Dental Caries and Periodontal Diseases Among Ethiopian Civilians

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THE Interdepartmental Committee on Nutrition for National Defense (*1*) conducted a nutrition survey in Ethiopia during the fall of 1958. A team of American and Ethiopian nutritionists, food technologists, biochemists, physicians, and a dentist visited widely within the country. In each area visited an attempt was made to assess certain physical characteristics in a selected sample of men, women, and children. Blood and urine samples were taken for biochemical analysis. Data concerning food production and availability and dietary patterns were also obtained.

Dental examinations, included as a part of the physical appraisals, were completed on 1,085 civilian males and females aged from 5 through 84 years. This sample included residents of 8 of 11 geographic regions visited by the team (fig. 1), and it had representation from the major ethnic groups. The survey presented an opportunity to study oral diseases in a population for which little information has been available.

All dental observations were made by the one dentist, using a portable chair and standard dental mirrors and explorers, under natural light. Findings for dental caries, fluorosis, molar attrition, periodontal diseases, dental calculus, and debris are discussed below.

Methods

The DMF index (*2*) was used to estimate prevalence of dental caries. Each permanent tooth was recorded as either free of dental caries or as decayed, missing, or filled. Obvious cavitation was required to designate a tooth as carious. No attempt was made to obtain histories for missing teeth. Except in the younger age groups where some permanent teeth were apparently unerupted, any missing tooth was considered lost due to dental caries. Anomalies of enamel were recorded, and dental fluorosis was evaluated according to Dean's classification (*3*).

Molar attrition was estimated by the method of McCombie (*4*). Each molar tooth was scored from 0 to 4 according to the following scale:

Observation	*Tooth score*
No signs of attrition	0
Enamel facets only	1
Dentin exposed on occlusal surface	2
Cuspal pattern eliminated; occlusal surface essentially horizontal	3
Maximum height of crown of tooth above amelocemental junction less than 3 mm	4

The scores were totaled and divided by the number of molar teeth present and results entered as the attrition score for the individual.

Two methods were used to assess the clinical status of periodontal tissues. The periodontal index, or PI (*5*), was used to estimate the prevalence and severity of periodontal disease. Cumulative loss of periodontal support was rated according to the gingival recession score as reported by Stahl and Morris (*6*). This score, based on a count of teeth around which gingival tissues had receded apically beyond the cemento-enamel junction, was expressed as the mean percent of teeth involved.

The relative extent of supragingival calculus and debris in each mouth was estimated on a scale from 0 to 3. A zero score indicated free-

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dom from these deposits. Scores of 1, 2, and 3 indicated deposits judged to be slight, moderate, or heavy, respectively. Scores were recorded separately for each type of deposit.

Blood and urine samples were obtained from 211 persons (pregnant women were excluded). Laboratory determinations performed on these samples included serum levels of ascorbic acid and vitamin A and urinary excretion of thiamine, riboflavin, and N'methylnicotinamide. Procedures used to make the determinations and suggestions for interpretation of results are presented in detail in the ICNND Manual for Nutrition Surveys (*7*).

Findings

Dental caries. The prevalence of dental caries in the Ethiopian sample was extremely low. Mean numbers of decayed, missing, and filled (DMF) permanent teeth and the percentage of persons free of dental caries are shown in table 1. Seventy-seven percent of those examined were free of dental caries, ranging from 90 percent in the 5- to 9-year age group to 47 percent in persons older than 50 years. No person was completely edentulous; the maxillary arches of two persons were edentulous but no edentulous mandibles were seen. Individuals under 40 years of age averaged somewhat less than one DMF tooth; those over 50 years of age averaged slightly less than three DMF teeth. Decayed and missing teeth comprised most of the total since only seven persons, 0.6 percent, had evidence of restorative dental care. Of 669 DMF teeth, 347 were missing, 161 were decayed, 149 were considered as indicated for extraction because of dental caries, and only 12 teeth had been restored. Most of the DMF teeth were molars. Where destruction of tooth substance was not extensive, carious lesions were seen predominantly in pits and fissures of occlusal and buccal surfaces.

Dental caries experience in deciduous teeth was also low. In the 5- to 9-year age group the mean number of decayed, indicated for extraction, and filled (def) teeth was 0.36, and at 10 to 14 years of age it was 0.11.

No important differences in dental caries experience were seen between males and females (table 1). Within each age group DMF means for males and females were similar and in no instance was a difference statistically significant ($P \leq .01$). Males at a mean age of 24.3 years and females at a mean age of 23.1 years averaged 0.62 ± 0.08 and 0.61 ± 0.10 DMF teeth, respectively.

Clinical signs of slight dental fluorosis were seen in only 8 percent of the total sample. According to Dean's classification (*3*), fluorosis scores were low, ranging from questionable to very mild. Central water supplies were not generally available and inhabitants of a given area obtained water from multiple sources. Nevertheless, water samples were collected in six locations and later analyzed for fluoride. Results (*8*) indicated that fluoride content ranged from 0.14 up to 0.91 parts per million, somewhat below concentrations considered optimum (*9*) for prevention of dental caries.

Molar attrition scores for the Ethiopian sample are shown in table 2. As expected, these

Table 1. Mean numbers of DMF teeth among 1,085 Ethiopian civilians, by age group and sex

Age group	Males			Females			All persons			Percent caries free
	Number	Mean age	Mean DMF±SE	Number	Mean age	Mean DMF±SE	Number	Mean age	Mean DMF±SE	
5–9	36	7.4	0.19±0.09	26	7.9	0.04±0.00	62	7.6	0.13±0.05	90
10–14	183	12.6	.20± .05	127	13.0	.16± .04	310	12.8	.18± .03	88
15–19	170	16.9	.22± .05	27	16.5	.19± .12	197	16.8	.21± .05	86
20–29	154	23.2	.44± .09	55	22.9	.26± .08	209	23.0	.39± .07	79
30–39	74	33.8	.69± .15	50	32.7	.74± .17	124	33.4	.71± .11	65
40–49	59	43.7	1.29± .28	26	41.2	1.39± .46	85	42.9	1.32± .20	58
50 and over	68	59.1	2.74± .66	30	53.4	3.17± .79	98	57.4	2.87± .52	47
Total	744	24.3	.62± .08	341	23.1	.61± .10	1,085	23.9	.62± .06	77

Figure 1. Geographic regions of Ethiopia from which dental sample was drawn

scores increased steadily and significantly with age. In the younger age groups slight enamel facets were common. Attrition of occlusal surfaces gradually increased with age, and in persons older than 40 years molar teeth were worn to the extent that loss of cuspal pattern and exposure of dentin were common observations. No important differences were apparent in attrition scores between males and females (table 2). All males examined had a mean attrition score of 1.10±0.02; at a similar mean age, the score for females was 1.06±0.03.

Within the Ethiopian sample there was little difference in the prevalence of dental caries among residents of the eight geographic areas from which examinations were obtained (fig. 1). Dental caries experience was low in all areas and a high percentage of each subsample was free of dental caries.

Of the several ethnic groups represented in the sample, only three, Amhara, Tigrean, and Galla, were observed in numbers sufficient for comparisons of dental findings among groups. The total sample for each of these groups averaged less than one DMF tooth per person and approximately 75 percent of each subsample was free of dental caries.

For other within group comparisons, the Ethiopian sample was subdivided on the basis of dental caries experience. One group consisted of 754 persons free of dental caries and the other 245 persons having one or more carious lesions. Eighty-six individuals with missing teeth only were excluded. Mean periodontal scores and mean scores for calculus, debris, recession, and attrition were computed for the two groups. At comparable ages, persons with carious lesions scored higher in the other dental findings. Differences between groups were more consistent and pronounced in scores for debris (table 3). Within each age group, mean debris scores were higher for persons with carious lesions. Although the magnitude of the scores differed, only a negligible percentage of either group was scored as free of debris.

Team nutritionists estimated, from a questionnaire survey, the frequency of sugar, jam,

Table 2. Molar attrition scores among Ethiopian civilians, by age group and sex

Age group	Males			Females			All persons		
	Number	Mean age	Mean attrition score ±SE	Number	Mean age	Mean attrition score ±SE	Number [1]	Mean age	Mean attrition score ±SE
5–9	32	7.5	0.50±0.08	26	7.9	0.55±0.08	58	7.7	0.52±0.05
10–14	178	12.7	.73± .02	126	13.0	.69± .03	304	12.8	.72± .02
15–19	167	16.9	.87± .02	27	16.5	.93± .06	194	16.8	.88± .02
20–29	152	23.2	1.02± .03	55	22.9	1.07± .04	207	23.1	1.03± .02
30–39	72	33.8	1.49± .06	49	32.5	1.34± .05	121	33.3	1.43± .04
40–49	59	43.7	1.76± .07	23	41.4	1.69± .10	82	43.1	1.74± .06
50 and over	59	58.7	2.21± .09	27	53.3	2.30± .12	86	57.0	2.24± .07
Total	719	24.1	1.10± .02	333	22.6	1.06± .03	1,052	23.6	1.08± .02

[1] Of the 1,085 persons in the sample, 33 could not be scored for molar attrition.

and honey consumption for 1,300 individuals (*8*). Less than half of the respondents reported daily use of these foods and 20 percent indicated they never used these items. Results of dental examinations were available for 420 of the respondents. Their dental caries experience and their reported frequency of sugar, jam, and honey consumption are shown in table 4. Persons who reported relatively frequent use of these foods had, on the average, slightly higher DMF means than those who reported less frequent use. This same trend was evident in the percentage of persons positive for dental caries.

Dental examination and dietary information were available from 18 sublocations. These areas were divided into groups by locations in which less than 25 percent, 25 to 50 percent, and more than 50 percent of the samples reported at least weekly use of sugar, jam, or honey. Dental caries experience for these groups was determined and adjusted to a mean age of 25 years (fig. 2). DMF means were 0.79, 1.07, and 1.42, respectively, indicating a tendency for dental caries to be more prevalent in groups using sugar, jam, or honey more frequently.

Periodontal diseases. Periodontal diseases were prevalent and severe in the Ethiopian sample. This was reflected in the relatively high periodontal index score shown in table 5. Only 30, or about 3 percent, of the 1,085 persons were considered free of overt gingival inflammation. Under age 30, moderate to severe gingival inflammation was the usual clinical finding. After age 30, periodontal pockets were widespread. Pockets were observed in 29 percent of the 30- to 39-year age group and the condition of periodontal tissues deteriorated rapidly with age. Two-thirds of persons over 50 years of age had clinical signs of advanced alveolar bone loss.

There was little difference in the prevalence

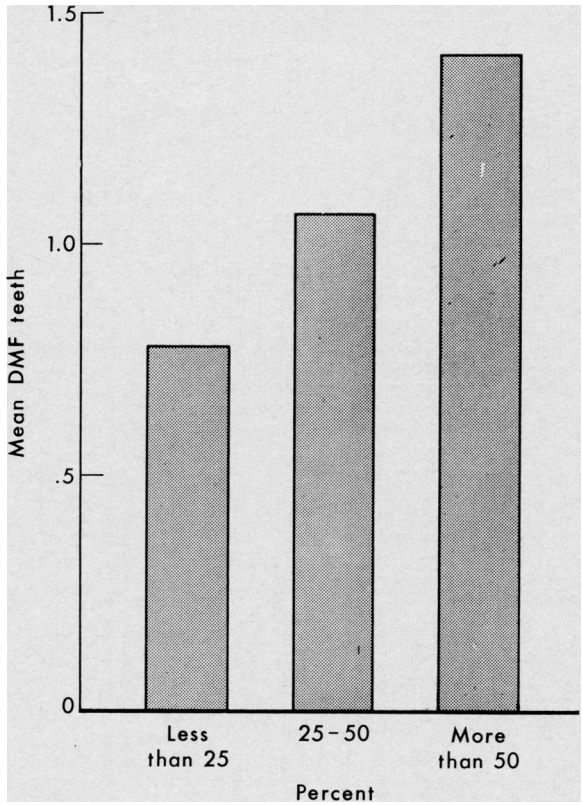
Table 3. Comparison of debris scores for Ethiopian civilians with and without dental caries, by age group

Age group	With dental caries			Without dental caries		
	Number	Mean age	Score ±SE	Number	Mean age	Score ±SE
5–9	15	8.0	1.87±0.02	46	8.1	1.43±0.08
10–14	52	13.2	1.75± .03	253	13.3	1.46± .05
15–19	28	17.2	1.39± .12	164	17.3	1.18± .05
20–29	41	23.5	1.54± .13	142	23.5	1.35± .07
30–39	41	33.9	1.93± .11	72	33.7	1.50± .09
40–49	30	43.3	1.93± .14	39	43.4	1.74± .15
50 and over	38	58.5	2.18± .09	38	57.3	1.97± .12
Total	245	29.2	1.80± .05	754	21.5	1.42± .03

Table 4. Dental caries experience of Ethiopian civilians, by age group and frequency of sugar, jam, or honey consumption

Age group	Seldom or never			Weekly or daily		
	Number	Mean DMF	Percent with dental caries	Number	Mean DMF	Percent with dental caries
10–14	46	0.028	2.2	103	0.194	12.6
15–19	22	.136	9.1	56	.196	17.9
20–29	35	.429	17.1	30	.633	30.0
30–39	25	.360	24.0	29	.552	34.5
40–49	14	.143	14.3	18	1.556	38.9
50 and over	20	1.900	30.0	22	1.727	50.0

Figure 2. Dental caries experience of three groups, according to reported frequency of sugar, jam, or honey consumption



and severity of periodontal diseases between Ethiopian males and females (table 5). Age-specific PI scores for these groups were similar, and only in persons aged 10 to 14 years was the difference statistically significant ($P \leq .01$). At comparable mean ages all males had a mean PI score of 1.03, and the mean score for females was 1.01.

Periodontal index scores also are presented in table 5 for a quasi-random sample of Baltimore, Md., residents (*10*). Comparisons of findings indicated that Ethiopians scored higher in all age groups than did white persons examined in Baltimore. At younger ages, scores for Ethiopians were higher than those for Baltimore Negroes but at older ages scores for these groups were similar.

Gingival recession. Mean gingival recession scores for the Ethiopian sample were minimal in the younger age groups (table 6). At ages 30 to 39 recession of periodontal tissues had affected, on the average, about 15 percent of the teeth. Scores increased rapidly with age. In persons over age 50, the cemento-enamel junction was exposed in slightly more than half the teeth. Ethiopian males had experienced slightly but consistently more gingival recession than Ethiopian females but differences in scores between these groups were not statistically significant ($P \leq .01$).

Oral hygiene. Deposits of supragingival calculus and debris were seen in more than 90 percent of persons examined. Only 3 percent of the sample was scored as free of debris and only 8 percent as free of calculus. Relative amounts of supragingival calculus and debris seen in the Ethiopian sample are shown in table 7. Calculus, observed even at the youngest ages, increased steadily in amount with advancing age. Debris deposits were extensive during the mixed dentition stage, less extensive between

Table 5. Mean periodontal index scores for 1,085 Ethiopian civilians, by age group and sex

Age group	Males	Females	All persons		Mean PI score, Baltimore	
	Mean PI score ±SE	Mean PI score ±SE	Mean PI score ±SE	Percent with periodontal pockets	White	Negro
5–9	0.65±0.05	0.50±0.06	0.59±0.04	0	----------	----------
10–14	.73± .03	.59± .03	.67± .02	4	----------	----------
15–19	.61± .02	.63± .07	.61± .02	3	0.20	0.33
20–29	.86± .06	.85± .07	.86± .04	8	.30	.45
30–39	1.13± .10	1.43± .18	1.25± .09	29	.66	1.17
40–49	1.96± .21	1.63± .27	1.86± .17	47	1.03	1.99
50 and over	2.51± .25	2.62± .33	2.54± .20	66	1.71	2.79
Total	1.03± .04	1.01± .06	1.02± .03	16	----------	----------

15 to 30 years of age, and thereafter they increased with age.

Mean periodontal index scores were calculated for groups with slight, moderate, or heavy accumulations of calculus and debris (table 8). Scores were lowest for groups with slight deposits; they increased substantially for groups with moderate deposits, and were highest for groups with heavy deposits. Persons over 40 years of age with slight accumulations of calculus and debris had about the same group mean periodontal scores as those under 20 years of age with heavy deposits. The percentage of persons with periodontal pockets followed the same general pattern in these groups as did PI scores. But the percentage of persons with periodontal pockets increased sharply with age regardless of the extent of calculus or debris.

Table 6. Mean gingival recession scores for 1,085 Ethiopian civilians, by age group and sex

Age group	Males	Females	All persons
	Mean gingival recession score ±SE	Mean gingival recession score ±SE	Mean gingival recession score ±SE
5–9	0.3±0.19	0.2±0.19	0.2±0.14
10–14	1.3± .22	1.1± .22	1.2± .16
15–19	1.6± .24	1.4± .58	1.6± .22
20–29	6.8±1.00	5.8±1.33	6.5± .82
30–39	17.2±1.99	11.4±1.82	14.9±1.42
40–49	33.2±3.89	23.0±4.09	30.0±3.00
50 and over	57.5±4.10	45.0±5.70	53.7±3.37

Table 7. Mean supragingival calculus and debris scores for 1,085 Ethiopian civilians, by age group and sex

Age group	Mean calculus scores			Mean debris scores		
	Males	Females	Total	Males	Females	Total
5–9	1.2	0.8	1.0	1.6	1.4	1.5
10–14	1.4	1.2	1.3	1.7	1.3	1.5
15–19	1.5	1.3	1.5	1.2	1.2	1.2
20–29	1.6	1.8	1.7	1.3	1.5	1.3
30–39	1.9	2.0	1.9	1.7	1.5	1.6
40–49	2.1	2.0	2.0	1.9	1.7	1.9
50 and over	2.3	2.3	2.3	2.1	2.0	2.1

Table 8. Mean periodontal index and mean recession scores for Ethiopian civilians, by relative amounts of supragingival calculus and debris

Amount of calculus or debris and age group	Number persons	Mean PI score	Percent with periodontal pockets	Mean recession score
Calculus slight:				
Under 20	381	0.52	1	0.84
20–39	119	.47	4	5.67
40 and over	31	1.01	32	15.68
Calculus moderate:				
Under 20	159	.85	4	2.03
20–39	156	.98	15	9.22
40 and over	87	1.81	53	39.60
Calculus heavy:				
Under 20	29	1.14	12	2.22
20–39	58	2.06	47	20.29
40 and over	65	3.36	78	61.27
Debris slight:				
Under 20	324	.48	1	1.07
20–39	167	.65	7	6.84
40 and over	37	1.09	38	27.29
Debris moderate:				
Under 20	209	.82	4	1.35
20–39	126	1.28	22	11.99
40 and over	89	1.96	55	38.78
Debris heavy:				
Under 20	36	1.11	4	2.13
20–39	40	1.76	36	15.77
40 and over	57	3.47	80	63.26

Gingival recession scores also were directly related to relative amounts of calculus and debris (table 8). At each age interval, persons with heavy accumulations of either calculus or debris had recession scores that were about two to three times higher than scores for persons with slight deposits.

Biochemical. Mean periodontal index and gingival recession scores were calculated for groups based on results of laboratory determinations for serum levels of ascorbic acid and vitamin A and urinary excretion of thiamine, riboflavin, and N′methylnicotinamide (table 9). According to ICNND standards (7), 51 persons had deficient or low determinations for one or more of these nutrients. This group had a PI score of 0.99 and a recession score of 9.9. Periodontal and recession scores for 66 persons who had acceptable or high values for all these nutrients were 0.83 and 12.1, respectively, and not notably different. The highest PI score recorded was 1.17 for persons with deficient or

Table 9. Mean periodontal index and gingival recession scores for Ethiopian civilians, by serum levels of ascorbic acid and vitamin A and urinary excretion of thiamine, riboflavin, and N'methylnicotinamide

Nutrient levels [1]	Number of persons	Mean age	Mean PI score ±SE	Mean gingival recession score ±SE
All values acceptable or high; all 5 determinations made	66	23. 5	0. 83±. 08	12. 1±2. 6
Deficient or low values for thiamine, riboflavin, or N'methylnicotinamide	20	27. 5	. 82±. 16	9. 6±3. 5
Deficient or low values for vitamin A	12	27. 2	1. 11±. 41	16. 8±8. 4
Deficient or low values for ascorbic acid	67	27. 9	1. 17±. 14	15. 0±2. 6
Deficient or low values in one or more of the stated nutrients; all 5 determinations made	51	25. 3	. 99±. 15	9. 9±2. 3

[1] The nutrient levels (7) were determined as deficient or low and acceptable or high by values that were less than or greater than 66 for thiamine (μg./gm. creatinine), 80 for riboflavin (μg./gm. creatinine), 1.6 for N'methylnicotinamide (mg./gm. creatinine), 20 for serum vitamin A (μg./100 ml.), and 0.2 for serum ascorbic acid (mg./100 ml.).

Table 10. Simultaneous effects of nine factors on scores for periodontal disease and gingival recession in 117 Ethiopian males and females

Factors	Periodontal disease	Gingival recession
Coefficient of multiple correlation	+0. 70	+0. 75
Percent of variance explained	49	57
Of the variance explained, percent accounted for by:		
Age	35	81
Sex	6	0
Oral hygiene	53	9
Molar attrition	0	8
Ascorbic acid	2	0
Vitamin A	2	0
Thiamine	0	1
Riboflavin	0	2
N'methylnicotinamide	0	0

Table 11. Partial correlation coefficients [1] between serum and urinary levels of five nutrients with scores for periodontal disease and gingival recession in 117 Ethiopian males and females

Nutrient	Periodontal disease	Gingival recession
Ascorbic acid	−0. 07	0. 12
Vitamin A	. 06	−. 08
Thiamine	. 01	. 00
Riboflavin	−. 13	. 14
N'methylnicotinamide	−. 02	. 06

[1] Effects of age and oral hygiene kept constant.

NOTE: To be statistically significant at $P \leq .05$, r must be at least ±.18.

low levels of ascorbic acid. Persons deficient or low in vitamin A had the highest gingival recession score, 16.8. These scores were somewhat greater than those for the group with acceptable and high values for all five nutrients but differences were not statistically significant ($P \leq .01$).

The pronounced effects of age and oral hygiene might easily overshadow a possible relation between nutrition and periodontal health. Therefore, multiple and partial correlation analyses were made for the 117 persons from whom all biochemical determinations were available.

Simultaneous effects of nine factors on PI and gingival recession scores were assessed (table 10). The coefficient of multiple correlation between these factors and periodontal scores was +0.70 and between these factors and gingival recession +0.75. Simultaneous effects of the nine variables accounted for 49 percent of variation in periodontal and 57 percent of variation in recession scores. Oral hygiene and age explained 88 percent of this variance in PI scores. Age alone accounted for about 80 percent of the variance in gingival recession. The other variables apparently exerted only a slight influence on periodontal health.

Partial correlation coefficients between serum and urinary levels of the five nutrients with scores for periodontal diseases and gingival recession are presented in table 11. In these correlations the effects of age and oral hygiene were kept constant. Even so the resulting

coefficients of partial correlation did not indicate a significant relationship between levels for any of these nutrients and scores for periodontal disease or gingival recession.

Discussion

These dental findings were observed in a population which has a minimum of professional dental care and one in which the procedures of oral hygiene are not routine. Only 7 of 1,085 individuals had evidence of having received restorative dental care. Deposits of supragingival calculus and debris were abundant in virtually all persons examined.

When findings for dental caries in the Ethiopian sample are compared with those commonly reported from similar studies conducted in the United States (*10*), it is obvious that importantly fewer Ethiopians have experienced dental caries; in those that have, importantly fewer teeth have been attacked. Individuals under 40 years of age averaged less than one DMF tooth per person; those over 50 years of age averaged approximately three DMF teeth per person. At a mean age of 23.9 years, 77 percent of the sample was free of dental caries.

Within the Ethiopian sample, findings for dental caries varied little among the various subgroups. The most striking finding was the very low prevalence in all segments of the population.

Clinical evidence of slight fluorosis was observed in only 8 percent of the sample, and water analysis indicated suboptimal fluoride intake. It appeared doubtful that the almost uniformly low experience with dental caries in Ethiopians could be attributed to ingestion of fluoride.

This low prevalence of dental caries occurred in a population whose diet was considered by the nutritionists (*8*) deficient in calories and high in carbohydrates. The traditional Ethiopian diet contains little sugar and other refined foods. It is possible that the carbohydrates in the diet are not particularly cariogenic or that, as has been suggested (*11–13*), use of unrefined foods, such as whole grains, affords some protective effects. Within the sample, dental caries experience tended to be higher for individuals and for groups reporting a more frequent use of sugar, jam, or honey.

Apparently this relative freedom from dental caries was observed in people subsisting on a diet that was at least inadequate in certain respects. Evaluated by ICNND criteria (*7*), dietary and biochemical evidence indicated that intakes of thiamine, riboflavin, and niacin were adequate, but ascorbic acid and vitamin A nutriture was suboptimal. This finding seems consistent with reports from other studies (*14–16*) which suggest that a low rate for dental caries does not necessarily depend on any known superiority of nutrition as such.

The consistency of the Ethiopian diet is soft. Nothing can be said directly about the adhesive properties of the diet. However, supragingival deposits of soft debris were prevalent.

Molar attrition scores for Ethiopians appeared to be higher than similar scores reported from other areas (*17,18*). Although attrition scores were high and prevalence of dental caries was low within the sample, subgroups with dental caries had more attrition than similar groups free of dental caries.

Levels of periodontal diseases in Ethiopia were generally higher than those reported for residents of Baltimore, Md. (*10*). Apparently, however, periodontal diseases were less severe in Ethiopians than in populations of other countries, particularly those in southeast Asia (*19–21*) from which comparable data were available.

Although clinical signs of periodontal destruction were prevalent and severe in Ethiopia, tooth loss did not appear to be as great as might be expected. The abrupt increase in missing teeth after about 40 years of age, reported from some studies (*10*, *20*, *21*) and regarded as indicative of tooth loss due to periodontal disease, was not apparent in this sample.

Within Ethiopia findings for periodontal diseases were similar for residents of different geographic regions. No important differences were seen between the three ethnic groups, Amhara, Galla, and Tigrean, which comprised almost all of the dental sample.

No unique clinical signs of periodontal diseases were observed. Disease appeared predominantly inflammatory, and no person examined had clinical characteristics consistent with a classification of "periodontosis." Only two persons, both young adult males, were classified

as having ulceromembranous gingivitis. Periodontal index and gingival recession scores were directly related to scores for supragingival calculus and debris. The clinical condition of periodontal tissues was significantly better in persons relatively free of these deposits.

Within the limitations of the methods used in this survey, findings failed to demonstrate any significant relations between severity of periodontal diseases and varying levels of serum ascorbic acid and vitamin A and urinary excretion of thiamine, riboflavin, and N'methylnicotinamide. Most of the variation in periodontal index and gingival recession scores was accounted for by the combined effects of age and oral hygiene.

Summary

A dental survey of 1,085 Ethiopian civilian males and females, aged 5 through 84 years, was completed as part of a nutrition survey in Ethiopia conducted by the Interdepartmental Committee on Nutrition for National Defense in 1958. The prevalence of dental caries was low but the occurrence of periodontal diseases was widespread in this sample.

At a mean age of 23.9 years, 77 percent of the sample was free of dental caries. Persons younger than 40 years averaged less than one decayed, missing, or filled tooth per person; those older than 50 years averaged about three decayed, missing, or filled teeth per person.

The low dental caries experience of the sample could not be attributed to superior nutrition or ingestion of fluoride. The Ethiopian diet is traditionally high in total carbohydrates, but low in refined carbohydrates. Analysis of water from six of the eight geographic regions from which the sample was drawn indicated that fluoride content was somewhat below concentrations considered optimum for prevention of dental caries.

Deposits of supragingival calculus and debris were seen in more than 90 percent of the sample. The condition of periodontal tissues was directly related to the relative amounts of supragingival calculus and debris.

Serum levels of ascorbic acid and vitamin A and urinary excretion of thiamine, riboflavin, and N'methylnicotinamide did not appear to be associated with either periodontal index or gingival recession scores in 211 persons for whom these determinations were made.

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Occupational Health Notes

Airport Employees

Many civil airports lack immunization programs and other health services for employees, according to a study by the Division of Occupational Health, Public Health Service, and the Federal Aviation Agency. A recent smallpox incident involving an air passenger has pointed up the need for occupational health services for airport employees, many of whom have daily contact with overseas travelers.

At the Logan International Airport in Boston, occupational health services, as well as emergency care for passengers, are being provided 24 hours a day in a clinic recently established by the Massachusetts General Hospital.

CO Produced by a Blue Flame

Carbon monoxide detected in the heat-treating department of a large manufacturing company in Ohio was traced to a water heater in a washroom. The washroom was located in the heat-treating room, partitioned by walls that reached only part way to the ceiling.

The 60-gallon heater was too small to supply all the hot water needed, and the burner flame was often turned on to its maximum height. Although the flame was blue, indicating complete combustion, carbon monoxide was given off when the flame impinged against the cold surface of the water tank.

In many cases of carbon monoxide inhalation in industrial plants in Ohio, the gas has been traced to a blue flame, misleading plant personnel who were unaware of the effects of the flame when it impinges against a cold surface.

Reduction of Silica Dust

In a foundry where olivine sand containing up to 5 percent free silica was used instead of silica sand, the free silica content of the airborne dust was found to be greatly reduced. The total dust count was as high as that produced by silica sand.

Foundry operations involving the use of bentonite, silica-type cores, and silica parting compounds also contribute to the silicosis hazard. Conversion to olivine sand therefore cannot be considered an alternative to effective ventilation.

Basic Reference List

A list of publications for a basic reference library in occupational health and related areas has been compiled by the Public Health Service at the suggestion of the Industrial Medical Association. An ad hoc IMA committee designated 10 reference works as the most important in the field of occupational health. The complete list, titled "Occupational Health Bookshelf," was published in the March 1963 *Journal of Occupational Medicine*. Reprints are available from the Division of Occupational Health, Public Health Service, Washington 25, D.C.

CDC Training Program, 1963–64

Training courses offered by the Communicable Disease Center, Public Health Service, from July 1963 through June 1964 are listed below. This list represents the complete schedule for the period. Courses listed under "Organization and Orientation" are especially developed for people from other countries. Additional information and application forms may be obtained from either the Chief, Communicable Disease Center, Atlanta 22, Ga., or the appropriate regional office of the Department of Health, Education, and Welfare. Applications should be submitted at least 6 weeks before the beginning of each course.

Epidemiology

Principles of epidemiology (101). Jan. 13–17; Atlanta.

Applied and field epidemiology (103). July 8–Aug. 2; Atlanta.

Applied epidemiology (112). Nov. 4–8; May 4–8; Atlanta.

Epidemiology for nurses (121). Mar. 16–20; Atlanta.

Principles of epidemiology for nurses (122). Dates and locations by arrangement with schools of nursing in universities and colleges.

Applied epidemiology for nurses (123). June 8–12; Atlanta.

Epidemiology for veterinarians (141, formerly course 140). Feb. 24–28; Atlanta.

Vector Control

Epidemiology and control of vector-borne diseases (201). Feb. 10–14; Atlanta. Other dates and locations by arrangement.

Insect control (203). Sept. 9–20; Atlanta.

Rodent control (211). Sept. 23–Oct. 4; Atlanta.

Insect and rodent control (221). June 8–19; Atlanta.

Mosquito control (231). Nov. 4–8; Atlanta.

Identification and biology of arthropods (241). Jan. 6–17; Atlanta.

Community Control of Communicable Diseases

Epidemiology for professional sanitarians (308). Jan. 6–10; Atlanta.

Epidemiology and control of foodborne diseases (311). May 11–15; Atlanta.

Practical procedures for control of foodborne diseases (312). Dates to be arranged; State and multistate presentations.

Principles of foodborne disease—epidemiology and control (313). Dates to be arranged; State presentations by arrangement.

Communicable disease control in the community—environmental (323). Feb. 24–28; Atlanta.

Communicable disease control in the community—administration (324). Nov. 25–29; Atlanta.

Community action for communicable disease control (381). Oct. 7–11; Huntsville, Ala.

Microbiology of the hospital environment (391). Sept. 16–20; Atlanta.

Venereal Disease Control

Orientation and training of venereal disease program physicians (412). Dates by arrangement; Venereal Disease Branch, Atlanta; Venereal Disease Research Laboratories, Chamblee; Fulton County Health Department, Atlanta.

Nursing work conferences on the control of venereal disease (421). Dates to be announced; location to be determined.

Nursing in venereal disease control (422). Monthly, September through June; New York City Department of Health, Bedford Health District, John F. Mahoney Training Center, 485 Throop Ave., Brooklyn 21, N.Y.

Venereal disease contact interview and investigation (431). Dates to be determined on basis of need; Venereal Disease Training School, Detroit City Health Department, Detroit, Mich.; Venereal Disease Training School, Los Angeles Department of Health, Los Angeles, Calif.

Current laboratory methods in the serology of syphilis (454). Sept. 16–Oct. 4; Dec. 2–20; Apr. 6–24; Venereal Disease Research Laboratory, Chamblee.

Management and control of syphilis serology by the central laboratory (455). May 11–22; Chamblee.

The *Treponema pallidum* immobilization (TPI) test (456). Dates by arrangement; Chamblee.

Introduction to fluorescent antibody methods (457). Oct. 21–25; Jan. 6–10; Feb. 24–28; Chamblee.

Fluorescent antibody methods in the diagnosis of the venereal diseases (458). Oct. 28–Nov. 8; Jan. 13–24; Mar. 2–13; Chamblee.

Darkfield microscopy for the detection and identification of the *T. pallidum* (459). Nov. 18–20; Nov. 20–22; Feb. 3–5; Feb. 5–7; Feb. 10–12; Feb. 12–14; May 4–6; May 6–8; Chamblee.

Health Mobilization

Emergency health services—the stateline training course (501). Dates by arrangement; State health departments.

Emergency health services—the community level training course (511). Dates by arrangement; local health departments.

Emergency health services—environmental health personnel in disasters (521). Dates by arrangement; State and local health departments.

Training Methods and Training Aids

Training methods (601). Sept. 4–6; Atlanta.

The preparation and use of training aids (611). Sept. 9–13; Atlanta.

Development of teaching presentations (631). Sept. 16–20; Atlanta.

Organization and Orientation

Principles, organization, and practice of communicable disease control (701). June 17–July 22; Summer 1964; Atlanta.

Applied epidemiology in communicable disease control (712). June 15–July 10 (tentative); Atlanta.

Nursing aspects of communicable disease control (720). Summer 1964; Atlanta.

Environmental aspects of communicable disease control (730). June 10–July 5, 1963; June 8–July 3, 1964; Atlanta.

Laboratory Methods

Laboratory methods in medical parasitology, part I (800). Sept. 9–Oct. 4; Atlanta.

Laboratory methods in medical parasitology, part II (801). Oct. 7–25; Atlanta.

Laboratory methods in medical mycology (815). Jan. 6–31; Atlanta.

Laboratory methods in the study of pulmonary mycoses (817). Feb. 10–21; Atlanta.

Laboratory diagnostic methods in veterinary mycology (940). Mar. 2–6; Atlanta.

Laboratory methods in the diagnosis of viral and rickettsial diseases (820). Dec. 2–20; Mar. 9–27; Atlanta.

Laboratory methods in the diagnosis of rabies (826). Oct. 28–Nov. 1; Apr. 6–10; Atlanta.

Laboratory methods in medical bacteriology (838). Feb. 24–Mar. 13; Atlanta.

Special problems in medical bacteriology (839). Mar. 16–20; Atlanta.

Laboratory methods in enteric bacteriology (850). Mar. 23–Apr. 3; Atlanta.

Laboratory methods in the diagnosis of tuberculosis and related mycobacterial infections (855). Jan. 13–24; Jan. 27–Feb. 7; Atlanta.

Bacteriophage typing of staphylococci (856). Dec. 2–6; Atlanta.

Principles of fluorescent antibody microscopy (845). Oct. 21–25; Atlanta.

Fluorescent antibody techniques in parasitology (848). Oct. 28–Nov. 1; Atlanta.

Fluorescent antibody techniques applied to streptococcus grouping and other bacterial identifications (860). Oct. 28–Nov. 8; Atlanta.

Serologic methods in microbiology (941). Mar. 30–Apr. 10; Atlanta.

Clinical chemistry instrumentation (890). May 4–15; Atlanta.

Basic spectrophotometry (892). Nov. 18–22; Atlanta.

Central services workshop (900). June 15–17; Atlanta.

Special training in mycology (818). Mycology Unit, Mycology and Parasitology Section, Laboratory Branch, Atlanta.

Special training in virus techniques (821). Virology Section, Laboratory Branch, Atlanta.

Special problems in determinative bacteriology and bacterial serology (851). General Bacteriology Unit, Bacteriology Section, Laboratory Branch, Atlanta.

Special problems in enteric bacteriology (852). Enteric Bacteriology Unit, Bacteriology Section, Laboratory Branch, Atlanta.

Special problems in mycobacteriology (853). Tuberculosis Unit, Bacteriology Section, Laboratory Branch, Atlanta.

Special problems in streptococcus and staphylococcus identification (854). Staphylococcus and Streptococcus Unit, Bacteriology Section, Laboratory Branch, Atlanta.

Special problems in fluorescent antibody techniques (861). Special Projects Unit, Bacteriology Section, Laboratory Branch, Atlanta.

Special problems in parasitology (862). Parasitology Unit and Parasitology Training Unit, Laboratory Branch, Atlanta.

Laboratory methods in the diagnosis of leptospirosis (864). National Leptospirosis Reference Laboratory, Atlanta.

Special training in hematology (894). Hematology Standardization Laboratory, Medical Laboratory Section, Laboratory Branch, Atlanta.

Special training in clinical chemistry (895). Medical Laboratory Section, Laboratory Branch, Atlanta.

Seminars

Seminars for professional organizations (011). Dates and locations by arrangement with program committees of professional organizations.

Regional symposia (012). Dates to be announced; locations by arrangement with PHS regional offices.

NOTE: *Where not specified, date of course is by arrangement.*

Federal Publications

Laboratory Manual for Medical Mycology. *PHS Publication No. 994; 1963; 296 pages; $2.25.*

This manual presents basic information necessary to carry out laboratory diagnosis of mycotic diseases and identification of pathogenic fungi. The material includes methods for collection of specimens and laboratory techniques useful for isolation and identification of pathogenic fungi. Serologic methods including fluorescent antibody studies useful in diagnosis of fungus diseases are also discussed. A bibliography and a glossary are included.

Mientras Su Bebe Esta En Camino. *Children's Bureau Publication No. 391; 1963; 20 cents.*

This Spanish edition of the Children's Bureau publication "When Your Baby Is on the Way" is intended to help Spanish-speaking citizens learn about good health practices during pregnancy. Like the English edition, it is geared to meet a special need for good health advice at the lower socioeconomic levels where complications in pregnancy and childbirth are most prevalent. With pictures and simple text, it describes the steps the mother needs to take during pregnancy, as well as how she can best use the health facilities of her community.

A Mental Health Manpower Studies Program. *PHS Publication No. 1027; 1963; 98 pages.*

What has been done and what is being planned to implement a systematic data collection and analysis program on mental health manpower in the United States is described. Mental health manpower is broadly defined as clinical and counseling psychologists, psychiatrists, psychiatric nurses and social workers, other professional personnel employed in mental health establishments, and psychiatric aides.

Also included are statistical tables, data analysis, and charts on various demographic and employment characteristics of psychiatrists who are members of the American Psychiatric Association and clinical and counseling psychologists who are on the National Register of Scientific and Technical Personnel.

Salaries of Dental Personnel in State Health Departments. *PHS Publication No. 1016; 1963; by Gcorge E. Mitchell and Kathryn J. Connor; 66 pages.*

The first published report on salaries of all types of dental personnel in State health departments, this publication shows salary ranges and distribution of positions within minimum and maximum salary categories as of December 31, 1962. Also included is a summary of job specifications and salary ranges of all State dental health personnel, arranged by region.

Areawide Planning of Facilities for Long-Term Treatment and Care. *PHS Publication No. 930–B–1; February 1963; 81 pages; 55 cents.* Presents findings of a joint committee of the American Hospital Association and the Public Health Service. Report covers the extent of need for services, current availability and adequacy of facilities and services, types and organization of facilities necessary to provide adequate treatment, care, and rehabilitation, and action required to attain these goals. Provides guidelines for areawide planning of facilities for long-term care.

The Progressive Patient Care Hospital: Estimating bed needs. *PHS Publication No. 930–C–2; 1963; 17 pages; 20 cents.* Summarizes findings of a progressive patient care study at the Manchester (Conn.) Memorial Hospital, conducted by the Public Health Service in 1959–60 as a Hill-Burton intramural research project. The study analyzes the variation in patient census in intensive care, intermediate care, and self-care units and presents a formula for determining bed needs for each of these units.

Hospital Engineer in the Construction Sequence. *PHS Publication No. 930–D–8; 1963; by Philip Dreifuss; 3 pages.* Stresses the need for including the hospital engineer in early phases of planning for hospital construction. Outlines functions of the engineer during construction and at the beginning of operation. (Reissue of an article from *Hospitals*, Journal of the American Hospital Association, August 1, 1958.)

Patients in Mental Institutions, 1960. *PHS Publication No. 963; 1963.*

PART I. PUBLIC INSTITUTIONS FOR THE MENTALLY ILL; *65 pages.*

PART II. PUBLIC MENTAL HOSPITALS; *76 pages.*

PART III. PRIVATE MENTAL HOSPITALS AND GENERAL HOSPITALS WITH PSYCHIATRIC FACILITIES; *57 pages.*

PART IV. PRIVATE INSTITUTIONS FOR THE MENTALLY RETARDED; *40 pages.*

Basic data on numbers and characteristics of hospitalized mental patients and on movement of the patient populations of the various facilities are presented. Administrative data are also included for the public mental hospitals and institutions. The text for each part gives definitions, limitations of the data, and coverage of facilities.

This section carries announcements of new publications prepared by the Public Health Service and of selected publications prepared with Federal support.

Unless otherwise indicated, publications for which prices are quoted are for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Public Health Service, Washington 25, D.C.

The Public Health Service does not supply publications other than its own.
