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ORIGINAL ARTICLE

TOOTH WEAR PREVALENCE AND SAMPLE SIZE DETERMINATION : A PILOT STUDY

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Tooth wear is the non-carious loss of tooth tissue, which results from three processes namely attrition, erosion and abrasion. These can occur in isolation or simultaneously. Very mild tooth wear is a physiological effect of aging. This study aims to estimate the prevalence of tooth wear among 16-year old Malay school children and determine a feasible sample size for further study. Fifty-five subjects were examined clinically, followed by the completion of self-administered questionnaires. Questionnaires consisted of socio-demographic and associated variables for tooth wear obtained from the literature. The Smith and Knight tooth wear index was used to chart tooth wear. Other oral findings were recorded using the WHO criteria. A software programme was used to determine pathological tooth wear. About equal ratio of male to female were involved. It was found that 18.2% of subjects have no tooth wear, 63.6% had very mild tooth wear, 10.9% mild tooth wear, 5.5% moderate tooth wear and 1.8 % severe tooth wear. In conclusion 18.2% of subjects were deemed to have pathological tooth wear (mild, moderate & severe). Exploration with all associated variables gave a sample size ranging from 560 – 1715. The final sample size for further study greatly depends on available time and resources.

Key words *: pilot study, tooth wear, prevalence and sample size determination*

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Introduction

Well-designed studies are vital to provide important information for the efficient planning, operation, monitoring and evaluation of health services. To obtain statistically valid results, the decision on how large a sample to be selected from the population is important to avoid unnecessary

Table 1: Sample size calculation using socio-demographic variables

Variable	P_o	n per group (A)	Cases (A x 1.35=B)	Controls (B x 4)	Total n
1. Sex (subject)	0.51	86	116	464	580
2. Levell of education (Parents or guardian)	0.82	187	253	1,012	1,265
3. Types of occupation (Parents or guardian)	0.78	156	211	844	1,055

expenditure of time and resources. The size of sample required depends on the objectives and outcome of the study (1, 2). Before sample size can be calculated some information must be gathered from the literature. In some instances, available information cannot be used due to certain variations in the population. To overcome this problem, a small-scale study, termed as a 'pilot study' is necessary prior to the true study to estimate variability in outcomes and help determine the sample size (3).

The prevalence, intra-oral distribution and etiology of tooth wear in European communities have been an area of investigation in the past decade (4, 5). However, there are not many studies available in Malaysia to clearly establish the prevalence and etiology of tooth wear. Presently there is one published data from Sabah, which revealed a prevalence of 95% moderate and 41% severe tooth wear in age the group of 14 - 77 yrs (6).

Tooth wear, which in part is preventable; bring about discomfort especially during eating hot, cold, sweet and sour foods. If left untreated it can lead to tooth morbidity and mortality. In developed countries the prevalence of tooth wear is on the rise, which could be due to changes in dietary patterns (7, 8). In a developing country like Malaysia, there has been a rapid increase in the proportion of people living in urban areas and many households rely on ready market food such as fruit juices and soft drinks (9). With obvious changes in dietary patterns, it is useful to identify tooth wear problem in the local scenario.

The author is interested to observe the prevalence of tooth wear and associated factors among 16-year-old school children in Kota Bharu Town, Kelantan. Information gathered from the literature was not suitable for comparison due to varying age groups and very different dietary patterns. Therefore a pilot study was suggested by experts to obtain information for the estimation of prevalence and sample size.

Materials and Methods

This pilot study involved 55 randomly selected sixteen-year-old school children from 'Sekolah Menengah Kebangsaan, Kubang Kerian 2, Kota Bharu, Kelantan'. All children gave consent prior to the study.

A self-administered questionnaire was designed based on the literature and expert opinions. Each child was given 2 parts of the self-administered questionnaire consisting of socio-demographic background of the family was completed by the children at home. They were permitted to make enquiries from parents or guardian if in doubt.

The second part of the questionnaire was completed by the children in the school and collected at the end of the session prior to clinical examination. This questionnaire consisted of items regarding other variables associated with the study outcome and food and drinks frequency record, which was adapted from Food Intake Survey of Malaysia (Kajian Pengambilan Makanan Malaysia 2002/2003). Most questions required a 'yes' or 'no' response.

The oral examination was carried out in the dental mobile bus using disposable plane mouth mirrors, dental probes to remove food debris and periodontal probes to measure pocket depth at cervical regions of teeth under good operating light. The child was seated on the dental chair with the operator behind and the recorder seated in front of the child. Charting of tooth wear and other oral findings were done using Smith and Knight Tooth Wear Index 1984 (TWI) and WHO criteria respectively. The Tooth wear index was designed to record levels of tooth wear regardless of the cause. Each visible tooth surface (buccal, lingual, occlusal

Table 2 : Sample size calculation using oral hygiene practice variables

Variable	P_o	n per group (A)	Cases (A x 1.35=B)	Controls (B x 4)	Total n
1. Type of tooth brush Britstles	0.84	209	282	1,128	1,410
2. Tooth paste	0.75	140	189	756	945
3. Mouth rinses	0.11	153	207	828	1,035
4. Frequency of tooth brushing	0.71	123	166	664	830

or incisal and cervical) was observed. Scores from 0 to 4 were given according to the severity of wear (10, 11). The raw data of tooth wear scores were then entered into a Microsoft Excel programme to determine pathological tooth wear. The SPSS version 11.5 was used for data management.

Sample size was then calculated based on the objectives of the true study. The first objective aimed to determine prevalence of tooth wear. The second objective aimed to compare pathological tooth wear between cases and controls. Cases were subjects with pathological tooth wear and controls were subjects with no pathological tooth wear. Sample size for the prevalence of raw and pathological tooth wear was calculated using the single proportion formula. The sample size for the case-control study was calculated using PS software (12).

Method of sample size calculation for prevalence of tooth wear:

a. Raw tooth wear

Calculation was done based on single proportion formula:

$$n = [Z_{./2} / f]^2 p (1-p)$$

b. Pathological tooth wear

Calculation was done based on single proportion formula:

$$n = [Z_{./2} / f]^2 p (1-p)$$

Where n = the sample size required, $Z_{\_/2}$ =95% confidence interval with a significant level for _ set at 0.05, f = the precision determined by expert and p = prevalence of outcome.

The PS software was used to calculate of sample size for the case-control study. Variables used for sample size calculation were sociodemographic variables, oral hygiene practice variables, food frequency record variables and other associated variables. In the PS software, _ (alpha) is the level of significance set at 0.05, ß was set at 0.2 and power of study (1- ß) was 0.8, _, the Odd ratio set at 2, M the ratio between prevalence of pathological tooth wear and no pathological tooth wear which was equal to 4, and P_0, the proportion of children being exposed in control group.

The PS software provided the sample size for one group. Thirty-five percent was added to the size of the sample to cater for 20% non-response and 15% inflated, as subjects need to be examined first before they can be excluded from the study. Subjects with fixed orthodontic appliances and those who have less than twelve teeth to be scored were excluded (13).

Table 3 : Sample size calculated using food and drink variables

	Variables	P_o	n per group (A)	Cases (A x 1.35=B)	Controls (B x 4)	Total n
1.	Coca-cola	0.67	111	150	600	750
2.	Fizzy cola	0.27	89	120	480	600
3.	Others (Pepsi, 100 Plus)	0.18	108	146	584	730
4.	Mango juice	0.31	85	115	460	575
5.	Orange juice	0.87	254	343	1,372	1,715
6.	Apple juice	0.44	83	112	448	560
7.	Ice lemon tea	0.71	123	166	664	830
8.	Dairy-product	0.69	117	158	632	790
9.	Mango (fruits)	0.82	187	253	1,012	1,265
10.	Pineapples	0.56	91	123	492	615
11.	Oranges	0.80	170	230	920	1,150
12.	Apple	0.82	187	253	1,012	1,265
13.	Pickles	0.47	84	113	452	565

Results

All children were Malays with about equal male to female ratio. Raw tooth wear results revealed a prevalence of 63.6 % very mild tooth wear (score 1), 10.9 % mild (score 2) and 5.5% moderate (score 3) and 1.8 % severe (score 4). The prevalence of pathological tooth wear (mild, moderate and severe) was 18.2%. Therefore the sample size calculated for the first objective of raw and pathological tooth wear was 284. For the second objective, when sample size was calculated using socio-demographic variables (Table 1), the level of parent or guardian education revealed the biggest sample size of 1,265 children. The ethnic group and income variables were not considered because all children were Malays and the latter was a numerical variable, which will reveal a smaller sample size. When sex was considered comparing male to female, the smallest sample size of 580 was obtained.

As shown in Table 2, oral hygiene practice variables were also used to determine the sample size. The type of tooth brush bristles, comparing medium and soft revealed the biggest sample size of 1,410 subjects, followed by mouth rinse use (n=1035), tooth paste use comparing Darlie and Colgate (n=945) and frequency of tooth brushing comparing twice and once per day (n=830).

When food and drink variables were considered (Table 3), orange juice intake revealed the biggest sample size (n=1,715) followed by mango and apple juice with similar sample size (n=1,265) and the remaining variables gave sample sizes between 565 to 1,150. The smallest sample size was obtained when apple juice intake was considered (n=560).

Table 4 illustrates the sample size obtained when other associated variables for developing tooth wear were calculated. Swimming in chlorinated pools and tooth grinding revealed the biggest sample size of n=1,215 and the intake of chewable vitamin C tablets revealed the smallest sample (n=580).

Discussion

The continuous use of teeth causes some degree of wear. Tooth wear is an irreversible process. Some researchers estimated that the wear of natural teeth due to mastication is a little more than the thickness of human hair per year (14).

The Smith and Knight tooth wear index (TWI, 1984) was one of the earliest indices available for use in epidemiological studies (10). Since then some modifications have been made by several researchers to obtain a simpler version of the index (11). Various studies have revealed the prevalence of raw tooth wear in many different ways (5,6,15, 16). A few studies revealed the findings of pathological tooth wear (17, 18). Although tooth wear occurs in combination, the effect of erosion is more dominant (11,19,20). The etiology of erosion is multifactorial, which involves host factors (saliva), tooth (acid resistant), time, diet, lifestyle, medication and environment (8, 21, 22). A few studies have explored the relationship between saliva and tooth wear (23, 24, 25). Saliva variables such as hydration, viscosity, pH, flow rate and buffering capacity was not explored in this pilot study due to budget and time constraints. Furthermore all saliva variables except viscosity of saliva are numerical variables, which will eventually reveal smaller sample sizes.

Many studies (15,18,26,27,28) have established the association between diet and tooth wear, especially erosion. Food frequency questionnaires were used for this purpose to determine the consumption and frequency of consumption such as daily or weekly.

Socio-economic status can influence

Table 4 : Sample size calculated using other associated variables

Variables	P_o	n per group (A)	Cases (A x 1.35=B)	Controls (B x 4)	Total n
1. Caries experience	0.67	111	150	600	750
2. Smoking	0.18	109	147	588	735
3. Swimming	0.09	180	243	972	1,215
4. Vomiting	1.00	-	-	-	-
5. Tooth grinding	0.09	180	243	464	1,215
6. Chewable Vitamin C	0.29	86	116		580

behavior. Several studies have attempted to evaluate the relationship between socioeconomic status (SES) and tooth wear (18, 23) in children. Al-Dlaigan et al. (25) found that 61% of children from the lowest SES group had erosion compared to 31% in the highest SES group.

Dental erosion is associated with people who have a very high standard of oral hygiene (8). Oral hygiene practices like brushing teeth last at night, technique of tooth brushing, type of toothbrush used and frequency of brushing were found to have an association with erosion (29).

Other associated factors explored in previous studies such as the effect of taking chewable Vitamin C tablets (23), clenching and grinding habits (15,29) and swimming in chlorinated pools were also explored in this pilot study.

After exploration of all possible variables, it was found that intake of oranges yielded the biggest sample size (n=1,715) and the intake of apple juice gave the smallest sample size (n=560). The final selection of sample size for further study depends largely on available time and resources.

Conclusion

The overall prevalence of raw tooth wear among 16-year-old school children was 81.8% and prevalence of pathological tooth wear was 18.2%. The sample size for further study may vary in the range of 560 - 1,715 depending on available time and resources.

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