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# USE AND NUTRIENT COMPOSITION OF TRADITIONAL NAVAJO FOODS

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Traditional foods of the Navajo were examined to determine the adequacy of their traditional diet. Descriptive data on the traditional foods were collected during six months of anthropological fieldwork. Samples of 92 foods were analyzed for proximate composition, eight minerals, and some for two vitamins. The present-day use of these foods was assessed by administering a modified food frequency questionnaire to 86 Navajo women. Wild food plants were found to be infrequently used but nutritious, some had exceptionally high concentrations of vitamin A. Corn foods were more frequently used and had a high mineral content, especially when culinary ash was added. Sheep were often home-butchered, and most parts still consumed. The results suggested that the Navajo would have been able to meet their nutritional requirements with traditional foods if sufficient amounts and proportions were consumed, and that increased use of some of the traditional foods today could mean improved nutrient intakes.

**KEY WORDS:** Navajo Indians, native foods, Native American diet, wild foods, nutrient composition, minerals, vitamins, Indian corn, ethnoscience, Navajo diet.

## INTRODUCTION

It is commonly thought that the diets of pre-Columbian American Indians were fairly well balanced and composed of nutritious foods. This is difficult to test, because traditional diets are seldom consumed by Native Americans today, except by some of the elderly. Instead, the diets of many Native Americans are composed primarily of modern refined foods, and there is widespread use of high-calorie low-nutrient foods such as potato chips and soft drinks. These dietary patterns may be related to the high incidence of modern-day health disorders among Native Americans, such as obesity, diabetes and dental caries (Task Force on Indian Health, 1976).

The Navajo Indians of southwestern United States are typical examples of this phenomenon. Like most other Native American groups, the Navajo suffer from high rates of adult obesity and diabetes, infant mortality and high-risk pregnancies, alcoholism, poor dental health and early adult death (W.I.C., 1980; Navajo Area Indian Health Service, 1982). Certain vitamin and mineral deficiencies have been reported among some Navajo (Butte, Calloway and van Duzen, 1981), and their modern diet may be related to many of their current health problems.

The diet of the Navajo has changed dramatically since pre-Columbian times. Archeological data suggest that the diet consisted only of wild plants and animals

until around the thirteenth century, when the Navajo, an Athabaskan tribe originally from the north, migrated into the southwest and learned to farm from their new Pueblo neighbors. Corn became a major staple in the diet. A few centuries after this, the Spanish entering the area brought with them sheep and cattle, and the Navajo became herders (and consumers of mutton and beef) while still continuing to farm part-time. They also continued to hunt and gather to some extent (Downs, 1972).

Today, the Navajo Nation numbers over 151,000 tribal members and is the largest Native American tribe in the U.S., both in population number and in land area (Downs, 1972). The 27,000-square-mile reservation is located in parts of Arizona, New Mexico and Utah. The reservation land is harsh and dry, lying at elevations between 5,000 and 10,000 feet, and is sparsely settled.

In recent decades, many processed foods have been introduced into the diet as a result of government rationing, food distribution programs and the growth of trading posts and food stores throughout the reservation (Darby *et al*, 1956; Reisinger, Rogers and Johnson, 1969). Although mutton still appears to be frequently consumed, and some home-cultivated foods are also eaten, in general, traditional foods appear to be used infrequently in the contemporary Navajo diet. Few studies have been conducted to document this, although one study in 1972 showed that only 47 % of 281 Navajo households used one native food "occasionally" (Alford and Nance, 1976).

The nutritional implications of the declining use of traditional foods have not been adequately assessed. This is largely due to the limited information available both on the extent of consumption of Navajo foods and on the nutritional value of these foods. In an early study, 66 samples of foods from the Navajo daily diet were nutritionally analyzed, but only for moisture, fat, nitrogen and energy content (Carpenter and Steggerda, 1939; Steggerda and Eckardt, 1941). The preparations and uses of these foods were also examined, but it is difficult to identify some of the foods, because no Navajo or scientific names were recorded. Some Navajo food names were finally recorded by Bailey in 1940 in a detailed anthropological study of Navajo foods and methods of cooking (Bailey, 1940). Several other studies have described some of the wild foods used by the Navajo (Darby *et al*, 1956; Elmore, 1935; Underhill, 1953; Lacy, 1978;† Lacy, 1979‡). Recently the nutrient composition of traditional Hopi foods was determined (Kuhnlein, Calloway, and Harland, 1979; Calloway, Giauque and Costa, 1974), and some of these foods are similar to those of the Navajo.

In 1973, at the request of members of the Navajo Nation, Niesen and Sheehan\* of the University of Arizona studied Navajo interest in, and use of, native foods to ascertain whether a large scale nutrient analysis of the foods was justified. Facilitated by the director of the Navajo Food and Nutrition Services, the authors found much interest in the traditional foods and concluded that a larger study was needed and wanted.

Funding for such a project was finally obtained by the tribe in 1980, and the present study was undertaken to determine the nutritional value of the traditional

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\*Lacy, B. (1978). *Nanise: A Navajo Field Guide to 100 Reservation Species*. Navajo Health Authority Ethnobotany Project.

†Lacy, B. (1979). *Food That Grows on Earth*. Printed notes to slide presentation, Navajo Health Authority Ethnobotany Project.

‡Niesen, A.C., and E.T. Sheehan. (1973). *Analysis of Native Navajo Foods*. Unpublished research paper, Dept. of Nutrition and Food Science, University of Arizona, Tucson.

Navajo foods and to record knowledge of food preparations and beliefs before they are forgotten. The nutrient composition of many of the traditional foods still obtainable today is presented here, along with an assessment of their frequency of use.

## METHODOLOGY

### *Ethnographic Data Collection*

Ethnoscience methods were used to collect initial descriptive information on the use and preparation of traditional Navajo foods. This was done during six months of anthropological fieldwork on the reservation in 1979 and 1980. Formal, tape-recorded interviews, as well as informal interviews, were conducted with Navajo women knowledgeable about traditional ways. Participant observation (anthropologically studying a phenomenon through participation in it) was also used, especially in the preparation of some of the foods. The ethnographic data collection was continued in the summers of 1981 and 1982, when samples of the foods were collected for nutrient analysis. For most of the foods collected, the preparation was observed, recipes were recorded and weight/volume equivalents of typical portion sizes were estimated by one of the authors.

Navajo names of the foods were tape-recorded and transcribed using the current phonetic Navajo alphabet. The spelling of these names was checked and corrected by William Morgan, Sr., co-author of the 1976 Navajo language dictionary (Young and Morgan, 1976), according to the pronunciations provided by two Navajo women familiar with the traditional foods. Scientific names of wild food plants were taken from published ethnobotanies of the Navajo (Elmore, 1935) and other literature on their foods (Bailey, 1940; Underhill, 1953; Lacy, 1978; Lacy, 1979, see footnotes on previous page; Harrington, 1976); Navajo and English names, slides and drawings from these sources were matched with names and actual samples collected in the present study to ascribe the appropriate scientific names to the plants. Some degree of error may have been introduced here, as the plants were not checked by a botanist; and in some cases only the genus, and not the exact species, could be assigned to a given sample.

Data on the present-day use of the traditional foods were gathered in 1982 from 86 Navajo women of varying ages by using a modified food frequency questionnaire. This contained a list of fourteen traditional foods identified in the ethnographic fieldwork as being relatively common or at least widely known. The women were asked to self-report the frequency (daily, weekly, monthly, yearly or never) with which they used each food.

### *Food Sample Collection*

It was not possible, due to seasonal, time and budget constraints, to collect samples of all the traditional Navajo foods identified in the ethnographic data (Wolfe, 1981)<sup>†</sup>, or preparational variations or duplicate samples from many different cooks or areas; nonetheless, samples of a wide variety of foods were obtained. Samples of

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<sup>†</sup>Wolfe, W.S. (1981). *Navajo Foods and Foodways: Cultural and Nutritional Changes with Acculturation*. Unpublished Senior Honors Thesis, Dept. of Anthropology, Northwestern University, Evanston, IL.

92 traditional Navajo foods were collected, some being preparational variations of the same food. These were thought to represent the most commonly consumed and available of the traditional foods. Some wild foods were not collected because the Navajo women could not locate them.

The foods were collected and prepared by Navajo women knowledgeable about traditional cooking methods. Fresh samples were frozen immediately after preparation and transported frozen by car or air to the laboratories for analysis. Foods preserved by the traditional method of drying were collected and transported in clean plastic containers.

### *Laboratory Analyses*

*Proximate and mineral analyses.* Food samples were lyophilized upon arrival at the lab, and their moisture content determined. Each was then ground into a homogeneous sample and analyzed in triplicate. If variability was above the laboratory standard for a given nutrient, the analysis was repeated.

The 92 samples were analyzed for proximate composition by the following AOAC procedures (1980): crude protein by the Kjeldahl nitrogen determination method; crude fat by the Goldfish hexane extraction method; ash by use of an electric muffle furnace at 600° C; and crude fiber and lignin by the acid-detergent method of Van Soest (1963). Carbohydrate was determined by difference, and energy content was calculated from the total proximate composition.

Each sample was analyzed for eight minerals. Iron, calcium, magnesium, zinc, copper, sodium and potassium were determined by flame atomic absorption spectrophotometry; phosphorus was determined by the method of Koenig and Johnson (1942). Food samples were dry ashed in a muffle furnace at 450° C for 12 hours. The resultant ash was dissolved in 5% HCl and diluted to appropriate volumes. Lanthanum oxide was added to the samples of the magnesium and calcium to delete interference from other elements (Vaughan, Weber and Kemberling, 1979). All glassware used for mineral analysis was acid washed, and standard curves were run daily with all mineral determinations.

*Vitamin analyses.* The vitamin A activities of 39 food samples were determined by analysis for total carotene content using official AOAC methods (1980), 43.014-017 for fresh samples and 43.018-023 for dried. Retinol Equivalents (RE) of vitamin A were calculated on the basis of 1 RE = 6 µg of β-carotene, assuming the total carotene data was composed only of β-carotene. Thirteen food samples were analyzed for ascorbic acid (vitamin C) content using the dichloroindophenol method for the AOAC (1980), 43.056-060, modified by electromagnetic endpoint detection.

## RESULTS AND DISCUSSION

The names of each of the 92 Navajo foods examined in this study are listed in Table I. Many of the foods are known by more than one English or Navajo name, in which case only the more commonly used names are presented. The ingredients, preparations and estimated typical serving sizes (in household measures and in grams) of each food are also presented in this table.

TABLE I  
Names and descriptions of traditional Navajo foods analyzed.

English and scientific names	Navajo name	Ingredients and preparation	Typical serving	
			Household measure	Weight (gms)
<i>I.a. Breads and Mushes</i>				
Blue corn mush				
With ash	Taa'niit (Gad bit)	Blue corn flour ash, water Boiled	1 cup	240
Plain (no ash)	Tóschchiin (Gad ádin)	Blue corn flour water Boiled	1 cup	244
Frozen (“Navajo ice cream”)	Dah yistin	Blue corn flour ash, water Boiled, frozen	1 cup	244
Blue dumplings	K'ineeshbízhií (Naadqáq' ak'áán)	Blue corn flour ash, water Made into balls, boiled	1 cup	267
Blue bread, shaped	Bááh dootf'izhi	Blue corn flour ash, water	1 piece, 4" diam. × 7/8"	136
Blue mush tamale (“Mickey Mouse”)	Be'est'óní	Blue corn flour ash, water Wrapped in husks, boiled	1 in husk 5" × 1" × 1 1/2"	70
Navajo pancake				
Variation 1	Abe'bee neezmasí naadqáq' ak'áán bee alyaaígíí	Blue corn flour evap. milk Griddled	2 cakes 4 1/2" diam.	126
Variation 2	Abe'bee neezmasí ak'áán higaai bee alyaaígíí	Blue corn flour white wheat flour whole milk Griddled	2 cakes 4 1/2" diam.	100
Kneel-down bread				
Fresh	Nitsidigo'í	Fresh Indian corn Ground, wrapped and baked in husks	1 in husk 3" × 5 1/2"	105
Dried	Nitsidigo'í sháq'nií'nil	As above Dried in pieces (Soaked to eat)	1/2 cup dry	66
With blood (Navajo tamale)	Dił Nitsidigo'í	Ground fresh corn sheep blood, fat Wrapped and baked in husks	1 in husk 3" × 6 1/2"	179
Navajo cake				
Fresh	Yilkqáqđ (or alkqáqđ)	Yellow corn flour (parched) brown sugar wheat sprouts (dried and ground) Baked in pit in ground	1 piece 3" × 3" × 1 1/2"	110
Dried	Yilkqáqđ (or alkqáqđ) sháq'niiti'	As above Dried in pieces (Soak in milk to eat)	1/2 cup, dried	66

TABLE I continued

Baked Stuffed Squash Blossoms				
Variation 1	Naayízi bitá'itsohí	Blue corn flour whole milk Boiled into mush, blossoms filled, baked	2 medium	146
Variation 2	Naayízi bitá'itsohí	Blue corn flour white wheat flour whole milk Baked as above	2 medium	146
Navajo Fry Bread Plain	Dah díníilghaazh	White wheat flour baking powder, salt, warm water Dough flattened thin, deep-fat fried	1 piece 5" diam.	90
With powdered milk	Dah díníilghaazh abe' dibahí bił álya	White wheat flour baking powder, salt, powdered milk, warm water Fried as above	1 piece 5" diam.	90
With powdered milk and dehyd- rated egg mix	Dah díníilghaazh abe'dibahí dóó ayeezhii dibahí bił álya	White wheat flour baking powder, salt, powdered milk, dehydrated egg mix warm water Fried as above	1 piece 5" diam.	90
Flour tortilla	Náneeskaadí	White wheat flour baking powder, salt, warm water Dough flattened thin Griddled	1 piece 6" diam.	75
<i>I.b. Other Corn Products</i>				
Yellow Indian corn flour	Naadá' áftsoii ak'áán	Dried raw corn Ground finely	½ cup, dry	68
Blue Indian corn flour, parched	Naadá' doot'izhí názt'é	Dried raw corn Ground finely, parched	½ cup, dry	71
Blue Indian corn kernels, dried	Naadá' doot'izhí	Dried raw corn kernels Unground	½ cup dry kernels	65
Hominy corn Plain	Hanígaii	White Indian corn Kernels dried raw, boiled	1 cup cooked	285
With ash	Hanígaii gad bił shibéezhgo	White Indian corn Kernels dried raw, boiled in ash-water, rinsed	1 cup cooked	191
With baking soda	Hanígaii bił é'él'íní fitsooígí bił álya	White Indian corn Kernels dried raw, boiled in bking. soda-water, rinsed	1 cup cooked	228

Hominy corn				
From steamed corn	Łee'shibéézh sháá' niilch'il dóó názhbéezhgo	Dried steamed corn (below) Kernels boiled	1 cup cooked	230
Steamed corn, dried	Łee'shibéézh sháá'niilch'il	Fresh ears of corn Steamed overnight, dried, kernels removed	½ cup dry kernels	100*
Roast corn, dried	Naadáá' ditléé' sit'é dóó yilzhóo'- go sháá' niilch'il	Fresh ears of corn Roasted, dried, kernels removed	½ cup dry kernels	100*
Parched corn, yellow	Naadá áftsoii sit'é	Yellow Indian corn Kernels dried raw, parched whole	½ cup kernels	59*
"Coffee creamers"				
Steamed corn	Łee'shibéézh ts'áábái	Dried steamed corn Ground finely	1 tbsp.	10
Navajo cake	Yilkąąd (or akkąąd) ts'áábái	Dried Navajo cake Ground finely	1 tbsp.	10
Corn silk, dry	Naadáá' bitsiigha' nááłtsaii	Silk from Indian corn Dried (eaten as cereal)	1 cup, dry	12
<i>I.c. Wild Greens</i>				
Wild celery ( <i>Cymopterus</i> spp.) dried	Aza'aleeh nááłtsaii	Leaves Sun-dried	1 tbsp.	1
Wild onion ( <i>Alium cernuum</i> ) and Wild Celery ( <i>Cymopterus</i> spp.), dried	T'ohchin dóó aza'aleeh nááłtsaii	Small onion bulbs celery leaves Sun-dried together	1 tbsp.	1
Wild celery and onion soup	Aza'aleeh dóó t'ohchin bii'ool'éél	Dried wild celery dried wild onion blue corn flour, fat Boiled in water	Not determined	
Navajo spinach or Beeweed ( <i>Cleome serulatum</i> )				
Fresh	Waa' shibéezhgo	Leaves Rinsed, boiled	½ cup cooked	100
Dried (western reservation)	Waa' shibéezh dóó sháá' niitléé'	Leaves Rinsed, boiled, dried in clumps	¼ cup dry	15
Dried (eastern reservation)	Waa' shibéezh dóó sháá' niitléé'	Leaves Rinsed, boiled dried in clumps	¼ cup dry	15
Pigweed ( <i>Amaranthus retroflexus</i> )				
Fresh	Tl'ohdeisk'idii shibéezhgo	Leaves Blanched	½ cup cooked	115
Dried	T'ohdeisk'idii nááłtsaii	Leaves Blanched, dried in clumps	¼ cup dry	15
Prostrate pigweed ( <i>Amaranthus blitoides</i> ), fresh				
	Naazkaadii	Leaves Boiled 10 minutes	½ cup cooked	115

TABLE I continued

<i>I.d. Wild Berries and Fruits</i>				
Wolfberry ( <i>Lycium pallidum</i> )				
Fresh	Haasch'eedjag'	Berries rinsed	1/2 cup	66
Dried, plain	Haaschch'eedjag' shibeezhgo shag' niitfee'	Berries Boiled, sun-dried	1 tbsp. dry	8
Dried, with clay	Haaschch'eedjag' dleesh biigo	Dried berries Reboiled, mixed with special clay	1/2 cup	67
Squaw or wax currant ( <i>Ribes cereum</i> ), fresh				
	K'inijah'	Berries Rinsed	1/2 cup	66
Sumac or sour berry ( <i>Rhus trilobata</i> )				
Fresh	Tsiitchin	Berries rinsed	1/2 cup	33
Dried	Tsiitchin naaltsaii	Berries Rinsed, sun-dried whole	1/2 cup	38
Pudding (from fresh berries)	Tsiitchin toshchiin	Juice of boiled berries white wheat flour sugar Boiled until thickened	1/2 cup	125
Juniper or cedar berry ( <i>Juniperus monosperma</i> ), dried				
	Gad bididze' shibeezh doo naaltsaii	Berries Sun-dried whole (Boiled to eat)	1/2 cup dry	20
Desert Yucca ( <i>Y. angustissima</i> )				
Fresh	Hashk'aan sit'ee-go (dooohoh)	Fleshy fruit Baked, peeled and cored, pulp mashed	1/2 cup (1 fruit)	50
Dried	Hashk'aan shag' niilgizh (dooohoh)	Fleshy fruit Peeled and cored, sliced, sun-dried	1/2 cup (1 fruit)	10
Navajo banana or mountain Yucca ( <i>Y. baccata</i> )				
Dried	Neesdoig	Pulp of fleshy fruit Boiled, ground up, partly dried, molded into roll on stick, dried	1 roll 2" diam. x 4" long	80
<i>I.e. Wild Nuts and Seeds</i>				
Tumble mustard ( <i>Descurainia</i> or <i>Sisymbrium spp.</i> )				
	K'oste'	Tiny seeds removed from pods of dry plants (Ground and added to corn breads to eat)	1/2 cup	37
Pinyon nuts ( <i>Pinus edulis</i> )				
	Neesch'if'	Nuts Roasted in shell (shell not eaten)	1/2 cup with shells	70

*I.f. Cultivated Squashes and Melons*

Dried squashes ( <i>Cucurbita</i> spp.)		(All boiled to eat)		
Yellow crooked neck	Naayízi náhineest'áqz	Peeled, sliced, blanched, dried	½ cup dry	10
Yellow	Naayízi náhineest'áqz	Peeled, sliced, dried	½ cup dry	10
White scallop	Naayízi náhinees- t'áqz (higaafgí)	Peeled, sliced, blanched, dried	—	—
Zucchini	Naayízi yázhí náhineest'áqz	Sliced, dried	½ cup dry	10
Squash blossom soup	Naayízi bitá'ii- tsóhii bí'ool'éél	Squash blossoms Dried, boiled in water	½ cup	225
Squash seeds	Naayízi bik'áq' sit'é	Seeds roasted, salted	½ cup	32
Cantaloupe, Dried	Ta'neesk'áni náhineest'áqz	Peeled, sliced, sun-dried (Boiled to eat)	2 strips 10" × 1" × ¼"	60
Watermelon, Dried	Ch'éhjiyáán niheeshgizhgo sháq' ní'nil	Peeled, sliced thinly, dried	—	—

*I.g. Traditional Beverages*

Goat milk	T'ízi bíbe'	Fresh milk	1 cup	184
Navajo tea ( <i>Thelesperma</i> spp)				
Long variety	Ch'il ahwéhé nineezi'gí	Stems and flowers Dried in bundles, boiled in water	—	—
Short variety	Ch'il ahwéhé áhts' ístgí	Stems and flowers Dried in loose form, boiled in water	—	—
Mormon tea ( <i>Ephedra</i> spp.)	T'oh'azihii	Stems Dried in loose form, boiled in water	—	—

*I.h. Clay, Ashes, Salts*

Clay				
White	Dleesh figaaf	Dry clay, moistened	1 tbsp.	23
Grey	Dleesh íbáhtí	Dry clay, moistened	1 tbsp.	23
Ash				
Cedar or Juniper ( <i>Juniperus monosperma</i> )	Gad bíleeshch'ih	Green branches Set alight on grill, ash collected, sifted	1 tbsp.	5
Tumbleweed ( <i>Salsola</i> spp)	Ch'ildeenfnt bíleeshch'ih	Dry plants Set alight on grill, ash collected, sifted	1 tbsp.	8
Greasewood	Díwózhii bíleeshch'ih	Dry woody branches Set alight on grill, ash collected, sifted	1 tbsp.	4
Salt				
Native Rock	T'áá ashjiihii	Rock salt crystals	—	—
Zuni Lake	T'áá áshjiihii	Powdery white lumps	—	—

TABLE I continued

<i>I.i. Meat: Mutton</i>				
Combination dishes				
Mutton stew	Dibé bitsj' shibéézh	Mutton, potato, onion, carrot, celery, green chile pepper Boiled in water	—	—
Blood sausage	Dibé bidit shibéézh	Sheep blood, fat mutton, potato corn meal, spices Poured into stomach, tied, boiled	—	—
Intestines, Roasted	Dibé bich'íí' sit'é	Rinsed, one piece coiled around other, roasted	1" diam. × 10"	141
Liver	Dibé bizid			
Roasted	sit'é	Roasted fresh	1 liver	446
Boiled	shibéézh	Boiled fresh	1 liver	309
Heart	Dibé bijéédíshjoolí			
Roasted	sit'é	Roasted fresh	1 heart	139
Boiled	shibéézh	Boiled fresh	1 heart	183
Kidney, Roasted	Dibé bitsá' áshk'azhí sit'é	Roasted fresh	1 kidney	76
Lungs	Dibé bijéyilzólíi			
Roasted	sit'é	Roasted fresh	1 lung	126
Boiled	shibéézh	Boiled fresh	1 lung	97
Esophagus	Dibé bizágí			
Roasted	sit'é	Roasted fresh	1 esophagus	97
Boiled	shibéézh	Boiled fresh	1 esophagus	157
Feet, Roasted	Dibé bikee' sit'é	Skinned, roasted, meat removed	Meat from 1 foot	15
Skin, Roasted	Dibé kágí sit'é	Wool removed, skin cut in strips roasted	1 strip 8" × ¼" × ¼"	86
Head, baked				
Brain	dibé bitsiighąą'	Baked in head	1 brain	98
Tongue	Dibé bitsoo'	Baked in head	1 tongue	112
Eyes	Dibé bináá'	Baked in head	1 eye	28
Ears	Dibé bijaa'	Baked in head	1 ear	37
Other meat	Dibé bitsiits'iin bąąh atsí ígíí	Baked in head	Meat from 1 head	171

\*Variations are due to differing methods of preparation. For example, steaming before drying shrinks the kernels, while parching after drying enlarges the kernels.

### *Corn Foods*

Many traditional dishes contain Indian corn, a type of cultivated field corn (*Zea mays*). Blue, yellow and white corn are the varieties most commonly used. Other colors of corn, such as red or striped red and yellow, are mostly used ceremonially.

Blue corn, with its dark blue-black kernels, seems to be the most popular type of Indian corn used in the traditional corn breads and mushes. Exceptions are kneel-down bread, which is made from fresh young Indian corn of any color, and Navajo

cake, which is always made from yellow or white corn flour.

Most of the blue corn foods also contain culinary ash which is mixed with boiling water and added, after straining, to the blue corn flour "to make it blue." Dry blue corn flour is a grey-blue color but turns pink when boiling water (without ash) is added. Blue corn contains an anthocyanin pigment that turns a distinct greenish-blue color in the alkaline medium created by the ash (Calloway, Giauque and Costa, 1974). Some Navajo women commented that the ash also makes the corn dish taste better. Plain blue corn mush, prepared without ash, is generally given only to infants, the sick and the elderly. Frozen blue mush, today called "Navajo ice cream" by some, was traditionally made only in the winter months, when it was frozen by placing it outside on top of the hogan<sup>†</sup> overnight. A few "red ashes" or hot coals were placed on the center of the mush to keep bad spirits away during the night.

Blue dumplings, blue bread and blue mush tamales are also made from blue corn flour and ash. Navajo pancake and baked stuffed squash blossoms are made from blue corn flour and milk, without the addition of ash, and with or without the addition of white wheat flour. Although the pancake is still commonly served, the squash blossoms are not.

Kneel-down bread, made with fresh corn, is prepared frequently in late summer when the corn ripens and is popular among both children and adults. Navajo cake, most commonly prepared as part of the traditional girls' puberty ceremony, is infrequently prepared today, partly because of all the work involved and partly because fewer complete puberty ceremonies are being performed. Ground dried wheat sprouts are used to sweeten the cake, although sometimes brown sugar is added as well. In the past, the cake was reportedly sweetened by having children suck on corn meal and then spit it into the batter. The resulting product was sweet, presumably due to the action of salivary amylase. Navajo fry bread and flour tortilla are the most commonly consumed types of bread today. These breads are considered traditional by the Navajo although they have only been consumed in their present forms since the introduction of wheat flour by white traders.

Other corn products that were collected for the analysis included various kinds of Indian corn meal, which are often parched before use to enhance their flavor, some corn "coffee creamers" or finely ground corn used in coffee, and dried corn silk, which is eaten like cold cereal by some Navajo families. Two major kinds of hominy corn are prepared by the Navajos. Hominy made from dried uncooked corn kernels is traditionally boiled in ash-water to help soften the corn, but some Navajo cooks have begun to replace the ash with baking soda. Hominy is also made by boiling dried corn that has been steamed or roasted before drying. This steamed or roasted corn hominy does not require a softening agent such as ash because the corn has been cooked before drying and takes less time to soften upon boiling.

### *Wild Food Plants*

Although many of the traditional breads, mushes and corn products just discussed were found to be part of the daily diets of many Navajo (Wolfe, 1984)<sup>‡</sup>, wild food plants are much less frequently consumed. Wild celery (*Cymopterus spp.*) and wild

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<sup>†</sup>A hogan is a traditional Navajo house.

<sup>‡</sup>Wolfe, W.S. (1984). *An Ethnographic and Nutritional Investigation of Navajo Indian Foodways, Dietary Patterns, and Nutritional Status*. M.S. Thesis, Cornell University, Ithaca, NY.

onion (*Alium cernuum*) are traditionally used as flavoring agents, often dried together and later made into a soup. Several types of Navajo "spinach" (*Cleome serulatum*, *Amaranthus retroflexus* and *A. blitoides*) are gathered in spring and early summer. The small leaves of these plants are removed. Then they are boiled for immediate consumption or boiled, dried in clumps and stored to be eaten during the winter months, at which time they are reboiled to soften them.

Several wild berries and fruits are still gathered by some. One of these is a bright orange berry (*Lycium pallidum*) commonly called wolfberry in English, although its Navajo name translates literally as "food of the gods." Wolfberry is reported by Navajo informants to be toxic unless mixed with special clay found at the bottom of certain mesas or in the banks of certain lakes on the reservation. Fresh or dried wolfberries are boiled, mixed with a small amount of clay and eaten plain or on bread like a jam.

Squaw or wax currants (*Ribes cereum*) are similar to cultivated currants and are usually eaten fresh. Sumac or sour berries (*Rhus trilobata*) are popular and are still gathered by many. Sometimes they are eaten plain, but usually they are boiled and the resulting juice is mixed with flour and sugar and cooked to make a pudding.

The fleshy fruits of two species of *Yucca* are sometimes gathered and eaten. The fruit of the "desert Yucca" (*Y. angustissima*), which is bland, is baked and the pulp eaten like a potato. The fruit of the mountain variety (*Y. baccata*), called "Navajo banana" because of its sweet flavor, is eaten fresh like a banana or is boiled, formed into sticky rolls and dried for later use.

Few wild nuts or seeds are still being gathered, with the exception of the pinyon nut, which many Navajo gather every fall to be eaten or sold. Tumble- or tansy-mustard plants (*Descurainia spp.*) are still plentiful on the reservation, but the seeds are tiny and require a lot of work for very little food. The seeds have to be separated from the small pods and ground; then they are mixed with other flours and made into bread.

#### *Cultivated Squashes and Melons*

Squashes and melons are still cultivated by many Navajo families. The traditionally-dried forms of these were included in the analyses because they were classified as traditional foods by the Navajo women involved with the study. Summer squashes are sliced thinly (peeled or unpeeled) and placed on a screen in the sun to be dried. Larger winter squashes are dried by cutting the meat into long spiral strips which are hung in the open air to dry. Cantaloupe and watermelon are traditionally sun-dried in the same way as summer squash. The dried squashes and melons can be stored until needed, when they are prepared by boiling them briefly.

Other parts of the squash plant are also eaten. Squash blossoms are sometimes used fresh or dry to make a soup or are used to make baked stuffed squash blossoms (see "Corn Foods"). Squash seeds are roasted and eaten.

#### *Traditional Beverages*

Traditional beverages used by the Navajo include goat's milk and three kinds of wild tea. Goat's milk is not used regularly by many families on the reservation today, although it was used frequently in the past (Darby *et al*, 1956). Two species of "Navajo tea" (*Thelasperma spp.*) are still gathered by many and are often dried for year-round use. The third kind of tea, Mormon tea (*Ephedra spp.*), is widely available, but is seldom gathered because its taste is not well-liked.

### *Culinary Ashes and Salts*

Of the three major types of plants used to make the culinary ashes listed, juniper (*Juniperus monosperma*, commonly called "cedar") branches are the most frequently used. Green juniper branches are gathered, placed on a grill or screen and set alight. The ash is collected in a pan placed underneath. Ash is made in a similar fashion from dried tumbleweed or greasewood.

Two types of native salts were examined in this study, although neither is commonly used today. One is a sample of rock salt crystals collected from a woman living in the western part of the reservation who said that her grandparents used to use it for salt and that it was probably from the Grand Canyon. The other is a white powdery salt from Zuni Lake.

### *Sheep*

Sheep are home-butchered by many Navajo families, and usually almost all edible parts are eaten. The organs are usually consumed immediately after butchering, being roasted over an open fire. Some Navajos said that the reason the organs are eaten immediately is that they do not store well. The feet and skin are no longer commonly eaten, but the head is often baked and its various parts consumed. The larger pieces of meat are usually made into mutton stew or roasted and are often kept for later use. The blood is sometimes made into blood sausage.

### *Nutrient Analyses*

The results of the proximate, mineral and vitamin analyses for the foods just described are presented in Table II. The Navajo foods that were analyzed contained a broad spectrum of nutrients and most appeared to be nutritious. Highlights of the results are given below.

*Corn foods.* Many of the traditional corn breads and mushes were higher in fiber content than the more highly processed white breads purchased today. Fiber has recently been suggested to help in the dietary control of diabetes, a common health problem among Navajos, and also in the prevention of diseases such as colon cancer (Goodhart and Shils, 1980). Fiber in wholemeal corn contains phytates, however, which can bind certain minerals and make them unavailable for absorption. On the other hand, the Navajo tradition of adding culinary ash, which has a high concentration of essential minerals, to these high-fiber corn foods may offset the mineral-binding effect of the phytates. Corn breads and mushes to which ash was added had a much higher calcium, potassium and magnesium content, and somewhat higher concentration of iron and zinc, than those made without ash. Except for phosphorus, which was present in lower concentrations, all nutrient levels in the Navajo cornmeals were comparable to those found by Kuhnlein, Calloway and Harland (1979) in Hopi cornmeals.

Hominy corn boiled in water to which Juniper ash was added as a softening agent was also higher in mineral content than that cooked in plain water, without ash. Calloway, Giauque and Costa (1974) found similar results when they compared Hopi hominy made with bean-pod ash to a water-cooked control sample of Hopi dry white corn. Both the Navajo and the Hopi ash hominies had a higher calcium, magnesium, phosphorus, iron, zinc and copper content than their respective water-controls. Potassium levels in the Hopi ash hominy were also higher than in

TABLE II  
Nutrients in the 100 g of traditional Navajo foods

Common name	Water (g)	Energy (kJ)	Energy (cal)	Prot (g)	Carb (g)	Fiber (g)	Fat (g)	Ash (g)	Na	K	Ca	Minerals (mg)			Vitamins			
												Mg	P	Fe	Zn	Cu	A(RE)	C(mg)
Blue corn mush																		
With ash	84.2	250	52	1.4	11.8	0.6	0.3	1.7	18	160	334	42	3	tr	0.1	tr	4.3	
Plain	87.1	251	53	1.4	9.6	0.7	1.0	0.2	12	55	1	18	1	0.3	0.5	0.1	1.4	
Frozen	84.2	250	52	1.4	11.8	0.6	0.3	1.7	18	160	334	42	3	tr	0.1	tr	4.3	
Blue dumplings	71.5	529	110	3.2	21.9	1.6	1.1	0.7	45	113	77	51	21	2.0	0.9	tr	tr	
Blue bread, shaped	50.3	889	185	5.4	38.6	2.3	1.2	2.2	250	240	244	96	36	5.4	1.9	0.3	7.3	
Blue mush tamale	45.6	1005	209	4.3	44.8	2.4	1.4	1.6	52	44	327	77	31	5.5	1.4	0.3	6.3	
Navajo pancake																		
Variation 1	37.3	1250	260	8.7	46.9	1.6	3.5	1.9	779	324	204	76	280	2.5	2.9	0.4	12.5	
Variation 2	39.9	1245	259	8.2	43.6	0.9	5.8	1.6	92	469	14	126	27	2.2	3.5	0.3	9.0	
Kneel-down bread																		
Fresh	48.8	952	198	5.8	39.4	3.0	2.1	1.1	66	308	9	67	28	1.7	1.8	0.2	6.9	
Dried	8.2	1688	351	8.7	72.3	5.7	3.1	2.0	240	581	14	122	44	1.5	3.0	0.6	—	
With blood	43.1	1322	275	12.1	31.6	1.1	11.0	1.1	298	152	12	27	22	7.3	1.0	0.2	1.7	
Navajo cake																		
Fresh	56.0	726	151	4.8	28.9	7.6	1.9	0.8	43	138	12	59	10	4.2	1.4	0.4	7.9	
Dried	1.0	1635	340	10.9	65.0	17.2	4.2	1.8	96	310	28	132	23	9.4	3.1	0.8	—	
Baked stuffed squash blossoms																		
Variation 1	41.3	1173	244	11.7	40.0	1.5	4.3	1.3	93	329	80	95	35	1.6	2.0	0.1	—	
Variation 2	46.3	1058	220	7.0	39.0	1.9	4.6	1.2	76	291	77	73	37	2.6	1.6	0.2	—	
Navajo fry bread																		
Plain	28.4	1611	335	7.6	50.9	0.3	10.8	2.0	617	81	112	18	24	1.2	0.4	0.2	0 <sup>a</sup>	
Milk	28.9	1500	312	7.2	52.7	0.3	8.4	2.6	674	104	199	19	35	1.2	0.5	0.2	0 <sup>a</sup>	
Milk and egg	24.5	1645	342	8.6	54.2	0.2	9.8	2.7	694	143	198	20	39	1.3	0.5	0.2	12.2 <sup>a</sup>	
Flour tortilla	33.4	1231	256	7.3	56.7	0.2	0.5	2.0	620	85	123	20	34	1.5	0.4	0.2	0 <sup>a</sup>	
Yellow corn flour	6.8	1813	377	10.9	71.3	4.1	5.4	1.5	105	436	8	132	14	3.4	2.8	0.2	—	
Parched blue flour	4.2	1899	395	10.4	71.4	4.9	7.5	1.5	86	412	7	131	10	2.4	3.4	0.5	tr	
Dried blue kernels	0.9	1933	402	10.6	79.1	2.8	4.8	1.9	113	615	9	155	19	2.6	3.4	0.5	—	
Hominy corn																		
Plain	65.9	663	138	3.6	26.3	1.7	2.0	0.5	30	146	22	48	6	0.8	1.3	tr	2.7	
Ash	61.0	731	152	4.4	29.0	3.0	2.0	0.6	38	118	34	69	18	1.2	1.5	0.1	2.1	
Baking soda	74.6	456	95	2.3	20.6	1.4	2.3	0.7	254	47	18	14	4	0.3	0.3	tr	—	

<sup>a</sup> Calculated from recipe.

<b>Hominy corn</b>																		
From steamed corn	84.3	293	61	1.6	11.6	1.3	0.9	0.3	16	94	2	19	5	0.3	0.4	0.1	1.7	—
Dried steamed corn	1.0	1827	380	10.4	78.2	5.7	2.8	1.9	92	467	15	126	27	2.3	3.5	0.3	—	—
Dried roast corn	1.0	1842	383	9.9	73.3	8.2	5.6	2.0	104	593	13	121	29	2.2	2.6	0.4	—	—
Parched yellow kernels	1.5	1933	402	10.4	77.4	3.5	5.6	1.5	192	384	8	134	24	2.1	3.1	0.4	3.0	—
"Coffee creamer"																		
Steamed corn	3.5	1707	355	13.3	68.6	8.9	2.9	3.0	181	917	50	155	65	6.4	4.5	0.8	6.6	—
Navajo cake	1.0	1635	340	10.9	65.0	17.2	4.2	2.0	96	310	30	132	23	9.4	3.1	0.8	16.2	—
Dried corn silk	4.8	1452	302	17.1	53.5	17.2	2.0	5.0	85	2432	167	170	84	7.7	6.3	0.7	95.1	—
Dried wild celery	0.7	909	189	36.4	—	44.0	4.7	30.0	496	6254	3106	875	83	1.4	5.3	2.8	—	—
Dried wild onion																		
and wild celery	3.4	1563	325	10.0	69.2	13.5	1.3	7.0	101	1751	791	126	30	20.0	2.0	0.6	—	—
Wild celery and onion soup																		
Navajo spinach, <i>waa'</i>	84.7	394	82	5.7	4.3	0.2	4.7	0.4	97	86	125	5.4	1	6.3	0.1	0.1	19.9	—
Fresh	82.1	298	62	8.1	6.3	2.0	0.5	1.0	27	130	209	32	13	2.1	1.0	0.4	1990.9	2.2
Dried, western	4.6	1596	332	43.1	33.7	10.9	2.7	5.3	143	695	1114	170	67	11.3	5.2	2.1	—	—
Dried, eastern	6.9	1356	282	24.8	40.9	10.3	2.0	15.3	115	1798	2630	—	—	0.1	tr	tr	229.6 <sup>b</sup>	0 <sup>b</sup>
Pigweed																		
Fresh	85.7	153	32	4.2	4.0	2.3	0.4	3.4	24	523	468	39	—	tr	tr	tr	710.0	tr
Dried	0.1	1240	258	21.4	38.5	16.2	2.6	21.3	927	3249	2172	358	—	0.2	tr	tr	—	—
Prostrate pigweed																		
Fresh	86.4	177	37	3.6	5.2	1.9	0.2	2.7	22	340	416	15	—	tr	tr	tr	1174.5	4.2
Wolfberry																		
Fresh	85.0	221	46	2.5	7.8	3.5	0.5	0.6	21	219	23	16	7	2.9	0.4	0.3	1194.5 <sup>c</sup>	12.3 <sup>c</sup>
Dried	0.6	1457	303	16.5	52.0	23.3	3.2	3.8	142	1453	155	103	45	19.0	2.9	2.3	—	—
Dried, with clay	57.4	408	85	4.3	15.5	11.0	1.1	10.7	141	381	82	53	8	43.0	0.4	0.1	1909.5	9.0
Wax currant, fresh	52.1	697	145	2.9	31.2	7.6	1.0	5.0	81	557	284	108	61	27.0	1.1	0.6	238.9	0
Sumac or sour berry																		
Fresh	16.1	1577	328	9.3	36.5	20.0	15.5	2.4	116	890	58	68	50	9.4	1.8	0.9	1030.3	28.9
Dried	4.8	1106	230	12.0	35.4	27.8	16.9	3.2	95	982	93	90	57	10.0	1.6	0.9	—	—
Pudding	72.8	519	108	1.6	24.5	0.5	0.4	0.2	33	43	10	7	3	1.3	0.2	tr	15.2	3.3
Juniper berry, dried	1.9	1038	216	3.9	42.7	45.1	3.3	3.0	130	646	404	62	14	3.3	1.1	0.5	—	—
Desert Yucca																		
Fresh	86.2	240	50	0.8	8.9	2.2	1.3	0.6	11	103	90	26	3	0.6	0.2	0.1	—	—
Dried	4.5	1678	349	5.7	61.6	15.2	8.9	4.0	79	711	626	181	20	4.0	1.6	0.5	—	—

<sup>b</sup> Vitamin value is per 100 g prepared (reboiled).

<sup>c</sup> Vitamin value is per 100 g of boiled berries (water added).

TABLE II continued

Mountain Yucca, dried	0.3	1746	363	2.6	85.7	7.2	1.1	3.1	82	826	370	100	16	52.0	25.0	2.4	71.0	—
Tumble mustard seeds	6.1	428	89	14.3	5.9	28.7	4.7	18.9	93	2129	1632	314	6	0.1	0.3	0.1	7.8	—
Pinyon nuts	5.9	3227	671	14.5	7.4	5.0	64.8	2.4	81	739	11	233	15	3.5	4.7	1.1	24.2	—
Dried squash	3.6	1298	270	17.9	44.9	17.6	1.9	1.3	206	5133	363	238	145	6.5	4.3	1.5	—	—
Yellow crooked	0.4	1544	321	3.5	73.9	12.9	1.0	8.0	135	2853	301	175	64	2.1	1.7	0.5	—	—
White scallop	5.4	1390	289	19.0	50.5	11.0	0.8	13.3	197	5913	340	260	152	6.2	4.7	1.5	—	—
Zucchini	4.9	1418	295	7.9	63.5	16.2	0.6	7.0	205	2309	271	183	50	4.6	1.9	0.6	4.1 <sup>b</sup>	—
Squash blossom soup	91.9	264	55	0.7	1.5	0.7	5.1	0.1	325	173	19	11	3	1.6	0.1	tr	—	—
Squash, seeds	4.5	1544	321	21.8	14.5	35.8	19.5	3.8	575	919	55	261	92	3.3	4.9	0.7	23.5	—
Cantaloupe, dried	1.2	1697	353	6.0	80.2	3.4	1.0	8.2	167	2954	114	129	17	2.6	1.2	0.3	17.2 <sup>b</sup>	—
Watermelon, dried	2.0	1755	365	9.7	78.5	3.4	1.0	5.5	174	1767	89	147	34	14.0	0.9	0.4	—	—
Goat milk	88.0	2741	57	2.8	5.7	—	2.6	0.9	49	180	92	11	114	tr	0.2	tr	—	—
Navajo tea long	99.5	—	—	—	—	—	—	—	tr	13	3	1	—	—	—	tr	—	—
short	99.9	—	—	—	—	—	—	—	tr	36	18	6	—	tr	—	tr	—	—
Mormon tea	99.5	—	—	—	—	—	—	—	tr	25	10	3	—	—	—	tr	—	—
White clay	8.0	—	—	—	—	—	—	96.0	633	326	236	61	—	53	1.0	0.5	—	—
Grey clay	9.6	—	—	—	—	—	—	96.1	220	175	9	55	—	43	6.4	1.1	—	—
Ash	3.0	—	—	—	—	—	—	80.0	486	5117	13098	228	—	0.4	0.2	0.2	—	—
Juniper	3.2	—	—	—	—	—	—	91.2	383	642	9744	1749	—	0.5	3.8	0.3	—	—
Tumbleweed	2.1	—	—	—	—	—	—	90.0	507	3020	6639	1580	—	4.4	10.9	1.7	—	—
Greasewood	0.1	—	—	—	—	—	—	99.9	18787	55	—	9	—	1.4	0.1	0.1	—	—
Native rock	0.1	—	—	—	—	—	—	99.7	22011	19	94	12	—	0.9	0.1	0.1	—	—
Zuni Lake	83.9	293	61	9.4	4.2	0.9	1.2	0.5	48	76	11	12	10	0.9	1.5	tr	—	—
Mutton stew	61.9	933	194	11.8	13.5	1.7	9.5	1.7	430	186	18	27	18	6.8	0.8	0.3	—	—
Blood sausage	50.2	1216	253	28.8	4.9	0.6	13.4	2.1	223	501	45	45	12	8.5	3.9	0.7	—	—
Roast intestines	53.6	971	202	33.6	3.4	—	6.4	2.9	127	368	187	25	15	3.2	4.8	2.2	—	—
Roast liver	47.6	1197	249	37.6	3.6	—	9.0	2.2	146	308	5	13	27	0.6	4.4	1.9	—	—
Boiled liver	47.8	1274	265	29.3	8.3	—	12.8	1.8	322	392	30	36	25	7.9	3.4	0.8	—	—

<sup>b</sup> Vitamin value is per 100 g prepared (reboiled).

Boiled heart	44.5	1688	351	21.3	6.0	—	27.2	1.0	214	236	13	26	14	4.1	1.8	0.5	—
Roast kidney	34.8	2145	446	15.3	11.1	—	37.7	1.1	226	191	13	16	15	5.0	2.0	0.5	—
Roast lung	60.4	875	182	30.1	1.9	—	5.7	1.9	357	387	19	14	13	16.0	3.4	0.5	—
Boiled lung	65.7	634	132	26.4	2.7	—	3.8	1.5	301	359	17	20	28	17.0	2.9	0.4	—
Roast esophagus	35.1	2005	417	23.9	6.4	—	32.7	1.9	333	243	276	23	55	2.5	2.4	0.5	—
Boiled esophagus	53.1	1486	309	21.0	—	—	24.8	1.2	241	190	58	21	21	7.9	2.2	0.3	—
Roast feet meat	56.6	1091	227	31.9	0.1	—	11.1	1.3	339	168	100	9	20	5.1	0.9	0.1	—
Roast skin	43.8	1616	336	30.5	0.2	—	23.7	1.7	427	268	31	15	29	4.3	1.3	0.5	—
Head, baked																	
Brain	68.2	957	199	15.9	—	—	15.2	2.1	152	310	81	16	16	2.1	3.1	0.2	—
Tongue	46.7	1505	313	24.2	6.5	—	20.9	1.7	194	258	227	29	48	4.8	3.4	0.3	—
Eyes	50.0	1495	311	17.2	9.0	—	23.0	0.9	187	102	46	22	19	0.5	1.1	0.1	—
Ears	53.3	1486	309	19.9	1.1	—	24.7	1.1	134	148	30	15	20	6.2	2.2	0.1	—
Other meat	59.2	1010	210	29.1	1.0	—	9.6	1.1	184	236	17	21	22	4.9	3.4	0.3	—

This table is a reproduction of the data presented in the original document. It contains numerical values for various food items, organized in columns. The items listed include Boiled heart, Roast kidney, Roast lung, Boiled lung, Roast esophagus, Boiled esophagus, Roast feet meat, Roast skin, Head, baked, Brain, Tongue, Eyes, Ears, and Other meat. The values represent different metrics for each item, such as weight, volume, or nutritional content.

that of its control; the Navajo samples did not differ in this mineral. The overall sodium and calcium contents of the Navajo samples were higher than those of the Hopi samples, while the phosphorus content was lower. These differences were probably due to the different ashes and corns used. Nonetheless, both studies suggested that the use of natural ash fortification may have helped to assure the mineral adequacy of the traditional Indian diet.

The modern practice of substituting baking soda for ash to speed up cooking did not have this beneficial addition of minerals. In fact, hominy corn boiled in baking soda water had a lower mineral content than ash hominy except for sodium, which was quite high. Sodium has been linked to the development of hypertension (Goodhart and Shils, 1980). The Vitamin A content of baking soda hominy was lower as well.

The two Navajo corn "coffee creamers" analyzed in this study were both nutritious, especially when compared to the various commercial coffee creamers available in stores today. The Navajo samples were higher in protein, fiber, calcium, magnesium and iron, while lower in fat, calories and potassium, than the powdered coffee cream substitute listed in Pennington and Church (1980).

*Wild food plants.* Wild greens used by the Navajos were found to be excellent sources of vitamin A. One half cup (100 g) of the Navajo spinach *waa'* (*Cleome serulatum*) contained almost four times the U.S. recommended daily allowance (RDA) for vitamin A. Two species of *Amaranth*, *Naazkaadii* and *T'ohdeisk'idii* also contained high amounts of vitamin A. Significant amounts of the vitamin remained even after the greens were dried in the traditional manner, stored for over a year and then boiled to prepare them for consumption.

The mixing of special clays with boiled wolfberries (and wild potatoes, *Solanum jamesii*, although none were obtained in the present study) was an interesting traditional practice. The clays had a very high mineral content, but the extent of absorption of these minerals is not known. A more important function of the clays, and that recognized by Navajo informants, is their ability to "detoxify" and remove the bitterness of wolfberries and wild potatoes. Johns (1985) tested the grey Navajo clay from this study, along with several clays used by Bolivian Indians with their wild potatoes, and found that they had adsorptive capabilities under digestive conditions that would make them effective detoxicants of the glycoalkaloids found in wild potatoes. The adsorptive capability would be less in the mouth, but still enough to account for the reported decrease in bitterness. The Navajo sample showed the weakest adsorptive capacity of Johns' native clay samples, at 0.14 g/g for tomatine (a common glycoalkaloid) at pH 5.5 and 0.1 M ammonium acetate; but this was still approximately three times greater than the standard kaolin under similar conditions. Johns concludes that these culturally maintained geophagic practices appear highly adaptive for making bitter potatoes palatable and for increasing the resources available for human subsistence.

The three ashes and two rock salts examined varied in their mineral composition. The three plant ashes were all good sources of essential minerals and were better than the Zuni Lake and Grand Canyon salts in all minerals except for sodium, which was much lower. Iron concentrations were considerably higher only in the Greasewood ash. These results are generally in agreement with those of Kuhnlein (1980), who also found plant ash to be rich in potassium, calcium, iron, copper and zinc, and to have a higher concentration of these minerals than the Zuni Lake and Grand Canyon salts she examined. Except for calcium, which was about the same, all mineral levels in the Navajo plant ash samples were somewhat lower than the two

TABLE III  
Frequency of consumption of 14 Navajo traditional foods as reported by subjects (n = 86, numbers are percentages)

Navajo food	Frequency of consumption (%)				
	Never	Yearly <sup>a</sup>	Monthly <sup>b</sup>	Weekly <sup>c</sup>	Daily <sup>d</sup>
Cornmeal mush	9	12	35	23	21
Blue dumplings	36	16	27	17	4
Blue bread	43	16	19	21	1
Navajo cake	44	43	12	1	0
Hominy corn	14	22	34	27	4
Kneel-down bread (harvest frequency)	26	26	5	26	19
Goat milk	84	4	2	1	1
	Never		Sometimes when butcher	Always when butcher or 1/mo.	
Blood sausage	23		17	59	
	Never uses			Uses at least infrequently	
Wild sumac berry pudding		69		31	
Navajo spinach ( <i>waa</i> )		91		9	
Amaranth Tʼ <i>ohdeiskidii</i> )		92		8	
Sweet mountain Yucca		87		13	
Desert Yucca		98		2	
Wolfberries and clay		84		16	

<sup>a</sup>Less than 3 times per year.

<sup>b</sup>Once per month or less, but more than 3 times per year.

<sup>c</sup>Once per week or less, but more than once per month.

<sup>d</sup>More than once per week.

Hopi plant ash samples examined in Kuhnlein's study. These differences are probably due to the different plants used to make the ashes and the different soils in which the plants grew.

Sumac berries were found to contain Vitamin C. By the time they were boiled, however, and only the juice was used to make the pudding, much of the vitamin C was gone.

The popular roasted pinyon nut had a high protein, potassium, magnesium, iron and zinc content, but it was also rich in fat and, therefore, energy.

*Sheep.* Although the sizes of sheep herds are now regulated to prevent overgrazing, sheep are still a very popular food. The organ meats of the sheep were found to have a high protein, mineral, and fat content. Navajo blood sausage was found to contain much higher amounts of iron than the more commonly consumed luncheon meats being purchased at local trading posts today.

#### *Present-day Use of Traditional Foods*

The results of the reported frequencies of consumption of the 14 traditional foods

included in the food-frequency questionnaire are presented in Table III. Cornmeal mush (not specified as to type or color) was the most frequently consumed traditional food, with some women reportedly consuming it daily. Blue dumplings, a variation of blue cornmeal mush with ash, was consumed weekly or monthly by a number of the women, although some women commented that this food item is only supposed to be eaten in the winter or it will bring thunderstorms. Blue bread was less common but was consumed by a number of the women.

Navajo cake was consumed approximately once a year by almost half the women, but seldom with a frequency greater than yearly. The making of Navajo cake (a long and tiring project) is a traditional part of the girls' puberty ceremony, and some women commented that this was the major time when they ate it.

Hominy corn was consumed weekly or monthly by about two thirds of the sample. It was seldom prepared in the traditional fashion from dried whole corn, however, but rather was bought frozen and pre-prepared.<sup>†</sup> During the corn harvest season, kneel-down bread appeared popular, being eaten daily or weekly by nearly half of the sample.

Goat milk was very infrequently consumed, with 84 % of the sample never consuming it and another 4 % consuming it less than three times per year. More than half of the women claimed to make blood sausage every time they butchered a sheep, or about once a month.

Of the wild foods, for which consumption was tabulated on a "yes" or "no" basis rather than in actual frequencies, wild sumac berry pudding was reported to still be consumed, at least to some extent, by 31 % of the women. None of the other wild foods were used by a very large number of women, although wolfberries and clay was consumed by 16 % of the sample and sweet mountain Yucca by 13 %.

Unfortunately, the knowledge of wild plant foods and their preparation seems to be more difficult to pass down through the generations than that of some of the corn and sheep foods, and thus it is being lost more quickly. Whereas Indian cornmeal and sheep can be purchased, wild plants must be collected. They, therefore, require both a knowledge of where to look for them and the ability to recognize them before they flower (many greens are edible only before flowering). Moreover, plants require particular habitats. A dryer climate than in the past and the overgrazing of sheep have been detrimental to the growth of wild food plants on the reservation.

## CONCLUSION

The traditional Navajo diet appears to have included foods from each of the four basic food groups. In the bread and cereal group were various kinds of corn breads and mushes, other dried corn foods such as hominy, and the still popular fry bread and tortilla. This group was an important source of fiber and iron (and likely of some of the B vitamins, for which analyses were not done in the present study). When ash was added to foods in this group, significant amounts of minerals, such as calcium, were also provided.

Various fresh and dried wild plants, fruits and berries, as well as cultivated

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<sup>†</sup>This information was not always specifically obtained but was concluded from a number of additional comments.

squashes and melons, made up the fruit and vegetable group. This group provided important sources of vitamins, including A and C, and fiber.

The meat and protein group consisted primarily of mutton and other sheep parts, which provided a good source of protein and minerals, some of the organs being especially good sources of iron. The pinyon nuts, squash seeds and tumble mustard seeds analyzed were also sources of protein, probably especially good sources if complemented by corn products.

The only food in the milk and dairy group that was analyzed here was goat's milk, although traditionally three types of goat cheese were made and sheep milk was also consumed. This group is usually a major source of calcium, but the Navajo seem to have obtained much of their calcium from other sources, such as culinary ash and clay. The milk group is also generally an important source of riboflavin, but this vitamin was not examined in this study.

As has been found in other nutrient analyses of traditional Native American foods (Kuhnlein, 1980; Calloway, Giaouque and Costa, 1974; Kuhnlein, Calloway and Harland, 1979), most of the traditional foods analyzed here appear to be nutritious. If these foods indicate the quality of the traditional Navajo diet, and if they were available in sufficient quantity in the past, it is likely that requirements for the nutrients analyzed here would have been met. However, the use of these traditional foods is decreasing today, while the use of foods of lower nutritional quality is increasing. The results presented here suggest that the poor diet of the Navajo today could be improved by the addition of some of their own traditional foods. In addition, traditional foods could be served to the elderly and others in hospitals and care facilities using the food composition tables reported here rather than modern foods that are unfamiliar to them and that add to the already high anxiety of being in an unfamiliar setting. Such use of traditional foods would support the policies of self-sufficiency and cultural integrity being adopted by most Native American tribal governments today.

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#### REFERENCES

- Alford, B.B., and E.B. Nance (1976). Customary foods in the Navajo diet. *J. Amer. Dietet. Assoc.* **69**, 538-539.
- Association of Official Analytical Chemists (1980). *Official Methods of Analysis*. 13th Ed., Washington, D.C.
- Bailey, F. (1940). Navaho foods and cooking methods. *Am. Anthropol.* **42**, 270-290.
- Butte, N.F., D.H. Calloway and J.L. Van Duzen (1981). Nutritional assessment of pregnant and lactating Navajo women. *Am. J. Clin. Nutr.* **34**(10), 2216-28.

- Calloway, D.H., R.D. Giaque and F.M. Costa (1974). The superior mineral content of some American Indian foods in comparison to federally donated counterpart commodities. *Ecol. Food Nutr.* 3, 203-211.
- Carpenter, T.M., and M. Steggerda (1939). The food of the present-day Navaho Indians of New Mexico and Arizona. *J. Nutr.* 18, 297-305.
- Darby, W.H., C.G. Salsbury, W.J. McGanity, H.F. Johnson, E.B. Bridgforth and H.R. Sandstead (1956). A study of the dietary background and nutriture of the Navajo Indian. *J. Nutr.* 60 (Suppl. 2), 3-85.
- Downs, J.F. (1972). *The Navajo*. Holt, Rinehart and Winston, Inc., New York.
- Elmore, F.H. (1935). *Ethnobotany of the Navajo*. U.N.M. Press, Albuquerque, N.M.
- Goodhart, R.S., and M.E. Shils (Eds.) (1980). *Modern Nutrition in Health and Disease*. 6th Ed., Lee and Febiger, Philadelphia.
- Harrington, H.D. (1976). *Edible Native Plants of the Rocky Mountains*. U.N.M. Press, Albuquerque, N.M.
- Johns, T.A. (1985). *Chemical Ecology of the Aymara of Western Bolivia: Selection for Glycoalkaloids in the Solanum X Ajanhuiri Domestication Complex*. Ph. D. Thesis, University of Michigan, Ann Arbor.
- Koenig, R.A., and C.R. Johnson (1942). Colorimetric determination of phosphorus in biological materials. *Ind. Eng. Chem. Anal.* 14, 155-156.
- Kuhnlein, H.V., D.H. Calloway, and B.F. Harland (1979). Composition of traditional Hopi foods. *J. Am. Dietet. Assoc.* 75, 37-41.
- Kuhnlein, H.V. (1980). The trace element content of indigenous salts compared with commercially refined substitutes. *Ecol. Food Nutr.* 10, 113-121.
- Navajo Area Indian Health Service (1982). *Navajo Area Vital Events (Mortality-Natality) Report, Calendar Year 1979*. NAIHS, Window Rock, Arizona.
- Pennington, J., and H. Church (1980). *Bowes and Church's Food Values of Portions Commonly Used*. J.B. Lippencott Company, Philadelphia.
- Reisinger, K., K. Rogers and O. Johnson (1969). Nutritional survey of Lower Greasewood, Arizona Navajos. In Moore W.M., M.M. Silverberg and M.S. Read (Eds.), *Nutrition, Growth, and Development of North American Indian Children*. DHEW Publ. No. (NIH) 72-26, Washington, D.C.
- Steggerda, M., and R.B. Eckardt (1941). Navaho foods and their preparation. *J. Am. Dietet. Assoc.* 17, 217-225.
- Task Force on Indian Health, U.S. Congress (1976). *Report on Indian Health: Final Report to the American Indian Policy Review Commission*. U.S. Government Printing Office, Washington, D.C.
- Underhill, R. (1953). *Here Come the Navaho*. Indian Life and Customs No. 8, U.S. Indian Service, Haskell Institute, Lawrence, Kansas.
- Van Soest, P.J. (1963). Use of detergents in the analysis of fibrous foods: I. Preparation of fiber residues of low nitrogen content. *J. AOAC* 46, 825-829.
- Vaughan, L.A., C.W. Weber and S.R. Kemberling (1979). Longitudinal changes in the mineral content of human milk. *Am. J. Clin. Nutr.* 32, 2301-2306.
- W.I.C. (1980). *W.I.C. Report*. Tuba City Navajo W.I.C. Program, Tuba City, Arizona.
- Wolfe, W.S. (1984). *An Ethnographic and Nutritional Investigation of Navajo Indian Foodways, Dietary Patterns, and Nutritional Status*. M.S. Thesis, Cornell University, Ithaca, NY.
- Young, R.W., and W. Morgan (1976). *The Navajo Language*. Deseret Book Company, Salt Lake City, Utah.