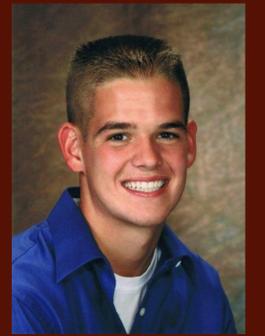




# Childhood Caries and Sweetened Beverages

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## Abstract

Break down in the tooth enamel (decay) occurs when susceptible tooth surfaces are exposed to acids produced when bacteria in the mouth are exposed to sugars or starches (fermentable carbohydrates) in food and beverages that we consume. The normal pH in the mouth drops from a neutral range to an acidic level and these conditions persist for up to 30 minutes after finishing a meal or beverage. Recurrent decay, adjacent to dental fillings, results from this same exposure. Therefore, one might expect that the more frequently a person consumes sugar-containing foods and beverages the higher their rate of both dental decay and/or number of dental fillings they will have. **Methods:** This cross sectional study included 84 subjects between the ages of 4 and 12 years of age who had class I or class II dental fillings. This study had IRB approval from the University of Minnesota Human Research Protection Program. All subjects 8 years of age and older provided assent and informed consent was obtained from each child's legal guardian, regardless of age, before any study procedures were conducted. Each child, along with their guardian, was queried about their typical daily dietary habits, including the types and number of beverages they consume. A dental examination was performed and all fillings and/or decayed surfaces were recorded. Correlations between dietary habits and decay experience were calculated. **Results:** The results from the data analyses showed that there wasn't a definite linear relationship ( $r^2$  value) between the number of sweetened beverages and the number of decayed and/or filled tooth surfaces (dfs). This study also shows that even a more comprehensive multifactorial risk assessment as defined by the Caries Management by Risk Assessment (CAMBRA) model does not correlate to the extent of the disease. **Conclusions:** This study illustrates that dental caries is a multi-factorial disease and it is difficult to find linear/predictive conclusions when using a single variables and current multifactorial models.

## Introduction

In our society there has been a problem of increased decay in primary teeth (baby teeth). The increased consumption of sweetened beverages such as: soda, juices, and flavored milk is believed to be associated with this phenomenon. There have been a number of public initiatives, such as the "Sip all Day get Decay" campaign from the Minnesota Dental Association that have focused on raising public awareness as to how much sugar is actually contained in some of the most commonly consumed beverages. This study examines the correlation of sweetened beverage consumption with the number of decayed and /or filled tooth surfaces (dfs) in 4 to 12 year olds who have a history of dental decay. We also calculated each child's caries risk using the Caries Management by Risk Assessment (CAMBRA).

## Research Objective

**Objective:** The purpose of this study was to compare the number of decayed and/or filled tooth surfaces (dfs) with the average number of self-reported sweetened beverages consumed on a daily basis.

## Methods

### Patient Population:

A convenience sample of 84 qualifying subjects between the ages of 4 and 12 were recruited from the University of Minnesota School of Dentistry and community dental offices.

### Study Design:

- This was a cross sectional study.

### Study Procedures:

- Participants' guardians read the informed consent documents; the study procedures were discussed, and accepting guardians provided consent.
- Participants 8 years of age and older read the informed "assent" documents; the study procedures were discussed, and accepting subjects provided assent; this was in addition to the consent provided by their guardian.
- Subjects received an oral examination to determine and record the dfs and also any active lesions.
- The subjects, with the help of their guardians, completed the dietary assessment and CAMBRA assessment forms.

### Dietary Assessment (figure 1):

- This instrument was adapted from Teresa Marshall's dietary form from the University of Iowa
- Prior to collecting the dietary habits subjects were told that the most important part of the dietary information was that it was what they "really" do rather than what they thought was "ideal" and that there were no "wrong" or "right" answers.
- The form was then completed with the guardian/subject

### CAMBRA Assessment (figure 2):

- The practitioner went through the CAMBRA assessment form with the subject and guardian to obtain an overall caries risk assessment of the subject.
- The CAMBRA index, from Dr. John D.B. Featherstone, is used to determine individual caries risk.

Once finished, each subject received a \$100 gift card to Target and their parking was paid for.

### Data Analysis:

- Made compilation of total sweetened drinks by combining number of chocolate milk, soda, and juice drinks; then compared the total sweetened drinks to dfs and the CAMBRA data.
- Compiled graph from scatter plotting single variables against each other and trying to find a predictive r-squared value or correlation.

Dietary Assessment (Figure 1)		CAMBRA Assessment (Figure 2)	
Food and Drink Cavity Risk		Caries Risk Assessment Form - Children Age 6 and Over/Adults	
Year Child's Diet	Current Behavior	For Example	Assessment Date by the (please check) (last line) or (last)
Risk Factors	Total # Meals	Breakfast, lunch or dinner	YES = CIRCLE YES = CIRCLE YES = CIRCLE
MEALS & SNACKS	Total # Snacks	Any other times child eats food	1. Does not eat or inadequate portion of the diet
	# School provided Meals and Snacks	Breakfast/Lunch program	2. Inadequate portion of total energy
MEAL PATTERNS	Eats at about the same times each day	Yes/No	3. Inadequate portion of total protein
	Food or Drink at Regular Times	Yes/No	4. Inadequate portion of total fat
BEVERAGES	List 3 most common beverages consumed:	Bal. Diet	5. Inadequate portion of total calcium
	1. Soda	Yes/No	6. Inadequate portion of total iron
	2. Juice	Yes/No	7. Inadequate portion of total potassium
	3. Milk	Yes/No	8. Inadequate portion of total phosphorus
	4. Other	Yes/No	9. Inadequate portion of total zinc
	5. Water	Yes/No	10. Inadequate portion of total magnesium
	6. Tea	Yes/No	11. Inadequate portion of total copper
	7. Coffee	Yes/No	12. Inadequate portion of total selenium
	8. Other	Yes/No	13. Inadequate portion of total iodine
	9. Other	Yes/No	14. Inadequate portion of total manganese
	10. Other	Yes/No	15. Inadequate portion of total boron
	11. Other	Yes/No	16. Inadequate portion of total molybdenum
	12. Other	Yes/No	17. Inadequate portion of total vanadium
	13. Other	Yes/No	18. Inadequate portion of total chromium
	14. Other	Yes/No	19. Inadequate portion of total cobalt
	15. Other	Yes/No	20. Inadequate portion of total nickel
	16. Other	Yes/No	21. Inadequate portion of total silicon
	17. Other	Yes/No	22. Inadequate portion of total sulfur
	18. Other	Yes/No	23. Inadequate portion of total phosphorus
	19. Other	Yes/No	24. Inadequate portion of total chlorine
	20. Other	Yes/No	25. Inadequate portion of total bromine
	21. Other	Yes/No	26. Inadequate portion of total fluorine
	22. Other	Yes/No	27. Inadequate portion of total calcium
	23. Other	Yes/No	28. Inadequate portion of total magnesium
	24. Other	Yes/No	29. Inadequate portion of total potassium
	25. Other	Yes/No	30. Inadequate portion of total sodium
	26. Other	Yes/No	31. Inadequate portion of total zinc
	27. Other	Yes/No	32. Inadequate portion of total iron
	28. Other	Yes/No	33. Inadequate portion of total copper
	29. Other	Yes/No	34. Inadequate portion of total manganese
	30. Other	Yes/No	35. Inadequate portion of total selenium
	31. Other	Yes/No	36. Inadequate portion of total iodine
	32. Other	Yes/No	37. Inadequate portion of total bromine
	33. Other	Yes/No	38. Inadequate portion of total fluorine
	34. Other	Yes/No	39. Inadequate portion of total calcium
	35. Other	Yes/No	40. Inadequate portion of total magnesium
	36. Other	Yes/No	41. Inadequate portion of total potassium
	37. Other	Yes/No	42. Inadequate portion of total sodium
	38. Other	Yes/No	43. Inadequate portion of total zinc
	39. Other	Yes/No	44. Inadequate portion of total iron
	40. Other	Yes/No	45. Inadequate portion of total copper
	41. Other	Yes/No	46. Inadequate portion of total manganese
	42. Other	Yes/No	47. Inadequate portion of total selenium
	43. Other	Yes/No	48. Inadequate portion of total iodine
	44. Other	Yes/No	49. Inadequate portion of total bromine
	45. Other	Yes/No	50. Inadequate portion of total fluorine
	46. Other	Yes/No	51. Inadequate portion of total calcium
	47. Other	Yes/No	52. Inadequate portion of total magnesium
	48. Other	Yes/No	53. Inadequate portion of total potassium
	49. Other	Yes/No	54. Inadequate portion of total sodium
	50. Other	Yes/No	55. Inadequate portion of total zinc
	51. Other	Yes/No	56. Inadequate portion of total iron
	52. Other	Yes/No	57. Inadequate portion of total copper
	53. Other	Yes/No	58. Inadequate portion of total manganese
	54. Other	Yes/No	59. Inadequate portion of total selenium
	55. Other	Yes/No	60. Inadequate portion of total iodine
	56. Other	Yes/No	61. Inadequate portion of total bromine
	57. Other	Yes/No	62. Inadequate portion of total fluorine
	58. Other	Yes/No	63. Inadequate portion of total calcium
	59. Other	Yes/No	64. Inadequate portion of total magnesium
	60. Other	Yes/No	65. Inadequate portion of total potassium
	61. Other	Yes/No	66. Inadequate portion of total sodium
	62. Other	Yes/No	67. Inadequate portion of total zinc
	63. Other	Yes/No	68. Inadequate portion of total iron
	64. Other	Yes/No	69. Inadequate portion of total copper
	65. Other	Yes/No	70. Inadequate portion of total manganese
	66. Other	Yes/No	71. Inadequate portion of total selenium
	67. Other	Yes/No	72. Inadequate portion of total iodine
	68. Other	Yes/No	73. Inadequate portion of total bromine
	69. Other	Yes/No	74. Inadequate portion of total fluorine
	70. Other	Yes/No	75. Inadequate portion of total calcium
	71. Other	Yes/No	76. Inadequate portion of total magnesium
	72. Other	Yes/No	77. Inadequate portion of total potassium
	73. Other	Yes/No	78. Inadequate portion of total sodium
	74. Other	Yes/No	79. Inadequate portion of total zinc
	75. Other	Yes/No	80. Inadequate portion of total iron
	76. Other	Yes/No	81. Inadequate portion of total copper
	77. Other	Yes/No	82. Inadequate portion of total manganese
	78. Other	Yes/No	83. Inadequate portion of total selenium
	79. Other	Yes/No	84. Inadequate portion of total iodine
	80. Other	Yes/No	85. Inadequate portion of total bromine
	81. Other	Yes/No	86. Inadequate portion of total fluorine
	82. Other	Yes/No	87. Inadequate portion of total calcium
	83. Other	Yes/No	88. Inadequate portion of total magnesium
	84. Other	Yes/No	89. Inadequate portion of total potassium
	85. Other	Yes/No	90. Inadequate portion of total sodium
	86. Other	Yes/No	91. Inadequate portion of total zinc
	87. Other	Yes/No	92. Inadequate portion of total iron
	88. Other	Yes/No	93. Inadequate portion of total copper
	89. Other	Yes/No	94. Inadequate portion of total manganese
	90. Other	Yes/No	95. Inadequate portion of total selenium
	91. Other	Yes/No	96. Inadequate portion of total iodine
	92. Other	Yes/No	97. Inadequate portion of total bromine
	93. Other	Yes/No	98. Inadequate portion of total fluorine
	94. Other	Yes/No	99. Inadequate portion of total calcium
	95. Other	Yes/No	100. Inadequate portion of total magnesium
	96. Other	Yes/No	101. Inadequate portion of total potassium
	97. Other	Yes/No	102. Inadequate portion of total sodium
	98. Other	Yes/No	103. Inadequate portion of total zinc
	99. Other	Yes/No	104. Inadequate portion of total iron
	100. Other	Yes/No	105. Inadequate portion of total copper
	101. Other	Yes/No	106. Inadequate portion of total manganese
	102. Other	Yes/No	107. Inadequate portion of total selenium
	103. Other	Yes/No	108. Inadequate portion of total iodine
	104. Other	Yes/No	109. Inadequate portion of total bromine
	105. Other	Yes/No	110. Inadequate portion of total fluorine
	106. Other	Yes/No	111. Inadequate portion of total calcium
	107. Other	Yes/No	112. Inadequate portion of total magnesium
	108. Other	Yes/No	113. Inadequate portion of total potassium
	109. Other	Yes/No	114. Inadequate portion of total sodium
	110. Other	Yes/No	115. Inadequate portion of total zinc
	111. Other	Yes/No	116. Inadequate portion of total iron
	112. Other	Yes/No	117. Inadequate portion of total copper
	113. Other	Yes/No	118. Inadequate portion of total manganese
	114. Other	Yes/No	119. Inadequate portion of total selenium
	115. Other	Yes/No	120. Inadequate portion of total iodine
	116. Other	Yes/No	121. Inadequate portion of total bromine
	117. Other	Yes/No	122. Inadequate portion of total fluorine
	118. Other	Yes/No	123. Inadequate portion of total calcium
	119. Other	Yes/No	124. Inadequate portion of total magnesium
	120. Other	Yes/No	125. Inadequate portion of total potassium
	121. Other	Yes/No	126. Inadequate portion of total sodium
	122. Other	Yes/No	127. Inadequate portion of total zinc
	123. Other	Yes/No	128. Inadequate portion of total iron
	124. Other	Yes/No	129. Inadequate portion of total copper
	125. Other	Yes/No	130. Inadequate portion of total manganese
	126. Other	Yes/No	131. Inadequate portion of total selenium
	127. Other	Yes/No	132. Inadequate portion of total iodine
	128. Other	Yes/No	133. Inadequate portion of total bromine
	129. Other	Yes/No	134. Inadequate portion of total fluorine
	130. Other	Yes/No	135. Inadequate portion of total calcium
	131. Other	Yes/No	136. Inadequate portion of total magnesium
	132. Other	Yes/No	137. Inadequate portion of total potassium
	133. Other	Yes/No	138. Inadequate portion of total sodium
	134. Other	Yes/No	139. Inadequate portion of total zinc
	135. Other	Yes/No	140. Inadequate portion of total iron
	136. Other	Yes/No	141. Inadequate portion of total copper
	137. Other	Yes/No	142. Inadequate portion of total manganese
	138. Other	Yes/No	143. Inadequate portion of total selenium
	139. Other	Yes/No	144. Inadequate portion of total iodine
	140. Other	Yes/No	145. Inadequate portion of total bromine
	141. Other	Yes/No	146. Inadequate portion of total fluorine
	142. Other	Yes/No	147. Inadequate portion of total calcium
	143. Other	Yes/No	148. Inadequate portion of total magnesium
	144. Other	Yes/No	149. Inadequate portion of total potassium
	145. Other	Yes/No	150. Inadequate portion of total sodium
	146. Other	Yes/No	151. Inadequate portion of total zinc
	147. Other	Yes/No	152. Inadequate portion of total iron
	148. Other	Yes/No	153. Inadequate portion of total copper
	149. Other	Yes/No	154. Inadequate portion of total manganese
	150. Other	Yes/No	155. Inadequate portion of total selenium
	151. Other	Yes/No	156. Inadequate portion of total iodine
	152. Other	Yes/No	157. Inadequate portion of total bromine
	153. Other	Yes/No	158. Inadequate portion of total fluorine
	154. Other	Yes/No	159. Inadequate portion of total calcium
	155. Other	Yes/No	160. Inadequate portion of total magnesium
	156. Other	Yes/No	161. Inadequate portion of total potassium
	157. Other	Yes/No	162. Inadequate portion of total sodium
	158. Other	Yes/No	163. Inadequate portion of total zinc
	159. Other	Yes/No	164. Inadequate portion of total iron
	160. Other	Yes/No	165. Inadequate portion of total copper
	161. Other	Yes/No	166. Inadequate portion of total manganese
	162. Other	Yes/No	167. Inadequate portion of total selenium
	163. Other	Yes/No	168. Inadequate portion of total iodine
	164. Other	Yes/No	169. Inadequate portion of total bromine
	165. Other	Yes/No	170. Inadequate portion of total fluorine
	166. Other	Yes/No	171. Inadequate portion of total calcium
	167. Other	Yes/No	172. Inadequate portion of total magnesium
	168. Other	Yes/No	173. Inadequate portion of total potassium
	169. Other	Yes/No	174. Inadequate portion of total sodium
	170. Other	Yes/No	175. Inadequate portion of total zinc
	171. Other	Yes/No	176. Inadequate portion of total iron
	172. Other	Yes/No	177. Inadequate portion of total copper
	173. Other	Yes/No	178. Inadequate portion of total manganese
	174. Other	Yes/No	179. Inadequate portion of total selenium
	175. Other	Yes/No	180. Inadequate portion of total iodine
	176. Other	Yes/No	181. Inadequate portion of total bromine
	177. Other	Yes/No	182. Inadequate portion of total fluorine
	178. Other	Yes/No	183. Inadequate portion of total calcium
	179. Other	Yes/No	184. Inadequate portion of total magnesium
	180. Other	Yes/No	185. Inadequate portion of total potassium
	181. Other	Yes/No	186. Inadequate portion of total sodium
	182. Other	Yes/No	187. Inadequate portion of total zinc
	183. Other	Yes/No	188. Inadequate portion of total iron
	184. Other	Yes/No	189. Inadequate portion of total copper
	185. Other	Yes/No	190. Inadequate portion of total manganese
	186. Other	Yes/No	191. Inadequate portion of total selenium
	187. Other	Yes/No	192. Inadequate portion of total iodine
	188. Other	Yes/No	193. Inadequate portion of total bromine
	189. Other	Yes/No	194. Inadequate portion of total fluorine
	190. Other	Yes/No	195. Inadequate portion of total calcium
	191. Other	Yes/No	196. Inadequate portion of total magnesium
	192. Other	Yes/No	197. Inadequate portion of total potassium
	193. Other	Yes/No	198. Inadequate portion of total sodium
	194. Other	Yes/No	199. Inadequate portion of total zinc
	195. Other	Yes/No	200. Inadequate portion of total iron
	196. Other	Yes/No	201. Inadequate portion of total copper
	197. Other	Yes/No	202. Inadequate portion of total manganese
	198. Other	Yes/No	203. Inadequate portion of total selenium
	199. Other	Yes/No	204. Inadequate portion of total iodine
	200. Other	Yes/No	205. Inadequate portion of total bromine
	201. Other	Yes/No	206. Inadequate portion of total fluorine
	202. Other	Yes/No	207. Inadequate portion of total calcium
	203. Other	Yes/No	208. Inadequate portion of total magnesium
	204. Other	Yes/No	209. Inadequate portion of total potassium