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## RESEARCH ARTICLE

### Risk Behaviors for Eating Disorders Among Brazilian Female Adolescents

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#### Abstract:

##### Background:

Eating disorders are complex conditions that cause serious emotional and physical problems.

##### Aim:

The aim of the study was to evaluate the behavioral risk for eating disorders in Brazilian female adolescents and their association with dental caries and erosion.

##### Materials and Methods:

This cross-sectional study included 200 students from public and private schools aged 15-18 years divided into two groups according to behavioral risk: **Group 1** - adolescents without risk and **Group 2** - adolescents at risk / disorder situation. Sociodemographic information (age and type of school), use of dental services, eating habits, and Body Mass Index (BMI) was obtained. The Bulimic Investigatory Test of Edinburgh (BITE) was used to identify behavioral risk. Caries experience was assessed using the DMFT index, while dental erosion was evaluated using the O'Sullivan index. Data were analyzed using descriptive and inferential statistics, with a significance level of 5%.

##### Results:

The highest overweight and obesity percentages were verified among adolescents at risk / disorder, respectively, 33% and 16%. There was a statistically significant association between behavioral risk and variables standard dietary pattern ( $p < 0.001$ ), strict diet ( $p < 0.001$ ), fasting for 24 hours ( $p < 0.001$ ), self-induced vomiting ( $p < 0.001$ ), and BMI ( $p < 0.001$ ). There was also a statistically significant difference between behavioral risk and the presence of dental caries ( $p < 0.05$ ) and erosion ( $p < 0.001$ ).

##### Conclusion:

Behavioral risk for eating disorders in female adolescents was associated with standard dietary patterns, strict diet and, self-induced vomiting. Adolescents at risk / eating disorders for bulimia were related to dental caries and erosion.

**Keywords:** Body dysmorphic disorders, Bulimia nervosa, Diet, Adolescents, Behavioral risk, Vomiting.

#### Article History

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## 1. INTRODUCTION

The prevalence of eating disorders has increased in Brazil and other countries, becoming an essential public health problem [1, 2]. This condition is relatively common among adolescents and young people, especially in women [3], with ages ranging from 14 to 19 years [4].

Anorexia and bulimia nervosa are among eating disorders [5], which cause women to adopt inappropriate eating behaviors, such as induced vomiting [6] and binge eating [7]. In addition, eating disorders are related to negative feelings related to body image [8] due to a beauty pattern currently diffused by the media, which exerts a marked effect on the female population [9].

Eating disorders, in addition to establishing fear of weight gain and pathological concern with body shape [4], can also

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cause significant clinical alterations, including changes in the oral health status of these individuals, such as increased incidence of caries and the development of dental erosion [10]. The oral environment could be influenced both by bacterial activity and acidic foods and beverages. In fact, an acid environment can alter roughness [11]. Therefore, the early detection of these eating disorders is important for establishing the prognosis and treatment of these disorders [12].

Knowing that individuals with eating disorders are ashamed of their behavior [13], that early erosive lesions on permanent teeth as a result of acts such as self-induced vomiting as well as caries lesions can compromise the dentition throughout the individual's life, requiring extensive restorative procedures, epidemiological studies should be carried out for the identification of these individuals and for early diagnosis, aiming at the implementation of adequate curative and preventive measures.

Therefore, the aim of this study was to evaluate the behavioral risk for eating disorders in female adolescents and associated factors, as well as their relationship with dental caries and erosion.

## 2. MATERIALS AND METHODS

### 2.1. Study Design and Sample

This cross-sectional study is part of a larger research project [14] and was conducted, from August 2017 to April 2018, in public and private high schools of Campina Grande, Paraíba, Brazil, northeastern Brazil, a city with about 404,072 inhabitants, divided into eight health districts, with Human Development Index (HDI) of 0.72 and Gini Coefficient of 0.58.

The sample consisted of 200 female students, after sample calculation, taken from a larger study [14], aged 15 to 18 years old, who were divided into two groups according to the risk behavioral: **Group 1** - adolescents without risk and **Group 2** - adolescents at risk / disorder. Those who used fixed orthodontic appliances, or who were already diagnosed with eating disorders and who were being treated for eating disorders or adolescents with gastroesophageal reflux were excluded [14].

### 2.2. Socio-Demographic and Behavioral Data Collection

Data on age, school type, use of dental services, eating habits (regular dietary pattern, strict diet, fasting for 24 hours, and self-induced vomiting) were recorded in a questionnaire. Fasting for 24 hours or intermittent fasting is an eating pattern that cycles between periods of fasting and eating.

### 2.3. Bulimic Investigatory Test of Edinburgh (BITE)

This tool presents final results of two scales, one is the symptoms and the other is the severity [15]. The scale of symptoms has three possible outcomes: situation of "no risk" for the development of eating disorders (score <10); "risk situation" (score  $\geq$  10 and less than 20) for the development of eating disorders, which suggests an unusual eating standard without all the criteria that characterize an eating disorder; "eating disorder situation" (scores from 20 to a maximum of 30), characterized by the presence of binge-eating behavior and a high possibility of the presence of bulimia, which is

considered as the main indicator for the occurrence of eating disorders. It is recommended that subjects responding to the questionnaire should be considered for their behavior in the last three months [15]. Therefore, Group 1 comprised of adolescents with scores <10, while Group 2 included adolescents with scores between 10 and 30.

### 2.4. Dental Caries and Dental Erosion

Dental examinations were performed by two trained and calibrated examiners. The inter-examiner agreement obtained a value of 0.97, and intraexaminer agreement obtained a value of 0.98.

Dental caries was assessed through the DMFT index [16], while dental erosion was evaluated using the O'Sullivan index [17], adapted for use in the four upper incisors [18] and the first permanent molars [19].

Dental examinations were conducted in private rooms provided by the schools. Adolescents were positioned face to face with the examiner. At this stage, all appropriate personal protective equipments were used. Examinations were performed under artificial lighting (headlamp Petzl Zoom, Petzl America, Clearfield, UT, USA) with mouth mirrors (Prisma Instrumentos Odontológicos Ltda., São Paulo, SP, Brazil) packaged and sterilized, and sterile gauze pads (used to clean and dry the teeth) [14].

### 2.5. Body Mass Index (BMI)

Height and weight were measured for BMI calculation using a stadiometer (Model 206, Seca Corp., Hamburg, Germany) and a digital scale with a precision of 0.1 kg (Model W-110H, Welmy Ind. e Com Ltda., Santa Bárbara do Oeste, SP, Brazil). Adolescents were classified as: underweight (BMI <17.7), normal weight (BMI between 17.8 and 23.4); overweight (BMI between 23.5 and 28.1) and obesity (BMI  $\geq$  28.2) [20].

### 2.6. Data Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS for Windows, version 18.0, SPSS Inc., Chicago, IL USA). Bivariate analyses were performed to test the association between eating disorder condition and dental caries and erosion, using the Pearson Chi-square and Fisher's exact tests. The statistical significance level was set at 5%.

### 2.7. Ethical Considerations

This research project was approved by the Ethics Research Committee of the State University of Paraíba (Protocol No. 2.006.615) and the participants were informed about the purpose and methodology of the study and signed a consent form.

## 3. RESULTS

Most participants were 15 years old (35%), public schools (74.5%) which had used dental services in the last six months (57%) (Table 1). The occurrence of risk / behavior disorder was higher among adolescents in public schools (70%).

Female adolescents at risk / disorder had a lower frequency of regular dietary patterns when compared to those without risk (28% versus 55%). On the other hand, the adoption of a strict

diet, fasting for 24 hours and self-induced vomiting were more frequent among adolescents at risk / disorder, respectively, 22%, 58%, and 35%. BMI analysis showed that the highest overweight and obesity percentages were verified among adolescents at risk / disorder, respectively, 33% and 16%. There was a statistically significant association ( $p<0.001$ ) between adolescents without risk and those at risk / disorder for variables regular dietary standard, strict diet, fasting for 24 hours, self-induced vomiting and BMI (Table 2).

Regarding the components of the DMF-T Index, the percentage of decayed, missing and filled teeth was higher in adolescents with no behavior risk, respectively 89%, 25%, and 59%. However, the presence of dental erosion was higher in adolescents at risk / disorder (24%). The bivariate analysis revealed a statistically significant difference between the behavior risk and the presence of dental caries ( $p<0.05$ ) and dental erosion ( $p<0.001$ ) (Table 3).

**Table 1. Distribution of adolescents according to age, type of school, and dental visit according to the risk behavior.**

Variables	Risk Behavior				Total	
	No Risk		Risk / Disorder		N	%
	N	%	N	%		
<b>Age (in Years)</b>	-	-	-	-	-	-
15	32	32.0	38	38.0	70	35.0
16	36	36.0	33	33.0	69	34.5
17	25	25.0	15	15.0	40	20.0
18	7	7.0	14	14.0	21	10.5
-	-	-	-	-	-	-
<b>Type of School</b>	-	-	-	-	-	-
Public	79	79.0	70	70.0	149	74.5
Private	21	21.0	30	30.0	51	25.5
-	-	-	-	-	-	-
<b>Dental visit in the last 6 months</b>	-	-	-	-	-	-
Yes	53	53.0	61	61.0	114	57.0
No	47	47.0	39	39.0	86	43.0

**Table 2. Distribution of adolescents according to eating habits, the occurrence of self-induced vomiting and BMI.**

Variables	Risk Behavior				p-value
	No Risk		Risk / Disorder		
	N	%	N	%	
<b>Regular dietary standard</b>	-	-	-	-	-
Yes	55	55.0	28	28.0	<0.001
No	45	45.0	72	72.0	
-	-	-	-	-	-
<b>Strict diet</b>	-	-	-	-	-
Yes	2	2.0	22	22.0	<0.001
No	98	98.0	78	78.0	
-	-	-	-	-	-
<b>Fasting for 24 hours</b>	-	-	-	-	-
Yes	19	19.0	58	58.0	<0.001
No	81	81.0	42	42.0	
-	-	-	-	-	-
<b>Self-induced vomiting</b>	-	-	-	-	-
Yes	3	3.0	35	35.0	<0.001
No	97	97.0	65	65.0	
-	-	-	-	-	-
<b>BMI</b>	-	-	-	-	-
Underweight	17	17.0	5	5.0	<0.001
Normal	70	70.0	46	46.0	-
Overweight	11	11.0	33	33.0	-
Obese	2	2.0	16	16.0	-

**Table 3. Distribution of adolescents according to DMF-T index and presence of dental erosion, according to the risk behavior.**

Variables	Risk Behavior				p-value
	No Risk		Risk / Disorder		
	N	%	N	%	
<b>DMF-T Components</b>					
Decayed	-	-	-	-	-
Yes	89	89.0	68	68.0	<0.05
No	21	21.0	32	32.0	-
<b>Missing</b>					
Yes	25	25.0	18	18.0	>0.05
No	75	75.0	82	82.0	-
<b>Filled</b>					
Yes	59	59.0	54	54.0	>0.05
No	41	41.0	46	46.0	-
<b>Dental Erosion</b>					
Yes	4	4.0	24	24.0	<0.001
No	96	96.0	76	76.0	-

#### 4. DISCUSSION

This research aimed to analyze the occurrence of eating disorders in female adolescents. The choice for this population group was based on previous studies that pointed out a higher frequency of this condition among females [14, 21]. It is possible that the female predominance is due to the adoption of unhealthy eating behaviors as a measure to reduce body fat [6] since women are constantly concerned about their body shape [14].

In this study, 15-year-old adolescents had a higher frequency of eating disorders, a result similar to that described in other studies developed in Brazil [8, 22]. Some researchers have already warned about body image satisfaction in adolescence, highlighting the great concern about body weight and shape, which may lead to inadequate eating practices [23]. In addition, it is possible to observe that with age advancement, the percentage of girls at risk for eating disorders in this study decreased, which may indicate that puberty progress reduces the prevalence of inappropriate eating behavior [6].

Concerning the school type, it was found that students from public schools composed most of the sample, confirming the previous findings [14, 22, 24]. The greater participation of public school students in epidemiological studies may be related to the easy access to these schools, since managers understand the importance of conducting community-oriented studies and are extremely cooperative, providing unrestricted access for researchers. On the other hand, the opposite is verified in private institutions, in which students pay high tuition and managers understand this activity as an action that disrupts the school's administrative and educational routine, thus interfering with learning. In this research, specifically, one-fourth of students were from private schools.

With regard to the presence of eating disorders, female students from public schools presented a higher frequency of this condition. Relationship between school type and higher prevalence of eating disorders was not found among Finnish adolescents [3]; however, among Norwegian students eating disorders were more common in girls at some schools than others, and this is not explained by the individual character-

istics of the students [25]. Schools with more girls, or more highly educated parents, are likely to have some students with eating disorders because female gender and parental education are risk factors for eating disorders [25].

Regarding the visit to the dentist in the last 6 months, it was observed that the majority of female adolescents, including those at risk / disorder, had visited this professional during this period, and this information is essential since dentists are often responsible for identifying risk situations, preventing and treating implications in the oral cavity related to eating disorders [7]. Moreover, although dentists may be one of the first health professionals to recognize symptoms of eating disorders [10], many prefer not to report their suspicions either due to the lack of confidence in their diagnosis or to the fear of losing the patient [22].

Almost one-third of adolescents at risk / eating disorder did not adopt a regular dietary pattern, confirming previous findings [23, 24]. In addition, it was observed that those belonging to the risk / disorder group had a more strict diet, similar to that found in female Norwegian students [3]. These inadequate dietary practices are a regular practice for an increasing number of women, in which dietary restriction proves to be a harmful strategy for coping with adverse daily situations [23, 24].

There was a statistically significant difference between fasting for more than 24 hours and the presence of behavioral risk for eating disorders, confirming results described among female American adolescents [26]. This is probably explained by the fact that many adolescents believe that this is the easiest and fastest way to lose weight and reach the desired body weight, regardless of subsequent consequences [23].

Self-induced vomiting was more frequent among students at risk / eating disorder, confirming previous findings described in Sweden [12] and Brazil [24]. The use of compensatory methods to control weight gain, such as self-induced vomiting, is common in girls with eating disorders [3], which habit is related to a high incidence of oral pathologies [5]. Gastric acid can cause, for example, tooth erosion [7, 27 - 30], causing irreversible damage to tooth enamel.

The presence of overweight and obesity was higher among girls belonging to the risk / behavioral disorder group for eating disorders. This overweight situation was also found in other studies [14]. Body image dissatisfaction due to the beautiful pattern and search for a perfect body established by the media and society [8] can induce compulsory eating episodes followed by inadequate attempts to compensate for excess weight [14]. The socioeconomic context could influence the presence of tooth erosion and obesity, modulating behaviors such as diet or lifestyle habits [31].

The percentage of students with dental caries was high in both groups. Several studies have already demonstrated a high prevalence of this condition in women with behavioral risk for eating disorders [14, 22, 24, 32]. Parallel factors to be considered are an individual's oral hygiene [33], cariogenicity of the diet, malnutrition, genetic predisposition, fluoride experience during tooth development, and ingestion of certain types of medication [32]. Another component of the DMF-T Index that was elevated was tooth loss. The oral health indicator that has been described as the most negatively influencing quality of life is tooth loss [34]. Therefore, educational actions aimed at the prevention of an inadequate nutritional status also have considerable potential with regard to benefitting the promotion of oral health [35].

Dental erosion is not a new phenomenon and should be used to refer to the chemical process - tooth demineralization without the involvement of bacteria [36]. Epidemiological studies have indicated that dental erosion is a condition of growing concern that is prevalent in all age groups [31, 37]. In this study, dental erosion was evaluated using index teeth. The use of index teeth is considered adequate since they are exposed in the mouth for a longer period of time when compared to other teeth, being more susceptible to the action of possible etiological factors [18].

A higher prevalence of dental erosion was observed in adolescents at risk / behavioral disorder, confirming previous results [12, 22]. Possibly, this condition is related to the habit of self-inducing vomiting in this group of adolescents, a characteristic behavior in individuals with eating disorders [5, 10]. Erosive lesions resulting from acid attack affect specific regions of the teeth, but the enamel portions located near the gingival margin remain intact [38]. It is important to note that individual susceptibility to dental enamel erosion differs among individual [39].

Limitations of this study should be addressed. First, the cross-sectional design of the study allowed to observe these findings in one specific moment, without being able to consider the causal and temporal relationship. The second limitation is the use of the WHO criteria for the diagnosis of dental disease, which not allow the diagnosis of initial enamel lesions, allowing only the registration of lesions cavitated in dentin. However, the DMFT index is established by the WHO and used by several studies [14, 35, 40, 41].

## CONCLUSION

The behavioral risk for eating disorders was associated with standard dietary patterns, strict diet, and self-induced vomiting. Adolescents at risk / eating disorders for bulimia were related to dental caries and erosion.

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the State University of Paraíba Ethics Research Committee, Brazil (Protocol No. 2.006.615).

## HUMAN AND ANIMAL RIGHTS

This study followed the recommendations of the Declaration of Helsinki and Resolution 466/12 of the Brazilian National Health Council.

## CONSENT FOR PUBLICATION

Written informed consent was obtained prior to the study.

## AVAILABILITY OF DATA AND MATERIALS

The data sets analyzed during the current study are available from the corresponding author [A.L.C.] upon reasonable request.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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Declared none.

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