of the FFQ SC score as compared to the FBC SC score, with mean values of 5.5 (SD= 1.9) and 3.4 (SD= 1.9), respectively ($p < 0.001$) (not shown in Table 4). Spearman's correlation coefficient, rho, for the FFQ SC and FBC SC scores was 0.30 ($p < 0.001$). The corresponding figures for 10-12 yr and 13-14 year old students were 0.25 and 0.40 ($p < 0.001$), respectively. Crude agreement between students confirming intake at least 3 days a week and less than 3 times a week ranged from 50-55% (biscuits, chocolate, soft drinks, coffee, desserts), through 55%-65% (ice cream, sweets) to 87% (tea). The least and most frequently reported sugar items estimated by both methods were intake of chocolate and tea. To assess the ability of the FFQ to rank individuals into broad categories of sugar intake, the FFQ SC scores were divided into quartiles. A GLM ANOVA, adjusting for age and gender revealed a statistically significant increase ($F=10.5$, $df=3$, $p < 0.001$) in the mean FBC

SC scores by increasing FFQ quartiles. The adjusted mean values were 2.9 (95% CI 2.5-3.3), 3.1 (95% CI 2.5-3.6), 3.4 (95% CI 3.1-3.8) and 4.6 (95% CI 4.1-5.0) in quartile 1, 2, 3 and 4, respectively. Bonferroni post hoc showed that the mean values of quartile 4 differed statistically significantly from those in quartile 1, 2 and 3. Correspondingly, for all 8 sugar items, mean FBC sugar intake increased across the FFQ categories, at least 3 days a week and less than 3 days a week. With respect to intake of biscuits, deserts and tea, the increase was statistically significant for the older age group, only.

The proportions of children who reported consumption of sugared snacks and drinks at least once the previous day across 5 consecutive days are depicted in Table 5. The day to day variation was limited but varied across the food items. GLM with frequency daily consumption from FBC as within subject factor (time) and the corresponding FFQ item in terms of (1) at least daily and (2) less than daily as between subject factors revealed no statistically significant two-way interactions. This confirms the visual evidence of stability in rank as depicted for daily soda consumption in Figure 1. Thus, the FBC mean daily frequency consumption within the FFQ categories maintained their relative position in rank across the 5 days. One-way ANOVA revealed that reported intake of all sugared items in the FBC showed stability in ranking between day 1 and day 5 with the “at least daily” and “less than daily” FFQ categories being statistically significantly different at each follow-up day ($p < 0.005$).

Socio-demographic correlates of sugar consumption

The proportions of pupils in the main FFQ study (n=614) who reported intake of sugared snacks and drinks at least 3 days a week ranged from 57% (chocolate) to 93% (sugared tea). Gender differences with a higher proportion of girls than boys reporting that intake were statistically significant for biscuits, chocolate and sweets. A GLM ANOVA with the sum FFQ SC sugar score, (mean= 5.8, SD= 2.0, range 0-8) as dependent variable and age, gender, parental education and caries experience as fixed factors, revealed statistically significant effects of gender (F=6.7, df=1, p=0.010) and age group (F=4.1, df=1, p=0.045) (Table 6). An interaction effect between age and DMFT status (F=3.6, df=1, p=0.058) approached statistical significance. Stratified analysis revealed a negative and positive relationship between DMFT and the mean FFQ SC scores in the younger (10-12 yr) and older (13-14 yr) age groups, respectively. Subgroup analyses (n=325) with FFQ SC and FBC SC scores as dependent variables and gender, mothers education, age and DMFT as independent variables revealed similar estimated effects as those revealed by the main sample analysis (n=614).

Discussion

Fair to moderate reproducibility was established for most FFQ items. According to Landis and Koch (26), kappa values at and below 0.20, in the ranges of 0.21-0.40, 0.41-0.60, 0.61-0.80 and 0.81-1.00 indicate poor, fair, moderate, good and very good agreement, respectively. On the group level, no mean differences were observed between the two time periods (Table 2). A short one week interval was used in the present study to avoid the possibility of confusing dietary changes and lack of repeatability in these young individuals (22).

It has been suggested that the simplest method for comparing frequency data is to calculate the percentage agreement within a certain number of units (14). Comparing the categories at least 3 days a week / less than 3 days a week based on the FFQ an FBC method, revealed less satisfactory agreement (50-55%) for biscuits, chocolate, soft drink, coffee and desert, moderate agreement (60%) for sweets and ice cream and good agreement (87%) for tea, only (14). The mean consumption estimated by FFQ and FBC did differ statistically significantly, with the highest consumption identified by the FFQ across all sugar items. Overestimation of children's food intake with FFQ is a common finding in the literature (12-15,27,28). Earlier studies of Norwegian (19) and British adolescents (30,31) as well as Spanish adults (32) observed overestimation for most nutrients by FFQ when compared to weighted dietary records. According to the present data, over reporting was a larger problem with chocolate, biscuits and ice cream than with soft drinks, sugared tea and deserts. Thus, lack of agreement was most extensive with the items least frequently reported, suggesting that main course food items consumed on an everyday basis might be recalled more accurately as compared to secondary food items such as sugared snacks (27). Pupils might also have over reported intake of sugared snacks due to social desirability because commercialised sugar products increasingly gain social importance in non-industrialised countries (1-2)

An exact agreement at group level between the results from FFQ and FBC is not necessarily critical to the ability of the FFQ to rank or classify individuals into broader groups (22). Thus, the FFQ distinguished reliably between those having high and low average weekly and average daily intake as assessed by the FBC,

demonstrating its ability to correctly classify subjects into broader groups of intake of sugared snacks. Nevertheless, the correlation coefficients obtained ranged from 0.14 - 0.30, suggesting rather poor ability of the FFQ to rank subjects, particularly regarding the single sugar items. A plausible explanation might be low inter-subject variation and restricted ranges of assessment scales on both the FFQ and FBC instrument (22). Moderate reliability on the part of both assessment methods might have contributed to the small validity coefficients estimated (22). The rank order coefficients observed were similar to those obtained previously by several authors, but lower than those reported by others (13,16, 31,27). A number of researchers have suggested that validity coefficients in the range 0.30-0.70 could indicate satisfactory agreement between FFQ and dietary records (33), whereas Romieu et al (34) recommended coefficients in the range 0.20-0.50 to be satisfactory.

The present findings should be interpreted in light of the assumed accuracy of the reference method applied. If the 5 day FBC was biased towards underestimation of sugar snacking due to forgetfulness, lack of compliance and unstructured eating patterns, then the validity of the FFQ would be underestimated as well. A limitation connected with the FBC is the coverage of 5 school days only. Since there was no school on Saturday and Sunday checklists were not collected on those days. If the consumption of certain sugar items is strongly connected with certain days of the week, the FBC may not give a true picture of the average weekly intake. Little difference was observed across the 5 days regarding the ability of the FFQ categories to discriminate between high and low average daily consumption (Fig 1). This suggests that variation in sugar consumption over time was not a major source of variability in the FBC data.

Questions have been raised as to whether FFQ assessing usual food intake is suitable at all to young individuals (35). Although oral health questionnaires with children in the age group 6-10-year-olds have been found to have a high level of concordance between child and care-giver (36), children below the age of 12 have been considered too young to report their own food intake with acceptable accuracy (14). This suggests that recalls and records work better at that age than do FFQ (12). In this study, the FFQ sum scores were appropriate for the purpose of classifying subjects into broader groups of sugar snacking and the appropriateness tended to improve with increasing age of the participants.

On average respondents showed a relatively high overall level of sugar intake with the highest intake reported for females and older pupils. This adds to the construct validity of the FFQ. Higher sugar consumption in females has been commonly reported in studies of community populations in sub-Saharan Africa (18,19). On the other hand, children's sugar frequency intake was not positively correlated with their DMFT status. This has been reported previously (39) and might be attributed to the overall high level of sugar consumption identified. In a previous study of 3-5 year olds in Uganda, children of parents with low level of education consumed more sugared snacks and drinks and had higher caries prevalence than did their counterparts having parents with longer education (20). Similar results with respect to sugar intake in 4-year-olds have been reported from industrialised countries (37-38). This association was not observed in the present study, which also corroborate findings reported elsewhere (37-38). This appears to imply that parental influences are less important among 10-14 year old primary school children.

In sum, the ability of the FFQ to classify Ugandan school children into broad categories of low and high sugar snacking was acceptable. The results indicate that the eight item sugar FFQ is inappropriate for estimating absolute intake but could discriminate between high and low consumers and might be applicable to identify children at risk and for examining differences between child populations. In spite of the practical advantages of the short sugar snacking FFQ as tested in this study it needs further revision to become a valid measurement for the measurement of sugar snacking in 10-14 year old urban school children.

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Figure text

Fig. 1. Mean frequency of daily soda consumption as reported by FBC at day 1 through day 5 in groups reporting soda consumption at least daily and less than daily by FFQ

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Table1. Distribution of study participants according to selection of sample and exclusion criteria

	n	(%)
Standard seven children attending 11 government schools in Kampala central	2589	
Size of systematic random sample	826	(100.0)
Children who did not return consent forms	125	(15.1)
Children who refused to be examined	20	(2.4)
Children above 15 years of age excluded from analyses	67	(8.1)
Children for FFQ survey	614	(74.3)
Children selected to participate in 5-days FBC	394	(100.0)
Number of children who completed five days FBC	325	(82.5)

Table 2. Percentage (n) of participants by socio-demographic characteristics (n=614)

	Male % (n)	Female %(n)	All
<i>Age(yrs)</i>			
10-12	53.4(148)	64.7(218)	59.6(366)
13-14	46.6(129)	35.3(119)**	40.4(248)
<i>Mother's education</i>			
Low	54.5(139)	60.7(181)	57.9(320)
Higher	45.5(116)	39.3(117)	42.1(233)
<i>Father's education</i>			
Low	37.3(91)	41.9(124)	39.8(215)
High	62.7(153)	58.1(172)	60.2(325)
<i>Wealth index</i>			
Most poor (1)	21.2(56)	18.6(61)	19.8(117)
Very poor	17.0(45)	21.3(70)	19.4(115)
Poor	19.7(52)	21.6(71)	20.8(123)
Little poor	20.5(54)	19.2(63)	19.8(117)
Least poor (5)	21.6(57)	19.2(63)	20.3(120)
DMFT>0	37.9(105)	42.1(142)	40.2(247)

** p<0.01

Table 3. Reproducibility: Intake of sugared snacks per week based on FFQ at Time 1 and Time 2, median (P25,75), *mean*. Wilcoxon's signed rank test and kappa (n=40)

	Time 1	Time 2	P	Kappa
Biscuits	3.0 (2.0,3.0) 2.7-	3.0 (2.0,3.0) 2.7	0.964	0.55
Chocolate	3.0 (1.0,3.0) 2.4	3.0 (2.0,3.0) 2.6	0.198	0.39
Ice sticks	3.0 (3.0,3.7) 2.9	3.0 (2.0,3.0) 2.8	0.112	0.17
Soft drinks	3.0 (1.2,3.0) 2.4	3.0 (2.0,3.0) 2.5	0.711	0.40
Coffee	3.0 (1.2,3.0) 2.6	3.0 (2.0,3.0) 2.7	0.410	0.16
Tea	3.0 (3.0,4.0) 3.1	3.0 (3.0,4.0) 3.1	0.572	0.29
Sugared deserts-	3.0 (2.2,3.7) 2.8	3.0 (3.0,3.0) 2.8	0.967	0.23
Sweets	3.0 (3.0,4.0) 3.0	3.0 (3.0,3.0) 2.9	0.654	0.23
Sugar ADD scores	22.0 (20.2,24.0) 22.4	23.0 (19.0,25.0) 22.3	0.723	0.45

Table 4. Relative validity: Mean and (sd) for intake of sugared snacks and drinks, Chi square (Mc Nemar's test) and the Spearman's correlation coefficient (rho) based on the FFQ and 5 days FBC (n=325).

	FFQ	FBC	Chi	P	rho
	Mean (sd) <i>f</i>	Mean (sd) <i>f</i>	Square		
Biscuits	0.6 (0.4)	0.3 (0.3)	41.5	<0.001	.17**
Chocolate	0.5 (0.4)	0.1 (0.3)	119.9	<0.001	.21**
Ice sticks	0.7 (0.4)	0.5 (0.4)	59.1	<0.001	.22**
Soft drinks	0.6 (0.4)	0.4 (0.3)	25.4	<0.001	.16**
Coffee	0.6 (0.4)	0.3 (0.4)	71.6	<0.001	.25**
Tea	0.9 (0.2)	0.8 (0.3)	6.5	<0.001	.14**
Sugared deserts-	0.7 (0.4)	0.4 (0.4)	53.7	<0.001	.24**
Sweets	0.7 (0.4)	0.5 (0.4)	26.2	<0.001	.27**

**p<0.001

f The average of the 0,1 variables is the proportion who scored 1-at least 3 days a week

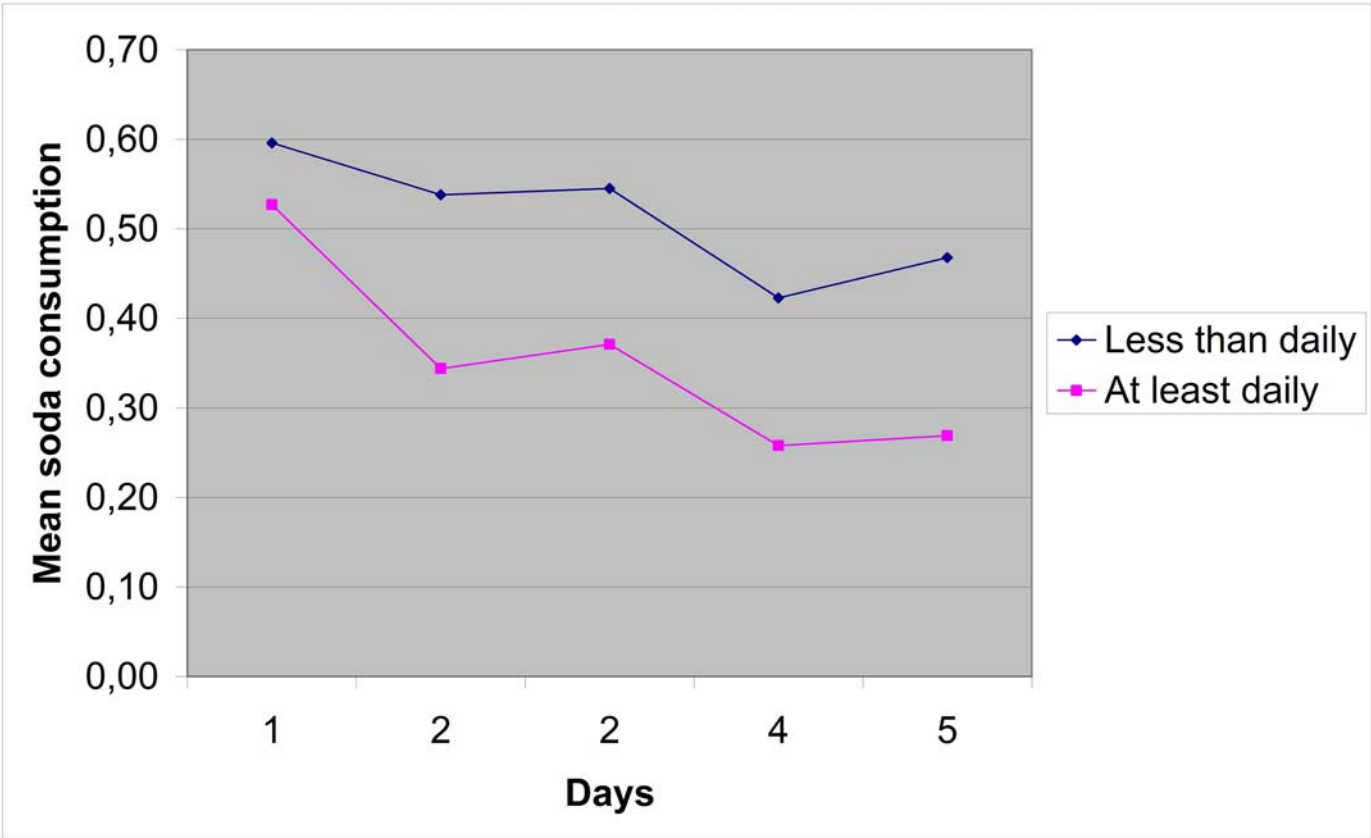
Table 5. Day to day variation in intake of sugared snacks and drinks based on the FBC. Percentage of those reporting at least once a day intake (n=325).

Sugar items,	Day 1	Day 2	Day 3	Day 4	Day 5
	%	%	%	%	%
Biscuits	28.7	29.8	26.6	25.7	25.4
Chocolate	12.3	11.1	9.1	10.2	9.4
Ice-stick	21.1	39.5	39.8	39.5	36.3
Soda	37.4	29.8	30.7	25.0	24.0
Tea	87.1	81.0	73.7	75.0	77.2
Coffee	29.2	24.3	26.6	25.7	24.6
Deserts'	37.4	34.8	29.8	29.8	28.7
Sweets'	39.2	36.8	37.4	42.7	36.3

Table 6. Adjusted mean FFQSC scores and 95% Confidence Interval (95% CI) by socio-demographic and clinical variables (n=614).

	n	Mean (95% CI)
<i>Gender</i>		
Girl	290	6.0 (5.7-6.2)
Boy	244	5.5 (5.2-5.7)*
<i>Mother's education</i>		
Lower	309	5.7 (5.4-5.9)
Higher	225	5.8 (5.5-6.1)
<i>Age group</i>		
10-12 yr	320	5.5 (5.3-5.8)
13-14 yr	220	5.9 (5.6-6.2)*
<i>Caries prevalence</i>		
DMFT=0	319	5.8 (5.5-6.0)
DMFT>0	215	5.7 (5.4-5.9)

*p<0.05



Paper V

Self-reported dental pain and associated factors in Ugandan schoolchildren

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ABSTRACT

There is a limited amount of research on the prevalence and determinants of subjective oral health indicators in children. **Objective:** to assess the prevalence of self-reported dental pain and to explore its relationship with socio-demographic characteristics in 10-14 year olds attending primary schools. **Method:** A cross-sectional survey was conducted during January-March 2004, including 11 public primary schools in Kampala, Uganda. A total of 614 children completed questionnaires administered in schools. Dental caries and plaque status were recorded in permanent teeth. **Results:** Experience with dental pain was confirmed by 42.1% boys and 52.3% girls. The crude prevalence of dental caries was 37.9% in boys and 42.1% in girls. Plaque was present on anterior teeth and 84.3% complained of at least one oral problem. Multiple logistic regression analysis revealed that reporting at least two oral problems (OR = 2.7), being dissatisfied with dental appearance (OR = 2.7) and having visited a dentist twice during the previous 3 years (OR = 2.2) were associated with higher odds of reported dental pain. **Conclusion:** A substantial proportion of school children had experience with dental pain. Dental pain associated positively with dental caries, subjective oral health indicators and dental attendance. Knowledge about the extent and significance of dental pain is important for the planning and evaluation of preventive and treatment efforts.

INTRODUCTION

Emerging consensus in the literature has identified three major dimensions of oral health related quality of life (OHRQoL); clinically assessed disease and impairments, disease and treatment specific symptoms and functional and psychological disability (1,2). Over the years, several subjective oral health indicators have been developed for application in adults (3-6). There is a lack of OHRQoL measures designed for children, although paediatric oral disorders are numerous and likely to affect children's quality of life negatively (7,8). Few attempts have been made to assess the prevalence and determinants of OHRQoL generally and dental pain particularly in the child populations of non-industrialized countries. In this study, dental pain is considered to be synonymous with toothache and described as pain originating from innervated tissues within the tooth or immediately adjacent to it (9).

Untreated dental caries might lead to dental pain, which in turn results in impacts of affected play and sleep, avoidance of certain types of food and decreased school performance (9-11). In low-income countries like Uganda, the exposure to dental services is low, and toothache has been cited as a common reason for children to seek dental care (12,13). Previous studies involving 13-19-yr-old Ugandan school children have provided evidence of high rates (44%) of delayed

treatment demand (dental visiting because of toothache), indicating a need for emergency care for later stages of dental caries (12). As a result of a growing consumption of foods and drinks with added sugars and inadequate oral health care services, it is expected that caries experience of children will increase in Uganda and other sub-Saharan African countries (14). Previous national estimates for Uganda have placed the mean DMFT (decayed, missed and filled teeth) for 12-year-olds at 0.5 in 1987, 0.4 in 1988 and 0.4 in 1993 (15). National averages mask differences within the country with mean DMFT estimates varying from 0.6 to 2.9 across urban and rural communities (16).

Most epidemiological studies of the dental health situation in child populations have inquired about dental pain by asking parents (9,17). In the USA, 5% of 5-12-yr-olds reported some pain from their teeth/ gums in the previous 3 months according to their parents (18). Among South Australian children aged 5-15 yr, 12% (5-yr-olds) and 32% (12-yr-olds) reported a history of toothache (19). Shepherd et al. (10) interviewed 8-yr-old British children and found a prevalence of 47.5%. In non-industrialized countries, the prevalence and severity of children's dental pain has usually been higher than the figures presented in UK, the USA and Europe. Ratnayake and Ekanayake (13) examined 8-yr-old Sri Lanka children and found a lifetime prevalence of oral pain of 49% and 53% as reported by

children themselves and their parents, respectively. Naidoo et al. (20) examined 8-10-yr-olds in the Western Cape of South Africa and found a prevalence of dental pain within the past two months as high as 70%. In a recent study of 12-yr-old Ugandan school children from a rural sub-county, toothache in the last four weeks was reported by 36.5%, whereas 20.2% and 6.4% needed a filling and one or more teeth extracted, respectively (15).

According to the biopsychosocial model dental pain is known to have both biological and psychosocial components. Thus, dental pain perceptions are complex functions of socio-demographic status, individual characteristics such as knowledge, beliefs and expectations, in addition to the principle pathological cause of dental caries (5,21). Although found to be consistently associated with severity of tooth decay, conditions such as erosion, trauma and exfoliation of primary teeth can also give rise to dental pain. A review of the epidemiology of dental pain and dental caries in child populations has shown that dental pain is prevalent among children even in contemporary populations with historically low levels of caries experience (9). In the health and lifestyle survey conducted among Finnish adolescents, 1977-1997, no tendency for the prevalence of toothache to decline across time was recorded despite a corresponding decline in caries experience (22). Among 5-10-yr-old South Australian school children, experience of toothache at any time in a child's lifetime was reported by 9% of parents of subjects who had no clinical evidence of dental caries (19). In developed countries, toothache has been reported to be most prevalent in individuals of low income and education (13,17,22). Moreover, the caries-toothache association is found to be strongest in populations with reduced access to dental care, in lower socioeconomic status groups and in populations where dental caries is largely untreated (9). Less frequent dental attendance patterns have been associated with low prevalence of reported dental pain among children in non-industrialized countries (13).

Description of the extent and distribution of dental pain is important when assessing the burden of dental diseases in children. Focusing on 10-14-year-old primary school children in Kampala, Uganda, this study aimed to assess the prevalence of dental pain and its association with dental caries experience, socio-demographic characteristics, oral hygiene, dental attendance and self-reported oral health. Socio-demographics as possible effect modifiers of the association between dental caries and dental pain was also investigated.

MATERIAL AND METHODS

Study population and sampling method

A cross-sectional study was conducted among children attending standard seven in primary schools in Kampala (0.3 mg fluoride/L), the capital city of Uganda.

The study was conducted during January-March 2004 using a structured questionnaire and a clinical examination. A list of all government (public) primary schools ($n = 13$) within the Kampala central division (area 14.7 km²) was obtained from the Division Headquarters. Two primary schools with less than 30 children were excluded due to limited size leaving 11 schools to constitute the sampling frame of 2589 standard seven pupils. A sample size of 650 children was calculated based on an assumed prevalence of reported dental pain of 50%, a standard error of 5% and a design effect of 2 (21). Lists of all students in standard 7 were obtained from the school authorities and every third student in each school was randomly selected to participate. This sampling strategy provided a sample that was self-weighting, implying that each participating student had the same probability of being selected into the study. Allowing for refusal to give informed consent and 701 signed letters were returned. The help of teachers was elicited in reminding the children to return the signed forms and to set an appropriate date for the data collection. A total of 67 pupils were excluded due to a wide age range (15-18 yr) and to being absent from school on the day of data collection. Twenty pupils who completed the questionnaire survey refused to be examined clinically and were also excluded from the study. The final participation rate for the main questionnaire survey and clinical study was 74% ($n = 614$).

Ethical considerations

Ethical clearance was obtained from the ethical research committees in Norway and Uganda. Written permission to conduct the study was obtained from the Ministries of Health and Education in Uganda, local administration authorities and the school authorities. Written informed consent was obtained from the parent on behalf of their children.

Clinical examination

The clinical examination was carried out under field conditions in the class-room setting by one dentist (SNK), whereas a trained assistant recorded the observations. Students were examined whilst seated on a chair, using a head lamp as source of illumination. Initially visible plaque on anterior maxillary teeth was recorded. Dental probes and plane mouth mirrors were employed. The teeth were cleaned and dried with cotton roles before being examined for caries using the decayed, missing and filled tooth index (DMFT) as described by the World Health Organization (23). Caries was recorded as being present when a lesion in a pit/fissure or on a smooth surface had a detectable softened floor, undermined enamel, softened wall or a temporary filling in addition to sticky enamel lesions. A tooth was considered missing if there was a history of extraction due to pain and or the presence of a cavity. Lesions were recorded as present when a carious

cavity was apparent on visual inspection under field conditions (DMFT = 0 and DMFT > 0). Calibration exercise was carried out at the Institute for Pediatric Dentistry, Faculty of Dentistry, University of Bergen, Norway.

Questionnaire survey

The structured questionnaire comprised various socio-demographic and oral health related variables. The questionnaire was constructed and administered in English, which is the language of instruction in all formal academic institutions in Uganda. Health professionals reviewed the survey instrument for semantic, experiential and conceptual equivalence. Sensitivity to culture and selection of appropriate words were considered. The questionnaire was pilot tested and adjusted accordingly before being used in the field. The main researcher (SNK) and four trained assistants administered the questionnaire in schools as part of the classroom activity to provide a standard administration. Questions were read out loud one at a time while the participants filled in the responses on their own.

Dependent variable

Self-reported dental pain was assessed using one single question. The participants were asked whether or not they had experienced dental pain during the previous 12 months. Response categories were given as yes (1) and no (0).

Independent variables

Bleeding gums and sore mouth were inquired in terms of (1) yes and (0) no. *A self-reported oral problem index* was constructed from the two items. Aspects of the dwelling were assessed including fuel used for cooking as indicators of socioeconomic status. The predictor variables used in the analyses, their coding and the number of subjects (%) according to categories are given in Table 1.

Statistical analysis

Data was entered using STAR OFFICE and transferred to SPSS version 13.0 for analyses. Univariate analyses were performed by use of chi-square statistics and logistic regression. Reproducibility was assessed using Cohen's kappa and Spearman's correlation coefficient. Multiple variable analysis was conducted using multiple logistic regression.

RESULTS

Characteristics of participants

A total of 614 students, 45.1% boys, mean age 12.4, SD = 1.0, 59.6% younger (10-12yr) participated in the questionnaire survey and were examined for dental caries. Most of the younger students were girls. A majority confirmed brushing with toothpaste (98%). In Uganda most of the commercialised toothpaste is

fluoridated. Above three in five participants reported at least one oral symptom and 553 (90.1%) were satisfied with their mouth and teeth. A majority, 346 (56.4%) did not confirm dental attendance during the previous 3 years (Table 1).

Test-retest reliability

Forty students (50% boys, mean age 12.6, SD = 1.0) completed the questionnaire and were examined clinically a second time after one week. The examiner agreement for the clinical examination in terms of DMFT was found to be acceptable (Cohen's kappa = 0.75). Spearman's correlation coefficient across the questionnaire variables were 0.38 (toothache), 0.56 (satisfaction with oral condition), 0.53 (satisfaction with dental appearance), 0.84 (dental attendance), 0.74 (household energy source), and 1.00 (age and gender).

Prevalence of caries experience, plaque and self-reported dental pain

The first molars (270 teeth) were most frequently affected with untreated decay, closely followed by the second molars (220 teeth). The lower molars were more frequently affected than their upper counterparts (Figure 1). The mean DMFT was 0.98, SD = 1.6, range 0-15. The prevalence of untreated dental caries, DT>0, was 235 (38.3%), constituting 95% of the DMFT score. The age specific prevalence of caries experience (DMFT>0), visible plaque and self-reported dental pain in boys and girls is depicted in Table 2. Dental pain was confirmed by 284 participants (47.6%, 95% CI 43.7-51.5), 42.1% (95% CI 36.3-47.9) boys and 52.3% (95% CI 48.0-58.0) girls. Among males, 47.9% versus 35.2% (p<0.05) of 10-12-yr-olds and 13-14-yr-olds confirmed dental pain.

Table 1. Number (%) of subjects by category on independent variables.

Variables	Categories (code)	N (%)
<i>Gender</i>	Girl (1)	337 (54.9)
	Boy (2)	277 (45.1)
<i>Age</i>	10-12 (1)	366 (59.6)
	13-14 (2)	248 (40.4)
<i>Household energy source</i>	Electricity (0)	159 (26.0)
	Other (wood/charcoal) (1)	453 (74.0)
<i>Dental visit last three years</i>	Never (1)	346 (56.4)
	Once (2)	163 (26.5)
	Twice (3)	105 (17.1)
<i>Caries experience</i>	DMFT = 0 (0)	367 (59.8)
	0<DMFT<3 (1)	159 (25.9)
	DMFT≥3 (2)	88 (14.3)
<i>Plaque score</i>	No (0)	275 (44.8)
	Yes (1)	339 (55.2)
<i>Dental appearance</i>	Satisfied (0)	509 (83.2)
	Dissatisfied (1)	103 (16.8)
<i>Symptoms</i>	None (0)	200 (34.0)
	One (1)	281 (47.8)
	Two (2)	107 (18.2)

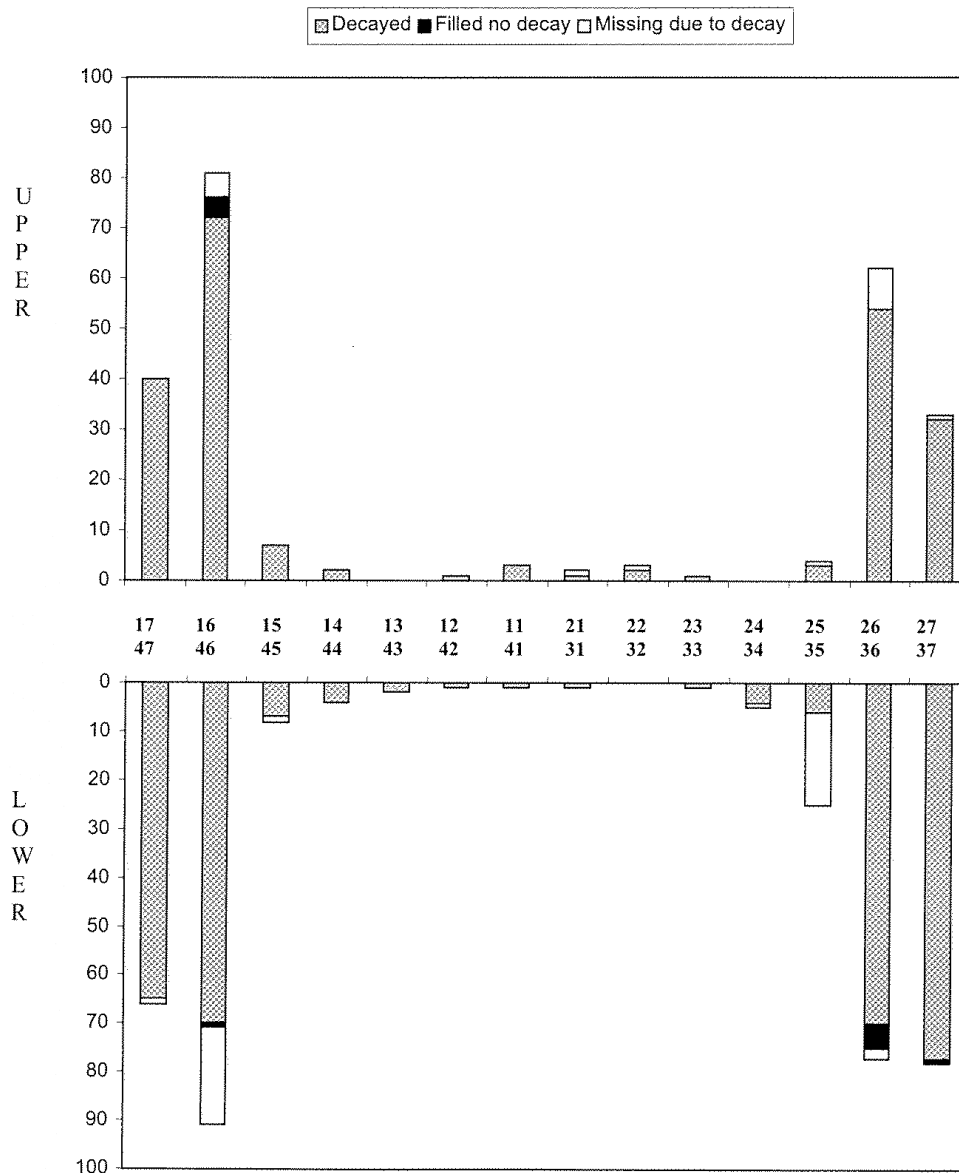


Figure 1. Number of decayed, missed and filled teeth according to tooth type in the upper and lower jaw.

Table 2. Prevalence of reported dental pain, prevalence of caries experience and prevalence of the presence of dental plaque by age and gender.

	Boys			Girls		
	All	10-12	13-14	All	10-12	13-14
DMFT>0	37.9 (105)	33.1 (49)	43.4 (56)*	42.1 (142)	36.7 (80)	52.1 (62)*
Plaque present	60.0 (166)	65.5 (97)	53.5 (69)*	51.3 (173)	54.1 (118)	46.2 (55)
Dental pain-yes	42.1 (112)	47.9 (69)	35.2 (43)*	52.0 (172)	52.3 (112)	51.3 (60)

* p<0.05

Correlates of self-reported dental pain

Caries free children reported experience with dental pain less frequently than their counterparts having DMFT>0 (42.0% versus 55.8%, p<0.001). In children with dental pain experience, 45.4% had DT>0 and

46.1% had never visited a dentist. Table 3 depicts the percentage of participants who reported dental pain by socioeconomic characteristics, oral health related behaviour and self-reported oral health in the total sample and separately for participants with and without dental caries experience. Boys tended to report

Table 3. Percent (n) of participants who reported dental pain by socio-demographics, behavioural and clinical characteristics in the total sample and separately for subjects with and without dental caries experience.

	All % (n)	DMFT > 0	DMFT = 0
<i>Age</i>			
10-12	50.6 (181)	60.3 (76)	45.3 (105)
13-14	43.6 (103)	50.9 (58)	36.0 (45)*
<i>Gender</i>			
Girls	52.0 (172)	60.7 (85)	45.5 (87)
Boys	42.1 (112)*	49.0 (49)*	38.0 (63)
<i>Oral problems</i>			
None	37.5 (75)	47.6 (39)	30.5 (36)
One	47.6 (131)	53.3 (57)	44.0 (74)
Two	63.8 (67)**	72.1 (31)*	58.1 (36)**
<i>Plaque</i>			
no	42.9 (114)	48.9 (43)	39.9 (71)
yes	51.4 (170)*	59.9 (91)	44.1 (79)
<i>Dental appearance</i>			
Satisfied	42.9 (212)	50.8 (99)	37.8 (113)
Dissatisfied	70.3 (71)**	77.3 (34)**	64.9 (37)**
<i>Dental visits</i>			
Never	38.8 (131)	42.7 (47)	36.8 (84)
Once	57.0 (90)	69.9 (51)	45.9 (39)
Twice or more	62.4 (63)**	63.2 (36)**	61.4 (27)*

**p<0.001, *p<0.05

dental pain least frequently – at least those having experience with dental caries. Dental plaque, oral symptoms and children’s global ratings of oral health were statistically significantly associated with dental pain. The prevalence of reported dental pain increased by increasing number of reported dental visits and more strongly among those having DMFT>0 than among their caries-free counterparts.

Table 4 depicts the unadjusted and adjusted odds ratios for having experienced dental pain according to clinical and non-clinical variables. Socio-demographics entered in the first step explained 1.8% of the variance in reported dental pain (Nagelkerke’s R² = 0.018, Model Chi-Square 7.9, df 3, p = 0.047). Entering behavioural variables and self-reported oral health in a second step raised the explained variance to 14.5% (Nagelkerke’s R² = 0.145, Model Chi-Square = 66.3, df 8, p = 0.000). Entering DMFT and plaque scores in the final step raised the explained variance by 1.6 percentage points (Nagelkerke’s R² = 0.016, Model Chi Square = 73.3, df = 10, p = 0.000). In the final model, dental pain was found to be associated with reporting at least two oral problems (OR = 2.7), being dissatisfied with dental appearance (OR = 2.7) and having visited a dentist twice during the previous 3 years (OR = 2.2). Frequency of dental visiting showed a dose-response relationship with reported pain with OR’s of 1.9 and 2.2 for children confirming dental visits once and twice, respectively. A similar pattern was shown for the relationship between dental caries

Table 4. Dental pain regressed upon socio-demographic characteristics, subjective oral health ratings and dental status, unadjusted (unadj) and adjusted (adj) OR and 95% CI.

	OR unadj	95% CI	OR adj	95% CI
<i>Age group</i>				
10-12	1		1	
13-14	0.7	0.5–1.0	0.76	0.5–1.1
<i>Gender</i>				
Girl	1		1	
Boy	0.7	0.4–0.9	0.6	0.5–1.1
<i>Source of cooking</i>				
Electricity/gas	1		1	
Other sources	1.2	0.8–1.6	1.1	0.6–1.6
<i>Oral problems</i>				
None	1		1	
One	1.6	1.1–2.1	1.5	1.1–2.2
Two	2.9	1.8–4.7	2.7	1.6–4.9
<i>Dental appearance</i>				
Satisfied	1		1	
Dissatisfied	3.1	1.9–4.9	2.7	1.5–4.7
<i>Dental visits</i>				
Never	1		1	
Once	2.1	1.4–3.0	1.9	1.3–2.8
Twice	2.6	1.6–4.1	2.2	1.4–3.5
<i>Caries</i>				
DMFT = 0	1		1	
0<DMFT<3	1.7	1.1–2.3	1.4	1.0–2.1
DMFT≥3	1.9	1.2–3.1	1.8	1.1–3.0
<i>Plaque</i>				
No	1		1	
Yes	1.4	1.1–1.9	1.2	0.8–1.7

Nagelkerke’s R² = 15.5

and reported pain with those having 0<DMFT<3 and DMFT≥3 being 1.4 and 1.8 times more likely to report dental pain than their caries free counterparts. The interaction between source of fuel and DMFT status upon dental pain added significantly to the model (p = 0.012). Separate regression models for those having electricity (higher SES group) and those having wood/charcoal (lower SES group) as a source of fuel showed a statistically significant positive relationship between DMFT status and dental pain in the high SES group, only. Age seemed to modify the relationship between dental attendance and dental pain with a positive association being statistically significant among the 10-12-yr-olds only.

DISCUSSION

The results of the present study indicate that the prevalence of dental pain was high (47.6%) among 10-14-yr-old children attending primary school and varied systematically with attitudinal, behavioural and clinical characteristics of the study population. Compared to the European average DMFT score of 2.6 in 12-yr-olds, the present mean DMFT score was low (24). It

accords, however, with previously reported estimates of Ugandan children of comparable ages (16). Moreover, the very high proportion of unrestored teeth assessed (95% of the DMFT score) is consistent with findings from other developing countries (25). It is not possible to assert that the present results demonstrate the crude impact of each explanatory variable considered since they could be biased by background confounding factors. However, the participants might be representative for the child population of 10-14-yr-olds in Kampala since about 90% of children of school-going age (6-14 yr) attend primary schools according to national statistics (26). Because of the realities of life in Uganda, general population surveys of children and adolescents are difficult to conduct, and even the national oral health survey of 12-year-olds was confined to school-going children (27).

Structured self-administered questionnaires as applied in this study have certain limitations (28). Bias due to social desirability, acquiescence and lack of recall are frequently encountered with children (7). Self-reported dental pain is subject to misclassification, because children fail to identify the pain as dental in origin and might include other conditions in their reports (9). Nevertheless, recently developed generic and disease specific oral health related quality of life questionnaires have demonstrated that with appropriate technique it is possible to obtain valid and reliable reports from children (7,8). Age specific questionnaires have been recommended for 6-7, 8-10 and 11-14-yr-olds since those groups are homogeneous in terms of roles and cognitive abilities. A study involving self-completion of dental self-report questionnaires by 6-9-yr-old children showed a high level of concordance between the child and caregiver and appeared to be clinically valid (29). Whereas the reliability coefficients observed in this study indicated moderate reproducibility across questionnaire variables, the positive association found between DMFT status and dental pain supports the validity of children's self-reports. To improve the validity of the single item dental pain measure utilized, further research should include additional questions about more recently experienced dental pain, its perceived causes and impacts.

Comparing the present prevalence rate across child populations should be done with caution due to the various time frames and age groups utilized in different studies. The prevalence estimated in this study accords with the lifetime prevalence (any toothache ever) reported among 5-15 year old Australian school children and that of 8-year-olds from the city of Harrow in England (10,19). It was in accordance with pain experienced during the last four weeks among 8-yr-olds from Sri Lanka (13). However, the prevalence of dental pain among 10-14-yr-old Ugandan school children was higher than that reported in their rural counterparts and also higher than the prevalence found in Brazilian school children of comparable age

(17,15). Despite the various recall periods used, variation in disease patterns and severity might explain the difference observed among rural and urban Ugandan schoolchildren. Okullo et al. (30) observed a higher caries experience among slightly older adolescents in urban Kampala as compared to rural Lira and attributed this regional gradient to the availability of sugared snacks and drinks in towns (31).

Independent of the frequency of dental attendance, the results revealed a positive association between dental caries experience and reported dental pain. Obviously, children's dental pain could be avoided and family quality of life improved through strengthening of the preventive and therapeutic dental services for primary school children (32). The association was moderately strong, however, and only about half of the children with dental pain experience had untreated dental caries. Other possible causes of dental pain in this age group might have been trauma to teeth and eruption of permanent teeth or exfoliation of deciduous teeth. The present finding supports those presented in previous studies suggesting that caries experience is a consistent clinical correlate of dental pain in children (9,13,17). Evidence suggest that low family income and educational level associate with increased dental pain in children after controlling for confounding factors (22). Incidentally, the lack of a social gradient as observed here might be unique to the participants investigated, confirming the social homogeneity of Kampala city children attending primary school. Children's socioeconomic status occurred as a significant modifier of the association between caries experience and reported dental pain with the strongest relationship found in children from higher socioeconomic status families. Previous studies of sub-Saharan African origin have identified a social gradient in dental caries experience with children from upper social classes being those most seriously affected (14). In contrast, contemporary evidence from industrialised countries have shown that the lower the material standard of living, the worse the oral health whatever measure are used to assess this, be they clinical or self-reported indicators (9). Moreover, it is noteworthy that children who had seen a dentist once or twice during the previous 3 years reported dental pain more often than their counterparts with no dental visits. Similar results have been reported previously and might be attributed to symptomatic dental attendance patterns and need for emergency care in later stages of dental caries rather than an unexpected response to dental treatment (12,33).

In sum, the present study indicates that the prevalence of reported dental pain was high in 10-14-yr-old children attending primary school in Kampala. Although the average DMFT was low, untreated caries contributed 95% of children's caries experience. Dental pain was most frequent in children having untreated dental caries, being dissatisfied with their oral health and among those who had attended a dentist most

frequently. The caries–dental pain relationship was stronger in children from higher socioeconomic backgrounds. Knowledge about the extent and significance of reported dental pain clearly indicates a need to strengthening preventive and therapeutic dental services among primary school children in Kampala.

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Appendices

APPENDIX I

Serial number

Date

CONSENT FORM

(Parent/Caregiver)

Title of the project:

Reporting on dental caries prevalence and associated risk factors: a study among nursery school children in Uganda

Name of researcher:

Kiwanuka Suzanne N.

Please tick in the box

1. I confirm that I have read and understood the information sheet for the above study and have had the opportunity to ask questions.

2. I understand that my participation is voluntary and that I am free to withdraw at any time with out giving any reason.

3. I agree that my child(child's name) and I will take part in the above study.

Name of child's parent/caregiver

Date

Signature

___/___/___

Name of interviewer

Date

Signature

___/___/___

Section A

General information about child and parent / caregiver

Nursery school.....

Child's name.....

Child's date of birth.....

Tribe.....

Religion.....

Child's gender

- Male
- Female

Respondent's relation to the child

- Mother
- Father
- Other (please specify)

.....

1. What is your age? (Age of respondent)

.....

2. What is your (present) marital status?
(Please tick one only)

- Single
- Married
- Divorced/separated
- Widowed

3. At what level did the child's mother finish her full time education? (Please tick one only)

- Primary school
- Secondary school
- Further education (college)
- Higher education (university/higher learning institution)
- No formal education
- Other (please specify)

.....

4. At what level did the child's father finish his full-time education? (Please tick one only)

- Primary school
- Secondary school
- Further education (college).
- Higher education (university/higher learning institution)
- No formal education.
- Other (please specify)

.....

5. Who owns the house your family is living in at the moment? (Please tick one only)

- Owned by the family
- Rented house
- Owned by the government
- Owned by my employers

6. How many bedrooms does the house you are living in have? (Please tick one only)

- 1
- 2
- 3
- 4
- More than 4

7. What kind of roof does the house you are living in have? (Please tick one box)

- Iron sheets
- Concrete
- Tiles
- Grass thatched
- Asbestos sheets

8. What source of energy do you use for lighting the house at night? (Please tick one box)

- Electricity
- Paraffin lamp
- Gas light
- Candle light
- Other (Please specify)

.....

9. What source of energy do you use in the home for cooking? (Please tick one box)

- Electricity
- Gas
- Paraffin
- Charcoal
- Firewood
- Other (Please specify)

.....

10. How many children are living in your house now? (Please tick one box)

- 1
- 2
- 3
- More than 3

11. What birth order is this child?

.....

12. Who does your child live with? (Tick as many as apply)

- Both parents
- Mother only
- Father only
- Grand parents
- Other relatives
- Other (Please specify)

.....

13. Who usually looks after your child during the day? (Please tick one box)

- Mother at home
- Grand parents
- Sister/brother
- Other relative
- Father at home
- Friend/neighbour
- House maid
- Day nursery

Section B

The following questions are related to your child's eating habits

1. When your child was a baby did you;
(please tick one box)

- Only breast-feed?
 Only bottle-feed?
 Both breast and bottle-feeding was done?

2. Has your child ever used a
dummy/pacifier?

- Yes No

If yes, has your child's dummy/pacifier ever
been dipped in something sweet to make it
taste nice?

- Yes No

3. How often does your child take tea,
porridge or milk with added sugar? (Please
tick one)

- Not everyday
 Once a day
 Twice a day
 Three times a day
 More than three times a day

4. How often does your child take drinks
like soda? (Please tick one box)

- Not everyday
 Once a day
 Twice a day
 Three times a day
 More than three times a day

5. How often does your child eat sweets
(such as toffees, chocolates, and chewing
gum?)

- Daily
 Several times a week
 Once a week
 Occasionally
 Never

6. How often does your child eat sugary
foods like cakes, biscuits and ice cream?

- Daily
 Several times a week
 Once a week
 Occasionally
 Never

Section C

The following questions are about your attitude towards sugared snacks and foods

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
1. As a family we intend to control how often our child takes sugared foods and drinks					
2. As a family we would like to control our child's sugar intake					
3. To control how often our child takes sugared snacks and drinks between meals might prevent tooth decay					
4. To control how often our child takes sugared snacks and drinks between meals might make them behave well					
5. The people in our family feel it is important that we control how often our child takes sugared foods and drinks between meals					
6. The people in our family control their intake of sugared foods and drinks between meals					
7. The people we know well would feel it was important that we control how often our child takes sugared foods and drinks between meals					
8. As a family we feel it is difficult to control how often our child takes sugared foods and drinks between meals					

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
9. If clean water is available ,we as a family would be able to control how often our child takes sugared foods and drinks between meals					
10. If time allows, we as a family would be able to control how often our child takes sugared foods and drinks between meals					
11. The chances that our child will get tooth decay in the future is great					
12. As a family we worry a lot that our child will have tooth decay in the future					
13. To control how often our child takes sugared snacks and drinks between meals is good					
14. To control how often our child takes sugared snacks and drinks between meals is not wise					

Section D

The following questions are about tooth brushing/tooth cleaning

1. What is used to clean your child's teeth?
(Please tick one only)

- Tooth brush
- Chewing stick
- Cloth
- Finger
- Other (Please specify)

.....

2. How old was your child when he/she first started having his or her teeth cleaned/brushed? (Please tick one only)

- Under 1 year
- 1-2years
- 2-3years
- Over 3 years
- Teeth are not cleaned / brushed

3. Who usually brushes your child's teeth?
(Please tick as many as apply)

- Child
- Parent
- Someone else
- Teeth are not brushed

4. How often are the child's teeth cleaned / brushed? (Please tick one only)

- Never
- Less than once a day
- Once a day
- Twice a day
- More than twice a day

5. Has your child started using toothpaste?

- Yes No

If yes, what toothpaste does the child use?
(Please tick as many as apply)

- Toothpaste bought in shops
- Ash/Charcoal
- Salt
- Other (Please specify)

.....

Section E

The following questions are related to dental attendance and oral care

1. Before today, have you ever taken your child to a dentist?

Yes No

If yes, did the dentist examine the child?

Yes No

2. Has your child had a toothache in the last year?

Yes No

If yes, how many times? (Please tick one box)

- Once
 Twice
 Three times
 Don't remember

3. What is your usual reason for going to see a dentist? (Please tick one box)

- Regularly for check up
 Regularly for treatment
 Only if I have problems with my teeth or gums
 I do not visit a dentist

4. How often do you take tea, porridge or milk with added sugar? (Please tick one box)

- Not everyday
 Once a day
 Twice a day
 Three times a day
 More than three times a day

5. How often do you take drinks like soda? (Please tick one box)

- Not everyday
 Once a day
 Twice a day
 Three times a day
 More than three times a day

6. How often do you eat sweets (such as toffees, chocolates, and chewing gum?)

- Daily
 Several times a week
 Once a week
 Occasionally
 Never

7. How often do you eat sugary foods like cakes, biscuits and ice cream?

- Daily
 Several times a week
 Once a week
 Occasionally
 Never

8. How many times do you brush your teeth per day? (Please tick one box)

- Once
 Twice
 Three times
 Don't know

9. Would you like to get more information on oral/dental health?

Yes No

Section F

The following questions are related to the parent's / caregiver's opinion of own oral health, availability to dental treatment, dental attendance and belief in keeping teeth for life

1. How many teeth (natural teeth) do you have in your upper jaw? Please, count them.

.....

2. How many teeth (natural teeth) do you have in your lower jaw? Please, count them.

.....

3. How do you consider the present condition of your mouth and teeth, do you consider it very good, good, bad or very bad?

- Very good
- Good
- Bad
- Very bad
- Neither good nor bad

4. Are you satisfied or dissatisfied with the appearance of your teeth?

- Satisfied
- Dissatisfied
- I don't know

5. Is it easy for you to get a dentist appointment if you need it?

- I can easily get a dental appointment
- I can possible get a dental appointment
- It is difficult to get a dental appointment

6. How often do you attend to dental examination/treatment?

- Regularly, at least once a year
- Twice during the last three years
- Less often
- No visits during the latest three years
- Occasionally, only when I have pain
- Never

7. Last time you visited a dentist, was that to have: (Please tick one box)

- One tooth or teeth extracted
- Treatment for pain
- Check up/conservative treatment
- I have never visited a dentist

8. Is dental treatment costs expensive?

- Dental treatment costs are expensive
- Dental treatment costs are reasonable
- Dental treatment costs are cheap

9. Do you think that you can keep all your teeth for life?

- Yes
- No
- I don't know

10. How do you think people at your age react to losing front tooth or teeth?

- Very upsetting
- Upsetting
- Indifferent/not upsetting at all

APPENDIX II

District

THE CHILD	THE EXAMINER
CHILD'S NAME: ID NO: _____ DATE OF BIRTH: ____/____/____ GENDER Male <input type="checkbox"/> Female <input type="checkbox"/>	EXAMINER'S NAME: NOTES:

DENTITION STATUS

Upper right

Upper left

55	54	53	52	51	61	62	63	64	65
85	84	83	82	81	71	71	73	74	75

Lower right

Lower left

PLAQUE	TOOTH CODES		NOTES
Plaque present on upper anterior teeth Yes <input type="checkbox"/> No <input type="checkbox"/>	Sound tooth Decayed Filled with decay Filled no decay Missing due to caries Missing any other reason Trauma/fracture	0 1 2 3 4 5 T	

APPENDIX III

HOW TO ANSWER THIS QUESTIONNAIRE

This is not a test.

However, it is important that you answer all the questions. The answers you give will help dentists find ways of improving oral health of young people in Uganda.

Read all instructions carefully and answer each question as best as you can. Together we will read each question carefully; you will then write your answer before we go on to the next question. Please answer all the questions as honestly as possible

If you do not understand the instructions or are confused about a particular question, raise your hand and the supervisor will come and assist you.

The information you provide will be treated confidentially and used for statistical purposes only. No participant will be identified with the information he/she has given.

Section A

The first questions are about you and your family. Read each question carefully and tick off the answer that fits you the best. Tick only one answer () for each question.

1. School

.....

2. Address/Pin code

.....

3. Are you a boy or a girl?

1 Boy 2 Girl

4. Year of birth.

.....

5. Where do you live now?

1 Home 2 Hostel

6. What is your religion?

1 Hindu

2 Muslim

3 Christian (catholic protestant)

4 Other (specify)

.....

7. At what level did your mother finish her full time education?

1 Primary school (P1 – P7)

2 Secondary school (S 1-S6)

3 Degree (University)

4 Master degree (Further studies)

5 Not attended school

6 Other (specify)

.....

7b. Mother's work

.....

8. At what level did your father finish his full time education?

1 Primary school (P1 – P7)

2 Secondary school (S1-S6)

3 Degree (University)

4 Master degree (Further studies)

5 Not attended school

6 Other (specify)

.....

8b. Father's work

.....

9. Does any member of your family (with whom you live) own a bicycle?

1 Yes 2 No

10. Does any member of your family (with whom you live) own a motorcycle?

1 Yes 2 No

11. Does any member of your family (with whom you live) own a car?

1 Yes 2 No

12. Does any member of your family (with whom you live) own a television?

1 Yes 2 No

13. Does your family (with whom you live) own a refrigerator (fridge)?

1 Yes 2 No

14. At home from where do you get drinking water?

- 1. Tap / Pipe / well
- 2. River / Pond / Stream
- 3. Other (specify)

.....

15. Who owns the house your family is living in at the moment?

- 1 Rented house
- 2 Owned by the family
- 3 Owned by the government
- 4 Owned by the employers

16. How do you consider the economic situation of your family at home?

- 1 We are among the rich in the area
- 2 We are not rich but we manage to live well
- 3 We are neither rich nor poor
- 4 We struggle with the little we have
- 5 We are among the poor in the area

17. How many rooms are there in your home?

- 1 One
- 2 Two to five
- 3 Six or more
- 4 We don't have a house

18. What is the main source of cooking fuel at home?

- 1 Gas stove / Electric cooker
- 2 Kerosene stove
- 3 Wood
- 4 Cow dung
- 5 Charcoal

Section B

The following are questions about your mouth and teeth. Please tick () only one answer for each statement.

1. What do you think is the state of your mouth and teeth?

- 1 Very good
 2 Good
 3 Bad
 4 Very bad

2. Are you satisfied or dissatisfied with your mouth and teeth?

- 1 Very satisfied
 2 Satisfied
 3 Dissatisfied
 4 Very dissatisfied

3. How satisfied/dissatisfied are you with the appearance of your teeth?

- 1 Very satisfied
 2 Satisfied
 3 Dissatisfied
 4 Very dissatisfied

4. Think back on the last 12 months – have you ever had:

1=yes, 2=no, 3=don't know		
A Bleeding gums?	1 <input type="checkbox"/>	2 <input type="checkbox"/> 3 <input type="checkbox"/>
B Sore mouth?	1 <input type="checkbox"/>	2 <input type="checkbox"/> 3 <input type="checkbox"/>
C Bad breathe?	1 <input type="checkbox"/>	2 <input type="checkbox"/> 3 <input type="checkbox"/>
D Toothache?	1 <input type="checkbox"/>	2 <input type="checkbox"/> 3 <input type="checkbox"/>
E Food stuck in your teeth?	1 <input type="checkbox"/>	2 <input type="checkbox"/> 3 <input type="checkbox"/>

5. Which of the following do you think are important reasons for looking after your teeth?

	YES	NO
A To look good to other people		
B For my teeth to look nice		
C To avoid false teeth		
D I like my breath to smell fresh		
E To avoid toothache		
F To avoid dental treatment		

Section C

The next questions are about hygiene and food habits. Please read each question carefully and answer as honestly as possible. *Please tick () only one answer for each question.*

1. How often do you brush your teeth?

- 1 More than one time a day
 2 Once a day
 3 Several times a week
 4 Never

2. Do you usually brush your teeth before breakfast?

- 1 Yes 2 No

3. Do you usually brush your teeth before going to bed?

- 1 Yes 2 No

4. Do you usually brush your teeth after mealtime?

- 1 Yes 2 No

5. After meals do you usually wash your mouth with water?

- 1 Yes 2 No

6. For cleaning your teeth what do you use?

	YES	NO
A Finger		
B Tooth brush		
C Mango leaf		
D Chewing stick		
E I don't clean my teeth		

7. With what substance do you clean your teeth?

	YES	NO
A Toothpaste		
B Ash / Charcoal		
C Salt / Oil		
D I don't use anything		

8. What kind of toothpaste do you use (See figure and fill in the blank)?

.....

9. During the last three years – how many times have you visited the dentist?

- 1 Never
 2 One time
 3 Two to five times
 4 Six and above

10. If you have attended a dentist during the last three years – what was the main reason?

	YES	NO
A Toothache		
B Wanted a check up		

11. If you have *not* attended a dentist during the last three years – what was the main reason?

1 Dental visit expensive

2 Fear

3 No need

12. Have you ever smoked, chewed or sniffed any tobacco products?

1 Yes

2 No

Section D

We would like to ask you how often you usually take sugared snacks and drinks. Please tick () only one answer for each question.

1. How often do you eat sweet biscuits?

1 More than one time a day

2 Once a day

3 3-5 times a week

4 Less than three times a week

3. How do you usually eat your chocolate?

1 All at once in a short time

2 Slowly in small amounts

3 I do not take sweets

2. How often do you eat chocolates?

1 More than one time a day

2 Once a day

3 3-5 times a week

4 Less than three times a week

4. During a normal day when do you usually have your chocolate?

1 At meal times

2 Between meal times

3 Both at meals and between meals

4 I do not take sweets

5. How often do you have ice sticks?

- 1 More than one time a day
- 2 Once a day
- 3 3-5 times a week
- 4 Less than three times a week

6. How often do you have soft drinks (pepsi, coco cola etc)?

- 1 More than one time a day
- 2 Once a day
- 3 3-5 times a week
- 4 Less than three times a week

7. How do you usually drink your soft drinks (pepsi, coca-cola etc)?

- 1 All at once in a short time
- 2 Slowly in small amounts
- 3 I do not take sweets

8. During a normal day when do you usually have soft drinks (pepsi, coca-cola etc.)?

- 1 At meal times
- 2 Between meal times
- 3 Both at meals and between meals
- 4 I do not take sweets and soft drinks

9. How often do you take sugared tea?

- 1 Several times a day
- 2 Once a day
- 3 3-5 times a week
- 4 Less than three times a week

10. How often do you take sugared coffee?

- 1 More than one time a day
- 2 Once a day
- 3 3-5 times a week
- 4 Less than five times a week

11. How often do you eat sweetened fruits/desserts?

- 1 More than one time a day
- 2 Once a day
- 3 3-5 times a day
- 4 Less than three times a day

12. How often do you take fresh fruits?

- 1 More than one time a day
- 2 Once a day
- 3 3-5 times a week
- 4 Less than three times a week

13. How often do you take fruit juice?

- 1 More than one time a day
- 2 Once a day
- 3 3-5 times a week
- 4 Less than three times a week

14. How often do you take sweets like candies, toffees, chewing gums etc?

- 1 More than one time a day
- 2 Once a day
- 3 3-5 times a week
- 4 Less than three times a week

15. How do you usually eat your sweets?

Give your comments if any:

- All at once in a short time
- Slowly in small amounts
- I do not take sweets

.....
.....
.....
.....
.....

16. During a normal day when do you usually have your sweets?

- At meal times
- Between meal times
- Both at meals and between meals
- I do not take sweets

.....
.....
.....
.....
.....

Thank you for your co-operation

APPENDIX IV

CHILD'S NUMBER -----

Male Female

DATE OF BIRTH: ___ / ___ / _____

SCHOOL-----

DENTITION STATUS

Upper right

Upper left

18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38

Lower right

Lower left

TOOTH CODES		NOTES
Sound tooth	0	
Decayed	1	
Filled with decay	2	
Filled no decay	3	
Missing due to caries	4	
Missing any other reason	5	
Fissure sealant	6	
Bridge abutment, special crown veneer	7	
Unerupted crown	8	
Not recorded	9	
Trauma/fracture	T	

Visible plaque on upper anterior teeth

1	Yes
0	No

APPENDIX V

Date. _____

This record will be repeated Monday (regarding Sunday), Tuesday (regarding Monday), Wednesday (regarding Tuesday), Thursday (regarding Wednesday), Friday, (regarding Thursday)

Id number _____

Please answer the following questions:

(1) What is the name of the school you attend? _____

(2) What class do you attend? _____

(3) What is your gender? _____

(4) Year of birth? _____

We would now like to ask you about the different kinds of sugared snacks and drinks that you took yesterday. If you took any of the sugared snacks and drinks yesterday we would also like to know how many times you took this sugared snacks and drinks (e.g. once, twice or three times).

Please note that we are NOT interested in the sugared snacks and drinks that you eat usually – only about what you ate and drank yesterday.

1. Did you take sweet biscuits yesterday?

Yes

No

If yes - how many times did you take sweetened biscuits yesterday? _____ number of times

2. Did you take chocolate yesterday?

Yes

No

If yes - how many times did you take chocolate yesterday? _____ number of times

3. Did you take sweets (e.g. candy, toffee, chewing gum) yesterday?

Yes

No

If yes - how many times did you take sweets yesterday? _____ number of times

4. Did you take ice sticks yesterday?

Yes

No

If yes - how many times did you take ice sticks yesterday? _____ number of times

5. Did you take sweetened deserts yesterday?

Yes

No

If yes - how many times did you take sweetened desert yesterday? _____ number of times

6. Did you take tea with sugar yesterday?

Yes

No

If yes - how many times did you take tea with sugar yesterday? _____ number of times

7. Did you take coffee with sugar yesterday?

Yes

No

If yes - how many times did you take coffee with sugar yesterday? _____number of times

8. Did you take milk with sugar yesterday?

Yes

No

If yes - how many times did you take milk with sugar yesterday? _____number of times

9. Did you take cakes yesterday?

Yes

No

If yes - how many times did you take cakes yesterday? _____number of times

10. Did you take rice yesterday?

Yes

No

If yes - how many times did you take rice yesterday? _____number of times

11. Did you take soft drinks yesterday? (e.g. coca cola-----)

Yes

No

If yes - how many times did you take soft drinks yesterday? _____number of times

12. Did you take juice yesterday? (e.g. ribena, splash, orange juice-----)

Yes

No

If yes - how many times did you take juice yesterday? _____number of times

ERRATA

Correction list

We regret that a number of errors with respect to the reference list occurred for the final part of the discussion in Paper I.

Paper 1: Dental caries experience and its relationship to social and behavioural factors among 3-5-year-old children in Uganda

Page 337, left column line 14: “sub-Saharan corrected to sub-Saharan African. And right column line 22: “primary” corrected to “nursery”.

Page 339 Table 1: column 4 line 4 “13” corrected to “113”

Page 342, left column, line 17: “ this is the first” corrected to this is the first study

Page 343, left column, line 22: [20,20,32,35,37, 41] corrected to [32,38]

Page 343, left column, line 27: [20,20,32,34] corrected to [20,32,34,39,40]

Page 343, left column, line 32: [17,17,29,31,37,40] corrected to [31]

Page 343, left column, line 39: [38,39,41,42] corrected to [39-42]

Page 343, right column. line 16: [43,44,44,45] corrected to [43,44,45]

Page 343, right column, line 50: [46,47,47,48] corrected to [46,47,48]

Page 344, left column, line 4: [48,49] corrected to [49]

Page 344, right column, line 8: [39,42,46,47] corrected to [39,42]

Ref 15: Tiromwe corrected to Tirwomwe

Ref 17: Harris R, Nicoll AD, Adair PM, Pine CM. Predictors of dental caries in young children: a qualitative systematic review of the literature. Community dental health 2003 corrected to Harris R, Nicoll AD, Adair PM, Pine CM. Risk factors of dental caries in young children: a systematic review of the literature. Community Dental Health 2004; 21: 71-85

Ref 49: Bhayat Cleaton-Jones P corrected to Bhayat A, Cleaton-Jones P

Paper III: Examining intention to control pre-school children's sugar snacking: a study of careers in Uganda.

Page 11: right column, paragraph 3, line 15; "primary" corrected to "nursery".

Page 15: Table 4 heading line 2- "caries-free and level of education" corrected to "caries –free and low level of education".