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DIVISION OF RURAL HOME RESEARCH

**DENTAL DECAY AMONG TEXAS
SCHOOL CHILDREN**



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**In cooperation with U. S. Department of Agriculture.

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Among 6701 school children of Texas, dental decay was found in approximately 70 per cent of the white group, 65 per cent of the Mexican, and 45 per cent of the negro. The number of decayed teeth per child was greater among white children than among either Mexican or negro. One or more of the 6-year molars, the first permanent teeth, were decayed in about one-third of the children of each race. Among the white children however the 6-year molar constituted a smaller percentage of all decayed teeth than among Mexican or negro children.

More of the younger than the older children in San Antonio had decayed teeth, but among children in Brazos, Hidalgo, and Jefferson counties decayed teeth were more often found among the older than the younger ones. With all children the numbers having decayed 6-year molars increased rapidly with age up to 12 or 14 years.

Slightly more girls than boys in each race had decayed teeth.

The data secured in this study suggest a beneficial effect upon the teeth of liberal amounts of milk and a detrimental effect upon the teeth of excessive amounts of cereals and sweet foods in comparison with other foods.

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DENTAL DECAY AMONG TEXAS SCHOOL CHILDREN*

JESSIE WHITACRE

The observation is frequently made that dental decay or "caries" is the most widespread physical defect today. It has afflicted mankind for many generations; Howe (28) has observed that there has been little or no improvement in the condition in the last four or five decades. A vast amount of attention especially in the past ten years has been given to the subject of dental defects and their causes. Investigations include both numerous surveys and many experiments for which usually animals, but sometimes human beings, have served as subjects. Notwithstanding the extensive study of the problem no satisfactory solution has been reached.

Several current theories as to the cause of caries have entire or qualified support from some workers, and some of them opposition from others. Among these theories may be mentioned heredity (11, 38), bacterial action producing acid which in turn dissolves the enamel of the tooth (47, 9, 18, 14, 30, 27, 56), a systemic theory as opposed to localized agents (5, 3, 15, 28, 55, 6, 42), the acid-base balance theory applying sometimes to the blood stream, sometimes to the saliva, sometimes to the diet (6, 31, 32, 33, 34, 22, 23, 24, 37, 52, 40, 36), a poor diet according to current standards (7, 8, 29, 35), overabundance of cereals in the diet (22, 23, 24, 57, 45, 46, 50), and deficiency of particular nutrients as calcium, phosphorus, vitamin A, C, or D, (43, 17, 44, 25, 48, 41, 1, 26, 59, 12, 13, 19, 20, 21). Among most of the theories, there is general agreement that diet either directly or indirectly has much influence on the soundness of teeth. It is recognized that the influence of diet is not always immediately evident. Carious teeth in children who at a given time have a good diet may be the reflection of dietary inadequacies of some previous period, perhaps years earlier or even of prenatal malnutrition.

The tooth most susceptible to decay (4, 39) is the "first molar" or "6-year molar", so called because it appears at about the sixth year of age and is the first tooth of the permanent set to erupt. Calcification of the 6-year molar tooth is begun before birth and hence it is subject to both prenatal and postnatal nutritional influences. It is therefore exposed to the factors of decay for a longer period of time than any other tooth.

SOURCE OF DATA

Dental data were secured from two sources, first, the pupils of the schools of Brazos, Hidalgo, and Jefferson counties participating in the dietary study reported in Bulletin 489 (58), and, second, the pupils in three representative schools of San Antonio cooperating with the Division of Rural Home Research in a study of growth in height and weight of school children. These two groups of school children are hereafter called respectively the 3-county group and the San Antonio group.

*Submitted for publication February 22, 1934

In the first study the teeth of each child were examined by local dentists, using a mirror and explorer. At the same time, one of the observers made an entry on a chart showing which teeth, both temporary and permanent, were decayed or abscessed. The number of teeth which had been filled and of the permanent ones which had been extracted were recorded also. No distinction was made as to size of cavities. All teeth which had unfilled cavities, fillings, abscesses, and the permanent ones which had been extracted were regarded as carious. Each unsound tooth was counted only once even though it might have more than one defect, for example, both a filling and an unfilled cavity. In each mouth which was free from cavities, abscesses, and fillings, and had not lost any permanent teeth, the teeth were classified as sound.

In the second study, condition of the teeth was one item in the physical well-being of the pupils as judged by a pediatrician. A tongue depressor only (no mirror or dental explorer) was used in these inspections of the teeth, but the same criteria of defectiveness were used as in the first study.

INCIDENCE OF SOUND AND CARIOUS TEETH

Relation to Race and Sex

In both studies from which dental data are taken, white, Mexican, and negro children* were included, the entire number totalling 6701. Tables 1 and 2 show the great extent to which dental decay had attacked the children of the three races. Owing to the difference in the method used in the two studies to identify carious teeth, the findings have been tabulated separately according to method. The consistently higher average number of carious teeth per child among comparable groups of children examined with mirror and explorer than without them, indicates that the former method was the more searching. Nevertheless the interrelations of races with respect to carious teeth are concordant in the two studies, which are used jointly in making generalizations.

The best race record in both studies with respect to the proportion of children having one or more decayed teeth was held by the negroes, with approximately 45 per cent of their group affected; the Mexicans were second, with about 65 per cent affected; the white children were the worst, with about 70 per cent in the carious group. But there are no consistent race relationships which hold in the two studies with reference to percentage of children having decayed 6-year molars. With respect to the average number of carious teeth per child, less pronounced and less consistent race and sex differences appear, yet the greater extent of decay among white children as compared to that among either Mexican or negro is seen in the slightly higher average number of all carious teeth as well as of 6-year molars.

*The children included in this study, all citizens of the United States, have been classified into three groups, Mexicans, other whites, and negroes. As a matter of convenience, these groups are referred to as race groups, and for the sake of brevity in this Bulletin the designation "white" is used for the second of these groups.

Table 1. Summary by races of the incidence of sound and of carious teeth among Texas school children

How examined	Race	Sex	No. examined	Sound teeth			One of more carious teeth			Carious 6-yr. molars			Percentage of all carious teeth		
				Children		No. of teeth Av. per child	Children		No. of teeth Av. per child	Children		6-yr. molars	Other teeth		
				No.	Per cent		No.	Per cent		No.	Per cent			Total	
with mirror and explorer (3-county group)	White	Both	3742	1201	32.1	2541	67.9	9826	3.9	1695	45.3	4027	2.4	41.0	59.0
	Mexican	Both	289	121	41.9	168	58.1	462	2.8	104	36.0	219	2.1	47.4	52.6
	Negro	Both	895	486	54.3	409	45.7	1327	3.2	324	36.2	673	2.1	50.7	49.3
without mirror and explorer (San Antonio group)	White	Both	711	190	26.7	521	73.3	1549	3.0	237	33.3	471	2.0	30.4	69.6
	Mexican	Both	518	179	34.6	339	65.4	838	2.5	203	39.2	355	1.7	42.4	57.6
	Negro	Both	546	274	50.2	272	49.8	684	2.5	155	28.4	279	1.8	40.8	59.2

Table 2. Summary by sex in each race of the incidence of sound and of carious teeth among Texas school children

How examined	Race	Sex	No. examined	Sound teeth			One or more carious teeth			Carious 6-yr. molars			Percentage of all carious teeth			
				Children		No. of teeth Av. per child	Children		Per cent	Children		No. of teeth Av. per child	6-yr. molars	Other teeth		
				No.	Per cent		No.	Per cent		No.	Per cent				Total	Total
with mirror and explorer (3-county group)	White	Boys	1960	654	33.4	1806	66.6	5023	3.9	800	40.8	1932	2.4	38.5	61.5	
		Girls	1782	547	30.7	1235	69.3	4803	3.9	895	50.2	2095	2.3	43.6	56.4	
	Mexican	Boys	146	61	41.8	85	58.2	249	2.9	56	38.4	122	2.2	49.0	51.0	
		Girls	143	60	42.0	83	58.0	213	2.6	48	33.6	97	2.0	45.5	54.5	
	Negro	Boys	386	231	59.8	155	40.2	478	3.1	116	30.1	248	2.1	51.9	48.1	
		Girls	509	255	50.1	254	49.9	849	3.3	208	40.9	425	2.0	50.1	49.9	
	without mirror and explorer (San Antonio group)	White	Boys	362	92	25.4	270	74.6	780	2.9	115	31.8	217	1.9	27.8	72.2
			Girls	349	98	28.1	251	71.9	769	3.1	122	35.0	254	2.1	33.0	67.0
		Mexican	Boys	243	90	37.0	153	63.0	362	2.4	80	32.9	141	1.8	39.0	61.0
			Girls	275	89	32.4	186	67.6	476	2.6	123	44.7	214	1.7	45.0	55.0
		Negro	Boys	272	144	52.9	128	47.1	311	2.4	61	22.4	105	1.7	33.8	66.2
			Girls	274	130	47.4	144	52.6	373	2.6	94	34.3	174	1.9	46.6	53.4

From another viewpoint, however, the race relationships in the incidence of caries are reversed. The decayed 6-year molars among white children constitute a smaller percentage of the entire number of their decayed teeth than is true for either Mexicans or negroes of corresponding sex. Or, expressed otherwise, the excess of total caries among white children over that among Mexicans and negroes occurs more largely in the other teeth than in the 6-year molars. Apparently the 6-year molar was relatively a somewhat more vulnerable tooth among the Mexicans and negroes than the white children in the two studies reported here; or, the other teeth of the white children were relatively more vulnerable than were those of the Mexicans and negroes. Racial characteristics while probably having some weight in determining the proportion of children who succumb to caries may be less of a factor than is commonly supposed.

On the whole, though not uniformly (Table 2), the girls of the three races show somewhat higher percentages with decayed teeth than do the boys; but in one group of white children more boys than girls had one or more carious teeth, and in one of the Mexican groups percentages of the sexes having one or more carious teeth were equal, and more boys than girls had carious 6-year molars. The sex difference is too small, however, to be given serious consideration.

Number of Carious Teeth per Child

A distribution has been made for each of the three races of the children who had one or more carious teeth, according to the number of teeth involved per child. The occurrence of 1, 2, 3, and 4 carious 6-year molars has also been determined. Table 3 contains these data, and a graphic presentation of the percentage of children in each numerical class of carious teeth, from 1 tooth successively through 10, and for 11 or more teeth is given in Figures 1 and 2.

The most striking feature of these data as brought out in the graphs is the relatively larger proportion of the Mexican and negro groups having only 1 or 2 carious teeth as compared with the white children, among whom nearly as many had 3 or 4 carious teeth as had only 1 or 2. This race relationship holds both for "any tooth" and for the 6-year molars alone. The more frequent occurrence among white children than among either Mexican or negro of the higher numbers of carious teeth (5 or more) is readily seen in the graphs, especially in the 3-county group. The highest number of carious teeth in the mouth of a negro child (a girl of 18 years) was 10, of a Mexican (a boy of 9 years) 12, and of a white child (a boy of 18 years) 21. In these graphs as in the data given in Table 2, the small sex differences may be detected, the slightly worse record for carious teeth among the girls than the boys being more apparent with the 6-year molars than with "any tooth". The three largest sex differences are in the case of the negro children in the 3-county group having one decayed 6-year molar, and the Mexican and negro children in the San Antonio group having two decayed 6-year molars. The graphs also

further emphasize that the carious 6-year molars constitute a higher percentage of all carious teeth among negro and Mexican than among white children.

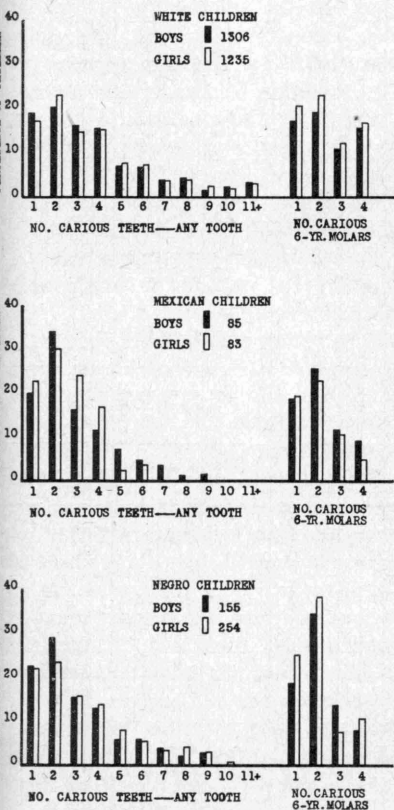


Fig. 1. Incidence of caries with respect to number of carious teeth per child. (3-county group.)

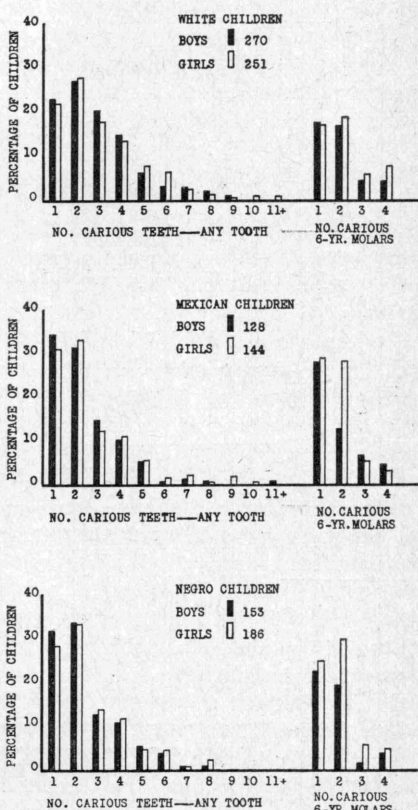


Fig. 2. Incidence of caries with respect to number of carious teeth per child. (San Antonio group.)

Relation to Age

The distribution of the children with carious teeth among year-of-age classes was made for boys and girls together, since sex difference in occurrence of caries was small and, since this procedure would provide larger numbers in the year-of-age classes, especially for the Mexicans and negroes. Data from the two studies were kept separate and are shown in Table 4. Figures 3, 4, and 5 present graphically the age incidence of carious teeth for the 7-year to 18-year groups inclusive for all groups composed of at least 24 individuals.

Table 4. Incidence of caries with reference to age

3-county group																
Age years	Sex	White children					Mexican children					Negro children				
		Total No.	With 1 or more carious teeth				Total No.	With 1 or more carious teeth				Total No.	With 1 or more carious teeth			
			Any tooth		6-yr. molar			Any tooth		6-yr. molar			Any tooth		6-yr. molar	
			No.	%	No.	%		No.	%	No.	%		No.	%	No.	%
6	Both	26	19		3		1	1				7	3			
7	Both	188	112	59.6	18	9.6	3	2		1		15	10		3	
8	Both	325	209	64.3	82	25.2	4	1				34	13	38.2	3	8.8
9	Both	389	264	67.9	140	36.0	17	8		2		51	16	31.4	9	17.6
10	Both	448	295	65.8	184	41.1	19	14		4		70	24	34.3	16	22.9
11	Both	375	255	68.0	201	53.6	24	12	50.0	7	29.2	93	29	31.2	21	22.5
12	Both	374	254	67.9	217	58.0	50	25	50.0	14	28.0	120	45	37.5	33	27.5
13	Both	400	270	67.5	221	55.3	53	26	49.1	22	41.5	105	40	38.1	27	25.7
14	Both	401	277	69.1	228	56.9	35	22	62.9	12	34.3	114	48	42.1	36	31.6
15	Both	315	225	71.4	158	50.2	34	20	58.8	17	50.0	86	42	48.8	16	18.6
16	Both	217	158	72.8	116	53.5	24	20	83.3	12	50.0	79	50	63.3	28	35.4
17	Both	160	114	71.3	79	49.4	17	13		10		64	50	78.1	22	34.4
18	Both	79	63	79.7	34	43.0	6	3		2		42	30	71.4	13	31.0
19	Both	31	15		8		1					9	5		1	
20	Both	13	11		6		1	1		1		6	4		2	
21	Both	1														
Total	Both	3742					289					895				

San Antonio Group

7	Both	23	15		3							3	1			
8	Both	83	65	78.3	8	9.6	5	5		2		17	12		2	
9	Both	128	98	76.6	36	28.1	32	27	84.4	14	43.8	50	33	66.0	11	22.0
10	Both	164	131	79.9	63	28.4	63	55	87.3	23	36.5	71	46	64.8	17	23.9
11	Both	192	136	70.8	81	42.2	98	64	65.3	37	37.8	66	31	47.0	21	31.8
12	Both	84	54	64.3	34	40.5	12 ⁵	77	61.6	52	41.6	66	32	48.5	20	30.3
13	Both	28	18	64.3	11	39.3	96	57	59.4	43	44.8	67	27	40.3	18	26.9
14	Both	8	4		1		57	34	59.6	21	35.6	63	34	54.0	29	46.0
15	Both	1					25	9	36.0	5	20.0	77	30	39.0	20	26.0
16	Both						16	11		6		43	16	37.2	10	23.3
17	Both											16	5		4	
18	Both						1					6	5		3	

For the 3-county group, the graphs for "any tooth" trend upward with age, the rise in percentage being much sharper for Mexican and negro than for white children, especially from age 13 years and over. At 16 years of age and above, the percentage of Mexican and negro children in this group having carious teeth was found to be as high as among white children. This evidence is contradictory to the usually unqualified superiority of tooth condition credited to the Mexican and negro children compared with white children. The percentage of children with carious 6-year molars increased rapidly up to 12, 13, or 14 years in each race; following this peak there was a fall in the percentage of white children having carious 6-year molars, but a further increase among later age groups of both the Mexican and negro children.

With reference to the occurrence of decay in "any tooth" in the San Antonio group the graphs for all three races have a downward trend, the percentage of children with one or more carious teeth decreasing with age. This relationship between age and caries in "any tooth" is opposite to that found in the 3-county group. The graphs for carious 6-year molar teeth found in the San Antonio group have the same general trend for all three races up to the age of peak incidence, as in the group from the three counties. After the peak of incidence, the graph for white children is similar in the two studies, downward with age, but for the Mexicans and negroes in the San Antonio group there is a consistent decline as contrasted with the later rise in the 3-county group. These differences in downward trend of any one graph for 6-year molars have been found to be statistically significant, the probable error of the frequency distribution being more than four times the difference in the neighboring frequencies.

From the graphs derived from the data of the one study it would seem that age of the child, or the length of time which the agents of decay have to act upon the teeth, may be one factor in determining the occurrence of caries; but the opposite trend of the age-caries graphs from the other study indicates that age cannot be the only factor. Since all three races in the San Antonio group show a decline with the age in the percentage of children with one or more decayed teeth, and in this respect are consistently in contrast with the corresponding races in the 3-county group, some common predisposing factor (or factors) among younger children and protective factor (or factors) among older children must have been operating in the San Antonio locality, that differed from those operating among the children in Brazos, Hidalgo, and Jefferson counties. The data of these two studies afford no clew to account for the differences found between the two groups of children. The three-day diet records kept by the children in San Antonio indicate that the average diet of this group is essentially like that of the children in the Brazos, Hidalgo, and Jefferson county group. San Antonio school physicians and elementary supervisors knew of no hygienic program in the school at or prior to the time of this study there that might have had an influence on the dental conditions found.

The marked susceptibility of the 6-year molar to decay in comparison

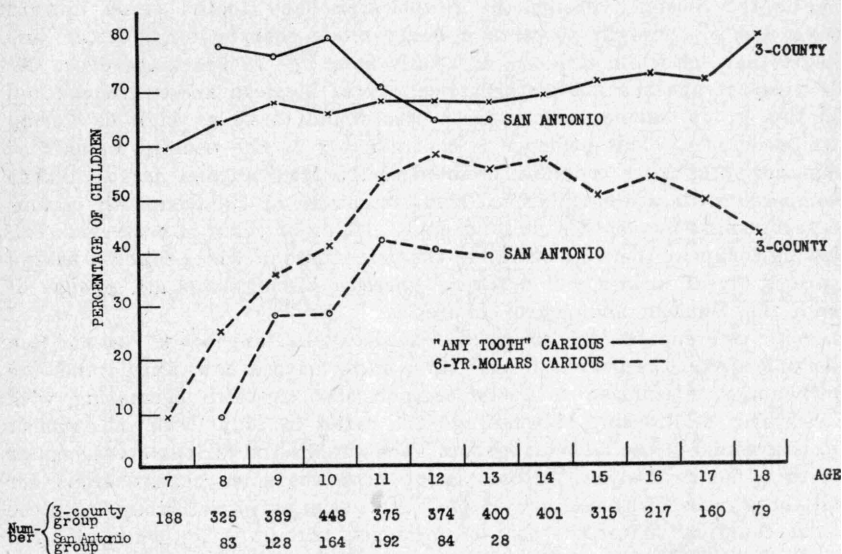


Fig. 3. Incidence of caries with reference to age—white children.

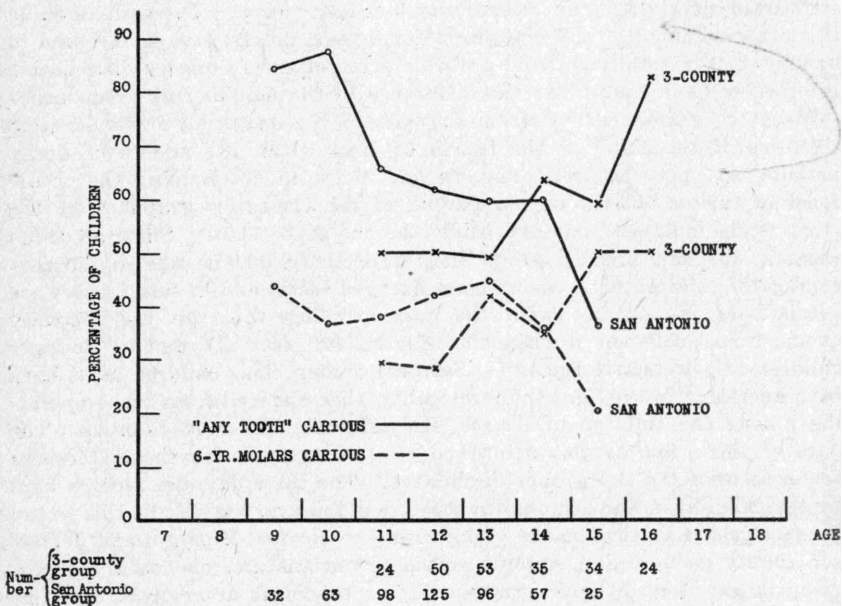
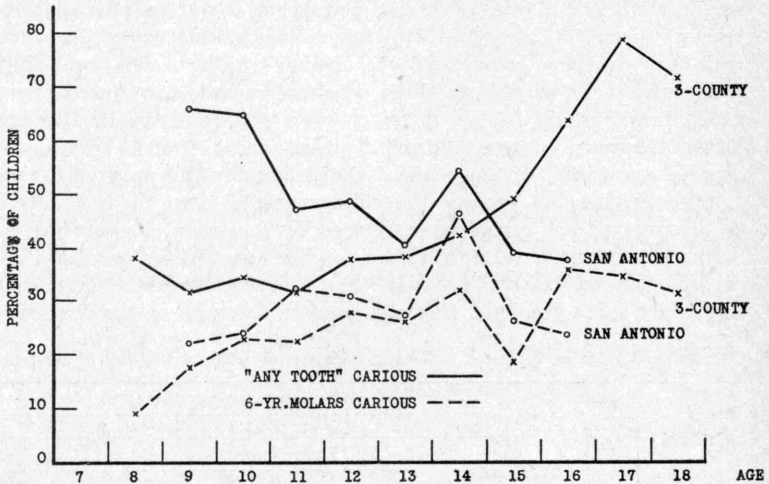


Fig. 4. Incidence of caries with reference to age—Mexican children.

with any tooth, is emphasized by the more rapid increase with age in decay of the 6-year molars in the age groups ranging from 8 to 12 or 14 years.



Number
 { 3-county group
 { San Antonio group

RELATION OF DIET TO CARIES

The data analyzed to determine what relationship appeared between diet and condition of teeth were secured in the dietary study made in Brazos, Hidalgo, and Jefferson counties. As previously mentioned, the

Fig. 5. Incidence of caries with reference to age—negro children.

dental data are the findings of cooperating local dentists who used a mirror and explorer for the examinations. The children with one or more carious 6-year molars made up the group with carious teeth. This seemed the most desirable procedure, first, because the structural resemblance of the four 6-year molars among themselves is closer than to other teeth; second, because they are open to attack of the agents of decay for a longer period of time than any other teeth; and third, because of their higher susceptibility to decay (4, 39) compared to other teeth. The 6-year molar has been used by other workers also (10, 15, 16) as an index of decay.

The information regarding diet was provided by written records of all food eaten by the individual children for a week (58). The children of the three counties who kept diet records two seasons constituted the largest group used for this analysis. Because no significant seasonal differences in diet were found, an arbitrary choice was made of diet records of that season in which the child's teeth were examined. For the most part these diet records were secured in fall and winter for the 765 white children and the 119 Mexican children, and they were about equally divided between spring and winter for the 428 negro children.

One cup or one glass of milk ($\frac{1}{2}$ pint) was called one serving and estimations of amounts in milk-containing foods as custard, cream soups, ice cream, and cocoa were consistently applied to all records. Distributions of the children in each race having sound teeth and those having carious 6-year molars were made according to the number of servings eaten per day of milk, cereals, fruits, vegetables, and sweet foods. Sweet foods included candy, molasses, syrup, sugar, and all sweetened foods as pie, cake, cookies, ice cream, cocoa, etc. Cereals included all foods in which the only or chief constituent was a grain product as all kinds of bread, breakfast foods, pie, cake, cookies, rice, and grits. Each class interval in each distribution was regarded as a unit and the number of children having sound and of those having carious 6-year molar teeth expressed as a percentage of the group. Percentages were not calculated for fewer than 10 children.

Table 6. Caries in 6-year molars in relation to cereals in the diet of white children

Group	Teeth	Cereals—average number servings daily												
		1.1-2.0		2.1-3.0		3.1-4.0		4.1-5.0		5.1-6.0		6.1 & +		
		Boys												
Boys														
No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
3-county	Sound	6		18		52		50		9		5		
	Carious 6-yr. molars	12	67.0	34	65.4	83	61.5	48	49.0	16	64.0	4		
	Girls													
	Sound	4		21		49		53		21		3		
	Carious 6-yr. molars	4		34	61.8	100	67.1	87	62.1	43	67.2	9	75.0	
	Boys													
Brazos county	Sound	4		9		32		26		4		2		
	Carious 6-yr. molars	4		12	57.1	39	54.9	27	50.9	7	63.6	4		
	Girls													
	Sound	1		9		32		30		10		2		
	Carious 6-yr. molars	2		13	59.1	52	61.9	50	62.5	22	68.8	6		
	Boys and Girls													
12-year in 3-county	Sound	1		2		21		12		4				
	Carious 6-yr. molars	2		6		28	57.1	30	71.4	12	75.0	2		
13-year in 3-county	Sound	2		6		9		19		4		2		
	Carious 6-yr. molars	5		12	67.0	21	70.0	10	34.5	12	75.0	4		
14-year in 3-county	Sound	1		8		13		8		5				
	Carious 6-yr. molars	3		13	61.9	32	71.1	23	74.2	10	67.0	2		

Suggestive evidence of relationship between caries and the several food classes tried were found only for milk, cereals, and sweet foods. These data are given in Tables 5, 6, 7, 8, and 9, and a graphic presentation of them in Figures 6, 7, and 8.

Table 7. Caries in 6-year molars in relation to sweet foods in the diet of white children

Group	Teeth	Sweet foods—average number servings daily											
		0-1.0		1.1-2.0		2.1-3.0		3.1-4.0		4.1-5.0		5.1-6.0	
		Boys						Girls					
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
3-county	Sound	20		53		47		16		3		1	
	Carious 6-yr. molars	37	64.9	83	51.0	47	50.0	23	59.0	6		1	
		Girls											
	Sound	14		66		45		19		6		1	
	Carious 6-yr. molars	24	63.2	93	58.5	88	66.2	55	74.3	12	67.0	5	
Brazos county		Boys											
	Sound	11		27		29		7		3			
	Carious 6-yr. molars	19	63.3	34	55.7	22	43.1	13	65.0	5			
		Girls											
	Sound	6		38		24		11		5			
	Carious 6-yr. molars	12	66.7	50	56.8	47	66.2	28	71.8	8	61.5		
		Boys and Girls											
12-year in 3-county	Sound	3		17		16		4					
	Carious 6-yr. molars	8	72.7	29	63.0	27	62.8	16	80.0				
13-year in 3-county	Sound	4		19		7		12					
	Carious 6-yr. molars	6	60.0	22	53.7	15	68.2	21	63.6				
14-year in 3-county	Sound	6		11		9		9					
	Carious 6-yr. molars	10	62.5	29	72.5	25	73.5	19	67.9				

A beneficial effect of milk in the diet is suggested by the graphs. For both the 3-county and the Brazos county groups, the graphs trend downward, the percentage of children having carious 6-year molars declining as the amount of milk in the diet was greater. But in the age groups, only the graph for the 14-year group trends downward. Apparently some other factor had a greater influence than milk upon the condition of teeth among the 12-, 13-, and 14-year groups. The possibility that this factor might have been either cereals or sweets (or both) is suggested by the upward trend of the graphs for sweets and for cereals for these age groups.

Table 8. Caries in 6-year molars in relation to cereals in the diet of negro children

Group	Teeth	Cereals—average number servings daily											
		1.1-2.0		2.1-3.0		3.1-4.0		4.1-5.0		5.1-6.0		6.1 & +	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
3-county	Sound	3		24		46		38		11		2	
	Carious 6-yr. molars			8	25.0	26	36.1	9	19.1	9	45.0	1	
	Girls												
	Sound			8		46		56		21		6	
	Carious 6-yr. molars	3		13	61.9	30	39.5	39	40.5	26	55.3	3	
Brazos county	Boys												
	Sound	1		20		36		9		2			
	Carious 6-yr. molars	2		12	37.5	23	43.8	10	52.6	2			
	Girls												
	Sound			11		38		26		6			
Carious 6-yr. molars	3		14	56.0	42	52.5	32	55.2	18	75.0			

A detrimental influence of cereals and of sweets in excess as compared with other foods, is suggested by the upward trend of a preponderance of the graphs for cereals and sweets. As cereal foods were more abundant

Table 9. Caries in 6-year molars in relation to sweet foods in the diet of negro children

Group	Teeth	Sweet foods—average number servings daily											
		0-1.0		1.1-2.0		2.1-3.0		3.1-4.0		4.1-5.0		5.1-6.0	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
3-county	Sound	37		51		26		9				1	
	Carious 6-yr. molars	15	28.8	17	25.0	18	40.9	3	25.0				
	Girls												
	Sound	24		57		45		11					
	Carious 6-yr. molars	17	41.5	41	41.8	37	45.1	15	57.7	4			
Brazos county	Boys												
	Sound	18		29		15		3		3			
	Carious 6-yr. molars	10	35.7	24	45.3	15	50.0	5					
	Girls												
	Sound	18		35		23		5					
Carious 6-yr. molars	20	52.6	48	57.8	28	54.9	10	67.0	3				

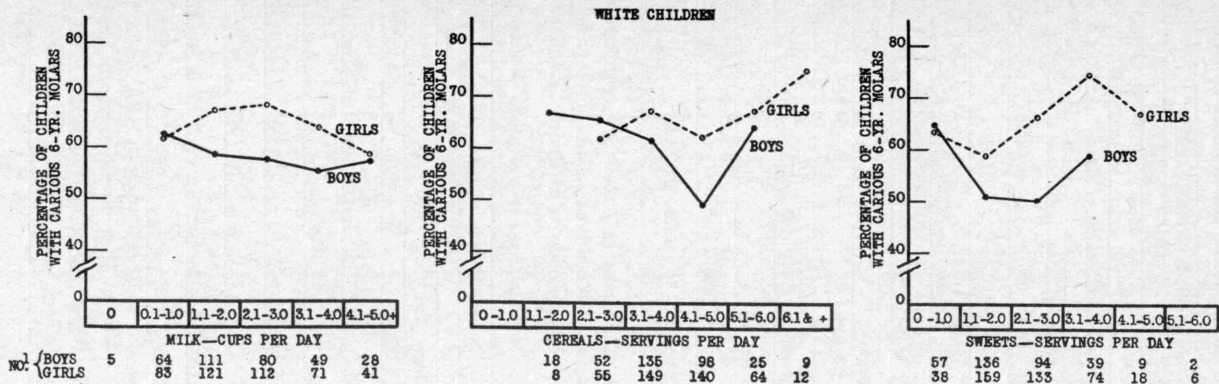
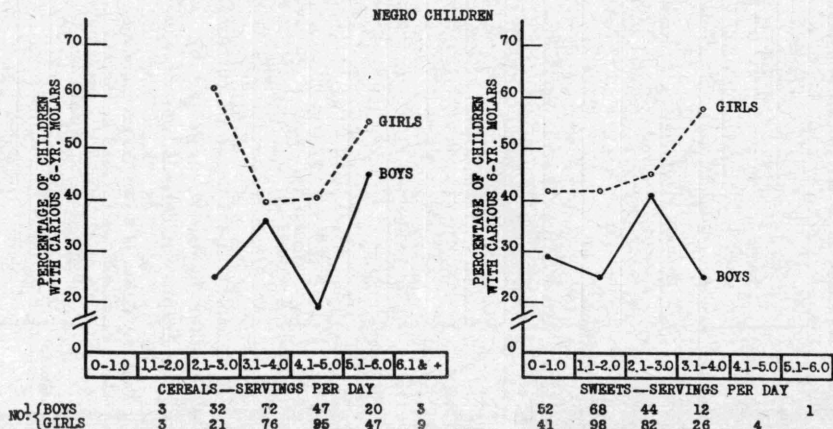
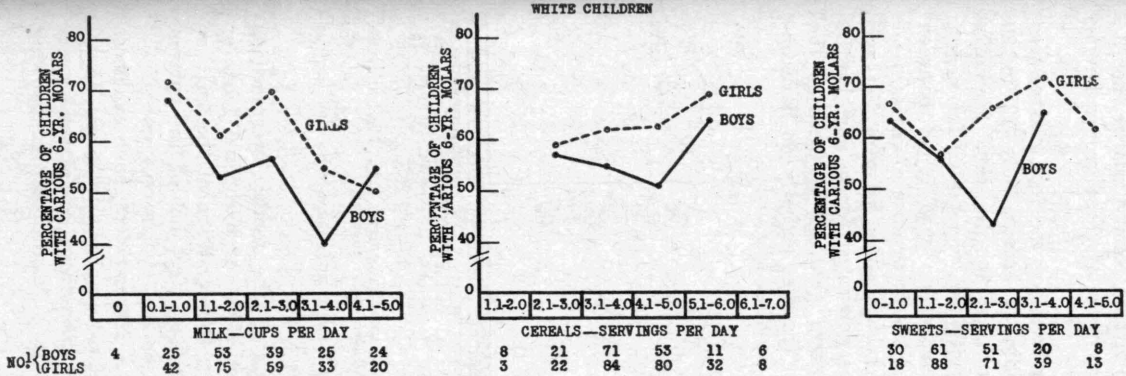


Fig. 6. Relation between certain classes of food and caries among 765 white, and 428 negro children in Brazos, Hidalgo, and Jefferson counties.

¹The numbers include the children who had sound teeth and those who had carious 6-year molars.

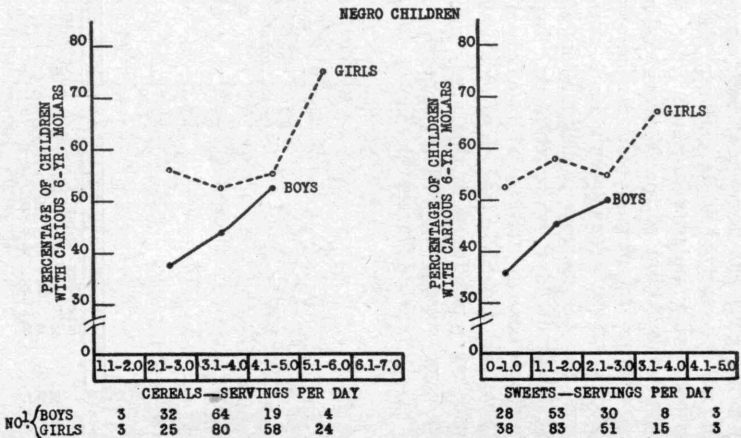




Brazos county.

Fig. 7. Relation between certain classes of food and caries among 399 white children and 312 negro children in

¹The numbers include the children who had sound teeth and those who had carious 6-year molars.



there was an increased percentage of children with carious 6-year molars among the white girls and the negro boys in the three counties, among both white and negro boys and girls in Brazos county, and in two of three age groups of white children. Similarly, as sweet foods were more frequently eaten by both the white and the negro girls of the three counties,

by white girls and negroes of both sexes in Brazos county, and by the 12-, 13-, and 14-year old white children, the percentage of these groups having carious 6-year molars increased.

The distribution of the Mexican children in all of the food classes was too narrow to permit test for relationship to caries, only 12 to 20 per cent of the group having more than two servings per day. Similarly there was too narrow a distribution of fruits and vegetables for negro, and of fruits for white children. No relationship was found between vegetable consumption by white children and the occurrence of caries.

That more definite and more consistent relationships between diet and caries were not found in this study may be accounted for in part by the following suggestions. The diet records were qualitative; there is the possibility that different classes of food in the diet actually do have op-

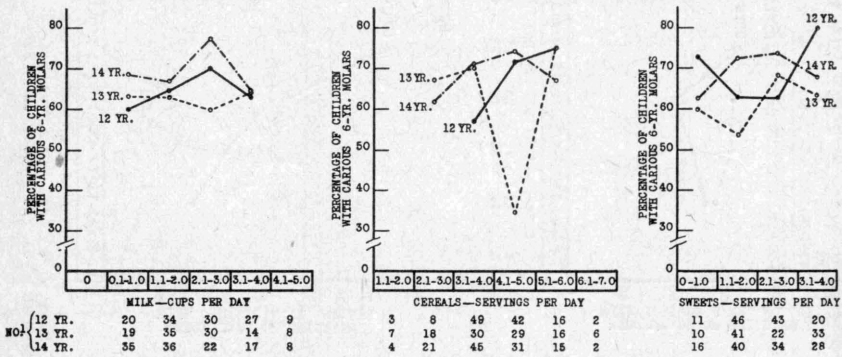


Fig. 8. Relation between certain classes of food and caries among 12-, 13-, and 14-year old white children in Brazos, Hidalgo, and Jefferson counties.

¹The numbers include the children who had sound teeth and those who had carious 6-year molars.

posite effects in influencing the soundness of the teeth; interrelations between various foods as well as the direct effect of individual foods or classes of foods may be conducive to caries; the condition of the teeth at the time of examination may be reflecting the effect not of the current diet but that of some earlier time; and probably food is only one of the determining factors in the process of decay. Nevertheless, such evidences as appear point to the desirability of continued emphasis upon the liberal use of milk, and caution against excessive amounts of cereals and sweet foods as compared with other classes of food in the diet of growing children.

COMPARISON WITH OTHER STUDIES

The findings in the dietary study which included the careful dental examinations have been compared with those of several other surveys made since 1925: for white children, these were made by Reynolds (49) in Virginia, by Davies (10) in Massachusetts, by Ahmann, Abbot, and Westover

Table 10. Incidence of caries. Comparison of contemporaneous studies.

Study	No. cases	Age years	Percentage with 1 or more carious teeth						Percentage of white children with 1 or more carious 6-year molars					
			White children			Negro children								
			1 or more	1-4	5 or more	1 or more	1-2	3 or more	1 or more	1	2	3	4	
Va., Aug., 1926 (Reynolds)	boys and girls.....	462	6-14	85	48	37								
	boys and girls.....	323	6-14				60							
Mass., Mar., 1928 (Davies)	non-dairying locality.....	168	6-16	83 ¹	61	22				85	11	16	17	41
	dairying locality.....	232	6-17	65 ¹	54	11				66	17	19	11	19
	both localities.....	400	6-17	74 ¹	58	16				74	15	18	13	28
Fla., June, 1930 (Ahmann, Abbott and Westover)	boys.....	807	6-19	51										
	girls.....	713	6-19	41										
Atlanta, Oct. 1928 (Sterling)	boys and girls.....	5079	6-14				68	33	35					
S. C., Sept., 1930 (Frayser and Moser)	boys and girls.....	322	8-10	96						56	20	22	9	5
U. S. Public Health Service, Oct., 1931 (Stoughton and Meaker)	boys.....	5528	6-14	63 ^t	36 ^t	27 ^t								
	girls.....	5623	6-14	56 ^t	23 ^t	33 ^t								
	boys.....	6057 ²	6-19	69 ^p	53 ^p	16 ^p								
	girls.....	6378 ²	6-19	73 ^p	53 ^p	20 ^p								
	boys.....	6057 ²	6-19	91 ^{tp}	40 ^{tp}	51 ^{tp}								
	girls.....	6378 ²	6-19	90 ^{tp}	40 ^{tp}	50 ^{tp}								
Texas, 1934 (Whitacre)	boys.....	1960	6-20	67	48	19				41	11 ^a	13	7	10
	girls.....	1782	6-20	69	48	21				50	14	16	8	12
	boys.....	386	6-20				40	21	19					
	girls.....	509	6-20				50	23	27					

¹Only permanent teeth considered

²Entire number distributed: Ga., 5274; Ill. and Mo., 2749; Md., 4412.

^tTemporary teeth

^pPermanent teeth

(2) in Florida, by Frayser and Moser (16) in South Carolina, by Stoughton and Meaker under auspices of the United States Public Health Service (53, 54) in Illinois, Missouri, Georgia, and Maryland; for negroes, the survey was made by Sterling under auspices of the United States Public Health Service (51) in Atlanta, Georgia.

The percentage of the children found to have defective teeth as reported in these contemporaneous studies is summarized in Table 10. In all these studies the carious teeth were identified by a dentist's examination except in the case of Virginia, where the records of teachers' inspection as well as those from the dental clinics were used for white children, while for negro children inspections were made by college-trained negro teachers or by public health nurses. In the Texas study, and in the Public Health Service surveys (studies by Stoughton and Meaker, and by Sterling) the carious class included all teeth decayed, abscessed, or filled, and the permanent teeth extracted; such teeth were referred to by Stoughton and Meaker as "total past decay". The Massachusetts study considered only permanent teeth, whereas in the others both temporary and permanent teeth were included. The Florida workers included as carious both filled and unfilled teeth but not extracted ones. The South Carolina study did not include filled teeth but regarded stains and calculus as well as caries, abscesses, and extracted teeth as defects, since it was said that all these conditions indicate either present or past need of dental care.

Confirmation is given by these seven contemporaneous studies to the common observation that dental defects exist in an appallingly large percentage of all school children, but that fewer negroes are affected than whites.

With respect to number of carious teeth per child, in the studies of white children of three states—Virginia, Massachusetts, and Texas—a decidedly larger percentage of children was found with 1 to 4 decayed teeth than with 5 or more, whereas the reverse is reported in the Public Health Service survey of white children in Georgia, Illinois, Missouri, and Maryland. The study of negro children in Atlanta by Sterling (51) shows half again as many children to be affected with caries as were found among the Texas negro children; in each study approximately equal percentages had caries in 1 or 2 teeth as in 3 or more. Since nearly half of Stoughton and Meaker's group of white children lived in Georgia, it appears that there really was a higher incidence of caries among the Georgia children than among the Texas children with respect to the number of white and negro children affected, and also with respect to the number of teeth involved in the white children. Since no data are given by Stoughton and Meaker or by Sterling concerning factors such as dietary or hygienic habits which may have a bearing upon the soundness of the teeth, no attempt is made to suggest the reason for the greater prevalence of caries reported in these Public Health Service studies than was found in the Texas survey.

The highest incidence of carious 6-year molars was found in the Massachusetts study, 74 per cent having one or more of these teeth decayed

as compared with 45 and 56 per cent respectively in Texas and South Carolina. Also a higher percentage of the Massachusetts children had three or four carious 6-year molars than did Texas or South Carolina children.

As between the sexes, caries was found in this study to be slightly more prevalent among girls than boys, as was true in the case of the permanent teeth in Stoughton and Meaker's survey of white children, but the reverse relationship was reported by Stoughton and Meaker for temporary teeth alone, and by the Florida workers for temporary and permanent teeth together. Stoughton and Meaker suggest that boys may be slower than girls in losing their temporary teeth, and thus had a larger number of such teeth to be counted than had girls at the time of examination.

The positive relationship between larger amounts of milk and good teeth in the white children as found in this study agrees with that found in the contemporaneous studies in Virginia (49), Florida (2), and Massachusetts (10). Reynolds reports for Virginia that "high positive correlations are found between the percentage that use the larger amounts of milk in each year of age and the percentage of perfect teeth in both negro and white school groups." Ahmann, Abbott, and Westover found that 54 per cent of the Florida children who used milk had sound teeth, but only 10 per cent of those not using milk. Also caries was twice as common among the non-users of milk as among the users, the percentage of children affected being respectively 66 and 33. In the Massachusetts study, Davies found 35 per cent of the children in the dairying community had sound permanent teeth while there were but 17 per cent in the non-dairying community. A like difference appeared in the condition of 6-year molars. In the dairying community, one-third of the group had sound 6-year molars in contrast to only one-eighth of the group in the non-dairying community.

The negative relationship found in this study for both white and negro children between frequency of eating cereal and sound teeth harmonizes with the studies of Mellanby (45), Mellanby and Pattison (46), Hawkins (22, 24), and Sampson (50). The indication that sweet foods are harmful to teeth lends weight to the long-held distrust of sugar, which Hawkins includes with the bread and pastries, against which he warns and which Eddy (12) recently observed could not be dismissed as a possibility in cause of tooth decay. It accords also with Reynolds' (49) finding of the candy-eating habit common in 61 per cent of the pre-school children in her study associated with a high percentage of carious and stained teeth.

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SUMMARY

The condition of the teeth has been determined for 6701 school children including 4453 white, 807 Mexican, and 1441 negro. The decayed teeth of 4926 children were identified by dentist's examinations with mirror and explorer; of the remaining 1775 children, by a pediatrician using a tongue depressor but no mirror or explorer.

Decay was found to be wide spread among all three races. By both methods of examination the races ranked in the same order according to the percentage of children having one or more decayed teeth, white poorest Mexican next, and negro best. White children had the poorest record also in average number of decayed teeth per child. The highest number of decayed teeth in any one negro child's mouth was 10, in a Mexican's 12 and in a white child's 21.

One or more of the 6-year molars were decayed in approximately one third of each race group but in the two studies the races were not ranked in any consistent order. The decayed 6-year molars constituted a smaller percentage of all decayed teeth among white children than among either Mexican or negro. Apparently the 6-year molar was relatively a somewhat more vulnerable tooth among the Mexican and negro than among the white children in this study. While inherent racial characteristics probably have some influence in determining susceptibility to decay, they may not be as great a factor as is commonly supposed.

As to decay in any tooth in relation to age, the two groups of children, one in San Antonio, the other in Brazos, Hidalgo, and Jefferson counties show contrasting results. In all three races of the latter group the percentage of children having one or more decayed teeth increased with age while in the corresponding race groups in San Antonio the percentage of children having caries decreased with age. Among all children the percentage with decayed 6-year molars increased rapidly up to 12 or 14 years of age, after which there was a decline in 4 of 6 age groups. Apparently

some factor (or factors) predisposing to decay in the younger children and protective in the older ones was operating in the San Antonio groups that was not operating among the children from Brazos, Hidalgo, and Jefferson counties. Age appears to be one factor, but not the only one, in determining the number of children in whom decay occurs.

The girls for the most part had slightly higher percentages of their numbers with decayed teeth than did the boys of the same race and in this difference the 6-year molars predominated. The data of this study afford no suggestion to explain this small difference.

An analysis of the data for relationship between diet and occurrence of caries was made. Among the classes of foods examined in this respect, only milk, cereals, and sweet foods were found to show suggestive relationship to caries. As the consumption of milk increased, the percentage having carious 6-year molars decreased in 5 out of 7 groups of white children. On the contrary, as the consumption of cereals increased, there was an increase in the percentage having decayed 6-year molars among 6 out of 7 groups of white children and 2 out of 4 groups of negroes; also as the consumption of sweets increased, 5 out of 7 groups of white children and 3 out of 4 negro groups showed an increased percentage with decayed 6-year molars. This suggests that milk in the diet is conducive to soundness of teeth and that excessive amounts of cereals and sweet foods in comparison with other foods are detrimental.

No difference was found in the diets of the three races to account for the lower prevalence of decayed teeth among the Mexican and negro as compared with that among the white children, nor for the fact that 6-year molars constituted a larger proportion of all decayed teeth among Mexican and negro than among white children.

The findings of this study in general agree with those of contemporaneous studies of similar nature in eastern and southern sections of the United States, both with respect to the high incidence of caries, and to the relationship existing between certain classes of food and the occurrence of caries.

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