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Relationship between school performance and dental health and treatment needs in schoolchildren

Relação do desempenho escolar com condição dental e necessidade de tratamento em escolares

Relación entre el rendimiento escolar y el estado dental y la necesidad de tratamiento en estudiantes

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Abstract:
Objective: to evaluate the association between dental conditions and treatment needs, and academic performance in elementary school students. **Methods:** a cross-sectional observational study conducted in 2024 with children assessed for oral health at a municipal school and divided into three groups: one with better academic performance (group A), one with greater need of dental treatment (group B), and one with worse academic performance (group C). The data collected included the index of decayed, missing, and filled permanent teeth and decayed, extracted, and filled deciduous teeth, in addition to school performance, analyzed using non-parametric Mann-Whitney U statistical tests. **Results:** 167 children participated. Lower academic performance (group C) did not necessarily mean greater treatment needs for dental caries when compared to group A. In the group with greater dental treatment needs (group B), the average academic performance (76.0) was below the average performance (79.8) of all children who participated in the study. **Conclusion:** children with poor oral health were more likely to experience impaired academic performance. This evidence highlights the need for integrated actions between health and education.
Keywords: Oral health; Educational status; Dental care; Parent-child relations.

Resumo:
Objetivo: avaliar a associação entre as condições dentais e necessidade de tratamento, e o desempenho em escolares dos anos iniciais do ensino fundamental. **Método**: pesquisa observacional transversal realizada em 2024 com crianças avaliadas quanto à saúde bucal em uma escola municipal e divididas em três grupos: um com melhor desempenho escolar (grupo A), com maiores necessidades de tratamento dentário (grupo B) e outro com pior desempenho escolar (grupo C). Os dados coletados incluíram o índice de dentes permanentes cariados, perdidos e obturados e dentes decíduos cariados, extração indicada e obturados, além do desempenho em disciplinas escolares, analisados por testes estatísticos não paramétricos de Mann-Whitney U. **Resultados**: participaram 167 crianças. O menor rendimento escolar (grupo C) não significou, necessariamente, que maiores necessidades de tratamento para cárie dentária, quando comparadas ao grupo A. No grupo com maiores necessidades de tratamento dentário (grupo B), a média do rendimento escolar (76,0) ficou abaixo da média do rendimento (79,8) de todas as crianças que participaram do estudo. **Conclusão**: as crianças com condições bucais insatisfatórias apresentaram maior chance de comprometimento no rendimento escolar. Essas evidências destacam a necessidade de ações integradas entre saúde e educação.
Palavras-chave: Saúde bucal; Escolaridade; Assistência odontológica; Relações pais-filho.

Resumen:
Objetivo: evaluar la asociación entre las condiciones dentales y la necesidad de tratamiento, y el rendimiento escolar de los alumnos de los primeros años de la enseñanza primaria. **Método**: estudio observacional transversal realizado en 2024 con niños evaluados en cuanto a su salud bucodental en una escuela municipal y divididos en tres grupos: uno con mejor rendimiento escolar (grupo A), con mayores necesidades de tratamiento dental (grupo B) y otro con peor rendimiento escolar (grupo C). Los datos recopilados incluyeron el índice de dientes permanentes cariados, perdidos y obturados y dientes deciduos cariados, extracción indicada y obturados, además del rendimiento en las materias escolares, analizados mediante pruebas estadísticas no paramétricas de Mann-Whitney U. **Resultados**: participaron 167 niños. El menor rendimiento escolar (grupo C) no significó necesariamente mayores necesidades de tratamiento para la caries dental, en comparación con el grupo A. En el grupo con mayores necesidades de tratamiento dental (grupo B), el promedio de rendimiento escolar (76,0) fue inferior al promedio de rendimiento (79,8) de todos los niños que participaron en el estudio. **Conclusión**: los niños con condiciones bucales insatisfactorias presentaron una mayor probabilidad de compromiso en el rendimiento escolar. Estas evidencias destacan la necesidad de acciones integradas entre salud y educación.
Palabras-clave: Salud bucal; Escolaridad; Atención odontológica; Relaciones padres-hijo.

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INTRODUCTION

Tooth decay negatively affects a child's quality of life, resulting in problems such as difficulty chewing, speaking, and sleeping. Children who experience extreme toothache are three times more likely to be absent from school, which, in turn, is directly related to their academic performance[1].

Tooth decay results from the accumulation of dental biofilm and frequent exposure to sugars in the diet, and addressing these modifiable factors makes it possible to prevent or even halt tooth decay[2], with parental or guardian supervision being essential.

Parental awareness of the oral health problems faced by the child is also essential for seeking dental services[3] and reinforcing home care, aiming to improve the child's quality of life.

Currently, the school environment has been highlighted for the development of intersectoral health-education activities through the School Health Program (*Programa Saúde na Escola* - PSE), detailed in the "Thematic Book of the School Health Program: Oral Health"[4], which includes actions such as: identifying the main oral health problems and treatment needs, health education, promoting healthy school meals, supervised oral hygiene, and topical fluoride application.

Oral health teams, within their respective areas of coverage, are responsible for developing oral health actions. The direct participation of the entire school community, as well as other health professionals working in the shared territory, is essential for identifying needs and developing collective activities at the school[4]. This intersectoral public policy clearly demonstrates the importance of health, including oral health, for the child's good development and academic performance; however, it must be mentioned that this health/academic performance binomial is only achieved with parental participation in this process.

Studies conducted on parental involvement in children's school life show that family participation enhances the child's academic performance[5,6]. When the family remains on the sidelines of their children's education, failing to take a more appropriate role in their development, the negative effects become evident and easily noticeable, such as: poor performance, learning difficulties, lack of interest in proposed activities, and changes in behavior, such as apathy and aggressiveness[5].

Regarding the ways in which families can be involved in school life, participation begins at home, by demonstrating the importance of studies and the learning acquired at school, by monitoring schoolwork, encouraging reading, and also in the school environment, through parental involvement in parent-teacher meetings and in artistic, cultural, and sporting events that schools always offers[7]. Thus, this study aims to evaluate the association between dental

conditions and treatment needs, and the performance of elementary school students in the early years of primary education.

METHODS

This is a cross-sectional observational study developed in 2024 in the city of Cascavel/PR, Brazil, with 4th and 5th grade students enrolled in a municipal school.

The exclusion criteria were: the student not being present on the days of the examinations and/or having physical or psychological problems that could prevent communication and the performance of the examinations and/or using orthodontic braces and/or the guardian denying interest in the study.

The examiner, previously trained, performed the examinations in the same area of the school, under natural light and using a hand flashlight, with the aid of a wooden spatula and a plane mirror, with the examiner seated and the child being examined seated in front of them. All children who participated in this study received a toothbrush and toothpaste so that they could perform supervised brushing before examination in order to improve the diagnosis.

To assess dental condition, the index recommended by the World Health Organization [8] was used, which was adapted to record treatment needs in national epidemiological studies by the Brazilian Ministry of Health[9].

Each child was examined and completed an individual dental condition and treatment need form, from which it is possible to infer the average number of decayed, missing, and filled permanent teeth (DMFT) and the average number of decayed, extracted, and filled deciduous teeth (deft). In addition, the need for curative treatment (restoration, pulpal repair plus restoration, and extraction) per tooth was recorded.

After completing all forms, to assess school performance, eight subject grades were collected from each child, referring to the first and second trimesters of the 2024 school year, in the subjects of Portuguese, Mathematics, Geography, and History. The simple arithmetic mean of these eight grades was calculated for each child. After the data were analyzed, 75 students were selected and divided equally. The children were divided into three groups: A, B, and C.

Group A included those with the highest grades above the average in their subjects in 2024. Group B included those with the greatest need for restorative treatment (restoration, pulpal repair plus restoration, and extraction) counted per tooth, and Group C included those with the lowest grades above the average. The groups were divided based on school report cards and epidemiological examination.

Grades in each subject were compared between groups using the Mann-Whitney U test, with a significance level of 0.05. To statistically compare the number of children needing treatment between groups, the Chi-square goodness-of-fit test was used with a significance level of 0.05.

The DMFT, deft indexes and the number of teeth needing treatment were compared between children in groups A, B, and C using the non-parametric Mann-Whitney test. Whitney-U test, with a significance level of 0.05. This test was used because the data did not present a normal distribution (Shapiro-Wilk test).

These data were also tabulated using minimum, maximum, mean, and standard deviation values. Finally, the DMFT and deft indexes and the number of teeth requiring treatment were also compared only among the children who presented treatment needs. This comparison was performed using the non-parametric Mann-Whitney-U test, with a significance level of 0.05. This test was used because the data did not present a normal distribution (Shapiro-Wilk test).

The study was previously approved by the Ethics and Scientific Merit Committee under opinion number 6.930.246.

RESULTS

There were 175 students enrolled, and 167 participated. Based on the grades from the first and second trimesters, it was possible to establish an average grade of 79.8, with a minimum individual value of 55.7 and a maximum of 97.8.

Considering the dental treatment needs of the children evaluated, 76 (45.5%) were caries-free, 17 (10.2%) had at least one tooth affected by caries, however, their teeth were treated, and the remaining 74 (44.3%) needed curative dental treatment. (Table 1).

Comparisons between the deft and DMFT indices and the number of decayed teeth requiring treatment in children from groups A and B showed statistically significant differences between the groups, with group B showing higher values for all three indices analyzed. The deft index for group B was 4.04 ± 2.17, while for group A it was 1.24 ± 1.90 ($p<0.0001$). For DMFT, the values obtained were 1.36 ± 1.55 for group B and 0.16 ± 0.55 for group A ($p=0.00037$). For the number of decayed teeth requiring treatment, the value for group B was 4.92 ± 1.15, and for group A it was 1.28 ± 2.05 ($p<0.0001$) (Table 2).

Table 1. Percentage and absolute numbers of children with and without the need for restorative dental treatment for caries. Cascavel/PR, Brazil, 2024.

Variables	%	Nº
Children free of caries (deft and DMFT = 0) not requiring treatment	45.5	76
Children with (deft and DMFT ≥ 1) not requiring treatment	10.2	17
Children with (deft and DMFT ≥ 1) requiring treatment	44.3	74
Total of children examined	**100.0**	**167**

Table 2. Minimum, maximum, mean values and standard deviations (SD) of the deft, DMFT indices and the number of teeth requiring treatment in children from groups A and B. Cascavel/PR, Brazil, 2024.

Variables	Minimum	Maximum	Mean	SD	p-value
deft | Group A (n = 25)	0	6	1.24	1.90	**0.0001**
deft | Group B (n = 25)	0	8	4.04	2.17	
DMFT | Group A (n = 25)	0	2	0.16	0.55	**0.00037**
DMFT | Group B (n = 25)	0	5	1.36	1.55	
No. of teeth requiring treatment. | Group A (n = 25)	0	6	1.28	2.05	**0.0001**
No. of teeth requiring treatment. | Group B (n = 25)	3	8	4.92	1.15	

Observation: Values in bold text indicate statistical significance. *P-value*: Mann-Whitney U test.

Comparisons between the deft and DMFT indexed and the number of decayed teeth requiring treatment in children from groups A and C did not show statistically significant values for the three indices analyzed. The deft index for group C was 1.20 ± 1.89 and for group A it was 1.24 ± 1.90 (p > 0.786). For DMFT, the values obtained were 0.44 ± 0.96 for group C and 0.16 ± 0.55 for group A (p > 0.221). For the number of decayed teeth requiring treatment, the value for group C was 1.48 ± 2.06 and for group A it was 1.28 ± 2.05 (p > 0.738) (Table 3).

Comparisons between the deft and DMFT indices and the number of decayed teeth, performed exclusively among children who needed treatment (group A: 9 and group B: 25), showed statistically significant differences (p-value: 0.0363) for the number of decayed teeth and teeth needing treatment (Table 4).

Table 3. Minimum, maximum, mean values and standard deviations (SD) of the deft, DMFT indices and the number of teeth requiring treatment in children from groups A and C. Cascavel/PR, Brazil, 2024.

Variables	Minimum	Maximum	Mean	SD	p-value
deft | Group A (n = 25)	0	6	1.24	1.90	**0.786**
deft | Group C (n = 25)	0	6	1.20	1.89	
DMFT | Group A (n = 25)	0	2	0.16	0.55	**0.221**
DMFT | Group C (n = 25)	0	3	0.44	0.96	
No. of teeth requiring treatment. | Group A (n = 25)	0	6	1.28	2.05	**0.738**
No. of teeth requiring treatment. | Group C (n = 25)	0	6	1.48	2.06	

Observation: *P-value*: Mann Whitney-U test.

Table 4. Means and standard deviations (SD) of the number of decayed teeth requiring treatment only in children from groups A and B who presented treatment needs. Cascavel/PR, Brazil, 2024.

Indexes	Group A (n = 9)		Group B (n = 25)		p-value
	Mean	SD	Mean	SD	
No. of decayed teeth requiring treatment	3.55	1.87	4.92	1.5	**0.0363**

Observation: values in bold indicate statistical significance. P-value: Mann-Whitney U test.

DISCUSSION

Overall, research[10-12] on the topic of caries and school performance seeks to study the association between poor oral health and higher chances of low academic performance, and has suggested as causes for this association the impact that toothache has on the performance of daily school activities and absence from the classroom due to visits to the dentist.

In this study, no statistically significant difference was found between the groups with the best and worst school performances (groups A and C) in the need for dental treatment, both in terms of the number of children affected by caries disease, and also the average number of teeth that needed treatment among them. Thus, school performance between the extreme groups (best and worst) did not constitute a risk indicator for the presence of caries lesions and the need for dental treatment.

However, when children with the best performance (group A) and children with the greatest need for dental treatment (group B) were analyzed together, there was significance between the groups (p-value 0.0001). In group A, the final average grade was 91.6, and all children had 32 teeth (an average of 1.2 per child) requiring dental treatment.

In group B, 123 teeth (an average of 4.9 per child) requiring dental treatment were identified, and the final average grade in this group was 76.0. The average school performance

among the students analyzed was 79.8, demonstrating that the group with the worst oral health conditions had a lower average performance.

In view of this, the children with the best school performance had 3.8 times fewer teeth requiring dental treatment when compared to the group of children with the highest number of treatment needs. Even when only the children in group A were evaluated, the children had an average of 3.5, while in group B, the average was 4.9 per child requiring treatment.

Other studies[12-14] have also shown that children with decayed teeth were more likely to have poor school performance, corroborating the results found here. The differences observed between groups A and B were important in order to infer that the lack of parental support in school activities that caused poor school performance[6] also extended to parental support regarding their children's oral health, resulting in unresolved treatment needs.

The need for dental treatment among the children examined was present in 44.3%, and when analyzing the composition of these deciduous and permanent teeth, in decayed, missing and restored teeth, it was found that the decayed component, which represents a need for treatment, was 78.6%, and the teeth that received dental treatment, restored and missing, represented 18.4% and 3.0%, respectively. These findings maintain a profile very similar to the preliminary data from the SB Brasil 2020[15] National Oral Health Survey, as well as from previous national research[16], in which the decayed component of the deft and DMFT indices was the most prevalent.

This epidemiological situation requires a proactive care model that organizes its demand from social spaces, such as schools and homes, offering continuous care, monitoring and encouragement of self-care capacity in the parent/child dyad required by chronic conditions, such as dental caries. This model, however, is still incipient due to the lack of understanding of professionals and users[17].

Regarding users, studies[18-20] have shown that many parents do not have an adequate level of knowledge regarding the ideal time to take their children for dental checkups and that parents' self-care with oral health has a great influence on family members, that is, parents who do not care about their own oral health do not have the habit of regular visits to the dental office, and often have the same attitude towards their children[21].

This context is exacerbated by cultural and access/accessibility barriers, which influence the search for dental treatment, such as parents' lack of awareness of the need to treat decayed deciduous teeth[22], the availability of the service[23] and the time required to reach a nearby health center[24].

The way the dental care model is structured, often organizing the provision of services reactively to problems/emergencies that arise in primary care, coupled with parents' lack of awareness of the urgent need for continuous attention during the silent stages of caries, has generated this care debt, in which the decayed component of the deft/DMFT indices becomes the most prevalent among children.

In this way, care is perpetuated to solve the acute phases of caries, usually self-perceived by people, becoming one of the main reasons for seeking oral health services, both for adults[25], adolescents[26], and also for children[27]. It can be expected that, in this situation, a large proportion of these patients will abandon treatment after the resolution of the problem that led them to the emergency service.

Children and adolescents who seek health services motivated by toothache and who experience discontinuity are subject to new episodes of pain and suffering, including impacts on their daily activities, such as going to school. The consequence of seeking health services due to pain leads the child to have more fear of dental treatment compared to those who regularly visit the dentist, making it more difficult to control the child's pain and anxiety[28].

The high demand for curative dental services, due to lack of parental supervision, coupled with negligence of regular dental check-ups, emphasizes the need for surveillance of children's oral health, especially in high-risk micro-areas and schools, as a continuous practice by the oral health team in the area covered by the Family Health Unit.

Surveillance actions, aimed at detecting treatment needs and identifying risk factors (lack of toothbrush, toothpaste, and supervision during brushing), articulated with a referral scheme to address treatment needs, are crucial to improving the situation found in this study.

CONCLUSION

Children with poor oral health did not perform well in school, suggesting that, in addition to a lack of monitoring of their oral health, they do not receive adequate supervision in other areas of their lives, such as formal education.

There is a need for oral health actions in schools aimed at identifying children with dental treatment needs in order to communicate with parents about the oral problems faced by the child, simultaneously with a process of accessibility to dental treatment at the primary health care unit.

This study has limitations inherent to the moment of data collection, to which environmental components were not added, especially the level of education of caregivers, monthly family income, and access to oral health services. Other information from the children's

teachers about parents' interest in improving their children's performance through supervision of homework, attendance and interest in school meetings would enrich the correlation of the study.

Despite this, the study can reflect realities in school health, especially in oral health, with a view to providing attention in the area, as well as facilitating the process so that this factor does not hinder learning.

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