

## A Preliminary Investigation into the Dietary and Oral Practices Associated with Fractured Teeth and Prostheses in a Trinidadian Population

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### INTRODUCTION

The clinical presentation of fractured teeth is wide ranging. Patients may present with fractured cusps or marginal ridges to incomplete fracture presenting as “cracked tooth.”<sup>[1,2]</sup>

Factors such as histological anomalies, occlusal anatomy, the presence of a restoration with its associated cavity design, and restorative material type have all been investigated as etiologic factors in explaining tooth fracture.<sup>[3,4]</sup>

Evidence of cracked teeth, previously referred to as “cracked tooth syndrome,” has featured predominantly in the literature. Trushkowsky concluded that the most common cause of cracked tooth syndrome is that of “a masticatory accident” biting suddenly on a hard object

such as bone with excessive force.<sup>[5]</sup> Harder objects require a longer contraction of the masseter muscle which exerts a greater the force on teeth.<sup>[5]</sup>

Talim and Gohil identified betel nut chewing, inadvertent biting of lead shot, cherry stones, and “granary” bread as potential etiological factors associated with coronal fractures of posterior teeth in an Indian population.<sup>[6]</sup>

Patel and Burke have examined specific foods that are associated with tooth fracture and attempted to correlate

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### ABSTRACT

**Objectives:** This preliminary study seeks to determine the relationship between fractured teeth, restorations, prostheses, and specific dietary practices.

**Methodology:** Anonymous questionnaires were randomly distributed to a convenience sample of Trinidadian adults at various locations around the country, after gaining consent. Data were analyzed using the software; Statistical Package for the Social Sciences for significant associations between various types of food and broken teeth or prosthesis using odds ratios.

**Results:** Three hundred questionnaires were completed. Seventy-five percent of the patients preferred crunchy or hard foods and 51% of the respondents liked crushing bones, mostly chicken bones. It was observed that respondents with a dietary preference for fried whole chana, split chana, crab, and sugarcane were significantly associated with broken dentures. Respondents eating whole chana also had a significant association with broken teeth and broken dentures. Associations were found between some dietary preferences, ethnicities, and age groups.

**Conclusions:** Significant associations between age, ethnicity, sex, and certain dietary practices and habits were found. There also appears to be a significant relationship between patients with fractured teeth, restorations, and prostheses with certain dietary preferences.

**KEYWORDS:** Dietary influences, ethnic food, fractured prosthesis, fractured teeth, oral habits

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the incidence of fractured teeth with the compressive strengths of certain foods.<sup>[7]</sup> The influence of various dietary-related parameters and tooth geometry on the failure modes of teeth have also been studied, and it was determined that the nature of catastrophic tooth fracture is associated with dietary habits and food characteristics such as the food particles' size and their mechanical properties.<sup>[8]</sup>

Patients in the Caribbean island of Trinidad often present to the dentist with complete or incomplete cracked teeth fractured restorations and prostheses. Patients also give a concurrent or recent history of biting hard food such as bones. A large part of Trinidadian culture is the diversity of prepared culinary dishes that utilize a wide variety of ingredients including various cuts of meat of both reared and wild animals.<sup>[9]</sup> There is anecdotal evidence that generally, the population appears to relish crushing ice, bones, traditional sweets, and other foods that have been prepared in such a way to make them hard and crunchy.

As part of a comprehensive management strategy, patients who present with fractured teeth, restorations, or prostheses in Trinidad are often advised to avoid all hard foods by oral health-care practitioners using such anecdotal evidence with no scientific basis for such advice. There are no data that show how much of the population actually engage in biting or crushing hard foodstuffs specific to the national diet. It is, therefore, difficult to ascertain whether such conditions are due primarily to patients' diets, parafunctional habits or faulty restorations, or a combination of all these factors. The aim of this study seeks to (i) give preliminary data on the prevalence of specific dietary practices related to the biting or crushing of hard foods during normal chewing cycles and if these practices are associated with fractured teeth, restorations, or prostheses and (ii) the reported prevalence of fractured teeth/prostheses. Our null hypotheses stated that there would be no significant associations associated with biting on any type of food and fracture of teeth or prostheses.

**METHODOLOGY**

A questionnaire was developed before data collection. The questionnaire had questions related to the respondent's dietary preferences with respect to hard foods common to the Trinidadian diet. There were also questions related to reporting of fractured teeth, restorations, and prostheses [Questionnaire]. The questionnaire was subjected to a face validity exercise during a pilot phase. Content specialists and potential respondents gave feedback on the exclusion and inclusion of items on the questionnaire. The questionnaire had an open-ended section for

respondents to identify any other habits that might exert high biting forces on the dentition other than food.

A power analysis determined a minimum of 300 respondents, who were required to ensure statistical robustness. Ethical approval was granted by the Ethics Committee of the Faculty of Medical Sciences, The University of the West Indies (Approval letter CEC197/05/16) before administration of the questionnaire to potential respondents. The questionnaire was anonymously administered over a 2-month period to a random sample of adult Trinidadian persons 18 years and older, throughout various locations throughout Trinidad after gaining written informed consent from each of the prospective respondents. The sample population consisted of university students and dental patients attending the Dental Polyclinic at the School of Dentistry and dental patients from various randomly selected private practices throughout the country. Data were collated and analyzed using SPSS® 17.0 Statistical Software (SPSS Inc., Chicago, Illinois, USA) for signification associations using odds ratios.

**RESULTS**

Three hundred responses were obtained. Basic demographic information for the respondents is shown in Figure 1. Nearly 37.7% of the respondents reported ever having had a broken tooth. Of those wearing dentures, 46% reported having a broken denture on at least one occasion and 23% reported having a tooth broken off a denture on a least one occasion.

The relative percentages of respondents indicating the preferred specific food(s) are shown in Figure 2. Of the total respondents, 75% of respondents reported a preference for crunchy foods. Fifty-one percent of respondents liked crushing bones. The specific types of bones commonly crushed are presented in Figure 3. Patients who reported a dietary preference for whole chana were at a significantly higher risk for having broken teeth, broken dentures, and broken teeth off dentures [Table 1]. A dietary preference for whole

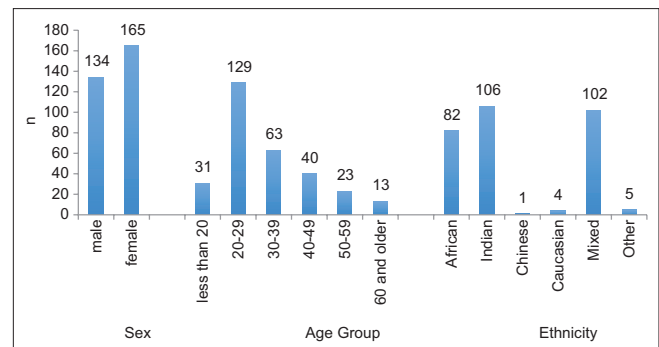
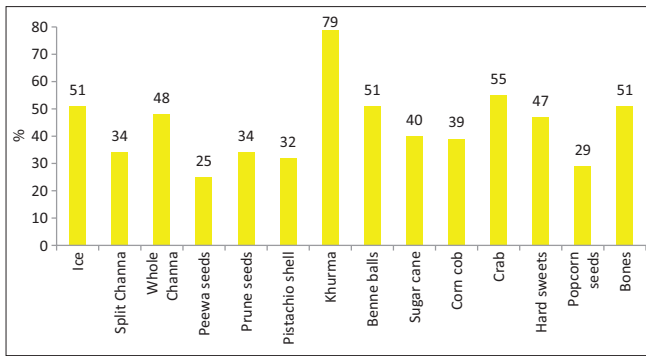


Figure 1: Demographic details of the sampled population



**Figure 2:** Graph showing relative number of respondents with a preference for crushing specific hard foods

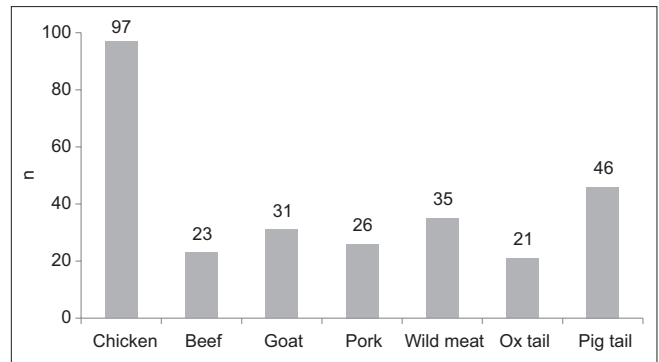
fried split chana (yellow lentils) was associated with a significantly higher risk for a broken denture [Table 1]. Patients with dietary preferences for crushing crab shells or chewing on sugarcane were associated with a significantly higher risk for broken denture teeth. Persons of East Indian ethnicity were significantly associated with crushing of whole chana when compared to other ethnicities [Table 1]. Younger age groups (<20 years) were significantly associated with a preference for crushing hard candy. Conversely, older age groups (>30 years) were significantly associated with a preference for harder more traditional sweets such as Benne balls and Khurma and various types of bones [Table 2]. With respect to crushing bones, respondents showed a significant preference for chewing chicken bones compared to bones of other types of meat ( $P < 0.0001$ ) [Figure 3]. Persons of mixed ethnicity demonstrated a significant preference of crushing bones of pork and ox-tail compared to other ethnicities [Table 3]. Males showed a significant preference for crushing bones from goat and wild meat compared to females [Table 3]. No significant differences were discovered between the occurrence of fractures in both the younger and older age groups.

There was a significant association of younger persons using their teeth to open bottles with metal or plastic caps. Males were significantly associated with opening of metal bottle caps when compared to females [Table 4].

No significant associations were found with a history of fractured teeth or prostheses when other foods and habits were examined. There were also no significant associations with respect to ethnicity and sex and other types of investigated food.

**DISCUSSION**

The null hypothesis had to be partially rejected since significant associations were found between certain foods, such as chana, split chana, crab, and sugarcane, and broken teeth and/or dentures.



**Figure 3:** Graph showing the preferences for various types of bones among the respondents

**Table 1: Statistical significances trends observed for various crunchy foods**

Foodstuff	Variable	P	OR	95% CI
Whole	Broken tooth	0.00	1.76	1.10-2.84
Chana	Broken denture	0.00	0.38	0.20-0.71
	Broken denture tooth	0.03	0.47	0.30-0.76
	East Indian versus other ethnicities	0.01	1.33	1.08-1.64
Split Chana	Broken denture tooth	0.01	0.50	0.31-0.82
Crab	Broken denture tooth	0.02	0.42	0.25-0.71
Sugarcane	Broken denture tooth	0.00	0.06	0.01-0.44

OR=Odds ratio, CI=Confidence interval

**Table 2: Significant associations between hard candy eaters and age group**

Foodstuff	Variable	P	OR	95% CI
Hard Candy	<20 years versus 20 years and older	0.00	1.56	1.20-2.01
Khurma	<30 years versus 30 years and older	0.00	1.76	1.10-2.84
Benne balls	<30 years versus 30 years and older	0.00	0.71	0.58-0.90
Bones	<30 years versus 30 years and older	0.00	0.66	0.53-0.82

OR=Odds ratio, CI=Confidence interval

**Table 3: Significant associations between crushing bones and ethnicity/sex**

Bone type	Variable	P	OR	95% CI
Pork	Mixed race versus other ethnicities	0.04	1.69	0.99-2.89
Ox-tail	Mixed race versus other ethnicities	0.05	1.78	0.97-3.28
Goat	Males versus females	0.02	0.58	0.36-0.94
Wild meat	Males versus females	0.01	0.59	0.39-0.91

OR=Odds ratio, CI=Confidence interval

This preliminary investigation seeks to understand the relationship between the prevalence of specific dietary and oral practices related to the biting and crushing of hard foods and/or objects and the occurrence of fractured teeth, restoration, or prostheses. This research project utilized a convenience sample and must be interpreted with caution. Nevertheless, it gives an indication of dietary practices and habits of some of the population. The age groups ranged from 18 to 60 years and above with the majority of respondents falling in the age range

**Table 4: Significant association between oral habits and age/sex**

Habit	Variable	P	OR	95% CI
Opening bottles with metal caps	<20 years versus 20 years and older	0.02	2.12	1.23-3.66
Opening bottles with plastic caps	<20 years versus 20 years and older	0.04	1.62	1.05-2.50
Opening bottles with metal caps	Males versus females	0.00	0.35	0.21-0.60

OR=Odds ratio, CI=Confidence interval

of 20–29 years. This would be expected in this sampling method since a large proportion of the total sample was university students. This is noteworthy since respondents in such a sampling would have more pairs of functional, occluding teeth compared to older respondents where loss of posterior support, due to tooth loss, could be a confounding factor in the fracture of remaining teeth.

The ethnic breakdown of the respondents closely mirrored that of the overall Trinidadian population. The diversity of various ethnic groups is reflected in the variety of foods that are consumed and included in this study. Foods such as whole chana (fried chickpeas), split chana (fried yellow lentil peas), and khurma (crispy fried sweet dough glazed with granulated sugar) were introduced by the East Indian population and are usually eaten as snacks. Benne ball (a sweet spherical-shaped sweet made of sesame seeds and dark molasses) and crab dishes were introduced by Afro-Trinidadian descendants of African slaves. Twenty-six percent of respondents favored khurma. It was a personal preference among East Indian respondents over 30 years of age.

Fifty one percent of the sampled population crushed bones. Researchers have theorized the habit of chewing bones as part of natural evolutionary biology. The nutrients gained from bone marrow are highly digestible and have been associated with larger brain sizes of early humanoids.<sup>[10]</sup> The propensity for bone chewing may be a vestige of such evolutionary behavior. Nearly 97% of the respondents that chewed bones, preferred chicken bones as opposed to all other types of bones ( $P < 0.0001$ ). This is possibly due to the relative softness of chicken bones compared to other types of bones and the ease at which it could be chewed.

Contrary to the research done by Trushkowsky which concluded that the chewing of bones can be harmful to the oral cavity in terms of cracked and fractured teeth, this was unsupported by this study.<sup>[5]</sup> A plausible explanation could be the disparity in the spread of age ranges within the sample population. Fracture of teeth is normally a catastrophic event that occurs after many cycles (years) of fatigue as a result of continuous chewing.<sup>[11]</sup> The teeth of this younger population would not have yet been subjected to the critical amount of fatigue cycles. In addition, younger persons with more

pairs of occluding teeth can more evenly distribute chewing forces across the dentition, minimizing the risk of catastrophic fracture of teeth. Younger persons would also less likely have teeth that are heavily restored and that are at an increased risk of fracture. Given this explanation, the finding that there was no significance in the reported incidence of fractures between young and older age groups was also unexpected. This, however, could be explained, statistically with the numbers of persons over 40 years only making up 25% of the entire sample.

It was a noteworthy finding that foods with a spherical or cylindrical cross-section; chana, Benne balls, crab, and fresh cane were significantly associated with broken dentures or broken denture teeth. Chana specifically was highly significantly associated with broken teeth. The authors postulated that food items with such configurations can span opposing convex surfaces of triangular ridges of teeth with wedging forces and initiate crack formation. Hard objects often initiate cracks in teeth as a result of the high masticatory forces required to crush such foods.<sup>[11]</sup> The impact strength of denture bases made of polymethyl methacrylate is poor compared to metal denture frameworks, and dentures could be easily broken when subjected to higher masticatory forces.<sup>[12]</sup>

The fact that there is a high prevalence of cracked teeth and prostheses in people of Indian descent only was unexpected because it is assumed that the large diversity of the population and the exposure of all people to the dietary cultural practices of various ethnicities would lead to the adoption, in part, of the dietary practices of other ethnicities. Further research needs to be centered on the inclusion of a robust clinical examination and a more detailed patient questionnaire into the study protocol, since these were not included in the current methodology and is the major limitation of the current study. Such examination should include specifically the broken teeth, at the time of fracture, to determine the extent of fracture, whether the tooth was previously restored, the approximate size of the cavity preparation, and material used to restore cavity preparations. The questionnaire would illicit information regarding parafunctional habits. In addition, patients wearing dentures would have dentures critically examined to ascertain whether denture

design or material factors could have contributed to failure.

## CONCLUSIONS

Significant associations between age, ethnicity, sex, and certain dietary practices and habits were found. There also appears to be a significant relationship between patients with fractured teeth, restorations, and prostheses with certain dietary preferences. These results can be used to inform future studies to determine the forces needed to cause such damage and the role that hard foods play in tooth fractures.

## FINANCIAL SUPPORT AND SPONSORSHIP

Nil.

## CONFLICTS OF INTEREST

There are no conflicts of interest.

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## QUESTIONNAIRE

1. Age \_\_\_\_\_
2. Sex: Male (1)  Female (0)
3. Identified Ethnicity
  - African (1)
  - Indian (2)
  - Chinese (3)
  - Caucasian (4)
  - Mixed (5)
  - Other (6)

Do you wear/have any of the following:

4. Complete Dentures Yes  No
5. Partial Dentures Yes  No
6. Crowns Yes  No
7. Bridges Yes  No
8. Implants Yes  No

Have you ever had any of the following?

9. Broken tooth? Yes  No
10. Broken Fillings? Yes  No
11. Broken Denture Yes  No
12. Broken tooth off denture? Yes  No
13. Broken Crown? Yes  No
14. Broken Bridge? Yes  No
15. Do you like crunchy/hard foods? Yes  No

Do you like biting on any of the following?

16. Ice Yes  No
17. Split Chana Yes  No
18. Whole Chana Yes  No
19. Peewa seeds Yes  No
20. Prune/Salt prune seeds Yes  No
21. Pistachio shell Yes  No
22. Khurma Yes  No
23. Benne Balls Yes  No
24. Ripping Sugar Cane Yes  No
25. Corn husk Yes  No
26. Crab Yes  No
27. Mints/Hard Candy Yes  No
28. Popcorn seeds Yes  No
29. Are you vegetarian? Yes  No

If the answer to 26 is no, please go to question 38

30. Do you bite bones? Yes  No

If the answer to 27 was yes, then what kind?

31. Chicken Yes  No
32. Beef Yes  No
33. Goat Yes  No
34. Pork Yes  No
35. Wild meat Yes  No
36. Ox tail Yes  No
37. Pig tail Yes  No

38. Please list any other hard foods you like to bite/crush

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Do you use your teeth to do any of the following?

39. Open bottles with metal caps? Yes  No

40. Open bottles with plastic caps? Yes  No

41. Open paper envelopes? Yes  No

42. Open plastic packaging? Yes  No

43. Please list any other things you use your teeth for other than biting into foods?

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