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VINÍCIUS AGUIAR LAGES

AVALIAÇÃO DAS CONDIÇÕES DE SAÚDE BUCAL EM ESTUDOS MULTICÊNTRICOS QUE ABORDAM DOENÇAS CRÔNICAS RELACIONADAS COM DIETA E ESTILO DE VIDA

EVALUATION OF ORAL HEALTH CONDITIONS IN MULTICENTER STUDIES INVESTIGATING CHRONIC DISEASES RELATED TO DIET AND LIFESTYLE

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Tese apresentada à Faculdade de Odontologia de Piracicaba, da Universidade Estadual de Campinas, como parte dos requisitos exigidos para a obtenção do título de Doutor em Odontologia, na Área de Saúde Coletiva.

Thesis presented to the Piracicaba Dental School of the University of Campinas in partial fulfillment of the requirements for the degree of Doctor in Dentistry, in Public Health Area.

Orientadora: Profa. Dra. Maria da Luz Rosário de Sousa

Este exemplar corresponde à versão final da tese defendida pelo aluno Vinícius Aguiar Lages, e orientada pela Profa. Dra. Maria da Luz Rosário de Sousa

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RESUMO

Nos estudos multicêntricos de coorte, ocorre a condução simultânea e controlada de um mesmo protocolo em diversas instituições e o principal foco destas pesquisas são os determinantes comuns às doenças investigadas. O objetivo desta tese foi avaliar as condições de saúde bucal em estudos multicêntricos voltados para doenças crônicas relacionadas com dieta e estilo de vida, como o IDEFICS e I.FAMILY, na Europa, e o SAYCARE, na América do Sul. Para isso, foram realizados 2 estudos. O objetivo do primeiro foi avaliar os efeitos de uma intervenção para prevenção de obesidade sobre a prevalência da doença cárie dentária de crianças espanholas participantes do estudo multicêntrico IDEFICS. Duas cidades participaram da coorte: Huesca, onde houve estímulo ao menor consumo de açúcar, como parte das medidas da intervenção de 2 anos; e Zaragoza (controle). A prevalência de cárie foi avaliada pelo exame dos primeiros molares permanentes na faixa etária de 7 a 11 anos, utilizando o ICDAS. Esses dentes erupcionam aos 6 anos e no baseline eram livres de cárie, pois não estavam na cavidade bucal. Foram escolhidas como desfechos mancha branca, reunindo os critérios 1 e 2 do ICDAS, e cárie não tratada, juntando os critérios 4, 5 e 6. Investigou-se associação destes com variáveis socioeconômicas, IMC, frequência de consumo de açúcar, sexo e percepção dos pais sobre o peso dos filhos. Para isso, aplicou-se o teste do qui-quadrado, com p<0,05. A amostra consistiu de 281 crianças. A prevalência de lesões de cárie foi maior em Huesca, apesar da intervenção. Não houve associação entre os desfechos com as variáveis estudadas (p>0,05). Concluiu-se que a intervenção do estudo IDEFICS não causou efeitos positivos sobre a prevalência de cárie nas crianças da Espanha. O segundo estudo comparou, dentro do projeto piloto do SAYCARE, índices epidemiológicos adotados pela OMS para cárie dentária e doença periodontal, com outros usados para a mesma finalidade. A saúde bucal de pré-escolares (N=101), escolares (N=100) e adolescentes (N=111) de Teresina foi avaliada. A doença cárie foi avaliada pelos índices ICDAS e CPOD, e a doença periodontal pelos índices PSR e CPI. Em seguida, os resultados diagnósticos destes índices foram comparados por meio de porcentagens (análise descritiva). Em todas as faixas etárias estudadas, houve alta prevalência de cárie, sendo a quantidade de lesões de mancha branca maior que as lesões cavitadas em dentina, segundo o código ICDAS. O índice CPOD apontou menor prevalência de cárie que o ICDAS, pois não considera lesões de mancha branca e cavitação em esmalte. Foi observada alta prevalência de sangramento gengival, especialmente entre adolescentes. A comparação entre os resultados do PSR e do CPI apontou resultados diagnósticos semelhantes. Neste segundo estudo, concluiu-se que o ICDAS é mais apropriado para descrever a prevalência de cárie em estudos multicêntricos. Porém, o índice CPI demonstrou ser mais apropriado que o PSR, por ser mais prático e rápido, diante dos resultados semelhantes. Assim, avaliar a saúde bucal em estudos multicêntricos resulta na obtenção de dados com mais qualidade de informação e, consequentemente, podem possibilitar políticas públicas mais amplas e efetivas.

Palavras-chave: Estudo multicêntrico. Dieta. Saúde bucal. Cárie dentária. Doenças periodontais.

ABSTRACT

In multicentric cohort studies, simultaneous and controlled conduction of the same protocol occurs in several institutions and the main focus of these studies are the determinants common to the diseases investigated. The objective of this thesis was to evaluate oral health conditions in multicenter studies for chronic diseases related to diet and lifestyle, such as IDEFICS and IFAMILY in Europe and SAYCARE in South America. For this, two studies were developed. The objective of the first was to evaluate the effects of an intervention to prevent obesity on the prevalence of dental caries disease of Spanish children participating in the multicenter IDEFICS study. Two cities participated in the cohort: Huesca, where there was a stimulus to lower sugar consumption, as part of the intervention measures of 2 years; and Zaragoza (control). The prevalence of caries was evaluated by examination of the first permanent molars in the age group of 5 to 10 years, using the ICDAS. These teeth erupt at age 6 and were baseless in the baseline because they were not in the oral cavity. White spots were selected as criteria, with criteria 1 and 2 of ICDAS, and untreated caries, combining criteria 4, 5 and 6. The association of these variables with socioeconomic variables, BMI, frequency of sugar consumption, gender and perception of the parents on the weight of their children was investigated. For this, the chi-square test was applied, with p<0.05. The sample consisted of 281 children. The prevalence of caries lesions was higher in Huesca, despite the intervention. There was no association between the outcomes and the variables studied (p> 0.05). It was concluded that the intervention of the IDEFICS study did not have positive effects on the prevalence of caries in children in Spain. The second study compared, within the pilot project of SAYCARE, epidemiological indices adopted by the WHO for dental caries and periodontal disease, with others used for the same purpose. Oral health of preschool children (N = 101), school children (N = 100) and adolescents (N = 111) of Teresina were evaluated. The caries disease was evaluated by the ICDAS and DMFT indexes, and the periodontal disease by the PSR and CPI indexes. Then, the diagnostic results of these indices were compared by means of percentages (descriptive analysis). In all the studied age groups, there was a high prevalence of caries, and the amount of white spot lesions was higher than the lesions cavitated in dentin, according to the ICDAS code. The DMFT index showed a lower prevalence of caries than the ICDAS, since it does not consider lesions of white spot and cavitation in enamel. A high prevalence of gingival bleeding was observed, especially among adolescents. The comparison between PSR and CPI results showed similar diagnostic results. In this second study, it was concluded that the ICDAS is more appropriate to describe the prevalence of caries in multicenter studies. However, the CPI index proved to be more appropriate than the PSR, because it was more practical and fast, given the similar results. Thus, assessing oral health in multicenter studies results in obtaining data with higher quality of information and, consequently, can make broader and more effective public policies.

Key words: Multicenter study. Diet. Oral health. Dental caries. Periodontal diseases.

SUMÁRIO

1 INTRODUÇÃO

Nos estudos multicêntricos ocorre a condução simultânea e controlada de um mesmo protocolo em diversas instituições, mas também é foco de atenção a obtenção de resultados em número expressivo de maneira rápida e a avaliação de variáveis em diversas amostras populacionais não relacionadas (Worthington, 2004; Chuang et al., 2005). Estudos multicêntricos com avaliação das condições de saúde bucal não são comuns, principalmente quando esta inclusão consta como um módulo integrante de um projeto destinado a investigar etiologias e métodos de prevenção comuns a uma série de doenças crônicas não transmissíveis como as doenças cardiovasculares, obesidade e diabetes. Isso aconteceu nos estudos europeus IDEFICS - Identification and prevention of dietary- and lifestyle-induced health effects in children and infants (Ahrens et al., 2011) e IFAMILY - Investigating the determinants of food choice, lifestyle and health in European children, adolescents and their parentes (Ahrens et al., 2016), e em um projeto piloto com delineamento semelhante na América do Sul, denominado SAYCARE - South American Youth/Child Cardiovascular and Environment Health Study (SAYCARE Study, 2017)

O IDEFICS foi um estudo prospectivo de coorte com crianças de oito países da Europa (Suécia, Alemanha, Hungria, Itália, Chipre, Espanha, Bélgica e Estônia), iniciado em 2007. Investigou-se as causas das doenças relacionadas à dieta e ao estilo de vida, com foco principalmente no excesso de peso e obesidade. Nesta coorte, houve a implementação de um programa de intervenção para prevenção primária da obesidade (Ahrens et al., 2011). Dando continuidade ao IDEFICS, o estudo IFAMILY verificou determinantes do comportamento alimentar em crianças, adolescentes e seus pais (Ahrens et al., 2016). Nesta fase, que teve início em 2013, aconteceu uma avaliação em saúde bucal de crianças e adolescentes da Espanha, que foi o único país onde ocorreram os exames odontológicos, especificamente nas cidades de Zaragoza e Huesca. Posteriormente, baseado nestes estudos, surgiu o SAYCARE, que incluiu a avaliação em saúde bucal em seu projeto piloto, realizado em 2016 e 2017, mantendo os mesmos coordenadores da pesquisa em saúde bucal ocorrida na Espanha. O SAYCARE foi desenvolvido no Brasil, em duas cidades brasileiras (São Paulo e Teresina), e em outros cinco países da América do Sul (Argentina, Chile, Colômbia, Peru e Uruguai) (SAYCARE Study, 2017).

Assim, a avaliação das doenças cárie e periodontal (gengivite e periodontite), que são as doenças bucais mais prevalentes no mundo, nestes estudos multicêntricos da Europa (IDEFICS e IFAMILY) e no estudo SAYCARE, foi uma abordagem pioneira. No grupo de

crianças e adolescentes que tiveram sua saúde bucal examinada no estudo IFAMILY, havia uma amostra muito pequena com sobrepeso ou obesidade, que se manteve desde o baseline ocorrido no IDEFICS, e não foi suficiente numericamente para possibilitar a investigação da associação de lesões de cárie com a obesidade nesta população específica. Assim, nestes estudos europeus, foram investigadas as relações de cárie dentária com outros determinantes importantes, como os sociodemográficos e comportamentais, e por isso a avaliação de saúde bucal envolveu estes dois projetos, que constituíram fases importantes de uma mesma coorte na Espanha. No projeto piloto SAYCARE, houve uma abordagem metodológica, com a comparação e discussão de índices de saúde bucal utilizados em levantamentos epidemiológicos (WHO, 1997; Pitts, 2004; ADA e AAP, 1992), que foram testados nesta etapa do estudo com dados de Teresina, uma das cidades participantes.

Atualmente, existe uma forte discussão sobre a relação da cárie dentária com a obesidade (Hayden et al., 2013; Hooley et al., 2012), a qual cresce de forma alarmante em todo o mundo (WHO, 2014; WHO, 2017), e sobre a relação das doenças periodontais com a obesidade e com as morbidades cardiovasculares (Genco et al., 2005; Nadeau et al., 2011; Trevisan e Dorn, 2010). O principal foco destas pesquisas são os determinantes comuns a estas doenças crônicas, como o consumo de açúcar existente entre obesidade e cárie (Sheiham e James, 2015; Costacurta et al., 2014), e o desenvolvimento de políticas públicas preventivas de largo alcance social (Sheiham e Willians, 2015). Por isso, os estudos multicêntricos de coorte são uma ferramenta importante para avaliar a inter-relação existente entre estas doenças e estudar a influência do meio ambiente e da cultura sobre o processo saúde-doença (Worthington, 2004; Chuang et al., 2005).

O objetivo desta tese foi avaliar as condições de saúde bucal em estudos multicêntricos voltados para doenças crônicas relacionadas com dieta e estilo de vida. Para isso, foram desenvolvidos dois estudos. O primeiro avaliou os efeitos de uma intervenção para prevenção de obesidade sobre a prevalência de cárie dentária de crianças espanholas do estudo IDEFICS. O segundo estudo comparou índices de saúde bucal usados para levantamentos epidemiológicos no estudo SAYCARE.

2. ARTIGOS

2.1 EFEITOS DE UMA INTERVENÇÃO PARA A PREVENÇÃO DE OBESIDADE SOBRE A PREVALÊNCIA DE CÁRIE DENTÁRIA EM CRIANÇAS ESPANHOLAS DO ESTUDO IDEFICS

EFFECTS OF AN INTERVENTION FOR THE PREVENTION OF OBESITY ON THE PREVALENCE OF DENTAL CARIES IN SPANISH CHILDREN FROM THE IDEFICS STUDY

Manuscrito a ser submetido na revista Public Health Nutrition

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RESUMO

Objetivo: Avaliar os efeitos de uma intervenção para a prevenção de obesidade sobre a prevalência da doença cárie dentária de crianças espanholas participantes do estudo multicêntrico IDEFICS. **Métodos:** Duas cidades participaram da coorte: Huesca, onde houve intervenção (2 anos) com estímulo ao menor consumo de açúcar; e Zaragoza (controle). A prevalência de cárie foi avaliada pelo exame dos 1º molares permanentes na faixa etária de 7 a 11 anos, utilizando o ICDAS. Esses dentes erupcionam aos 6 anos e no baseline eram livres de cárie, pois não estavam na cavidade bucal. Foram escolhidas como desfechos mancha branca, reunindo os critérios 1 e 2 do ICDAS, e cárie não tratada, juntando os critérios 4, 5 e 6. Investigou-se associação destes com variáveis socioeconômicas, IMC, frequência de açúcar, sexo, parto e percepções dos pais sobre os filhos. Para isso, aplicou-se o teste do qui-quadrado, com $p < 0,05$. **Resultados:** A amostra consistiu de 281 crianças. A prevalência de mancha branca (52,8%) e cárie não tratada (40,6%) foi maior em Huesca, apesar da intervenção. Não houve associação entre os desfechos com as variáveis estudadas ($p > 0,05$). **Conclusão:** A intervenção na prevenção de obesidade do estudo IDEFICS não causou efeitos positivos sobre a prevalência de cárie nas crianças da Espanha.

Palavras-chave: Estudo multicêntrico. Saúde bucal. Cárie dentária. Obesidade. Estilo de vida.

ABSTRACT

Objective: To evaluate the effects of an intervention for the prevention of obesity on the prevalence of dental caries disease in Spanish children participating in the multicenter IDEFICS study. **Methods:** Two cities participated in the cohort: Huesca, where there was a 2-year intervention which encouraged less sugar consumption; and Zaragoza (control). The prevalence of caries was evaluated by examining the 1st permanent molars in the 7-11 age range, using the ICDAS. These teeth erupt at 6 years of age and at the baseline were free of caries because they were not present in the oral cavity. As outcomes, white spots were selected, combining the ICDAS criteria 1 and 2, and untreated caries, combining criteria 4, 5 and 6. Their association with socioeconomic variables, BMI, frequency of sugar intake, gender, birth, and parents' perceptions of their children, was investigated. To do so, the chi-square test was applied, with $p < 0.05$. **Results**: The sample consisted of 281 children. The prevalence of white spots (52.8%) and untreated caries (40.6%) was higher in Huesca, despite the intervention. There was no

association between the outcomes and the variables studied (p>0.05). **Conclusion**: The intervention for the prevention of obesity in the IDEFICS study did not exert any positive effect on the prevalence of caries in Spanish children.

Keywords: Multicentric study. Oral health. Dental caries. Obesity. Lifestyle.

INTRODUCTION

The prevalence of childhood obesity has increased rapidly in Europe, and in other continents, and has become a serious global public health problem [1]. This problem tends to persist into adult life, and is a risk factor in the occurrence of various chronic diseases, such as cardiovascular disease and diabetes [1,2]. The fact that eating habits are a key common etiological component of both obesity and dental caries [3,4] stimulates interest as the latter is also a serious public health problem in several countries [5] and the prevalence of both diseases can be reduced with healthy diets and low sugar consumption [4].

Studies on the relationship between obesity and dental caries present inconclusive results. Some have shown a positive association between them [3,6], while others [7-9] show no relationship between these factors in schoolchildren, but found that the higher the parents' educational level, the lower the prevalence of obesity and dental caries among their children. Socioeconomic inequalities can create unequal opportunities among people [10] and have different effects on these diseases, as they are influenced by factors such as education, income and saccharose-rich diets [3,10].

To face this growth of obesity in the population, the multicentric IDEFICS (Identification and prevention of dietary- and lifestyle-induced health effects in children and infants) was set up. It was a prospective cohort study in a large diverse sample of children in Europe, which started at the beginning in 2007. It investigated the causes of dietary and lifestyle-related diseases and disorders, with a main focus on overweight and obesity [11]. This cohort involved the drawing up, implementation and assessment of a community-oriented intervention program for the primary prevention of obesity in a controlled study project [12]. Spain was the focus of this study and it took place in the cities of Zaragoza and Huesca. This intervention part of the IDEFICS study examined the feasibility, efficacy, and sustainability of a coherent set of intervention modules which addressed diet, physical activity, and stress management [12].

The IFAMILY study, which continued on from the IDEFICS, verified determinants of eating behavior in children, adolescents and their parents of European origin [13]. Based on data collected from more than 10,000 children who were under 10 years old in the IDEFICS study, the IFAMILY reevaluated these children and their families as they moved on to adolescence and identified those who maintained healthy diets and eating habits from the implementation of the intervention program onwards, and compared them to children who had not received the intervention [13]. This phase, which began in 2013, included a major innovation, the inclusion of oral health assessment of Spanish children participating, thereby providing a pioneering Dentistry study within a cohort with a focus on behaviors, lifestyles and eating habits. No studies with such an approach were found in the literature. The purpose of this study was to evaluate the effects of an intervention for the prevention of obesity on the prevalence of dental caries disease in Spanish children participating in the multicentric IDEFICS study.

METHODOLOGY

The IDEFICS and I.FAMILY studies

A cohort of 16,224 2 to 9-year-olds from eight European countries (Sweden, Germany, Hungary, Italy, Cyprus, Spain, Belgium and Estonia) participated in the first population survey of the IDEFICS study. Defined as T0, it took place between September 2007 and May 2008 and was the first stage (baseline) of the prospective cohort study with the largest European infant cohort established until then and was also the initial stage for the IDEFICS intervention. All children in the defined age group residing in the regions studied and attending public primary schools (grades 1 and 2), preschools or kindergartens were eligible to participate. In addition to the signed informed consent provided by parents, each child was invited to give their verbal approval. The T0 exams included anthropometric data, lifestyle, biological markers, behavioral and sociodemographic characteristics and were based on a highly standardized protocol, as set out by Ahrens et al. [11].

The IDEFICS study was not designed with population representativeness of each country. In most countries, the regions selected were individual cities or communities, most of which were located in the same geographical area. The intervention and control regions in each country were selected for convenience, such as the distance between the research teams involved, in order to reduce costs. The T0 occurred in the intervention and control regions selected in these countries, allowing researchers to assess and describe health conditions, eating

habits and lifestyle of children in Europe, taking regional, social, biological and gender aspects into account. After this phase, the primary prevention program was implemented in the selected intervention regions only. The intervention was designed to address key behaviors in relation to obesity (diet, physical activity and stress) at four levels: individual (children), family (parents), school and community. At these levels, six messages related to these behaviors were worked on, through 10 separate modules with intervention measures targeting each level. The six messages were: 1 - Increase water consumption; 2 - Increase consumption of fruit and vegetables; 3 - Reduce daily screen time (television and computer); 4 - Increase daily physical activity; 5 - Improve the quality of family life; and, 6 - Ensure adequate sleeping hours. The intervention design and details of the different intervention modules of the IDEFICS study are described, according to their level of intervention, in Verbestel et al. [12] and Pigeot et al. [14].

The short-term effects of the intervention were evaluated during the second survey, called T1, 2 years after T0, repeating the same exam modules with children from both control and intervention areas, to compare both regions of each country. At the end of T1, 69% (N = 11,189) of the children who had participated in T0 were reevaluated. Dropout between the exams was higher among those with overweight, low schooling, children of single parents and low scores for well-being [15]. The prevalence of overweight and obesity stratified by gender and country were recorded. In 2010, a second follow-up, defined as T2, was conducted using a questionnaire sent through the postal service to all intervention participants to evaluate sustainability of behavioral change.

As a starting point for the IFamily study described in Ahrens et al. [13], another follow-up exam (T3) was carried out between 2013 and 2014 (Figure 1), when those children who had participated in T0 and T1 were now 5 to 17-year-olds, with an almost equal proportion of boys and girls. This stage included an assessment of the oral health conditions of the children who had participated in the study in Spain, the only country where this initiative occurred. As the aim was to investigate entire families, all siblings in the same age range as these children were invited. The role of family characteristics, family structure and family life in relation to child development is one of the main focuses of IFamily [13], in which at least one parent of each index child participated and provided information about their family. Thus, a total of 6,167 families from the eight countries, with an average of 2 children per family, provided the necessary data for the IFAMILY. In Spain, it is estimated that 1,591 children participated in the baseline and 445 of these had their oral health assessed in T3, 281 (59.2%) aged from 5 to 10 and 194 (40.8%) from 11 to 14 years.

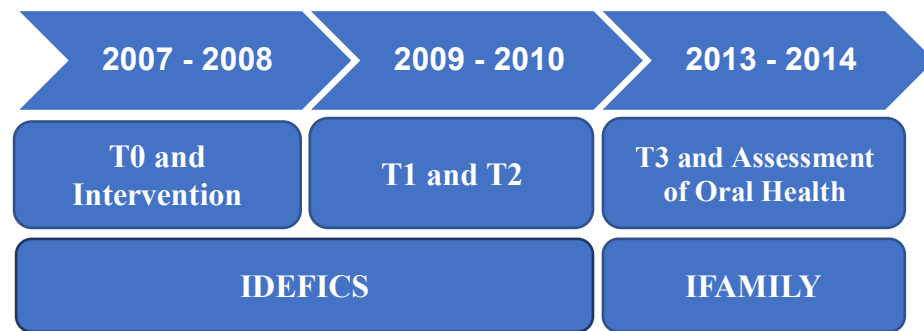| 2007 - 2008	2009 - 2010	2013 - 2014
T0 and Intervention	T1 and T2	T3 and Assessment of Oral Health
IDEFICS		IFAMILY

Figure 1 - Schedule of exams of the IDEFICS cohort and the IFAMILY study. T0, Initial research phase (baseline); T1, first exam after intervention; T2, questionnaires sent to participants via postal service to assess the intervention; T3, second exam after intervention, with assessment of oral health in Spain.

All applicable institutional and governmental regulations as regards the ethical use of human volunteers were followed during this research. Required approvals by the Research Ethics Committees were obtained by each center doing the fieldwork. No child underwent any procedure without their parents' prior consent for exam, sample collection, subsequent analysis and storage of personal data and samples collected.

Population and study design

The present study included 281 children from the Spanish cohort in the IDEFICS study, participating from baseline (T0) and aged from 7 to 11 in T3 (IFAMILY), when they participated in the oral health assessment. The Spanish city of Zaragoza was selected as a control and the intervention occurred in Huesca, 72 km away. The study was approved by the Aragão (Spain) Clinical Research Ethics Committee in 2013. Parents signed a free informed consent form (FICF), and the children gave consent for exams and sample collection. The aim of the dietary intervention, considered the most important for this study because of the common risk factor for caries and obesity, set out to improve the children's eating habits, by increasing their daily consumption of water, fruit and vegetables [12,14] and, thus reduce their intake of sugars. There was no intervention in oral hygiene habits, such as frequency of brushing or use of dental floss, for example.

Data on gender, frequency of sugar intake and children's anthropometrics were obtained at T0. From the questionnaires applied to parents also at T0, information on family income and parents' levels of education were collected. Another questionnaire answered by parents at T3 described their perception of their children's weight. Assessment of oral health occurred only

at T3, based on a partnership between the University of Zaragoza (Spain) and the Piracicaba Faculty of Dentistry (São Paulo, Brazil). In order to evaluate the effects of dietary intervention on the prevalence of caries, the exam of first permanent molars (teeth 16, 26, 36 and 46) only were considered, as they were not present in the oral cavity at T0 and, therefore, when they erupted they were caries-free. The first molars appear in the mouth at around 6 years of age [16] and, during their eruption phase, considered high risk for the development of caries [17], the children in this study were in or had already gone through the period of the IDEFICS intervention. The caries (caries-free and with caries) and white spots (free of white spots and with spots) variables were chosen as outcomes, and an investigation was undertaken to see if there was any association between these and the socioeconomic, diet and body weight of children at T0, by comparing the results of the control area (Zaragoza) with that of the intervention area (Huesca).

Frequency of sugar intake

The frequency of sugar intake was estimated using a suitable appropriately reproduced [18] and validated [19] Children's Eating Habits Questionnaire (CEHQ). This tool investigated the frequency of food consumption and behavior associated with overweight, obesity and children's general health. The CEHQ includes a Food Frequency section (FFQ) in which parents or other caregivers living with the child reported the frequency of their child's consumption of sugar foods over a typical week in the previous 4 weeks. This allowed for the reduction of likelihood of a "special week", for example due to holidays or illness. Consequently, week to week variability was reduced. In the CEHQ-FFQ, the same general description of each food was used in each country to guarantee standardization between the eight countries surveyed. To facilitate completion of the questionnaire, the same response scale was used for all dietary items of the CEHQ-FFQ. The response options were as follows: Never/less than once a week, 1-3 times a week, 4-6 times a week, 1 time a day, 2 times a day, 3 times a day, 4 or more times a day, and No idea. This scale was adopted using the eating habits questionnaire of the Early Childhood Longitudinal Survey of the United States Department of Agriculture [20] as a basis. Intake frequencies were evaluated without trying to quantify portion sizes. For the present study, this variable was divided into "Up to 3 times a day" and "4 or more times a day", as a sugar consumption frequency greater than 4 times a day is directly related to the development of caries disease [21].

Anthropometry

The children's weight was measured by weighing scales with a Tanita BC 420 SMA scale (TANITA Europe GmbH, Sindelfingen, Germany) while their height was measured using a SECA 225 stadiometer (SECA GmbH & Co. KG., Hamburg, Germany). The measurements were taken in the morning, with the children fasting and wearing underwear only. Body Mass Index (BMI) was calculated according to the International Obesity Task Force (IOTF) (22), where low weight = $BMI < 17 kg/m^2$, normal weight = $17 kg/m^2 \leq BMI < 25 Kg/m^2$, overweight = $25 Kg/m^2 \leq BMI < 30 Kg/m^2$ and obesity = $BMI \geq 30 Kg/m^2$.

Questionnaire applied to parents

Parents answered questionnaires on the socioeconomic data of the family and their perceptions of their children's body weight [11]. Data on the parents' education levels were based on the International Standard Classification of Education (ISCED) [23], which allowed for a comparison between the countries and was used to determine the parents' maximum education levels, a socioeconomic evaluation criterion. Levels 0-2 are classified as low, while levels 3-4 are medium and 5-6 are high levels of education. Family income was evaluated by the question "What is your monthly family income?", using specific Spanish categories based on people's average net income [24]. The answers were grouped into low, medium or high incomes. Parents' perceptions of their child's weight were classified as "underweight, adequate or overweight".

Oral Health Assessment

The children's oral health was assessed at T3 on the basis of exams for the prevalence of dental caries and periodontal disease, and observation of the amount of accumulated bacterial plaque. For all of these exams, a dental diagnostic plane mouth mirror Nº5 and a spherical calibrated periodontal probe were used, under artificial light, with both examiner and child seated.

Caries disease was evaluated by the International Caries Detection and Assessment System - ICDAS [25], which combines the use of visual and tactile signs of caries lesions and allows for detection of the disease in its early stages. The examination was performed after prophylaxis, relative isolation and drying of the teeth with a portable air jet. The clinical stages of the caries lesions were established according to the histological classification proposed by Ekstrand et al. [26], ranging from the identification of a white spot on a dental surface, which could need drying to be visualized (code 1) or not (code 2), lesions on dental enamel (code 3), to a cavity visible in dentin (codes 4, 5 and 6). Codes 1 and 2 were considered for white spots,

and codes 4, 5 and 6 were used for untreated caries, and these lesions were summed up for each outcome. Thus, an association was sought between the prevalence of white spot lesions and untreated carious lesions and socioeconomic factors, gender, diet, body weight and parental perception of the weight of their children.

The existence of periodontal disease was evaluated by the Community Periodontal Index (CPI), according to the methodology recommended by the World Health Organization (WHO) [27] for epidemiological surveys in oral health. The codes are: 0 - Healthy sextant, 1 - Gingival bleeding, 2 - Dental calculus, 3 - Shallow periodontal pocket, between 3.5 and 5.5mm, and 4 - Deep periodontal pocket, greater than 5.5mm. The amount of plaque was observed according to the Plaque Index (PI) proposed by Silness and Loe [28], by means of the following codes: 0 - Absence of biofilm, 1 – Tooth clean with biofilm detectable only with probe, 2 – Moderate deposit of biofilm visible to the naked eye, and 3 – Large accumulation of biofilm filling the entire gingival margin. Data on periodontal conditions were analyzed in a descriptive manner, with the prevalence of periodontal disease by sextant, with a view to describing the oral health of the patients, without any relation to the outcomes used.

Examiner calibration was carried out through theoretical discussions and practical activities, simulating the different conditions and situations that the professionals would encounter during the practical work. The examiners were calibrated for ICDAS II caries criteria with a standard examiner, who also assisted in data collection (Maria da Luz Rosário de Sousa). First they did an on-line calibration (https://www.icdas.org/icdas-e-learning-course), and then an exercise with 20 children. The Kappa values weighted for inter-examiner and intra-examiner agreement exceeded 0.85 for the ICDAS II and CPI indices.

Statistical analysis

Descriptive statistics were used to define sociodemographic and oral health characteristics. Pearson's Chi-square test was used to compare categorical variables (gender, educational level, income, frequency of sugar intake and BMI, with dental caries and white spots as outcomes). Data were analyzed using IBM SPSS Statistics, Version 20. The significance level was set at 0.05.

RESULTS

The socioeconomic characterization of the T3 sample was similar to that at the baseline. There was a slight reduction in the percentage of low-income children and an increase in the number of middle-income children in both cities (Table 1).

Table 1 – Socioeconomic data of the total sample at T0 (2007) and of the sample of 7 to 11-year-olds at T3 (2013), per Spanish city.

Variable per city		T0	T3
Total sample		N=1,509 (100.0%)	N=281 (100.0%)
Zaragoza			
Sample		N=799 (52.9%)	N=175 (62.3%)
Level of education	Low	76 (9.77%)	6 (5.6%)
	Medium	281(36.1%)	40 (37.4%)
	High	421 (54.11%)	61 (57.0%)
	Total	778 (100.0%)	107 (100.0%)
Family income	Low	125 (17.0%)	9 (7.4%)
	Medium	409 (55.95%)	76 (62.8%)
	High	197 (26.94%)	36 (29.8%)
	Total	731 (100.0%)	121 (100.0%)
Huesca			
Sample		N=710 (47.1%)	N=106 (37.7%)
Level of education	Low	39 (5.55%)	3 (4.1%)
	Medium	316 (45.0%)	39 (53.4%)
	High	347 (49.4%)	31 (42.5%)
	Total	702 (100.0%)	73 (100.0%)
Family income	Low	84 (13.0%)	3 (4.1%)
	Medium	457 (70.96%)	59 (78.6%)
	High	103 (16.0%)	13 (17.3%)
	Total	644 (100.0%)	75 (100.0%)

The prevalence of children with dentin carious lesions (p=0,015) and with white spots (p=0,016) in the first molars was higher in Huesca, despite the intervention (Figure 2).
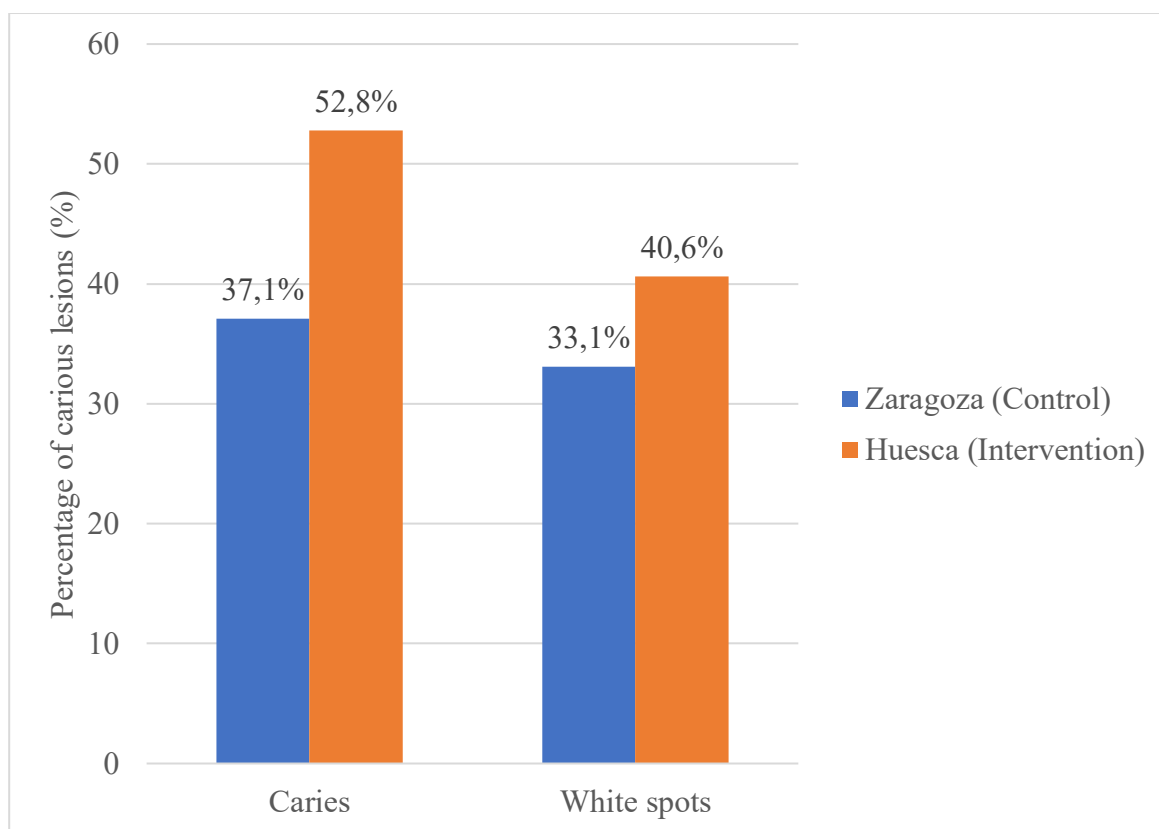
Figure 2 – Prevalence of caries and white spots assessed in the first permanent molars of 7 to 11-year-olds in the post-intervention period (T3), in Zaragoza and Huesca, Spain, 2013-2014.

The analysis of first molars with carious lesions in Zaragoza shows that 54.2% of them were at the initial caries stage, while in Huesca this rises to 59.6%. The Zaragoza children presented a lower percentage of visible plaque, but presented a higher percentage of sextants with bleeding. In Huesca, there were more children with localized visible plaque and plaque in the whole gingival margin, and although they presented a lower percentage of sextants with bleeding, 5% presented calculus, a more serious condition (Table 2). There was no association between caries and white spot disease with the socioeconomic, gender, parents' perception of their children's weight, sugar consumption or body weight variables in any of the cities. The results of parents' perception of their children's weight showed responses which were inconsistent with their children's actual weight for those considered underweight, despite having normal weight (Tables 3 and 4).

Table 2 – Oral health data for 7 to 11-year-olds per city, at T3, in terms of the I.FAMILY study, Spain, 2013.

Oral Health data	Zaragoza (Control)		Huesca (Intervention)	
	N	%	N	%
First molars with carious lesions (ICDAS)				
White spots after drying	49	32.8%	33	28.9%
White spots without drying	21	14.0%	18	15.8%
Enamel cavitation	11	7.4%	17	14.9%
Darkened dentin without visible cavitation in enamel	7	4.7%	2	1.38%
Dentin cavitation less than ½ the surface	3	2.0%	1	0.9%
Dentin cavitation more than ½ the surface	58	38.9%	43	37.7%
Total	149	100.0%	114	100.0%
Bacterial Plaque Index (Silness PI)				
No plaque	54	30.85%	23	21.69%
Plaque visible with probe	68	38.85%	41	38.67%
Localized plaque visible	24	13.7%	21	19.81%
Plaque visible in whole gengival margin	29	16.57%	20	18.86%
Total	175	100.0%	106	100.0%
Periodonal condition per sextant examined (CPI)				
Healthy	643	65.88%	419	69.6%
Bleeding	319	32.68%	152	25.25%
Calculus	14	1.43%	31	5.14%
Total	976	100.0%	602	100.0%

Table 3 - Distribution of variables for 7 to 11-year-olds per city in the IDEFICS study in Spain, for untreated caries.

Variables	Untreated caries							
	Huesca (Intervention)				Zaragoza (Control)			
	No	Yes	Total	p	No	Yes	Total	p
Leval of education								
High	16(51.6%)	15(48.4%)	31(100.0%)		36(59.0%)	25(41.0%)	61(100.0%)	
Medium	16(41.0%)	23(59.0%)	39(100.0%)		26(65.0%)	14(35.0%)	40(100.0%)	
Low	2 (66.7%)	1 (33.3%)	3(100.0%)	0.526	4(66.7%)	2(33.3%)	6(100.0%)	0.805
Family income								
High	7 (53.9%)	6(46.1%)	13(100.0%)		21(58.3%)	15(41.7%)	36(100.0%)	
Medium	24(40.7%)	35(59.3%)	59(100.0%)	0.496	50(65.8%)	26(34.2%)	76(100.0%)	0.397
Low	2 (66.7%)	1 (33.3%)	3 (100.0%)		4 (44.4%)	5 (55.6%)	9 (100.0%)	
Frequency of sugar intake								
Up to 3 times a day	9 (47.3%)	10(52.6%)	19(100.0%)		25(64.1%)	14(35.9%)	39(100.0%)	
4 or more times a day	1(100.0%)	0 (0.0%)	1 (100.0%)	0.305	5 (41.7%)	7 (58.3%)	12 (100.%)	0.167
BMI								
Underweight	1 (25.0%)	3 (75.0%)	4 (100.0%)		4 (80.0%)	1 (20.0%)	5 (100.0%)	
Normal	37(47.4%)	41(52.6%)	78(100.0%)	0.380	72(59.0%)	50 (41.0%	122(100.0%)	0.619
Overweight	0(0.0%)	0 (0.0%)	0 (0.0%)		1 (50.0%)	1 (50.0%)	2 (100.0%)	
Parents' perception of their children's weight								
Underweight	9 (37.5%)	15(62.5%)	24(100.0%)		14(45.1%)	17(54.9%)	31 (100.0%)	
Adequate	28(51.0%)	27(49.0%)	55(100.0%)	0.353	62(66.7%)	31(33.3%)	93 (100.0%)	0.99
Overweight	0 (0.0%)	1(100.0%)	1 (100.0%)		1(50.0%)	1 (50.0%)	2 (100.0%)	
Gender								
Male	27(53.0%)	24(47.0%)	51(100.0%)		52(66.7%)	26(33.3%)	78 (100.0%)	
Female	23(41.8%)	32(58.2%)	55(100.0%)	0.252	58(59.8%)	39(40.2%)	97 (100.0%)	0.350

Table 4 – Distribution of variables for 5 to 10-year-olds per city in the IDEFICS study in Spain, for white spots.

Variables	White spots							
	Huesca (Intervention)				Zaragoza (Control)			
	No	Yes	Total	p	No	Yes	Total	p
Level of education								
High	19(61.3%)	12(38.7%)	31(100.0%)		39(64.0%)	22(36.0%)	61(100.0%)	
Medium	22(44.9%)	27(55.1%)	49(100.0%)	0.883	28(70.0%)	12(30.0%)	40(100.0%)	0.819
Low	2 (66.7%)	1 (33.3%)	3(100.0%)		4(66.7%)	2 (33.3%)	6 (100.0%)	
Family income								
High	9 (69.2%)	4(30.8%)	13(100.0%)		23(63.9%)	13(36.1%)	36(100.0%)	
Medium	33(56.0%)	26(44.0%)	59(100.0%)	0.651	53(69.7%)	23(30.3%)	76(100.0%)	0.623
Low	2 (66.7%)	1 (33.3%)	3 (100.0%)		5 (55.6%)	4(44.4%)	9 (100.0%)	
Frequency of sugar intake								
Up to 3 times a day	15(79.0%)	4(21.0%)	19(100.0%)	0.608	26(66.7%)	13(33.3%)	39(100.0%)	0.597
4 or more times a day	1(100.0%)	0 (0.0%)	1 (100.0%)		7 (58.3%)	5 (41.7%)	12 (100.%)	
BMI								
Underweight	1 (25.0%)	3 (75.0%)	4 (100.0%)		4 (80.0%)	1 (20.0%)	5 (100.0%)	
Normal	48(61.5%)	30(38.5%)	78(100.0%)	0.146	78(66.1%)	40(33.9%)	118(100.0%)	0.697
Overweight	0 (0.0%)	0 (0.0%)	0 (0.0%)		1 (50.0%)	1 (50.0%)	2 (100.0%)	
Parents' perception of their children's weight								
Underweight	15(62.5%)	9 (37.5%)	24(100.0%)		15 (48.4%)	16(51.6%)	31 (100.0%)	
Adequate	33(60.0%)	22(40.0%)	55(100.0%)	0.458	67(72.0%)	26(28.0%)	93 (100.0%)	0.49
Overweight	0 (0.0%)	1(100.0%)	1 (100.0%)		1(50.0%)	1 (50.0%)	2 (100.0%)	
Gender								
Male	31(60.8%)	20(39.2%)	51(100.0%)	0.785	53(68.0%)	25(32.0%)	78 (100.0%)	0.783
Female	32(58.2%)	23(41.8%)	55(100.0%)		64(66.0%)	33(34.0%)	97 (100.0%)	

DISCUSSION

The highlight of this study is the inclusion of oral health assessment in a multicentric European cohort project which investigates chronic diseases with common lifestyle and dietary risk factors such as obesity, diabetes and cardiovascular diseases. Despite the fact that the dental exams took place in Spain only, although eight countries participated in the study, it was innovative, as the IDEFICS was the European multicentric cohort study involving the largest sample of children among studies undertaken to date, none of which included oral health among their analyses, though caries is also diet-related. As it was a longitudinal study, an analysis of the same population in early childhood and, subsequently, their health outcomes in early adolescence, also contributed to the significance of the study. In addition, the diagnosis of caries with the ICDAS index [25], which considers initial stages of caries, such as white spots and enamel lesions during oral exams, has a great advantage over the DMFT – Decayed, Missing and Filled Teeth [27], which only considers cavitations at the dentin level. Among the first molars with carious lesions, more than half were at the initial stage, and would not have been noticed if the DMFT had been used.

The prevalence of untreated caries and white spots was higher in Huesca, despite the intervention. De Bourdeaudhuij et al. [29] found that the intervention had no positive effects on diet or lifestyle, such as the consumption of water, soft drinks and fruit juice; fruit and vegetable intake; daily TV viewing time and computer use; and daily levels of physical activity (sports and outdoor games) for the total sample of 2 to 9-year-olds in the eight European countries. Families with lower incomes, a poorer quality of life or were migrants presented the worst results, with lower adherence to the intervention measures [15]. Possible limitations of the IDEFICS intervention were mentioned: dependence on parents' answering of questionnaires on child behavior; interference from local, regional or national governments in the fight against obesity in the different countries; differences in the penetration of the IDEFICS intervention in each country, given the different cultural contexts, for which there were no adaptations in strategies; and differences in the measure of intervention at child and parent level [29]. It should be emphasized that there was no intervention in oral hygiene behavior in Spain.

There was no association between untreated caries and white spots with body weight. The fact that a child was underweight, of normal weight or overweight/obese did not influence their oral health or vice versa. This result is in agreement with studies which also did not find this relation with the same age group in the Netherlands, Brazil and Spain [7-9], but found a relationship between social determinants and dental caries disease and obesity, such as lower

family income and parents' lower educational levels, although this was also not shown in our study. However, Alm et al. [6] and Hayden et al. [3] argue that there is an association between these diseases, while Parkar and Chokshi [30] found that underweight children are more likely to experience caries. Through a systematic review of the literature, Hooley et al. [31] stated that there is no evidence to suggest that dental caries is associated with either high or low BMI.

Although the exact nature of such associations is not clear, it is possible that there are different factors involved in the development of caries in children with high or low BMI or with different socioeconomic profiles. According to Costa et al. [9], the conflicting results of the studies could be related to the research design, variations in the environment in which the data were collected, socioeconomic status of the sample, nutritional status measures used, caries assessment indexes used and age differences in the children examined. Nevertheless, it is suggested that combined strategies be implemented simultaneously to control caries and obesity, as they present diet as a common risk factor. The frequency of sugar consumption was not associated with caries and white spots in this study either, but that was probably due to the fact that only 71 parents answered this particular question, of whom only 12 reported consumption more than 4 times a day, as it has already been proven that sugar consumption is directly involved in these diseases [4,32].

Most interventions in the prevention of obesity and dental caries focus on modifying health behavior. These policies and strategies must be accompanied by other government efforts to improve public education, and deterioration of the state of health and nutrition of the population. Traditional preventive and curative approaches, based solely on education and health care are considered unsustainable and ineffective. Such strategies should target the broader upward flow of social factors which affect sugar consumption. People's decisions to consume sugars is deeply rooted in the social, economic and environmental conditions in which they grow up, live, work and age. Thus, sustainable environments for health promotion should be created so that there is a behavior of commitment to health, where the consumption of sugar is the difficult choice and the consumption of vegetables and fruit is the easy choice in terms of availability and accessibility [10,33].

Political and economic changes at local, state and national levels could promote and encourage healthier food choices [33]. The United Kingdom and Mexico, for example, have successfully passed legislation on drinks containing sugar using successful taxation prototypes adapted from alcohol and tobacco [34,35]. Some experiments already reported suggest that a 20% tax on sugar-added beverages could reduce the prevalence of caries, obesity, diabetes and other comorbidities, and reduce treatment costs and lead to behavioral changes in food choice [36,37].

At the same time, sugar-free food, drinks and medicines should not be taxed. Fiscal returns could be used to subsidize the price of vegetables, fruits and sugar-free medicines [37].

For Grinsberg [38], the ideal would be to establish both short- and long-term goals for reducing people's sugar consumption, until the WHO recommended rate of a maximum of 5% of daily total calorie intake is reached, as the rewards arising out of reduced mortality, morbidity and health expenditures would gradually be enormous, as is happening in Israel. The WHO has recognized that dental diseases are the most common non-communicable diseases worldwide and that the treatment of dental disease is costly [39]. Governments must pressure the food and drug industries, with the backing of appropriate legislation, to reduce the sugar content of their products and offer a wide variety of sugar-free alternatives. Meals provided in schools and other public establishments, such as hospitals, should be sugar free or at least with reduced sugar. All of the aforementioned policies should be supported by initiatives to increase public awareness of the need to reduce the intake of sugary foods and beverages from childhood through life, using national and mother and child nutrition programs [33,39].

Sugary drinks with simple packaging, no attractive colors, and warning labels about the dangers of sugar could reduce the likelihood of buying these beverages. Such measures make the product less attractive and create a perception of lower quality and taste for the consumer [40]. All such changes occur amidst the complexities of interactive social, cultural, political, and financial forces which rarely align themselves to promote healthy eating. As in the case of public health efforts to reduce tobacco use, there are keen corporate interests with powerful incentives to oppose or undermine these efforts. This has long been recognized in the case of the tobacco industry and is becoming better recognized in the case of the food and drinks industry [38].

One limitation to this study was the fact that the oral health exam was undertaken only after the intervention, during T3, which meant it was impossible to provide dental follow up for the children throughout the study to compare data on dental caries and the periodontal condition in the initial period (T0). Another limitation was that the ICDAS II index was used only in the first permanent molars, which was necessary in the circumstances. For future multicentric cohort studies focusing on diet, obesity and lifestyle, it is suggested that children's oral health be assessed from the baseline, that all teeth be examined, and that macroeconomic policies of wide social reach, such as the taxation of foods rich in sugar and advertising restrictions be included in the intervention measures of the study. Future investigations involving parents' perception of their children's weight would also be important, as a perception incompatible

with their children's weight could stimulate diets which lead to weight gain and the development of dental caries.

CONCLUSION

The intervention for the prevention of obesity in the IDEFICS study did not have a positive effect on the prevalence of dental caries disease in the children participating in the Spanish cohort. Nevertheless, we suggest that non-communicable diseases with diet as a common etiological factor should be addressed through common control strategies, especially through macroeconomic policies which discourage the consumption of sugar-rich foods and, consequently, reduce health inequalities.

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2.2 ÍNDICES DE SAÚDE BUCAL PARA LEVANTAMENTOS EPIDEMIOLÓGICOS: UMA COMPARAÇÃO NO ESTUDO SAYCARE

ORAL HEALTH INDICES FOR EPIDEMIOLOGICAL SURVEYS: A COMPARISON IN THE SAYCARE STUDY

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RESUMO

Objetivo: Comparar, dentro do estudo SAYCARE, índices epidemiológicos adotados pela OMS em saúde bucal para cárie dentária e doença periodontal, com outros usados para a mesma finalidade. **Métodos:** Pré-escolares, escolares e adolescentes de Teresina tiveram a saúde bucal avaliada no projeto piloto do SAYCARE. A doença cárie foi avaliada pelos índices ICDAS e CPOD e a doença periodontal pelos índices PSR e CPI. Em seguida, os resultados diagnósticos destes índices foram comparados por meio de porcentagens (análise descritiva). **Resultados**: Em todas as faixas etárias estudadas, existe alta prevalência de cárie, sendo a quantidade de lesões de mancha branca maior que as cavitadas em dentina, segundo o código ICDAS. O índice CPOD apresentou piores resultados que o ICDAS, pois não considera lesões de mancha branca e cavitação em esmalte. Foi observada alta prevalência de sangramento gengival, especialmente entre adolescentes. A comparação entre os resultados do PSR e do CPI apontou resultados diagnósticos semelhantes. **Conclusão:** A análise da comparação dos resultados dos índices CPOD e ICDAS aponta que o ICDAS é mais apropriado para descrever a prevalência de cárie em estudos multicêntricos. Porém, a avaliação das condições periodontais parece ser mais adequada com o índice CPI, quando comparado com o PSR.

Palavras chave: Índices de Saúde Bucal. Cárie dentária. Doença periodontal. Estudo multicêntrico. Metodologia.

ABSTRACT

Objective: To compare, within the SAYCARE study, the epidemiological indices adopted by the WHO in oral health for dental caries and periodontal disease with others used for the same purpose. **Methods**: The oral health of preschoolers, schoolchildren and adolescents from Teresina was evaluated in the SAYCARE pilot project. Caries disease was evaluated by the ICDAS and DMFT indices while for periodontal disease the PSR and CPI indices were used. The diagnostic results of these indices were then compared by means of percentages (descriptive analysis). **Results**: In all age groups studied, there was a high prevalence of caries, where the number of white spot lesions was higher than that of dentine caries, according to the ICDAS code. The DMFT index presented worse results than the ICDAS, as the former does not consider white spot lesions or enamel cavitation. A high prevalence of gingival bleeding was also seen, especially among adolescents. Comparisons between PSR and CPI results showed similar diagnostic results. **Conclusion**: Analysis of the comparison of the results of the DMFT and ICDAS indices indicates that the latter is more appropriate when describing the prevalence of caries in multicentric studies. However, the CPI index seems to be better suited to the evaluation of periodontal conditions than the PSR.

Key words: Oral Health Indexes. Dental caries. Periodontal disease. Multicentric study. Metodology.

INTRODUCTION

Dental caries and periodontal disease (PD) are prevalent oral health problems worldwide whose relationships with other systemic conditions have been studied[1]. The inclusion of oral health assessment in multicentric studies such as the South American Youth/Child Cardiovascular and Environment Health Study (SAYCARE) is innovative. It generates a vital discussion on deciding which indices should be applied, considering not just those advocated by the World Health Organization[2], such as the Decayed, Missing and Filled Teeth (DMFT) and the Community Periodontal Index (CPI), for caries and periodontal disease, respectively, which present certain limitations liable to make the evaluation of more detailed results of longitudinal studies unfeasible, as in the case of SAYCARE, which evaluates other aspects such as diet, obesity, cardiovascular risk and lifestyle.

Through the International Caries Detection and Assessment System (ICDAS), Pitts (2004)[3], pointed out that the DMFT takes into account only those teeth or dental surfaces which present carious lesions extending to the dentin[2], which is verified in several cross-sectional and longitudinal studies[4-7], while disregarding the early stages of the disease. Both DMFT and ICDAS methods use visual or visuo-tactile detection[8,9] of dental carious lesions, but the ICDAS also deals with white spots and initial enamel lesions[3,9]. Consequently, studies comparing caries prevalence using both methods, confirm that the ICDAS presents a higher prevalence of the disease[10,11]. This is significant especially in populations with a low prevalence of dental caries, where carious lesions present low progression rates and are mainly in the early stages[12]. In addition, the ICDAS presents good reliability and validity in both deciduous and permanent dentitions[9,13-15].

The CPI is criticized because its methodology does not examine all teeth, but is confined to specific teeth previously standardized for the examination[2]. Another index arising out of CPI modifications, and advocated by the American Dental Association (ADA) and the American Academy of Periodontology[16], is Periodontal Screening and Recording (PSR), which provides more detailed diagnosis because all teeth are examined. It is widely used in both the United States and Canada[17], and can be used in the qualified detection of risk groups and can safely be used even with children[18]. However, there is little discussion in the literature on a comparison between these two indices[17].

As diet and habits can change over time, the DMFT index may not reflect this change, as new enamel lesions and changes in the extent or depth of existing lesions are not evaluated[19,20]. The ICDAS provides information on the stage, severity, and progression of a

patient's carious lesions[3,9], and is the ideal index for studies involving other factors such as diet and lifestyle[19-21]. Likewise, the CPI also may not diagnose changes that have occurred, as these may occur in teeth which only indices, such as the PSR examine[17]. This study sets out to compare, within the SAYCARE study, the epidemiological indices, adopted by the WHO, in oral health for dental caries and periodontal disease, the two most prevalent diseases, in both children and adults[1], with other indices used for the same purpose.

METHODS

The SAYCARE study

The SAYCARE (South American Youth/Child Cardiovascular and Environment Health Study) proposes to verify unhealthy behavior and lifestyles, with common risk factors and associated with chronic diseases, such as caries, periodontal disease, obesity, cardiovascular and diabetic diseases from childhood onwards, so that preventive measures can be incorporated into health promotion policies. The SAYCARE multicentric study will be carried out in Brazil, in two cities (São Paulo and Teresina), and in five other South America countries (Argentina, Chile, Colombia, Peru and Uruguay). In this first stage in which doctors, dentists, physical educators and nutritionists participated, the pilot project was developed with a view to studying the validity and reliability of the anthropometry tools, oral health, sedentarism and physical activity, blood tests, and the diet questionnaire.

For this research, only oral health data from the pilot project related to data collection in Teresina were used. The institutes involved were the University of São Paulo (Department of Preventive Medicine of FMUSP), the State University of Campinas (Department of Social Dentistry of FOB) and the Federal University of Piauí (Department of Health Sciences), working in partnership with the University of Zaragoza (Spain), internationally known for its experience in multicentric studies in Europe, such as the IDEFICS (Identification and prevention of dietary and lifestyle-induced health effects in children and infants)[22].

Ethical considerations

This research was approved by the Research Ethics Committee of the Faculty of Medicine at the University of São Paulo (FMUSP), on September 17, 2014, registered as research protocol 232/14, entitled: Design and Implementation of the SAYCARE Study:

"South American Youth/Child Cardiovascular and Environmental Study", following the guidelines of the National Health Council's resolution 466/12. The study was conducted in schools where the Management Board received a formal request which detailed the importance, objectives and methodology of the study, in order to obtain their consent and collaboration for the project. The ethical considerations, objectives, importance, benefits and risks of the study were explained to the volunteers and/or people responsible who agreed to participate in the study, and who signed a Free and Informed Consent Term (FICT).

Population and Study design

In this cross-sectional observational epidemiological study, preschoolers (5 to-6-year-olds), schoolchildren (7 to 12-year-olds) and adolescents (13 to 17-year-olds), regularly enrolled in public and private schools in Teresina, State capital of Piauí, in the Northeast region, were evaluated. The sample size was calculated on the basis of experience in multicentric projects involving children and adolescents with a previous feasibility pilot study[23,24]. This calculation took into consideration the validation of the blood pressure monitor, used as a reference. The sample calculation was carried out to verify reliability and agreement between the mercury column measurement and automatic monitor methods, in the population under study. For this calculation the parameters used were: two-tailed α of 0.05 (type I error), a β or power of 0.10 (type II error), correlation coefficient, Cronbach's alpha (α) of 0.88 and a concordance ratio of 95%[24].

On the basis of these parameters, it was estimated that a sample of 102 individuals in each age group (preschoolers, schoolchildren, and adolescents) from each participating city, including that of this study, Teresina, would be necessary for validation and agreement between the two methods. Predicting a 15% loss and rejection, 60 public school and 60 private school students were invited, which resulted in 120 students per age group for each city invited to participate, totaling 360 subjects per capital. In each city a public and private school for each age group was selected for convenience reasons. Children and adolescents, 50% male and 50% female, in each place were randomly selected from the list of students enrolled. Students who were pregnant or unable to respond to the questionnaire were excluded, as were those whose parents, guardians and/or the individual themselves did not consent. As inclusion criterion, all those selected who presented the FICT signed by their parents/guardians and who were not included in the exclusion criteria, were admitted.

The oral health of Teresina children and adolescents was evaluated by means of a clinical examination and data referring to caries and periodontal disease were recorded, in a standardized SAYCARE form. Oral exams were carried out by dentists who had done the calibration process, using standardized methods. Individual protective equipment was used to prevent cross infection. The results of 2 indices used for caries evaluation, the ICDAS and DMFT, and 2 for evaluation of their periodontal condition, the PSR and CPI, were then compared. Teresina was the only city in the SAYCARE study where the CPI was applied.

Training and calibration of examiners

The training and standardization session took place in Teresina, in March 2015, where 2 examiners, dentistry graduates, participated. They were trained in accordance with the recommendations of the World Health Organization (WHO)[2] and trained and calibrated to use the ICDAS[3], PSR[16] and the Community Periodontal Index (CPI)[2].

The examiners were standardized in accordance with a standard examiner or "Gold Standard", who was highly experienced in examinations with the indices used. In the inter-examiner calibration, the examiners evaluated the same group of subjects and the results were compared to each other. The whole calibration process was planned for a 20-hour workload for each work team. For the theoretical discussion of all indices, codes and criteria, 8 hours were allocated for presentation and discussion with the examiners. In this stage, the e-learning program provided free of charge by the ICDAS Foundation for prior training (www.icdas.org)25 was used. During the practical discussion (12 hours), each participant examined students who were also examined by the Standard Examiner. The form and the data collection method were applied to a number of non-sampled patients, corresponding to 10% of the total sample. Working along with the "Gold Standard", discrepancies in the clinical findings, diagnostic criteria, codes and registry errors were identified until an acceptable level of agreement of at least 90% for ICDAS and 80% for PSR and CPI was reached, with the "Gold Standard" and between the other examiners. To calculate these agreements, the Kappa coefficient was used. Kappa values between the examiners ranged from 0.72 to 0.991, with agreement of 96.7% to 98.1% for the ICDAS index, while for the PSR index, the values ranged from 0.68 to 0.96, with agreement of 94.4% to 98.4%.

After this step, the examiners met for another training phase, in which the same indices, codes and criteria used were tested in an intra-examiner calibration, where there was over 75% agreement per examiner for each index. Intra-examiner Kappa values ranged from 0.92 to

0.969, with agreement of 98.4% to 99.5%, for the ICDAS index while for the PSR index, it varied from 0.53 to 0.976, with agreement of 75.4% to 98.4%. The examiners were then considered eligible for participation in the pilot study.

Assessment of caries disease

The ICDAS criteria, which allow for the detection of the disease in its initial stages were used[3]. The examination was carried out after teeth had been brushed. Then relative insulation was used and the teeth were dried for approximately 5 seconds with an air jet from a mini compressor (200VA, 60Hz) with the aid of artificial lighting (headlamp, 120 lumens). For all of these exams, a dental diagnostic plane mouth mirror Nº5 and a spherical calibrated periodontal WHO-probe were used, with both examiner and child seated. The clinical stages of the carious lesions were established according to the histological classification proposed by Ekstrand et al.[26], ranging from the identification of a white spot located in fossulae, which would require drying in order to be visualized (code 1), to the visible cavity in dentin (code 6).

The ICDAS criteria were: 0) sound, without caries; 1) first visual change in enamel, visible as a white spot after drying; 2) white spot visible without drying 3) localized enamel cavitation, without clinical signs of dentinal involvement); 4) dark shadow underlying dentin; 5) cavity visible in dentin, with less than one third of the surface involved; and, 6) extensive cavity visible in dentin, with more than one third of the dentin involved. Lesion activity was not evaluated. In the schoolchildren age group, who have mixed dentition, 1 was attributed for lesions in mixed dentition and 2 for those in permanent dentition.

Subsequently, on the basis of these criteria, the results were converted to the DMFT index, considering the ICDAS code 4 as a cutoff point, from which it is considered that there is a lesion in dentin[3,25], a condition required by the DMFT criteria, according to WHO, if a carious lesion is to be registered in the exam[2]. Thus, ICDAS codes 4, 5 and 6 were considered for the DMFT index. Codes 1 and 2, for a white spot, and code 3, for a lesion in the enamel were considered as diagnostic criteria for the ICDAS only. This conversion methodology was successfully used in studies by Elsalhy et al.[20] and Almerich-Silla et al.[27]. The results of these two indices were then compared to each other.

Assessment of periodontal disease

The Community Periodontal Index (CPI)[2] and Periodontal Screening and Recording (PSR)[16] were used to evaluate the periodontal conditions. The examination conditions followed the recommendations advocated by the WHO for epidemiological surveys[2]. The periodontal examination was undertaken before the teeth were cleaned, that is, before the evaluation of caries, so that the results would not be affected. A spherical periodontal WHO-probe was used as demanded by both index criteria. The PSR index was first applied followed by the CPI, as the WHO index considers only the following index teeth up to 19 years: numbers 16, 11, 26, 36, 31 and 46. The PSR considers all teeth for the exam.

The mouth was divided into six sextants comprising teeth 17-14, 13-23, 24-27, 37-34, 33-43 and 44-47 and measurements were made by examining the gingival groove of the teeth with the probe in a parallel position to the long axis of each tooth. All teeth, except third molars, were examined in six sites, 3 per vestibular and 3 per lingual, and only the most severe code of the sextant was recorded in an individual file, according to the codes: 0 - Sound sextant, 1 – Gingival bleeding, 2 - Dental calculus, 3 - Shallow periodontal pocket, between 3.5 and 5.5mm, and 4 - Deep periodontal pocket, above 5.5mm. In the PSR, these codes can also be accompanied by an asterisk (*), as the insertion of this code (*) in the sextant means there are problems such as furcation involvement, mobility, gingival attachment loss and more than 3.5mm gingival recession. However, in children under 15 years of age, pockets (codes 3 and 4) were not recorded, as soft tissue changes could be associated with eruption and not with pathological periodontal changes. Similarly, the asterisk (*) code was not used because the conditions it represents are not common in that age range. The results obtained from each index were then compared.

Statistical analysis

Descriptive statistics were used to characterize the oral health situation of children and adolescents and to compare the results in percentages, in accordance with the indices used for the diagnosis of caries (ICDAS and DMFT) and periodontal disease (PSR and CPI). Pearson's Chi-square test was applied for comparison of caries prevalence according to the ICDAS and DMFT codes. The data were analyzed using IBM SPSS Statistics version 20. The level of significance was set to 0.05.

RESULTS

The final sample consisted of 312 students, of whom 101 were preschoolers, 100 were schoolchildren and 111 adolescents. In the public schools, there were 55 preschoolers, 57 schoolchildren and 58 adolescents, and in the private schools, there were 46, 43 and 53, respectively. There was a greater than predicted sample loss in private schools, except among adolescents, as many of the children initially qualified for the study refused to undergo the dental exams and were therefore excluded from the sample. The prevalence of caries according to the initial stages of the disease and dentin lesions among students is shown in Table 1.

Table 1 - Total dental surfaces with caries lesions, according to the ICDAS index codes, by type of school and age group. Teresina, Piauí, Brazil, 2016.

Type of school	Age group	Carious lesions by ICDAS codes						Total carious lesions
		1	*2*	*3*	*4*	*5*	*6*	1+2+3+4+5+6
Public schools	Preschoolers	17	37	31	6	103	54	248
	Schoolchildren (1)	1	28	30	7	71	83	220
	Schoolchildren (2)	9	49	25	0	16	26	125
	Adolescents	22	60	38	8	29	46	203
Private schools	Preschoolers	15	44	20	5	30	8	122
	Schoolchildren (1)	7	22	14	3	32	12	90
	Schoolchildren (2)	4	17	12	3	2	1	39
	Adolescents	13	27	21	7	23	22	113

Note: As schoolchildren have mixed dentition, 1 refers to deciduous dentition and 2 to permanent dentition.

The percentages of surfaces with carious lesions in students are distributed by school type in Graphs 1 and 2. The ICDAS index presented better diagnostic results than the DMFT (Graphs 3 and 4).
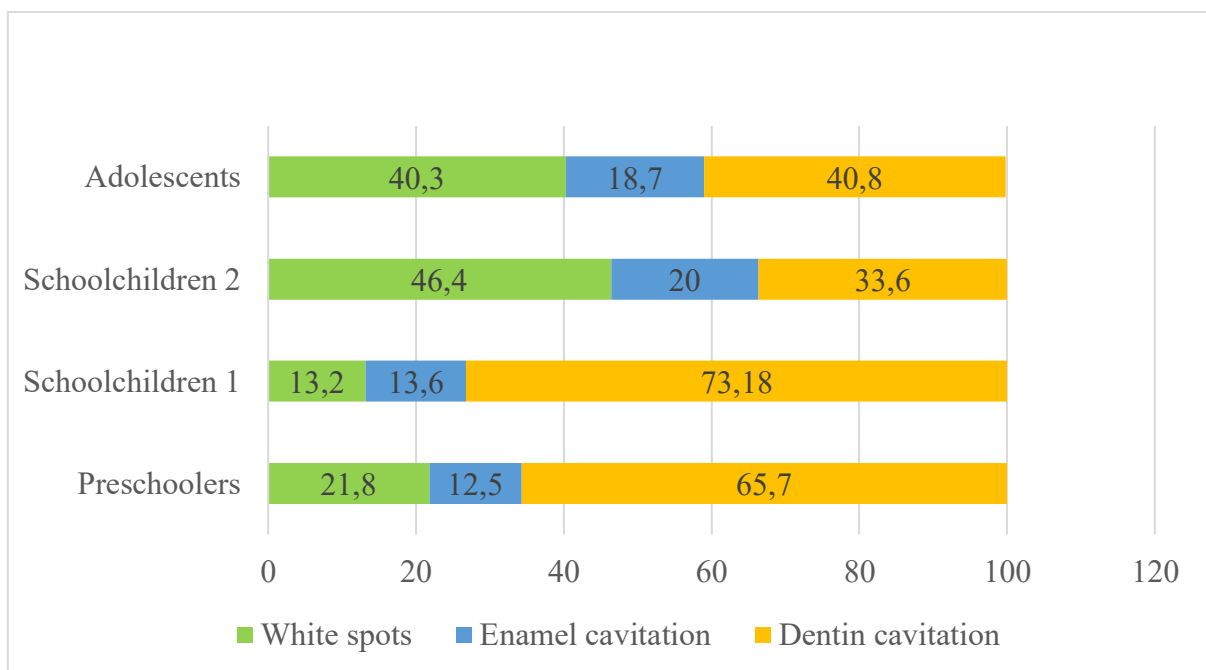
Graph 1 - Distribution of percentages of surfaces with carious lesions among public school students. Teresina, Piauí, Brazil, 2016.
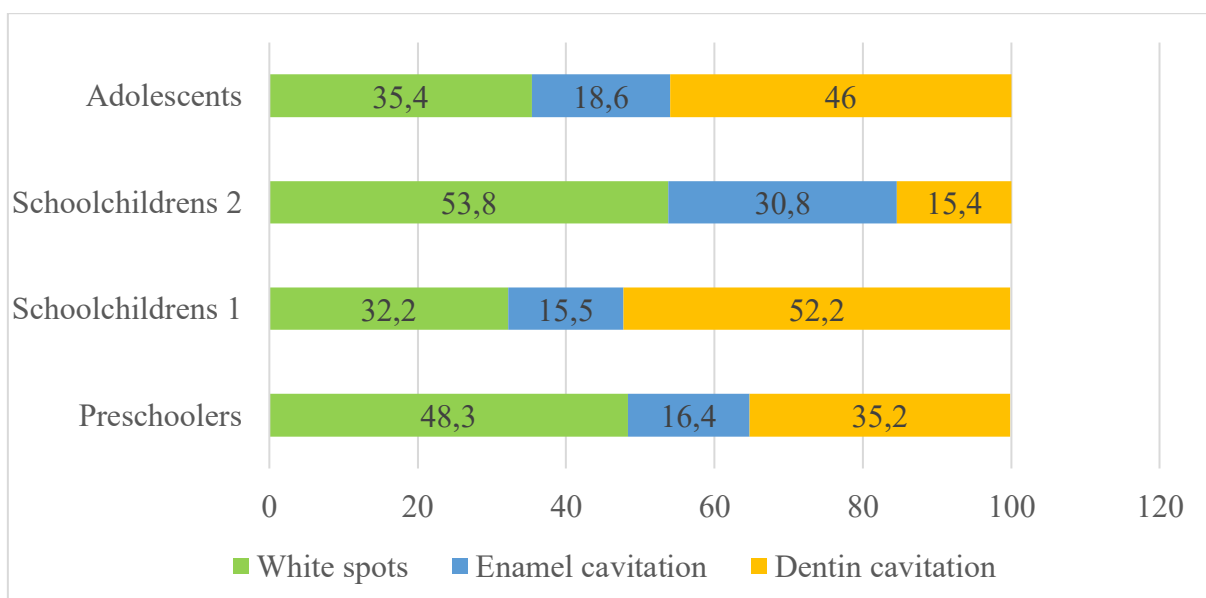
Graph 2 - Distribution of percentages of surfaces with carious lesions among private school students. Teresina, Piauí, Brazil, 2016.

Among public school preschoolers, schoolchildren and adolescents in Teresina, 55.2% (N = 30), 50.8% (N = 29) and 46.0% (N = 27) of students, respectively, were free of caries according to the DMFT index, when DMFT by dental surface criteria were used. When evaluated by the ICDAS, these percentages were reduced to 48.3% (N = 26), 39.0% (N = 22) and 28.3% (N = 16), respectively.

In private schools, 69.8% (N = 32) of preschoolers, 67.2% (N = 29) of schoolchildren and 51.8% (N = 27) of adolescents were free of caries according to the DMFT index. According to the ICDAS, 54.7% (N = 25), 51.2% (N = 22) and 39.3% (N = 21), respectively, had no carious lesions. Thus, in the public and private schools, in all age groups, the ICDAS index had a higher prevalence of caries (p <0.001) when compared to DMFT.
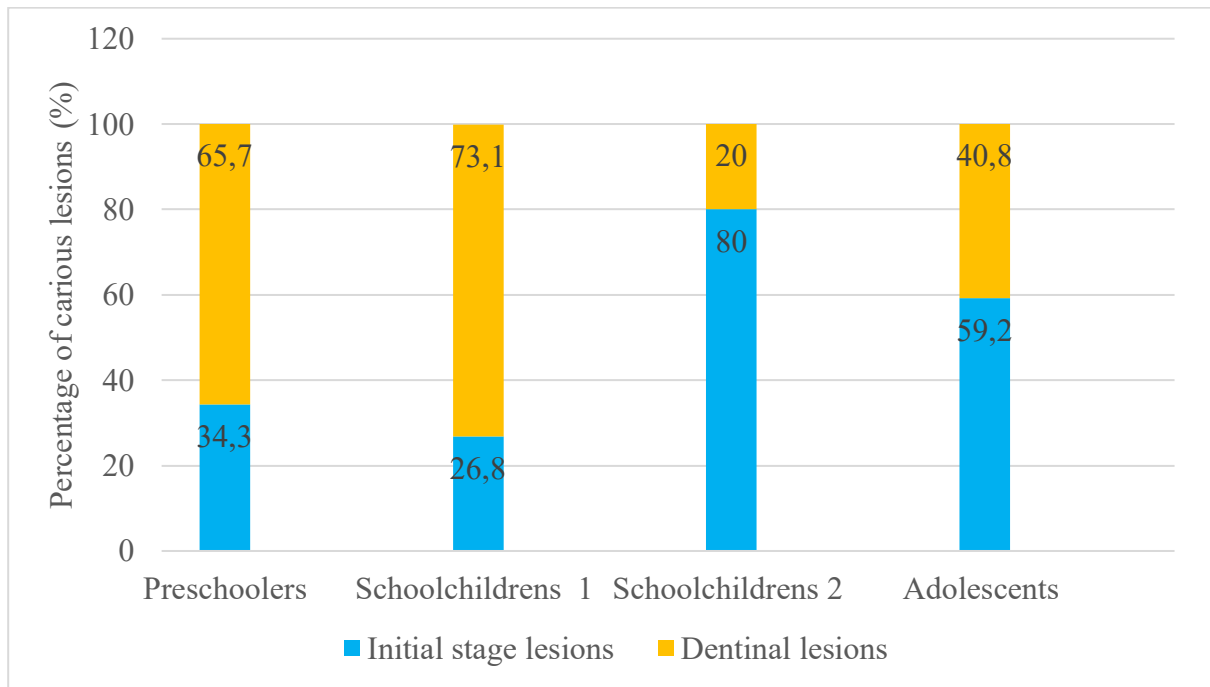
Graph 3 - Comparison of diagnostic results of ICDAS and DMFT indices by public school student.
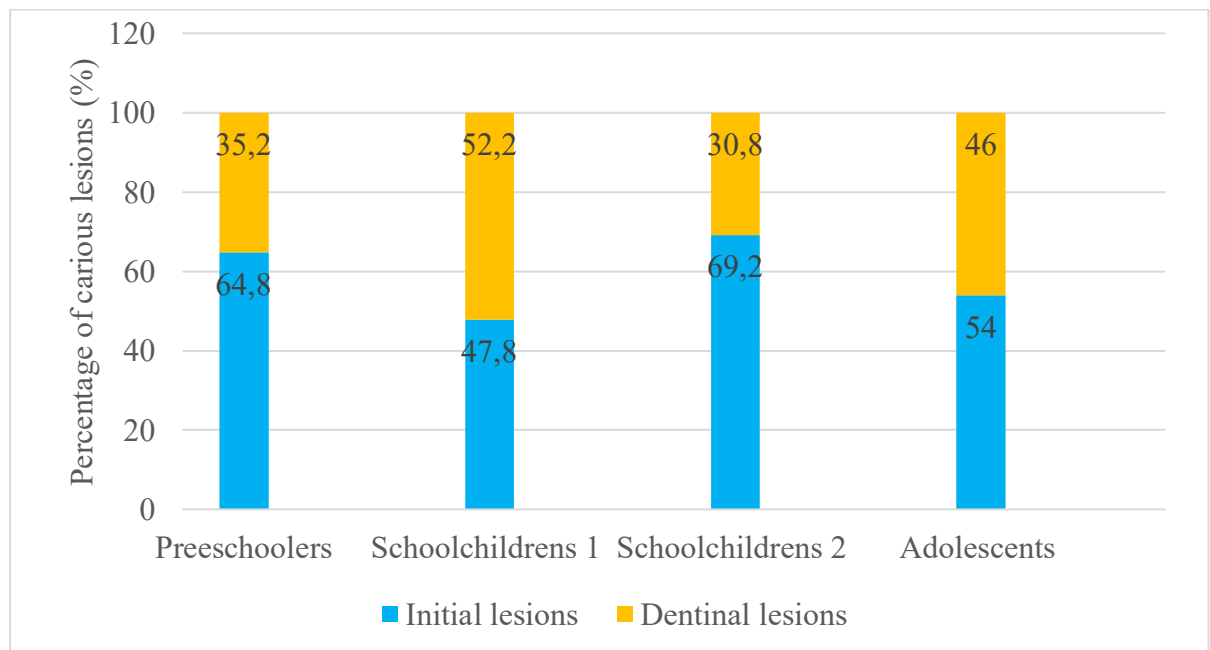
Graph 4 - Comparison of diagnostic results of ICDAS and DMFT indices by private school student.

Analysis of periodontal condition data in the public schools shows that, according to the CPI index, 29.3% (17) of the preschoolers, 49.2% (29) of the schoolchildren and 41.7% (25) of adolescents presented bleeding. In the private schools, the prevalence of bleeding was also the most common condition, with 15.1% (8) in preschoolers, 39.7% (23) in schoolchildren and 41.1% (23) in adolescents. When the PSR was applied, the prevalence of bleeding increased among the private school schoolchildren and adolescents, rising to 44.8% (26) and 46.4% (26), respectively (Table 2).

The prevalence of periodontal disease, represented mainly by gingival bleeding and calculus in the age groups studied, presented very similar results with the two indices, according to Tables 2 and 3, despite the fact that the PSR showed a higher prevalence in certain sextants. As for the periodontal pockets of 3 to 5 mm, there was only one divergence among public school adolescents. According to the CPI, sextant 4 had one single pocket, while there were two pockets when the PSR was applied.

Table 2 – Prevalence of gingival bleeding by sextant, according to CPI and PSR indices. Teresina, Piauí, Brazil, 2016.

School and Age group	Sextants											
	1		2		3		4		5		6	
	CPI	PSR	CPI	PSR	CPI	PSR	CPI	PSR	CPI	PSR	CPI	PSR
Public Schools												
Preschoolers	29.3% (17)	29.3% (17)	13.8% (8)	13.8% (8)	29.3% (17)	29.3% (17)	29.3% (17)	29.3% (17)	8.6% (5)	8.6% (5)	24.1% (14)	25.9% (15)
Schoolchildren	52.5% (31)	55.9% (33)	25.4% (15)	27.1% (16)	55.9% (33)	55.9% (33)	49.2% (29)	49.2% (29)	23.7% (14)	25.4% (15)	40.7% (24)	47.5% (28)
Adolescents	40.0% (24)	40.0% (24)	31.7% (19)	33.3% (20)	33.3% (20)	41.7% (25)	41.7% (25)	41.7% (25)	20.0% (12)	26.7% (16)	38.3% (23)	40.0% (24)
Private Schools												
Preschoolers	13.2% (7)	13.2% (7)	11.3% (6)	11.3% (6)	15.1% (8)	17.0% (9)	15.1% (8)	15.1% (8)	7.5% (4)	9.4% (5)	17.0% (9)	18.9% (10)
Schoolchildren	48.3% (28)	48.3% (28)	22.4% (13)	22.4% (13)	36.2% (21)	37.9% (22)	39.7% (23)	44.8% (26)	19% (11)	19% (11)	37.9% (22)	39.7% (23)
Adolescents	39.3% (22)	41.1% (23)	42.9% (24)	42.9% (24)	37.5% (21)	39.3% (22)	41.1% (23)	46.4% (26)	33.9% (19)	33.9% (19)	41.1% (23)	46.4% (26)

Table 3 - Prevalence of gingival calculus by sextant, according to CPI and PSR indices. Teresina, Piauí, Brazil, 2016.

School and Age groups	Sextants											
	1		2		3		4		5		6	
	CPI	PSR	CPI	PSR	CPI	PSR	CPI	PSR	CPI	PSR	CPI	PSR
Public Schools												
Preschoolers	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.7% (1)	1.7% (1)	0.0%	0.0%
Schoolchildren	0.0%	0.0%	0.0%	0.0%	0.0%	1.7% (1)	0.0%	0.0%	5.1% (3)	5.1% (3)	0.0%	0.0%
Adolescents	8.3% (5)	15% (9)	1.7% (1)	1.7% (1)	11.7% (7)	11.7% (7)	6.7% (4)	8.3% (5)	11.7% (7)	11.7% (7)	3.3% (2)	10.0% (6)
Private Schools												
Preschoolers	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Schoolchildren	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	10.3% (6)	10.3% (6)	0.0%	0.0%
Adolescents	1.8% (1)	1.8% (1)	1.8% (1)	1.8% (1)	0.0%	5.4% (3)	0.0%	0.0%	5.4% (3)	5.4% (3)	0.0%	0.0%

DISCUSSION

In epidemiological surveys, the WHO and World Dental Federation (FDI) have been recommending for decades the DMFT index for caries diagnosis and the CPI index for the evaluation of periodontal disease[2,28]. However, these indices are currently being questioned in terms of their methodology, criteria and sensitivity[3,16]. In this study, we verified that the recent ICDAS index presents higher diagnostic results of caries than those of the DMFT. However, the results provided by the CPI and PSR indices were very similar. This discussion is significant, especially during the decision-making process on the methodologies to be used in multicentric studies such as SAYCARE.

As regards DMFT, one of the main reasons these institutions alleged for its persistent use is greater ease of comparison with the results of other epidemiological studies, as it is renowned among researchers and in the world's scientific literature[2,28]. However, these studies minimize the need for the prevention of caries disease[3,7]. Based on visual criteria, the ICDAS

system was also developed for the standardized collection of data on caries in different situations and allows for a better comparison between studies, as it can be compared with other indices, including the DMFT itself, because their codes can be dismembered[3,9]. In addition, the ICDAS allows for the planning of preventive treatment, interception or monitoring of carious lesions at individual and population levels[29,30].

In terms of difficulties, certain authors cite the fact that, in addition to the material commonly used in traditional epidemiological surveys, a mobile compressor with an air syringe for drying teeth and the visual aid of an artificial head light are needed to use ICDAS, all of which increases the time needed and cost of research[27]. However, the feasibility and validity of this index in epidemiology has been the subject of numerous publications[13-15,31]. Other authors state that when the ICDAS is used the results of data collection are superior in quality, with greater detail of caries epidemiology, and that this should be considered more important than the difficulties described above[32,33].

In the studies which opted for the ICDAS, there is a clear tendency towards an increase in enamel lesions, whether white spots or cavitations, represented by codes 1 to 3, which reflects a higher prevalence of caries at the enamel level than at the dentin level[11,21,34,35], as was also seen in Teresina. There was an increase in caries prevalence in all age groups in this study with the ICDAS index, which also occurred in studies by Joseph et al.[36] (France) and Aidara and Borgeous[10] (Senegal), which reported increases of 28.2% and 43%, respectively, in the prevalence of caries using the ICDAS method, when compared with that of the WHO. Mendes et al.[37] report that most children classified as "caries-free" according to the WHO criteria show carious lesions without cavitation and affirm that the caries develops but does not progress in most children, showing that the idea that the prevalence of dental caries has declined worldwide is not true. The progression of caries disease into cavitated lesions with dentinal involvement seems to have decreased[10,36]. It is probably more appropriate to control the factors associated with caries progression than to simply evaluate and treat carious lesions with cavitation[37].

The DMFT index underestimates lesions which do not require any invasive treatment, and contributes to inequalities within a population and even in the individual, because it decreases the total number of carious lesions and their degree of severity[10,36,37]. The number resulting from this assessment does not provide any information about the stage or penetration depth of the lesion, types of restoration or their conditions[5,8]. In other words, the DMFT only provides a number which shows those teeth or surfaces that have carious lesions, teeth which were lost or restored[2]. On first contact, the ICDAS system codes are numerous and challenging, but with training the system becomes logical, efficient and easy to use[39,40]. What the system

lacks is just one general evaluation measure on the patient's state of carious disease for all teeth and surfaces, as already exists in the DMFT[39,40].

Interestingly, the data from this study show that there is a pressing need to emphasize oral health care, such as the use of toothbrushes, toothpaste and floss, mouthwashes, and greater access to fluoride and regular dental visits, as also noted by Banava et al.[11] and Guido et al.[19]. The first visit to a dentist and the first preventive intervention should be carefully planned and worked on more thoroughly, especially among preschoolers and schoolchildren, as these still depend on parents or guardians to determine their health behavior[38].

Initial lesions are more severe in under 5-year-olds, because these depend on their parents for feeding and doing their oral hygiene[41]. Because diet and habits can change over time, the DMFT index may not reflect this change in the oral environment in the short term, as new enamel lesions and changes in the lesion depth, likely with a sugar-rich diet, with items, such as soft drinks and other sugary beverages, are excluded[20,42]. That would only be possible with the ICDAS, for reasons already mentioned. Ferraz et al.[21] show that the inclusion of non-cavitated lesions according to the ICDAS II criteria in the diagnosis of dental caries in the sample under study indicated a higher prevalence of caries among obese children, when compared to children of normal weight, and that this did not happen when the DMFT index was used.

On the other hand, the comparison of the results of the CPI and PSR periodontal indices presented an almost unknown reality, as few publications addressing this issue were found in the literature and none using the same methodology. In summary, the diagnoses provided were very similar, which would indicate that the CPI is more suitable for epidemiological surveys according to this descriptive study. This is justified because, as the CPI evaluates only index teeth, the periodontal examination is less time-consuming and less costly and maintains the validity of the data obtained, as argued by Vettore et al.[43]. An examination of 6 points in all teeth, advocated by the PSR, involving up to 168 probing sites per mouth, excluding third molars, results in 168 measures for each person, and requires a major effort for epidemiological surveys of multicentric studies, which seems unnecessary according to the results found. However, other studies using the CPI have reported situations where the patients' periodontal health did not reflect the hierarchical distribution of the codes, and resulted in erroneous evaluation of the severity of the disease[44,45].

Overweight and obesity could be related to periodontitis, which is the more advanced stage of periodontal disease, as obesity could produce certain effects on systemic health and affect the host's susceptibility to periodontitis due to inflammatory mediators[46]. This

connection could have relevant public implications for health, as both diseases are significant risk factors for cardiovascular diseases[47,48].

Multicentric studies require more precise and more sensitive epidemiological diagnoses, if associations with other diseases, such as obesity and cardiovascular diseases, for example, are to be investigated more thoroughly, and result in more effective public policies on the control of common etiological factors. The inclusion of non-cavitated or cavitated enamel lesions in the caries detection system improves the sensitivity of studies, especially in populations with a low prevalence of dental caries, as such lesions present low rates of progression and are mainly found at the early stages[36,37]. The identification of these lesions during their initial stage is a crucial challenge in the diagnostic process, which allows for the control of re-mineralization before going on to form a cavity[49].

CONCLUSION

Analysis of the comparison of results of the DMFT and ICDAS indices indicates that the latter is more appropriate for describing the prevalence of caries in large epidemiological surveys, such as multicentric studies, especially in the context of prevention and investigation of association with other chronic diseases. However, evaluation of periodontal conditions seems to be more appropriate with the CPI than with the PSR index, whose examination has been shown to be more time-consuming and disadvantageous considering that the diagnostic results of both indices are similar.

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3 DISCUSSÃO

Nesta tese, os 2 estudos desenvolvidos reforçaram a importância da discussão da avaliação da saúde bucal em estudos multicêntricos, seja pela determinação de prevalências das doenças cárie e periodontal na população estudada ou na busca de associações destas com outras doenças sistêmicas, ou seja pelo debate de índices a serem utilizados na pesquisa. Estes resultados contribuem para uma coleta de dados com mais qualidade e com melhores cuidados de prevenção ou tratamento em saúde bucal a serem implementados conjuntamente com outras medidas de promoção de saúde geral.

No Brasil, existem experiências bem-sucedidas de participação da Odontologia em estudos de coorte, em população idosa (São Paulo - SP) (Lebrão et al., 2015) e em adolescentes acompanhados desde o nascimento (Pelotas - RS) (Peres et al., 2016), que também mostraram que a coleta de dados sobre as condições bucais é viável em estudos de coorte multidisciplinares desde que haja financiamento adequado e justificado a partir do entendimento da saúde bucal como parte integrante da saúde geral. Assim, embora a logística no que diz respeito à organização e coleta dos dados durante as fases de seguimento demandem mais recursos humanos, trabalho e financiamento, essa experiência tem mostrado que o esforço é válido frente ao conhecimento acumulado ao longo dos anos do estudo com relação aos indicadores e preditores de saúde bucal e geral, tão importantes e necessários para o planejamento dos serviços de saúde (Lebrão et al., 2015; Peres et al., 2016).

No artigo 1, não houve associação de cárie com fatores socioeconômicos, percepção dos pais sobre o peso dos filhos, frequência de açúcar e peso corporal. Apesar disso, outros estudos mostraram o contrário, indicando que esta temática permanece controversa. Muitos estudos descrevem associações de cárie com menor renda e escolaridade (Antunes et al., 2004; Piovesan et al., 2009), com medidas antropométricas (Alm et al., 2011; Costa et al., 2013) e consumo do açúcar (Costacurta et al., 2014; Ccahuana-Vásquez et al., 2007). Na literatura, há um consenso de que os açúcares estão implicados em várias doenças não-transmissíveis, incluindo cárie dentária e obesidade (Costacurta et al., 2014; Ccahuana-Vásquez et al., 2007; Joury et al., 2016; Sheiham e James, 2014; Sheiham e James, 2015). Isso, por si só, já serve de base para o desenvolvimento de políticas de redução do consumo de açúcar. Entre as medidas mais transformadoras e com resultados positivos, estão aquelas em nível macroeconômico e macropolítico, como a cobrança de impostos sobre o açúcar e seus derivados e limitações na publicidade destes (Schwendicke et al., 2016; Bollard et al., 2016).

A prevalência de cárie não tratada e de mancha branca foi maior em Huesca, apesar da intervenção, o que está de acordo com De Bourdeaudhuij et al. (2015), que relataram baixa aderência às mensagens da intervenção em todos os países participantes. Apesar da diminuição em larga escala observada em alguns países, a doença cárie continua a ser um grande problema de saúde pública. Cárie não tratada em dentição permanente afeta 36% da população mundial (Marcenes et al., 2013). O desenho de estudo mais confiável para demonstrar a associação entre o consumo de açúcar e o desenvolvimento de cárie são os estudos de coorte prospectivos, conforme sugere Costa et al. (2013). Uma limitação do primeiro artigo foi a não coleta de dados de cárie no baseline, o que deve ser evitado em próximas pesquisas. Isso ocorreu porque a equipe de dentistas examinadores só teve a oportunidade de participar do projeto após a intervenção.

Padrões de mudança de consumo de açúcar ocorrem ao longo do curso de vida. Há uma mudança no comportamento desde a infância até a adolescência, com jovens sendo mais independentes na seleção de seus alimentos e bebidas. Isso poderia aumentar o risco de desenvolvimento de cárie (Guido et al., 2011; Elsalhy et al., 2013). Diante disso, surgiram questionamentos sobre os índices de saúde bucal utilizados nos estudos multicêntricos IDEFICS e IFAMILY, os índices ICDAS e CPI. Com o intuito de verificar se estes realmente seriam os mais adequados para o delineamento de um próximo estudo multicêntrico na América do Sul, o SAYCARE, e seriam capazes de refletir as doenças e, por conseguinte, a dieta, estes índices foram comparados com o CPOD, preconizado pela OMS (WHO, 1997), e com o PSR, recomendado pela Academia Americana de Periodontologia (ADA e AAP, 1992), respectivamente. Este estudo comparativo encontra-se no segundo artigo.

Para a doença cárie, os resultados diagnósticos foram melhores com o índice ICDAS (Pitts, 2004), porque considera lesões de mancha branca e cavitação ao nível do esmalte. O ICDAS permite o rastreamento de lesões que acompanham mudanças na dieta, que surgem com mais facilidade e em menor tempo como estágios iniciais da cárie, o que não seria possível com o CPOD, que considera como cárie somente lesões ao nível da dentina, as quais demoram mais a se desenvolverem (Elsalhy et al., 2013). Além disso, nas faixas etárias estudadas, independente do tipo de escola, a prevalência de lesões que passariam despercebidas pelo CPOD foi alta. Isso é mais preocupante entre pré-escolares e escolares, que dependem de seus responsáveis para a escolha do alimento e hábitos de higiene bucal (Guido et al., 2011).

Avaliação e diagnóstico de condições periodontais que são passíveis de prevenção é uma tarefa complexa e desafiadora. No entanto, é essencial esse cuidado em levantamentos epidemiológicos, dado que as consequências de doença periodontal (perda de inserção, de osso

alveolar e, consequentemente, perda de dente), são em grande parte irreversíveis (Preshaw, 2015). Para a avaliação da condição periodontal, o CPI pareceu mais apropriado, visto que os resultados foram semelhantes quando comparados aos do PSR, e o índice da OMS apresenta maior praticidade em levantamentos de grande porte populacional como os multicêntricos.

4 CONCLUSÃO

A avaliação das condições de saúde bucal nos estudos multicêntricos IDEFICS e IFAMILY não confirmou associações com determinantes socioeconômicos e peso corporal, e a intervenção na prevenção de obesidade sobre a prevalência de cárie dentária de crianças espanholas não mostrou efeitos positivos. A discussão sobre o uso de índices da OMS e outros mais recentes, porém também empregados em levantamentos epidemiológicos, revelou que o ICDAS é o mais adequado para avaliação de cárie, especialmente num contexto de prevenção; e que o CPI realmente é mais indicado para doenças periodontais, em virtude de sua maior praticabilidade. Assim, avaliar a saúde bucal em estudos multicêntricos como os deste estudo, se traduz em maior qualidade de dados encontrados e pode possibilitar políticas públicas mais efetivas, que reduzem as desigualdades em saúde bucal e geral.

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APÊNDICE 1 - FICHA DE EXAME DE SAÚDE BUCAL NO ESTUDO IFAMILY.

ifamily

Salud Oral

Please stick the participant's ID here.

Cod: ☐☐☐☐☐
Num: ☐☐☐

Examen ☐
(1 o 2)

Caries Dental

Superficie — Superior Derecho

	18	17	16	I 16 17	A/I	15	14	13	12	11	21	22	23	24	25	26	I 26 27	A/I	27	28
				I		55	54	53	52	51	61	62	63	64	65		I			

Superior Izquierdo

M / O / D / B / L

PUFA ⊕

Superior Derecho — Inferior

	48	47	A/I	I 46 47	46	45	44	43	42	41	31	32	33	34	35	A/I	I 36 37	36	37	38
				I		85	84	83	82	81	71	72	73	74	75	I	I			

Inferior Izquierdo

M / O / D / B / L

PUFA ⊕

Condición Periodontal

PLACA BACTERIANA VISIVEL ( ) SI ( ) NO
Quantidade ____

0 = sem placa
1 = local cervical
2= local posteriores ou anteriores
3= local posteriores e anteriores

0 = Normal
1 = Sangramento
2= Cálculo
3= Sangramento + cálculo

CPI

OBSERVACIONES

HMI

PRESENCIA: ( ) SI ( ) NO
DIENTE AFECTADO: ( ) MUELLA ____
( ) INCISOR ____

PUFA

P = visible pulpal involvement
U = ulceration caused by dislocated tooth fragments
F = fístula
A= abscess

ICDAS II

0 = sem selante ou restauração
1 = selante parcial
2= selante completo
3= restauração de cor branca
4= restauração de amálgama
5= coroa de metal
6= coroa ou venner de porcelana ou ouro
7= restauração quebrada ou perdida
8= restauração temporária

0 = superfície sadia
1 = mudança visual em esmalte (com secagem)
2= mudança visual em esmalte (sem secagem)
3= microcavidade em esmalte sem dentina visível
4= microcavidade em esmalte com manchamento em dentina
5= Cavidade com dentina visível (< 1/3)
6= Extensa cavidade com dentina visível (> 1/3)

APÊNDICE 2 - FICHA DE EXAME DE SAÚDE BUCAL NO ESTUDO SAYCARE

Saycare Study

Saúde Bucal

Cod: ☐☐☐☐☐☐
Num: ☐☐☐

Exame ☐
(1 ou 2)

Cárie Dentária

Superfície — Superior Direito / Superior Esquerdo

				55	54	53	52	51	61	62	63	64	65				
	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
M																	
O						⌐	⌐	⌐	⌐	⌐	Ι						
D																	
V																	
P																	
PUFA ⊙																	

Superfície — Inferior Direito / Inferior Esquerdo

				85	84	83	82	81	71	72	73	74	75				
	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
M																	
O						□	□	□	□	□	□						
D																	
V																	
L																	
PUFA ⊙																	

Condição Periodontal

1°	2°	3°
6°	5°	4°

PSR
0 = Sadio
1 = Sangramento
2 = Cálculo
3 = Sangramento + cálculo

PLACA BACTERIANA VISÍVEL:
( ) Sim ( ) Não
Quantidade: _____

0 = sem placa
1 = local cervical
2 = local posteriores ou anteriores
3 = local posteriores e anteriores

Perguntas:
1. Quantas vezes ao dia você escova os dentes?
   1 ( ) Nenhuma
   2 ( ) 1 vez
   3 ( ) 2 vezes
2. Quantas vezes ao dia você usa o fio dental?
   1 ( ) Nenhuma
   2 ( ) 1 vez
   3 ( ) 2 vezes

PUFA

P = envolvimento pulpar visível
U = ulceração causada por fragmento dentário
F = fístula
A = abcesso

ICDAS II

Códigos para restauração e selante
0 = Sem selante ou restauração
1 = Selante pacial
2 = Selante total
3 = Restauração com resina, IV
4 = Restauração de amálgama
5 = Coroa em aço inoxidável
6 = Porcelana, ouro, venner
7 = Restauração ausente ou fraturada
8 = Restauração temporária

Código para cárie dentária
0 = Superfície sadia
1 = Alteração inicial em esmalte após secagem
2 = Alteração inicial em esmalte sem secagem
3 = Descontinuidade em esmalte, sem dentina visível
4 = Manchamento em dentina (sem cavidade)
5 = Cavidade com dentina visível (1/3 superfície)
6 = Cavidade extensa com dentina visível

ANEXO 1 – APROVAÇÃO DO COMITÊ DE ÉTICA (ESTUDO IFAMILY)

GOBIERNO DE ARAGON
Departamento de Sanidad,
Bienestar Social y Familia

Informe Dictamen Favorable
Proyecto Investigación Biomédica
C.P. - C.I. PI13/0012
13 de febrero de 2013

Dña. María González Hinjos, Secretaria del CEIC Aragón (CEICA)

CERTIFICA

1º. Que el CEIC Aragón (CEICA) en su reunión del día 13/02/2013, Acta Nº 03/2013 ha evaluado la propuesta del investigador referida al estudio:

Título: I. Family- Determinants of eating behaviour in European children, adolescents and their parents.

Investigador Principal:Luis Alberto Moreno Aznar. Universidad de Zaragoza
Versión Protocolo: enero 2013
Versión Hoja de Información al paciente y consentimiento informado: 31/01/2013

2º. Considera que

- El proyecto se plantea siguiendo los requisitos de la Ley 14/2007, de 3 de julio, de Investigación Biomédica y su realización es pertinente.
- Se cumplen los requisitos necesarios de idoneidad del protocolo en relación con los objetivos del estudio y están justificados los riesgos y molestias previsibles para el sujeto.
- Son adecuados tanto el procedimiento para obtener el consentimiento informado como la compensación prevista para los sujetos por daños que pudieran derivarse de su participación en el estudio.
- El alcance de las compensaciones económicas previstas no interfiere con el respeto a los postulados éticos.
- La capacidad de los Investigadores y los medios disponibles son apropiados para llevar a cabo el estudio.

3º. Por lo que este CEIC emite un **DICTAMEN FAVORABLE.**

Lo que firmo en Zaragoza, a 13 de febrero de 2013

Fdo:

Dña. María González Hinjos
Secretaria del CEIC Aragón (CEICA)

ANEXO 2 - APROVAÇÃO DO COMITÊ DE ÉTICA (SAYCARE)

MEDICINA
USP
COMITÊ DE ÉTICA EM PESQUISA

APROVAÇÃO

O Comitê de Ética em Pesquisa da Faculdade de Medicina da Universidade de São Paulo, em sessão de 17/09/2014, APROVOU o Protocolo de Pesquisa nº 232/14 intitulado: "DESENHO E IMPLEMENTAÇÃO DO ESTUDO SAYCARE: SOUTH AMERIC YOUTH/CHILD CARDIOVASCULAR AND ENVIRONMENT STUDY" apresentado pelo Departamento de MEDICINA PREVENTIVA

Cabe ao pesquisador elaborar e apresentar ao CEP-FMUSP, os relatórios parciais e final sobre a pesquisa (Resolução do Conselho Nacional de Saúde nº 466/12).

Pesquisador (a) Responsável: Heráclito Barbosa de Carvalho
Pesquisador (a) Executante: Augusto César Ferreira de Moraes

CEP-FMUSP, 17 de Setembro de 2014.

Prof. Dr. Roger Chammas
Coordenador
Comitê de Ética em Pesquisa