A Nutritional Study of a Community of Kiowa Indians

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Although Oklahoma has a large Indian population, very little is known concerning the nutritional status or dietary practices of these people. With the idea of obtaining such information a group of Kiowa Indians at Carnegie, Oklahoma was studied. There is little intermarriage with the white race in this group and it was the right size. The investigation, undertaken during the summer of 1951, was a joint project of the United States Indian Service in Oklahoma, the State Health Department, and the School of Home Economics at the University of Oklahoma. The plan included a dietary study of representative families, a medical examination, and blood tests for whole blood specific gravity, plasma specific gravity, plasma proteins, ascorbic acid, and pyruvic acid.

In order to determine the nutritional condition of people, several methods may be used, such as medical and dental examinations, blood tests for various vitamins or the protein and hemoglobin content, urine examinations, or an investigation of the dietary practcies. All of these have been thought to have a bearing upon the nutritional state of the individual, and have been used in various investigations.

Not many studies have been made on Indians. Carpenter and Steggerda (4) investigated the habits of the Navajos of New Mexico and Arizona, Pijoan, Elkin, and Eslinger (12) the ascorbic acid deficiencies among the Papago Indians, Anderson, Calvo, Serrano, and Payne (1) the nutritional condition of the Otomi Indians of Mexico, and Pijoan and Elkin (11) the extent of anemia in Shoshone Indian infants due to prolonged and exclusive milk feedings.

The group of Indians in the present study included about 107 families who lived in or around Carnegie, Oklahoma, in the southwestern part of

the state. The group was selected by the Area Medical Officer of the Western Division, Federal Indian Agency, who gained consent of the tribal leaders. A random selection was made of approximately 25 per cent of the 107 families (about 30 families or 81 people) ranging in age from five to 78 years.

The families selected were visited by two public health nurses and the senior author to see if they were willing to cooperate in the study. If not, further random selections were made. A nutritional questionnaire (developed by the senior author) was used for a 24-hour dietary recall history of each cooperating family at the time of the initial visit, and an appointment at the Federal Agency Clinic for a physical examination was given. They were instructed to omit breakfast the morning of the examination.

As each Indian family arrived at the clinic, fasting venous blood was drawn and a urine sample was taken. After this procedure each person was served a light breakfast.

The same nutritional questionnaire was used for a second 24-hour dietary recall history. Certain values were arbitrarily given to eight food groups: meat, fish and poultry; milk; eggs; fruits (including citrus or good ascorbic acid sources and other fruits); vegetables (green or yellow, potatoes, legumes, etc.); cereals (whole grain or enriched as well as refined); fats (butter, fortified margarine, etc.); and bread, and the dietary histories scored accordingly. The average for the two days diets was used as the final score for diets.

Each person was given a physical examination with emphasis upon the physical signs usually associated with nutritional deficiencies. Findings were recorded on a form developed by the Federal Indian Agency.

Part of the venous blood was used for the specific gravity and pyruvic acid tests. The rest was centrifuged and the plasma used for specific gravity and ascorbic acid tests.

For the specific gravity checks on blood the copper sulphate method of Phillips, *et al.* (10) was used. The figures for specific gravity of whole blood and plasma plus the calculations from the charts included in the material were used to compute the hemoglobin and plasma protein values. The Mindlin and Butler (9) method was used for the ascorbic acid determinations and the Friedemann and Hangen (6) method for the pyruvic acid.

The diets were scored according to the number and size of servings of each of the eight food groups (previously listed) served per person per day. The highest possible score, 155, indicated a normal amount of the food recommended in each of the food groups for each member of the family. In this study a dietary plan scored 125 or above was considered

TABLE I

Distribution of Diet Scores of 30 Indian Families

Diet Scores	Number of Families
50—59	1
60—69	5
70—79	4
80—89	7
90—99	8
100—109	3
110—119	2
120—129	0
(Maximum=155)	Total 30

adequate, 100 to 125 borderline and below 100 deficient. No family scored 125 or above, only five of the thirty families had diets that scored 100 to 125, one-half scored 80 to 100 and one-third below 79 (Table I). The greatest deficiency was milk, with vegetables and fruits next in line. Other deficiencies in descending order were fats, meat, fish and poultry, eggs and cereals (Table II). No diet was deficient in bread, and 29 families had practically no milk, even though there were children in most of these families.

TABLE II

Classification of Food Groups and Amounts Used by 30 Indian Families.

Food groups	Number of families with adequate amounts	Number of families with borderline amounts	Number of families with deficient amounts
Meat, Fish and Poultry	16	2	12
Milk	0	1	29
Eggs	19	0	11
Fruits	2	3	25
Vegetables	2	1	27
Cereals	18	2	10
Fats	10	2	18
Bread	29	1	0

As for the physical examinations 81 persons were checked for 74 separate symptoms of nutritional deficiencies. Mild signs occurred 118 times, moderate signs 88 times and severe cases 30 times. Twenty-seven persons had at least one symptom and 18 had combinations of two or more deficiencies. The most common difficulty involved the teeth. There were 26 cases of mild or moderate malocclusion, and 22 cases of mild, 18 of moderate, and 10 of severe dental caries. There were also several cases of loss of teeth, some of excess subcutaneous fat, 27 of mild or moderate symptoms of gingivitis, and 13 cases of mild or moderate fissuring of the tongue.

Using the method of Phillips, *et al.* (10) the specific gravity of the whole blood and plasma was determined and from these figures the hemoglobin and plasma protein were charted. These authors give six to eight grams per 100 ml. for the normal range of plasma protein. The means for the different ages in this group all came within this range with the figures being closer to six than to eight. One person had a plasma protein concentration below six, 39 had values between six and seven, and 24 had values between seven and eight grams per 100 ml.

The mean hemoglobin values for the children were only a little below the figures considered normal (12.6 to 13.4 grams per 100 ml.) by Wintrobe (14), but the adults were farther from the normal (14 $\pm$ 2 to 16 $\pm$ 2 grams per 100 ml. (14)) than the children were. Forty per cent of the children had values below 12 grams per 100 ml., 44 per cent of the women had values below 12 grams per 100 ml., and only two of the nine men came within the normal range. Approximately 50 per cent of all the Indians examined had values below the means ordinarily considered normal. The hemoglobin values of the present group are slightly lower than those found by Anderson, Calvo, Serrano, and Payne (1) for the Otomi Indians of Mexico.

The mean values for pyruvic acid of the blood for all age groups were higher than the figures considered normal, ranging from 0.83 to 3.35 mg. per cent with a mean of 1.65 mg. per cent. Bueding, Stein, and Wortis (2) say that a figure above 1.30 mg. per cent is abnormally elevated and that the blood of persons with a thiamine deficiency may reach a figure of 1.80 mg.

per cent. Horwitt and Kreisler (7) comment that "Though it is proper to suspect pathology whenever a basal pyruvic acid level exceeds 1.2 mg. per cent, such levels are not uncommon even in the absence of any metabolic disorders". They feel that the pyruvate figures should be compared with the blood glucose level before deciding there is a pathological condition. Williams, Mason, and Wilder (13) checked two women at the start of a dietary experiment and noted pyruvic acid values of 0.7 to 0.8 mg. per cent. At the end of 110-116 days on a restricted thiamine intake the mean had risen to 1.2 to 1.5 mg. per cent, somewhat the same as for the women in the present study.

The ascorbic acid figures averaged 0.68 mg. per 100 ml. plasma, a figure that is slightly above the minimum figure of 0.6 mg. per 100 ml. plasma suggested by Butler, *et al.* (3) and McLester and Darby (8). However, Donelson, *et al.* (5) recommend 0.8 mg. per 100 ml., at least for adults. Forty-four per cent of the younger children had values below 0.8 mg. and 22 per cent had values below 0.6 mg. per 100 ml. For the older children, 70 per cent had ascorbic acid figures below 0.8 mg. and 40 per cent values below 0.6 mg. Seventy per cent of all the adults had values below 0.8 mg. per 100 ml. plasma. Anderson, *et al.* (1) in their study of the Otomi Indians found mean values for ascorbic acid for the different age groups of 1.16 to 1.28 mg. per 100 ml., values all higher than those obtained for the Oklahoma Indians.

The insufficiencies found in the dietary studies, specifically in milk, vegetables and fruits, and meat, fish, and poultry, indicate diets low in mineral elements (especially calcium), vitamins (the B vitamins and ascorbic acid in particular), and fairly low in protein. These lacks show up in the results of the various tests—90 per cent of the group showing some signs of poor nutrition, such as considerable dental caries, some gingivitis and fissuring of the tongue, somewhat low hemoglobin figures, particularly for the adults, fairly high pyruvic acid values, and low ascorbic acid figures.

It must be kept in mind that a dietary study of this type does not give exact information, for the food intake may not be recalled correctly by the informant, the information is for only two days and for just one season of the year. However, the fact that the nutritional condition of the Indians did not rate very high might indicate that perhaps the information is not too far removed from the average diet of these people. It is, therefore, recommended that (a) a greater effort be made to help this group of Indians improve their dietary habits, (b) special emphasis be placed upon the importance of the "protective foods", (c) these people be shown how to use the canned and dried milks, since nearly every family had children and very few families had any means of refrigeration, (d) these families be encouraged to have vegetable gardens, raise chickens, and have their own cows, and (e) they receive instruction in canning and preserving so that their vegetables can be prepared for winter as well as summer use. Although the classes and help of the Home Demonstration Agent are available, it may be necessary, at least for a tme, to increase the staff in order to give these people additional help so that they will improve their dietary habits.

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