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SCIENTIFIC SECTION

Digit sucking in children resident in Kettering (UK)

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Introduction

Non-nutritive sucking habits are one of the most important environmental factors affecting a person's occlusion, particularly when the habit is persistent. Initial sucking habits are described as 'a daily habit, evident in the small child for several months' whilst prolonged habits are those 'which prevail until at least 6 or 7 years of age'.[1]

The reported prevalence of initial dummy and finger sucking habits varies between different countries. Scandinavian studies report figures ranging from 70 to 95% of the age groups studied, with dummy suckers being the majority.[1–5] Before 1970, there was less interest in dummy sucking and hence the prevalence of the initial sucking habits was reported as low, prevalences between 19 and 37% for child groups of different ages and countries (Gardiner: UK, 1956; Klackenberg: Sweden, 1960; Bowden: Australia, 1966).[6–8]

Reports of the prevalence of prolonged digit sucking also vary greatly. Popovich[9] reported a figure of 12.9% among 155 Canadian 10-year-olds and 7.2% of 135 12-year-olds. Baalack and Frisk[10] found that 8% of their Swedish sample of 8158, 12-year-olds were prolonged digit suckers at 7 years of age and only 1.9% at 12 years of age. These differences between the Canadian and Swedish study may be due to differing sample sizes and variation in child rearing practices. In a retrospective study of 920 Swedish children, Larsson[2] found that the prevalence of prolonged digit sucking at 9 years of age was 12%. Both the Swedish studies were robust and well designed epidemiological studies with high response rates (80–100%) to their questionnaires. In addition, Larsson's team interviewed the children and validated the parental responses by telephone, increasing the reliability of their results.

There have been relatively few studies of non-nutritive sucking prevalence in the United Kingdom. In 1956, Gardiner[6] interviewed and examined 1000 Sheffield school children aged 5–15 years. The prevalence of an initial digit sucking habit was 27.2%, with 11.2% of the children demonstrating a history of sucking beyond the age of 5 years. The prevalence of an initial dummy sucking habit was 19.5% and less than 3% of these were reported to subsequently develop a digit sucking habit.

The prevalence of sucking habits is known to depend on a number of factors including age, sex, race, socio-economic status and the availability of dummies.[11] There is some evidence that the number of siblings and the mode of feeding have an influence on the prevalence of digit sucking, although this is not conclusive.[11] The aim of the present study was to assess the prevalence of digit sucking amongst primary school children resident in Kettering, and to consider if there were differences between genders, ethnic groups, levels of material deprivation, number of siblings, and association with the use of dummies. This study would provide the basis of a template for investigating digit sucking throughout the United Kingdom.

Materials and methods

The sampling frame included 1886 children aged 7–11 years old in mainstream, state maintained primary schools in Kettering and his/her parent/guardian. All the children in the schools were included.

Permission to approach local authority schools was granted by the Northamptonshire Local Education Authority. The study was approved by the Northamptonshire Local Research Ethics Committee and by the Kettering General Hospital NHS Trust Research and Development (R&D) Committee, REC reference number: 05/Q2503/40.

Focus group meetings were used to identify qualitative issues important to dentists, orthodontists, patients and parents. Self-completion postal questionnaires were developed for children and parents. Most of the questions were closed questions and respondents were given the opportunity to give their comments at the end of some of the questions. Microsoft Word (Microsoft

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Corporation, Seattle, WA, USA) was used to calculate the readability of both questionnaires as described by Williams.[12] They both had a high readability score (>95).

A panel of consultant orthodontists, two community dental officers, a consultant child clinical psychologist, and a dental hygienist who is now a primary school teacher reviewed the questionnaire to test the validity of the questionnaires. A pilot study was then carried out in a school not included in the main study to assess the validity, reliability and acceptability of the questionnaires.

A statistician and database development officer were both consulted to design the response-coding scheme. A database was developed using Microsoft Access (Microsoft Corporation, Seattle, WA, USA).

Subjects were pre-warned about the study. Head teachers were asked to contact all parents briefly outlining the purpose of the study before the questionnaires were sent out. In addition, the local media broadcasted details of the study in the form of a bulletin in the Kettering Evening Telegraph, and interviews on Northants FM radio, BBC Northampton radio and on BBC Anglia News. Posters were sent to all the head teachers to put up on notice boards informing parents and students that the study was about to take place.

Envelopes containing a child questionnaire, a parent questionnaire, an information leaflet, a consent form and either a reflector, an activity puzzle book or a gel pen as an incentive, were delivered to the schools. Both parents and children were asked to complete the questionnaire at home, ideally without conferring with each other. Head teachers were urged to send out reminders to all the subject's parents to participate in the study. The questionnaires were collected from the schools a fortnight later.

Data were stored, collated and analysed using SPSS for Windows, release 12.0. Categorical data were analysed using the Chi-squared test and numerical data using the Student's *t*-test or Mann Whitney U as appropriate. Statistical significance was accepted at the 5% level ($P<0.05$). Univariable and multivariable logistic regression analyses were undertaken in order to investigate possible associations between patient factors and the likelihood of a child having ever sucked a digit or dummy and of a child being a prolonged digit sucker.

The socio-economic background of the children was assessed by allocating a Townsend score based on the postcode of each child.[13] The Townsend score is a measure of levels of material deprivation and includes four variables: unemployment, overcrowding, lack of owner occupied accommodation and lack of car ownership. This score is a summation of the standardised scores for each variable where scores greater than zero indicate greater levels of material deprivation. Hence subjects with a positive Townsend deprivation score are considered to be living in an area that is relatively deprived. Conversely subjects with a negative score are deemed to be living in a relatively affluent area. Subjects were dichotomised accordingly for the purpose of this study.

Results

Eleven out of thirteen schools agreed to participate in the study. The response rate from 1886 children was 713 (39.9%). The characteristics of the included children are shown in Table 1. The sample consisted of 331 (46.4%) boys and 382 (53.6%) girls and their parents. The children surveyed were from years 3–6 (7–11 year olds), with similar numbers of children in each year group. The majority of the sample was white (642, 90.0%), with 56 (7.9%) from other ethnic groups and 15 (2.1%) unreported ethnicity. The mean number of children in each family was 2.46 (SD 1.135). The analysis of Townsend scores showed that 371 (52.0%) of the children lived in relatively affluent areas, while 267 (37.4%) lived in comparatively deprived areas and 75 (10.5%) did not report their postcode.

Most habits began in the first year of life. Significantly more females ($n=114$) than males ($n=54$) had an initial digit sucking habit ($P<0.001$) but there was no gender difference in the dummy-sucking group. The prevalence of dummy sucking was 46.4% ($n=331$) and was inversely related to the prevalence of digit sucking ($P<0.001$) with only 7.6% ($n=54$) of the sample demonstrating both habits. The univariable logistic regression analyses indicated that females were more likely than males to have ever sucked a digit or dummy (OR=1.717, 95%CI=1.244 to 2.368, $P=0.001$). Non-white children were half as likely to have ever had a sucking habit as white children (OR=0.560, 95%CI=0.322 to 0.977, $P=0.041$) (Table 2). These results were confirmed by the multiple regression analysis (Table 3).

All the dummy suckers had ceased the habit before 7 years of age. The main method reported for giving up dummy sucking was throwing the dummy away. The most common responses from children for giving up a sucking habit were 'no real reason', 'when started school' and 'mum/dad asked me to'. The most popular digit sucking habit-breaking techniques used included offering the child a reward and using a foul tasting liquid over the thumb. Only three patients had used a dental brace.

Table 1 Characteristics of the responding children in relation to their sucking habits*

	Never sucked		Ever sucked (digit or dummy)		Ever sucked (dummy only)		Prolonged sucker (digit only)		All	
	N (217)	%	N (496)	%	N (382)	%	N (86)	%	N (713)	%
Gender										
Male	121	55.8	210	42.3	171	51.7	25	29.1	331	46.4
Female	96	42.3	286	57.7	211	48.3	61	70.9	382	53.6
Year of schooling										
3	44	20.3	129	26.0	103	27.0	27	31.4	172	24.3
4	50	23.0	121	24.4	89	23.3	21	24.2	171	24.0
5	60	27.6	117	23.6	92	24.0	23	26.7	177	24.8
6	63	29.0	129	26.0	98	25.7	15	17.4	192	26.9
Ethnicity										
White	190	87.6	452	91.1	354	92.7	77	89.5	642	90.0
Non-white	24	11.1	32	6.5	17	4.5	9	10.5	56	7.9
Not reported	3	1.4	12	2.4	11	2.8	0	0	15	2.1
Area of residence										
Relatively affluent	122	56.2	249	50.2	191	50.0	40	46.5	371	52.0
Relatively deprived	73	33.6	194	39.1	150	39.3	38	44.2	267	37.4
Not reported	22	10.1	53	10.7	41	10.7	8	90.7	75	10.5

*The categories 'ever sucked' and 'prolonged sucker' are not mutually exclusive. The total of children is the sum of 'never sucked' and 'ever sucked'.

The prevalence of prolonged digit sucking habits at the time of the study was 86 (12.1%). The univariable logistic regression analysis demonstrated that the probability of a child having a prolonged sucking habit was independent of year of schooling, ethnicity, socio-economic status and the number of children in the family. However, females were significantly more likely to be prolonged digit suckers than boys (OR=2.326, 95% CI=1.423 to 3.801, P=0.001) (Table 2). Multiple logistic regression (Table 3) confirmed the results from the univariable regression in that gender was the only significant predictor of having a prolonged digit sucking habit.

A quarter of parents of prolonged digit suckers reported the habit took place for more than 6 hours a day. The children and the parents reported that the

Table 2 Univariable logistic regressions for odds ratios of habits

	Ever sucked (digit or dummy)			Prolonged sucker (digit only)		
	OR	95%CI	P value	OR	95%CI	P value
Gender						
Male	1			1		
Female	1.717	1.244, 2.368	0.001	2.326	1.423, 3.801	0.001
Year of schooling						
3	1			1		
4	0.825	0.513, 1.327	0.429	0.757	0.410, 1.399	0.374
5	0.665	0.419, 1.056	0.084	0.808	0.443, 1.472	0.485
6	0.698	0.443, 1.102	0.123	0.458	0.235, 0.894	0.022
Ethnicity						
White	1			1		
Non-white	0.560	0.322, 0.977	0.041	1.405	0.663, 2.980	0.375
Area of residence						
Relatively affluent	1			1		
Relatively deprived	1.302	0.922, 1.839	0.134	1.373	0.854, 2.208	0.191
Family size						
Each additional child	1.031	0.893, 1.191	0.679	1.130	0.946, 1.350	0.179

habit occurs mainly when going to sleep, when tired, while watching TV and when unwell. Sixty nine per cent of the persisting digit suckers would like to give up the habit, 18% of the persistent suckers were not sure and 13% responded that they would not like to stop. In contrast, 87% of parents with prolonged digit suckers would like their child to stop the habit, 10.5% were unsure and 2.5% did not wish their child to stop. Most parents of persisting suckers admitted to trying to stop the habit (74%). Only 22% of parents of persistent digit suckers had taken advice from their dentist, 2.6% from their doctor, 4% from a friend and 1% from a nurse. Furthermore, 74% had not sought advice to stop the habit.

Discussion

The results demonstrate that for these children, gender and ethnicity had a bearing on the prevalence of ever having a sucking habit whilst only gender was associated with a prolonged digit sucking.

All the primary schools excluding special schools in Kettering were approached to avoid selection bias. Two schools did not agree to participate in the study. Both schools were in close proximity to two other schools serving the same catchment population and it is hoped that this would not yield significantly different results.

Children aged 7–11 years old were surveyed as the permanent dentition erupts during this period and digit sucking may have a significant impact on the occlusal development. Primary school children are usually more willing to participate in studies than secondary school children who have more pressures on their time.

The response rate was 40%, which is lower than that obtained by others who have investigated digit sucking. However, a study of response rates in school surveys has shown a decline in rates from 1995 to 2004, with a mean of 45% and a range of 20–75% in 2004.[14] Poor response rates have been shown to lead to bias because people from higher social groups and non-ethnic minorities are more likely to complete questionnaires than other groups.[15] The results for this study must therefore be interpreted with caution and the possibility of non-response bias cannot be overlooked. Unfortunately schools were unable to release demographic data of the pupils, which did not permit comparison of responders and non-responders. However, there was no distinct difference between socio-economic status and the ethnic groups of the respondents from each school as they were all selected from a small town. It is possible that digit suckers were more likely to respond to a questionnaire on a subject that is more relevant to them or that digit suckers were too embarrassed to respond but it was not possible to control for this.

Williams[12] made several recommendations to increase the response rate. During this study a number of these recommendations were employed. A publicity campaign was undertaken to ensure subjects knew about the study and official hospital paper was used for all correspondence. The child questionnaires were brightly animated and printed in colour. In addition, a non-monetary incentive for a child was included with every set of

Table 3 Multivariable logistic regressions for odds ratios of habits

	Ever sucked (digit or dummy) $n=638$			Prolonged sucker (digit only) $n=638$		
	OR	95%CI	*P* value	OR	95%CI	*P* value
Gender						
Male	1			1		
Female	1.552	1.098, 2.195	0.013	2.225	1.318, 3.754	0.003
Year of schooling						
3	1			1		
4	0.841	0.505, 1.402	0.508	0.840	0.439, 1.610	0.600
5	0.667	0.404, 1.103	0.114	0.759	0.391, 1.474	0.416
6	0.653	0.401, 1.066	0.088	0.525	0.263, 1.050	0.068
Ethnicity						
White	1			1		
Non-white	0.519	0.285, 0.944	0.032	1.532	0.679, 3.455	0.304
Area of residence						
Relatively affluent	1			1		
Relatively deprived	1.258	0.882, 1.795	0.204	1.205	0.739, 1.966	0.454
Family size						
Each additional child	1.031	0.882, 1.206	0.699	1.120	0.927, 1.352	0.240

questionnaires. Each subject was also assured of the anonymity of the survey. Schools were asked to address the envelopes to personalise them to increase the chance of parents opening the envelopes found in a child's school bag. The head teachers recommended that the completed questionnaires were returned to school within a week of distribution rather than parents posting them. A return postal address was however, included on the envelopes to give parents the option to send the completed questionnaires directly to the hospital. All head teachers were also urged to send out reminders to parents to return their questionnaires but there was no way of ensuring this happened in every school. Despite this the return rate was disappointing. We feel that this may be attributed to a number of factors; the interest of the head teacher, the commitment of the schoolteacher and the volume of schoolwork at the time of the survey. Unfortunately it was not possible to influence all these factors or identify them in particular schools. It was noted that the three schools that imparted a response rate above 50% all had head teachers that were demonstrably more enthusiastic and dedicated about the study. The response rate may have been improved if the study had been carried out during school visits from the Community Dental Service or there had been research assistants who could have been present on-site to help pupils complete the survey and encourage their parents to participate in the study. In addition, sending a repeat questionnaire may have increased the return rate but this was not acceptable to the schools due to time constraints. Further improvement in the robustness of the data could have been made by direct examination or interview of children and their parents to verify the answers as described by Larsson.[2] Unfortunately, due to time and financial constraints this was not possible but could be considered for any future studies.

It is well known that retrospective questionnaire based studies asking children and their parents about their sucking habits are prone to recall bias.[16] There is the possibility that parents with several children in the family cannot remember if that particular child had a sucking habit or not. Parents were urged not to influence the children's responses. Nonetheless, it is impossible to know whether the child responses were completely exclusive from their parent's. A child may not remember if they had a dummy sucking habit, which may have only lasted a few months and would be expected to check with their parents or the sucking habit is part of family folklore. This study showed that there was good agreement between parent and child reporting. This fact suggests the child and parent may have conferred in their responses but does not invalidate the fact of the sucking habit itself and may even reinforce the validity of the data.

In this study, the prevalence of an initial sucking habit was 70%, with the majority being dummy suckers, which is comparable to Larsson's 1971 study. The prevalence of an initial digit sucking habit was 23.6%, which is only a little lower than the other United Kingdom based study in 1956.[6] However this finding represents a sizeable percentage, where the habit may lead to malocclusion and the need for future orthodontic treatment, and is therefore a significant finding. With increasingly limited resources allocated to orthodontics in the United Kingdom, prevention programmes may be cost-effective and therefore collection of this data is important.

The prevalence of sucking habits in children has been reported to vary with a number of factors including age, gender, ethnic origin, number of siblings and socio-economic status. Most of the children in the present study developed their sucking habit in the first year of life, which is in agreement with Traisman and Traisman.[17] All the dummy suckers had ceased the habit before school age. This is not surprising as dummy sucking at school is not encouraged and there is increasing social pressure to stop. In contrast, 51.5% of the initial digit suckers persisted with the habit at the time of the study. It is well reported in previous studies that digit sucking continues into early adolescence.[2,9,10] This may be because the thumb cannot be disposed of like a dummy. This study however, has confirmed that as a child gets older the habit reduces. This may be due to a combination of peer pressure, emotional maturity, parental request and rewards.

The results of this study and previous studies clearly confirm that there is a gender difference in the prevalence of digit sucking habits with girls having a significantly greater prevalence of initial and prolonged digit sucking habits than boys.[2,10]

This study supports previous work in that there was no significant association between the number of children in a family and the prevalence of sucking habits.[18]

Whilst other investigators have reported a significantly greater prevalence of digit sucking habits among children of higher socio-economic groups, this was not confirmed in the present study.[19] This may be either because there were no significant differences between socio-economic groups due to the small area covered, or that the low response rate filtered out certain socio-economic groups. The present study cannot prove this but the most relevant factor is probably that the socio-economic groupings in Kettering are similar.

The prevalence of dummy sucking in this study was inversely related to the prevalence of early digit sucking. This leads one to speculate that if a child accepts a dummy, he/she is less likely to engage in a digit sucking habit. Several studies have indicated that such a correlation exists.[4,9,20] In view of the potential occlusal effects of digit sucking, parents should perhaps be encouraged to give their child a dummy if an early habit commences. In this study it was reported by the parents that in all cases the dummy sucking habit is discontinued with little intervention apart from parental request, offering a reward and throwing the dummy away. This reinforces the advice of most orthodontic experts who feel that dummy sucking does not need to be addressed as it usually stops spontaneously before the permanent dentition erupts.[7,21,22]

Only 31% of the parents of persistent digit suckers in this study reported the habit occurring for more than 4 hours a day. According to Proffit,[21] pressure against the teeth has to exist for at least 6 hours a day to result in tooth movement. If this is true then the incidence of malocclusion in this cohort, exacerbated by the sucking habits should be low. This will be evaluated at a later stage.

About half of the digit suckers stated that they gave up their digit sucking habit for 'no real reason' or because they started school. This is probably associated with peer pressure, greater self-awareness and coercion from parents and teachers.

The majority of children felt the habit would make their teeth look different. Most of the persistent digit suckers and their parents wished to give up the habit. However, very few had taken advice. Digit sucking can exacerbate malocclusions and therefore parents and children need to be supported in helping tackle persistent habits. Table 4 outlines the management protocol for digit sucking habits.[23] This could be carried out by the child's dentist, general medical practitioner, health visitors, and by distributing patient information leaflets. It the habit should persist and the child has a visible malocclusion, they should be referred to an orthodontist for further care.

Table 4 Management protocol for digit-sucking habits[23]

Primary dentition
• No treatment indicated
• If dummy-related advise use of 'orthodontic dummy'
• Reassure parents that anterior open bite should resolve when habit stops
Early mixed dentition
• Advise patient to give up habit
• Use simple *aides memoire* or daily rewards
Late mixed dentition
• Consider deterrent appliance if advice has not worked
• May need orthodontic expansion of upper arch
Permanent dentition
• Spontaneous resolution of anterior open bite unlikely
• Refer for specialist opinion

Conclusions

The results of this questionnaire based study give some epidemiological insight into the prevalence of digit sucking habits. The data should be interpreted with caution as the study was retrospective and had a lower than ideal response rate.

- The prevalence of initial sucking habits amongst primary school children in Kettering is 69.6% (496).
- 46.4% of the 7–11 year olds in Kettering have had a dummy sucking habit.
- Most habits begin in the first year of life. The prevalence of digit sucking declines with increasing age.
- 23.6% of the 7–11 year olds in Kettering have had an initial digit sucking habit.
- 12.1% of 7–11 year olds in Kettering have a digit sucking habit persisting beyond the age of 7.
- Prolonged digit sucking is more common in girls than boys (♀/♂, 2 : 1).
- Children who use a dummy are less likely to become digit suckers.

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