The dependence of dental caries on oral hygiene habits in preschool children from urban and rural areas in Poland

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Abstract

Introduction. Dental caries is considered to be a modern civilization disease; however, the state of oral health negatively influences psychological and sociological relations in children which leads to feelings of discomfort from early age.

Objective. The aim of study was evaluation of the association between incidence of dental caries (d/ft index) in preschool children from urban and rural areas, and determining the relationship between dental caries intensity and hygienic habits.

Materials and Method. 844 children aged 3–6 years from the city and the countryside were examined. The survey was conducted among parents/care givers regarding dental care of children. With parents’ consent, the children had a dental examination.

Results. The incidence of caries was recorded at the level of 52.61%, with an average value of 4.31 on the d/ft index; however, for the children from the urban area this ratio amounted to 4.15, and in the countryside it reached the value of 4.7. A correlation was found between age and area of residence of the children and various components of hygienic behavior model.

Conclusions. More than a half of the children had dental caries in combination with a high frequency of unsatisfactory hygiene needs. There is a relationship between oral hygiene habits and age of the children, depending on the place of residence.

Key words
dental caries, preschool children, dental health, hygiene practices, DFT index

INTRODUCTION

Among oral diseases, dental caries is considered to be a modern civilization disease and often becomes the subject of dental epidemiological researches. The faulty state of oral health negatively influences the psychological and sociological relations in children, leading to feelings of discomfort from an early age.

Due to the fact that dental caries is an infectious disease [1], an appreciable intensity of milk-teeth caries in children is a factor predisposing for the development of caries in permanent teeth. This may lead in the future in the future to precocious loss of teeth, chewing organ deformities and disorders of the whole body [2]. The prevalence of dental caries in preschool children in the developed countries has decreased over the past few decades. However, it is still high in the preschool children group. This problem concerns mainly low-income environments with limited access to dental care, little attention devoted to properly conducted hygienic treatment and lack of intent to treat milk dentition, which is necessary for reducing the intensity of teeth caries [3, 4]. In 2012, according to the Polish Central Statistical Office, the number of children aged 3–6 amounted to almost 1.7 million, representing approx. 4.4% of the total population, with approx. 0.7 million children coming from rural areas. Caries treatment generates high costs that are only marginally covered by the National Health Fund guaranteed catalogue of services. It is worth noting that in Poland the number of conducted caries prevention programmes funded from the national budget is insufficient. This problem prompted the consideration of the relationship between cause and effect of this disease, and the eventual possibility of controlling and prevention in children from an early age, regardless of the place of residence.

The aims of dental caries prevention promoted by the World Health Organization initially assumed that up to 2010 the percentage of children free from cavities will increase to 60%. However, in 2010, when monitoring this disease, Poland was not qualified to the group of countries which met the required standard. Today, these objectives for Poland have been postpone ntido 2025 [5], whereas in other European countries a decrease of dental has been noted for the last several years in children aged 3–6 years and, at the same time, an increase in the proportion of children free from cavities [6, 7, 8].
OBJECTIVE

The aim of this study was evaluation of the association between the incidence of dental caries (d, ft index) in preschool children (aged 3–6 years) from urban and rural areas, as well as to determine the relationship between the intensity of dental caries and hygienic habits of the children.

MATERIALS AND METHOD

The population for this study were preschool children aged 3–6 years from the city and countryside of Lublin province in eastern Poland. Due to the lack of consent from some parents/care givers of 864 children who pre-qualified for the study, a total of 844 children finally participated: 636 children from urban areas and 208 from rural areas. The children were divided according to place of residence, age and gender (Tab. 1). The study was conducted in the period from April 2013 – June 2014. The parents were informed about the purpose of the study.

The first part of the study was a survey and the second part a clinical observation. The initial stage was to obtain the consent of directors of the tests performed. In the next stage, questionnaires were distributed among the parents which concerned the oral hygiene habits of their children: frequency, systematics, independence and length of treatments carried out, kinds of tooth paste used, and other hygienic material used for daily care. Also included were questions about the time of introduction of the first hygiene treatments and involvement of children in these activities. Dental examination included only those children whose parents gave a written consent.

In the children's dental examination assessment, criteria according to the World Health Organization guidelines for epidemiological studies were used [9]. Examinations were performed by one dentist examiner. As missing teeth (mt) were stated in only three children (one per each), removed for an unspecified reason, these teeth was omitted in further analyzes. On the basis of the obtained data, the occurrence of dental caries was calculated as well as its intensity, measured by an average value of d, ft index, dependently on gender, age and place of residence of the children. The study was conducted according to sanitary requirements, in artificial lighting, using a sterile disposable probe and mirror. Dental examination results were registered on a prepared diagram.

The survey results were statistically analyzed: mean value of the caries intensity (d, ft) was calculated based on the value of ‘d’ (decayed teeth) and ‘ft’ (filled teeth) for each patient, and each result was used as a dependent variable. The independent variables were: self-reliance in brushing teeth, frequency, duration and regularity of these procedures, time-to-learn how to brush teeth and hygienic accessories type which are used for this purpose. The relationship of the independent variables and gender, age and residence area of the children was also examined, as well as relationship was dependent variables from the criteria of sample distribution in the study. Data were analyzed using t-Student's test, ANOVA and \( \chi^2 \) test of SPSS 20.0 [10]. Non-parametric Spearman's correlation coefficient was also estimated.

The study was approved by Medical Ethics Committee of Medical University of Lublin, Poland.

RESULTS

Due to the lack of relationship between independent variables (answers) and gender of the children, this criterion was omitted in the results analysis. The study showed that the intensity of dental caries in preschool children (measured by the average value of d, ft index) increased with age on which it depended significantly (\( p \leq 0.05 \)). The study did not demonstrate any relationship between the dt and ft and child's gender (Tab. 2). The dt and ft value for city children amounted to 4.15, while for children from rural areas it was 4.70. In each age group, within the city and the countryside, the number of teeth with dental carries was the greatest (dt). The number of decayed teeth ranged from 2.5 – 4.45 among children from the city and from 2.56 – 5.00 in rural areas. In the 3–5 years age group, a bigger number of decayed teeth was observed in children from rural areas. The number of filled teeth varied in urban areas from 0.59 – 1.11, and in rural area from 0.75 – 1.82. Detailed values, including distribution according to place of residence, children’s age and gender are presented in Table 3.

The frequency of caries in the studied group ranged from 40.91% – 66.04% in the city, and in rural areas from 47.06% – 70.00% (Tab. 4). Taking into consideration the place of residence, the study did not show a direct relationship between the independent variables (answers) and the value of d, ft index. However, in this population, different dependencies of parents’ answers in relation to the child’s age than to their residence were observed.

As many as 96% of children did not brush their teeth after every meal. In this group, the majority were children from urban areas. This may be caused by a large number of parents’ duties and who did not pay attention to this fact, and the belief that it is enough to brush teeth in the morning and evening. The regularity of this activity considerably depended

<table>
<thead>
<tr>
<th>Area</th>
<th>City</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Age</td>
<td>3</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>54</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area</th>
<th>City</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Age</td>
<td>3</td>
<td>3.06</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>5.26</td>
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<td></td>
<td>5</td>
<td>2.62</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>4.92</td>
</tr>
<tr>
<td></td>
<td>Total (sex)</td>
<td>3.94</td>
</tr>
<tr>
<td></td>
<td>Total (area)</td>
<td>4.16</td>
</tr>
</tbody>
</table>

a - differences between children in various age are significant at \( p \leq 0.05 \)
Table 3. The number of decayed (dt) and filled (ft) teeth in evaluated population of children

<table>
<thead>
<tr>
<th>Area</th>
<th>City</th>
<th>Country</th>
<th>Total (age)</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2.50</td>
<td>2.22</td>
<td>2.67</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>4.02</td>
<td>4.00</td>
<td>4.93</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>2.12</td>
<td>3.03</td>
<td>4.17</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>4.04</td>
<td>4.95</td>
<td>1.50</td>
</tr>
<tr>
<td>Total (sex)</td>
<td>3.17</td>
<td>3.55</td>
<td>3.32</td>
<td>4.14</td>
</tr>
<tr>
<td>Total (area)</td>
<td>3.36</td>
<td>3.90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4. The frequency of dental caries in evaluated population of children

<table>
<thead>
<tr>
<th>Sex</th>
<th>Age</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>44.83</td>
<td>112.50</td>
<td>63.64</td>
<td>57.89</td>
<td>54.59</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>40.63</td>
<td>50.75</td>
<td>43.06</td>
<td>70.45</td>
<td>55.35</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>37.70</td>
<td>52.63</td>
<td>50.00</td>
<td>64.63</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5. The dependence of oral hygiene habits of children in relation of their living area and age (part I)

<table>
<thead>
<tr>
<th>Question</th>
<th>Area</th>
<th>age (years)</th>
<th>χ² (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>city</td>
<td>country</td>
<td>3</td>
</tr>
<tr>
<td>Is your child brushes teeth by itself?</td>
<td>yes</td>
<td>60.9</td>
<td>22.51</td>
</tr>
<tr>
<td></td>
<td>no</td>
<td>14.45</td>
<td>2.13</td>
</tr>
<tr>
<td></td>
<td>notatall</td>
<td>4.03</td>
<td>1.66</td>
</tr>
<tr>
<td>How many times child brushes teeth daily?</td>
<td>once a day</td>
<td>25.83</td>
<td>9.48</td>
</tr>
<tr>
<td></td>
<td>twice a day</td>
<td>41.47</td>
<td>12.8</td>
</tr>
<tr>
<td></td>
<td>more than twice a day</td>
<td>4.03</td>
<td>0.71</td>
</tr>
<tr>
<td>Since when child was taught to brush its teeth?</td>
<td>since 1st year of life</td>
<td>48.82</td>
<td>13.98</td>
</tr>
<tr>
<td></td>
<td>since 2nd year of life</td>
<td>20.14</td>
<td>7.11</td>
</tr>
<tr>
<td></td>
<td>since 3rd year of life</td>
<td>6.16</td>
<td>3.08</td>
</tr>
<tr>
<td></td>
<td>notatall</td>
<td>0.24</td>
<td>0.47</td>
</tr>
<tr>
<td>Does your child brush its teeth after every meal?</td>
<td>yes</td>
<td>5.69</td>
<td>1.66</td>
</tr>
<tr>
<td></td>
<td>no</td>
<td>69.67</td>
<td>22.99</td>
</tr>
<tr>
<td></td>
<td>yes, often</td>
<td>10.9</td>
<td>7.35</td>
</tr>
<tr>
<td>How often your child does forget to brush its teeth?</td>
<td>yes, sometimes</td>
<td>51.18</td>
<td>14.69</td>
</tr>
<tr>
<td></td>
<td>no</td>
<td>12.8</td>
<td>2.61</td>
</tr>
<tr>
<td>Does your child use dental floss?</td>
<td>yes</td>
<td>5.21</td>
<td>1.18</td>
</tr>
<tr>
<td></td>
<td>no</td>
<td>70.14</td>
<td>23.46</td>
</tr>
<tr>
<td>How long does your child brush its teeth?</td>
<td>less than 1 minute</td>
<td>18.48</td>
<td>8.06</td>
</tr>
<tr>
<td></td>
<td>2 minutes</td>
<td>44.79</td>
<td>13.98</td>
</tr>
<tr>
<td></td>
<td>3 minutes</td>
<td>12.09</td>
<td>2.61</td>
</tr>
</tbody>
</table>
Table 6. The dependence of oral hygiene habits of children in relation of their living area and age (part II)

<table>
<thead>
<tr>
<th>Question</th>
<th>area</th>
<th>country</th>
<th>age (years)</th>
<th>(\chi^2) (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you replace tooth brush of your child?</td>
<td>every month</td>
<td>14.93 3.08</td>
<td>3</td>
<td>0.123</td>
</tr>
<tr>
<td></td>
<td>every 3 months</td>
<td>35.78 13.74</td>
<td>5</td>
<td>0.014</td>
</tr>
<tr>
<td></td>
<td>rarer than every 3 months</td>
<td>13.51 3.08</td>
<td>4</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>when it is destroyed</td>
<td>11.14 4.74</td>
<td>6</td>
<td>0.000</td>
</tr>
<tr>
<td>What kind of tooth paste does your child use?</td>
<td>paste dedicated for children</td>
<td>69.67 22.99</td>
<td>3</td>
<td>0.591</td>
</tr>
<tr>
<td></td>
<td>paste dedicated for adults</td>
<td>4.98 1.18</td>
<td>4</td>
<td>0.200</td>
</tr>
<tr>
<td></td>
<td>without paste</td>
<td>0.71 0.47</td>
<td>5</td>
<td>0.767</td>
</tr>
<tr>
<td></td>
<td>parents have to remind and look after</td>
<td>25.83 8.06</td>
<td>6</td>
<td>0.000</td>
</tr>
<tr>
<td>What kind of attitude has your child in relation to oral hygiene?</td>
<td>take care by itself</td>
<td>25.83 8.06</td>
<td>3</td>
<td>0.767</td>
</tr>
<tr>
<td></td>
<td>unwillingly</td>
<td>18.01 7.11</td>
<td>5</td>
<td>0.000</td>
</tr>
<tr>
<td>Does your child take care of oral hygiene?</td>
<td>willingly</td>
<td>57.35 17.54</td>
<td>4</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>unwillingly</td>
<td>18.01 7.11</td>
<td>5</td>
<td>0.000</td>
</tr>
<tr>
<td>Does it happen that after evening toilet</td>
<td>yes, often</td>
<td>6.64 3.08</td>
<td>3</td>
<td>0.000</td>
</tr>
<tr>
<td>your child has sweet drinks or food before the sleep?</td>
<td>yes, rarely</td>
<td>31.99 10.9</td>
<td>4</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>no</td>
<td>36.73 10.66</td>
<td>6</td>
<td>0.000</td>
</tr>
<tr>
<td>Does your child brush its teeth in the morning?</td>
<td>regularly, before breakfast</td>
<td>25.12 2.37</td>
<td>3</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>regularly, after breakfast</td>
<td>22.27 10.66</td>
<td>5</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>irregularly</td>
<td>27.96 11.61</td>
<td>6</td>
<td>0.000</td>
</tr>
</tbody>
</table>

DISCUSSION

The risk assessment of dental caries is currently considered as a civilization disease, and is the subject of researches worldwide in various age groups. The high frequency of caries incidence in the preschool children group indicates the needs for analysis of the factors affecting this parameter, as well as accomplishment of hygiene procedures in children from the city and the countryside. The oral health status of preschool children is mainly affected by the effectiveness of prevention and education [11]. This depends largely on the attitude of the parents [12, 13], and assessment of their awareness can be a valuable tool in understanding a possible method of changing the health behaviours aimed at improving the oral health of children [14]. The reform of the education system provides an opportunity to introduce a nationwide dental education programme, similar to the developed countries, which may also contribute to balancing the frequency of healthy differences and reduction of dental caries in urban and rural areas.

Already in 2003, the dental health of children aged 3–6 years in 14 provinces of Poland appeared to be bad or very bad, which can be associated with a reduction in the number of prevention programs for preschool aged children. In all provinces, prevention activities for this age group remain almost exclusively in the hands of parents [12, 15]. However, the frequency of dental caries in the analysed population was slightly lower than in studies by other authors. According to the literature, the incidence of caries ranges from 49.4% – 78.84% in preschool children [16]. Based on a review of papers published in the Polish dental journals in 2004–2009, the frequency of caries in research by Szymańska and Szałewski [17] in 3-year-olds amounted to 45–77%, 50–66% in the 4-year-old children group, and increased with the children’s age up to 57–94% for 6-year olds. Research by Słowik- Gabryelska et al. [5] showed a high proportion of caries in preschool children, of up to 92%, with the highest value in boys from rural areas (93%) and lowest in girls from the city (79%). A higher frequency of dental caries among children in rural areas has also been confirmed by other authors [14,18]. These differences highlight the problem of smaller access to dental care as well as health awareness of parents in rural areas, especially connected with need of milk-teeth treatment.

In the presented study, the average value of the \(d\) indicator increased with the age of the respondents, regardless of their gender, and in the assessment of particular components of these indices, a big number of teeth with caries as well as a small number of filled teeth was observed, and confirmed by other authors. The average value of the \(d\) for 3-year-old children in Poland is 2.2–2.5, for 4-year-olds it ranges from 3.42 – 6.07; for 5-year-olds – 5.11–6.2 and in the oldest group of preschool children it may be between 5.24 – 7.37 [19, 20, 21]. In this study, the number of teeth with active caries among children in the city was the highest for the group of 6-year-olds, while in the rural area in 4-year-olds.

As can be seen from epidemiological studies in Poland, the frequency of dental caries in children and the \(d\) indicator slightly decreased; however, it is still very high in comparison to other EU countries [16]. Research conducted in the Czech Republic by the Institute of Dental Research showed an increase in proportion off children free of caries, from 23.9% in 1998 to 44.9% in 2010, and a reduction of the number of decayed teeth during that period from 2.5 – 2.2 [22]. A lower value of the \(d\) indicator has also been observed among preschool children in Italy, England, Wales and Scotland [6, 7, 8].

The current study shows that children from rural areas significantly more often brush their teeth alone, which may be explained by the fact of a greater intensity of dental caries among these children. Passive attitude of parents towards hygiene procedures may result in a faster development of caries due to improper and inaccurate treatment of teeth [23]. The percentage of those who brush their teeth alone...
Aneta Kamińska, Leszek Szalewski, Justyna Batkowska, Jan Wallner, Eliza Wallner, Anna Szabelska, Janusz Borowicz. The dependence of dental caries on oral hygiene needs in this age group.

The dental caries epidemiological picture of children from rural areas and in the approach to oral health, has caused a reduction in the proportion of children with caries disease in Poland, which is higher than in other European countries, changes in society and in the approach to oral health, as well as the treatment of children and greater control of these activities. This is very important, especially in the rural areas where children take care of oral hygiene less willingly and rarely perform oral hygiene treatments, compared with children from cities.

It is recommended that parents should be educated about the guidelines for the prevention of dental caries and oral care, as well as the treatment of children and greater control of these activities. This is very important, especially in the rural areas where children take care of oral hygiene less willingly and rarely perform oral hygiene treatments, compared with children from cities.

3. The State health policy should aim to compensate for differences in health between urban and rural areas.

CONCLUSIONS

1. The frequency and intensity of dental caries in milk teeth in preschool children increases with their age. An early age at which children are taught to brush their teeth reduces the value of this indicator.

2. It is recommended that parents should be educated about the guidelines for the prevention of dental caries and oral care, as well as the treatment of children and greater control of these activities. This is very important, especially in the rural areas where children take care of oral hygiene less willingly and rarely perform oral hygiene treatments, compared with children from cities.

3. The State health policy should aim to compensate for differences in health between urban and rural areas.

REFERENCES