Nutritional and Oral Health Conditions in High School Students

Condiciones de salud oral y nutricional en estudiantes de secundaria

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ABSTRACT

To describe the relationship of oral diseases and nutritional status in high school students. A total of 203 high school students were evaluated nutritionally and orally according to the World Health Organization (WHO). A descriptive analysis, frequency, average tables, and a statistical analysis (Spearman correlation test) were performed with SPSS ver. 22 statistical software for Windows. Nutritionally, 146 students showed a normal Body Mass Index (BMI), six had malnutrition, 41 had overweight, and 10 had obesity. In the oral evaluation, the average number of caries was 3.08 ± 2.78, malnutrition showed 3.6, overweight 2.75, and obesity, 2.9. The risk of caries can be increases the greater the age, height, weight, skin-fold thickness, and periodontal disease. There is no significant statistical correlation between oral diseases and nutritional issues; however, qualitative analyses of patients with dental loss or oral diseases express significant deficiencies in their nutritional health.

KEYWORDS

Nutritional status; Caries; Periodontal disease; High school students.

RESUMEN

Describir la relación de enfermedades orales y estado nutricional en estudiantes de secundaria. Se evaluaron nutricionalmente y oralmente de acuerdo con la Organización Mundial de la Salud a 203 estudiantes de secundaria. Se realizó un análisis descriptivo, frecuencia, tablas de promedio y un análisis estadístico (prueba de correlación de Spearman) con el software SPSS versión 22 para Windows. Nutricionalmente 146 estudiantes mostraron un índice de masa corporal normal, 6 con malnutrición, 41 con sobrepeso y 10 con obesidad. En la evaluación oral el promedio de caries fue de 3.08 ± 2.78, desnutrición mostró 3.6, sobrepeso 2.75 y obesidad 2.9. A mayor edad, altura, peso, grosor de los pliegues cutáneos y la enfermedad periodontal el riesgo aumenta. No existe una correlación estadística significativa entre enfermedades orales con cuestiones nutricionales, sin embargo, los análisis cualitativos de pacientes con pérdida dental o enfermedades orales expresan deficiencias importantes en su salud nutricional.

PALABRAS CLAVE

Estado nutricional; Caries; Enfermedad periodontal; Estudiante de secundaria.

INTRODUCTION

In adolescents, an increase has been noted in habits of malpractice, especially in relation to nutritional and oral care (20). The American Academy of Pediatric Dentistry guidelines for oral health care in adolescents established the following main alterations: caries; periodontal disease; malocclusion problems; temporomandibular dysjunction, and congenital tooth loss (14).

Caries cannot occur in the absence of a diet with fermentable carbohydrates; therefore, caries has been characterized as a "bacteria-diet" disease. In Mexico, 90% of Mexican population is affected by caries, principally those between 0 and 15 years of age, its being a very common illness(12,24,7).

The American Academic of Periodontology refers that loss of insertion and bone support in adolescence is uncommon; however, it emphasizes that progression and frequency increase from the ages of 12-17 years compared with children aged

5-11 years (20). For the development of periodontal disease, the state of oral hygiene is important; this is quantified through the Simplified Oral Hygiene Index (OHI-S). Lack of hygiene becomes evident with increasing age; thus, in children aged 6-9 years, 35.1% have an of OHI-S>0, while in adolescents aged 15-19 years, this is 54.9% (8).

NUTRITIONAL STATUS

One of the main health problems related to nutritional status is obesity. According to World Health Organization (WHO) guidelines, obesity is defined as an abnormal or excessive accumulation of fat that can be harmful to health. It presents in two forms; primary and secondary. Primary obesity is due to genetics, nutrition, behavior, and psychosocial factors that lead to an imbalance between food intake and energy expenditure, while secondary obesity is linked to specific pathological conditions, such as Cushing's syndrome, hypothyroidism, Stein-Leventhal syndrome, the use of certain medications, and hypothalamic endocrine disorders (15,16).

RELATIONSHIP OF ORAL DISEASES AND NUTRITIONAL STATUS

Obesity and its relationship with sugar have been linked to a higher incidence of cariogenic microorganisms, caries, and periodontal disease, loss of dental organs, xerostomia, and malocclusions (15). According to Modéer, 18 obese children had lower salivary rate than normal children and greater gingival inflammation (16) Pannunzio stated that children with a higher Body Mass Index (BMI) had alterations in the composition of saliva as favorable factors for conditioning caries (18).

Leptin, a hormone produced mainly by adipose tissue for the control of appetite and the accumulation of reserves, could be directly involved in the process of skeletal growth, since it accelerates the production of Gonadotropin-Releasing Hormone (GnRH) in the hypothalamus and exerts an effect on the anterior pituitary to accelerate pubertal development (6).

A positive relationship has been observed between the accumulation of visceral fat and periodontal disease. Pischon suggested that the secretion of inflammatory cytokines increases in individuals with a greater amount of adipose tissue, favoring inflammation in patients with periodontitis (27).

Torres suggested that exocrine glandular systems may be compromised by long periods of malnutrition, having important implications for antimicrobial defenses at the systemic level (27). Malnutrition and high exposure to fluoride may affect the severity of dental fluorosis, because tooth development and growth take place simultaneously in the human body (22).

The aim of this study was to describe the relationship among the presence of Decayed, Missing or Filled Teeth (DMFT), Simplified Oral Hygiene Index (OHI-S), and community periodontal

index (CPI) index associated to nutritional status in high school students in Zacatecas, Mexico.

MATERIALS AND METHODS

This study was authorized by Ethical Committee of Pediatric Dentistry Program of University of Zacatecas, Mexico (CE-PO- UAZ-001-2016). Recruitment, informed assent and informed consent was obtained by the parents' authorization for the children's participation in our study. Only 203 students of three high school in Zacatecas (not represent all high school in Zacatecas) aged 12-15 years were collected and accepted to participate. The inclusion criteria were: high school between 12-15 years, parent´s signature the informed consent, patient has disposition to collaborate and be enrolled between August and July 2016. The exclusion criteria are opposite. The selection of sample was made by non-probabilistic convenience. Sharing information on the objectives and procedures of clinical oral and anthropometric evaluations was carried out by a sole medical resident of the Program at Pediatric Dentistry UAZ. The kappa value for intra-observer agreement was
0.85. The personal data of the patient were divided into anamnesis and the relation to the elevation of the respective oral indexes.

ORAL EXAMINATION

The oral evaluation was conducted in accordance with WHO guidelines with a #5 mirror and a periodontal probe. The prevalence of caries was measured from the Decayed, Missing or Filled Teeth (DMFT) index. The presence of plaque and dental calculus was recorded by means of the OHI-S. To obtain the individual index of the OHI-S, the scores for each tooth were added together and divided by the number of surfaces analyzed. To determine the Community Periodontal Index (CPI), the WHO probe was employed. Six indicator teeth were examined in order to avoid confusing

the deep grooves associated with the periodontal pockets; for this same reason, when examining patients under 15 years of age, the pockets were not registered, and only gingival bleeding and calculus were considered.

ANTHROPOMETRIC EXAMINATION

The anthropometric measurements were taken according to WHO guidelines as follows: wear light clothes and without any material or accessory that weigh something (keys, coins, rings, watch, etc.), with footwear, and with the study subjects of not presenting edema.

Weight was determined with participants in an erect and relaxed position, facing the scale, with a fixed view on a horizontal plane. The palms of the hands were extended and resting laterally on the thighs, with the heels slightly separated, the feet forming a slight "V" and with no movement. The measurement was made in duplicate using a mechanical scale (Charisma®) on a flat, horizontal, and firm surface.

SIZE

This was performed with the patient on their back and making contact with the portable stadiometer (SECA®), with their eyes fixed toward the front on a horizontal plane, with their feet and knees together, the posterior face of the buttocks and the head well attached to the stadiometer. At that moment, an object was placed on the vertex, supported in turn on the measuring tape to read the participant's height in centimeters.

WAIST CIRCUMFERENCE

This measurement was performed with the patient relaxed, erect, arms resting on the thighs and abdomen uncovered. The inferior costal margin

and the upper border of the iliac crest are palpated. The average distance was marked; the tape was placed without compressing it around the waist to measure the circumference. The measurement was performed during the expiration.

HIP CIRCUMFERENCE

The patient must be standing, in profile position, with feet together and upper limbs on the side of the trunk, with bare hips, and the tape measure was passed around the prominent part of the hips for their registration in centimeters.

SKINFOLDS

The measurement was performed with the patient relaxed, the fold formed in parallel with the longitudinal axis with the thumb and forefinger of the left hand, separated from the underlying muscle and measured at that point, placing the caliper (Hergom model BF01, graduated 2 x 2 millimeters) perpendicular to the fold. The reading of the measurement was made 2-3 s after having set the caliper in place.

Based on the parameters measured, the following calculations were made: Body Mass Index (BMI) and height-for-age using the WHO AnthroPLUS (WHO) program, waist/hip index, and body density according to the Durnin formula (3):

Children 12-16 years old:
D=1.1533-0.0643 log ∑ folds Girls=12-16 years:
D=1.-139-0.0598 log ∑ folds. -

The percentage of fat according to the Siri equation26 was also calculated for its later classification into normal, limit, and obese:

Fat%=(4.95 /D)-4.5) * 100.

DATA PROCESSING

Once the data were collected and captured on an Excel sheet, these were coded and the variables to be analyzed were defined and the Spearman covariate or correlation test was performed ($p = 0.05$), using the SPSS ver. 22 statistical software package for Windows. A descriptive analysis was made with tables of frequency distribution, means, percentages, and Standard Deviations (SD).

RESULTS

For the 203 high school students, age distribution was 41 aged 12 years, 50 aged 13 years, 69 aged 14 years, and 43 aged 15 years. Average age was 13.56 years (SD, ±1.038), and distribution by gender was as follows: 59.1%, feminine gender 40.9%, masculine gender. From the total sample, average height was 162.04 cm (SD, ±8.19 cm), maximal height was 185 cm, and minimal height is 140 cm.

In the height-for-age classification: 194 adolescents are in norm-size-for-age, 115 girls and 79 boys in short stature-for-age, with one girl tall-size-for-age, and five boys tall-size-for-age, for a total of six tall-size-for-age children and two girls very tall-size-for-age.

Regarding body weight (see Figure 1), the results showed that the majority of the population studied had a weight of between 41 and 50 kg, and average weight was 53.61 kg. (SD, ±11.09 kg).

In relation to Body Mass Index (BMI), the average was 21.24 (SD, ±13.14), 146 adolescents had normal BMI (86 girls and 60 boys), there were six with malnutrition (three girls and three boys), 41 with overweight (24 girls and 17 boys), and 10 with obesity (six girls and four boys).

Mean Waist Circumference (WC) and Hip Circumference (HC) values increased with age in the case of the females, with the highest value found at age 15 years; among the males, the highest value was found at 14 years of age. The average WC of the total sample was 79.27 cm (SD,
±9.62 cm) and HC was 92.16 cm (SD, ±9.67 cm).

Considering the WHO criteria for the waist/ hip index, patients were classified according to the risk of cardiovascular and metabolic diseases as follows: low risk, 55 (50 boys and five girls); moderate risk, 60 (23 boys and 37 girls); high risk, 81 (79 girls and two boys), and very high risk, seven (four boys and three girls). The percentage distribution is depicted in Figure 2.

With respect to the average of the skin folds, we may observe in Table 1 that the largest fold is the subscapular fold in girls aged 14 years and the smallest is the bicipital fold in boys 13 years. It was also revealed that female gender is greater in terms of the average values of the folds compared to male gender.

According to the percentage of body fat, the average was 25.18% (SD, ±3.28), with a minimal percentage of 18.52% and maximal percentage of 32.87%.

The percentage of body fat increases with age (Table 2): at the age of 14 years, it was observed that female gender had a higher percentage of body fat compared with that of the male gender.

The average DMFT index was 3,088 (SD,
±2.78) for the full sample; in females this was 3.22, and in males, 3.13. Females have more decayed, filled, and lost teeth than males. The largest number of decayed teeth occurred in the age group of 14 years.

According to the determination of relative caries experience, adapted from Grainger and Nikiforuk (1960), there was a high risk for 24 subjects, a low risk for 98 and resistance for 79 adolescents.

With regard to the CPI, Table 3 demonstrated that dental organs 36/37 had has the higher healthy score, compared to dental organs 16/17, which also exhibited a higher rate of bleeding.

Finally, in relation to oral hygiene, there were 92 patients with (good), 93 with (regular), and 18 with (poor) oral hygiene. The DMFT in the cases of malnutrition was 3.66, in overweight 2.72, in obesity 2.72, and in normal weight, 3.23.

In the multivariate correlation analysis, it can be observed that in relation to age, as height increases and weight increases; consequently, each of the variables was influenced by weight and height, including BMI, total body fat, sum of folds, and waist/hip index.

There was a negative correlation between age and the number of decayed teeth, indicating that at an older age, the number of decayed teeth decreases in both genders; however, in males, tooth loss increased at an older age. There was a significant correlation between age and periodontal status, that is, as the age increases, periodontal health is affected. Periodontal involvement is observed when there is poor oral hygiene.

The BMI has a positive correlation with the waist/hip index, the sum of the folds, and total body fat, indicating that when the BMI increases, so do the aforementioned variables. The number of teeth with decay possesses a negative correlation with the level of oral hygiene; therefore, when oral hygiene is poor, the number of decayed teeth increases.

No significant correlation was found among the DMFT index, the CPI, the OHI-S index with BMI, the waist/hip index, the average of folds, and the percentage of body fat.

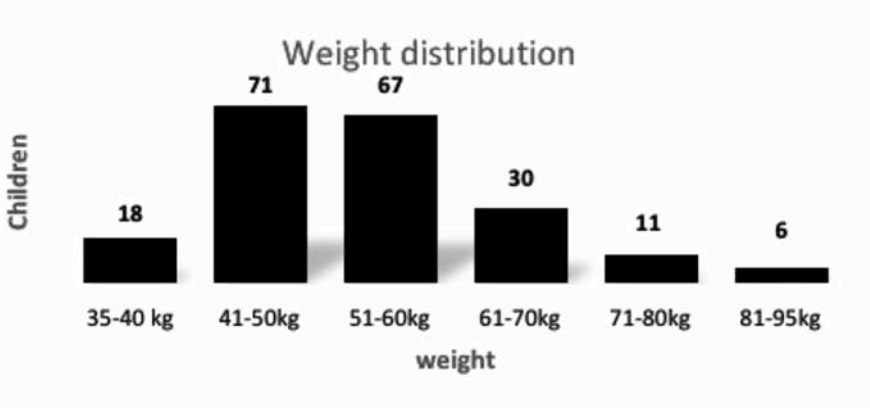

Figure 1. Represent distribution of the weigh in student between 35 and 95 kg. The principal weight oscillates between 41 and 60 kg (138 students). Only 6 students present values between 81 and 95 kg.

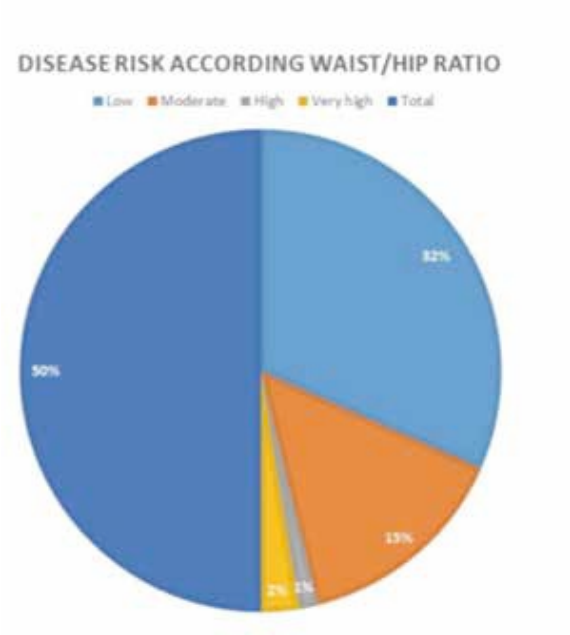

Figure 2. The figure 2 shows a low risk represent a 32%, moderate 15%, high 1% and very high only 2%.

Table 1. Mean values and standard deviation of skinfolds distributed by gender and age.

Age (years)	Subscapular	Bicipital	Tricipital	Suprailiac	Total
12					
Girls	12.5±1.58	10±1.15	10.41±1.44	10.666±1.52	10.89 ±1.10
Boys	12±2.23	9.52±2.065	9.64±2.029	9.76±1.71	10.23±1.18
13					
Girls	12.96 ±1.77	10.51±2.12	11.09±2.18	11.09±2.18	11.41±1.06
Boys	11.68 ±1.52	9.26 ±1.19	10.42 ±1.57	9.47±1.46	10.21±1.10
14					
Girls	14.02 ±1.73	11.68±2.030	12.43±2.33	11.95±2.34	12.52±1.04
Boys	12.88±1.78	9.92±1.41	10.96±1.50	10.66±1.92	12.52±0.90
15					
Girls	13.90±2.65	11.63±3.68	12.27±3.76	13.36±3.18	12.54±0.96
Boys	12.66±2.22	10.19±1.66	11.42±1.53	10.19±1.53	11.11±1.18

In Table 1 observed a skinfolds distributed by gender and age. That the largest fold is the

subscapular fold in girls aged 14 years and the smallest is the bicipital fold in boys 13 years. It was also revealed that female gender is greater in terms of the average values of the folds compared to male gender.

Table 2. Distribution by gender and age of body fat expressed in percentage.

Age (years)	Feminine	Masculine	Total
12	26.15 %	21.59 %	47.74 %
13	26.82 %	21.28 %	48.1 %
14	27.98 %	22.55%	50.53 %
15	27.88 %	22.81 %	50.69 %

Table 2 represents percentage of body fat in high school 12 to 15 years. The high values are represented in 14 and 15 years in both genders.

Table 3. Community periodontal index (CPI) in evaluated teeth.

Teeth	Healthy	Gingival bleeding	Calculus
17/16	18	20	3
11	184	17	2
26/27	182	18	3
47/46	180	18	5
31	173	14	16
36/37	185	16	2

The CPI is represented in Table 3. The teeth 36 and 37 have healthy values and 26/27 and 47/46 present further gingival bleeding. In the other hand teeth 31 present more calculus.

DISCUSSION

Oral diseases, malnutrition, obesity, and overweight comprise health problems for children and adolescents in Mexico. ENSANUT mentioned that 35% of adolescents are overweight or obese. At the national level, this represents around 325,131 individuals between 12 and 19 years of age. These proportions of overweight represent 23.7% of females and 19.6% of males (17).

Kosti and Zelocuatecatl noted the identification of carbohydrates as a risk factor for the development of overweight and obesity and a factor for the development of carious lesions in children and adolescents (11,28).

Sadeghi evaluated 747 students (aged 12-15 years); 75% were underweight, 72.8% were normal weight, 13.8% were at risk of being overweight,

and 5.9% were obese.23 The DMFT average was 2.83; in the low weight this was 2.91, normal weight 2.92, at risk of overweight 2.54, and with overweight, 2.34. In comparison with our study, there is a difference, with a DMFT of 3.66 in malnutrition, 2.75 overweight, 2.9 obesity and three at normal weight. According to these data, the results obtained in our study are in agreement with those of Prashanth (21).

Cereda *et al.*, through the determination of nutritional status and DMFT in a sample of 1,190 schoolchildren aged 5-15 years, concluded that there is no statistically significant association between the presence of caries and nutritional status (1). Therefore, we agree with the idea expressed by these authors based on the results obtained. Other authors, such as Costacurta (2), Luna (13), and D'mello (4), agreed on the fact that BMI and dental caries do not present a direct correlation;

however, the high consumption of carbohydrates exerts a considerable effect as a risk factor for the presence of caries and weight gain.

One of the objectives of this study was to determine the relationship between central adiposity (WC, waist-hip index), peripheral adiposity (skin folds) and caries, with no relationship among these variables in our study, unlike the results from Peng *et al*., who found, in a study conducted with children aged 12 years in Hong Kong, an association between the experience of caries with central and peripheral adiposity, but not with general adiposity measured by the BMI (19).

With regard to the relationship between nutritional status and periodontal disease, authors such as Kesim (10) and Fadel (5) propose that the number of episodes of obesity among adolescents is associated with calculus, periodontal disease, and gingivitis; however, according to the data presented in our study, there is no statistically significant relationship between obesity and the presence of periodontal alterations, coinciding with the results obtained by Sede (25).

Irigoyen-Camacho sought to identify the relationship between the percentage of body fat and the clinical degree of oral hygiene, finding an association between the percentage of fat (OR=1.06), and poor oral hygiene (OR=20-09). Analysis of our data showed that the percentage of body fat and the clinical degree of oral hygiene did not show a significant statistical association in our population (9).

Our study revealed that the relationship between nutritional status and oral diseases (caries-periodontitis) was not statistically difference, however according to clinical observations and the etiology of these conditions, we can suggest that they simply coexist and, more than as a determinant or the presence of a direct dependence, they represent a risk factor, in that they share common etiological factors. However, the complexity in the intervention of the variables, for the case of oral diseases, would be cariogenic or periodontics pathogenic microorganisms, hygiene habits, and exposure to a diet rich in carbohydrates, in addition to alterations in flow and salivary composition, which entertain relevant importance, in addition to alterations, in nutritional status, dietary habits, and genetic constitution, representing a variable of weight. One limitation of this study was sample size and localization; we need to obtain more samples and additional high schools for more investigations in the future.

CONCLUSIONS

There is no significant statistical correlation between oral diseases and nutritional issues; however, qualitative analyses of patients with dental loss or oral diseases express significant deficiencies in their nutritional health.

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