

RELATIONSHIP BETWEEN HIGH WEIGHT AND CARIES FREQUENCY IN GERMAN ELEMENTARY SCHOOL CHILDREN

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Abstract

Objektive: Most industrialized countries experienced a change in dietary habits within the last 10 years. Growing obesity may result in an increased incidence of metabolic diseases as well as in a higher caries frequency.

Methods: In an interdisciplinary study, 842 elementary school children (414 girls and 428 boys, age: 6-11 years; elementary grades 1-4) were examined. The dental examination included the determination of caries frequency (DF-T-/df-t-values) and the medical evaluation assessed the pupils' general health (i.e. the height and body weight; body mass index).

Results: The study showed that 33.7% of all school children had no decayed or filled teeth (38% of the girls, 30% of the boys). 73.9% of all pupils were within the normal weight range (74.3% of the boys, 73.4% of the girls), 12.9% of the children were overweight (12.4% of the boys, 13.5% of the girls), and 13.2% were even obese (13.3% of the boys, 13% of the girls). 35.5% of the pupils with normal weight had healthy teeth, whereas the number dropped to 27.5% in children that were overweight, and to 29.7% in the obese children. The caries prevalence (DF-T-, df-t-values) also showed a significant association to weight (Fisher-Test, $p = 0.022$ for df-t-distribution and $p = 0.011$ for DF-T-distributions). Children with normal weight were found to have average df-t-values of 2.09 (DF-T: 0.57), overweight children an average df-t-value of 2.48 (DF-T-value: 0.91), and obese children showed 3.3 (DF-T-value: 0.88).

Conclusions: Since this study showed an association between an increase of dental caries and high weight in elementary school children, the importance of nutrition with respect to high weight should be considered in future preventive programs, in addition to oral hygiene measures.

Key words: Caries prevalence, high weight, elementary school children

INTRODUCTION

To promote and maintain dental health, almost all industrial nations have been conducting national preventive programs for decades, which according to social rules, health insurance laws, and population structure, have brought about a significant decrease in dental decay, particularly in children and adolescents [16, 22]. Besides oral hygiene, the main factors of oral health include fluoridation, patient cooperation, a healthy

diet, which among other factors should not contain too many low molecular carbohydrates and acid-containing nutrients. The current global changes within the last decade towards consumption of soft drinks and fast food have led to serious dietary changes of the population. The changes in diet, together with a lack of activity and less exercise, the increasing popularity of personal computers, influences by the media, and social changes in family structure, contributed to the ever increasing number of overweight people worldwide [6]. In some countries obesity has doubled within the last 20 years. Besides these living conditions, genetic disposition can also influence an increase in body fat in some cases [1]. Since overweight people generally are at a higher risk for diseases or premature death, it can be assumed that medical care, as well as the need for medications is higher when compared with people of normal weight [8]. Several studies proved that the BMI correlated positively with the number of doctors' appointments and medications, but negatively with preventive measures and preventive medical checkups [26]. A survey at the American Center for Disease Control among 195,005 adults established that overweight and obese people are at greater risk for diabetes, high blood pressure, asthma, hypercholesterolemia, arthritis and general poor health [15]. A study of 1,585 Australian pupils, age between 7 to 15, also showed an increasing tendency of high weight (11-21%), obesity (4-7%) already in elementary school children, and also an association between BMI and disposable income [23]. The percentage of overweight children in Germany is approximately 10-20%, and a significant rising trend can be clearly recognized. Numerous studies furnish evidence that the BMI value can be used as a standard for the total body fat mass [4, 17]. The use of BMI in children and adolescents to define obesity and high weight is recommended by the Childhood Group of International Obesity Task Force (IOTF), as well as by the European Childhood Obesity Group (ECOG) [2, 7, 20].

On the one hand, oral health is strongly influenced by the daily intake of food; on the other hand oral health can also play a significant role in nutritional intake and general status of health, particularly in older people. People with early tooth loss clearly showed a deviation from preferred foods, as well as a deficiency of certain vitamins and microelements [3, 10]. Numerous studies of people over 65 also established a significant correlation between oral health and nutritional habits. People with dentures that functioned properly,

and who still had, by definition, more than 20 teeth, were able to better nourish themselves with fruits and vegetables. These people showed a satisfactory nutritional state and an acceptable Body Mass Index [14].

The currently comprehensive dental prophylactic programs performed on children attending kindergarten and elementary school are supposed to recognize already existing problems, to initiate as soon as possible the necessary therapies in order to avoid later risks of disease. This study also was to examine a possible correlation between presence of caries lesions and the nutritional habits taking into account the Body Mass Index in elementary school children.

MATERIAL AND METHOD

A total of 842 elementary school children (school year 2002/2003, classes 1-4; 428 boys and 414 girls, age: 6-11 years) from 4 elementary schools with socially diverse backgrounds from a medium sized German city (representative selection of the city) took part in this examination. This study was a cooperation between the Dental Hospital and the Department of Paediatrics of the Johannes Gutenberg University, Mainz. An examination of the pupils only took place with the written consent of the parents and/or guardian.

The dental examination, which was performed solely by dentists of the Dental Hospital (Operative Dentistry) was non-invasive (Mirror, probe, cotton roll) and included optimal illumination of the oral cavity. Before the examination, the pupils were requested to clean their teeth well, as usual. After oral establishing a dry field with cotton balls and wads, the condition of the teeth was examined and recorded on special forms. Decayed deciduous teeth, and decay on permanent teeth that were in need of treatment, were marked as cavities. If fillings were present, they were marked as sufficient or insufficient treatment. Missing teeth were not marked correspondingly, since no definite statement could be made without a proper anamnesis whether the tooth really existed, or if an early extraction had taken place. Due to organizational and/or missing indication criteria, no X-rays were taken. To detect the caries frequency the DF-T- (df-t) value was used, since it gives a good insight into the state of decay in the patient [9]. The findings always referred to the respective tooth (DF-T-/df-t-value), not to the tooth surface (DF-S-/df-s-value). If both the deciduous and permanent teeth were present, only the permanent teeth were evaluated.

Besides documenting age and sex of the children, qualified physicians of the Department of Paediatrics recorded the height and weight. The height of the children was measured with a portable measuring unit. The weight was established with a portable digital scale, and the weight was always rounded off to the nearest 100-gram value. The body mass index ($BMI = \text{body weight} / \text{body height}^2$ (kg/m^2)) was used to determine high weight or obesity, and the respective percentile was evaluated with corresponding tables. The internationally recognized classification of BMI with low weight ($BMI < 20$), normal weight ($BMI: 20-25$), high weight ($BMI: 25-30$), and obesity ($BMI > 30$) was conducted with special tables from the obesity consortium for children and adolescents [1].

The biometrics analysis of this cross-sectional data was performed with the software SPSS[®] (Version 10.0 for Windows[®]). For continuous parameters such as DF-T- and df-t-index or BMI, mean value, median and quartile were allocated for the total study, as well as for the partial one. Graphic illustrations were also included in the form of non-parametric charts. The description of categorical endpoints was based on absolute and suitably relative frequencies. Significant comparisons were performed in cases of unrelated test series with Wilcoxon Tests for continuous endpoints and with Fisher Tests for categorical endpoints; the results of these tests were combined. A p-value < 0.05 can be seen as an indicator of statistical significance. Associations between categorical characteristics such as classification of the BMI into categories, "normal weight", "high weight", and "obesity", and the presence of a healthy dentition was also evaluated on their statistical significance by means of a Fisher Test. Graphic illustrations were done as bar graphs.

RESULTS

In this study a total of 428 boys and 414 girls (elementary school grade 1 - 4) with an age between 6 and 12 years were examined. Grade 1 had 258 children (125 boys, 133 girls), Grade 2 had 227 children (129 boys, 98 girls), Grade 3 had 182 children (83 boys, 99 girls), and Grade 4 had 175 children (91 boys, 84 girls).

By recording height and weight, the respective body mass index (BMI) could be determined, and the characteristic percentile could be recorded by also taking into account the age and sex. Only 2.1% of the children in the study ($n = 18$) were underweight, 71.7% ($n = 604$) of the children were of normal weight, 12.0% ($n = 109$) of the children were overweight, and obesity was present in 13.3% ($n = 111$) of the children. The pupils with low weight (2%) were pooled with normal weight children in additional calculations that resulted in a total percentage of normal weight children with 73.9%. 12.4% of the boys were overweight and 13.0% obese, which did not result in a significant gender difference in the obese category (Fisher Test: $p = 0.884$).

At the time of the examinations only 37% of the children (boys: 30.6%; girls: 37% ; Fisher Test: $p = 0.167$) were without decayed or filled teeth. By taking into account the BMI value, 36% of the normal weight children had healthy teeth, whereas only 28% of the overweight children and 30% of the obese children showed healthy dentitions (Fig. 1 and 2).

When the frequency of caries lesions (DF-T; df-t) in relation to BMI was recorded in teeth of the first dentition (df-t-values) as well as in the permanent teeth (DF-T-values) statistically local significant differences (Wilcoxon $p = 0.022$ for the df-t-value and $p = 0.011$ for the DF-T-value) could be established. While children with normal weight showed a median DF-T-value of 0.57, overweight children had a median DF-T-value of 0.91, and obese children one of 0.88 (Table 1). The gender difference of the frequency of cavities in relation to BMI resulted in a slightly higher occurrence of cavities in boys (Fig. 3 and 4), particularly with the DF-T-index and if they were overweight.

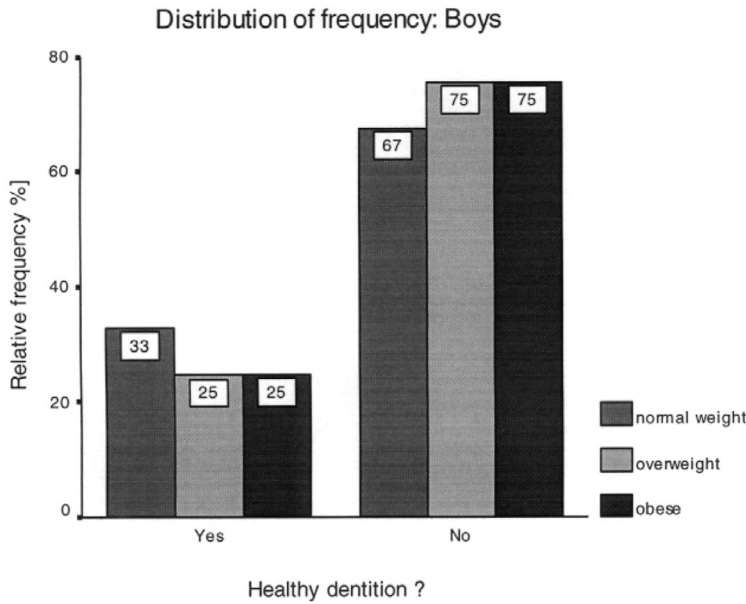


Fig. 1. Prevalence of healthy teeth among elementary school children with normal weight, overweight and obese (n = 428 boys).

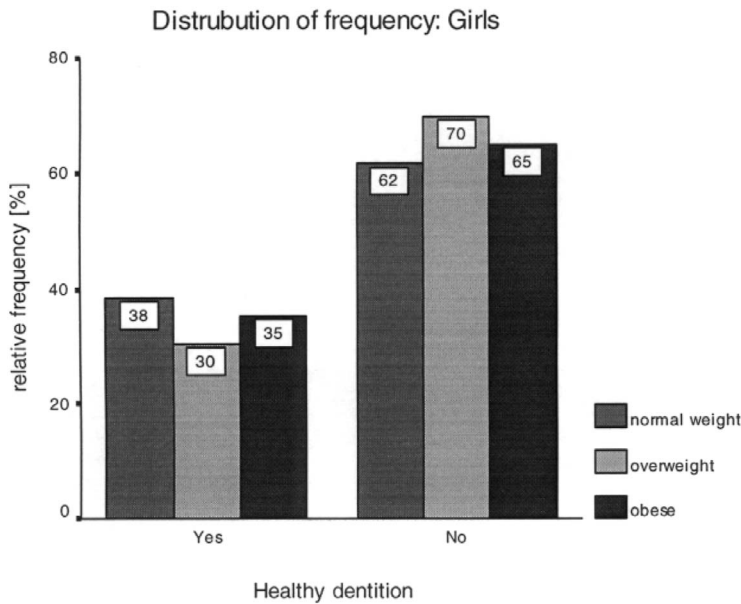


Fig. 2. Prevalence of healthy teeth among elementary school children with normal weight, overweight and obese (n = 414 girls)

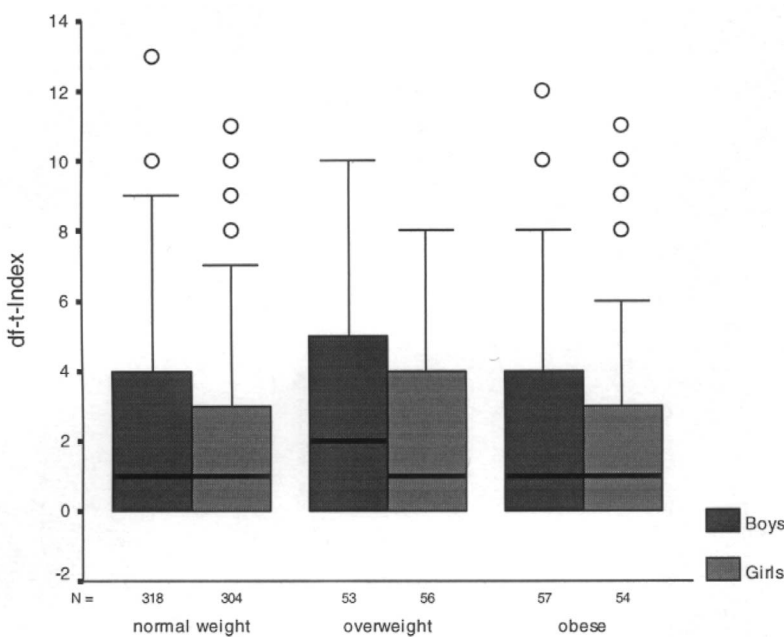


Fig. 3. Graphic charts showing distribution of the df-t-index of boys (n = 428) and girls (n = 414) at elementary age, arranged in tiers according to age (classified into age-related normal weight, overweight and obesity). The horizontals denote median and quartiles, the verticals denote minimum and maximum occurring df-t-values, as well as outliers (circles), and extreme values (asterisks) with more than double or triple quartile distance from the median.

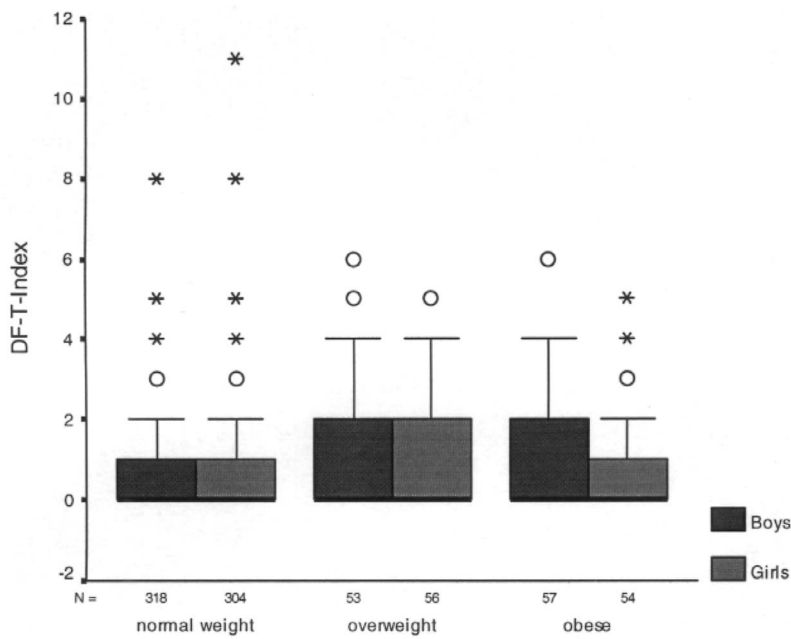


Fig. 4. Graphic charts distributing the DF-T-Index of boys (n = 428) and girls (n = 414) in elementary school age, arranged in tiers according to their weight (classified into age-related normal weight, overweight and obesity). The horizontals denote median and quartile, the verticals minimum and maximum occurring DMF-T-values, as well as outliers (circles) and extreme values (asterisks) with more than double or triple quartile distance from the median.

Table 1. Distribution of caries frequency (df-t-values and DF-T-values) of a total of 842 elementary school children relative to body weight. Classification was done based on BMI into normal weight (n = 622), overweight (n = 109) and obese children (n = 111).

	Average Value	Median (1. – 3. Quartile)	Maximum Value
<i>df-t-Index</i>			
normal weight (n = 622)	2.08	1 (0 – 4)	13
overweight (n = 109)	2.48	2 (0 – 4)	10
obese (n = 111)	2.23	1 (0 – 4)	12
<i>DF-T-Index</i>			
normal weight (n = 622)	0.57	0 (0 – 1)	11
overweight (n = 109)	0.91	0 (0 – 2)	6
obese (n = 111)	0.88	0 (0 – 1)	6

DISCUSSION

To promote healthy teeth in children, most industrial nations have been conducting preventive programs for many decades. As an objective for healthy teeth for 12 year-olds for the year 2000, a standard value of 2.0 DMF was established by the WHO in 1979 [24]. In this study, an average DMF-T value of 1.02 could be detected for the children in grade 4, who were at an average, 10 years old. Most people only realize the importance of oral health when the results of tooth loss and the lack of chewing ability become obvious. Quality of life of a human being essentially depends on the degree of possibilities and positive feelings as how to manage important situations in life [18]. The significant, important determinants of quality of life include oral health and healthy teeth [12, 19], since oral changes and/or disorders can result in physical as well as psychological problems. Within the last decade a large increase in the number of overweight and obese children and adults has been noted [20]. High weight

and obesity are considered risk factors, as well as low socioeconomic status, low income, high weight of parents, life style and genetic disposition [5, 13, 25]. One of the main risks of obesity in childhood is that it will probably continue into adulthood and with it all the associated health risks. This study examined a relation of dental health and high weight in order to consider possible dental problems associated with weight disorders in future preventive programs.

Most industrialized countries currently show a significant per cent increase in overweight and/or obese adults, as well as children in every age group [21], which is blamed on the change in nutritional habits. In Germany e.g., the presence of obesity in children rose dramatically since the reunification of Germany a decade ago [11]. At the beginning of the 1990's, comparative data from the US showed that 11% of the children were obese. In 2001 and 2002, an increase in obesity in the total population by app. 80% was recorded. Examinations of middle school children in Nuremberg noted that 5% of the children are under-

weight, 80% are normal, and 15% were overweight. 42% of the students had a healthy dentition, and at least 48% had at least one tooth filled. Another health report (Kreis Heinsberg) from the year 2000 verified that 10% of the children already exhibited signs of obesity. This current study of elementary school children showed that 12.9% of all children were overweight, and 13.2% were classified as obese. This high number of overweight children at 26% in an average German city reflects the current trend of the rise in obesity in the entire population.

Our study shows that the children with normal weight had significantly less dental caries in their deciduous teeth, as well as in their permanent teeth, than the overweight children did. While children with normal weight were without decayed or filled teeth in 35.5%, this number dropped in overweight children to 27.5%. These results indicate that future preventive measures must include strategies to prevent and reduce high weight and/or obesity in the population, particularly in children and adolescents, besides just promoting dental hygiene. The significant success in the reduction of caries prevalence with preventive programs in schools could represent an exemplary concept for corresponding health efforts in the area of nutritional guidance and an increase in physical activities.

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