An Interdisciplinary Oral Health Program for Children in Kindergartens of Northern Italy

Antonina Orlando  
Universita degli Studi di Milano-Bicocca

Maeregu Woldeyes Arisido  
Universita degli Studi di Milano-Bicocca

Stefano Briscidi  
Universita degli Studi di Milano-Bicocca

Luca Maccà  
Universita degli Studi di Milano-Bicocca

Stephanie Graci  
Universita degli Studi di Milano-Bicocca

Maria Cristina Panzeri  
Universita degli Studi di Milano-Bicocca

Fulvia Mecatti  
Universita degli Studi di Milano-Bicocca

Paola Palestini  
Universita degli Studi di Milano-Bicocca

Emanuela Cazzaniga (emanuela.cazzaniga@unimib.it)  
Universita degli Studi di Milano-Bicocca  
https://orcid.org/0000-0002-5006-2280

Research article

Keywords: Children, oral health, dental caries, educational programme, nutrition, kindergartens, prevention, public health

Posted Date: August 18th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-50630/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License
Abstract

**Background:** The aim of the study was to investigate if a parents’ training program on nutritional and oral health behaviours held by health professionals can influence children habits in a sample of kindergartens in Northern Italy.

**Methods:** The study designed was a longitudinal study. The study population were children aged 6–36 months attending four kindergartens. Parents were invited to participate filling out a self-administered questionnaire, and after having returned the informed consent form they were asked to participate to a training meeting. Parents had to fill out a questionnaire at baseline and after 3 months from the training meeting. The questionnaire included information on socio-demographics about parents, oral hygiene habits of parents and child, and eating habits of child. Wald test was used to analyse data collected.

**Results:** After the training program, almost all children were able to use a toothbrush suitable for kids (from 91% at the baseline to 99% after the 3-months). The analysis shows that the given training significantly increased the number of children who use toothpaste from 86% at baseline (95%CI: 85%-88%) to 96% (95%CI: 94%-98%). The use of fluoride toothpaste significantly increased after the training intervention as the baseline measure of 59% proportion increased to 80%. The intervention study showed a positive impact on the number of pupils who wash their tooth more than twice per week and on the timing of oral hygiene as both night and morning time proportion increased after the 3-month. Regarding the feeding habits the given consultation resulted in a statistically significant increase regarding the importance of morning snack from 94% at baseline (95%CI: 92%-96%) to 97% after 3-month (95%CI: 94%-99%). Another promising effect of the education is the decrease from 47% at baseline (95%CI: 46%-49%) to 42% after the study (95%CI:41%-43%) of the bad habit of having a snack after dinner.

**Conclusions:** Results of our study have shown that a parents training intervention can have good results on the oral hygiene and eating habits of children of this age group. To underline the importance of several professional figures who work together with a common purpose.

**Background**

Dental caries (tooth decay) is one of the most prevalent infectious diseases among children and is caused by the activity of the common oral micro flora (1).

Caries can be considered as a lifestyle disease that can largely be prevented by maintaining strict but simple nutritional habits (e.g., low sugar intake, limited night-time bottle-feeding and no sharing of eating utensils) and by applying appropriate oral health behaviours (e.g., regular dental visits, tooth brushing and using fluoridated toothpaste) (1, 2).

Recent epidemiological surveys indicate a reduction in the prevalence of caries in Italy which is in line with the trend observed in industrialized countries (3, 4). Nobile et colleagues reported that 19% of the
children aged 36-71 months attending kindergartens had experienced early childhood caries (ECC) (5).

Given the existence of a correlation between caries of deciduous dentition and the prevalence of caries in permanent dentition (6), we think it is necessary to intervene from early childhood (3) to develop good dental hygiene habits.

Another important aspect is the feeding of the first years of life. It is, indeed, proven that the food choices and frequency are important risk factor for caries in children (7). Early feeding habits, involve a number of simultaneous and interrelated behaviours, such as breastfeeding, bottle-feeding and the introduction of complementary foods (8). Moreover, it is demonstrated that some feeding behaviours established in the first three years of the child's life may be maintained in later years, potentially impacting in oral health over the life course (9). In particular, specific feeding practices, initiated earlier than 12 months, have been linked to caries: addition of sweeteners and sweet snack consumption before 6 months (10).

Parents can be considered the most important actor in caries prevention especially for children under the age of 10. The parents’ willingness to invest time and effort to do so will depend, among other things, on their knowledge and their perceptions of the effectiveness of preventing caries by maintaining proper oral hygiene (1, 11).

Moreover, schools can provide an ideal setting for nutrition interventions as they serve as a focal point to involve families and educators, to implement effective and sustainable aid for children. Studies have shown that nutrition education programs have an effect on improving good eating habits, it is important to underline that the parental involvement can increase children's nutritional behaviour (12).

The aim of this study was to investigate if a parents’ training program on nutritional and oral health behaviours held by health professionals can influence children habits.

**Methods**

**Study design**

The Ethics Committee of University of Milano-Bicocca approved this longitudinal study (protocol 298 03/04/2017). The study was conducted with the informed consent of all caregivers and in full accordance with the ethical requirements of the World Medical Association Declaration of Helsinki (2008).

The study was based on kindergartens located in the northern part of Italy, with four nursery locally named as ‘Bambini Bicocca’ (Milan), ‘Le Ciliegine’ (Monza), ‘La Piccola Tribù’ (Grignano, BG), ‘Maria Bambina’ (Lissone, MB).

**Prevention of caries program**
Parents and kindergartner educators were counselled on general and oral health, toothbrushes and Typodont were used for the illustration of correct oral hygiene manoeuvres. It was advised that tooth brushing should be started at time of eruption of the first tooth and should be undertaken twice a day after meals with an age appropriate toothbrush and a pea-sized layer of fluoride toothpaste (1000 ppm NaF or amine fluoride) (13, 14). Parents should schedule a dental visit in the first year of life of their children followed by regular dental care with annual dental examinations. Every family received a folder with brief information materials and a toothbrush and fluoride toothpaste were provided as incentives.

The main nutritional aspects treated during the meeting were the importance of taking five meals per day, in particular having a morning and afternoon snack, the role of fruit and vegetables daily consumption, the importance of drinking water according to the World Health Organization guidelines (15). Particular attention was given to instruct parents to prefer slowly absorbed sugars and drastically reduce the intake of free sugars with the diet. The child diet should include fibre-rich foods and low in simple sugar. Water should be preferred over any sweetened drink in order to intake less than 10% of energy from free sugars as recommended by WHO (16).

**Questionnaire and data collection**

After the signing of the informed consent, all parents were invited to fill out a questionnaire (baseline, T1). Next, there was a parents’ training meeting in which correct oral hygiene manoeuvres and correct eating habits were explained. The meeting were realized by health professionals (dental hygienists and nutritionists) of University of Milano-Bicocca. After 3 months (T3) from the training meeting the same questionnaire was given to evaluate the general improvement of family habits.

The questionnaire (supplementary material 1) completed by parents included information on: socio-demographics status about parents (sex, age, education level) and child (sex, age, gender, date and place of birth), oral hygiene habits of parents and child (frequency of tooth brushing at the moment of the interview, supervision of toothbrushing, use of toothpaste, exposure to fluoride), nutritional habits (frequency of the snack during the day, type of food intake).

**Statistical analysis**

A longitudinal study was adopted, with data collection at baseline (T1) and after 3-month (T3).

Descriptive statistics and plots were used to summarize the data. The trend/evolution of the main variables such as quantity and timing of tooth washing, feeding habit during the follow-up (from T1 to T3) was evaluated using a linear mixed-effects model with a random intercept and random slope by treating time as a continuous variable. These response variables were assumed to follow a binomial distribution in the linear mixed effects model.

**Results**
The number of subjects interviewed at baseline T1 were N=103, and after the training intervention 68 of them provided complete data. The average age of the participating children at baseline was 2.249 (2 years and 3 months) (SD=0.91 years) with the youngest 0.55 (6 months) and the oldest 5 years. With regards to the parents who received the training, the average age at baseline was 36.89 (SD=4.78) with the youngest 18.54 and the oldest 49.90 years. 72.5% of the parents completed university degree qualification, while 26.5% and 1% completed high school and middle school (higher than elementary), respectively. As for parents dental cleaning habit, 2% clean once a day, 56.1% clean twice and 41.9% three times per day.

Table 1. Impact of the study intervention.

|                          | Baseline   | After 3-month follow-up | P-value |
|--------------------------|------------|-------------------------|---------|
| Autonomy                 | 33(27,40)  | 30(28,32)               | 0.636   |
| Toothbrush for kids      | 91(86,96)  | 99(98,100)              | **0.00826** |
| Use of Toothpaste        | 86(85,88)  | 96(94,98)               | **0.0494** |
| Use of fluoride toothpaste | 59(50,69) | 80(79,83)               | **0.0275** |
| Number of wash per week  | 46(44,64)  | 59(57,61)               | 0.1250  |
| Night wash               | 80(78,82)  | 90(88,91)               | 0.1310  |
| Morning wash             | 57(54,59)  | 68(65,70)               | 0.2152  |
| Dental visit             | 12(10,14)  | 14(12,16)               | 0.8737  |
| Feeding habit            |            |                         |         |
| Morning snack            | 94(92,96)  | 97(94,99)               | **0.0038** |
| Afternoon snack          | 2.8(2.7,3) | 3.4(3.0,3.5)            | **0.0256** |
| Night snack              | 47(46,49)  | 42(41,43)               | 0.6015  |

Table 1 reports results with regard to the impact of the given study intervention on a set of 8 variables used to describe oral hygiene. These variables include, toothbrush for kids, use of fluoride toothpaste, the habit of toothpaste use, number of dental wash per week (indicated as greater than or less than twice per week), time of wash and various snack time and dental visit.

We noticed that after the training program, almost all children were able to use an appropriate toothbrush suitable for the kids. This was confirmed by the increase from 91% at the baseline to 99% after 3-month with a strongly significant P-value=0.0082. The analysis of the data also shows that the given training significantly increased the number of children who use toothpaste from 86% at baseline (95%CI: 85%-88%) to 96% (95%CI: 94%-98%) with P-value=0.0494. The use of fluoride toothpaste was
significantly influenced by the training intervention as the baseline measure of 59% proportion was increased to 80% with P-value=0.0275. The intervention study increased the number of pupils who wash their tooth more than twice per week from 46% at baseline (95%CI: 44%-64%) to 59% after 3-month (95%CI: 57%-61%), although the increase was not statistically significant (P-value=0.1250). Similarly, the intervention showed a positive impact on the timing of oral hygiene as both night and morning time proportion increased after the 3-month. The trend of these variables are also reported in Figure 1.

Regarding the feeding habits the given consultation resulted in a statistically significant increase regarding the importance of morning snack from 94% at baseline (95%CI: 92%-96%) to 97% after 3-month (95%CI: 94%-99%) with P-value=0.0038. The number of pupils favouring afternoon snack is generally low, but the intervention training significantly increased from 2.8% to 3.4% with P-value=0.0256. Another promising effect of the education is that the decrease from 47% at baseline (95%CI: 46%-49%) to 42% after the study (95%CI:41%-43%, P-value=0.6015) of the bad habit of having a snack after dinner.

Figure 2 shows the box plot of the feeding behaviour, in which the study intervention generally influenced the type of food intake. Specifically, the frequency of meat and fish are greatly increased after three months. Cheese consumption has shown a slight increase after the study. While none of the foods has shown a decreasing trend, pizza and egg remained relatively stable.

**Discussion**

One of the main results achieved by our project was to increase the number of children using toothbrush and toothpaste specific for the age group. Regarding toothpaste, we had a statistically significant increase in children using one containing fluorine. The use of fluorine is the principal factor that reduces the prevalence of caries (3, 17). Fluoride is known to prevent caries by inhibiting demineralization enhancing remineralization and inhibiting bacterial growth (18). In fact, the national guidelines for the promotion of oral health and the prevention of oral pathologies in developmental age (14) indicate that from 6 months to 6 years of age (age group in which our children fall), fluoroprophylaxis can be carried out through the use of a toothpaste containing at least 1000 ppm of fluorine, 2 times a day, in a pea-size dose.

The National Guidelines for the Promotion of Oral Health and the Prevention of Oral Diseases in Developmental Age (13) also emphasize that since the eruption of the first deciduous tooth, the teeth must be thoroughly cleaned with gauze or rubber finger. The use of the toothbrush with a small-head soft brush should be started as soon as possible (19) to familiarize the child with it.

The analysis of the data also report an increasing trend in the number of daily washes, both in the evening and in the morning. The removal of soft deposits from oral surfaces is important for the maintenance of dento-periodontal health (14). However, there is only a weak relationship between the frequency of brushing and the reduction in the incidence of caries: it is, in fact, difficult to distinguish between the preventive effect given by the mechanical removal of the plaque and the effect offered by the fluorine contained in the toothpaste (5, 14). The Italian guidelines report that the correct brushing of
the teeth, at least twice a day, prevents gingivitis; there is scientific evidence that the correct oral hygiene habits must be acquired during childhood (19), to be strengthened later during adolescence. Our data highlight another important fact, our educational intervention has reduced the number of children who brush their teeth independently without any parental support. In fact, it is strongly suggested that oral hygiene for children from 0 to 3 years should be complete parents responsibility (5, 20, 21); also it is important that parents set a good example: the child who sees parents brushing their teeth daily several times a day is spontaneously led to imitate them (1, 2, 13).

Unfortunately, our data report that there was no increase in the number of children who made their first dental visit, a topic that we had instead emphasized during the parents’ meeting. In fact, it is known that the first dental visit should be made around 18/24 months regardless of the presence or absence of dental problems (3, 22). Moreover that patients under 6 years of age with low risk of developing caries should carry out check-ups every 12 months in case the dentist evaluates a greater risk, the visits will be more frequent (14).

As for the development of caries, it must be emphasized that there are various carbohydrates that can be effectively fermented by bacteria. In addition to sucrose, in order of cariogenicity, there are glucose, maltose, fructose and lactose (23). Therefore, the intake of drinks and foods containing simple carbohydrates is not recommended outside main meals (6, 17, 19, 24). In this regard, we have observed only a slight trend in the reduction of children who snack at night. The use of sweetened pacifier and the non-nutritional use of the bottle containing sugary drinks must be strongly discouraged (13, 14) especially at night, when the salivary flow is greatly reduced. In this regard, during the meetings, we suggested to the parents to continue, at least for a certain period of time, bottle feeding at night, if this was used to aid sleep, but only with water (13).

School-based educational programs held by health professionals may offer the best opportunities for implementing useful and sustainable interventions that are effective in both children and adolescents (12). Contento defined nutrition education as “any combination of educational strategies, accompanied by environmental supports, designed to facilitate voluntary adoption of food choices and other food- and nutrition-related behaviors conducive to health and well-being” (25). For successful nutrition education interventions it is important to study the specific characteristics of effective nutrition education programs and to identify the aspects of nutrition education that are essential for the age group considered (26). We hypothesized that the success of the food education intervention is due to the strategy adopted: engaging neo-parents, generally more likely to improve, organizing face-to-face sessions in order to use appropriate and effective communication, identifying specific behaviors to be modified, and the support of teachers.

Our project has ambitious goals for the future such as involving a larger number of individuals, expanding the geographical range of interest and structuring increasingly appropriate meetings.

Conclusion
In conclusion, the results of our study suggest that most of the known modifiable factors concerning eating habits and oral hygiene are still widespread in the population. Moreover, importance emerged of a teamwork composed of nutritionists and dental hygienists who work together in order to achieve the same goals, the health of the child.

Abbreviations
Not applicable

Declarations

Ethics approval and consent to participate
This study was conducted in full accordance with the ethical requirements of the World Medical Association Declaration of Helsinki (2008). The Ethics Committee of University of Milano-Bicocca approved this study (protocol 298 03/04/2017). This study was conducted with the informed consent of all caregivers.

Competing interests
The authors declare that they have no competing interests.

Funding
The study received financial support by Lions Club Ponte S. Pietro Isola (Bergamo, Italy). The funder had no role in study design, data collection and analysis, decision to publish or preparation of the manuscript.

Authors' contributions
EC and AO designed and coordinated the study. SB, LM, AO and EC performed the parents’ training meeting. MCP helped in the meeting organization. MWA, FM and PP contributed to the data analysis and results interpretation. EC and SG wrote the manuscript. All authors read and approved the final manuscript.

Availability of data and materials
The datasets used and/or analysed during the current study available from the corresponding author on reasonable request.

Acknowledgments
We thank the educators of kindergartens involved for the excellent cooperation.

References
1. Vermaire JH, van Exel N. Parental attitudes towards oral health and caries-risk in their children. Int J Dent Hyg. 2018 May; 16(2):241-248. doi: 10.1111/idh.12296. Epub 2017 Jun 14.

2. Baggio S, Abarca M, Bodenmann P, Gehri M, Madrid C. Early childhood caries in Switzerland: a marker of social inequalities BMC Oral Health. 2015 Jul 22;15:82. doi: 10.1186/s12903-015-0066-y.

3. Ferrazzano GF, Sangianantoni G, Cantile T, Ingenito A. Relationship Between Social and Behavioural Factors and Caries Experience in Schoolchildren in Italy. Oral Health Prev Dent. 2016;14(1):55-61. doi: 10.3290/j.ohpd.a34996.

4. Campus G, Sacco G, Cagetti M, Abati S. Changing trend of caries from 1989 to 2004 among 12-year old Sardinian children. BMC Public Health. 2007 Mar 1;7:28. doi: 10.1186/1471-2458-7-28

5. Nobile CG, Fortunato L, Bianco A, Pileggi C, Pavia M. Pattern and severity of early childhood caries in Southern Italy: a preschool-based cross-sectional study. BMC Public Health. 2014 Feb 27;14:206. doi: 10.1186/1471-2458-14-206.

6. Jordan AR, Becker N, Jöhren HP, Zimmer S. Early Childhood Caries and Caries Experience in Permanent Dentition: A 15-year Cohort Study. Swiss Dent J. 2016;126(2):114-119.

7. Ccahuana-Vásquez RA, Tabchoury CP, Tenuta LM, Del Bel Cury AA, Vale GC, Cury JA. Effect of frequency of sucrose exposure on dental biofilm composition and enamel demineralization in the presence of fluoride. Caries Res. 2007; 41(1):9-15

8. Ruel MT, Menon P. Child feeding practices are associated with child nutritional status in Latin America: innovative uses of the demographic and health surveys. J Nutr. 2002 Jun; 132(6):1180-7.

9. Fall CH, Borja JB, Osmond C, Richter L, Bhargava SK, Martorell R et al., COHORTS group. Infant-feeding patterns and cardiovascular risk factors in young adulthood: data from five cohorts in low-and middle-income countries. Int J Epidemiol. 2011 Feb; 40(1):47-62.

10. Thitasomakul S, Piwat S, Thearmontree A, Chankanka O, Pithpornchaiyakul W, Madyusoh S. Risks for early childhood caries analyzed by negative binomial models. J Dent Res. 2009;88:137–141

11. Schwarzer R, Cao DS, Lippke S. Stage-matched minimal interventions to enhance physical activity in Chinese adolescents. J Adolesc Health. 2010 Dec;47(6):533-9. doi: 10.1016/j.jadohealth.2010.03.015. Epub 2010 May 14.

12. Orlando A, Cassera A, Palestini P, Cazzaniga E. Can Nutrition Education in Primary Schools be an Efficient Way to Prevent Obesity in Adult Life? A Review of the Literature. ACTA SCIENTIFIC NUTRITIONAL HEALTH September 2019; Volume 3 Issue 9

13. Linee guida nazionali per la promozione della salute orale e la prevenzione delle patologie orali in eta’ evolutiva, Ministero del Lavoro, della Salute e delle Politiche Sociali, Italia, 2008

14. Linee guida nazionali per la promozione della salute orale e la prevenzione delle patologie orali in età evolutiva, Aggiornamento, Ministero della Salute, Italia, 2013

15. World Health Organization guidelines. http://www.who.int/nutrition/publications/guidelines. Accessed 20 May 2020.
16. Paglia L, WHO: healthy diet to prevent chronic diseases and caries, Eur J Paediatr Dent. 2018 Mar;19(1):5 doi: 10.23804/ejpd.2018.19.01.01

17. Palacios C, Joshipura K, Willett W. Nutrition and health: guidelines for dental practitioners. Oral Dis. 2009 Sep;15(6):369-81. doi: 10.1111/j.1601-0825.2009.01571.x. Epub 2009 May 15.

18. American Academy of Pediatrics, Maintaining and improving oral health of young children, Pediatrics 2014; 134:1224-1228

19. Wagner Y, Heinrich-Weltzien R. Evaluation of a regional German interdisciplinary oral health programme for children from birth to 5 years of age. Clin Oral Investig. 2017 Jan;21(1):225-235. doi: 10.1007/s00784-016-1781-8. Epub 2016 Mar 16.

20. Castilho AR, Mialhe FL, Barbosa Tde S, Puppin-Rontani RM. J Pediatr (Rio J). Influence of family environment on children's oral health: a systematic review. 2013 Mar-Apr;89(2):116-23. doi: 10.1016/j.jsped.2013.03.014.

21. Corrêa-Faria P, Paixão-Gonçalves S, Paiva SM, Pordeus IA. Incidence of dental caries in primary dentition and risk factors: a longitudinal study. Braz Oral Res. 2016 May 20;30(1):S1806-83242016000100254. doi: 10.1590/1807-3107BOR-2016.vol30.0059.

22. Raccomandazioni cliniche in odontostomatologia, Ministero Della Salute, settembre 2017

23. Karjalainen S. Dent Update. 2007 Jun;34(5):295-8, 300. doi: 10.12968/denu.2007.34.5.295 Eating patterns, diet and dental caries.

24. Ugolini A, Salamone S, Agostino P, Sardi E, Silvestrini-Biavati A. Trends in Early Childhood Caries: An Italian Perspective. Oral Health Prev Dent. 2018;16(1):87-92. doi: 10.3290/j.ohpd.a39816.

25. Contento IR. Nutrition Education: Linking Research, Theory, and Practic. Burlington, MA Jones & Bartlett Learning; 2016. 3rd ed.

26. Murimi MW, Moyeda-Carabaza AF, Nguyen B, Saha S, Amin R, Njike V. Factors that contribute to effective nutrition education interventions in children: a systematic review. Nutr Rev. 2018 Aug 1;76(8):553-580. doi: 10.1093/nutrit/ny020.

Figures
Figure 1

Predicted proportion of pupils from the longitudinal models regarding their oral hygiene.
Figure 2

The box plots summarizing the feeding habits before and after the intervention study.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- questionnaire.docx