Original Research
Cariology

Relationship between intrinsic and extrinsic factors with Erosive Tooth Wear in adults: a cross-sectional study

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Abstract: The objective of this study was to explore the relationship between intrinsic and extrinsic factors and a high cumulative score of the Basic Erosive Wear Examination (BEWE) in a Chilean adult group. A cross-sectional study was performed with the Ethics Committee's approval from the Universidad de los Andes. A consecutive adult (18 to 46 years old) sampling (n = 553) from the Health Center in San Bernardo-Chile, was selected from September 2016 to January 2017. Dental exams were performed by two trained and calibrated examiners, according to the BEWE index. In order to search for potentially related factors, a hetero-applied questionnaire previously developed and evaluated was applied. Our interest was individuals with severe erosion tooth wear (BEWE ≥ 14). Logistic regression models reporting crude odds ratio (OR) and adjusted OR by age, 95% confidence interval (95%CI), and p-values were estimated. Variables, odds ratios and 95% CI related with BEWE ≥ 14 were: age (OR 1.1 [1.07–1.14]); currently drinking alcohol (OR 1.59 [1.06-2.39]); esophagitis (OR 8.22 [1.60–42.22]); difficulty to swallow (OR 2.45 [1.10–5.44]); chest pain (OR 2.07 [1.18–3.64]); anorexia (OR 3.82 [1.07–13.68]); vitamin C intake (OR 1.92 [1.08–3.43]). Age, alcohol consumption, self-reported esophagitis, history of gastric symptoms, anorexia, and vitamin C intake were related as risk factors to high BEWE scores in this sample of Chilean adults in San Bernardo, Chile.

Keywords: Tooth Wear; Tooth Erosion; Risk Factors; Oral Health.

Declaration of Interests: The authors certify that they have no commercial or associative interest that represents a conflict of interest in connection with the manuscript.

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Introduction

There is a growing interest in non-carious lesions, including dental wear, increasing studies in recent years. Still, detection in routine dental examinations is necessary to have adequate individual management and correct epidemiological surveillance of the condition.[1] In 2019, the European Organization for Caries Research (ORCA) and the International Cariology Research Group for Dental Research (IADR) held a consensus workshop on dental wear terminology. "Tooth wear" was defined as a condition that corresponds to the cumulative surface loss of mineralized tooth substance due to physical or chemo physical processes (dental erosion, attrition, abrasion). While "erosive tooth wear" was defined as tooth wear with dental erosion as the primary etiological factor. On the other hand, "dental erosion" was described as a process where the chemical

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loss of mineralized tooth substance is caused by the exposure to acids not derived from oral bacteria.[2]

The prevalence of erosive tooth wear in the adult population is heterogeneous among different studies. Several authors reported that it is a common condition[3] and would have increased even in the last years.[4] The basic Erosive Wear Examination (BEWE) has been designed to score for diagnostic criteria using existing indices. The criteria for grading erosive wear vary between 0 to 3 per surface/tooth/sextant as a maximum value, and then the sum is the cumulative BEWE score from 0 to 18. There is a proposal of categories for this index related to the risk and clinical management, being a BEWE ≥ 14 a high-risk level or high complexity level.[5,6] Using the BEWE index and the same cut-off (at least one tooth with score 2-3); the prevalence in permanent teeth observed in Poland was 13.4% in 18-year-old,[7] in the UK, 54.4% between 18–35 years old,[8] and in Chile 97.9% between 18–46 years old.[9]

Over time many patient-related nutritional factors interacting with the tooth surface have been attributed to the development of erosive tooth wear.[8,10,11] Several studies have also tried to evaluate the relationship or association with different factors with these conditions and processes, which refers to exogenous and endogenous acid sources and their impact on prevalence in risk groups (7). Among the factors studied there can be found: gastro-oesophageal reflux disease,[12] eating disorders,[13] high frequency of consumption of acidic beverages,[14] alcohol disorders, fruit consumption,[15] among others. Identifying associated factors, both protective and risky, can help us understand and study the etiology of the condition, generating new questions about it and hypotheses. Knowledge also helps us identify patients who require prioritization and control of these factors by the clinicians. It is necessary to expand the knowledge about this condition through a valid and straightforward index such as the BEWE and identify its risk factors to implement preventive measures and suitable treatment, information that is not available in Chile so far.

Then, the purpose of this study was to explore the relationship between intrinsic and extrinsic factors and high BEWE cumulative score in an adult group of Universidad de los Andes Health Center, in San Bernardo, Metropolitan Region, Chile, during 2016.

Methodology

A cross-sectional study was developed. The Research Board of Faculty of Dentistry and Scientific-Ethics Committee of the Faculty of Medicine from Universidad de los Andes approved the study protocol and informed consent documents (register/date 22122014). Our report followed the Strengthening the Reporting of Observational Studies (STROBE) statement.[16] This study has been conducted in full accordance with ethical principles, including the World Medical Association Declaration of Helsinki (version 2008) and the additional requirements of Chilean law.

The study was performed by clinical research staff, including two field coordinators (recruitment and monitoring of clinical exams and questionnaires), two examiners, two trained recorders, and four interviewers.

A consecutive sample of adult populations seeking dental or medical care from Universidad de los Andes Health Center (CESA) in San Bernardo-Chile was recruited from September 2016 to January 2017. The estimated sample of 553 participants was obtained assuming an erosion prevalence of 36%, 4% margin of error, a 95% confidence interval, and 2% more than the prevalence of BEWE score 2–3 described by Vered et al.[17] Participants were selected between 18 to 46 years old, had at least one tooth per sextant, signed informed consent, and had no fixed orthodontic treatment. It was not exclusion criteria for systemic diseases.

According to the BEWE index, two examiners performed the oral exams in standard conditions at CESA dental Clinic, using number 5 dental mirrors and probe with a ball tip of 0.5 mm. The calibration process included training in theoretical and practical aspects of this type of lesion. One of the expert authors of the index (A. L.) previously encoded a series of clinical pictures, and then the examiners identified the code from the same images.

Cohen's kappa values obtained were 0.85 and 0.80 for examiner 1 and 2, respectively. Data were registered in a dental record designed for this examination. Surfaces buccal, occlusal/incisal, and palatal/lingual of all teeth were scored by the examiners, except third molars, as follows: no signs of erosive tooth wear (score 0); initial loss of surface texture (score 1); evident loss of hard tissue but less than 50% of the surface area affected (score 2); and more than 50% of the surface area affected (score 3). Scores 2 and 3 do not distinguish whether the dentin is involved. The highest score for each sextant was recorded, and the sum corresponds to the BEWE cumulative score [5], whose range could be between 0 and 18.

A questionnaire was developed as an information-gathering tool to collect factors related to erosive tooth wear in Chile's adult population. The first document was generated from a literature review and the opinion of the research group. The sociodemographic questions, habits, and self-report of diseases were used in the National Health Survey of Chile 2009-2010. The document was modified based on experts' recommendations, adding or eliminating some questions or changing the responses' categories. A focus group was then held with six volunteers from the same place where the individuals would be recruited to evaluate the questionnaire's degree of understanding. Modifications were made again. In the face validity and content participate experts from different areas, as nutrition medical doctor, gastroenterologist, dentists, methodologist, and expert in market studies, evaluating the form.

Four interviewers were trained. The questionnaire's pilot study was conducted between January and August 2016 to verify the fifteen volunteers' comprehension degree and reproducibility questions and answers. The timing to answer was evaluated and repeated assessment with a difference of one week. As a result, it was obtained an exhaustive hetero-applied questionnaire, divided into several sections (sociodemographic variables, habit variables, history of diagnosed diseases, history of gastric symptoms, history of eating disorders, medical drugs consumption, beverage consumption by type and frequency, habits related to beverage consumption, food consumption by type and frequency and oral hygiene habits, dental health history associated with erosive tooth wear, sensitivity, dry mouth, and bruxism). The participants had to remember what they ate and drank during the last week regarding beverage and food consumption. Sheets containing pictures and diagrams of some questions and frequency charts were used to facilitate question understanding.

The variable analyzed as the outcome was individuals with a BEWE cumulative score of 14 or higher. Variables analyzed as possible factor related from the questionnaire were: a) sociodemographic variables: sex (female/male), age (years), educational level (high, medium, low); b) habit variables: sport practice, sport type (none, aerobic, anaerobic, watersport, walking/skating), tobacco smoking currently, frequency of tobacco (do not smoke / occasionally), alcohol drinking currently; c) self-reported diseases (diabetes, arterial hypertension, obesity, pneumonia, asthma, depression, cancer, hiatal hernia, gastroesophageal reflux, gastric ulcer, chronic gastritis, esophagitis); d) history of gastric symptoms (difficulty to swallow, sensation of acidity, reflux feeling, chest pain, nausea/vomiting, indigestion or discomfort, nighttime cough); e) history of eating disorder (rejection of food [not sick], eating large quantities of food, obsession with the physical, anorexia, bulimia); f) medical drugs consumption and frequency (vitamin C, aspirin); g) beverage consumption: water (water pipe, purified water or mineral water), sparkling water, fruit juices (natural juice, packaged juice, drink mix), regular soft-drinks, light or zero or diet soft drinks, energy drinks, isotonic drinks, black tea, green tea, coffee, mate/herbal infusion, wine, and dairy products (milk, cheese, yogurt, dessert with milk, butter or margarine); h) food consumption (fruits, chocolates).

The data collected from clinical exams and questionnaires were transferred with double-entry using Epidata software version 4.4 (EpiData Association, Odense, Denmark) to digital records until a final database was obtained.

The age was described by median and interquartile range. Percentages and absolute frequencies described categorical variables. Logistic regression models were estimated considering dichotomous outcome

(BEWE cumulative score ≥ 14), reporting crude odds ratio (OR) and adjusted OR by age, 95% confidence interval (95%CI), and its respective p-value. The analysis was performed with Stata Software 16.1 (StataCorp Texas USA).

Results

Five hundred and fifty-three volunteers were recruited. The final sample was 522 because we lost 31 from incomplete data, 405 women and 117 men, whose median age was 30 years. The prevalence of BEWE ≥14 was 27.4% (95%CI: 23.6–31.4). Age was associated as a risk factor for having BEWE ≥14 with an OR 1.1 (95%CI: 1.07–1.14; p-value < 0.001) (Figure 1). Figure 2 shows a significant association adjusting by age between the alcohol drinking group, self-report of esophagitis, difficulty swallowing, chest pain, and anorexia as risk factors for a high cumulative BEWE score. Males, watersport practice, tobacco smoking, asthma, gastroesophageal reflux, gastric ulcer, chronic gastritis, indigestion or discomfort, nighttime cough, and bulimia had a higher prevalence of BEWE ≥ 14, but the association was not statistically significant. Vitamin C consumption was a risk factor for high BEWE, adjusted for age with an OR of 1.92 (95%CI: 1.08–3.43; p-value: 0.03). Diet soft drinks had a higher prevalence of BEWE ≥ 14 (OR: 2.84, 95%CI: 0.84–9.59, p-value: 0.09), and green tea and dairy products had a lower prevalence of cumulative BEWE score, as shown in Figure 3.

Discussion

Prior research reported several intrinsic and extrinsic factors related to erosive tooth wear in different populations.[12,18] However, there are no studies in Chile about it as far as we know. In this report, we evaluated related factors with a high BEWE cumulative score (BEWE ≥ 14) in an adult group who seek dental or medical care in San Bernardo-Chile, through a clinical exam and questionnaire applied on the same day. We found age, alcohol drinking consumption, gastric symptoms, anorexia, and vitamin C intake related to an increase in the risk of BEWE ≥ 14. These prevalence is higher than found. Our findings coincide with that reported by González-Aragón et al.[19] and Chu et a.[20] They found a relationship with an OR of 1.64 (95%CI: 1.26–2.13) in México adolescents and a significant slope of 0.243 (p-value: 0.046) in China. Concerning alcohol consumption, in a large-scale cohort in Finland, heavy alcohol drinking for at least fifteen years was reported as an extrinsic factor related to erosive tooth wear (OR: 3.0; 95%CI 1.37–6.59).[12] Also, this is presented by Aidi et al.[21] with alcohol

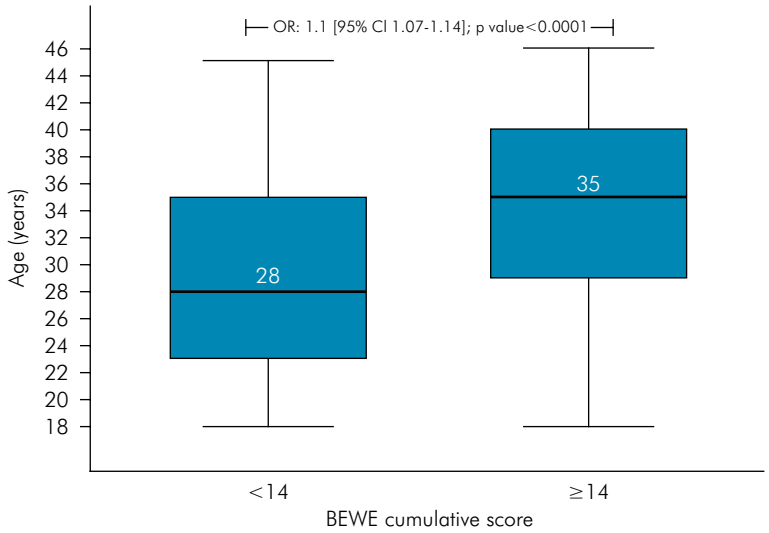

Figure 1. Age(years) of individuals by categories of BEWE cumulative score.

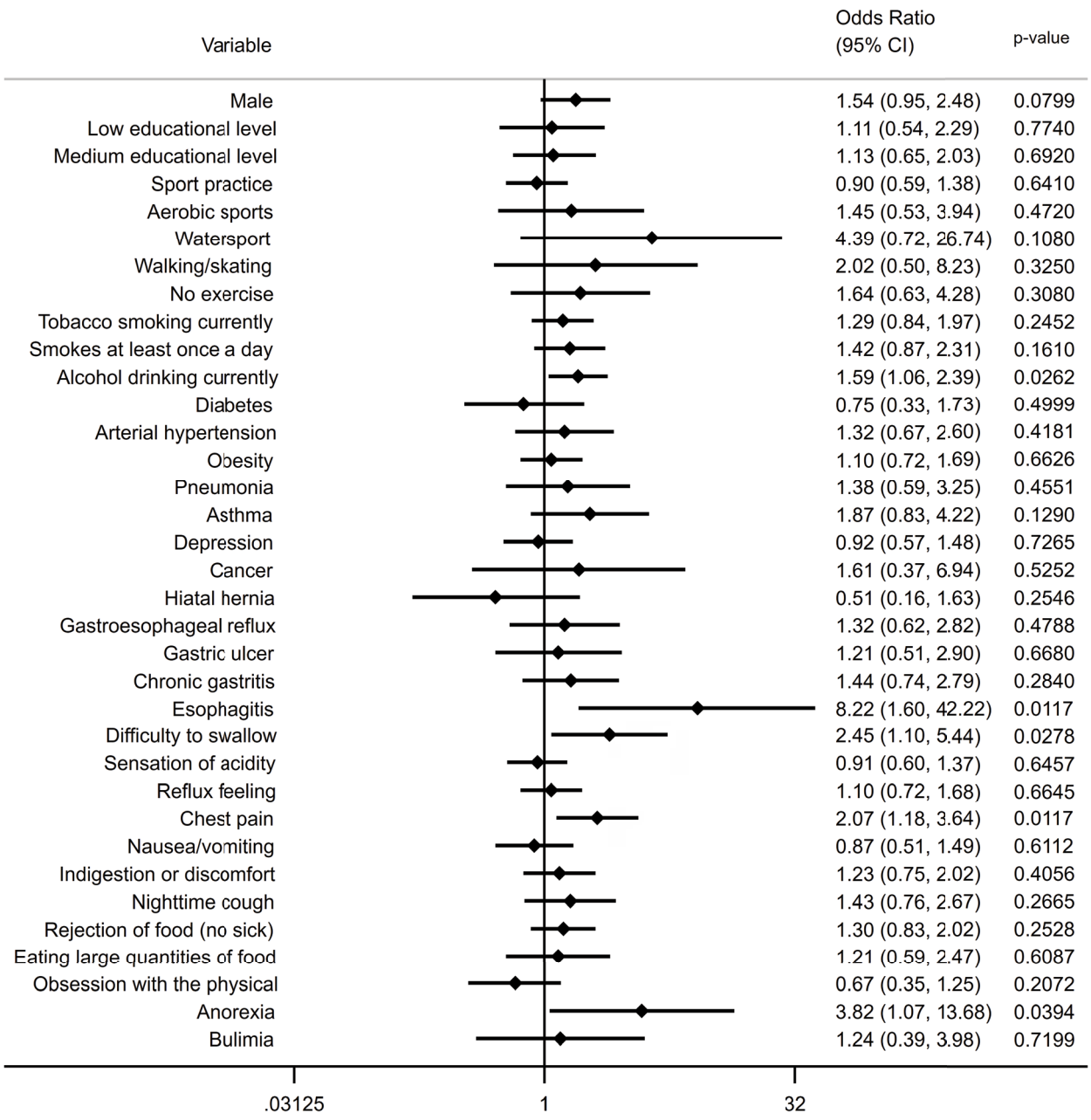

Figure 2. Relationship between sociodemographic variables, habits and self-report of diseases diagnosed with BEWE ≥ 14 (age-adjusted logistic regression model).

mixed consumption. On the other hand, it has been reported that gastroesophageal reflux is associated with erosive tooth wear,[22] then we found a higher but not significant frequency of BEWE ≥ 14 in individuals with reflux; however, we showed a significant association with some conditions and symptoms related, such as esophagitis, difficulty to swallow, and chest pain.[23] Similar results are supported by other publications that evaluate this relationship.[22,24] According to eating disorders, we describe a higher prevalence of severe erosive tooth wear in patients that auto report anorexia like systematic reviews.[25,26] Besides, we found a relationship between vitamin C use and higher BEWE with an OR of 1.9, as the

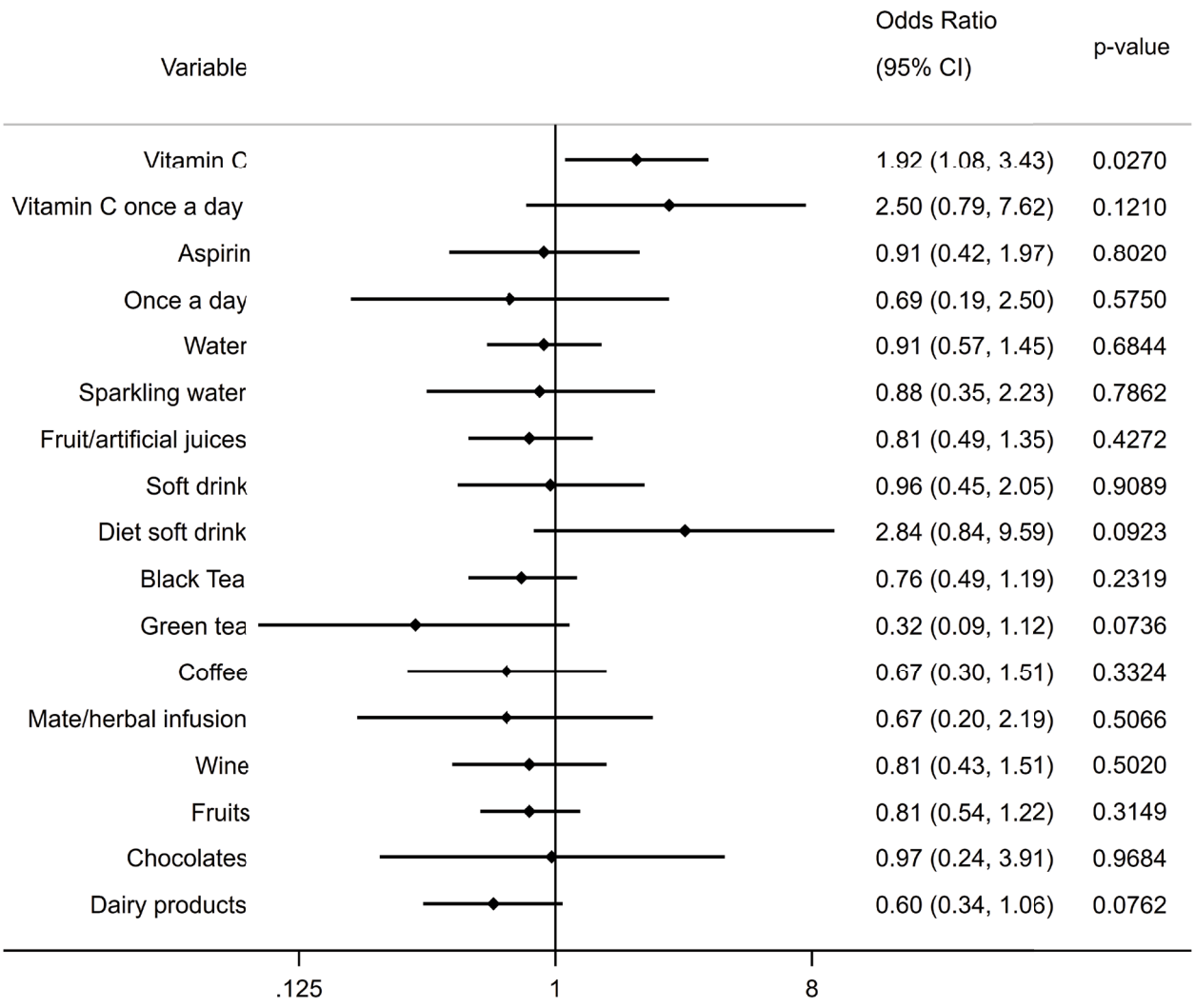

Figure 3. Relationship between the use of vitamin C, aspirin, food and beverage consumption with BEWE ≥ 14 (age-adjusted logistic regression model).

European Federation of Conservative Dentistry Report indicates.[27] Although some studies show a relationship between male sex and erosion,[12,28] a higher proportion of men with a higher level of BEWE was observed in our work, this was not significant (OR: 1.54; 95%CI: 0.95–2.48; p-value: 0.0799). These variations should be extrinsic factors such as eating and drinking habits among sexes and differences between populations.[29]

Our research's limitations include the cross-sectional and observational nature of the design that does not permit to show causality but only suggests it; the consecutive sampling represents a single health centre; and overrepresenting females. Also, despite finding a large difference between groups, the sample size did not allow a significant association to be observed for some low-frequency exposures since the sample size was calculated for the study whose purpose was to estimate dental erosion prevalence.[9] It is important to mention that diet soft drink consumption (two per day intakes or more) had almost double BEWE ≥ 14 frequency. Interestingly, despite the relationship not appearing statistically significant, a protective trend is observed since the frequencies were lower in those exposed for some variables as green tea (OR: 0.32; p-value:

0.0736). Dairy products appear with a protective OR, which has also been found in some publications.[19,30] Moreover, exploring habits, behaviors, and food intakes is challenging because they risk bias like recall. This is why we did our best to avoid it, making a hetero-applied instrument, training the interviewers, and explaining in a good way to the volunteers.

Risk factors knowledge of erosive tooth wear is relevant for correct diagnosis and decision-making in dental practice as part of a multidisciplinary team.

Conclusion

We conclude that age, alcohol consumption, esophagitis self-report, history of gastric symptoms, anorexia, and vitamin C intake were related to high BEWE scores in this sample of Chilean adults in San Bernardo, Chile.

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