APPRAISAL: HEALTH & NUTRITIONAL STATUS OF ESKIMO

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Alaska

An Appraisal of the Health and Nutritional Status of the Eskimo

A REPORT BY THE INTERDEPARTMENTAL COMMITTEE ON NUTRITION FOR NATIONAL DEFENSE

AUGUST 1959

ARCTIC HEALTH RESEARCH CENTER
FAIRBANKS, ALASKA 99701

FRONTISPIECE

GUIMSA WASSILIA
(Medicine Man at Napaskiak)

ASSISTANT SECRETARY OF DEFENSE
WASHINGTON 25, D. C.

HEALTH AND MEDICAL

August 31, 1959

On behalf of the Interdepartmental Committee on Nutrition for National Defense (ICNND), it is my pleasure to transmit this report, An Appraisal of the Health and Nutritional Status of the Eskimo in Alaska.

The clinical and biochemical phases of the survey, conducted in March-April 1958, included the Eskimo National Guardsmen and a random sampling of eight Eskimo and two Indian villages. This was a cooperative undertaking of the ICNND with the Arctic Health Research Center, the Division of Indian Health of the U. S. Department of Health, Education, and Welfare, the Alaska Command of the U. S. Armed Forces, and the Alaska National Guard. A detailed report of the dietary studies conducted in the ten Alaskan villages will be published at a future date by the Arctic Health Research Center. Dr. Christine Heller of the Arctic Health Research Center is continuing these investigations. See "The Alaska Dietary Survey: 1956-1961" by Heller & Scott PHS Pub. 999-AH (AHRC M 58)

The evaluation of the dietary intake, customs, and habits of these few remaining native villages will enable a much more meaningful evaluation of the clinical data. The Alaskan aboriginal people have and will continue to have a remarkably successful adaptation to their environment and unique food supply. The purpose of this study was to establish a baseline of nutritional appraisal in order to evaluate in future years the effects of cultural transition in relation to health. Continued assistance to provide medical and dental care, housing, and economic development is most essential. I wish to call your attention to the general conclusions of this report on page 118.

Frank B. Berry

Frank B. Berry, M.D.

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I - PREFACE

1. Administrative History

A program of research on the nutritional status of Alaskan natives has been under way in the Arctic Health Research Center, Anchorage, Alaska, for several years. The present study arose from the interests of the Department of Defense.

At a meeting of the Interdepartmental Committee on Nutrition for National Defense (ICNND) 28 May 1956, Dr. Frank B. Berry reported that the Secretary of Defense had inquired if the ICNND would be interested in conducting a nutrition survey of the Alaskan natives. This proposal was considered favorably by the Committee, and the Secretariat was authorized to explore the possibilities further. Discussions were held with Dr. Jack Haldeman, Chief, General Health Service, Public Health Service, Department of Health, Education, and Welfare (HEW) and Dr. John C. Cutler, Program Officer, Bureau of State Services, HEW. Toward the end of 1956, the Committee received a formal request from the Arctic Health Research Center for assistance in financing and conducting a nutrition survey of the Alaska National Guardsmen while they were in their annual encampment in Anchorage and also in completing a survey of the inhabitants of ten native villages. The Committee appointed an ad hoc group, with representatives from the General Health Service, Bureau of State Services and the Division of Indian Health of the Public Health Service; and including Dr. E. M. Scott of the Arctic Health Research Center, Anchorage, and Dr. John B. Youmans, Consultant to the ICNND, to meet in April 1957 to draft a proposal for Committee action.

At a meeting in May 1957 the Committee agreed to serve as a coordinating and sponsoring agency for a nutrition survey of the two National Guard Battalions during their 1958 encampment and a clinical and biochemical survey of the inhabitants of the ten native villages in which the Arctic Health Research Center, with the aid of the Division of Indian Health, had been conducting a survey of food intake and dietary habits.

2. Acknowledgments

Many people have contributed to the work of this study. The names are arranged here according to their respective organizations.

Arctic Health Research Center, Anchorage, Alaska

Dr. A. B. Colyar - Director, Arctic Health Research Center

Alaska National Guard

Brig. General Thomas P. Carroll, Adjutant General, Alaska National Guard
Major William H. Crawford, Commander, First Scout Battalion
Major Harry E. Voelker, Commander, Second Scout Battalion

Alaska Native Health Service

Dr. Joseph A. Gallagher - Area Officer in Charge, Anchorage
Dr. Robert I. Frazier - Medical Officer, Kotzebue
Dr. Elmer E. Gaede - Medical Officer, Tanana
Dr. William A. Brownlee - Medical Officer, Bethel

Village Teachers

Mr. and Mrs. Roman W. Kinney, Akiak
Mr. and Mrs. Emil Kowalczyk, Kasigluk
Mrs. Mary McDougall, Napaskiak
Mr. and Mrs. John F. Gordon, Hooper Bay
Mrs. Ida A. Hunter, Newktok
Mr. and Mrs. Fred G. Fisher, Point Hope
Mr. and Mrs. Russell McLaughlin, Shishmaref
Mr. and Mrs. Walter A. Ortman, Allakaket
Mr. and Mrs. Ley M. Kahl, Huslia
Mr. and Mrs. S. William Benton, Noatak

U.S. Military Organizations - Alaskan Command

Lt. General Frank A. Armstrong, USAF - Commander in Chief, Alaskan Command
Maj. General G. C. Mudgett - Commander, U.S. Army, Alaska
Brig. General John R. Copenhaver - USAF Surgeon, Alaskan Command
Colonel Sterrett E. Dietrich - U.S. Army, Surgeon
Lt. Colonel Wade F. Heritage - U.S. Army, Deputy Surgeon
Lt. Colonel George D. Pleasants - Post Surgeon, Ft. Richardson

Finally, the subjects themselves should be complimented for their pleasant welcomes, patient forbearance and altogether cheerful and intelligent willingness to help with the tasks at hand.

Team Members

Dr. John B. Youmans - Field Director, Army Medical Research and Development Command
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Dr. Edward M. Scott - Deputy Director, Arctic Health Research Center
Dr. George V. Mann - Clinician,[2] National Institutes of Health
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Dr. Donald B. Kettlecamp - Clinician,[1] Alaska Native Health Service
Dr. Ruth Coffin - Clinician,[2] Alaska Native Health Service
Dr. Christine A. Heller - Nutritionist,[1] Arctic Health Research Center

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1/ Field Team Member, Kotzebue party.
2/ Field Team Member, Bethel party.

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Miss Anna J. Pitney - Chemist, Arctic Health Research Center
Mr. Lyndon Sikes - Chemist, Arctic Health Research Center
Dr. Milton Silverman - Biochemist,[2] National Institutes of Health
Dr. Albert L. Russell - Dentist, National Institutes of Health
Mr. Carl L. White - Statistician, National Institutes of Health
M/Sgt. Dale O. Starr - NCO in Charge, Dispensary, Fort Richardson
M/Sgt. Harold G. Coffman - X-ray Technician, Dispensary, Fort Richardson
SP-5 Ronald J. Murphy - Technician, Dispensary, Fort Richardson

3. Objectives

The extent of success of the adaptation of the Eskimo to a uniquely limited and precarious food supply in a harsh environment has been a challenging question to physiologists for over a century. Arctic explorers have often discussed this problem and some have taken highly controversial positions based on their estimates either of the merits of the Eskimo dietary regimen or the status of the natives' health. The present study was undertaken to investigate this question in cooperation with the Arctic Health Research Center (AHRC) of the Department of Health, Education, and Welfare, the Alaska Command of the U.S. Armed Forces, and the Alaska National Guard.

Members of the AHRC with the support of the Indian Health Service have been conducting systematic studies of the dietary habits of the Eskimo and, in particular, their hematological disorders. The present work was intended to complement those studies. The work described here was designed to evaluate the nutritional status of the Eskimo of all ages and both sexes by carrying out physical appraisals and biochemical measurements of specific nutrients in blood and urine. These data were then to be evaluated along with the dietary evaluations and food analyses made available by continuing studies of the Arctic Health Research Center. Additional measurements of consumption of food in the mess halls were made among the native members of the Armed Forces..

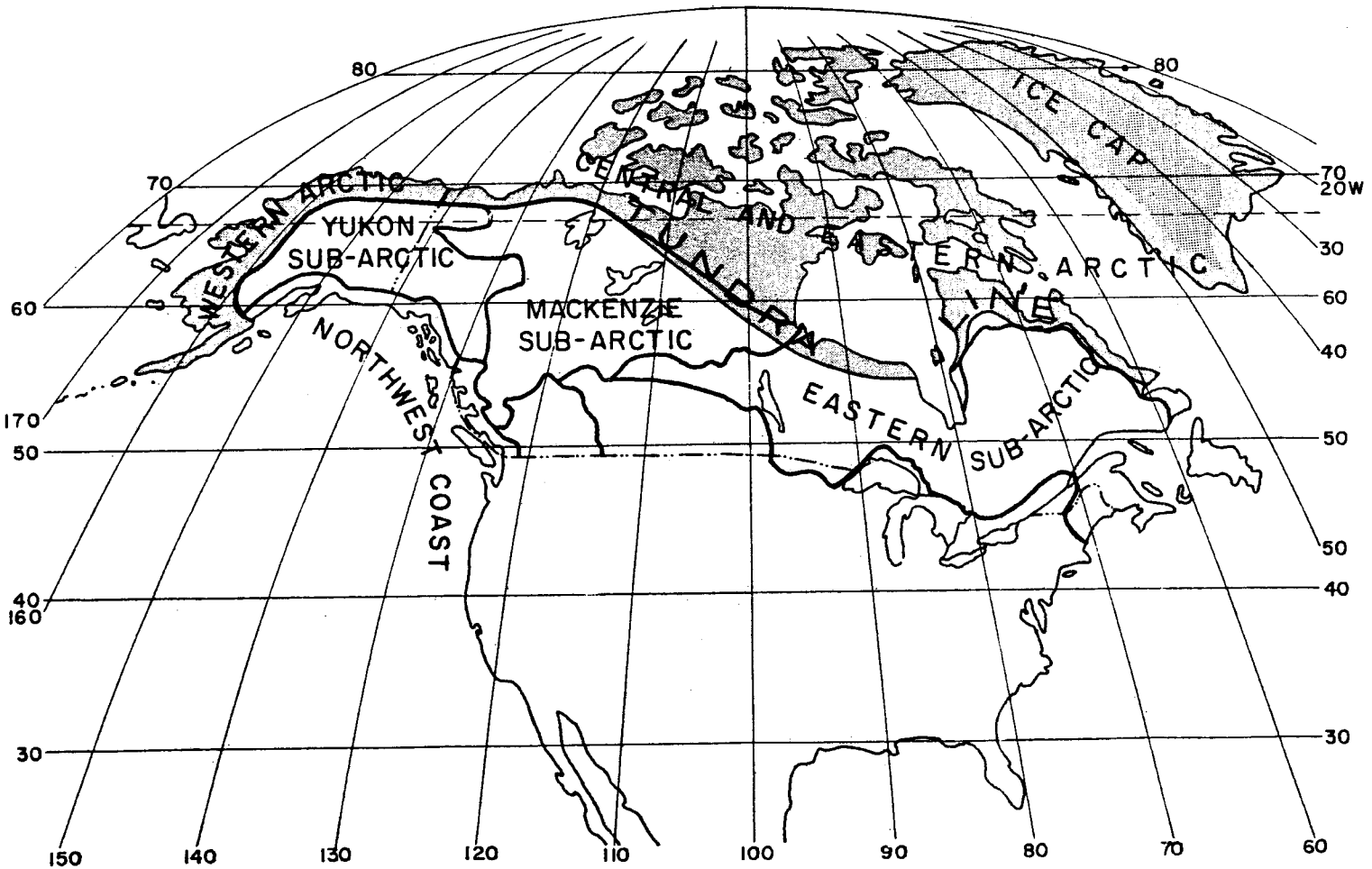
4. Explanatory Addendum

Since the present study was done and much of the report was written before or during the emergence of Alaska as the 49th state, there may be descriptions herein or references to agencies or procedures which have been superseded by new organizational arrangements.

2/ Field Team Member, Bethel party.

FIGURE I

NORTHERN CULTURAL AREAS AND TUNDRA REGION



II - INTRODUCTION

1. The Cultural Background

The Eskimos, Indians and Aleuts of Alaska vary widely in their cultural traditions and present day mode of living. At the time of the white man's arrival, the Eskimos occupied all the northern and western coasts of Alaska, and lived on the southern coast as far east as Prince William Sound and on Kodiak Island. The Eskimos were divided culturally into a Northern group, the Thule culture, and a Southern group, the Old Bering culture, with the dividing line situated on Norton Sound in the vicinity of Unalakleet. Northern Eskimos still speak the same language as the Siberian, Canadian and Greenland Eskimos, while the Southern Eskimo language is quite different. The Aleuts originally occupied the western half of the Alaska Peninsula and the Aleutian Islands. Thlingit Indians lived in southeast Alaska, while Athabascan Indians occupied the interior regions of the territory. The map in Figure I shows these regions while Table 1 gives the population of these cultural groups in 1950.

TABLE 1

ESKIMOS, INDIANS AND ALEUTS IN ALASKA IN 1950

	Population	Median Age
Eskimos	15,882	17.7
Athabascan Indians	6,783	--
Aleuts	3,892	17.9

Source: U.S. Census of Population, 1950, Vol. II, Parts 51-53. (1)

The Eskimo culture in North America has been traced back through the Christian era. The "Thule" culture based on whaling seems to have spread eastward from Alaska to Greenland during the period 500 to 1000 A.D. In the saga of Eric the Red, reference is made to "skraelings" (Eskimos) in Labrador in 1003. Possibly because of the disappearance of whales from the Central Arctic, a deviant culture based on fishing and sealing spread back to Alaska. These migrations appear to account for the presence of a single, primitive, Stone Age people with a common language and tools who occupied the 6,000 miles from Alaska to Greenland when Rink explored the latter area in about 1850. The oldest Eskimo culture is the "Old Bering" culture which flourished on both sides of the Bering Strait. This culture was based on the hunting of fish and sea mammals. In Eurasia the Arctic culture was based on reindeer breeding, as in Lapland, except for a limited area of Eskimo culture on the Chukchi peninsula(2).

The Eskimos, like the American Indians, are of Mongoloid ethnic origin. Eskimo skulls are narrow and oblong with a definite sagittal ridge. The lower jaws and maxillary bones are highly developed and

prominent. The skin, hair, epicanthal folds and lumbar pigment testify to their Mongoloid origin. In contrast to the Negro the Eskimos have narrow noses. As in the American Indian, blood group type O predominates among the Eskimos.

The present study was concerned primarily with the two groups of Eskimos, defined by geographic areas, and to a lesser extent with Athabascan Indians and Aleuts. In order to understand the situation of these people today it is important to review the primitive conditions under which they once lived, since all of them are now in transition between the primitive and a modern way of life. This transition began in the 18th century for the Aleuts with their introduction to the Russian explorers and traders who followed Vitus Bering into their territory. For the Indians and Eskimos the transition began later and at different times for different groups. The coastal Eskimos who lived on marine mammals were exposed to the white whalers and explorers of the 18th and 19th centuries, while some of the inland Eskimo and Indian villages have had important contact with white culture only during the past 60 years. The extent of acculturation is thus variable.

Eskimos have managed by a number of ingenious methods to maintain their numbers and to carry on a marginal existence under exceptionally adverse conditions. In order to survive in the Arctic, they have had to utilize every available resource. The primary consideration for the location of an Eskimo or Indian village in Alaska was the available food, fuel and water supply. The population balance in such an economy was important since overpopulation meant hunger and sometimes starvation. When the population became too large for the available food supply or if the food supply became scarce because of persistently unfavorable weather conditions or some other accident of nature, family groups would break away and try to find a more favorable place to establish themselves.

Winter homes were half buried in the ground and made of logs or whale ribs covered with sod. The walls and ceiling of the main living room were often lined with split driftwood, vegetable matting or skins. Existing examples of these homes, when well constructed, are surprisingly comfortable and can be heated with a minimum of fuel. They are, however, dark and small. Such houses were usually built at permanent living sites and were then occupied only in the winter when they could be kept reasonably free from condensation and seepage. In the spring, with the coming of the thaw, many of them became untenable. Because of dampness of the house and because of the necessity to search for food, the people moved out of the sod huts into tents at camp sites, often at considerable distances from the village. In the early days, tents were made of animal skins secured tightly over a willow frame. For many years now the great majority of Eskimos have used canvas tents. Even today, though a family may not wish to move away from the village for sealing or other activities, they will often move out of their winter residence into a tent pitched nearby.

It is important to recognize that Alaskan Eskimos are not nomadic people: They live in one or a few permanent homesites or campsites. Most of the sod houses have now been replaced by small frame or log structures. In one village in 1953 there were 36 houses with 47 rooms. The floor space per family was 227 square feet or an average of 51 square feet per person(3). Often these frame houses are poorly insulated and are therefore more difficult to heat adequately in winter than were the primitive sod houses.

Each village had its own seasonal schedule for hunting and fishing, but as in all hunting-fishing economies, there was a large element of chance in this activity. The welfare of the people who depended on hunting and fishing for food, clothing and fuel fluctuated accordingly. Through the summer most Eskimo and Indian families found it necessary to move from place to place in search of their supply of food. This was particularly necessary for the tundra1/ people who often traveled considerable distances from the village in order to obtain sufficient food. These campsites, usually family affairs, were visited year after year as long as they yielded food. Almost all edible foods were eaten, and since food resources varied in different regions, there were wide geographic differences in diets.

There were three general types of Eskimo diets under the conditions of the primitive culture(2). On the northern and northwestern coasts of Alaska, Eskimos were primarily dependent on sea mammals -- seal, walrus and whale -- for food. Farther south, chief dependence was on fish, while smaller numbers of interior Eskimos lived on land mammals, primarily on caribou. In none of these areas was there total dependence on any one type of food. Use of fish was universal, while shellfish, birds, birds' eggs, small mammals (including hares, porcupine, rabbits, muskrats, mink and beaver), berries, roots and green plants were eaten when available. In retrospect these diets would seem to have had certain things in common. All of them were probably very high in protein, moderate to high in fat content, and they contained very little carbohydrate. They were seasonally low in ascorbic acid, and must have been on occasion deficient in calories. Such diets, however, had no known nutritional disadvantages and no known advantages except that they are generally believed responsible for the fact that Eskimo teeth were very nearly free of caries. The Eskimo did not usually have a choice of foods from which to make a selection. Instead, his problem was the fundamental one of assuring a continuity of food and to this problem he devoted his energy, intelligence and ingenuity.

1/ The tundra is the vast, treeless area of western and northern Alaska. It is generally flat, dotted with ponds and sloughs and underlaid with permafrost. The vegetation in the summer consists of low shrubs and grasses and in the winter the surface may be buried to a depth of several feet with snow. The winds pack and drift this snow almost continually. An approximate outline of the tundra is shown in Figure I.

2. Demographic Factors

Eskimos today live on a combination of foods obtained from the traditional sources and foods bought from stores. The latter are for the most part cereals and sugars. Some of the factors which presently affect the food habits of Eskimos are as follows:

Eskimos now live at a low economic level. In a study made in 1955(4), the estimated annual per capita cash income in 23 Eskimo villages ranged from $69 to $475. Unless the Eskimo lives in one of the larger towns and has some education, he has little or no opportunity for a job with a steady income. The income for a village comes from a variety of sources. Fishing for profit provides income for many families in the Bristol Bay area and at the mouth of the Yukon. While such fishing may require considerable capital for a boat, the profits are large if the fishing is good. However, the trend in recent years has been toward smaller catches of salmon. Some men from villages in the Kuskokwim area obtain employment in the canneries on Bristol Bay. The pay is high, averaging $600 for the month or six weeks when the cannery operates. Trapping provides part of the income of most villages. Fur prices are now low, however, and only mink, muskrat and beaver are profitable enough to encourage the effort involved in trapping. Twenty mink, 700 muskrat, or 20 beaver would represent a good year's trapping for one man in some areas. Generally, however, fewer than this are obtained. During the 1957-58 season, average market prices for mink were $30, muskrat $0.25 and beaver $25.

Service in the National Guard produces an appreciable proportion of the total income in the villages. In addition, a few Eskimos work on river barges in the summer or as storekeepers or janitors. Crafts, such as ivory carving, basket weaving and making of souvenirs, provide some income for Eskimos. A major source of income in all villages is welfare. A large number of Eskimos are eligible for various forms of public assistance including Old Age Assistance and Aid-to-Dependent-Children. Welfare payments amount to between one fifth and one third of the cash income in most communities. In four of the villages included in the present survey, mean per capita income in 1955(4) was estimated as follows:

Village	Mean Income per Capita	Percent of Income from Welfare
Napaskiak	$173	28
Akiak	475	32
Kasigluk	138	35
Hooper Bay	137	30

The population in Alaska is sparse and the communities are small. In 1950 about 80 percent of the 287 places named in the census had fewer than 199 persons(1). This smallness was probably originally related to the availability of food in the surrounding area. The

creation of schools, stores, churches and postoffices in some villages has tended to attract native families and to enlarge the villages, whereas many small villages listed in 1950 are no longer in existence.

Eskimos seemed to accept Christianity readily and today every village has at least one church which is an important part of the social life. Denomination of the churches is shown in Table 2 for the villages included in the present study.

Schools have been in existence in Alaska for many years, but there was never enough money to provide one for each of the smaller villages, and until the past ten years there was little opportunity for a high school education except in towns with a permanent white population. Village schools (formerly called "Territorial Schools") are operated by the State or by the Bureau of Indian Affairs (BIA). In recent years the latter agency has started a special type of school -- The Instructional Aid School -- in certain villages. In these schools the village furnishes the building, and a teacher is provided by the Bureau of Indian Affairs. Such teachers are often not fully qualified.

Stores or trading posts were established in Alaska by the Russians, and traders have since been an important part of village life. Starting in the late 1930's, the Bureau of Indian Affairs helped to establish cooperative stores in many of the large villages. There are several communities, however, which still have no store, and people must go varying distances for supplies. The typical village store has a very limited stock of supplies and limited storage facilities. In the usual case, there is no place for storage where freezing can be avoided in the winter or where food can be kept frozen in the summer.

The water supply of the Eskimo and Indian is traditionally the nearest river, lake, or pond. A hole is cut in the ice in winter to dip water, or cakes of ice are cut, hauled on sleds to the home and then melted for use. Melting of ice is difficult in most areas because of the fuel shortage. The usual method of obtaining water in the winter is with a tank or barrel of ice in a corner of the house near the stove. The room temperature slowly melts this ice and the water is drawn off from the bottom. The difficulty of obtaining uncontaminated ice plus this melting process may contribute to the prevalence of enteric diseases. The true prevalence of these diseases has been difficult to measure since they occur sporadically and require long-term surveillance for measurement. In Napaskiak, one of the villages in the present study, an investigation was made which indicated a seasonal variation in the prevalence of diarrhea(5). The high level occurred in the summer and affected especially the children under 10 years of age(6). The infection rates for *Endamoeba histolytica* and *Diphylobothrium* sp. were found to be 8.6 and 34.5 percent, respectively.

Most of the coastal people have to depend on driftwood for their fuel. Some portions of the coast have a good supply but in others this wood is almost nonexistent. In some villages, where seal are

TABLE 2

ALASKA: CHARACTERIZATION OF THE VILLAGES IN THE STUDY, AND THE SIZE OF THE SAMPLES EXAMINED, 1958

Name	Type	Population	No. of Persons Examined	Churches	School	Store or Distance to Nearest Store	Distance to Hospital
Allakaket	Indian	120	75	Episcopalian	State	Co-op.	150 miles
Akiak	Southern Eskimo	187	76	Moravian	Bureau of Indian Affairs	1 Trader + Co-op.	20 miles
Hooper Bay	Southern Eskimo	435	96	Roman Catholic Swedish Covenant	Bureau of Indian Affairs	2 Traders + Co-op.	155 miles
Huslia	Indian	145	90	Episcopalian	State	Trader	135 miles
Kasigluk	Southern Eskimo	180	94	Russian Orthodox Moravian	Bureau of Indian Affairs	(None) (4 miles)	35 miles
Napaskiak	Southern Eskimo	137	81	Russian Orthodox	Bureau of Indian Affairs	(None) (1 mile)	6 miles
Newktok	Southern Eskimo	118	59	Roman Catholic	Bureau of Indian Affairs Instructional Aid	3 Traders	115 miles
Noatak	Northern Eskimo	400	69	Friends	Bureau of Indian Affairs	Co-op.	50 miles
Point Hope	Northern Eskimo	315	88	Episcopalian	Bureau of Indian Affairs	Co-op.	150 miles
Shishmaref	Northern Eskimo	200	77	Lutheran	Bureau of Indian Affairs	Co-op.	110 miles
	Totals	2,237	805				

easily obtained in quantity, seal blubber is still used to give a quick, hot fire for cooking. The tundra people have the most serious fuel problem. They must depend on small willow patches and river driftwood. Fuel shortage is often so acute in these areas that even in winter the house may be heated only during the cooking period. Because of the fuel shortage cooking procedures must of necessity be simple and of fairly short duration. In the northern wooded areas and along the southeastern coast where most of the Indians live, fuel is not a problem.

The disposal of refuse has been a difficult problem for the Eskimos because of the permafrost and the long winter freeze-up. Refuse accumulates on the surface and in the winter is more or less covered with snow. With the spring thaws, some of it is carried away, contaminating surface water which may also contribute to the high prevalence of enteric diseases. Although sled dogs are always tied up close to the house, a few stray dogs and all the pups run loose. Personal hygiene is restricted by the scarcity of water. In ancient times fur garments were washed in urine since its ammonia was the only available detergent, and women washed their hair in urine; men took sweat baths. Some efforts were made to keep houses clean. For example, grass or sedge was strewn on the floor and thrown away periodically. Brooms to sweep the dirt floors were made of bird feathers. Some improvement has been made in these aspects of sanitation in recent years, but the over-all improvement has not been great.

Eskimo travel is by boat in the summer and by dog sleds in the winter. Nearly every family owns a boat, an outboard motor, a sled and a team of dogs. The feeding of the latter is a considerable drain on available food resources. Often the dog population in Eskimo villages equals or exceeds the human population. Nearly all villages receive mail service by plane from one to three times a week.

3. Health Facilities

All Bureau of Indian Affairs schools, except some Instructional Aid Schools, all National Guard Units, and some traders and missionaries have two-way radio communication. Each village where two-way radios are located has the opportunity of daily communication with the Alaska Native Health Service (ANHS) hospitals. Advice is given from the latter to the operator of the radio, usually the teacher, on medical problems in the village. A notable difference is usually found in health conditions between those villages with and those without radio communication. An example of the content of an evening's medical conversation between the medical officer in charge at the Alaska Native Health Service Hospital, Bethel, and the teachers in the native villages reveals some insight into the medical problems. The following calls to Bethel were reported on March 10, 1958. Only the "chief complaints" are listed. These were generally relayed by the village teacher and some kind of medical program or advice was agreed upon. Each teacher has a stock of drugs including antibiotics, but except for penicillin almost no parenteral medication is possible.

Village	Complaint
Hooper Bay	1. A woman, eight months pregnant, with pain, fever and dysuria suggesting pyelitis.
	2. A young man with fever and malaise considered to be "flu."
	3. A young boy with penile swelling and urinary obstruction, considered to be balanitis.
	4. A woman with pleurisy.
Tanunak	1. An 18 month old child with a swollen and inflamed throat.
Pilot Station	1. A man with obstipation.
	2. A child with extensive eczema.
	3. A fever of 105° F. in a 4 month old baby - no localizing signs of infection.
Goodnews Bay	1. A woman with "flu."
	2. The supply of drugs very low.
Kipnuk	1. Query from the doctor concerning the condition of a patient with tuberculosis recently returned to the village on isoniazid therapy.
	2. Query about the three villagers who were sent to Bethel last month for medical care. What are their conditions?
Mountain Village	1. Query for news about a man recently sent to the Anchorage Hospital.
Scammon Bay	1. A 14 year old girl with pain in the right lower abdomen, vomiting and with fever.

A general description of the ecological and social factors which bear upon the health problems in western Alaska has been outlined in the report of a survey carried out in 1953-54 by the Graduate School of Public Health of the University of Pittsburgh(7). The Department of the Interior, which was then responsible for the health problems and programs in the native population of Alaska, invited the faculty of the School of Public Health of the University of Pittsburgh to survey the situation and make suggestions for improvement. In the summers of 1953 and 1954 such a survey was carried out by medical specialists. These

included experts in anthropology, nursing care, medical social services, tuberculosis control, hospital and medical care, sanitation, laboratory services and mental health.

Members of the party traveled through the major areas of Alaska. The observations were generally more concerned with the health organizations and demographic and environmental conditions than with clinical problems. The study was done at a critical time, because in July 1955 the responsibility for the health problems of the natives of Alaska was transferred by Public Law 568 from the Bureau of Indian Affairs of the Department of the Interior to the Department of Health, Education, and Welfare. The Pittsburgh report thus reflects the conditions of an older system.

When Secretary Seward purchased Alaska in 1867, the contract with the Czar stipulated, "The uncivilized tribes will be subject to such laws and regulations as the United States may from time to time adopt in regard to aboriginal tribes of that country." Health services and regulations were almost nonexistent until 1914 when a medical program was established in the Bureau of Education which was then the only governmental agency directly concerned with the natives. In 1916 this Bureau established a migratory medical boat on the Yukon, but during the first summer the physician, Dr. J. W. Houston, fell overboard and was drowned. Small health surveys indicated that tuberculosis, syphilis and "trachoma" were common. There is now reason to doubt that trachoma did, in fact, exist.

The first hospital for natives was built in Juneau in 1916. In 1931 when the Office of Indian Affairs assumed responsibility there were five Alaska Native Health Service (ANHS) hospitals for the Alaskan Indians and Eskimos with six doctors and 15 nurses for the entire population. There are now five general hospitals under the U.S. Public Health Service and these are located at Point Barrow, Bethel, Kanakanak, Kotzebue and Tanana. There are, in addition, two medical centers, one at Anchorage and another at Mt. Edgecumbe in southeastern Alaska near Sitka. Some specialized care, as for tuberculosis and mental disease, is obtained by contract in hospitals both in and outside Alaska. The 1958 budget of the Division of Indian Health, Public Health Service, for Alaska was:

Activity	
Hospital Operations	$ 8,702,000
Contract Patient Care	694,000
Field Health	784,000
Management Services	122,000
Total	$10,302,000

The territorial "self-help" with medical problems may be said to have begun in 1945 when the Alaska Department of Health was reorganized. The collection of demographic data in Alaska has been the responsibility of the Alaska Department of Health, although the several U.S. Commissioners throughout the state actually record the data which are in turn furnished for native areas by the resident teachers. The Alaska Bureau of Vital Statistics was formed in 1949. The assignment of ages among adults is apt to be uncertain and the registration of births, deaths, and especially causes of death are likely to be in error. The proportion of all death certificates signed by physicians is on the order of 65 percent; the proportion of deaths caused by tuberculosis signed by physicians is much lower, often no more than 35 percent. A disproportionately large number of the causes of death is assigned to senility and ill-defined causes.

The Alaska Department of Health maintains itinerant nurses in the outlying areas around Bethel. Such nurses, besides their usual duties related to public health, also render considerable medical assistance to the villages. There are three nurses and a supervisor in the Bethel area.

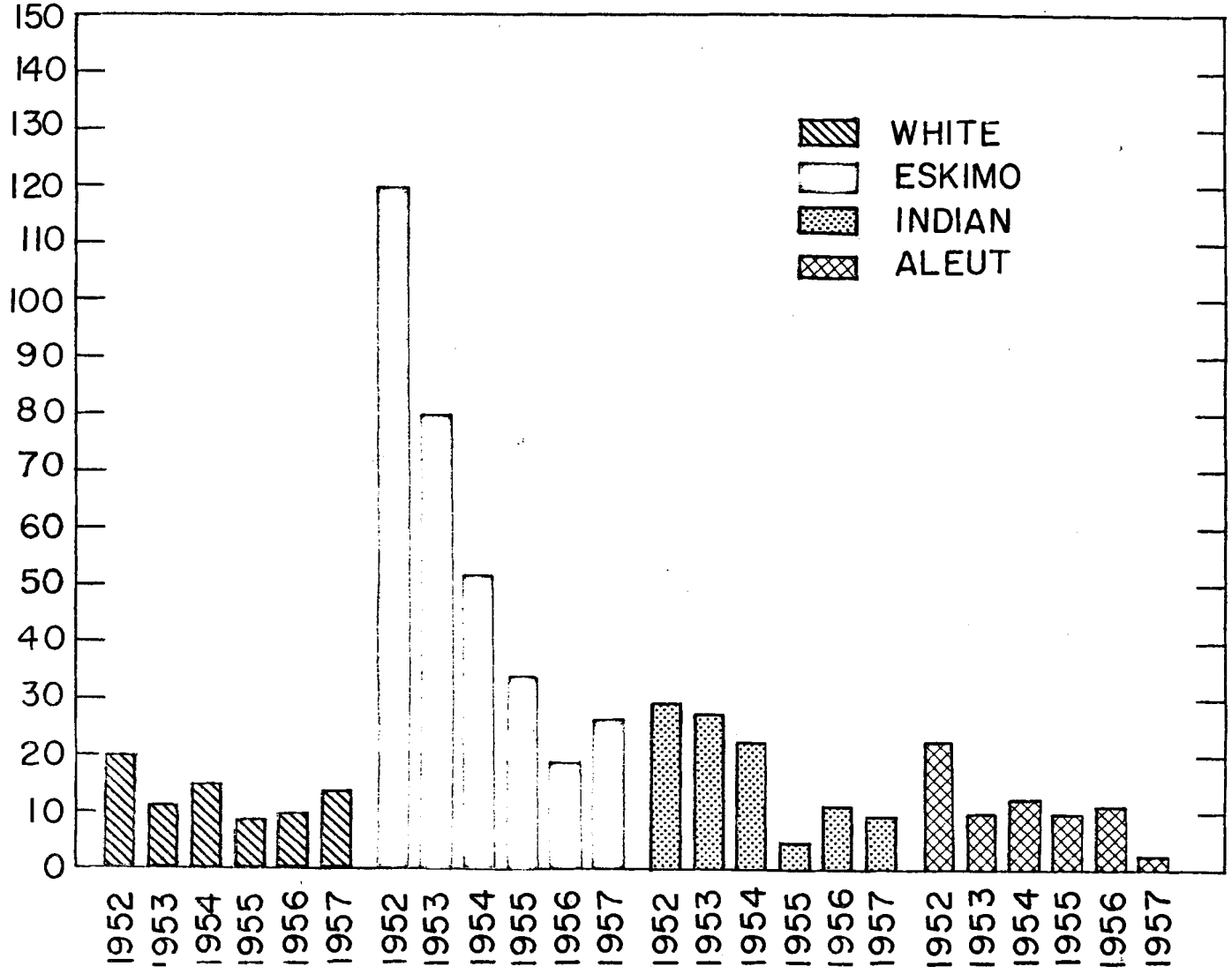
The sex ratio among all the native groups combined is about 1.0 in contrast to the white immigrant population in Alaska which has a (M/F) sex ratio of about 1.86. The native population reveals a high birth rate-high death rate combination. At maternal age 30 the birth rate for natives exceeds that of the white population almost twofold. The crude death rate in 1950(1) for the Alaskan natives was 17.0 per thousand, which may be contrasted with a rate of 9.6 per thousand for the United States as a whole. The native mortality is two to three times higher for persons 45 years and under than for a similar U.S. group. Among the males the native disadvantage is especially apparent between ages 15 and 40, which no doubt in part reflects the hazardous conditions of gathering food in a difficult terrain and climate.

In 1950 the infant mortality for Alaskan natives was 101 per thousand live births (that is, deaths occurring in infants under one year of age). This rate is about that of the U.S. in 1900 and is three times that for the U.S. in 1950. The Alaskan white population has an infant mortality rate of 24 per thousand, although it must be recognized that few Alaskan whites live in the environmental extremes typical of the native population. The principal cause of death among Alaskan natives in 1950 was tuberculosis, which caused about one third of all deaths and was thirty times more frequent in natives than in Alaskan whites. Accidents were the second important cause of death among the natives, and infectious diseases of the respiratory system (excluding tuberculosis) were the third most important. The concerted efforts of Federal and State health agencies have markedly diminished the tuberculosis problems of the natives since 1950(8). This change is shown in Figure II.

In 1956 the four leading causes of death in these people were accidents, influenza and pneumonia, heart disease and tuberculosis, in that order. The infant death rate among these races has dropped appreciably since 1945.

FIGURE II

TUBERCULOSIS MORTALITY FOR ALASKA BY RACE 1952--1957



The birth rates of racial groups in Alaska in 1956 are shown here(9):

Whites	32 per 1,000 population
Eskimos, Indians, Aleuts	52 per 1,000 population

The burden of disease in Alaska in 1950 and today bears a remarkable resemblance to that recorded for the United States in 1900. The opportunity for the application of modern medical skills and knowledge is obvious. "Native Alaska" could and should be made an almost ideal laboratory workshop for teaching, research and service.

4. General Plan of Study

A large proportion of the able-bodied Eskimo men are members of two battalions of a National Guard Reserve Unit which is brought to Camp Denali (at Fort Richardson near Anchorage) each year for a two-week training period. In good weather when the widely scattered villages are accessible the men are often away on sealing expeditions or tending traplines, so the period of National Guard duty offered a unique opportunity to study these Eskimo men. This was also an economical way of assembling data on people from many widely separated villages. It was fortuitous that the Guard training period occurred in late winter when native food supplies might be expected to be diminished and limited, thus placing the nutritional status of the people at a low ebb.

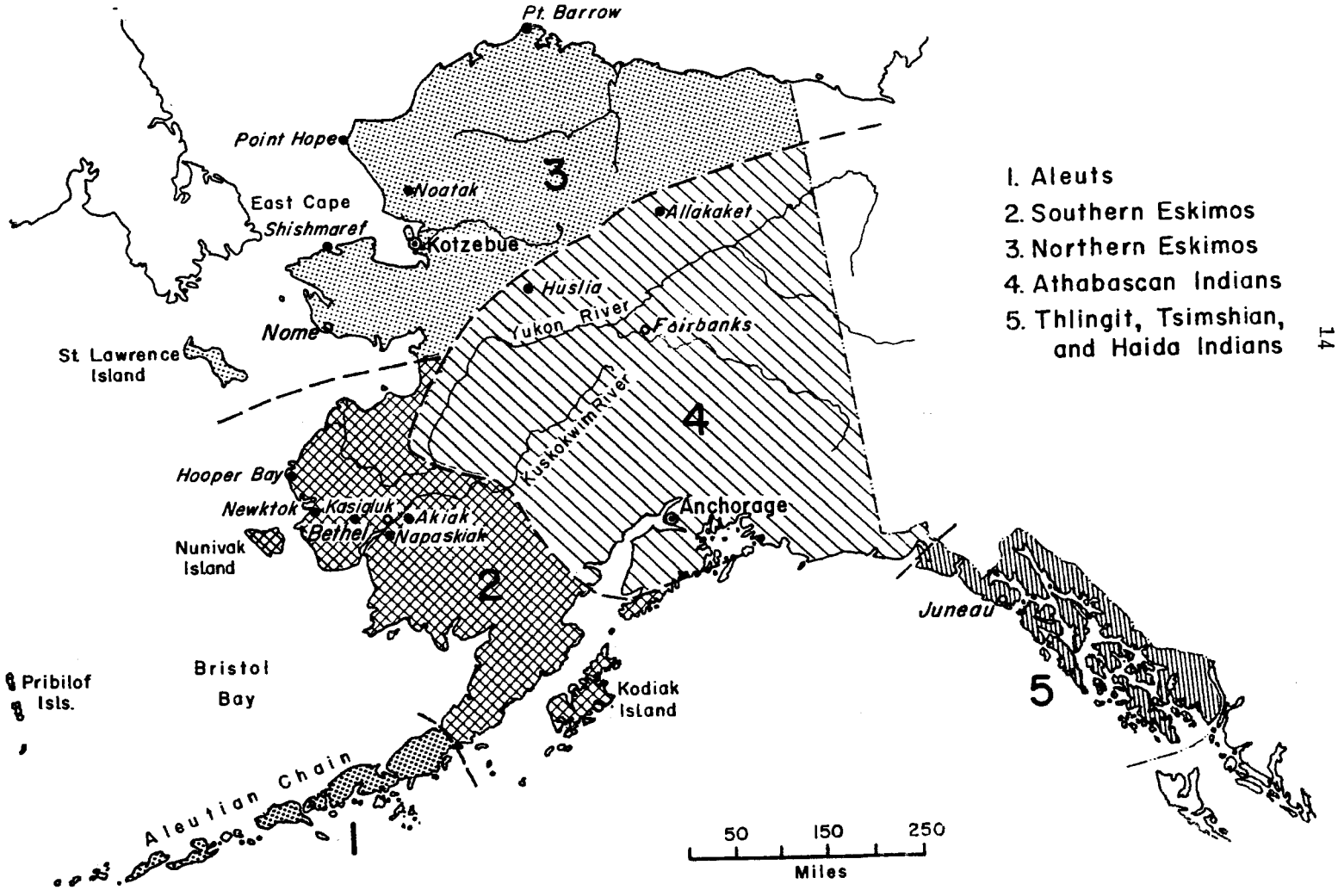
The clinical and biochemical methods used were those described in the "Manual for Nutrition Surveys" of the ICNND(10). Clinical observations were recorded on data cards for the "detailed clinical examination." No abbreviated clinical examinations were done. The neurological, cardiovascular and abdominal examinations and the skinfold measurements were made by two members of the Alaska Native Health Service medical staff.

Battalion 2 of the Eskimo Guardsmen arrived at Anchorage on March 1 and 2, 1958. The noncommissioned officers had arrived two weeks earlier. This unit comprises men from southwestern Alaska including the Aleutian chain and the Bering Sea islands except St. Lawrence and King Islands. Bethel and the Kuskokwim valley may be considered as its center. The men come from as far south as Dillingham, from west to Unalaska and the Pribilofs, and from north to Hooper Bay and the lower Yukon. They include two distinct ethnic groups, the Eskimos -- both inland and coastal -- and the Aleuts, who are few in number (Figure III). These men were examined during three days at Camp Denali. The group of examiners was then divided into two sections. One team proceeded to Bethel on March 7. In the following ten days they studied five villages in that area. A second team went to Kotzebue on March 7 where they undertook studies in five villages of that region.

Upon completion of these field studies the two parties returned to Camp Denali and on March 24-27 examined Battalion 1 of the Eskimo Guardsmen. These men were assembled from the northern villages of Alaska extending from Barter Island near the Canadian border to Nome

FIGURE III

PRINCIPAL ETHNOGRAPHIC DIVISIONS OF ALASKA, AND THE VILLAGES STUDIED



and Unalakleet on the Bering Sea. Men from St. Lawrence and King Islands were among the group, as were men from several Athabascan Indian villages in the interior.

5. Clinical Calibration Studies

The general plan of the examinations of the several groups is shown schematically in Figure IV. In all locations two physicians of the Alaska Native Health Service carried out measurements of pulse, blood pressure and skinfold thickness, auscultatory observation of the heart, palpation of the abdomen and tests of tendon reflexes, and also elicited the histories of diarrhea and tuberculosis. At Fort Richardson these two ANHS physicians selected subjects at random for examination. They did not sign the data cards, so that their examiner differences cannot be evaluated. In the villages one of the ANHS physicians was with each party and performed all the above-mentioned measurements, except the skinfold measurements on the subjects in the Bethel area, which were done by the biochemist's assistant.

Calibration of the nutritional appraisals was attempted by the two clinicians at several preliminary conferences. The clinician designated "examiner No. 2" had recently completed an extensive clinical experiment intended to reveal and correct examiner differences in the application of present methods. A preliminary clinical calibration was carried out by examining a group of 16 available Eskimo Guardsmen on two successive days under the procedural conditions that were later used for all Eskimo National Guardsmen. Each examiner filled out a data card for every man who came through the line to him on a random basis, but on the second day each man was assigned to the examiner he had not seen on the previous day. No consultations on findings between examiners were undertaken until the end of the second day. The results of this procedure are shown in column 1 of Table 3. These data -- handicapped by small numbers and especially by low prevalence of the attributes considered -- seem to indicate the examiners were in general agreement except for pingueculae, filiform atrophy, recession of gums, caries, and worn teeth.

The second set of reproducibility data (column 2 of Table 3) was obtained with 20 Eskimo Guardsmen who were sent back through the line by one or the other of the examiners during the first series of regular clinical examinations at Camp Denali. The selection of these duplicates was not randomized and was largely influenced by the work load, the duplicates being sent back when the load was light. The second examiner was always aware that this was a duplicate examination, since he was required to fill out a special card. Under these working conditions the examiner variation was larger, and if one arbitrarily assumes that a divergent classification by the examiners of more than 15 percent of the men for any finding disqualifies that class of observations, one must disqualify skin erythema, thickened conjunctivae, slight filiform atrophy, glossal furrows, three kinds of gum lesions, worn teeth and follicular hyperkeratosis. The independent dental examinations would retrieve a part of this information. The erythema and conjunctival and glossal changes would seem inconsequential in this population, but the

FIGURE IV

PLAN OF THE STUDY WITH NUMBERS EXAMINED

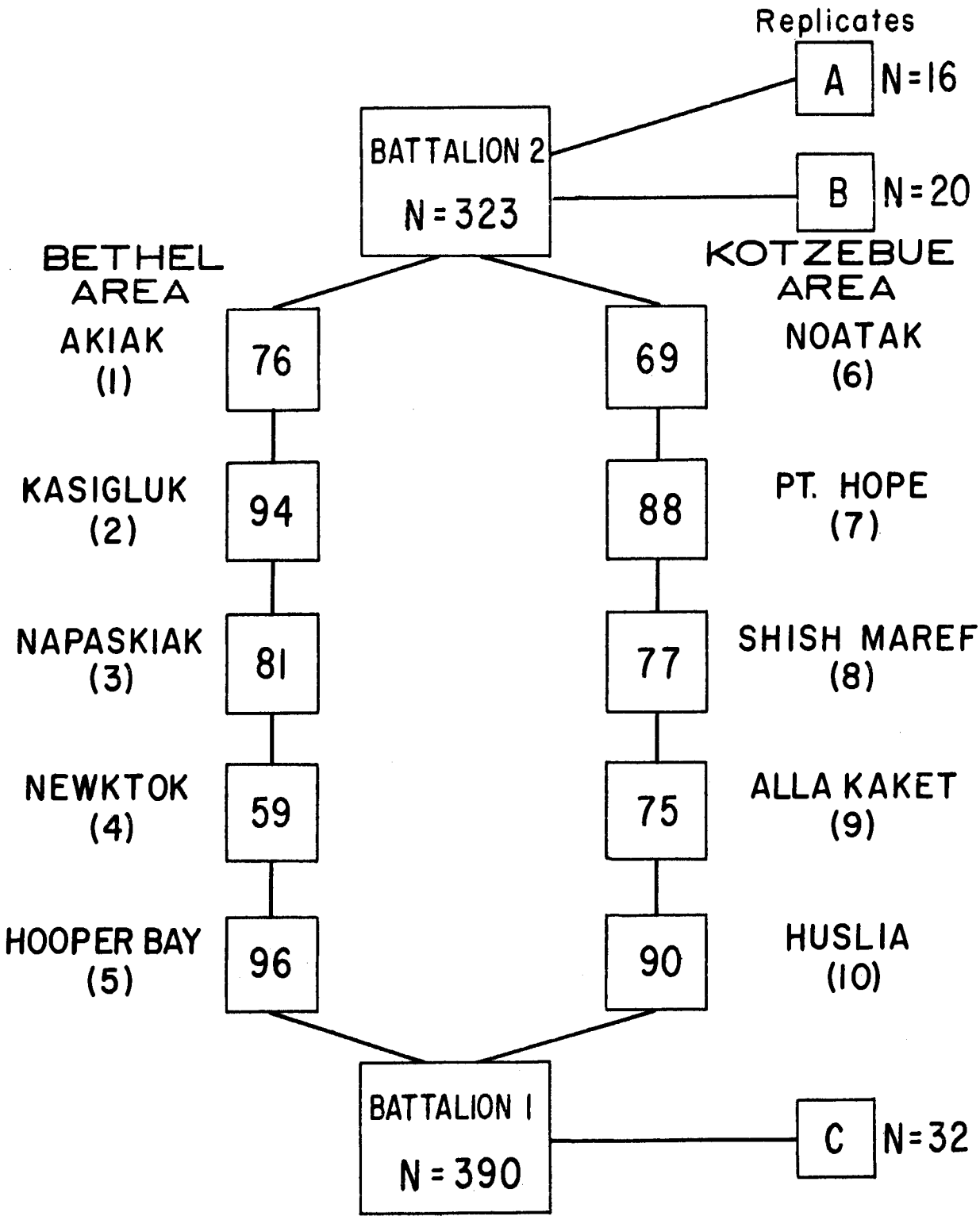


TABLE 3

ESKIMO MEN, ALASKA NATIONAL GUARD, 1958

CLINICAL CALIBRATION STUDIES 1/

	(1) Trials N = 16				(2) Bn 2 N = 20				(3) Bn 1 N = 32				(4) Total Duplicates N = 68			
Examiner No. 1	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+
Classification No. 2	-	-	+	+	-	-	+	+	-	-	+	+	-	-	+	+
Attribute																
General appearance 2/	13	3	-	-	16	4	-	-	26	6	-	-	55	13	-	-
Thyroid enlarged	16	-	-	-	19	-	1	-	26	1	4	1	61	1	5	1
Submaxillary enlarged	16	-	-	-	18	1	1	-	29	-	3	-	63	1	4	-
Nasolabial seborrhea	16	-	-	-	17	-	2	1	32	-	-	-	65	-	2	1
Other seborrhea	16	-	-	-	20	-	-	-	28	-	4	-	64	-	4	-
Erythema - head	14	1	-	1	13	4	-	3	28	2	-	2	55	7	-	6
Pigmentation - head	14	2	-	-	20	-	-	-	28	3	-	1	62	5	-	1
Thickened conjunctivae	15	1	-	-	16	4	-	-	21	6	1	4	52	11	1	4
Pingueculae	-	2	4	10	-	2	-	18	9	4	4	15	9	8	8	43
Bitot's spots	15	-	1	-	19	-	1	-	32	-	-	-	66	-	2	-
Conjunctival injection	16	-	-	-	19	1	-	-	26	4	2	-	61	5	2	-
Angular scars	14	1	1	-	17	-	3	-	32	-	-	-	63	1	4	-
Cheilosis	16	-	-	-	19	-	1	-	32	-	-	-	67	-	1	-
Filiform atrophy, slight	16	-	-	-	16	-	4	-	30	-	2	-	62	-	6	-
Glossal furrows	16	-	-	-	15	4	-	1	23	5	2	2	54	9	2	3
Red gums	16	-	-	-	11	-	7	2	30	-	1	1	57	-	8	3
Swollen gums	16	-	-	-	13	-	6	1	29	-	3	-	58	-	9	1
Gum recession	6	2	1	7	3	1	12	4	19	1	8	4	28	42	1	15
Unfilled caries	7	3	-	6	14	2	-	4	12	3	6	11	33	8	6	21
Worn teeth	1	8	1	6	2	3	1	14	16	5	2	9	19	16	4	29
Follicular hyperkeratosis	15	-	1	-	15	-	5	-	28	-	4	-	58	-	10	-
Xerosis	16	-	-	-	19	1	-	-	28	3	1	-	63	4	1	-
Acne	15	1	-	-	18	1	-	1	25	2	2	3	58	4	2	4

1/ The 43 items recorded for the detailed examination which were used exclusively in the Alaska Survey have been abridged here to include only the 23 items which showed sufficient prevalence of a sign to allow comparison of observers.

2/ Positive means less than "good general appearance."

follicular hyperkeratosis is an important area of dyscalibration. It will be shown later that this particular examiner difference is partially accounted for by an assignment of lesions by examiner 2 to follicular hyperkeratosis whereas examiner 1 assigned similar conditions to xerosis.

A similar estimate of examiner difference was carried out with the Battalion 1 men after the survey parties returned from the village surveys (column 3 in Table 3). The extent of the differences between examiners is both large and important. If the average difference between examiners in percent of subjects in which they disagree for all items is obtained for Battalion 2 and Battalion 1, the averages are respectively 16.6 N=25 and 14.0 N=25. There is no clear indication of a trend of examiner difference. For the total duplicate examinations (68 in all, column 4, Table 3), the examiners exceed 15 percent divergence for thickened conjunctivae and pingueculae, glossal furrows, gum atrophy and recession, unfilled caries, worn teeth and dental malposition. The divergence on follicular hyperkeratosis is just at 15 percent, but one examiner identified all of these (N=10) whereas the other examiner diagnosed 4 subjects with xerosis, not indicated by the first. These data are further condensed in Table 4. The secular consistency of the examiners is notable.

These clinical calibration studies were done on 5 percent of the subjects studied at Camp Denali. This approach will always be limited by the scarcity of clinical material showing a range of manifestations for many of the important clinical signs. The problem then is one of measuring the ability of individuals to fix their criteria for recognition of threshold levels of clinical signs. It appears that a more rigorous set of definitions should be used. It is also necessary that more extensive estimates of observer differences be made. The present data suggest that perhaps 10 percent of all the clinical appraisals should have been replicates, and this process should have been arranged to measure self-duplication as well as inter-examiner duplication.

The present studies appear to disqualify observation of thickened conjunctivae, pingueculae and follicular hyperkeratosis because of observational imprecision. The dental information will need to come from the independent dental examination.

TABLE 4

ESKIMO MEN, ALASKA NATIONAL GUARD, 1958

SUMMARY OF CALIBRATION STUDIES FOR THE CLINICAL EXAMINATIONS[1/]

Trial	Number of Observations	Examiner's Reaction: Agree Positive		Disagree No. 1 +		Disagree No. 2 +		Agree Negative	
		N	%	N	%	N	%	N	%
Trial 1	368	30	8.2	24	6.5	9	2.4	289	78.6
Battalion 2	460	49	10.7	28	6.1	44	9.6	319	69.5
Battalion 1	736	53	7.2	45	6.1	49	6.7	557	75.6
Totals	1564	132	8.4	97	6.2	102	6.5	1165	74.5

Conclusion - In 1564 observations recorded in duplicate after independent evaluation by examiner 1 and examiner 2:

Both agree positive findings in 8%
Both agree negative findings 75%
Disagree 13%
With examiner 1 positive 6.2%
With examiner 2 positive 6.5%

1/ Using the 23 items shown in Table 3.

III - NATIVE MEN IN THE NATIONAL GUARD

1. The Population Studied

The Eskimo Guardsmen represent the majority of all the able-bodied Eskimo men in Alaska. They appear to find membership in the Alaska National Guard (ANG) attractive because the service furnishes a cash income and also it supplies a pleasant social diversion for them.

It appears that no medical screening is done in the villages when the groups are assembled for the annual duty at Anchorage. It is likely that known tuberculosis and obvious crippling or chronic disease are causes for rejection, but the men are generally sworn in and assembled in Anchorage before application of the usual medical standards for military acceptance(11). The frequency and severity of grossly visible defects strongly suggested that these battalions were composed of "able-bodied volunteers" who had not been subjected to effective medical screening. In Battalion 2, four cases of active pulmonary tuberculosis were diagnosed by symptoms and x-ray among the 350 men present.

The Division of Tuberculosis Control of the Alaska Department of Health, as part of its tuberculosis case finding mechanism, has three itinerant x-ray technicians who travel to villages of known high incidence to take chest x-rays of all available inhabitants. Active and probably active cases diagnosed in this manner, as well as by laboratory or clinical means, are placed under medical supervision, and their known contacts are also examined. In 1958 this program identified 44 new active cases throughout Alaska among the Eskimos and Indians(12).

The noneffective rates at Camp Denali among the Eskimo National Guardsmen were not made available. Since the survey examination facility was also the battalion dispensary, it was observed that from 8 to 30 men appeared for sick call each morning from a battalion strength of about 400. During the work with each battalion small epidemics of what seemed to be a contagious respiratory disease occurred a few days after the men arrived in camp. This was variously called "flu," "pneumonia" and "measles" by the orderlies. The medical facilities available to these men were the same as those for all U.S. military personnel in Alaska. These facilities and the local mess and sanitary facilities would not be expected to have any lasting effect, however, since the men are in camp for only 14 days.

There is no question that duty with the Alaska National Guard has an important impact on these men, especially those from the Bethel area where acculturization has been slower. The Eskimos' acceptance of military food, clothing, customs and equipment is immediate and total. They are sometimes said to dislike beans and they often find cheese revolting, but mess sergeants find they eat anything offered them and they eat this completely. It has been said that the word "Eskimo," which means "one who eats raw meat" in the Athabascan language, would be more appropriately called "one who eats everything."

2. Clinical Findings

The general impression of physical appearance obtained from casual observation of the two battalions was that these men were active, rugged, deeply tanned and well-conditioned. They were short in stature, with "Oriental" faces, short limbs and long trunks, and they generally had a mesomorphic body type. The men in Battalion 1 who came from northwestern Alaska seemed somewhat taller, obesity was more frequent among them, and they more commonly had lighter eyes, hair and skin than the men in Battalion 2. The men in Battalion 1 were also more at ease, better acquainted with English, and their behavior was more like that of American troops. The height-weight measurements bear out some of these observations. A summary of the height, weight, skinfold, blood pressure and pulse measurements is shown in Table 5.

The relationship of weight to age is shown in Table 6. The small gains of weight with age are in contrast to the usual findings in white males in the United States. As noted above the men from northwestern Alaska (Battalion 1) were a little taller than those in Battalion 2, but no important trends were demonstrated. In particular, there is no evidence that Eskimo men are taller as their race becomes acculturated. These data also indicate there is very little obesity. (It should be remembered in using the U.S. Medico-Actuarial Tables of Standard Weight(13) that an appreciable increase of weight with age is incorporated in the "standard weight.") The fall of percent "standard weight" with age shown in Table 18a is thus largely an artifact due to the use of these U.S. reference tables(13). The percent distribution of men exceeding the calculated "standard weight" is shown in Table 5. The physical appearance of these men suggests that the percent "standard weight" in excess of 100 is often an artifact due to excessive bone and muscle mass; that is, the consequence of high activity rather than of fat deposits. Body composition data on these people are not available, but body composition may have some relevance to the physiological problem of adaptation to a cold environment. This interpretation of the small elevation of percent "standard weight" is also supported by the relation of weight to age shown for the village groups in Figure IX where the weights are essentially constant after age 25 to 29.

The pulse rates have little clinical interest, although there was evidence for important observer differences.

As is usually true of blood pressure data, the observers showed a predilection for the end digits 0, 5, and even numbers. For example, 76 percent of the diastolic blood pressures were recorded with a zero end digit and 82 percent of the systolic pressures recorded ended with zero. This recording artifact requires a careful selection of groups in the analysis and also influences the positioning of an arbitrary criterion of normalcy because it will affect the distribution of subgroups.

The mean systolic blood pressures are remarkably constant with age (Table 6). Furthermore, the number of men with systolic pressure of 160 or over comprises a very small percentage (8 men, 1.1 percent)

TABLE 5

ESKIMO MEN, ALASKA NATIONAL GUARD, 1958, BY BATTALION
ORIGIN, AGE, HEIGHT, WEIGHT, WEIGHT STATUS, SKINFOLDS, BLOOD PRESSURE & PULSE

		Bn 2	Bn 1	Total
Number of men examined		323	390	713
Number by Region of Origin 1/	1. Aleuts	38	-	38
	2. Southern Eskimos	285	24	309
	3. Northern Eskimos	-	345	345
	4. Athabascan Indians	-	21	21
Villages represented		26	29	55
Age	Mean (years)	30.8	28.1	29.3
Percentage Distribution	17-19 yrs	6.5%	10.8%	8.8%
	20-29 yrs	45.2%	54.3%	50.2%
	30-39 yrs	33.7%	27.2%	30.2%
	40-54 yrs	14.6%	7.7%	10.8%
Height (inches)	Mean ± S.E.	64.5 ± 0.1	66.2 ± 0.1	65.4 ± 0.1
	S.D.	2.3	2.2	2.4
Weight (pounds)	Mean ± S.E.	141.7 ± 0.9	149.2 ± 0.8	145.8 ± 0.6
	S.D.	15.9	16.0	16.4
Percent of "Standard Weight" 2/ $\left(\frac{\text{observed wt}}{\text{standard wt}}\right) \times 100$	Mean ± S.E.	103.6 ± 0.4	105.7 ± 0.5	104.8 ± 0.3
	S.D.	8.0	9.2	8.7
Percentage Distribution	80- 89%	3.4%	3.6%	3.5%
	90- 99%	27.9%	21.5%	24.4%
	100-109%	51.1%	43.6%	47.0%
	110-119%	14.9%	27.2%	21.6%
	≥ 120%	2.8%	4.1%	3.5%
Arm Skinfold Thickness	Median (mm)	5.9	6.9	6.3
Percentage Distribution	2- 4 mm	24.0%	24.0%	24.0%
	5- 9 mm	62.5%	43.9%	52.3%
	10-14 mm	10.7%	26.6%	19.5%
	≥ 15 mm	2.8%	5.5%	4.2%
Scapula Skinfold Thickness	Median (mm)	7.8	9.7	8.5
Percentage Distribution	2- 4 mm	2.8%	1.0%	1.8%
	5- 9 mm	73.5%	47.3%	59.1%
	10-14 mm	15.8%	36.7%	27.3%
	≥ 15 mm	7.9%	15.0%	11.8%
Systolic Blood Pressure (mm Hg)	Mean ± S.E.	125.4 ± 0.8	120.9 ± 0.7	122.9 ± 0
	S.D.	15.1	14.8	15.0
Diastolic Blood Pressure (mm Hg)	Mean ± S.E.	72.4 ± 0.7	69.7 ± 0.5	70.9 ± 0
	S.D.	12.2	10.5	11.3
% with B.P. ≥ 140/90 3/		5.9%	1.5%	3.5%
% with B.P. > 140/90 4/		2.5%	0.5%	1.4%
Pulse (beats/min.)	Mean ± S.E.	77.8 ± 0.6	77.3 ± 0.4	77.5 ± 0
	S.D.	10.0	8.4	9.2

1/ See Figure III for regions.
2/ U.S. Medico-Actuarial Tables (13) are used as an arbitrary standard.
3/ Systolic pressure at least 140 and diastolic pressure at least 90.
4/ Systolic pressure above 140 and diastolic pressure above 90.

TABLE 6

ESKIMO MEN, ALASKA NATIONAL GUARD, 1958, BY BATTALION AND AGE
HEIGHT, WEIGHT, WEIGHT STATUS, SKINFOLDS, BLOOD PRESSURE & PULSE

		Battalion 2				Battalion 1			
		Age (years)				Age (years)			
		17-19	20-39	40-54	Total	17-19	20-39	40-54	Total
Number examined		21	255	47	323	42	318	30	390
Height (inches) 1/		65.5±0.4	64.5±0.1	63.8±0.3	64.5±0.1	65.8±0.3	66.2±0.1	65.8±0.4	66.2±0.1
Weight (pounds) 1/		140 ± 3	141 ± 1	144 ± 2	142 ± 1	140 ± 2	150 ± 3	150 ± 3	149 ± 1
% of "Standard Weight"		108 ± 2	104 ± 1	102 ± 1	104 ± 1	107 ± 1	106 ± 1	100 ± 1	106 ± 1
Median Skinfold Thickness (mm)	Arm	6.3	5.9	5.4	5.9	8.9	6.7	7.1	6.9
	Scapula	8.3	7.7	7.6	7.8	10.7	9.5	8.8	9.7
Systolic Blood Pressure (mm Hg) 1/		125 ± 4	126 ± 1	122 ± 2	125 ± 1	119 ± 2	121 ± 1	120 ± 3	121 ± 1
Diastolic Blood Pressure (mm Hg) 1/		73 ± 2	73 ± 1	72 ± 2	67 ± 1	67 ± 2	70 ± 1	74 ± 1	70 ± 1
% with B.P. ≥ 140/90		0.0	6.3	6.4	5.9	0.0	1.9	0.0	1.5
Pulse (beats/minute) 1/		78 ± 2	78 ± 1	74 ± 1	78 ± 1	79 ± 2	77 ± 1	76 ± 1	77 ± 1

1/ Mean ± Standard Error.

TABLE 7

ESKIMO MEN, ALASKA NATIONAL GUARD, 1958, BY BATTALION
BLOOD PRESSURE (Mean ± Standard Error), BY HEIGHT

		Height (inches)		
		59-63	64-67	68-73
Systolic Blood Pressure (mm Hg)	Bn 2	122.3 ± 1.4	127.1 ± 1.1	127.8 ± 3.0
	Bn 1	117.6 ± 2.1	119.7 ± 0.9	125.1 ± 1.5
Diastolic Blood Pressure (mm Hg)	Bn 2	70.7 ± 1.0	73.0 ± 1.0	75.2 ± 1.9
	Bn 1	67.4 ± 1.6	69.9 ± 0.6	70.5 ± 1.1

of the entire group examined. In neither group was there a significant number of men with diastolic pressures over 90 mm Hg and there were only five men with pressures over 100 mm. Since these were casual blood pressure measurements taken under moderately stressful conditions they may be presumed to be high estimates. They suggest that hypertensive heart disease is not an important problem among these men. Rodahl has also made this observation(14). This fact is of particular interest because of the high protein diet which these men seem to have. It is of some interest that when systolic blood pressure is considered for each battalion by inch of height a definite trend is observed for higher mean pressure with increasing height. Grouping and comparing heights reveals mean differences as shown in Table 7. Diastolic pressures reveal a similar trend. It may be concluded that the observed blood pressure readings reveal little or no signs of high blood pressure as an indicator of cardiovascular disease and that the minor fluctuations of blood pressure observed are reasonably related to small differences of arm thickness. The absence of hypertension among the Eskimos may be of some importance in relation to the problem of causation of hypertensive heart disease among white cultures.

The summary of other clinical findings for the Eskimo Guardsmen is shown in Tables 8, 9 and 10. The data are shown for the battalions separately (Table 8) because they seem to represent two distinct populations. The examiners are also distinguished because of the procedural divergencies demonstrated above. Certain selected clinical signs are presented by battalion and age in Table 9 and by ethnographic origin in Table 10. The significant findings are as follows:

No important prevalence of goiter was observed in the men of Battalion 2 but an average prevalence of 10 percent was seen in Battalion 1. These were, without exception, small goiters which were judged to be enlarged either with nodules or symmetrically. A 9.9 percent incidence of goiter was found among northern Eskimos, and 14.3 percent of the Athabascan Indians had enlarged thyroid glands. No instance of thyrotoxicosis was seen. The prevalence of enlarged salivary glands was low; the glands were not grossly enlarged and the sign did not seem important (Figure V).

Erythema of the exposed parts was common, but this could be adequately explained by the known degree of exposure to sun, cold and wind. It was noted particularly among the Eskimos (Table 10). The late cutaneous results of cold injury which the men describe collectively as "ice" resemble x-ray injury, with cicatrization, depilation and dilatation of venules. Excessive pigmentation of exposed parts was also common in the older men and was sometimes dramatic about the face. Over the trunk and especially the back it assumed a mottled effect with an irregular deposition of pigment (Figure VI). This change strongly resembled the erythema ab igne more often seen about the shins in some U.S. rural populations. In these people this sign, restricted to males, is probably related to the "kashim" or sweat bath procedure.

TABLE 8

ESKIMO MEN, ALASKA NATIONAL GUARD, 1958, BY BATTALION
PERCENT PREVALENCE OF CLINICAL FINDINGS [1/], BY EXAMINER

		Battalion 2			Battalion 1			Total		
		Examiner			Examiner			Examiner		
		# 1	# 2	Total	# 1	# 2	Total	# 1	# 2	Total
Number examined		155	168	323	211	179	390	366	347	713
Suspected Disease	Tuberculosis	3.9	1.8	2.8	1.9	3.9	2.8	2.7	2.9	2.8
General Appearance	Good	85.8	100.0	93.2	83.4	98.9	90.5	84.4	99.4	91.7
	Fair	12.9	0.0	6.2	16.1	1.1	9.2	14.8	0.6	7.9
	Poor	1.3	0.0	0.6	0.5	0.0	0.3	0.8	0.0	0.4
Hair	Staring hair	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glands Enlarged	Thyroid	0.7	1.2	0.9	11.4	8.9	10.3	6.8	5.2	6.0
	Submaxillary	2.6	2.4	2.5	2.4	5.0	3.6	2.5	3.7	3.1
Skin - Face & Neck	Nasolabial seborrhea	0.0	5.4	2.8	0.5	2.2	1.3	0.3	3.7	2.0
	Other seborrhea	0.0	1.8	0.9	2.4	7.3	4.6	1.4	4.6	2.9
	Erythema, face/neck	21.9	6.0	13.6	13.7	7.8	11.0	17.2	6.9	12.2
	Pigmentation, face/neck	5.8	0.6	3.1	3.8	7.8	5.6	4.6	4.3	4.5
Eyes	Thickened conjunctivae	11.0	1.2	5.9	31.8	19.0	25.9	23.0	10.4	16.8
	Pingueculae	84.5	57.7	70.6	61.1	54.7	58.2	71.0	56.2	63.8
	Bitot's spots	1.3	0.6	0.9	0.0	0.0	0.0	0.5	0.3	0.4
	Circumcorneal injection	0.0	0.6	0.3	0.0	0.6	0.3	0.0	0.6	0.3
	Conjunctival injection	4.5	0.0	2.2	9.0	3.4	6.4	7.1	1.7	4.5
	Blepharitis	0.0	0.0	0.0	0.5	0.0	0.3	0.3	0.0	0.1
	Corneal scarring	6.5	9.5	8.0	4.3	2.2	3.3	5.2	5.8	5.5
Lips	Angular lesions	0.7	0.0	0.3	0.5	1.7	1.0	0.5	0.9	0.7
	Angular scars	3.2	5.4	4.3	0.0	0.0	0.0	1.4	2.6	2.0
	Cheilosis	0.0	1.2	0.6	0.0	0.0	0.0	0.0	0.6	0.3
Tongue	Filiform atrophy, sl.	0.7	13.1	7.1	9.5	10.6	10.0	5.7	11.8	8.7
	Filiform atrophy, mod.	1.3	1.8	1.5	2.8	2.8	2.8	2.2	2.3	2.2
	Fungiform atrophy	2.6	0.0	1.2	0.0	0.0	0.0	1.1	0.0	0.6
	Papillary hypertrophy	1.3	1.2	1.2	0.0	1.1	0.5	0.5	1.2	0.8
	Furrows	7.1	1.2	4.0	12.8	6.7	10.0	10.4	4.0	7.3
	Fissures, erosions, ulcers	2.6	0.0	1.2	1.4	0.0	0.8	1.9	0.0	1.0
	Serrations or swellings	5.8	8.9	7.4	1.9	9.5	5.4	3.6	9.2	6.3

TABLE 8 (Continued)

Gums	Red or swollen gums	9.7	25.6	18.0	5.2	14.0	9.2	7.1	19.6	13.2
	Atrophy or recession, pap.	40.0	66.7	53.9	23.7	43.6	32.8	30.6	54.8	42.4
	Bleeding gums	0.0	2.4	1.2	0.0	0.0	0.0	0.0	1.2	0.6
Teeth	Unfilled caries	27.0	20.9	23.8	42.2	44.1	43.1	36.8	34.4	35.6
	Filled caries	10.4	12.4	11.5	30.8	45.3	37.4	23.6	31.5	27.4
	Carious teeth, 0	62.6	65.1	63.9	32.7	20.1	26.9	43.3	39.0	41.2
	" " , 1-2	13.0	14.0	13.5	16.1	31.8	23.3	15.0	24.4	19.6
	" " , 3-4	15.7	9.3	12.3	20.4	21.8	21.0	18.7	16.6	17.7
	" " , 5+	7.0	7.0	7.0	26.1	24.0	25.1	19.3	16.9	18.1
	Edentulous	1.7	4.7	3.3	4.7	2.2	3.6	3.7	3.2	3.5
	Worn	60.0	45.7	52.5	34.1	30.2	32.3	43.3	36.7	40.1
	Fluorosis	0.0	0.0	0.0	1.4	2.2	1.8	0.9	1.3	1.1
	Malposition	7.8	4.7	6.1	19.9	5.0	13.1	15.6	4.9	10.4
Skin - General	Follicular hyperkeratosis	3.9	11.3	7.7	0.0	10.6	4.9	1.6	11.0	6.2
	Xerosis	1.3	0.0	0.6	14.2	0.6	7.9	8.7	0.3	4.6
	Acneform eruption	5.2	1.8	3.4	9.0	5.0	7.2	7.4	3.5	5.5
	Scrotal dermatitis	0.0	0.0	0.0	0.5	1.1	0.8	0.3	0.6	0.4
	Thickened pressure points	1.3	0.0	0.6	1.4	5.6	3.3	1.4	2.9	2.1
	Purpura or petechiae	0.6	0.0	0.3	0.0	0.0	0.0	0.3	0.0	0.1
	Hyperpigmentation	0.0	2.4	1.2	1.9	0.6	1.3	1.1	1.4	1.3
Abdomen	Hepatomegalia	0.0	2.4	1.2	0.5	0.0	0.3	0.3	1.2	0.7
Lower Extremities	Vibration sensation absent	1.3	0.0	0.6	0.0	0.0	0.0	0.5	0.0	0.3
	Loss of ankle jerk	0.6	0.6	0.6	0.5	0.0	0.3	0.5	0.3	0.4

1/ No findings of enlarged parotids, xerophthalmia, magenta tongue, "scorbutic-type" gums, crackled skin, pellagrous lesions, splenomegalia, ascites, or calf tenderness. Findings of 1 case each of glossitis, perifolliculosis and depigmentation of hair also omitted.

TABLE 9

ESKIMO MEN, ALASKA NATIONAL GUARD, 1958, BY BATTALION AND AGE
PERCENT PREVALENCE OF SELECTED CLINICAL FINDINGS

		Battalion 2				Battalion 1			
		Age (years)				Age (years)			
		17-19	20-39	40-54	Total	17-19	20-39	40-54	Total
Number examined		21	255	47	323	42	318	30	390
Suspected Disease	Tuberculosis	4.8	2.4	4.3	2.8	4.8	2.8	0.0	2.8
General Appearance	Good	90.5	92.9	95.8	93.2	83.3	91.5	90.0	90.5
	Fair	9.5	6.7	2.1	6.2	14.3	8.5	10.0	9.2
	Poor	0.0	0.4	2.1	0.6	2.4	0.0	0.0	0.3
Glands Enlarged	Thyroid	0.0	0.8	2.1	0.9	9.5	9.7	16.7	10.3
	Submaxillary	0.0	2.7	2.1	2.5	0.0	3.5	10.0	3.6
Skin - Face & Neck	Nasolabial seborrhea	4.8	3.1	0.0	2.8	4.8	0.9	0.0	1.3
	Erythema, face/neck	9.5	13.7	14.9	13.6	2.4	12.3	10.0	11.0
	Pigmentation, face/neck	4.8	2.7	4.3	3.1	2.4	6.3	3.3	5.6
Eyes	Thickened conjunctivae	0.0	6.3	6.4	5.9	11.9	26.4	40.0	25.9
	Pingueculae	38.1	69.4	91.5	70.6	23.8	61.0	76.7	58.2
	Conjunctival injection	0.0	2.4	2.1	2.2	11.9	5.7	6.7	6.4
	Corneal scarring	0.0	8.6	8.5	8.0	7.1	2.5	6.7	3.3
Tongue	Filiform atrophy, sl.	0.0	7.8	6.4	7.1	14.3	9.7	6.7	10.0
	" " , mod.	0.0	1.6	2.1	1.5	0.0	2.8	6.7	2.8
	Furrows	0.0	3.5	8.5	4.0	9.5	10.4	6.7	10.0
	Serrations and swellings	0.0	7.5	10.6	7.4	0.0	6.3	3.3	5.4
	Red, tip, or lat. margins	0.0	1.6	2.1	1.5	4.8	5.0	0.0	4.6
	Geographic tongue	4.8	0.4	0.0	0.6	2.4	1.9	0.0	1.8
Gums	Red or swollen gums	0.0	17.3	29.8	18.0	7.1	10.4	0.0	9.2
	Atrophy or recession		54.9	66.0	53.9	14.3	33.6	50.0	32.8
Teeth	No carious teeth	36.8	64.6	75.0	63.9	14.3	26.7	46.7	26.9
	Caries, filled 1-2	15.8	13.8	11.1	13.5	19.0	23.3	30.0	23.3
	or unfilled 3+	47.4	19.0	5.6	19.3	66.7	45.9	20.0	46.2
	Edentulous	0.0	2.6	8.3	3.3	0.0	4.1	3.3	3.6
	Worn	15.8	48.7	91.7	52.5	2.4	31.8	80.0	32.3
Skin - General	Follicular hyperkeratosis	9.5	8.6	2.1	7.7	7.1	4.7	3.3	4.9
	Xerosis	0.0	0.8	0.0	0.6	7.1	8.2	6.7	7.9
	Acneform eruption	9.5	3.5	0.0	3.4	11.9	6.6	6.7	7.2

TABLE 10

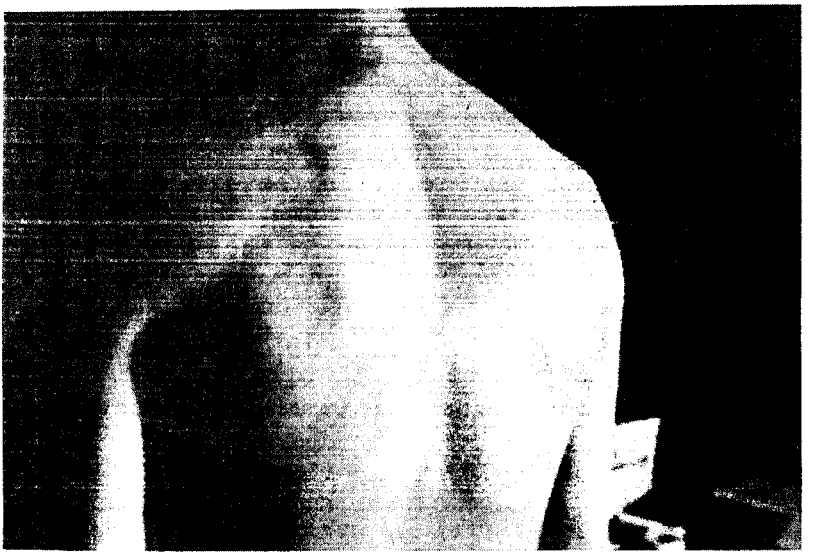
ESKIMO MEN, ALASKA NATIONAL GUARD, 1958, BY REGION OF ORIGIN
AGE, HEIGHT, WEIGHT, WEIGHT STATUS, BLOOD PRESSURE
AND SELECTED CLINICAL FINDINGS

		Ethnographic Region of Origin				
		Aleuts	Southern Eskimo	Northern Eskimo	Athabascan Indians	Total
Number examined		38	309	345	21	713
Villages represented		2	26	26	1	55
Age (years)		29.9	30.9	27.8	28.3	29.3
Height (inches)		65.3±0.5	64.4±0.1	66.3±0.1	66.6±0.5	65.4
Weight (pounds)		146 ± 4	141 ± 1	150 ± 1	146 ± 4	146
% of "Standard Weight"		105 ± 2	103 ± 1	106 ± 1	102 ± 2	105
Systolic Blood Pressure (mm Hg)		135 ± 3	124 ± 1	121 ± 1	128 ± 3	123
Diastolic Blood Pressure (mm Hg)		77 ± 2	72 ± 1	70 ± 1	68 ± 2	71
Suspected Disease	Tuberculosis	0.0	3.6	2.6	0.0	2.8
Glands Enlarged	Thyroid	0.0	1.9	9.9	14.3	6.0
	Submaxillary	0.0	2.9	3.5	4.8	3.1
Skin - Face & Neck	Nasolabial seborrhea	2.6	2.6	1.4	0.0	2.0
	Erythema, face/neck	0.0	15.5	11.0	4.8	12.2
	Pigmentation, face/neck	0.0	4.5	4.6	9.5	4.5
Eyes	Thickened conjunctivae	2.6	7.4	26.7	19.0	16.8
	Pingueculae	23.7	77.3	57.4	42.9	63.8
	Conjunctival injection	2.6	3.2	4.9	19.0	4.5
	Corneal scarring	5.3	8.7	2.9	0.0	5.5
Tongue	Filiform atrophy, sl.	5.3	7.1	11.0	0.0	8.7
	" " , mod.	5.3	1.0	3.2	0.0	2.2
	Furrows	0.0	6.1	9.0	9.5	7.3
	Serrations & swellings	2.6	8.1	5.5	0.0	6.3
	Red, tip, or lat. margins	2.6	1.6	4.9	0.0	3.2
	Geographic tongue	0.0	1.0	1.4	4.8	1.3
Gums	Red or swollen gums	7.9	18.4	9.6	4.8	13.2
	Atrophy or recession	36.8	55.7	32.8	14.3	42.4
Teeth	No carious teeth	21.1	68.7	24.9	42.9	41.2
	Caries, filled 1-2	13.2	14.8	22.6	33.3	19.6
	or unfilled 3+	44.7	16.1	48.7	23.8	35.7
	Edentulous	21.1	0.4	3.8	0.0	3.5
	Worn	21.1	59.1	29.9	33.3	40.1
Skin - General	Follicular hyperkeratosis	5.3	7.4	5.2	4.8	6.2
	Xerosis	0.0	2.3	7.2	4.8	4.6
	Acneform eruption	5.3	3.2	6.7	19.0	5.5

FIGURE V

ENLARGEMENT OF THE SUBMAXILLARY GLANDS

FIGURE VI



PIGMENTARY CHANGES IN A YOUNG ESKIMO MAN

Thickening of the conjunctivae, especially in the palpebral fissures, occurred commonly in the men and was difficult to judge. In general, it was diagnosed as present if lateral orbital pressure, through the lid, would cause definite folds to appear. Similarly, pingueculae of one or both palpebral fissures were both common and extensive. These sometimes protruded between the closed lids medially and were dry and lichenified on the surface. Although over half the men showed these ocular lesions, it seemed they could be reasonably attributed to environmental irritation rather than to nutritional causes. An age analysis (Table 9) conforms with this interpretation, the prevalence increasing regularly with age. The incidence was greatest among Eskimos from southern Alaska.

The Bitot's spots seen were rare, in the early examinations, and are in retrospect only suggestive of vitamin A deficiency. However, other corroborative evidence will be discussed in the section on the villages.

Conjunctival injection was noted in 11.9 percent of men 17 to 19 years of age in Battalion 1 (Table 9), and in 26.7 percent of northern Eskimos, and 19 percent of Athabascan Indians. This is attributed to environmental trauma rather than nutritional deficiency.

Corneal scarring represents an important cause of morbidity among the Eskimos. No signs of trachoma were seen in the present studies. Neither were there evidences of "snow blindness," although there were several young people in the villages who had active phlyctenular kerato-conjunctivitis (PKC) with typical photophobia. The exact nature of snow blindness seems not to be established. Whether there is a distinct entity, precipitated by excessive light and without corneal ulceration, is not clear. Certainly the Eskimos have been making and using narrow aperture "glasses" for many centuries, since these tools have been excavated by archeologists. Nevertheless, the occurrence of PKC has been very common in these people as judged by the presence of residual scars, and it is a continuing, although lessening, medical problem. The causation is not established, but it appears at least as probable that dietary factors are important as that the doctrinal assignment of cause to tuberculosis is true(15,16). The evidence indicates that while tuberculosis is often associated with PKC this is not invariably the case. In the present study the frequency of corneal scars was somewhat greater among Battalion 2 men from the less acculturated area of southwestern Alaska than in Battalion 1 (Tables 8 and 10). However, both groups had significant numbers of men with such scars. Casual observation suggested an age gradient, the lesions being more common in older men than in young men. An analysis of the prevalence of this stigma by age and battalion is shown in Table 9. These questions will be considered again with the village data.

Angular scars were rarely seen in Battalion 2 and none were observed in Battalion 1. Slight filiform atrophy of the tongue was occasionally reported. Moderate atrophy, being more consistent, is better considered About two percent of the men showed this lesion to the latter degree. A moderate degree of filiform atrophy was found in 5.3 percent of the Aleuts and 3.2 percent of northern Eskimos. The finding is of interest

because of the tendency of Eskimos to show a normocytic anemia of unknown cause(3). No true glossitis was seen. The other glossal changes are considered unimportant; the glossal serrations may possibly reflect a thick muscular tongue, developed by vigorous eating habits.

The dental data gathered by the clinicians are of interest in demonstrating the need for a specialized appraisal of oral manifestations. The clinicians did suspect both age and geographic gradients for dental caries (Tables 9 and 10). The extent of dental attrition was remarkable and strongly age-related. Fluorosis, even though rarely diagnosed, seems to have been mistaken for hereditary hypoplasia of enamel. Results of the dental study are presented on pages 33-40.

Both follicular hyperkeratosis and xerosis were seen and probably often confused by two examiners (see discussion above). In Table 11 is shown a summary of these clinical findings along with the rare diagnosis of Bitot's spots. The latter cannot be taken as conclusive evidence of past or present vitamin A deficiency, but they do require biochemical evaluation. The lack of correlation between presence of Bitot's spots and serum vitamin A levels shown in Table 11 illustrates the imprecision of this clinical attribute as an indicator of vitamin A nutriture.

TABLE 11

RELATION OF CLINICAL SIGNS AND BIOCHEMICAL FINDINGS, SERUM VITAMIN A, ALASKA, 1958

(Serum Vitamin A in micrograms per 100 ml. Mean ± standard error)

	Villages					
	National Guard		Bethel Area		Kotzebue Area	
	No.	Serum A	No.	Serum A	No.	Serum A
Total Survey	574	37 ± 1	196	31 ± 1	220	29 ± 1
Persons with follicular hyperkeratosis	34	37 ± 2	7	28 ± 7	69	30 ± 1
Persons with xerosis	30	38 ± 2	26	35 ± 3	0	---
Persons with Bitot's spots[1]	3	40 ± 13	2	12 ± 10	0	---

1/ Two of five subjects recorded as having Bitot's spots had serum vitamin A levels below 20 mcg/100 ml; this is not a significant difference (P= .16).

A similar comment may be made in regard to the lack of evidence of a relationship of serum ascorbic acid levels to the presence of red or swollen and bleeding gums (see Table 12).

TABLE 12

RELATION OF CLINICAL SIGNS AND BIOCHEMICAL FINDINGS, SERUM VITAMIN C, ALASKA, 1958

(Serum Vitamin C in milligrams per 100 ml. Mean ± standard error)

	Villages					
	National Guard		Bethel Area		Kotzebue Area	
	No.	Serum C	No.	Serum C	No.	Serum
Total Survey	648	.52 ± .01	222	.40 ± .02	208	.47 ± .
Persons with red or swollen gums	86	.56 ± .03	18	.42 ± .06	37	.49 ± .
Persons with bleeding gums	4	.65 ± .04	0	---	3	.44 ± .

In summary, the important clinical findings consisted of occasional thyroid enlargement in Battalion 1 and among northern Eskimos and Athabascan Indians, rare Bitot's spots, xerosis, phlyctenular corneal scarring, markedly extensive and variable caries, attrition of the teeth and periodontal disease, and cutaneous hyperpigmentation. The important negative findings were the lack of signs of inanition, anemia, or cardiovascular disease, or of specific signs of deficiency of B-vitamins or protein. The most serious medical problems observed were the high prevalence of infectious diseases, especially tuberculosis, the frequency of corneal scars and the generally poor teeth. Many of the observed defects suggested strong age and geographic patterns which promise to enlighten the search for causation. Nonetheless, these men appeared fit and rugged and in better physical condition than one might expect to find in a group of U.S. Caucasian recruits.

3. The Dental Study

a. Methods

All of the dental examinations were carried out by a single observer. The men were seated in a portable dental chair under a standard color-corrected examination light. Dental mouth mirrors and explorers were employed. Observations were dictated in code to an experienced recorder, who entered the data for each man upon an individual examination card separate from that used for the rest of the clinical observations and originally designed in the National Institute of Dental Research for use

in field studies of fluoride-caries relations. The race and exact age of the examinee and the village from which he came were unknown to the observer at the time of examination.

b. Results

The criteria used to appraise the conditions reported here are described in Appendix A. For the entire group of Alaskan males the lifetime caries experience was generally lower, and diseases of the periodontal tissues generally were more prevalent and severe, than in approximately 1,400 white males examined in Baltimore(17) and in Birmingham(18) in the United States. The caries experience in these two latter groups is considered to be moderate, and periodontal conditions possibly typical, for U.S. white males in general. These specific data were selected as a basis for comparison because the same criteria and methods were used as in Alaska, and because the Alaska examiner participated in all three studies. Comparative findings are shown in Table 13.

TABLE 13

ESKIMO MEN, ALASKA NATIONAL GUARD, 1958

COMPARISON OF DENTAL CARIES AND PERIODONTAL STATUS OF 713 ESKIMO GUARDSMEN WITH 1,400 WHITE MALE RESIDENTS OF BIRMINGHAM AND BALTIMORE

Age (years)	Numbers Examined Alaska	Mean Numbers of Decayed, Missing and Filled Permanent Teeth per Man		Mean Periodontal Scores 1/	
		Baltimore-Birmingham	Alaska	Baltimore-Birmingham	Alaska
15-19	63	11.3	10.2	.43	.40
20-29	359	12.9	9.5	.66	.69
30-39	214	13.3	7.7	.82	1.39
40-49	68	15.8	6.3	1.25	1.44
50-59	9	19.5	9.8	1.73	1.06

1/ The periodontal score for each individual is the average for the teeth present in the mouth. The criteria for scoring are given in Appendix A.

This comparison is useful, however, only for general orientation of the findings. There were four independent and geographically distinct patterns of dental caries experience, as measured by mean numbers of decayed, missing and filled permanent teeth per man. These patterns are summarized in Table 14.

TABLE 14

ESKIMO MEN, ALASKA NATIONAL GUARD, 1958

MEAN NUMBERS OF DECAYED, MISSING, OR FILLED PERMANENT TEETH IN FOUR GROUPS FROM THE FIRST AND SECOND BATTALIONS

Age (years)	Group I Men living in the 7 principal villages	Group II Men living in the 11 villages near the principal villages	Group III Men living in 24 relatively remote villages, except the following group	Group IV Men living in 13 villages in the Yukon-Kuskokwim delta area	F 1/
15-24	13.36 ± 0.76	12.93 ± 1.50	7.61 ± .57	3.51 ± .64	29.086
25-34	15.08 ± 1.05	14.43 ± 1.07	7.02 ± .56	2.44 ± .44	50.363
35 & over	16.85 ± 1.96	13.00 ± 2.14	6.51 ± .70	1.28 ± .32	43.357
All ages	14.45 ± 0.60	13.74 ± 0.81	7.11 ± .35	2.30 ± .27	123.757

1/ An F value higher than 5.79 indicates that the chance is less than one in 1,000 that these are samples from the same universe.

The 713 men examined in this study lived in 55 villages. Some villages were represented by as few as two men; in only one instance (Barrow, 69 men) did the sample from one village exceed 27. Individual ages ranged from 17 through 54 years; mean ages of the village groups ranged from 22.1 to 43.9 years. Since each characteristic reported here usually increases systematically with age it seemed necessary to correct each village score to the age composition of the entire group (using the "standard million" technic of demographers, an estimate of population composition as to age) for between-village comparisons.

Observed and age-corrected scores for dental caries experience, present periodontal disease and gingival recession are shown for each village in Table 15.

Given this number of small groups it is evident that sampling variation might lead to improper classification of any village for any characteristic, and that some of the age-corrected scores will represent gross misstatements. Nevertheless, the broad geographic differences in dental caries patterns are profound and obvious, and inspection of the data of Table 14 will show that little change from the group means of Table 14 will result if one or a series of borderline villages is shifted from one group to the next. In fact, only two villages in the array are clearly out of place -- Shungnak and Little Diomede -- included for geographic reasons in group III. In their oral characteristics men from

TABLE 15

ESKIMO MEN, ALASKA NATIONAL GUARD, 1958

ORAL STATUS OF MEMBERS OF FIRST AND SECOND BATTALIONS

Village	Number Examined	Mean Age	Mean DMF Teeth: Age Adjusted	Mean DMF Teeth: Observed[1/]	Mean Periodontal Score: Age Adjusted	Mean Periodontal Score: Observed[1/]	Mean Recession Score: Age Adjusted	Mean Recession Score: Observed[1/]
Group I: principal centers of population								
Bethel	14	26.6	11.0	7.9 ± 1.89	0.63	0.65 ± 0.20	8	7 ± 3.0
Barrow	69	26.0	13.1	13.6 ± 0.90	1.11	0.89 ± 0.15	18	14 ± 2.5
Kotzebue	19	26.2	14.2	14.2 ± 1.63	1.96	1.12 ± 0.51	30	18 ± 7.5
Dillingham	7	22.1	15.7	12.1 ± 2.97	0.21	0.37 ± 0.27	0	0
Unalaska	12	25.8	16.7	15.5 ± 1.76	1.40	0.80 ± 0.38	12	8 ± 3.5
Nome	17	22.1	17.1	14.5 ± 1.82	1.02	0.65 ± 0.16	6	8 ± 6.6
St. Paul	26	31.8	20.2	20.6 ± 1.27	1.34	1.34 ± 0.39	16	16 ± 4.7
All Group I	164	26.5	14.9	14.5 ± 0.60	1.22	0.90 ± .11	17	12 ± 1.7
White U. S. Males.....		26.5		13.0		.69		13
Group II: villages near the principal centers of population								
Noatak	22	29.0	11.3	11.8 ± 1.85	0.68	0.69 ± 0.20	10	11 ± 3.1
Deering	3	29.5	12.7	13.0 ± 4.93	0.84	1.47 ± 1.27	15	15 ±11.8
Tuluksak	8	33.1	12.8	11.1 ± 2.36	1.59	1.59 ± 0.46	18	18 ± 7.6
Wainwright	17	28.8	13.3	13.2 ± 2.01	1.49	1.57 ± 0.50	27	28 ± 7.9
Napaskiak	14	26.8	13.9	14.2 ± 1.98	1.29	1.24 ± 0.31	18	13 ± 5.3
Akiak	6	30.7	14.5	15.0 ± 4.24	1.36	1.26 ± 0.62	17	15 ±14.1
White Mountain	5	30.7	15.3	14.8 ± 2.22	0.71	0.90 ± 0.16	7	10 ± 5.7
Shishmaref	8	31.6	15.4	13.8 ± 3.41	0.44	0.59 ± 0.41	12	12 ± 4.0
Unalakleet	13	28.5	15.6	16.2 ± 2.43	0.86	0.90 ± 0.47	25	23 ±11.7
Elim	2	29.5	17.0	17.0 ± 1.00	0.75	0.75 ± 0.65	8	8 ± 3.0
Shaktoolik	2	33.5	21.5	21.5 ± 1.50	0.41	1.15 ± 1.15	21	29 ±29.0
All Group II	100	29.4	13.6	13.7 ± 0.81	1.04	1.08 ± 0.14	17	17 ± 2.5
White U. S. Males.....		29.4		13.1		0.74		15

TABLE 15 (Continued)
ESKIMO MEN, ALASKA NATIONAL GUARD, 1958
ORAL STATUS OF MEMBERS OF FIRST AND SECOND BATTALIONS

Group III: relatively remote villages, except those in the Yukon-Kuskokwim delta area								
Shungnak	16	29.1	2.1	1.8 ± 0.59	0.37	0.34 ± 0.12	3	4 ± 2.1
Little Diomede	7	29.2	3.3	4.4 ± 0.90	1.32	1.01 ± 0.67	19	16 ± 10.0
Kasigluk	7	26.9	5.4	5.4 ± 1.15	0.56	0.77 ± 0.22	5	4 ± 1.9
Akiachak	16	30.7	5.5	5.1 ± 0.83	1.38	1.60 ± 0.21	14	16 ± 6.1
Barter Island	5	31.7	5.6	5.6 ± 2.34	0.45	0.46 ± 0.29	9	9 ± 5.3
Alakanuk	16	32.1	5.9	5.3 ± 1.21	1.59	1.88 ± 0.47	10	13 ± 4.0
Teller	9	27.9	5.9	5.6 ± 1.51	0.58	0.54 ± 0.22	12	11 ± 3.9
Koyuk	4	23.8	6.1	6.5 ± 3.23	2.04	2.05 ± 0.53	11	12 ± 12.0
Kwethluk	17	31.3	6.2	5.1 ± 1.40	1.37	1.57 ± 0.37	12	14 ± 4.3
Stebbins	12	33.4	6.2	6.7 ± 1.81	1.35	1.68 ± 0.36	26	34 ± 8.7
Selawik	14	29.5	6.3	6.6 ± 1.48	0.49	0.50 ± 0.12	10	10 ± 4.6
Meade River	4	25.5	6.6	6.8 ± 3.04	0.52	0.55 ± 0.42	5	5 ± 4.8
Eek	14	28.7	6.8	6.9 ± 1.78	0.92	0.89 ± 0.20	8	7 ± 2.6
Mountain Village	14	36.7	6.8	7.5 ± 1.61	0.78	0.94 ± 0.28	15	20 ± 4.6
Wales	5	43.9	6.8	6.8 ± 1.32	1.22	1.22 ± 0.49	30	30 ± 11.8
Kivalina	11	26.8	7.9	7.7 ± 1.91	1.81	1.31 ± 0.56	28	19 ± 9.9
Gambell	22	27.6	8.4	9.2 ± 1.46	1.30	0.96 ± 0.30	19	16 ± 4.2
Kiana	8	22.8	8.8	7.4 ± 2.71	0.34	0.36 ± 0.15	4	3 ± 1.5
Noorvik	11	26.3	8.9	9.0 ± 2.64	0.78	0.55 ± 0.25	2	1 ± 0.8
Fort Yukon	21	28.3	9.2	9.0 ± 1.46	0.36	0.32 ± 0.17	9	4 ± 2.3
Savoonga	27	25.7	9.3	8.4 ± 1.08	0.88	0.70 ± 0.20	17	13 ± 2.6
King Island	5	33.5	9.6	9.4 ± 2.79	1.37	1.40 ± 0.32	13	15 ± 6.7
St. Michael	12	29.2	9.6	9.6 ± 1.63	1.64	1.72 ± 0.45	27	28 ± 9.3
Point Hope	20	32.0	10.4	10.1 ± 1.57	1.18	1.20 ± 0.32	14	15 ± 4.7
All Group III	297	29.6	7.1	7.1 ± .35	1.00	1.00 ± .07	13	13 ± 1.1
White U. S. Males.....		29.6		13.1		.74		15

1/ Standard error of the mean is included in the observed values.

TABLE 15 (Continued)
ESKIMO MEN, ALASKA NATIONAL GUARD, 1958
ORAL STATUS OF MEMBERS OF FIRST AND SECOND BATTALIONS

Village	Number Examined	Mean Age	Mean DMF Teeth: Age Adjusted	Mean DMF Teeth: Observed 1/	Mean Periodontal Score: Age Adjusted	Mean Periodontal Score: Observed 1/	Mean Recession Score: Age Adjusted	Mean Recession Score: Observed 1/
Group IV: villages in the Yukon-Kuskokwim delta area								
Newktok	5	28.5	0	0	0.93	0.82 ±0.52	12	11 ± 9.2
Chevak	6	29.3	0.4	0.2 ± 0.16	0.96	1.02 ±0.25	16	18 ± 6.2
Tanunak	11	37.8	0.4	0.6 ± 0.36	0.23	0.31 ±0.16	9	13 ± 3.2
Mekoryuk	15	37.4	0.6	0.9 ± 0.38	0.03	0.02 ±0.01	4	5 ± 2.0
Chefornak	5	22.3	1.1	0.4 ± 0.40	0.90	0.38 ±0.31	16	6 ± 6.0
Kwillingnak	20	30.9	1.8	1.5 ± 0.42	1.06	1.06 ±0.19	10	11 ± 2.4
Kipnuk	13	30.8	2.1	2.0 ± 0.60	0.65	0.71 ±0.17	15	15 ± 4.7
Hooper Bay	25	30.8	3.3	3.3 ± 0.88	0.73	0.88 ±0.28	10	13 ± 3.1
Tuntutuliak	11	30.1	3.4	3.2 ± 0.98	1.39	1.32 ±0.29	12	13 ± 4.6
Quinhagak	22	33.0	3.7	3.4 ± 0.76	0.97	0.95 ±0.17	6	7 ± 2.1
Napaskiak	7	27.4	4.1	4.1 ± 2.09	0.76	0.76 ±0.32	6	6 ± 3.9
Togiak	10	30.8	4.3	4.1 ± 1.46	1.54	1.65 ±0.55	4	4 ± 1.6
Scammon Bay	2	31.5	4.5	4.5 ± 2.50	0.20	0.20 ±0.20	12	12 ± 5.0
All Group IV	152	31.7	2.6	2.3 ± 0.27	0.76	0.83 ±0.08	9	10 ± 1.0
White U. S. Males.....		31.7		13.2		.77		17

1/ Standard error of the mean is included in the observed values.

these two villages more nearly resemble men from group IV villages, and the villages are similarly isolated. Shungnak is located near the headwaters of the Kobuk River about 100 air miles east of Kotzebue, and Little Diomede is an island in Bering Strait near the boundary with Soviet Russia.

Age-corrected scores are more appropriate for comparisons between villages, and observed scores for comparison with findings for white U.S. males.

(1) Dental caries

There was, as a rule, remarkably little variation in dental caries experience between men of a given age and village. The means for decayed, missing, filled (DMF) teeth of Eskimo men living in the seven principal villages were slightly but unimportantly higher than those for white U.S. males, rising with age in similar fashion. Means for men living in villages near these seven principal centers are about the same, but show a tendency for caries experience to be lower in men of older age. This tendency becomes marked in the two successive groups; in each group DMF means are progressively lower in progressively older groups of men. Since the DMF mean is a cumulative measure, this can occur only in populations where caries prevalence is on the increase, and the patterns seen here suggest that this increase is occurring at a relatively rapid rate.[1/]

The dental caries pattern cuts across ethnic boundaries; location for location, there is little difference in DMF means between Aleuts from Unalaska and the Pribilofs, southern Eskimos from the region generally south of Alakanuk, northern Eskimos from the region generally north of St. Michael, and Athabascan Indians from Fort Yukon. There is a loose tendency (possibly an artifact due to sampling variation) for DMF means in group III to increase from south to north, but there is no clear transition across an ethnic boundary. Neither does the term "isolation," as used here, denote lack of contact with other groups; in the course of summer migration nearly all of the men in groups III and IV leave their homes and live for a time in or near one of the principal villages. At this point in analysis no clear relationship between caries patterns and dietary habits or nutritional status has been developed.

1/ The means for group DMF typically rise in essentially straight-line fashion with age after permanent teeth begin to erupt at the age of six, gradually becoming asymptotic after the mean reaches a value of 15 to 18. Extrapolation of the present data suggest that after a generation, caries may become as prevalent in the group III villages as in villages in or near the principal centers of population, and that caries in the group IV villages may rise to about the levels now seen in group III. If this occurs the disease will then present a public health problem for these people quite as difficult as the present dental caries problem in the U.S.

(2) Periodontal disease

For the whole world population periodontal disease probably outranks dental caries in importance. Commonly called "pyorrhea," this disease attacks the soft and hard tissues supporting the teeth in the dental arch so that they loosen, become painful and ineffective in chewing, and are eventually lost. In this study periodontal disease was assessed by two measures -- the periodontal index or score which is a morbidity index of present and active disease, and gingival recession, a cumulative measure reflecting past loss of tissue, particularly bone. There was no relation, in the total population, between group findings for either of these measures and group findings for dental caries.

In 38 of the 55 villages periodontal scores (i.e., ratings of present disease) were higher than would be expected on comparison with scores for white males in the U.S., and in only five villages -- Mekoryuk, Scammon Bay, Fort Yukon, Tanunak and Shungnak -- were scores significantly or importantly lower. The typical clinical picture was one of moderate to severe gingivitis with widespread pocket formation, abundant oral debris, and heavy deposits of calculus, although some villages stood out as marked exceptions to this rule. Here, as in dental caries, there tended to be little variation between men from a given village.

The recession score is a relatively weak population measure when young persons are studied, since gingival recession is rarely marked in individuals prior to the middle and later years of life. Recession findings for the whole groups were neither markedly nor importantly different from the patterns reported (by an independent team of observers) for U.S. Army troops. Findings for the whole of group IV were, in fact, significantly lower.

In men 35 years of age or older, however, recession scores as outlined in Table 16 for the main groups are generally related to group caries scores. The series of differences shown might occur by chance slightly less than once in one hundred trials.

TABLE 16

ESKIMO MEN, ALASKA NATIONAL GUARD, 1958
GINGIVAL RECESSION SCORES, MEN 35 YEARS OF AGE OR OLDER,
FIRST AND SECOND BATTALIONS

Group	Number Examined	Mean Age	Mean Recession Score
I	15	41.9	39 ± 1.7
II	17	40.4	31 ± 6.9
III	68	41.2	28 ± 3.3
IV	57	40.5	17 ± 2.0
White U.S. males		41.0	26

IV - THE VILLAGE STUDIES

1. Bethel Area - the Situation in Akiak, Kasigluk, Napaskiak, Newktok and Hooper Bay

Bethel is the principal trading center of a large area of southwestern Alaska which includes most of the lower Yukon and Kuskokwim River areas. The town is on the Kuskokwim River at the head of deep water navigation. It is the air terminal for the only outside contact of the area during eight months of the year. The population is mixed white and Eskimo people. An electric service, high school and many other small-town facilities are available.

In winter the main occupation of many Eskimos in this area is trapping for mink, beaver and muskrat. In summer many find temporary work in canneries on Bristol Bay. In some cases almost the entire able-bodied population is transported to these canneries for a period of six weeks or more. Those who remain behind in the villages catch herring, smelt, pike, whitefish and salmon for their own use. The larger fish are filleted and air-dried for the winter cache, to be consumed by both dogs and humans. The tundra is dotted with small ponds and sloughs which are a source of whitefish, ling cod, blackfish and needlefish. Often these fish are eaten raw, and are thus a source of tapeworm infestation.

Hooper Bay and Newktok are sealing communities of coastal Eskimos. Since the seal kill is variable and uncertain depending upon the movement of the pack ice and tolerable sealing weather, this food supply is uncertain. The coastal Eskimos collect seal pokes, inverted seal skins filled with seal oil, which they take up the Kuskokwim for sale and barter to the river communities. The subcutaneous fat of newly butchered seal is cut into small portions about one by three inches in size and pressed into the inverted seal skin (which has had all the apertures, except the anus, tied off with string). After the poke is filled with these small pieces of blubber, it is plugged and left inside the Eskimo house at moderately high room temperatures and the oil is thus gradually rendered. When the contents of the poke have been removed, a sponge-like connective tissue residue representing the original stroma in which the oil was contained is left within the poke. This is considered a food delicacy. No applied heat is used in the rendering process. The tendency of the seal poke to collapse as oil is withdrawn for use maintains a minimum of air within and probably delays rancidity. On some occasions other foods, such as partially dried salmon or herring, are placed in seal oil in the poke and stored for considerable periods. Salmonberries, blueberries and wild greens may be stored in a seal poke or in barrels without the oil.

A seal poke weighing 100 pounds may bring $140 and will last a family a year. Seal oil is used as a major ingredient of such dishes as agutuk (Eskimo ice cream) or oknuk (soup). Other foods, especially dried fish, may be dipped into it at serving time. Hunters are convinced that it is more calorific than other foods and it is thought essential for a trip in intense cold.

Twice each year, in spring and fall, ships bring in supplies. Supplies for the year must be anticipated at this time, since the only recourse is to costly shipment by air from Anchorage. Mail order houses have an active year-round business in this area. An adult education class in one village had as two of its projects the following -- 1) how to write an order to a mail order house; 2) how to fill out a U.S. income tax return.

In Eskimo villages the dogs are an essential part of the economy, for they are the only beasts of burden. Wood, one of the few sources of fuel, must be hauled long distances from the river bottoms. People travel and supplies are hauled by dog sled. Some freighting for cash income is done with dogs. The average size of a team is five dogs. Fish are fed to them at variable times and in limited amounts so the dogs are generally thin and ravenous. They eat snow for water, snatching it as they run. The Kuskokwim dogs are small, averaging 30 to 50 pounds, and are nondescript in appearance. The dog population is threatened with canine distemper because of inadequate immunization.

The population counts for the villages included in the Bethel portion of the study and the numbers given clinical examinations in this survey are shown in Table 2. The sampling within the villages was done with the help of the resident teacher, who selected one or two adolescent boys as runners. They were instructed to bring into the schoolroom entire families, including all ages. The selection of families and their order of appearance was not controlled. Clinical appraisals were done on all persons 2 years old and over. Blood and urine samples were obtained from all persons 6 years of age and over, until 50 blood samples had been obtained in each village. At the end of the day the villagers were advised to bring forward the people who were sick or those with medical complaints who had not previously been seen. These persons were not included in the nutritional appraisal. The invitation invariably produced an assorted clinic. No assessment was made of the number who stayed away from the nutritional appraisals deliberately. In Hooper Bay most of the men were away sealing. In Kasigluk many men had gone for wood.

The presence of a school and one or more teachers has had an important influence upon the Eskimo communities. While introduction of a school has generally caused the villages to increase in size and thus often overburdened the available food supply it has also stimulated the acculturization of the community. Community leaders who have white customs, clothing, food and ideas have no doubt been important models for emulation. The school lunch programs, the mail which comes once or twice a week, the radio communication with the Alaska Native Health Service Hospital each evening and the formal instruction in English with material and methods very like those of schools in the rest of the United States all increasingly influence the life and health of the Eskimo people. There is a large age gradient in the use of English in the Bethel area; almost all school children speak English, but only rarely do adults over 40 years of age.

There are no physicians permanently located in the villages although there are three physicians associated with the hospital in Bethel. These physicians, a dentist and an x-ray technician visit the villages individually at irregular intervals of several months. The x-ray technician carries a portable x-ray machine which is largely used for chest films in a tuberculosis control program. Public health nurses also visit the villages at irregular intervals. A sanitary engineer of the Alaskan Department of Health is presently working in certain villages of the Bethel area in order to improve the water supply.

In most villages the teacher is the medical representative who mans the two-way radio contact. The costs of transportation to Bethel, Anchorage, or even to other states for medical treatment are borne by the patient, if that is possible; by the ANHS, if it is not. Since the distances are great such trips are expensive. Midwifery is done by women in the villages except for those areas near the Bethel hospital where some women may prefer to go for delivery when possible. About 225 babies are delivered annually to native women in the Bethel hospital.

The largest single health problem in the villages is tuberculosis. About 7 to 10 percent of the Eskimo population is being treated with drug therapy for this disease. In Akiak, for example, 13 of 130 people in the village were receiving chemotherapy in August 1958 and the records indicate that 38 other villagers have received this therapy since 1954. The annual incidence is now about one percent of the population and about one tenth of one percent of the population dies of tuberculosis each year. The first figure has been reduced by one half, the second by four fifths since 1952(8). The trends are shown in Figure II.

Akiak is a community of 130 people on the Kuskokwim River about 30 miles upstream from Bethel. Most of the people were dressed in excellent furs and mukluks, and there was evidence of a plentiful food supply.

There were no signs of caloric deficiency. Some obese women past 30 years of age were seen. There were many children with draining ears and impetigo was common, especially in children. One child with extensive bronchitis and fever was given sulfa drug therapy.

Each school child receives a hot lunch and a therapeutic multivitamin tablet every day1/. The lunch program has been in effect in the

1/ Contents of Multivitamin Tablet:

Vitamin A - 5,000 U.S.P. units	Ascorbic acid - 50 mg.
Vitamin D - 500 U.S.P. units	Vitamin E - 5 I.U.
Thiamine mononitrate - 3 mg.	Calcium carbonate - 250 mg.
Riboflavin - 3 mg.	Ferrous sulfate - 234 mg.
Pyridoxine hydrochloride - 0.5 mg.	Potassium iodide - 0.15 mg.
Vitamin B_{12} - 2 mcg.	Potassium sulfate - 5 mg.
Folic acid - 100 mcg.	Copper sulfate - 1 mg.
Niacinamide - 25 mg.	Magnesium oxide - 6 mg.
Calcium pantothenate - 5 mg.	Zinc sulfate - 1.5 mg.

Bureau of Indian Affairs School Program for about eight years. Vitamin administration is more recent. No active keratitis was seen in this village but there were many children with the corneal scars which are attributed to phlyctenular keratoconjunctivitis (PKC). The lesion was especially common in children over 7 years of age. Dry skin on the extensor surfaces and mild follicular hyperkeratosis were seen occasionally in children 8 to 16 years of age. The condition of the teeth varied markedly. Caries were rampant in many families, involving both deciduous and permanent teeth. People past 30 tended to have worn but intact and noncarious teeth (see Figure VII).

A man in his 40's was seen with incipient cardiac failure and a loud aortic diastolic murmur, probably a result of rheumatic heart disease. A middle-aged woman with typical active rheumatoid arthritis was examined.

The 77 clinical appraisals done in Akiak indicated the calorie supply was adequate, and that there had been a large incidence of phlyctenular keratoconjunctivitis in the past, although no acute cases were seen. Follicular changes suggested a mild or borderline vitamin A deficiency. Both the caries and the corneal scarring seen in this village suggested a familial pattern of prevalence.

Kasigluk is a village of 227 Eskimos about 35 miles west of Bethel on the tundra, a few miles from the Johnson River. The latter is an abundant source of fish in the summer. Nunapitchuk, a somewhat larger village, is four miles away across a small lake. Kasigluk has been moved in recent times from a location six miles north to be better accessible by boat. The village has a typical onion-turreted Russian Church and a smaller Moravian Church. There are many Russian names in the village and people with Mongoloid faces and light hazel eyes. The people seemed poor but were generally clean. The men showed signs of recent use of their steam baths, a custom which is thought by some to be a Russian importation but is more likely an intrinsic part of the Eskimo culture.

These people at Kasigluk must go long distances to the Kuskokwim flats for wood. The dogs were lean but strong; a team of five brought in a load of green poles weighing 300 to 400 pounds. The village has a poor water supply, consisting only of melted ice from nearby ponds. An epidemic of dysentery had occurred in this village during the two weeks prior to the survey team visit. The school children receive lunches and a multivitamin tablet each school day. New mothers also receive vitamin solutions for the babies and iron pills for themselves, but the teacher was uncertain that these materials are used. The caloric intake of the people seemed adequate.

Impetigo was common, and several children were put on courses of penicillin for treatment. The dispensation of sulfonamide ointment which is usually applied over the crusts is useless and possibly harmful. Two instances of atopic eczema were seen in children. Corneal scars were not common and were generally seen in subjects 10 years of age and over but not in younger children, and no active phlyctenular

FIGURE VIII

DENTAL ATTRITION IN A 32-YEAR-OLD
ESKIMO WOMAN

keratoconjunctivitis was seen. The teeth were generally carious in the children, and worn but intact in people past 30. Some skin dryness was noted in children but no follicular hyperkeratosis was seen. One woman of 40 with aortic insufficiency and mitral stenosis was examined. A recent history of migratory arthritis was elicited in one youth. He showed no signs of carditis. Prophylactic penicillin was recommended.

Napaskiak is a village of 152 persons on the south bank of the Kuskokwim River eight miles below Bethel. It has close contact with Bethel. Two other Eskimo villages are in the vicinity -- Oscarville, across the river, and Napakiak, down river. River fishing is the attraction. Napaskiak has been moved in recent times from a nearby and ancient site that had become susceptible to flooding due to channel changes of the river. Napaskiak has one of the few remaining "medicine men" or shaman (Frontispiece). The role of this man in the community's health could not be determined.

There were great extremes in the families here, some being thin, while others were well fed. The thin families were usually dirty. The teacher gives 60 children their lunch at 8:30 a.m. Half then go home and return for an afternoon teaching session. The others remain for the morning session. All students receive a multivitamin tablet in school each day.

This village has been included in a tuberculosis prophylaxis program since early 1958. A program for control of tuberculosis by ambulatory chemotherapy was begun in 1953 as a result of a recommendation of the Pittsburgh Health Survey(7) to the Secretary of the Interior. At the time of its inception the program was ambulatory because there were not enough hospital beds for all those needing the therapy. When more beds were available more of those who needed hospital treatment were admitted. The prophylactic control study mentioned at the beginning of this paragraph was started in 1958 as a separate project under the direction of Dr. George Comstock, Tuberculosis Control Program, Bureau of State Services of the U.S. Public Health Service. This is a research study on the prophylactic use of isoniazid being conducted in selected parts of the U.S., Alaska and Puerto Rico. Every person in the villages selected for the study is given medication each day for one year, half receiving isoniazid at a level of about 5 mg per kilogram of body weight and half receiving a placebo. All told about 60,000 people are participating in this study. It is hoped to measure the suppressive action of such medication upon the incidence of tuberculosis. No signs of isoniazid-induced seborrhea or dermatitis were seen in this or any village, although perhaps as many as 10 percent of the total native population are on isoniazid therapy.

The teeth were carious in Napaskiak except among people over 40 years of age. Exceptions to this were seen in a few Kipnuk women who had come here from the coast after marriage and generally had fine teeth. Again several cases of atopic eczema were seen. The teacher believes it is increasing in frequency. The males showed signs of the effects of taking steam baths (petechiae on the backs and shoulders),

but the women and children did not. Petechiae occurred commonly among older male children and adults but was uncommon in children under 10. No active keratitis was seen. Corneal scarring seemed to occur in families; dry skin and follicular changes were uncommon. The adult women often seemed pale. Tongue papillation was good. An old man with aortic stenosis was examined but heart murmurs were generally rare. A sick baby was brought back with the party to the Bethel Hospital and a diagnosis of meningococcal meningitis was confirmed. After a stormy course she recovered. Prophylactic sulfadiazine seemed to prevent additional cases in the village. This treatment was arranged by radio communication from Bethel after the bacteriologic diagnosis was established.

Newktok is an isolated village of 121 coastal Eskimos about 120 miles west of Bethel on the tundra, a few miles from Baird Inlet and the Bering Sea. The nearest postoffice is at Tanunak, 40 miles to the southwest on Nelson Island. There were many sod houses in the village.

The people at Newktok seemed very primitive; their faces were Mongoloid with prominent epicanthal folds. Very few could speak English. Their clothing was worn and poor. Both people and dogs were thin. The sleds were hand-hewn and lashed together with thongs. In one sod house the children were seen to scoop a frozen blackfish out of a tub in the anteroom and swallow it with a minimum of chewing. The lids were off the cans containing flour and sugar, and the contents were spread about the table top as though the children had been eating directly from the cans. Since this was the first tolerable weather for a week, the men were away sealing.

Many of the children in this village were grossly underfed, and pale and thin. Several families were heavily infested with head lice. With a few exceptions, the teeth were excellent. There were several slightly but definitely enlarged thyroid glands observed but no gross goiters. Many children had marked follicular hyperkeratosis and many others had dry skin. There were several adults with Bitot's spots. No signs of water-soluble vitamin deficiency or of scurvy were seen.

Hooper Bay is an ancient Eskimo settlement on the Bering Sea south of Cape Romanzof, with a population of 430. It is located on two low hills at the tip of a spit of land which encloses Hooper Bay from the north. The main source of livelihood is the sea, especially sealing. There are many dog teams for hauling the skin boats and meat to and from the open water a few miles away. Water is obtained by melting ice from a fresh-water pond a few miles back of the village on the tundra. Fuel is obtained from driftwood which is now plentiful, coming largely from the mouth of the Yukon which lies to the north. The houses are well built but without a semblance of orderly arrangement either among houses or within them. The indoor temperatures and humidity are very high. These, together with many unwashed Eskimos, unbutchered seals, drying skins and oozing seal oil pokes, produce an overpowering atmosphere for a white person.

The school lunch program and daily vitamin pill are administered here. Because of exceptionally good sealing, the people appeared prosperous and adequately nourished. There were many plump women and children. Teeth were good but worn in people past 20 years of age and carious in many children. There were many corneal scars, again seen in families and generally in people 12 to 20 years old. Children under 12 were not often so affected. Many of the women were pregnant. Some evidence of hypochondriasis was noted in adults. There was a single instance of goiter, a large soft gland in a 40 year old woman who had a history of thyrotoxicosis treated with N-propylthiouracil. Scleral thickening in the palpebral fissures and pingueculae were noted in many individuals. Here as in the other villages it was apparent that dental fillings meant tuberculosis because almost the only people who had had dental care were those who had gone outside for tuberculosis therapy.

2. Kotzebue Area - the Situation in Noatak, Point Hope, Shishmaref, Allakaket and Huslia

The Kotzebue phase of the present study centered among the northern or Arctic Eskimos who are for present purposes considered to be in ethnic area III (see Figure III). The Kotzebue study also included observations in two Indian villages in the mountains of the middle Yukon region lying in area IV.

The Eskimos north of Norton Sound (Nome) are much more sparsely distributed. The principal activity of the males is hunting, and seal, walrus and several species of whale are the chief game. The Eskimos along the Arctic coast find the whale kill highly variable since it depends strictly upon weather and hunting conditions. Polar bear have always been important not only as a source of food for man and dogs, but also as a source of income from sale of skins. St. Lawrence Island has an abundant supply of walrus in the spring, a good source of both meat and ivory. The people of St. Lawrence Island, Diomede Island and King Island are well known for their fine ivory carving which provides them with an important part of their cash income. The materials they make are taken to Nome in the summer and marketed.

The Arctic fox is trapped on the ice pack for its fur but neither this nor any other land carnivore is used for food except in dire emergency. The polar bear is a partial exception, for its meat is often eaten, although the liver seems never to be eaten and is widely regarded as poisonous. There is a collection of recent evidence to support the idea that polar bear liver is, in fact, poisonous for human consumption. Dr. William Rausch of the Arctic Health Research Center on one occasion ate 100 grams of polar bear liver and immediately became ill. Dr. Edward Scott of the same institution fed polar bear liver to white mice and an equivalent amount of vitamin A from fish oil to a control group of mice. Both groups of mice died(19). The concept of the toxicity of polar bear liver and that it is due to an excessive vitamin A content is widely accepted in scientific circles in Alaska.

The Indian villages, Huslia and Allakaket, which were included in the present study, are settlements on the Koyukuk River. These people are Athabascan Indians who range through the forested and mountainous areas of northwestern Alaska. Their principal activity is trapping beaver, mink and muskrat. The beavers are taken through holes in the ice in the late winter and spring with snares which are baited with willow twigs. Each trapper is allowed a seasonal limit of 20 beavers which average $40 per pelt. The beaver is a large animal weighing 30 to 60 pounds, and is widely used for food. The meat is said to resemble pork. The skins are stretched flat in an almost perfect circle for drying and are hauled about in large wafer-like stacks wrapped in burlap.

Caribou are migratory animals taken seasonally and somewhat unpredictably. Their meat is dried in the sun for storage in caches and the skins are widely used for clothing.

Fish are taken from the rivers with nets or fish wheels, a white man's invention and a useful one, for -- powered by the current -- it scoops up the teeming fish and deposits them in a tub requiring the fisherman only to empty the tub once he has properly placed the wheel and the diversionary fence.

The northern Eskimos have been more exposed to the white man than have the southern Eskimos through efforts of 18th century sailors to find a Northwest Passage, and subsequently through the extensive whaling activities which took place in the Arctic Ocean. Contacts with sailing ships reached a maximum in the middle of the 19th century. Possibly as a consequence, the northern Eskimos are advanced at least a generation over the Kuskokwim people in their cultural adaptation to the white race. Almost all speak English; they tend more strongly to adopt white men's clothing and habits of food and often have noticeable admixtures of white blood as reflected in coloration and conformation. The northern Eskimos are larger and less Asiatic-appearing than the southern Eskimos, although there are many exceptions to this generalization. Some of the village sites, such as that at Shishmaref Inlet, are very old, dating back 500 years or more. The attraction of these sites can only have been their convenience to the essential food supply. Eskimo villages are sometimes moved, but generally only to a better food supply.

Hunting on the ice pack is a dangerous occupation and the extent of this danger varies in different areas depending upon currents and weather conditions. In the Hooper Bay area young men do not go on the hunting expeditions until they are about 18 years of age. North of Bering Strait they go at 15 years. Since these boys are physically well developed at 15 years it appears that a maturation of judgment is recognized as essential. The active hunters are men 20 through 45 years, older hunters being rare.

These Eskimo men stripped down resemble professional athletes. They are heavily muscled, relaxed and loose-jointed, and have the appearance of finely trained men. Unlike the white man's concept of preparation for a physical ordeal, the Eskimo either does not eat

before he goes out on the ice pack for the day, or takes no more than a cup of tea or coffee. He believes eating would make him sluggish, less agile and less acute. Since he may stay out one to three days under rigorous conditions of activity and temperature, it is clear that he has both great stamina and efficient gluconeogenesis. When he returns he takes a very large meal. This ability to carry on while fasting may be related physiologically to the ability to consume a very high fat, high protein, low carbohydrate diet. It may also be a factor in prohibiting youths (who might be more susceptible to ketosis) from going out on the ice pack.

The sampling procedures in the Kotzebue area were carried out as described for the Bethel study above. Clinical studies were done on all persons 2 years of age and over; blood and urine samples were obtained from all persons 6 years and over, the urine samples being clean catch samples. In the Kotzebue area those members of the National Guard who were home were excluded from the village examinations in order for them to be seen at Camp Denali with their battalion.

Noatak is a village of 300 Eskimos on the Noatak River 60 miles north of Kotzebue. The food supply at Noatak is largely caribou which are hunted inland on the tundra, fish from the Noatak River, and seal and beluga whale from Kotzebue Sound. The teacher at Noatak gives each school child a lunch and a vitamin pill every school day. The principal clinical impairments found here were carious teeth and follicular hyperkeratosis.

Point Hope, which the natives call Tigara, often experiences severe weather. It is the main polar bear-hunting area for sportsmen, an activity which is a source of income for the Eskimos. A typical polar bear hunt has facetiously been described as follows: The sportsman pays $2,500 and is guaranteed a bear. The hunter and his pilot go out over the ice pack in a light plane until they spot a bear which they pursue in the plane until it falls exhausted on the ice. They then land, shoot the bear and take the skin. The sport seems more expensive than dangerous.

The main articles in the diet at Point Hope are seal and whale meat with some bear meat and fish. Caribou are taken in the fall and winter. The whale meat collected in the spring is cut up and stored in pits in the permafrost for later use. This natural refrigeration -- and not the perpetual cold, for the summers are actually quite warm -- is the basis for the legendary test of salesmanship in Alaska. A few Eskimos do have refrigerators, especially the traders. Many Eskimos have outboard motors. Almost every Eskimo boy dreams of becoming an airplane pilot. The men are clever mechanics and are said to have fashioned broken motor parts from ivory or bone when metal replacements were unavailable.

Sod houses are common in Point Hope. Alaskan Eskimos never build snow igloos except to amuse visitors from the outside and the results are often ludicrous. Whale ribs are often used for rafters for sod houses. No village planning is discernible. Snow drifts range up to 25 feet after a storm and the children slide down these on short baleen skis.

The children receive a school lunch and a daily multivitamin tablet. Clinical examinations here revealed many carious teeth and much follicular hyperkeratosis.

Shishmaref is a village of 200 people on a small island just off Shishmaref Inlet. The principal food is seal, which was plentiful during the winter preceding the survey, since the pack ice had been pushed toward the Siberian side by favorable winds. Some fish are also available. Many carious teeth were seen here and there was much dental attrition. Follicular hyperkeratosis was common. A school lunch and multivitamin pill are given to the children.

Allakaket is an Indian village of 100 people 150 miles north of Tanana. It consists of 10 to 15 log cabins, a school and an Episcopal Church. The main occupations and food sources are moose hunting, fishing and beaver snaring with a wire loop snare. The trap lines are 50 to 150 miles in length.

The calorie supply seemed limited in this village. The teeth were carious and follicular hyperkeratosis was common. Some filiform atrophy of the tongue was also noted, although it was of mild degree. No evidence of goiter was seen. One 18 month old child with rickets was seen here.

Huslia is an Indian village of 137 people. The diet consists mainly of beaver, dried fish, moose and caribou. Moose meat is much like beef in form and flavor while caribou is distinctive, resembling mutton. The calorie intake at Huslia seemed marginal, since many people were thin and the children appeared stunted. Follicular hyperkeratosis was common. The teeth were carious. This is the home of the most famous sled dog racer in Alaska, George Atla, known as the "Huslia Hustler."

The schools in these two Indian villages do not give the children school lunches or vitamin supplements.

3. Clinical Findings in the Villages

Since the men in the National Guard had recently come from the villages they were also representative of those nutritional environments. However, the 713 men came from 55 villages. The number from each village was thus so small that no useful purpose was served by relating them to their village of origin. An exception is Point Barrow, from which there were 69 men in the Guard. Throughout the evaluation of the data this axis of analysis has been considered, however (see Table 10, which presents selected clinical findings for men in the two battalions according to their area of origin).

A summary of the clinical findings in the villages is shown in Table 17. The northern and southern areas are shown separately, but all ages and both sexes are combined. This summary emphasizes certain negative findings. There was no scurvy and no gross inanition, although in certain villages, especially Newktok, the people seemed by their thinness to be

TABLE 17

ESKIMO AND INDIAN VILLAGES IN ALASKA, 1958, PERCENT PREVALENCE OF CLINICAL FINDINGS[1/]

	Villages[2/]	Bethel Area - Examiner # 1						Kotzebue Area - Examiner # 2					
		1	2	3	4	5	Total	6	7	8	9	10	Total
Number Examined		76	94	81	59	96	406	69	88	77	75	90	399
Suspected Disease	Tuberculosis	30.3	10.6	7.4	8.5	12.5	13.8	5.8	10.2	6.5	6.7	2.2	6.3
General Appearance	Good	82.9	87.2	79.0	66.1	82.3	80.5	98.6	100.0	98.7	98.7	100.0	99.2
	Fair	17.1	9.6	14.8	25.4	16.7	16.0	1.4	0.0	1.3	1.3	0.0	0.8
	Poor	0.0	3.2	6.2	8.5	1.0	3.4	0.0	0.0	0.0	0.0	0.0	0.0
Hair	Staring hair	0.0	0.0	0.0	18.6	0.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0
Glands Enlarged	Thyroid	3.9	0.0	2.5	10.2	4.2	3.7	1.4	0.0	0.0	0.0	0.0	0.3
	Submaxillary	0.0	1.1	0.0	0.0	0.0	0.2	5.8	6.8	3.9	1.3	2.2	4.0
Skin-Face & Neck	Nasolabial seborrhea	0.0	0.0	0.0	0.0	0.0	0.0	5.8	2.3	2.6	0.0	1.1	2.3
	Other seborrhea	0.0	0.0	1.2	0.0	0.0	0.2	1.4	0.0	1.3	0.0	0.0	0.5
	Erythema	14.5	25.5	7.4	61.0	17.7	23.2	11.6	21.6	33.8	5.3	3.3	15.0
	Pigmentation	0.0	2.1	2.5	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Eyes	Thickened conjunctivae	7.9	6.4	16.0	13.6	15.6	11.8	7.2	5.7	10.4	8.0	11.1	8.5
	Pingueculae	31.6	31.9	22.2	27.1	28.1	28.3	34.8	27.3	28.6	29.3	14.4	26.3
	Bitot's spots	0.0	0.0	0.0	3.4	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
	Circumcorneal injection	0.0	0.0	0.0	0.0	1.0	0.2	0.0	1.1	0.0	0.0	0.0	0.3
	Conjunctival injection	3.9	0.0	2.5	5.1	1.0	2.2	0.0	5.7	0.0	0.0	0.0	1.3
	Blepharitis	0.0	0.0	0.0	8.5	0.0	1.2	0.0	2.3	0.0	0.0	0.0	0.5
	Corneal scarring	21.1	12.8	11.1	20.3	9.4	14.3	8.7	5.7	5.2	4.0	7.8	6.3
Lips	Angular lesions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Angular scars	0.0	0.0	0.0	1.7	0.0	0.2	2.9	0.0	0.0	0.0	0.0	0.5
	Cheilosis	0.0	0.0	1.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0

TABLE 17 (continued)

	Filiform atrophy, sl.	9.2	6.4	9.9	13.6	6.2	8.6	7.2	4.5	2.6	12.0	5.6	6.3
	Filiform atrophy, mod.	3.9	0.0	2.5	1.7	0.0	1.5	0.0	0.0	0.0	2.7	0.0	0.5
	Fungiform atrophy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Papillary hypertrophy	0.0	0.0	0.0	0.0	1.0	0.2	1.4	2.3	1.3	0.0	1.1	1.3
Tongue	Furrows	1.3	7.4	9.9	3.4	3.1	5.2	4.3	2.3	2.6	2.7	1.1	2.5
	Fissures, erosions, ulcers	1.3	1.1	1.2	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0
	Serrations or swellings	0.0	6.4	3.7	0.0	0.0	2.2	0.0	0.0	0.0	1.3	3.3	1.0
	Red, tip, or lat. margins	3.9	4.3	4.9	0.0	0.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0
	Geographic tongue	1.3	0.0	1.2	0.0	3.1	1.2	2.9	0.0	3.9	0.0	0.0	1.3
	Red or swollen	1.3	3.2	9.9	8.5	7.3	5.9	17.4	2.3	7.8	13.3	18.9	11.8
Gums	Atrophy or recession	9.2	8.5	16.0	1.7	5.2	8.4	23.2	19.3	27.3	17.3	18.9	21.1
	Bleeding gums	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	4.4	1.3
	Unfilled caries	30.3	60.6	48.1	23.7	31.2	40.1	31.9	40.9	58.4	34.7	47.8	43.1
	Filled caries	17.1	9.6	13.6	0.0	12.5	11.1	46.4	23.9	11.7	9.3	13.3	20.3
	No carious teeth	50.0	31.9	44.4	76.3	57.3	50.2	23.2	37.5	29.9	57.3	41.1	38.1
Teeth	Caries, filled or 1-2	13.2	7.4	6.2	3.4	7.3	7.6	24.6	18.2	28.6	21.3	22.2	22.8
	unfilled 3-4	18.4	36.2	24.7	11.9	24.0	24.1	23.2	23.9	20.8	14.7	22.2	21.1
	5+	11.8	23.4	23.5	8.5	11.5	16.3	24.6	18.2	18.2	6.7	14.4	16.3
	Edentulous	6.6	1.1	1.2	0.0	0.0	1.7	4.3	2.3	2.6	0.0	0.0	1.8
	Worn	30.3	33.0	35.8	23.7	29.2	30.8	14.5	12.5	27.3	12.0	6.7	14.3
	Fluorosis	0.0	0.0	0.0	0.0	1.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
	Malposition	2.6	1.1	12.3	6.8	12.5	7.1	0.0	0.0	1.3	0.0	0.0	0.3
	Follicular hyperkeratosis	3.9	1.1	1.2	10.2	0.0	2.7	40.6	34.1	20.8	20.0	45.6	32.6
	Xerosis	19.7	21.3	11.1	22.0	10.4	16.5	0.0	0.0	0.0	0.0	0.0	0.0
Skin-	Acneform eruption	0.0	1.1	1.2	0.0	2.1	1.0	0.0	0.0	1.3	0.0	1.1	0.5
General	Thickened press. points	1.3	2.1	0.0	0.0	0.0	0.7	0.0	0.0	1.3	0.0	0.0	0.3
	Purpura or petechia	0.0	1.1	0.0	0.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
	Hyperpigmentation	2.6	0.0	0.0	0.0	3.1	1.2	0.0	1.1	0.0	0.0	0.0	0.3
Abdomen	Hepatomegalia	0.0	0.0	2.5	5.1	0.0	1.2	Examination of abdomen and Lower extremities omitted.					
Lower Extremities	Loss of ankle jerk	1.3	0.0	1.2	1.7	0.0	0.7						

1/ No findings of enlarged parotids, xerophthalmia, magenta tongue, "scorbutic-type" gums, crackled skin, pellagrous lesions, splenomegalia, ascites, or calf tenderness. Scrotal dermatitis not examined for.

2/ Villages referred to by number: Southern Eskimos: 1. Akiak 2. Kasigluk 3. Napaskiak 4. Newktok 5. Hooper Bay
Northern Eskimos: 6. Noatak 7. Point Hope 8. Shishmaref
Athabascan Indians: 9. Huslia 10. Allakaket

nearing undernutrition. It was noticeable that while signs of tuberculosis, phlyctenular keratoconjunctivitis and the scars of wounds and infections were plentiful, there were few chronically disabled people of any age. There was, by American standards, a remarkable scarcity of aged or infirm people. The fate of the aged was not apparent.

Scars of cold injury were common. The teeth were worn and carious, being best among the least acculturated people. Signs of rheumatic heart disease were seen. Some infectious disease was usually the most conspicuous ailment. Pediculosis was not uncommon. Despite the sparsity and lack of variety in the diet, evidence of gross deficiency diseases was rarely seen. The school lunch program and possibly the vitamin supplements to the basically meat diet seem to explain this observation in the Eskimo school children. Preschool children were generally well nourished. The mothers were often both thin and pale, especially those who had had recent pregnancies. Table 18 shows a summary of the prevalence of clinical findings in the villages by age, sex and area.

Incidence of thyroid enlargement was variable among the villages but when present was of small degree. Endemic goiter does not seem to be a serious problem. The facial erythema could be accounted for by exposure, as could the prevalent pingueculae. Bitot's spot were seen only in Newktok, the poorest, most primitive, and perhaps the least well situated village. Roughness of the skin was common, and the observers were not in agreement on their criteria for this finding and for follicular hyperkeratosis (see discussion above). The scarcity of water, no doubt, accounts for much of the skin disturbances.

The incidence of caries as indicated by the total of filled and unfilled carious teeth is shown in Tables 17 and 18. As predicted from the dentist's experience with the Eskimo National Guardsmen (see above) this defect was strongly related to the village location. A nutritional paradox lies in the low prevalence in Newktok, the most primitive and underfed village. The remarkable extent of dental attrition is illustrated in Figure VII. This was noted not only in adults but also in the deciduous teeth in children.

A striking difference in the relation of percent "standard weight" to age for the two areas is shown in Table 19a. The adults in the northern or Kotzebue study (villages 6 to 10) increase in "standard weight" with age in nearly the same manner as do whites. The southern Eskimos seem to decrease in "standard weight" with age which, allowing for the increase that is built into the "standard weight" ratio, means either no increase or a small decrease with age.

As with the men in the National Guard, the people in the northern villages are a little taller, but the rates of gain of height and weight with age among the children are not remarkable. A summary of heights and weights by sex and age for the 5 villages in each area combined is shown for reference purposes in Table 20 and in Figures VIII and IX. Canadians in the same age groups are included for comparison(20). The data for the Athabascan Indians are omitted from the figures, since their addition would make the illustrations difficult to see. They are given in Table 20.

TABLE 18

ESKIMO AND INDIAN VILLAGES IN ALASKA, 1958, PERCENT PREVALENCE, SELECTED CLINICAL FINDINGS BY AGE AND SEX

		BETHEL AREA 1/						KOTEZBUE AREA 2/					
		Age (years)				Sex		Age (years)				Sex	
		2-4	5-14	15-39	40+	Male	Female	2-4	5-14	15-39	40+	Male	Female
Number Examined		45	174	107	80	169	237	46	188	105	60	192	207
Suspected Disease	Tuberculosis	2.2	5.2	18.7	32.5	13.0	14.3	0.0	3.7	10.5	11.7	4.2	8.2
General Appearance	Good	91.1	78.2	89.7	67.5	79.3	81.4	100.0	98.4	100.0	100.0	99.5	99.0
	Fair	8.9	14.9	10.3	30.0	15.4	16.5	0.0	1.6	0.0	0.0	0.5	1.0
	Poor	0.0	6.9	0.0	2.5	5.3	2.1	0.0	0.0	0.0	0.0	0.0	0.0
Glands Enlarged	Thyroid	0.0	1.7	7.5	5.0	1.8	5.1	0.0	0.0	1.0	0.0	0.5	0.0
	Submaxillary	0.0	0.0	0.9	0.0	0.6	0.0	2.2	5.9	1.9	3.3	6.8	1.4
Skin-Face & Neck	Nasolabial seborrhea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	5.7	1.7	2.1	2.4
	Erythema	17.8	23.6	31.8	13.8	16.6	27.8	32.6	14.4	10.5	11.7	13.0	16.9
	Pigmentation	0.0	1.1	0.0	2.5	1.2	0.8	0.0	0.0	0.0	0.0	0.0	0.0
Eyes	Thickened conjunctivae	0.0	0.6	15.9	37.5	10.7	12.7	0.0	1.1	14.3	28.3	7.8	9.2
	Pingueculae	0.0	1.7	48.6	75.0	29.0	27.8	0.0	0.0	52.4	83.3	25.5	27.1
	Conjunctival injection	0.0	2.3	1.9	3.8	1.8	2.5	0.0	2.1	0.0	1.7	1.6	1.0
	Corneal scarring	8.9	16.7	18.7	6.2	16.0	13.1	0.0	1.6	2.9	31.7	6.2	6.3
Tongue	Filiform atrophy, sl.	2.2	1.1	18.7	15.0	5.9	10.5	8.7	6.4	4.8	6.7	7.8	4.8
	Filiform atrophy, mod.	0.0	0.0	1.9	5.0	0.0	2.5	0.0	0.5	1.0	0.0	0.5	0.5
	Furrows	0.0	2.9	4.7	13.8	7.1	3.8	0.0	1.6	2.9	6.7	3.6	1.4
	Serrations & swellings	0.0	0.0	3.7	6.2	3.6	1.3	0.0	0.0	1.0	5.0	0.5	1.4
	Red, tip, or lat. margins	0.0	0.0	3.7	8.8	3.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0
	Geographic tongue	4.4	1.1	0.0	1.2	2.4	0.4	2.2	0.5	1.9	1.7	1.6	1.0
Gums	Red or swollen gums	0.0	1.7	9.3	13.8	4.7	6.8	0.0	5.9	15.2	33.3	12.0	11.6
	Atrophy or recession	0.0	0.0	5.6	35.0	14.8	3.8	0.0	3.2	28.6	80.0	21.4	20.8
Teeth	No carious teeth	60.0	39.1	51.4	67.5	50.9	49.8	52.2	32.4	31.4	56.7	44.3	32.4
	Caries, filled 1-2	8.9	5.7	9.3	8.8	9.5	6.3	8.7	26.1	24.8	18.3	22.4	23.2
	or unfilled 3+	31.1	55.2	37.4	17.5	38.4	41.8	37.1	41.5	40.0	20.0	32.3	42.0
	Edentulous	0.0	0.0	1.9	6.2	1.2	2.1	0.0	0.0	3.8	5.0	1.0	2.4
	Worn	0.0	1.7	48.6	87.5	28.4	32.5	0.0	0.5	10.5	75.0	14.6	14.0
Skin-General	Follicular hyperkeratosis	0.0	5.2	1.9	0.0	4.7	1.3	17.4	50.5	24.8	1.7	33.9	31.4
	Xerosis	8.9	32.8	4.7	1.2	20.7	13.5	0.0	0.0	0.0	0.0	0.0	0.0
	Acneform eruption	0.0	0.6	1.9	1.2	1.2	0.8	0.0	0.0	1.9	0.0	1.0	0.0

1/ Bethel Area includes: Southern Eskimos from Akiak, Kasigluk, Napaskiak, Newktok and Hooper Bay.
2/ Kotzebue Area includes: Northern Eskimos from Noatak, Point Hope and Shishmaref, and the Athabascan Indian villages Huslia and Allakaket.

TABLE 19a

ESKIMOS AND ATHABASCAN INDIANS IN ALASKA, 1958
PERCENTAGE OF "STANDARD WEIGHT" 1/ BY AGE AND SEX

Age (years)	Southern Eskimo 2/				Northern Eskimo 3/				Athabascan Indian 4/			
	Male		Female, NP, NL 5/		Male		Female, NP, NL 5/		Male		Female, NP, NL 5/	
	No.	Mean ± S.E.	No.	Mean ± S.E.	No.	Mean ± S.E.	No.	Mean ± S.E.	No.	Mean ± S.E.	No.	Mean ± S.E.
5-9	47	114 ± 1	53	110 ± 1	29	109 ± 1	24	106 ± 1	22	104 ± 1	29	104 ± 2
10-14	33	110 ± 1	40	109 ± 1	30	108 ± 1	21	105 ± 2	17	103 ± 2	16	98 ± 2
15-44	93	105 ± 1	70	106 ± 2	71	107 ± 1	52	114 ± 2	20	98 ± 1	21	106 ± 3
45+	31	100 ± 2	27	95 ± 2	17	107 ± 2	11	110 ± 8	11	99 ± 2	7	114 ± 6

1/ U.S. Medico-Actuarial Tables used as an arbitrary standard for ages 15 years and over. The tabular weights were adjusted for shoes and clothing by subtraction of one inch and 5 pounds for both males and females. The Alaskan heights were taken without shoes; men were stripped to the waist, and women had on indoor clothing. No readjustment was made for this clothing. Baldwin-Wood standards were used for children < 15 years of age, with these standards as adjusted for indoor clothing.

2/ Southern Eskimos from 5 villages surveyed (Akiak, Kasigluk, Napaskiak, Newktok and Hooper Bay), including men from these villages in the National Guard.

3/ Northern Eskimos from 3 villages surveyed (Noatak, Point Hope, and Shishmaref), including men from these villages in the National Guard.

4/ Indians from 2 villages surveyed (Huslia and Allakaket).

5/ NP & NL means nonpregnant and nonlactating.

TABLE 19b

ESKIMOS AND ATHABASCAN INDIANS IN ALASKA, 1958

"OBESITY" IN ADULTS BY AGE AND SEX

Ethnographic Group, by Sex		15-44 years			45+ years		
		Number Examined	"Obese"1/	% "Obese"	Number Examined	"Obese"1/	% "Obese"
Males	Southern Eskimo2/	93	3	3.2	31	1	3.2
	Northern Eskimo2/	71	5	7.0	17	1	5.9
	Athabascan Indian2/	20	0	0.0	11	0	0.0
	Male Total	184	8	4.3	59	2	3.4
Females NP, NL3/	Southern Eskimo2/	70	11	15.7	27	0	0.0
	Northern Eskimo2/	52	15	28.8	11	4	36.4
	Athabascan Indian2/	11	2	9.5	7	3	42.9
	Female Total	133	28	21.1	45	7	15.6

1/ "Obesity" taken as $\geq$ 120% of "Standard Weight", using the U.S. Medico-Actuarial Tables in the manner described in Footnote 1 to Table 19a.

2/ See footnotes on Table 19a.

3/ NP and NL means nonpregnant and nonlactating.

TABLE 20

AVERAGE HEIGHT AND WEIGHT OF ESKIMOS AND ATHABASCAN INDIANS IN ALASKA, 1958, COMPARED TO CANADIAN 1953 SURVEY

Age	Southern Eskimo 1/						Northern Eskimo 2/						Athabascan Indians 3/						Canadians 4/			
	Male			Female			Male			Female			Male			Female			Male		Female	
	No.	Ht.	Wt.	No.	Ht.	Wt.	No.	Ht.	Wt.	No.	Ht.	Wt.	No.	Ht.	Wt.	No.	Ht.	Wt.	Ht.	Wt.	Ht.	Wt.
2	5	34	32	8	33	31	5	36	36	2	36	32	3	35	31	2	36	31	35	30	34	28
3	9	37	36	8	37	36	6	39	39	5	37	36	4	38	37	3	38	35	37	32	36	31
4	8	39	40	7	39	40	4	40	40	5	41	41	3	41	38	4	40	39	39	37	39	36
5	9	42	45	13	40	40	8	43	44	7	42	42	3	42	41	5	44	45	42	40	42	41
6	6	44	48	12	43	47	4	47	59	5	45	48	7	45	47	8	44	45	45	46	44	44
7	9	45	52	9	45	49	8	48	57	4	46	50	2	46	51	4	48	52	47	50	47	49
8	10	48	60	7	46	51	5	50	63	4	48	55	7	48	56	4	48	53	49	57	49	57
9	13	49	63	12	48	60	4	54	71	4	52	65	3	51	66	8	51	64	51	63	51	62
10	5	51	67	9	51	65	6	53	72	4	56	81	2	53	70	5	53	61	54	70	53	69
11	3	53	75	7	52	70	7	57	86	5	57	90	5	55	75	3	54	68	55	77	55	77
12	6	54	73	5	56	85	5	58	96	4	58	92	1	56	78	3	58	89	57	84	58	92
13	11	55	83	7	58	99	5	58	90	2	59	82	5	59	91	4	58	94	59	94	60	102
14	8	58	97	12	59	105	8	63	115	5	60	101	4	59	93	1	59	105	62	108	61	107
15	2	60	98	6	58	104	2	65	132	3	59	101	2	59	94	1	59	108	65	119	62	112
16-17	7	62	115	12	60	123	2	62	117	2	60	109	2	63	113	2	61	118	67	136	63	120
18-19	8	65	138	3	60	109	2	67	149	6	62	134	3	64	125	-	-	-	68	144	63	124
20-24	21	64	139	5	58	122	16	67	150	8	62	135	3	65	130	3	60	115	68	154	63	124
25-34	32	64	143	23	59	118	32	67	157	18	62	139	6	66	143	12	61	127	68	164	63	128
35-44	23	64	145	21	60	129	17	66	158	15	62	154	4	65	135	3	60	137	68	167	62	135
45-54	14	64	141	14	60	121	12	66	161	8	62	146	5	66	149	4	62	160	67	164	62	144
55-64	9	63	136	8	59	123	2	65	162	1	62	182	4	67	147	1	58	125	66	161	61	147
65+	8	63	148	5	58	121	3	65	159	3	59	138	2	66	160	2	61	143	65	155	61	138

1/ Southern Eskimos from 5 villages surveyed (Akiak, Kasigluk, Napaskiak, Newktok, and Hooper Bay), including men from these villages in National Guard.

2/ Northern Eskimos from 3 villages surveyed (Noatak, Point Hope, and Shishmaref), including men from these villages in National Guard.

3/ Indians from two villages surveyed (Huslia and Allakaket).

4/ See Reference 20.

Age in years to last birthday; height recorded to the nearest inch; weight recorded to nearest pound. Heights without shoes, and weights of males taken stripped to waist and females in indoor clothing. Pregnant and lactating women excluded.

FIGURE VIII

HEIGHT BY AGE AND SEX, ESKIMO VILLAGES, 1958
COMPARED TO CANADIAN POPULATION

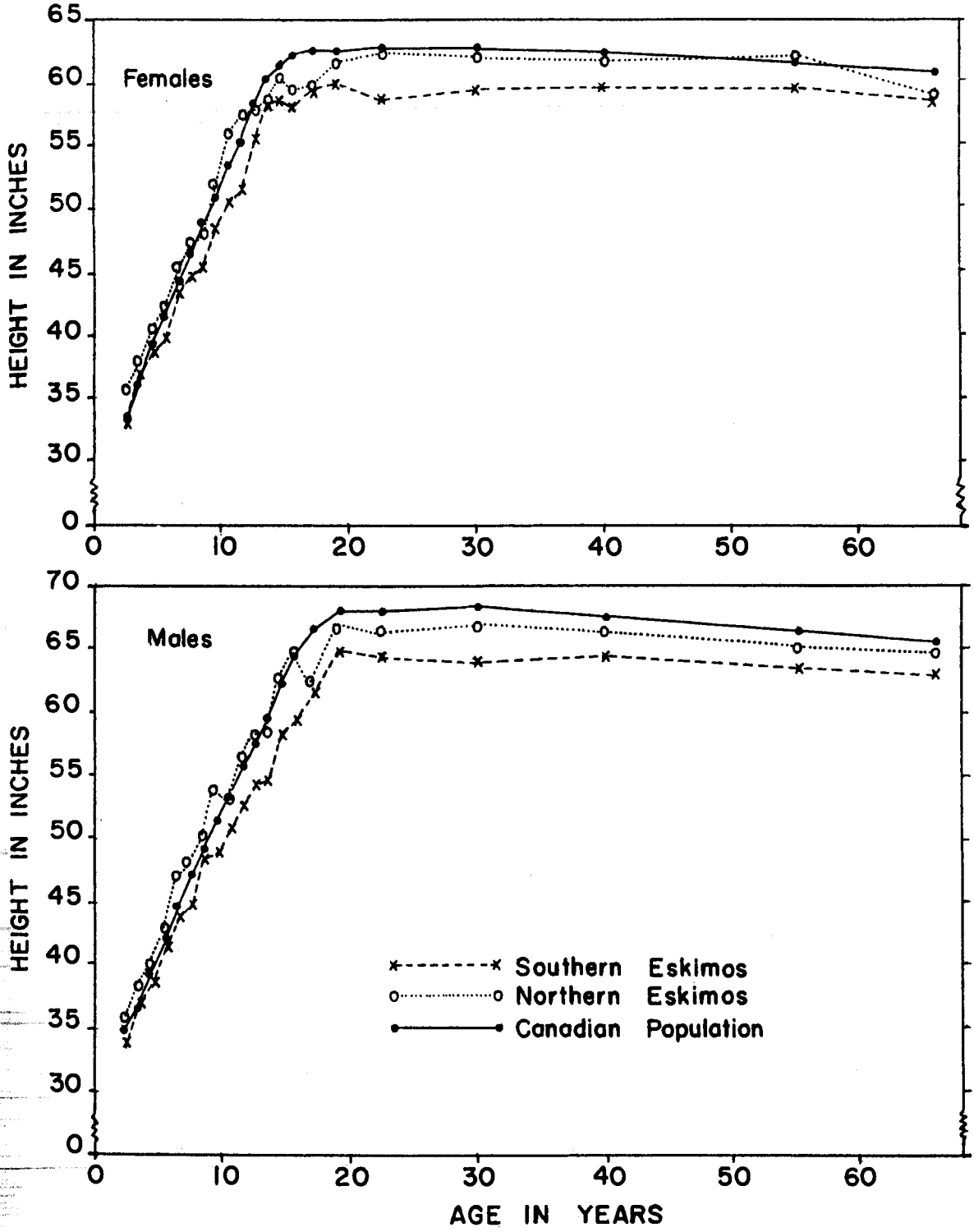
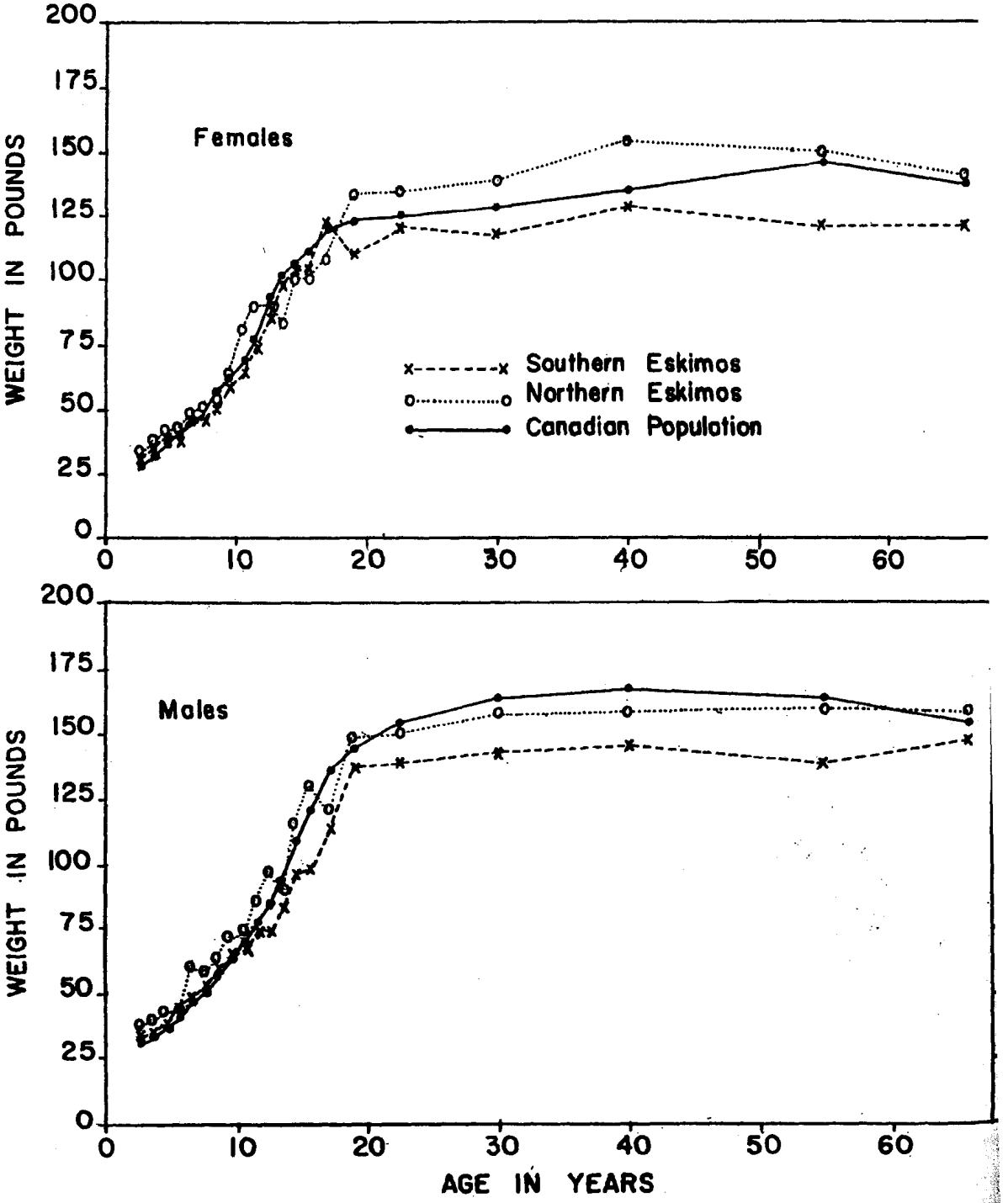


FIGURE IX

WEIGHT BY AGE AND SEX, ESKIMO VILLAGES, 1958

COMPARED TO CANADIAN POPULATION



Height growth was slowest in the southern Eskimos. It followed the Canadian population pattern closely until about 6 years of age, then dropped below it for the rest of the growth. Weight growth in the southern Eskimos was faster than the Canadian pattern until 8 to 10 years of age, then lagged below it. Adult height of the southern Eskimos is about 3 inches shorter than that of the Canadian population in both men and women. The adult weight of southern Eskimo women is about 10 pounds below that of the Canadian population.

Growth in both height and weight among the northern Eskimos closely followed that of the Canadian population throughout the growth period. Adult height is about one inch shorter than that of the Canadian population, for both men and women. Adult northern Eskimo women weigh about 10 pounds more than the Canadian population; adult northern Eskimo men weigh about 5 pounds less than the Canadian population.

The height curve for the Athabascan Indians falls close to that for the Canadian population. The weight curve for these people is close to that of the Canadian population until age 10, when it lags. Adult height of Athabascan Indians is similar to that of the northern Eskimos. Adult weight is least in young adults, rising strongly in older groups. However, with such small groups as these there is a possible differential age bias in the sampling.

Gross overweight was most prevalent in the northern Eskimo villages (Table 19b), especially in the women, and also in the women of the Athabascan Indian villages, and in young southern Eskimo women.

The numbers of males and females in successive age groups are too small in the various ethnographic groups for conclusive statements to be made, and considerable obesity in these small groups, especially in the older ages, produces indefinite averages. It is also possible that there is some degree of differential bias in sampling according to both age and sex, for example, there may have been sick people who did not attend the examinations in the villages, and some of the adult males not in the National Guard may have been away from the villages during the time of the interviews. In general, it appears safe to conclude that the middle-aged adults tend to be slightly shorter than the younger adults, and those over 65 are still shorter, with these differences being of small magnitude, similar in their appearance to the Canadian population. Beyond some rise in weight in the twenties, there appears to be little weight change with age in the southern Eskimo, and probably also in all the male groups examined, with probable rising patterns in women in the northern groups.

The pulse data were of no interest except that they showed a systematically higher rate by age for the northern than for the southern villages (Table 21, Figure X). The physician in the south was a woman. Table 22 shows the examiner differences for pulse and blood pressure measurements of men in the two battalions of National Guardsmen taken by a female (Examiner A) and male (Examiner B) clinician, respectively. The blood pressure readings made by examiner A are in all cases higher than those made by examiner B. For pulse rates, the reverse is true.

TABLE 21

ESKIMO AND INDIAN VILLAGES IN ALASKA, 1958
PULSE (MEAN ± S.E.) BY AGE, FOR VILLAGES BY ETHNOGRAPHIC GROUPS

	Southern Eskimo 1/		Northern Eskimo 2/		Athabascan Indian 3/	
Age (years)	No.	Pulse Beats/min.	No.	Pulse Beats/min.	No.	Pulse Beats/min.
2-4	45	87 ± 2	27	113 ± 2	19	109 ± 3
5-9	101	82 ± 1	53	99 ± 2	51	91 ± 1
10-14	73	81 ± 1	51	89 ± 1	33	85 ± 1
15-19	31	79 ± 2	17	89 ± 3	11	81 ± 1
20-44	92	80 ± 1	60	83 ± 1	33	79 ± 1
45-64	42	80 ± 1	20	78 ± 2	14	74 ± 2
65+	13	83 ± 3	6	71 ± 4	4	75 ± 3

1/ Southern Eskimos from 5 villages surveyed (Akiak, Kasigluk, Napaskiak, Newktok and Hooper Bay).

2/ Northern Eskimos from 3 villages surveyed (Noatak, Point Hope, and Shishmaref).

3/ Indians from 2 villages surveyed (Huslia and Allakaket).

FIGURE X

ESKIMO AND INDIAN VILLAGES IN ALASKA, 1958
BLOOD PRESSURES AND PULSE RATES, BY AGE

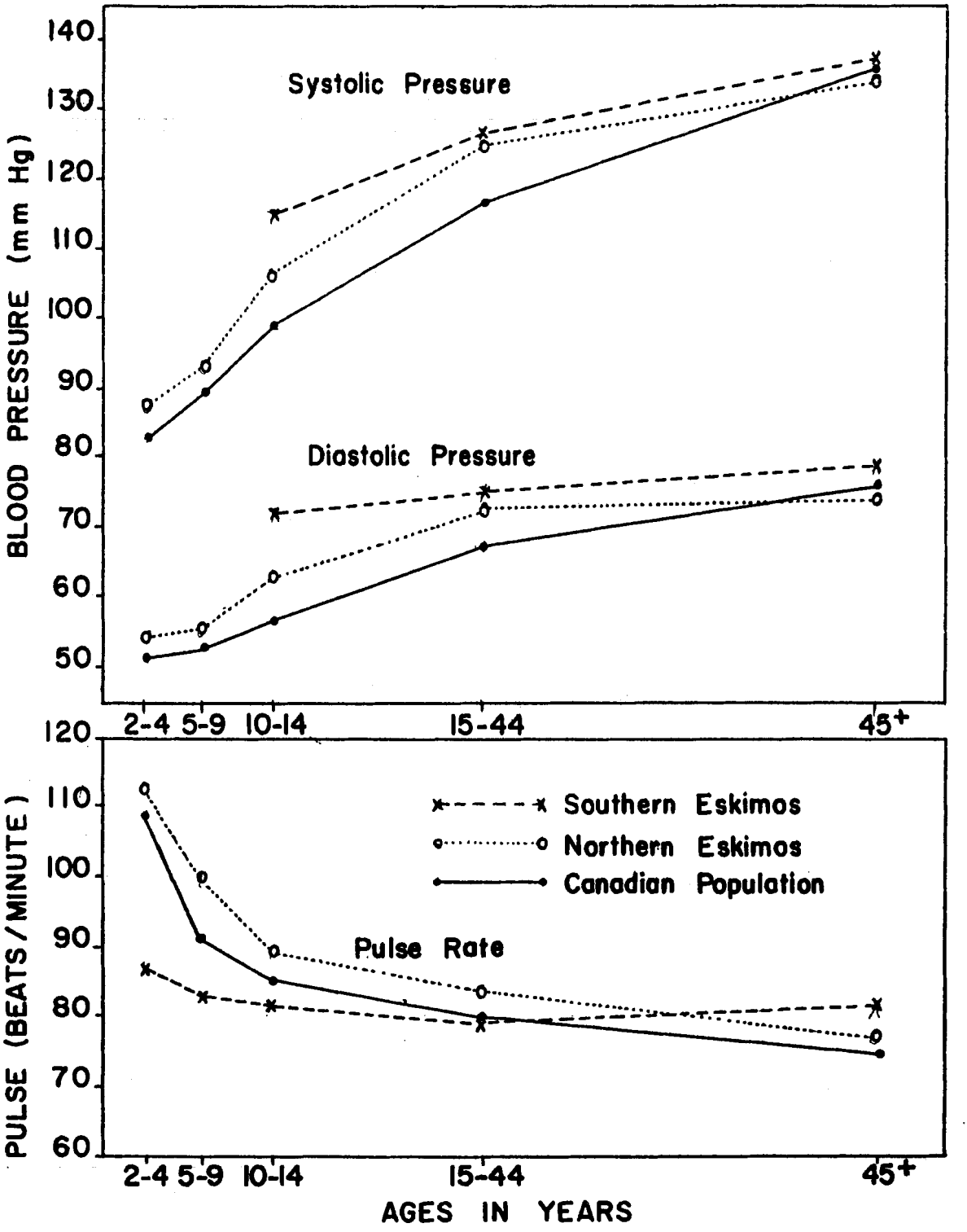


TABLE 22

ESKIMO MEN, ALASKA NATIONAL GUARD, 1958, BY BATTALION
BLOOD PRESSURE AND PULSE MEASUREMENTS, BY EXAMINER

		Examiner A	Examiner B	Total
		Female	Male	
Bn. 2	Number	158	165	323
B.P.1/	Systolic	128.0 ± 1.2	123.0 ± 1.1	125.4 ± 0.8
	Diastolic	76.4 ± 0.8	68.6 ± 1.0	72.4 ± 0.7
	Pulse	76.2 ± 0.8	79.3 ± 0.7	77.8 ± 0.6
Bn 1	Number	182	208	390
B.P.1/	Systolic	126.6 ± 0.9	115.9 ± 1.0	120.9 ± 0.7
	Diastolic	73.3 ± 0.7	66.2 ± 0.8	69.7 ± 0.5
	Pulse	75.7 ± 0.7	78.7 ± 0.5	77.3 ± 0.4

1/ B.P. = Blood Pressure in mm Hg. Mean ± Standard Error.

Thus the differences in pulse rates found in the villages can probably be considered an artifact. Table 22 is, therefore, presented as a caution in interpreting absolute levels in Table 21.

High blood pressure was no more common in the villages than it was among the men in the National Guard. The percent of subjects exceeding stated levels of pressure are shown by area, age and blood pressure in Table 23. Hypertension is conspicuous by its absence. The usual rise of blood pressure with age was noted, with a lesser rise of diastolic than of systolic pressure. These blood pressure findings confirm earlier observations among the Eskimos(15).

Blood pressure and pulse data have not been presented by sex because there were no sex differences except in older people, where measurements for the women slightly exceeded those for the men.

Since the skinfolds were measured by a single observer in each area, consideration of these is by area. The mean skinfold thicknesses by sex, age and area are shown in Table 24 and Figure XI. The female skinfolds tend to exceed those of the males and to increase with age in a more consistent manner after age 10. Below age 10 there is no sex difference. Altogether, the skinfold measurements have not made an important contribution above the general appraisal of appearance and the measurement of height and weight.

4. Discussion of Clinical Findings

The clinical examinations revealed no striking evidences of nutritional disease. When field observations revealed the wide-spread multivitamin supplementation of the Eskimo school children it was reasonable to expect that this practice, taken together with the high meat diet, would prevent vitamin deficiencies in the children. Still, it was not clear how deficiency of ascorbic acid could be avoided entirely since the visible intake of this vitamin among the unsupplemented adults appeared very low. No sign of scurvy was seen. This riddle required biochemical tests of the subjects and their dietaries. In the same way the apparently high intake of vitamin A from the fish and seal oils and livers did not fit well with the observations of occasional Bitot's spots, follicular hyperkeratosis and generally rough skin. The clinical observations confirmed the belief that the prime health impairments of the Eskimo are related to infectious agents.

A few people were seen with active phlyctenular keratoconjunctivitis (PKC) but these lesions were uncommon and comprised less than 0.1 percent of the entire population observed. The involvement was sometimes unilateral. The school teachers have been instructed to treat this disorder, easily recognized and severely disabling, with topical application of a cortisone ointment. The treatment gives prompt relief and seems to leave minimal scarring. It would be of great practical importance to determine whether these episodes of PKC are indeed related to infection and hypersensitivity alone, or whether vitamin A nutriture may play some role in the precipitation of the syndrome. It would be of interest to collect biochemical and clinical data from subjects with this lesion. In the meantime prompt steroid therapy is of great importance for the prevention of permanent disability.

TABLE 23

ESKIMO AND INDIAN VILLAGES IN ALASKA, 1958
BLOOD PRESSURE (MEAN ± S. E.) by AGE, for VILLAGES BY ETHNOGRAPHIC GROUPS

Age (years)	Southern Eskimo 1/ Blood Pressure (mm Hg)			Northern Eskimo 2/ Blood Pressure (mm Hg)			Athabascan Indian 3/ Blood Pressure (mm Hg)		
	No.	Systolic	Diastolic	No.	Systolic	Diastolic	No.	Systolic	Diastolic
2-4	No measurements on children under 12 years of age.			6	88 ± 3	54 ± 3	6	82 ± 3	52 ± 3
5-9				49	93 ± 2	56 ± 2	51	89 ± 2	53 ± 1
10-14	12	114 ± 3	72 ± 3	51	106 ± 2	63 ± 1	33	99 ± 2	57 ± 2
15-19	31	124 ± 2	75 ± 2	17	122 ± 3	72 ± 2	11	107 ± 5	67 ± 4
20-44	96	127 ± 1	75 ± 1	60	126 ± 3	74 ± 2	33	120 ± 3	68 ± 2
45-64	43	131 ± 3	78 ± 2	20	133 ± 5	74 ± 3	13	131 ± 8	72 ± 3
65+	13	155 ± 8	83 ± 3	6	142 ± 4	77 ± 3	4	155 ± 29	86 ± 13

1/ Southern Eskimos from 5 villages surveyed (Akiak, Kasigluk, Napaskiak, Newktok and Hooper Bay).

2/ Northern Eskimos from 3 villages surveyed (Noatak, Point Hope and Shishmaref).

3/ Indians from 2 villages surveyed (Huslia and Allakaket).

TABLE 24

ESKIMO AND INDIAN VILLAGES IN ALASKA, 1958
ARM and SCAPULA SKINFOLD THICKNESS by AGE and SEX, for VILLAGES by ETHNOGRAPHIC GROUPS
(Means in Millimeters)

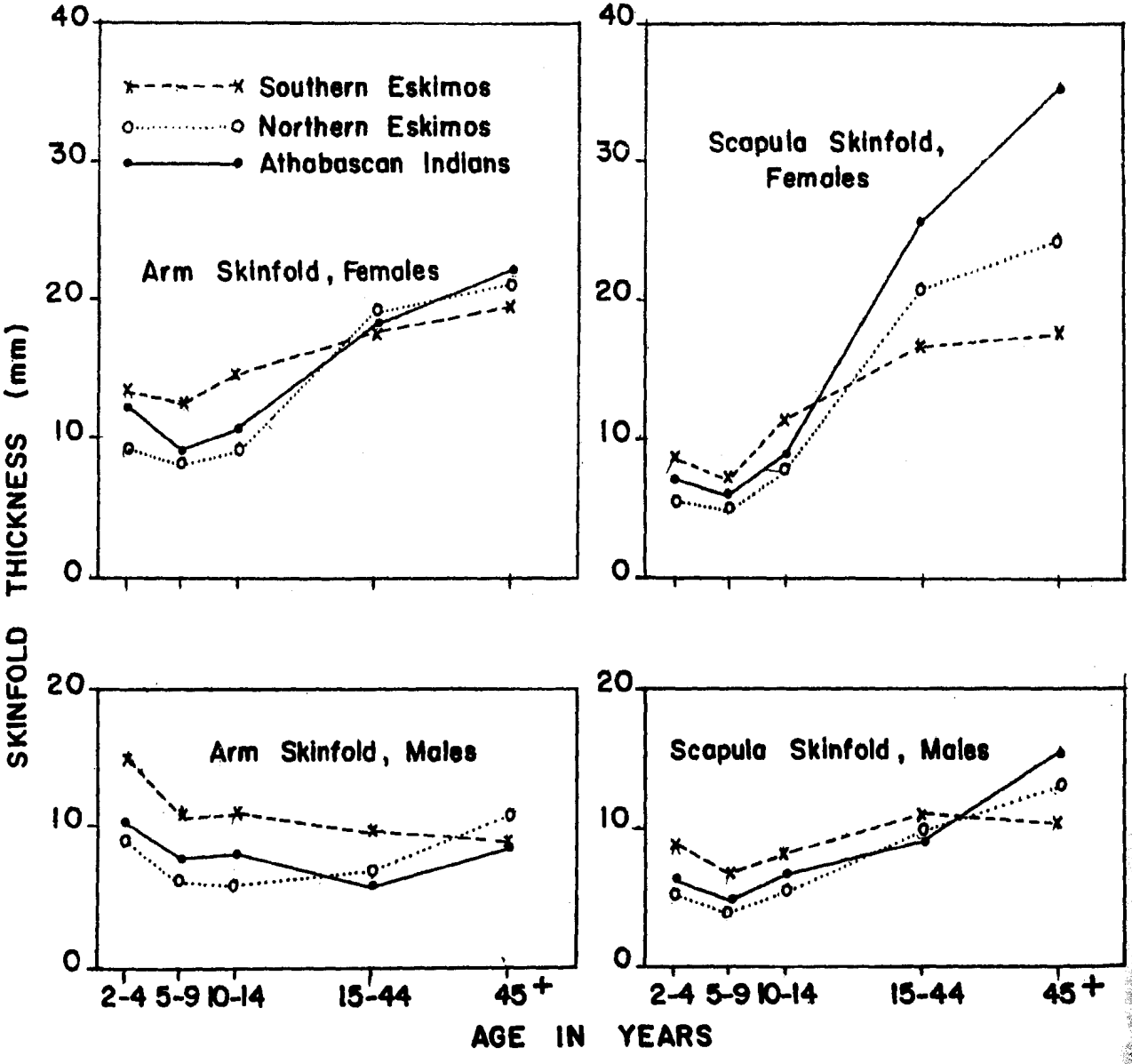
Age (years)	Southern Eskimo 1/						Northern Eskimo 2/						Athabascan Indians 3/					
	Male			Female			Male			Female			Male			Female		
	No.	Arm	Scap.	No.	Arm	Scap.	No.	Arm	Scap.	No.	Arm	Scap.	No.	Arm	Scap.	No.	Arm	Scap.
2-4	15	14.9	8.7	20	13.1	8.3	23	9.1	5.4	12	9.5	5.3	10	10.2	5.8	9	12.7	7.0
5-9	45	10.5	6.6	52	12.3	6.9	29	6.2	4.0	24	8.2	5.0	22	7.6	4.4	29	9.0	5.8
10-14	32	11.0	8.1	38	14.1	11.1	30	6.0	5.4	21	9.2	7.8	17	8.1	6.4	16	10.8	8.9
15-44	38	9.8	11.0	91	17.6	16.9	19	6.8	9.9	53	19.0	20.8	20	5.9	9.2	24	18.7	25.5
45+	28	8.7	10.5	25	19.4	17.4	11	10.9	13.0	12	21.3	24.4	11	8.7	15.3	7	22.0	35.6

1/ Southern Eskimos from 5 villages surveyed (Akiak, Kasigluk, Napaskiak, Newktok and Hooper Bay).

2/ Northern Eskimos from 3 villages surveyed (Noatak, Point Hope, and Shishmaref).

3/ Indians from 2 villages surveyed (Huslia and Allakaket).

FIGURE XI
ESKIMO AND INDIAN VILLAGES IN ALASKA, 1958
ARM AND SCAPULA SKINFOLD THICKNESS, BY AGE AND SEX



Despite the extensive use of isoniazid therapy no signs of pyridoxine deficiency were seen. In the children the vitamin supplements given at school may have forestalled this complication, but it appears that if pyridoxine deficiency is a complication of isoniazid therapy(21) it would be seen in the adults not given vitamin supplements. Perhaps it is not seen because the Eskimos receive a smaller daily dose (5 mg of isoniazid per kilogram of body weight) than the patients in whom pyridoxine deficiency has been noted to result from isoniazid administration at a level of 20 mg per kilogram of body weight per day.

The dental findings suggest that the introduction of refined carbohydrates into the diet of this aboriginal people is accelerating the development of dental disease. This circumstance offers an unusual opportunity to study the pathogenesis of caries. Perhaps the most ominous aspect of the Eskimos' food and health situation today is the uncertain disturbance of their precarious health balance which the steady introduction of white men's foods and food habits will effect. The isolation of the areas will tend to prevent the importation of varieties of foods. The replacement of essentially whole and raw animals with sugar and flour will almost certainly disrupt the remarkable adaptation which the Eskimo has had to his food supply. At the very least, continuing surveillance of nutritional status among the Eskimos will be necessary to detect incipient calamities. A continuing program of education and health service should be expected to ease this inevitable cultural transition.

V - DIETARY MEASUREMENTS

1. National Guardsmen - Camp Denali (Ft. Richardson)

The food consumption of the Eskimo Guardsmen was measured under Army garrison conditions. A three-day measurement was made for each battalion of men. The food was prepared by regular Army personnel using the Quartermaster menu as a guide. The survey team personnel collected five representative servings of each item served at each meal, and composites were made for each meal by procedures that have been described(22). These meal samples were then combined for the three days. Plate wastage was determined by scraping plates, removing the inedible portion and compositing the residue. Aliquots of both the meal and plate wastage composites were analyzed for protein, fat, moisture and ash. Data on food consumed outside the mess halls were obtained by a written questionnaire supplied to each man.

The summary of food consumption for the two battalions is shown in Table 25.

TABLE 25

ESKIMO MEN, ALASKA NATIONAL GUARD, FT. RICHARDSON, 1958

FOOD CONSUMPTION FROM THE MESS HALL ALONE, AVERAGE PER MAN PER DAY

Bn 2	Head Count	Calories	Protein gm	Fat gm	Carbohydrate gm
March 3	161	4045	160.9	174.6	457.6
March 4	160	4084	144.7	178.8	473.9
March 5	181	3895	179.8	172.9	404.9
Mean	167	4003	162.6	175.3	443.8
Bn 1					
March 24	197	3287	143.3	127.5	391.5
March 25	219	3739	147.3	169.4	406.2
March 26	225	3783	132.0	150.7	474.7
Mean	214	3616	140.9	150.0	425.7

The calorie intake was low in fat for Battalion 1 the first day. The average figures are, as might be expected, not unusual unless they be considered unusually large total intakes. The weather during both measurements was mild, never being subzero, and the wind was not excessive. However, both groups were in active training status with night maneuvers and were very active. In Table 26 the plate wastage is shown by battalion, day and nutrient. It is of interest that about half the total calories for plate waste are accounted for by fat.

TABLE 26

ESKIMO MEN, ALASKA NATIONAL GUARD, FT. RICHARDSON, 1958

PLATE WASTE, AVERAGE PER MAN PER DAY

Bn 2	Calories	Protein gm	Fat gm	Carbohydrate gm
March 3	259	10.1	14.2	22.6
March 4	212	4.9	10.2	25.1
March 5	166	7.7	9.2	13.1
Mean	210	7.6	11.1	20.0
Bn 1				
March 24	133	4.0	7.0	13.5
March 25	163	6.7	9.1	13.5
March 26	189	6.5	10.0	18.3
Mean	163	5.8	8.8	15.2

Table 27 presents the food consumed from sources outside the mess and the total food consumption from all sources. Battalion 2 averaged 652 calories and Battalion 1 averaged 764 calories per man per day from sources outside the mess. The total food consumption from all sources averaged 4,665 and 4,380 calories per man per day for Battalion 2 and Battalion 1, respectively.

TABLE 27

ESKIMO MEN, ALASKA NATIONAL GUARD, FT. RICHARDSON, 1958

FOOD CONSUMPTION FROM ALL SOURCES, AVERAGE PER MAN PER DAY

Bn 2	Calories	Protein gm	Fat gm	Carbohydrate gm
Food in mess	4003	162.6	175.3	443.8
Food outside mess 1/	652	13.0	46.0	60.0
Total from all sources	4655	175.6	221.3	503.8
Percent of Calories		15.1	37.3	43.1
Bn 1				
Food in mess	3616	140.9	150.0	425.7
Food outside mess	764	12.0	40.0	90.0
Total from all sources	4380	152.9	190.0	515.7
Percent of Calories		14.1	36.1	47.1

1/ Food and beverages from PX and service clubs.

The protein intake was entirely adequate averaging 153 to 175 grams per man per day. These values are in agreement with surveys performed in Army training camps throughout the United States(22). In the latter study, conducted at four basic and airborne training camps in a temperate environment, food consumption averaged 4,227 calories per man per day when corrected for body weight changes. In another study by Welch et al.(23) of men bivouacking in a subarctic environment, the caloric intake was found to average 4,163 calories per man per day for a three-week period. On the basis of these studies, the caloric requirement for military personnel in training activities may be considered to range between 4,100 and 4,300 calories per man per day. The present values for both of the National Guard Battalions in training were slightly higher than for other American troops in training. Since no body weight data were collected at the end of the survey, the food consumption data could not be corrected for such possible changes.

2. Villages (Preliminary)

a. Methods

A quantity of dietary data had been previously collected from seven of the ten villages which were visited by the nutrition survey team. These data were collected through personal interviews by the nutritionist, by intake records written by the family and, to a limited extent, by the weighing of the daily food intake by either the nutritionist or the Eskimo and Indian women after instruction by the nutritionist.

The method used to determine the various quantities of food consumed in the villages consisted of entries recorded by a household member on a form. The nutritionist instructed the Eskimos and Indians on its use. Meats, fish and bread were usually recorded by measuring the length, width and depth of the food item. For simplification of calculation these measurements were reduced to the nearest 0.5 cubic inch. Items such as evaporated milk, syrup, sugar, seal oil, etc., were measured and recorded by the teaspoon, tablespoon, or in cups. Quantities of soups and cereals were also recorded by cups. Vegetables, such as potatoes and onions, were classified as small, medium, or large. In many instances the Eskimo and Indian women prepared a recipe of unusual homemade items. Calculation of the quantity of the food item consumed was then made with the ingredients and apportioned to average servings (Table 28).

Most of the dietary records were collections for a seven-day period. In a few of the villages it was possible to obtain records for only three to four days. An attempt was made to obtain written seven-day intake records for each of the four seasons of the year, but because of the movement of the people to their various seasonal camps and to their summer work, this was not always possible.

The collection of these food records was begun in the fall of 1956. Quantitative analysis of most of the data was delayed due to the pressure of field work and the presence of unusual food items for which exact nutrient composition was not known. Rodahl(24) at the Arctic Aeromedical Laboratory in Fairbanks has published data on 69 native Alaskan foods but only for protein, fat, carbohydrate and cholesterol content. At the

TABLE 28

NUTRIENT COMPOSITION OF RECIPES FOR ESKIMO DISHES, AS CALCULATED

Food Item	Weight	Calories	Protein	Fat	Carbohydrate	Calcium	Phosphorus	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Vitamin C
	gm		gm	gm	gm	mg	mg	mg	I.U.	mg	mg	mg	mg
AKOOTAK (T. BERRY, NAPASKIAK)													
Salmonberries, 7 C	938	490	10.5	3.5	51.0	343	322	7.7	1120	0.21	0.56	3.6	801
Red Berries, 1 C	134	70	1.5	0.5	17.0	49	46	1.1	160	0.03	0.08	0.4	29
Seal Oil, 2 C	440	3960	0	440.0	0	0	0	0	12263	0	0	0	0
Pike, Cooked	768	619	143.6	1.2	8.4	2488	(1306)	(4.2)	100	0.10	0.10	(0.7)	17
Sugar, 1-1/2 C	300	1155	0	0	300.0	0	0	0	0	0	0	0	0
Total	2580	6294	155.6	445.2	376.4	2880	1674	13.0	13643	0.35	0.74	4.7	851
Nutrient Composition/100 gm		244	6.0	17.2	14.6	112	65	0.5	528	0.01	0.03	0.2	3
MOOSE BURGERS (G. YASKA JR., HUSLIA)													
Moose Meat	3864	4313	985.3	41.3	0	618	(3900)	(42.0)	0	0.81	14.10	(4.2)	154
Potato, 1 med.	142	118	2.8	0.1	27.1	16	80	1.0	30	0.14	0.06	1.6	22
Flour, 6 Tbs.	84	306	8.8	0.8	63.9	13	73	0.7	0	0.05	0.04	0.5	0
Moose Grease, 6 Tbs.	84	756	0	84.0	0	0	0	0	0	0	0	0	0
Total	4174	5493	996.9	126.2	91.0	647	4073	43.7	30	1.00	14.20	6.3	176
Nutrient Composition/100 gm		132	23.9	3.0	2.4	16	98	1.0	1	0.03	0.34	0.2	4
MOOSE ROAST (G. YASKA, HUSLIA)													
Moose Meat	2912	3249	742.6	32.0	0	466	(2800)	(32.0)	0	0.61	10.62	(3.2)	116
Potatoes, 2 small	100	83	2.0	0.1	19.1	11	56	0.7	20	0.11	0.04	1.2	17
Macaroni, 1/2 C	55	208	7.0	0.8	42.1	12	91	0.8	0	0.05	0.03	1.1	0
Moose Grease, 4 Tbs.	56	0	56.0	0	0	0	0	0	0	0	0	0	0
Catsup, 2 Tbs.	34	34	0.6	0.2	8.4	4	6	0.2	640	0.04	0.02	0.8	4
Total	3157	3574	808.2	33.1	69.6	493	2953	33.7	660	0.81	10.71	6.3	137
Nutrient Composition/100 gm		113	25.6	1.0	2.2	16	94	1.1	21	0.02	0.34	0.2	4

TABLE 28 (continued)

Food Item	Weight gm	Calories	Protein gm	Fat gm	Carbohydrate gm	Calcium mg	Phosphorus mg	Iron mg	Vitamin A I.U.	Thiamine mg	Riboflavin mg	Niacin mg	Vitamin C mg
BEAR MEAT SOUP (A. HENRY, HUSLIA)													
Bear Meat	3312	4316	847.9	102.7	0	563	0	0	0	0.65	19.00	0	76
Rice, 1/3 C (dry)	64	231	4.8	0.2	50.6	15	87	0.5	0	0.04	0.01	0.8	0
Macaroni, 1/2 C (dry)	55	208	7.0	0.8	42.1	12	91	0.8	0	0.05	0.03	1.1	0
Veg. Soup, 1 can	314	230	5.6	5.6	45.5	65	97	2.2	3120	0.06	0.25	1.9	22
Salt, 1/2 tsp.	0	0	0	0	0	0	0	0	0	0	0	0	0
Pepper, 1/3 tsp.	0	0	0	0	0	0	0	0	0	0	0	0	0
Water, 4 qts.	3720	0	0	0	0	0	0	0	0	0	0	0	0
Total	4773	4985	865.3	109.3	138.2	655	275	3.5	3120	0.81	19.29	3.8	98
Nutrient Composition/100 gm		104	18.1	2.3	2.9	14	6	0.1	1	0.02	0.40	0.1	2
MOOSE MEAT STEW													
Moose Meat	2990	3346	762.5	32.9	0	478	0	0	0	6.28	10.91	0	120
Potatoes, 2 med.	248	238	5.6	0.2	54.2	32	160	2.0	60	0.28	0.12	3.2	44
Rice, 1/2 C (dry)	96	346	7.3	0.3	75.8	23	160	0.7	0	0.06	0.02	1.6	0
Carrots, 1 can	246	69	1.2	1.0	15.0	54	59	1.5	29520	0.06	0.05	0.8	6
Dried Onions, 2 Tbs.	12	16	0.4	0	4.0	12	16	0	0	0	0	0	0
Salt & Pepper	0	0	0	0	0	0	0	0	0	0	0	0	0
Water, 4 qts.	3720	0	0	0	0	0	0	0	0	0	0	0	0
Total	7318	4015	777.0	34.4	149.0	599	395	4.2	29580	6.68	11.10	5.6	174
Nutrient Composition/100 gm		55	10.6	0.5	2.0	8	6	0.1	404	0.09	0.15	0.1	2
MOOSE MEAT STEW (SOUP)													
Moose Meat	11040	12353	2815.2	121.4	0	1770	0	0	0	2.31	40.30	0	442
Moose Fat	1200	10800	0	1200.0	0	0	0	0	0	0	0	0	0
Rice, 1/2 C (dry)	96	346	7.3	0.3	75.8	23	160	0.7	0	0.06	0.02	1.6	0
Macaroni, 1 C (dry)	110	415	14.1	1.5	84.2	24	182	1.6	0	0.10	0.07	2.2	0
Dried Onions, 1 Tbs.	6	8	0.2	0	2.0	12	8	0	0	0	0	0	0
Tabasco, 3 drops	0	0	0	0	0	0	0	0	0	0	0	0	0
Pepper, 1/4 tsp.	2	0	0	0	0	0	0	0	0	0	0	0	0
Potatoes, 2 small	200	166	4.0	0.2	38.2	22	112	1.4	40	0.22	0.08	2.4	34
Water, 4 qts.	3720	0	0	0	0	0	0	0	0	0	0	0	0
Total	16374	24088	2840.8	1323.4	200.2	1851	462	3.7	40	2.69	40.47	6.2	476
Nutrient Composition/100 gm		147	17.3	8.1	1.2	12	3	0.02	0	0.02	0.25	0.04	3

TABLE 28 (continued)

Food Item	Weight gm	Calories	Protein gm	Fat gm	Carbohydrate gm	Calcium mg	Phosphorus mg	Iron mg	Vitamin A I.U.	Thiamine mg	Riboflavin mg	Niacin mg	Vitamin C mg
(X4) MOOSE MEAT STEW (A. HENRY, HUSLIA)													
Moose Meat	9016	10089	2299.1	99.2	0	1443	0	0	0	1.89	32.91	0	360
Rice, 1/2 C (dry)	96	346	7.3	0.3	75.8	23	160	0.7	0	0.06	0.02	1.6	0
Potatoes, 2 med.	248	238	5.6	0.2	54.2	32	160	2.0	60	0.28	0.12	3.2	44
Dried Onions, 1 Tbs.	6	8	0.2	0	2.0	12	8	0	0	0	0	0	0
Salt, 1 tsp.	6	0	0	0	0	0	0	0	0	0	0	0	0
Pepper, 1/4 tsp.	2	0	0	0	0	0	0	0	0	0	0	0	0
Carrots, 1 can	246	69	1.2	1.0	15.0	54	59	1.5	29520	0.06	0.05	0.8	6
Water, 4 qts.	3720	0	0	0	0	0	0	0	0	0	0	0	0
Total	13340	10750	2313.4	100.7	147.0	1564	387	4.2	29580	2.29	33.10	5.6	410
Nutrient Composition/100 gm		81	17.3	0.8	1.1	12	3	0.03	222	0.02	0.25	0.04	3
MOOSE SOUP													
Moose Meat	1610	1798	410.6	17.7	0	258	0	0	0	0.34	5.88	0	64
Rice, 1/2 C	96	346	7.3	0.3	75.8	23	160	0.7	0	0.06	0.02	1.6	0
Macaroni, 1 C (dry)	110	415	14.1	1.5	84.2	24	182	1.6	0	0.10	0.07	2.2	0
Veg. Soup, 1 can	314	230	5.6	5.6	45.5	65	97	2.2	3120	0.06	0.25	1.9	22
Salt & Pepper	8	0	0	0	0	0	0	0	0	0	0	0	0
Water, 3 1/2 qts.	3220	0	0	0	0	0	0	0	0	0	0	0	0
Total	5358	2789	437.8	25.1	205.5	370	439	4.5	3120	0.56	6.22	5.7	86
Nutrient Composition/100 gm		52	8.2	0.5	3.8	7	8	0.1	58	0.01	0.12	0.1	2
SALMONBERRY ICE CREAM (ALEXIE (SMITH) MAXIE, NAPASKIAK)													
Tallow, 2 1/2 C	550	4960	0	550	0	0	0	0	0	0	0	0	0
Seal Oil, 2 C	440	3960	0	440	0	0	0	0	12270	0	0	0	0
Sugar, 1 C	200	770	0.1	0	199.0	0	0	0	0	0	0	0	0
Water, 1/2 C (cold)	120	0	0	0	0	0	0	0	0	0	0	0	0
Salmonberries, 3 C	369	210	4.5	1.5	51.0	147	138	3.3	480	0.09	0.24	1.2	345
Red Berries, 2 1/2 C	308	175	3.8	1.3	42.5	124	115	2.8	400	0.08	0.20	1.0	3
Total	1987	10075	8.4	992.8	292.5	271	253	6.1	13150	0.17	0.44	2.2	348
Nutrient Composition/100 gm		510	0.4	50.0	14.7	14	13	0.3	662	0.01	0.02	0.1	18

TABLE 28 (continued)

Food Item	Weight gm	Calories	Protein gm	Fat gm	Carbohydrate gm	Calcium mg	Phosphorus mg	Iron mg	Vitamin A I.U.	Thiamine mg	Riboflavin mg	Niacin mg	Vitamin C mg
SOURDOUGH BREAD													
Flour, 4 C	440	1540	40.4	4.4	324.8	1200	840	5.6	0	0.32	0.20	5.2	0
Water, 4 C	960	0	0	0	0	0	0	0	0	0	0	0	0
Baking Soda, 1 tsp.	10	0	0	0	0	0	0	0	0	0	0	0	0
Fat, 1/2 C (melted)	140	1260	0	140	0	0	0	0	0	0	0	0	0
Salt, 1/2 tsp.	5	0	0	0	0	0	0	0	0	0	0	0	0
Sugar, 1 Tbs.	12	40	0	0	12	0	0	0	0	0	0	0	0
Total	1567	2840	40.4	144.4	336.8	1200	840	5.6	0	0.32	0.20	0.52	0
Nutrient Composition/100 gm		181	2.6	9.2	21.5	77	54	0.4	0	0.02	0.01	0.03	0
POLAR BEAR SOUP (JACOB LANE'S FAMILY, POINT HOPE)													
Meat, 5 lbs.	2270	3092	601.6	70.4	0	363	0	0	0	0	13.0	0	90
Rice, 1 C	191	696	14.5	0.6	651.7	46	260	1.5	0	0.13	0.05	3.1	0
Salt, 3 tsp.	21	0	0	0	0	0	0	0	0	0	0	0	0
Onions, 1/2 C	75	49	1.5	0.2	11.3	35	48	0.6	60	0.04	0.04	0.2	0
Macaroni, 1 1/2 C (dry)	165	622	21.2	2.2	106.3	36	273	2.4	0	0.15	0.11	3.3	0
Water, 4 qts.	4000	0	0	0	0	0	0	0	0	0	0	0	0
Total	6722	4459	638.8	73.4	269.3	480	581	4.5	60	0.32	13.20	6.6	90
Nutrient Composition/100 gm		66	9.5	1.1	4.0	7	9	0.1	1	0.05	0.20	0.1	1
ESKIMO PANCAKE (AHSAYLBEYAK, KASIGLUK)													
Flour, 2 1/2 C	275	963	25.2	2.6	203.0	750	525	3.5	0	0.20	0.12	3.2	0
Salt, 1 tsp.	10	0	0	0	0	0	0	0	0	0	0	0	0
Whitefish Roe	300	260	24.0	15.0	7.2	112	0	0	0	0	0	0	37.5
Water, 2 C	440	0	0	0	0	0	0	0	0	0	0	0	0
Total	1025	1223	49.2	17.6	210.2	867	525	3.5	0	0.20	0.12	3.2	37.5
Nutrient Composition/100 gm		119	4.8	1.7	20.5	7	5	0.4	0	0.02	0.01	0.3	4

TABLE 28 (continued)

Food Item	Weight	Calories	Protein	Fat	Carbohydrate	Calcium	Phosphorus	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Vitamin C
	gm		gm	gm	gm	mg	mg	mg	I.U.	mg	mg	mg	mg
ESKIMO ICE CREAM (TOCKTOO FAMILY, SHISHMAREF)													
Oogruk Oil, 2 C	440	3960	0	440.0	0	0	0	0	12270	0	0	0	0
Water, 3/4 C	165	0	0	0	0	0	0	0	0	0	0	0	0
Salmonberries, 10 C	1230	700	15.0	5.0	170.0	490	460	11.0	1600	0.30	0.80	4.0	1150
Sugar, 8 Tbs.	96	384	0	0	99.2	0	0	0	0	0	0	0	0
Reindeer Back Fat, 1 pc.	276	2452	1.9	271.4	0	0	0	0	0	0	0	0	0
Total	2207	7496	16.9	716.4	269.2	490	460	11.0	13870	0.30	0.80	4.0	1150
Nutrient Composition/100 gm		343	0.8	32.4	12.2	22	21	0.5	630	0.01	0.04	0.2	52
DUCK SOUP (KASIGLUK)													
Ducks, 4, 150 gm each	600	1240	91.2	94.4	0	76	920	23.2	0	0	0	0	0
Rice, 3/4 C (raw)	191	692	14.5	0.6	151.7	46	260	1.5	0	0.13	0.05	3.1	0
Potatoes, 3 small	172	144	3.6	0.1	33.5	20	97	1.2	30	0.17	0.08	2.1	25
Salt, 2 Tbs.	24	0	0	0	0	0	0	0	0	0	0	0	0
Onion, 1	110	49	1.5	0.2	11.3	35	48	0.6	60	0.04	0.04	0.2	10
Water, 4 qts.	4000	0	0	0	0	0	0	0	0	0	0	0	0
Total	5097	2125	110.8	95.3	196.5	177	1325	26.5	90	0.34	0.17	5.4	35
Nutrient Composition/100 gm		42	2.2	1.9	3.9	3	26	0.5	1	0.01	0	0.1	1
ESKIMO ICE CREAM (KASIGLUK)													
Fresh Whitefish, 1/2	100	105	23.4	1.3	0	356	0	0	106	0.13	0.22	0	4
Snowdrift, 3 Tbs.	42	378	0	42.0	0	0	0	0	0	0	0	0	0
Seal Oil, 1 1/2 C	330	2970	0	330.0	0	0	0	0	9197	0	0	0	0
Sugar, 1/2 C	100	385	0	0	100.0	0	0	0	0	0	0	0	0
Salmonberries, 1 1/2 qts.	738	420	9.5	3.5	102.0	294	276	6.6	960	0.18	0.48	2.4	690
Cranberries, 1 1/2 C	170	81	0.7	1.2	19.2	24	18	1.1	75	0.05	0.03	0.2	20
Total	1380	4339	33.6	378.0	221.2	674	294	7.7	10338	0.36	0.73	2.6	714
Nutrient Composition/100 gm		314	2.4	27.4	16.0	49	21	0.6	749	0.03	0.05	0.2	52
SEAL MEAT SOUP (TUZROYLUKE, POINT HOPE)													
Seal Meat Bone, 1 1/4 lbs.	567	828	183.7	10.3	0	68	0	0	0	0.68	1.91	0	14
Dry Onion Shreds, 2 Tbs.	15	38	1.0	0.2	8.7	32	44	0.5	50	0.02	0.03	0.2	9
Salt, 2 Tbs.	24	0	0	0	0	0	0	0	0	0	0	0	0
Flour, 1 1/2 C	165	578	15.6	1.7	121.8	448	798	4.8	0	0.72	0.44	5.7	0
Water, 4 qts.	4000	0	0	0	0	0	0	0	0	0	0	0	0
Total	4771	1444	200.3	12.2	130.5	548	842	5.3	50	1.42	2.38	5.9	23
Nutrient Composition/100 gm		30	4.2	0.3	2.7	11	18	0.1	1	0.03	0.05	0.1	1

TABLE 28 (continued)

Food Item	Weight gm	Calories	Protein gm	Fat gm	Carbohydrate gm	Calcium mg	Phosphorus mg	Iron mg	Vitamin A I.U.	Thiamine mg	Riboflavin mg	Niacin mg	Vitamin C mg
MOOSE SOUP (DERENDOFF, HUSLIA)													
Moose Meat, 1 pc.(6" x 6" x 2")	1656	1853	422.4	18.2	0	265	0	0	0	0.35	6.04	0	66
Macaroni, 2 C (dry)	210	830	28.2	3.0	168.4	48	364	3.2	0	0.20	0.14	4.4	0
Rice, 1 C (dry)	187	677	14.2	0.6	148.5	45	254	1.5	0	0.38	0.06	7.2	0
Onion, 1/2 med.	55	25	0.7	0.1	5.7	18	24	0.3	30	0.02	0.02	0.1	5
Potatoes, 3 med.	426	354	8.4	0.3	81.3	48	240	3.0	90	0.42	0.18	4.2	66
Catsup, 1 Tbs.	17	17	0.3	0.1	4.2	2	3	0.1	320	0.02	0.01	0.4	2
Water, 4 qts.	3720	0	0	0	0	0	0	0	0	0	0	0	0
Total	6271	3756	474.2	22.3	408.1	426	885	8.1	440	1.39	6.45	16.3	139
Nutrient Composition/100 gm		60	7.6	0.4	6.5	7	14	0.1	7	0.02	0.11	0.2	2
BEEF & VEGETABLE SOUP (FRED BIFELT, HUSLIA)													
Canned Vegetable Mix, 1 can	330	203	10.3	4.4	35.9	81	125	1.9	0	0.12	0.19	0.31	19
Canned Tomato Sauce, 1 can	2149	90	4.5	1.2	17.9	27	92	2.7	1680	0.22	0.17	4.50	69
Canned Carrots	246	69	1.2	1.0	15.0	54	58	1.5	29520	0.06	0.05	0.8	6
Rice, 1/2 C (raw)	96	346	7.2	0.3	75.9	23	130	0.7	0	0.06	0.02	1.5	0
Potatoes, 3 med.	297	279	7.2	0.3	66.9	39	195	2.4	60	0.33	0.15	4.2	51
Onion, 1 med.	110	49	1.5	0.2	11.3	35	48	0.6	60	0.04	0.04	0.2	10
Macaroni, 1/2 lb.	227	856	29.1	3.2	173.7	50	375	3.4	0	0.21	0.13	4.6	0
Beef, 3 1/4 lbs.	1362	3126	200.0	252.0	0	114	176	29.7	0	0.87	1.77	48.0	0
Water, 8 qts.	8000	0	0	0	0	0	0	0	0	0	0	0	0
Total	10917	5018	261.0	262.6	396.6	388	1200	42.9	34320	1.91	2.52	65.1	155
Nutrient Composition/100 gm		46	2.4	2.4	3.6	36	11	0.4	314	0.01	0.02	0.6	1
CLAM SOUP (FRED BIFELT, HUSLIA)													
Minced Clam, 3 cans	270	132	20.0	2.7	5.4	222	318	16.2	210	0.12	0.24	2.7	0
Potatoes, 3 med.	297	279	7.2	0.3	66.9	39	195	2.4	60	0.33	0.15	4.2	51
Onion, 1 med.	110	49	1.5	0.2	11.3	35	48	0.6	60	0.04	0.04	0.2	10
Rice, 2/3 C (dry)	128	461	9.8	0.4	100.6	31	174	1.0	0	0.08	0.04	2.1	0
Macaroni, 2/3 C (dry)	82	308	10.4	1.2	62.0	18	135	1.2	0	0.08	0.05	1.7	0
Milk, Evap., 1/2 can	192	265	13.4	15.2	19.0	467	374	0.4	768	0.10	0.69	0.4	2
Water, 4 qts.	4000	0	0	0	0	0	0	0	0	0	0	0	0
Total	5079	1494	62.3	20.0	265.2	812	1244	21.8	1098	0.75	1.21	11.3	63
Nutrient Composition/100 gm		29	1.2	0.4	5.2	16	24	0.4	21	0.01	0.02	0.2	1

TABLE 28 (continued)

Food Item	Weight gm	Calories	Protein gm	Fat gm	Carbohydrate gm	Calcium mg	Phosphorus mg	Iron mg	Vitamin A I.U.	Thiamine mg	Riboflavin mg	Niacin mg	Vitamin C mg
MOOSE MEAT SOUP (GEORGE YASKA, HUSLIA)													
Moose Meat	1672	1867	426.4	18.4	0	268	0	0	100	0.35	6.10	0	67
Potato, 1 med.	126	105	2.5	0.1	24.1	14	71	0.9	20	0.12	0.04	1.3	17
Rice, 1/2 C	137	338	7.1	0.3	74.3	23	127	0.8	0	0.19	0.03	3.6	0
Macaroni, 1 C	110	415	14.1	1.5	84.2	24	182	1.6	0	0.10	0.07	2.2	0
Shortening, 4 Tbs.	48	432	0	48.0	0	0	0	0	0	0	0	0	0
Water, 4 qts.	4000	0	0	0	0	0	0	0	0	0	0	0	0
Total	6093	3157	450.2	68.3	182.6	329	380	3.3	120	0.76	6.24	7.1	84
Nutrient Composition/100 gm		52	7.4	1.1	3.0	5	6	0.1	2	0.01	0.10	0.1	1
BLACK BEAR SOUP (F. OLIN, HUSLIA)													
Bear Meat	908	1237	232.3	34.2	0	187	(1179)	(21.6)	0	(0.63)	6.31	(35.6)	25
Rice, 1/2 C	96	346	7.3	0.3	75.8	23	160	0.7	0	0.06	0.02	1.6	0
Macaroni, 1/2 C	55	208	7.0	0.8	42.1	12	91	0.8	0	0.05	0.03	1.1	0
Dry Onion, 1/4 C	15	20	0.5	0.1	4.6	17	24	0.2	28	0.01	0.01	0.1	12
Water, 4 qts.	3720	0	0	0	0	0	0	0	0	0	0	0	0
Total	4794	1811	247.1	35.4	122.6	239	1454	23.3	28	0.74	6.37	38.4	37
Nutrient Composition/100 gm		38	5.2	0.7	2.5	5	30	0.5	1	0.02	0.13	0.8	1
INDIAN ICE CREAM (F. OLIN, HUSLIA)													
Pike, 1 (dressed)	535	431	100.0	0.9	4.5	1733	(200)	(1.6)	440	0	0.69	(4.6)	12
Moose Grease, 2 C	448	2976	0	330.0	0	0	0	0	0	0	0	0	0
Wesson Oil, 1 C	220	1768	0	200.0	0	0	0	0	0	0	0	0	0
Sugar, 1 C	200	770	0.1	0	199.0	0	0	0	0	0	0	0	0
Raisins, 1 C	160	429	3.7	0.8	113.9	125	206	5.3	80	0.24	0.13	0.8	0
Total	1425	6374	103.8	531.7	317.4	1858	406	6.9	520	0.24	0.82	5.4	12
Nutrient Composition/100 gm		454	7.3	37.3	22.3	130	28	0.5	40	0.02	0.06	0.4	1

present time a program is under way to determine the nutrient content of many more Alaskan foods. The food samples were collected by personnel of the AHRC, frozen and shipped to the Army Medical Research and Nutrition Laboratory in Denver for analysis. Analyses have been completed on 75 Alaskan foods for protein, fat, moisture, ash, calcium, vitamin A, thiamine, riboflavin and ascorbic acid (Table 29).

b. Background Data

No Eskimo or Indian village today exists entirely on native foods. Most villages have one to two trading posts, often locally owned and operated, or the villages may be located fairly close to a trading center. The quantity and variety of food sold depend not only on the total cash income coming into the village but also on the priority given food purchases in the family spending program. Items such as fuel, outboard motors, trapping and hunting gear, lumber and other building materials, radios, gasoline-driven washing machines and "store" clothing compete for the few hundred dollars the average Eskimo or Indian may earn each year. The nutritional importance of the traditional local foods becomes apparent when so little money is available.

The most important food items sold in village stores are: milk, commercial fats, flour, cereal, crackers, sugar and sweets, vegetables, fruits, coffee and tea.

Most milk sold is evaporated milk. It is used in infant feeding formulas, on breakfast cereals, in coffee and in various dilutions as a beverage for young children. The actual amount used by a family depends to a great extent on their available money, which is not only variable throughout the year but also from year to year. Nonfat milk solids, canned chocolate toddy and condensed milk are used in small amounts. The condensed milk is taken by the men on their hunting, fishing and trapping forays during the winter. It does not freeze as does evaporated milk. Nonfat milk solids are not generally used, and there has not been an adequate teaching program to encourage their use.

Lard, hydrogenated cooking fats and edible tallow are the most important fats sold. Lesser amounts of margarine, butter and salad oils are used. Lard and hydrogenated cooking fats are used as a spread on bread; hydrogenated fats are also used in making agutuk (Eskimo ice cream) as is edible tallow. A considerable amount of edible tallow sold in some villages is used to prepare dog feed.

Flour, white and enriched, oatmeal, rice, macaroni and pilot bread and other crackers are the most important carbohydrate foods sold. Cookies and commercial cake, biscuit and pancake mixes are used in small amounts. Most bread is homemade. Yeast bread is made to some extent, but only in those villages where either a teacher or a missionary has taken the time to teach the women how to prepare and cook it. The usual bread is made of flour, water, fat and a leavening agent such as soda or baking powder. Pancakes are used almost universally throughout Alaska not only as a breakfast food but also as bread at other meals. They require a minimum of cooking fuel in their preparation, a very scarce item in many of the coastal and tundra villages. Rice and macaroni are used in fish and meat soups.

TABLE 29

CHEMICAL COMPOSITION OF ALASKAN FOODS, 1958

Nutrients/100 gm of Food

Food Items, Origin and Date Collected	Moisture gm	Ash gm	Protein gm	Fat gm	Carbohydrate gm	Calcium mg	Vitamin A I.U.	Thiamine mcg	Riboflavin mcg	Vitamin C mg
Mammals, Fresh Meat										
Polar Bear, Pt. Hope, March 1958	70.3	1.1	25.6	3.1	0.0	17	1400	23	573	2
Caribou, Noatak	70.6	1.1	26.7	1.2	0.4	28	trace	167	509	2
Caribou, Pt. Hope, March 1958	68.7	1.1	28.9	1.1	0.0	15	trace	113	670	3
Caribou, Shishmaref, March 1958	70.8	1.5	26.6	1.2	0.0	10	trace	186	772	4
Moose, Noatak, March 1958	72.4	1.0	25.5	1.1	0.0	16	1000	21	365	4
Muskrat, Kasigluk, 1958	73.4	1.1	22.4	1.3	0.0	25	2820	90	372	5
Beaver, Allakaket, March 1958	46.2	0.6	14.3	39.0	0.0	-	-	61	310	2
Seal, Pt. Hope, March 1958	64.7	1.1	32.4	1.8	0.0	12	-	120	337	3
Seal, Shishmaref, March 1958	68.5	1.2	29.6	0.4	0.3	33	-	0	380	6
Walrus, St. Lawrence, March 1958	59.9	1.3	26.5	11.6	0.0	15	-	281	372	4
Walrus, Shishmaref	76.5	0.7	15.4	5.2	0.0	-	-	-	-	2
Oogruk, Shishmaref, April 1958	69.6	1.2	26.7	0.4	0.0	10	1400	135	273	25
Whale, Pt. Hope, July 1958	75.0	0.9	23.6	0.7	0.0	17	-	85	80	8
Muktuk, Hide, Pt. Hope, July 1958	68.1	0.2	12.3	1.2	18.2	13	-	501	0	2
Meats, Dried										
Seal, Newktok Camp, 1958	41.2	2.6	46.0	6.6	0.0	19	360	174	353	7
Walrus, Savoonga, 1958	33.6	2.7	54.5	4.9	4.2	23	1732	84	282	5
Muskrat, Kasigluk, 1958	33.3	2.1	28.4	36.2	0.0	130	4170	41	535	6
Oogruk, Shishmaref, 1957	19.0	3.3	75.0	2.8	0.0	21	2160	84	390	3
Walrus Liver, Fresh, St. Lawrence, May 1958	73.4	1.2	17.6	3.2	4.6	23	17,800	151	912	19

TABLE 29 (continued)

Food Items, Origin and Date Collected	Moisture gm	Ash gm	Protein gm	Fat gm	Carbohydrate gm	Calcium mg	Vitamin A I.U.	Thiamine mcg	Riboflavin mcg	Vitamin C mg
Fats and Oils										
White Fish Oil, St. Lawrence, 1958	0.0	0.0	0.0	100.0	0.0	14	-	0	26	1
Seal Oil, Nunivak, 1957	0.0	0.0	0.0	100.0	0.0	-	3990	0	-	0
Seal Oil, Akiak	0.0	0.0	0.0	100.0	0.0	18	4080	20	62	1
Seal Oil (Old), Nunivak, 1957	0.0	0.0	0.0	100.0	0.0	14	2787	0	73	1
Seal Oil (New), St. Lawrence, 1958	0.0	0.0	0.0	100.0	0.0	trace	2407	0	117	0
Seal Blubber, Shishmaref, 1958	1.0	0.0	0.7	98.3	0.0	11	2360	0	24	1
Walrus Oil (Old), St. Lawrence, 1957	0.2	0.0	0.0	99.8	0.0	11	3266	0	64	1
Walrus Oil (New), St. Lawrence, 1958	0.0	0.0	0.0	100.0	0.0	15	2520	26	trace	0
Oogruk Oil (Old), Shishmaref, 1957	0.5	0.0	0.0	99.5	0.0	trace	642	0	45	0
Muktuk Blubber, Point Hope, 1958	9.5	0.9	2.8	85.2	1.7	15	278	243	-	-
Seal Blubber, Point Hope	1.0	0.0	0.0	99.0	0.0	-	-	501	59	7
Oogruk Oil (Old), St. Lawrence	0.5	0.0	0.0	99.5	0.0	-	2510	0	-	1
Fish Flesh, Dried										
Smoked Salmon	11.1	3.5	46.4	36.6	2.4	18	-	28	204	3
King Salmon, Kasigluk	14.1	3.3	51.0	24.9	6.7	19	219	99	224	5
Dog Salmon, Shishmaref, 1958	26.2	3.7	55.7	1.2	-	58	143	360	60	5
Pike, Kasigluk, June 1958	22.6	3.9	68.7	2.8	2.0	32	-	51	98	4
White Fish, Kasigluk, 1958	18.0	5.7	69.0	3.2	0.9	960	-	51	112	15
Fish Eggs, Fresh										
White Fish	83.8	0.6	8.0	5.0	2.4	54	-	137	673	13
King Salmon, Akiak, 1957	46.0	1.9	30.4	15.0	6.7	30	185	231	700	2
Herring, Nelson Island	73.7	1.3	23.6	0.2	1.2	46	-	10	298	7
Lush Fish, Shishmaref, June 1958	74.3	1.8	18.2	4.5	1.2	11	-	108	547	8
Smelt	61.6	1.5	21.4	5.6	9.9	32	-	-	-	-

TABLE 29 (continued)

Food Items, Origin and Date Collected	Moisture gm	Ash gm	Protein gm	Fat gm	Carbohydrate gm	Calcium mg	Vitamin A I.U.	Thiamine mcg	Riboflavin mcg	Vitamin C mg
Fish Eggs, Dried										
Herring, Nelson Island	20.4	2.7	64.4	4.0	8.5	25	-	0	208	8
Fish Liver, Fresh										
White Fish, Noatak	78.8	0.7	11.0	4.4	5.1	55	8300	14	952	8
Rainbow Trout	-	-	-	-	-	9	1720	289	882	15
Fresh Fish, Shishmaref, March 1958	60.2	1.0	8.3	24.7	5.8	40	-	186	402	7
Lush Fish, Akiak	45.9	0.5	5.6	42.0	6.0	-	3940	-	-	4
King Salmon, Bethel, June 1958	69.8	1.3	16.6	8.0	4.3	28	3140	97	703	13
King Salmon, Testes, Bethel, 1958	80.0	2.2	16.3	1.5	0.0	13	-	194	201	31
Birds										
Ptarmigan, Lower Kuskokwim	71.2	1.7	25.7	1.4	0.0	351	trace	71	229	7
Murre	58.9	1.2	5.3	2.5	32.2	17	-	122	588	7
Eider Duck, St. Lawrence, July 1958	68.3	1.1	12.3	1.1	17.2	17	-	801	676	12
White-breasted Auklet	65.1	0.7	29.7	2.2	2.7	25	-	482	660	6
Crested Auklet	68.0	1.5	25.5	5.0	0.0	23	-	179	1117	9
Least Auklet	64.4	1.6	28.8	3.4	1.8	15	-	532	738	11
Sea Pigeon	79.8	0.8	16.6	2.2	0.7	34	-	562	892	19
Cormorant, Legs, St. Lawrence	71.1	1.3	23.8	1.9	1.9	18	-	219	252	15
Cormorant, Breast, St. Lawrence, July 1958	73.4	1.3	21.2	1.9	2.2	21	-	33	689	5
White Breasted Puffin	67.0	1.4	26.7	2.5	2.4	17	-	315	358	15
Goose, Newktok Camp	71.5	2.0	24.0	0.6	0.0	18	-	89	545	5
Goose Liver	-	-	-	-	-	16	-	-	-	-
Devil Fish, Newktok Camp, 1958	80.8	1.5	11.7	5.3	0.7	329	-	46	95	3

TABLE 29 (continued)

Food Items, Origin and Date Collected	Moisture gm	Ash gm	Protein gm	Fat gm	Carbohydrate gm	Calcium mg	Vitamin A I.U.	Thiamine mcg	Riboflavin mcg	Vitamin C mg
Fish Flesh, Fresh										
White Fish, Noatak	70.9	2.0	25.8	1.3	0.0	356	106	135	222	6
Blackfish (Whole), Kasigluk, April 1958	79.4	1.7	16.9	0.7	1.4	880	83	0	214	6
Stickleback (Whole), Hooper Bay	71.9	4.5	20.7	2.2	0.7	901	467	44	1434	6
Rainbow Trout, Noatak, March 1958	72.9	1.2	24.4	1.5	0.0	54	trace	74	185	5
Lush Fish, Shishmaref, March 1958	74.2	1.0	24.2	0.7	0.0	81	101	167	380	5
Lush Fish, Akiak, April 1958	78.7	1.1	19.7	0.5	0.0	20	trace	74	74	3
Tomcod, Turamak, June 1958	78.1	1.6	19.6	0.3	0.0	250	-	55	139	2
Tomcod, Point Hope	71.7	4.3	20.2	3.8	0.0	494	120	269	625	5
Pike, Head End, Kasigluk	80.1	1.1	18.4	0.4	0.0	80	-	75	51	2
Pike, Middle Cut, Kasigluk	77.7	2.4	18.7	0.2	1.1	62	900	36	88	6
Pike, Tail Cut, Kasigluk	80.1	1.7	17.5	0.7	0.0	28	-	42	49	4
Smelts (Whole)	79.8	2.3	15.3	2.4	0.2	476	-	41	812	1
King Salmon, Head End, Bethel, June 1958	69.5	2.5	4.6	7.1	-	20	-	156	50	8
King Salmon, Middle, Bethel, June 1958	70.5	1.8	21.4	3.3	0.0	22	-	105	108	4
King Salmon, Tail End, Bethel, June 1958	66.1	0.9	5.5	8.4	9.1	14	-	219	46	5
Grayling, Noatak	70.2	4.8	23.4	1.6	0.0	532	81	-	-	4
Plants										
Marine Algae (Seaweeds)										
Alaria, St. Lawrence, 1958	73.9	5.4	1.6	0.4	18.6	303	-	74	102	69
Laminaria, St. Lawrence, 1958	84.2	3.2	0.5	0.2	11.9	138	-	42	99	50
Agarium, St. Lawrence, 1958	70.9	5.8	3.9	0.2	19.3	720	-	29	87	33

TABLE 29 (continued)

Food Items, Origin and Date Collected	Moisture gm	Ash gm	Protein gm	Fat gm	Carbohydrate gm	Calcium mg	Vitamin A I.U.	Thiamine mcg	Riboflavin mcg	Vitamin C mg
Flowering Plants										
Greens, St. Lawrence, 1958	80.5	1.2	4.3	0.8	13.2	205	-	49	258	377
Willow Leaves, St. Lawrence, 1958	66.5	0.7	3.7	1.2	28.0	129	-	88	186	298
Sedum, St. Lawrence, 1958	85.6	0.6	2.1	1.1	10.6	262	-	81	214	76
Sourdock, St. Lawrence, 1958	86.2	0.7	3.7	0.3	10.2	19	-	157	186	215
Salmonberries, Shishmaref, 1958	83.5	0.4	1.6	0.4	14.1	13	302	30	70	115

(Note: Before considering the chemical composition of fish, it should be realized that there is a considerable variation in such composition, so that analyses made on only a few samples cannot be considered representative, and, in fact, in many cases variation is so great that average composition is of only theoretical interest, since actually individual fish will vary so widely from such average values.

Doubtless the component of fish varying to the greatest degree is the oil (or fat) content. In addition to season of the year, other factors which may cause variation of oil content of fish include the nature of the food of the fish, locality where fish are caught, and the size and age. The water content of many species varies inversely with the fat or oil content. Fish also vary in composition at different sections of the same fish; fat content, for instance, is lower near the tail than the head.

Excerpt from: The Chemistry and Technology of Food and Food Products, edited by Morris B. Jacobs, Interscience Publishers, Inc., New York, Volume II, Chapter 22, pp. 933-974, 1951)

Granulated sugar, candy and gum are consumed more than other sweets such as commercial blend syrups, jams and preserves. The per capita intakes of sweets actually do not appear to be high in comparison with usage in the rest of the United States.

Only a limited number of fresh and canned vegetables are consumed. Onions, fresh and dried, are used extensively to flavor soups and stews. Potatoes and carrots would be eaten more often but they are costly and hard to keep and are usually available only at the time when the year's shipment of food is received. In most villages this is once a year during the summer or fall when the ice has gone.

Very few canned vegetables are popular. Corn is one of the exceptions. Fruits of all kinds -- fresh, dried and canned -- are well liked and eaten with relish. Cost is the limiting factor. A No. 2-1/2 can of fruit that would cost 30 cents in a continental U.S. grocery store may cost 55 to 75 cents in the Alaskan villages. Fresh fruits are difficult for the average village store to handle. A fresh apple or orange may cost from 10 to 50 cents.

Coffee and tea are taken extensively. Coffee is usually served for breakfast, tea for lunch and supper. Sugar is usually used in both. Evaporated milk is generally used in coffee, sometimes only enough to give color, but occasionally as much as one-fourth cup is put into each cup of coffee. In addition to the above, only limited quantities of canned meats, canned and dried soups, condiments and prepared desserts are used.

Data on the availability and preservation of native foods in the various villages are presented in Appendix C. These data also include remarks on the hunting and fishing cycles at each village.

c. Results

For the purpose of this report a preliminary table of food consumption in the villages was computed for 97 men between the ages of 16 and 75 years (Appendix B). Values were computed using food analysis data from the U.S. Army Medical Research and Nutrition Laboratory (Table 29), Rodahl(24), U.S. Department of Agriculture Handbook No. 8(25), and Bowes and Church(26). In some instances where food analyses were not available, values were assumed using items of similar nature. These data do not include any added vitamin supplementation.

The men were divided into four age groups, from 16 to 25, 26 to 40, 41 to 54, and 55 to 75 years (Table 30) and also separated by villages (Table 31) and the food intake values were tabulated according to these divisions. Daily food intakes for all the men averaged 1,855 calories, protein 136.0 grams, fat 72.9 grams, and carbohydrate 167.6 grams per man. Daily intakes of calcium, phosphorus, iron, vitamin A, thiamine, riboflavin, niacin and ascorbic acid are also summarized in these two tables. These intakes are in some contrast to those observed in the National Guard encampment where the food available to the men was almost unlimited. It must be assumed that the encampment measurements are highly atypical for Eskimo men. At the same time it is clear that the food pattern of Eskimos is highly variable from time to time. Accordingly, dietary surveys covering one or

TABLE 30

FOOD CONSUMPTION OF MEN IN VILLAGES - ALASKA, 1956 - 1958

Average Per Day for Each Age Group

Age Group	No. Men	Calories	Protein gm	Fat gm	Carbohydrate gm	Calcium mg	Phosphorus mg 1/	Iron mg 1/	Vitamin A I.U.	Thiamine mg	Riboflavin mg	Niacin mg 1/	Vitamin C mg
16-25 yrs	26	1896	136.8	66.8	191.9	958	1107	12.1	1395	0.65	1.88	15.9	35
S. D. ±		695	69.7	44.7	91.0	925	502	6.7	917	0.53	1.13	7.8	27
% of Consumed Calories			28.9	31.2	39.9								
26-40 yrs	29	1815	144.0	77.3	142.9	968	1106	10.1	1742	0.68	1.56	15.9	38
S. D. ±		942	136.1	48.2	68.5	1181	761	9.3	1921	0.88	1.82	12.7	34
% of Consumed Calories			31.8	38.3	29.9								
41-54 yrs	24	1933	140.8	72.6	178.0	1151	1020	9.2	1644	0.58	1.61	14.7	30
S. D. ±		752	83.0	46.3	66.8	1881	606	5.1	1214	0.42	1.03	14.6	37
% of Consumed Calories			29.1	33.8	37.1								
55-75 yrs	18	1753	115.6	75.0	158.2	1057	1042	10.3	1721	0.63	1.43	17.6	44
S. D. ±		703	59.7	49.2	86.3	1051	491	5.7	1561	0.39	0.66	10.9	49
% of Consumed Calories			26.4	38.5	35.1								
Mean	97	1855	136.0	72.9	167.6	1027	1073	10.5	1621	0.64	1.64	15.9	36
S. D. ±		784	95.2	46.4	79.4	1296	605	7.1	1449	0.61	1.29	11.7	36
% of Consumed Calories			29.3	35.4	35.3								

1/ Some of these values are assumed. No chemical analysis available.

TABLE 31

FOOD CONSUMPTION OF ALASKAN AND INDIAN MEN BY VILLAGES, 1956 - 1958

Village	No. Men	Calories	Protein gm	Fat gm	Carbohydrate gm	Calcium mg	Phosphorus mg	Iron mg	Vitamin A I.U.	Thiamine mg	Riboflavin mg	Niacin mg	Vitamin C mg
South													
Hooper Bay	19	1495	92.6	55.5	144.6	677	862	6.6	1288	0.51	0.99	9.6	34
Napaskiak	16	1467	103.3	71.8	103.7	582	590	4.6	1467	0.38	0.58	9.8	26
Newktok	11	1769	143.9	85.8	113.9	2682	1140	9.0	1752	0.75	2.07	26.2	32
Kasigluk	7	2327	219.0	94.4	150.8	2651	1555	12.6	1712	1.07	2.08	29.0	99
North													
Huslia	27	2035	149.2	51.0	251.5	632	1193	14.4	1442	0.65	2.00	16.5	29
Point Hope	11	2075	158.9	73.4	196.7	632	1177	12.2	2065	0.92	2.40	13.3	19
Shishmaref	6	2647	164.7	155.1	150.8	899	1445	17.6	2725	0.41	2.11	20.8	72
Mean for All Villages	97	1855	136.0	72.9	167.6	1027	1073	10.5	1621	0.64	1.64	15.9	36

a few days will often be poor representations of the long term performance. The excessively low values among some of these 97 men must reflect this kind of sampling error. A more accurate measurement of Eskimo food habits will be available when the entire dietary program is complete.

3. Discussion

The average daily caloric intake of the men living in the villages was considerably below the National Research Council allowance(27) for men weighing 60 kilograms and performing moderate activities. These minimal allowances of 2,850 calories for men aged 25, 2,700 for men aged 45, and 2,250 for men aged 65 are much higher than the average intake of 1,855 calories per man per day of the Eskimo and Indian men. These values were also lower than the 2,867 calories reported by Drury et al.(28) for a group of Eskimos at Anaktuvuk Pass.

This deficit of calories may then reflect upon the protein intake of 136 grams per day. Under these circumstances such a protein intake -- amounting to 25 to 30 percent of the calories -- may be in a physiological sense modest or even marginal. However, there was great individual variation, ranging from 22.9 to 379.5 grams per day. In general, values found in this study agree with the observations of Drury et al.(28) who found the protein intake averaged 29.9 percent of the total calories consumed by the Eskimos they studied.

Meat and fish are the most important daily food items. In villages favorably located for hunting and fishing, the people have meat or fish twice daily, sometimes thrice. This is especially true in the northern arctic villages.

Villages in the Kuskokwim-Yukon delta area sometimes experience a seasonal shortage of protein foods. For example, unless weather and shore ice conditions make sealing possible, Hooper Bay may be short of protein and other food nutrients from January through April, with March and April the most critical months. For several years the sealing at Hooper Bay had been poor to marginal until the winter of 1958, when both weather and shore ice conditions were again favorable for sealing.

However, the best sealing year at Hooper Bay cannot compare with sealing in some of the northern coastal villages. At Hooper Bay a good hunter considers himself fortunate if he secures 20 to 30 seals during the season; at Point Hope a good hunter can take 100 to 125 animals. The small seals (Phoca foetida) average 50 pounds in weight; the oogruk or large bearded seal (Erignathus bambatus) may weigh up to 600 pounds. During the winter months approximately one-half the weight of these animals, especially the females, may be fat or blubber. Consequently, the northern Eskimo may eat more seal and oogruk oil in his daily diet, not because his needs are greater but because he has a more abundant supply.

While the average protein content of the adult diet seems adequate, it is often quite variable in the small child's diet. As long as the infant is at the breast or on the bottle, the protein intake appears adequate. Bottle-fed infants usually get a formula made up of half evaporated milk

and half water. Occasionally sugar is added. Both bottle and breast babies are fed on demand. Nowadays most babies are weaned by the end of the first year, although they may continue to get the breast or bottle occasionally until about two years of age. Sometimes a toddler is kept on an almost exclusive milk diet, and while the children are allowed to taste the available meat, fish and other foods, they do not always get them in sufficient quantities to meet normal protein needs.

Infant feeding practices among the Eskimos have undergone considerable change since the white man first invaded the Arctic. In the old Eskimo culture, babies were breast fed for at least two years, sometimes considerably longer, the child usually being weaned with the advent of another child in the family. Family foods were introduced to the child by the mother who premasticated them and then transferred them from her mouth to that of the child. By the time the child had sufficient teeth it had already learned to accept and enjoy the taste of the usual family foods. Because of the possible relationship of this premastication practice to the spread of tuberculosis, this custom has been effectively discouraged. Unfortunately, no good substitute has been introduced to replace it. As a consequence, the diet of the toddler and young preschool child is often nutritionally deficient.

These dietary intakes of vitamin A are of great interest in relation to the observations discussed above of low serum vitamin A levels and suggestive clinical signs of deficiency of vitamin A. It appears that the chemical and clinical findings agree with dietary practices. The error was in assuming that because vitamin A was abundant in the food environment it was, in fact, eaten. This does not seem to be so.

The fat intake of the 97 men studied was surprising, since the average daily consumption of the four age groups was only 35 percent of the total calories consumed. These values were considerably lower than the fat-caloric intake of American military populations which average 43 percent of the total calories consumed(29). On the other hand, these values are in agreement with the work of Drury et al.(28), who reported a fat-calorie ratio of 35.2 percent in the diet of inland Eskimos living at Anaktuvuk Pass in Alaska. This finding is contrary to the popular belief that Eskimos consume a high fat diet, since they have large quantities of seal oil, oogruk oil and blubber available. It is probably explained in part by the distribution of fat in the marine animals these people eat. The fat of a seal and many other arctic animals is predominantly in the subcutaneous layer of blubber. The muscles contain little of the marbling characteristic of domestic fattened animals. This fact is emphasized in comparison of fat content of various meats shown in Table 32.

The average ascorbic acid intake of 36 mg per day was low but only when compared to the NRC recommended allowances of 75 mg per day(27); however, this average intake was in the "acceptable" range according to the ICNND guide for interpretation of nutrient intake (Table 33). Of the 97 diets studied 53 individuals consumed less than 30 mg per day ("low" intake 10 to 29 mg). Only two or three cases of known scurvy among Alaskan Eskimos have ever been reported by examining physicians and these

TABLE 32

FAT CONTENT OF COMMONLY EATEN MEATS

gm/100 gm Edible Portion - Uncooked

Alaskan Eskimo Diet			United States Diet		
Item	Protein	Fat	Item	Protein	Fat
Seal	32	1.8	Veal side	19	12
Walrus	27	12.0	Chicken	20	13
Whale	24	0.7	Pork side	12	45
Oogruk	27	0.4	Lamb side	16	28
Caribou	27	1.2	Beef roast	17	23
Moose	26	1.1	Beef steak	16	25
Polar bear	26	3.1	Hamburger	16	28
Beaver	14	39.0	Frankfurter	14	21

TABLE 33

GUIDE TO INTERPRETATION OF NUTRIENT INTAKE DATA

YOUNG ADULT MALES[1]

		Deficient	Low	Acceptable	High
Niacin	mg/day	< 5	5-9	10-15	> 15
Riboflavin	mg/day	< 0.7	0.7-1.1	1.2-1.5	> 1.5
Thiamine	mg/1000 cal.	< 0.2	0.20-0.29	0.3-0.5	> 0.5
Ascorbic Acid	mg/day	< 10	10-29	30-50	> 50
Vitamin A	I.U./day	< 2000	2000-3499	3500-5000	> 5000
Calcium	gm/day	< 0.3	0.30-0.39	0.4-0.8	> 0.8
Iron	mg/day	< 6.0	6-8	9-12	> 12
Protein	gm/kg	< 0.5	0.5-0.9	1.0-1.5	> 1.5

These guides are intended to apply to 25 year old physically active males of 67 in. (170 cm.) in height and 143 lb. (65 kg.) in weight, living in a temperate climate and consuming a varied diet. The quantities specified should never be considered as inflexible "requirements." In interpreting nutrition surveys of population groups, average values falling in one or another of the above categories conceal the fact that some individuals will receive more and others less than average. In addition, it is known that there is much variability from one to another individual in their requirement for various nutrients Variations in body size, activity, climate, types of food available and other factors modify requirements and, consequently, interpretation of survey data. The nutrient content of food may be altered materially during food preparation, a fact which must always be considered in evaluating dietary intake data.

1/ Prepared by the Interdepartmental Committee on Nutrition for National Defense.

were in infants who were "neglected." The usual symptoms of ascorbic acid deficiency -- spongy bleeding gums and easy bruising -- were not evident on clinical examination. Therefore, it must be assumed that the diet contains at least the minimal quantities of vitamin C required to prevent these symptoms.

Foods with high ascorbic acid value are available to the Indian and the Eskimo. Cloudberries (Rubus chamaemorus L.) are an excellent source and they are available in quantity in many parts of Alaska. These berries are gathered and stored for winter use by many Eskimo families; others use them only in season or store small amounts. From conversations with the older people in the villages it was found that the usual practice at one time was for each family to gather and store enough to last throughout the winter, although occasionally the berry crop was poor. The berries were stored either in seal pokes, or in tightly woven grass baskets which were buried in the ground until needed. The usual method today is to store the berries in barrels or kegs in a cool place.

When the berries are frozen during storage they retain a good share of their ascorbic acid. Totter(30) found winter-stored cloudberries averaged 90 mg of ascorbic acid per 100 grams of berries. One sample stored in an ice cellar for seven months contained 178 mg of ascorbic acid per 100 grams; another sample which had been allowed to ferment during storage had lost all of its ascorbic acid value. The present analyses of salmonberries stored for six months averaged 115 mg of ascorbic acid per 100 grams of berries (Table 29).

The young, tender, smooth leaves of one of the arctic willows (Salix pulchra) are collected in early spring in some areas. Totter(30) found fresh specimens contained over 500 mg of ascorbic acid per 100 grams. The present analysis of the willow leaves assayed 298 mg per 100 grams (Table 28). One sample tested, which had been stored for at least 10 months in an ice cellar, retained a significant amount of vitamin C. Willow leaves are stored raw, being first lightly marinated with fresh seal oil. They are usually stored in a cool cache. One sample of greens from St. Lawrence Island analyzed at the U.S. Army Medical Research and Nutrition Laboratory after storage for approximately two months contained 377 mg of vitamin C per 100 grams of greens (Table 29). The fresh tender leaves of sourdock (Rumex arctica) contain 400 or more milligrams of ascorbic acid per 100 grams (Totter, 30). Sourdock is used in considerable quantities in season. Some families still store varying amounts, cooked before storage, for winter use, but this practice is disappearing. Our sample of sourdock which had been stored for two months contained 215 mg of ascorbic acid per 100 grams of sourdock (Table 28).

Minute seedlings of Eriophorum ssp., the major part of the "mouse nuts" collected at Hooper Bay and other nearby villages, may also be a good source of vitamin C. Under the brown scruffy exterior is a green, succulent bud. The "mouse nuts" are collected by the people living in the Yukon-Kuskokwim River delta. A family may collect one or more 100-pound bags every fall. These "mouse nuts" are first gathered by the field mice who store them in underground caches around the margins of tundra lakes and ponds. The women hunt for these caches in the fall of the year. In the fall of 1957

no "mouse nuts" were available in the Hooper Bay area because a particularly high tide flooded the surrounding coastal tundra, wiping out the field mouse population. "Mouse nuts" are used in making agutuk (Eskimo ice cream), or oknuk (Eskimo soup). Plant seedlings and arctic alpine plants usually have a high ascorbic acid value.

There are areas, especially along the northwest and north Arctic coast, where these greens are either not available or available in only small amounts and thus are not a significant food in the local dietary. Yet ascorbic acid shortage, as judged by the criteria already mentioned, does not appear to be a problem. Undoubtedly fresh seal livers, fresh animal livers, and fish livers may furnish considerable amounts, especially when eaten in large quantity and raw, fresh, or frozen, as is the custom even today. However, these meats are available only in season.

Raw, fresh, or frozen fish and meat are also sources of vitamin C. In some of the tundra areas the small fish such as the sticklebacks (needlefish) and blackfish are used extensively throughout the winter and early spring and are usually eaten whole, raw, fresh, or frozen. Other foods eaten raw frozen are whale meat, seal meat, sheefish, grayling, tomcods, flounders and whitefish. Even if they contain only small amounts of ascorbic acid, they might be a significant source of this vitamin because of the quantities used daily in the diet during the winter months.

The vitamin A intake of the 97 men, averaging 1,621 International Units (I.U.) per day, was low when compared to the NRC recommended allowance of 5,000 I.U. per day, and the ICNND guide "low" of less than 3,500 I.U. Only 7 individuals consumed 3,500 I.U. or more. While many local foods are obviously rich in vitamin A, this vitamin is not always adequate in present-day Eskimo and Indian diets. Animal livers are of course an excellent source of vitamin A, but they are usually eaten only during the particular season when these animals are available. Seal liver, which is eaten either raw, frozen, or fried, is especially important in many of the coastal villages. Totter(31) found seal liver contained 75,200 I.U. per 100 grams of liver. Even a 50-gram serving once a week during the sealing season would assure attainment of the NRC adult recommended daily allowance(28)

Fish livers are an excellent source of vitamin A and are consumed during the fish runs. Small fish are always eaten whole and as a result should furnish a considerable quantity of vitamin A. Tomcod, ling cod and whitefish livers are especially prized in some areas. The tundra Eskimos make a cream dish of whitefish livers mixed with berries and sugar. This is, however, a delicacy rather than a regular item in the diet. Totter(30) found 100 grams of tomcod liver would furnish 12,210 I.U. of vitamin A.

Salmon is a fair source of vitamin A, pink salmon furnishing approximately 80 I.U. per 100 grams and King and Red salmon furnishing considerably more than this. In those areas where it is used almost daily throughout the year, either fresh or dried, salmon is an important steady source of vitamin A. However, improper storage destroys vitamin A. The high humidity prevalent during the summer on the tundra and some coastal areas makes it very difficult to dry fish adequately and to store them so that they do not become contaminated with molds.

Greens, such as willow leaves, sourdock and marsh marigold, when used in fairly large quantities should furnish considerable amounts of beta-carotene. Unfortunately, even though they are available in many areas, they are not used in the amounts that they were formerly, nor are they always stored under the old conditions.

Beluga whale, walrus, oogruk and seal oil when properly stored to prevent rancidity can also be good sources of vitamin A.

Despite these rich and varied sources of vitamin A and carotene the evidence of suboptimal vitamin A nutriture supplied by the serum levels in the survey herein recorded presents an anomaly. The low serum vitamin A levels were unexplained, as were the rare Bitot's spots. The linking hypothesis for further studies of this problem would seem to be a question as to the availability of the vitamin A and provitamins in these diets.

The thiamine intakes (0.65 mg per day) were considerably lower than the recommended allowances of the NRC(27). The latter states that the intake of males should not be below 1 mg per day, and alternatively presents data indicating that the minimal requirements for adults should be approximately 0.2 to 0.3 mg per 1,000 calories consumed.

The riboflavin consumption of 1.65 mg daily was sufficient to prevent deficiencies and to provide adequate body stores. The niacin intakes of 16 mg per day were satisfactory according to the ICNND guide, but slightly lower than the recommended NRC allowance of 18 to 21 mg daily for adult males between the ages of 25 and 65. It should be noted that even though some of the dietary intakes of the B-vitamins were marginal according to the NRC recommended allowances, the clinicians found little or no B-vitamin deficiencies in the Eskimo or Indian populations surveyed, nor would these have been expected at such intakes.

The calcium intake of 1 gram per day and the calcium-to-phosphorus ratio were adequate. These satisfactory levels were due primarily to the high consumption of fish, which in some instances were eaten whole, especially blackfish and needlefish. Whole blackfish contained 880 mg and the sticklebacks or needlefish 901 mg of calcium per 100 grams of fish. The calcium and phosphorus intakes, as bone, raise the question of whether a vitamin D requirement exists for even the children.

The average daily intake of 10 mg of iron should be sufficient to maintain normal nutrition. The cause of the mild anemia which has been reported among the Eskimos(3) is still unexplained. In the present survey neither the extent nor severity of anemia was notable.

As a final comment it should be noted as stated above that the vitamin content of many Eskimo and Indian diets has been supplemented in the past several years by administration of a multivitamin pill to school-age children as part of the Bureau of Indian Affairs school lunch program and to participants in the tuberculosis chemotherapy program. The practice of vitamin supplementation of infant diets is being encouraged by nurses, teachers and doctors, who have been successful in some instances in influencing village councils to furnish a suitable vitamin preparation to all mothers with small infants. This program, where instituted, is usually

financed by village subscription. Increased bottle feeding of infants makes such supplementation imperative. To date, the toddler and preschool child have usually not been included in these programs.

VI - BIOCHEMICAL FINDINGS

During the first three or four days of their encampment fasting blood and six-hour urine specimens were collected from the men in the two Eskimo battalions of the Alaska National Guard.

The blood samples were collected in two vacutainer tubes, a 20 ml size for whole clotted blood and a 10 ml oxalated tube containing 20 mg of the oxalate mixture per tube for the hematocrit and hemoglobin analyses. The oxalated blood specimens were analyzed daily for hemoglobin, hematocrit, serum protein,1/ and ascorbic acid at the Arctic Health Research Center in Anchorage. Serum from the whole blood sample was frozen for analysis elsewhere.

The six-hour urine volumes were measured, a 60 ml aliquot was acidified with 0.1 ml of concentrated hydrochloric acid and immediately frozen. The frozen serum and urine specimens were packed in dry ice and shipped air express to the U.S. Army Medical Research and Nutrition Laboratory in Denver, where they usually arrived within 20 hours, still in a frozen state.

There the serum was analyzed for vitamin A, carotene, total cholesterol, phospholipids and total fatty acids, and the urine was analyzed for thiamine, riboflavin, N'-methylnicotinamide and creatinine by the standard ICNND methods(10).

It was decided that 50 blood and urine samples were to be collected at each village. All individuals above the age of 3 years were given clinical examinations. The samples were obtained from the first 50 individuals over the age of 6 to be so examined. In the northern villages, 239 samples were collected, and in the southern areas, 222 specimens were collected from the men, women and children.

In the village studies a 60 ml aliquot of urine was acidified and frozen for future vitamin assay. The blood samples were allowed to stand and clot for 20 to 25 minutes, reamed with a wooden applicator, centrifuged, and the serum was then separated. A known aliquot was immediately pipetted into metaphosphoric acid for the estimation of ascorbic acid. The rest of the serum was frozen for further assays. Whenever time permitted, hemoglobin and serum protein determinations were performed in the field,2/ so that upon arrival at the home base in the evening only the hematocrit and ascorbic acid assays remained to be done. In this manner, the laboratory group was able to perform the analyses, clean the glassware and be prepared to leave for the next village on the next day, weather permitting.

All the frozen blood and urine samples were shipped in dry ice by air express to the Denver laboratory for the remaining analyses.

1/ Total protein was determined on serum in the field and on plasma in the laboratory in Anchorage. See Discussion, p.109.

2/ In the Bethel area, the samples were returned to the laboratory for analysis.

1. Methods

Hemoglobin and serum protein determinations were performed by the copper sulfate specific gravity method of Phillips and Van Slyke(32) with the gravities being recorded to the nearest 0.0005 unit. The hematocrit was determined using a Wintrobe tube(32) and centrifuging the blood at 3,000 revolutions per minute for 30 minutes or until no further packing of the cells occurred. Ascorbic acid in the serum was determined by the spectrophotometric 2,4-dinitrophenylhydrazine method of Roe and Kuether(33) with a modification by Schaffert and Kingsley(34). The protein in the serum was immediately precipitated with metaphosphoric acid for the vitamin C analysis and the filtrate was analyzed within 24 to 48 hours. Serum carotene and vitamin A were estimated by a modified Carr-Price reaction on the petroleum ether extract (Dann and Evelyn, 35, Lewis et al., 36, and Kaser and Stekol, 37).

Cholesterol was determined by a modified Schoenheimer and Sperry method(38). Total fatty acids were determined using a modified Smith and Kik(39) method, and phospholipids were determined by the method of Youngburg and Youngburg(40), measuring the lipid in terms of phosphorus.

In the urine, thiamine was determined by the thiochrome fluorometric procedure of Hennessey and Cerecedo(41) and Mickelsen et al.(42). Riboflavin was measured by the fluorometric procedure of Conner and Straub(43), while N'-methylnicotinamide was estimated fluorometrically by the method of Huff et al.(44).

Creatinine was measured by a modified Jaffe (alkaline picrate) reaction, using a modified Folin and Wu(45) method of Peters(46).

2. Results

Tables 34a, b, c and d give the number of blood and urine specimens collected from men, women and children during the study. In all, samples were obtained from 826 adult males, 145 adult females and 209 children for a total of 1,180 specimens. All individuals below the age of 15 years were classified as children.

The data in Table 34a summarize the results for serum protein, hemoglobin, hematocrit and packed cell volume in all the adult males, adult females and children. Table 40 gives the ICNND suggested guide to interpretation of biochemical data.

a. Serum Protein

The serum protein results are on the high side of normal; the mean for the male adults was 7.03 grams per 100 ml for the northern villages, 7.53 for the southern villages, 7.12 for the Eskimo guardsmen of Battalion 1 from the north and 7.14 grams per 100 ml for the guardsmen from the south. In adult women the mean was 7.21 and 7.74 grams per 100 ml, while the children had a mean of 7.06 and 7.67 grams per 100 ml for the northern and southern villages respectively. The highest percent of subjects having a serum protein level of less than 6.5 grams per 100 ml were the men (19 percent), women (6.6 percent) and children (8.8 percent) of the Kotzebue area.

TABLE 34 a

ALASKA, NUTRITION SURVEY, MARCH 1958*

BIOCHEMICAL FINDINGS, for NATIONAL GUARD and VILLAGES, by SEX and AGE[1/] GROUPS
TOTAL SERUM PROTEIN & HEMATOLOGY

		National Guard		Bethel Area [2/] (South)			Kotzebue Are [3/] (North)		
		Bn 2 (South)	Bn 1 (North)	Children[4/]	Women[5/]	Men[6/]	Children	Women	Men
Serum Protein Gm/100 ml	Number	316	382	87	65	56	113	76	63
	Mean	7.15	7.12	7.67	7.74	7.53	7.06	7.21	7.03
	S. E.	0.01	0.01	0.04	0.05	0.06	0.04	0.04	0.06
	S. D.	0.24	0.23	0.33	0.40	0.42	0.39	0.39	0.49
Percentage Distribution	< 6.5	2.2	2.1	0.0	0.0	1.8	8.8	6.6	19.0
	6.5-6.9	11.7	15.4	1.1	6.2	3.6	24.8	11.8	12.7
	≥ 7.0	86.1	82.5	98.9	93.8	94.6	66.4	81.6	68.3
Hemoglobin Gm/100 ml	Number	311	381	87	66	56	110	69	60
	Mean	14.3	14.6	12.6	12.8	13.7	12.2	12.4	13.3
	S. E.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	S. D.	0.9	0.9	1.0	1.2	1.0	0.7	1.0	0.9
Percentage Distribution	< 10.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0
	10.0-11.9	0.3	0.3	20.7	21.2	7.1	40.0	33.3	5.0
	12.0-13.9	36.7	27.3	73.6	66.7	53.6	59.1	59.4	75.0
	14.0-15.9	60.1	64.3	4.6	12.1	39.2	0.9	5.8	20.0
	≥ 16.0	2.9	8.1	1.1	0.0	0.0	0.0	0.0	0.0
Hematocrit Percent	Number	308	380	92	64	56	109	66	60
	Mean	47.1	47.0	40.1	40.8	44.0	41.3	42.2	45.5
	S. E.	0.2	0.1	0.2	0.4	0.4	0.3	0.4	0.3
	S. D.	2.7	2.4	2.4	3.1	3.0	2.9	3.1	2.5
Percentage Distribution	< 36	0.0	0.0	5.4	6.3	0.0	2.8	3.0	0.0
	36-41	2.6	2.4	75.0	57.8	16.1	61.5	43.9	6.7
	42-45	29.9	30.3	17.4	32.8	58.9	29.4	42.4	51.7
	≥ 46	67.5	67.4	2.2	3.1	24.9	6.4	10.6	41.7
Mean Corpuscular Hemoglobin Concentration Percent	Number	304	378	87	63	55	107	66	60
	Mean	30.5	31.1	31.6	31.7	31.4	29.6	29.3	29.4
	S. E.	0.1	0.1	0.3	0.3	0.3	0.2	0.2	0.2
	S. D.	1.5	1.5	2.4	2.1	2.6	1.7	1.9	1.3
Percentage Distribution	< 28.0	3.9	1.3	2.3	3.2	3.6	15.9	22.7	13.3
	28.0-29.9	28.9	19.6	14.9	20.6	21.8	46.7	43.9	53.3
	30.0-31.9	56.2	54.2	42.5	34.9	45.5	28.0	25.8	31.7
	32.0-33.9	9.2	22.5	32.2	31.7	20.0	9.3	4.5	1.7
	≥ 34.0	1.6	2.4	8.0	9.5	9.1	0.0	3.0	0.0

* See Table 34 d for footnote explanations.

TABLE 34 b

ALASKA, NUTRITION SURVEY, MARCH 1958*

BIOCHEMICAL FINDINGS, for NATIONAL GUARD and VILLAGES, by SEX and AGE[1/] GROUPS
SERUM VITAMIN C, A AND CAROTENE

		National Guard		Bethel Area[2/] (South)			Kotzebue Area[3/] (North)		
		Bn 2 (South)	Bn 1 (North)	Children[4/]	Women[5/]	Men[6/]	Children	Women	Men
Serum Vitamin C Mg/100 ml	Number	295	353	87	60	57	91	65	51
	Mean	0.54	0.51	0.45	0.37	0.32	0.47	0.49	0.44
	S. E.	0.02	0.02	0.04	0.04	0.04	0.02	0.03	0.03
	S. D.	0.31	0.30	0.34	0.33	0.27	0.23	0.25	0.20
Percentage Distribution	< 0.10	7.1	4.0	19.5	21.7	26.3	3.4	4.6	2.0
	0.10-0.19	8.8	11.3	5.7	11.7	15.8	14.3	1.5	11.8
	0.20-0.39	17.6	25.8	21.8	30.0	19.3	19.8	35.4	31.4
	≥ 0.40	66.4	58.9	52.9	36.7	38.6	62.6	58.5	54.9
Serum Vitamin A Mcg/100 ml	Number	233	341	75	55	48	98	61	59
	Mean	37.4	36.6	28.7	34.0	32.8	28.6	30.1	29.5
	S. E.	1.0	0.6	1.7	2.6	2.9	1.2	1.8	1.5
	S. D.	14.7	11.9	14.6	19.1	20.4	11.8	13.9	11.6
Percentage Distribution	< 10	2.1	1.2	4.0	1.8	2.1	2.0	3.3	0.0
	10-19	10.3	6.2	25.3	21.8	24.9	20.4	14.8	20.3
	20-49	64.8	79.5	60.0	56.4	54.2	72.4	72.1	71.2
	≥ 50	22.7	13.2	10.7	20.0	18.7	5.1	9.8	8.5
Serum Carotene Mcg/100 ml	Number	237	342	76	55	49	101	62	60
	Mean	105	107	61	54	56	56	53	60
	S. E.	2	2	3	4	4	3	3	5
	S. D.	37	38	27	27	28	30	24	38
Percentage Distribution	< 20	0.4	0.0	2.6	3.6	0.0	3.0	1.6	0.0
	20-39	1.7	1.2	17.1	36.4	34.6	37.6	38.7	36.7
	40-99	41.8	44.7	75.0	50.9	55.1	48.5	54.8	48.3
	≥ 100	56.1	54.1	5.3	9.1	10.2	10.9	4.8	15.0

* See Table 34d for footnote explanations.

TABLE 34 c

ALASKA, NUTRITION SURVEY, MARCH 1958*

BIOCHEMICAL FINDINGS, FOR NATIONAL GUARD AND VILLAGES, BY SEX AND AGE GROUPS[1/]

TOTAL FATTY ACIDS, PHOSPHOLIPIDS AND CHOLESTEROL

		National Guard	Bethel Area[2/] (South)			Kotzebue Area[3/] (North)		
			Children[4/]	Women[5/]	Men[6/]	Children	Women	Men
Total Fatty Acids (Mg/100 ml)	Number	21	50	38	20	52	28	20
	Mean	270	208	279	246	240	282	279
	S.E.	19	8	10	11	8	10	12
	S.D.	85	60	64	50	60	53	51
Phospholipids (Mg/100 ml)	Number	21	50	38	20	52	28	20
	Mean	8.6	7.8	9.0	8.3	8.6	9.4	9.3
	S.E.	0.7	0.2	0.3	0.4	0.3	0.3	0.4
	S.D.	3.4	1.4	1.9	1.7	2.0	1.5	1.6
Total Cholesterol (Mg/100 ml)	Number	21	48	38	17	44	18	16
	Mean	227	158	213	199	162	192	182
	S.E.	18	5	7	14	6	7	10
	S.D.	80	33	42	58	38	31	39

* See Table 34 d for footnote explanations.

TABLE 34 d

ALASKA, NUTRITION SURVEY, MARCH 1958

BIOCHEMICAL FINDINGS, for NATIONAL GUARD and VILLAGES, by SEX and AGE[1] GROUPS

URINARY EXCRETIONS

		National Guard		Bethel Area[2] (South)			Kotzebue Area[3] (North)		
		Bn 2 (South)	Bn 1 (North)	Children[4]	Women[5]	Men[6]	Children	Women	Men
Thiamine Excretion Mcg/gm Creatinine	Number	308	378	78	57	50	103	63	59
	Median	240	220	450	130	140	700	330	190
Percentage Distribution	<27	3.6	2.9	7.7	22.8	16.0	1.0	7.9	1.7
	27-65	3.2	5.3	7.7	12.3	14.0	3.9	3.2	13.6
	66-129	13.6	18.3	6.4	15.8	18.0	7.8	12.7	16.9
	≥ 130	79.5	73.5	78.2	49.1	52.0	87.4	76.2	67.8
Riboflavin Excretion Mcg/gm Creatinine	Number	310	380	78	60	51	104	64	59
	Median	610	600	1190	760	640	1160	910	780
Percentage Distribution	< 27	0.0	0.3	6.4	3.3	3.9	0.0	1.6	1.7
	27-79	0.6	2.4	0.0	0.0	0.0	0.0	0.0	1.7
	80-269	8.7	13.4	5.1	11.7	7.8	10.6	9.4	11.9
	≥ 270	90.6	83.9	88.5	85.0	88.2	89.4	89.0	84.7
N'Methyl-nicotinamide Excretion Mg/gm Creatinine	Number	311	370	79	60	49	91	59	52
	Median	13.5	10.6	16.3	13.6	12.2	18.2	14.1	13.6
Percentage Distribution	<0.50	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
	0.50-1.59	0.0	3.5	0.0	0.0	0.0	1.1	0.0	1.9
	1.60-4.29	2.9	14.9	2.5	6.7	2.0	4.4	3.4	1.9
	≥4.30	97.1	81.4	97.5	93.3	98.0	94.5	96.6	96.2

1/ The child group contains subjects 6-14 years of age; subjects 15 years or over in age are included under the women and men categories; with pregnant or lactating women excluded.

2/ Bethel Area includes: Southern Eskimos from Akiak, Kasigluk, Napaskiak, Newktok and Hooper Bay.

3/ Kotzebue Area includes: Northern Eskimos from Noatak, Point Hope and Shishmaref, and Athabascan Indians from Huslia and Allakaket.

4/ Children includes: Subjects 6-14 years of age.

5/ Women includes: Females 15+ years of age.

6/ Men includes: Males 15+ years of age.

b. Hemoglobin

The mean hemoglobin values for the adult males were 13.3 grams per 100 ml for the northern Eskimos, 13.7 grams for the southern Eskimos, 14.6 grams for Battalion 1 members from the north, and 14.3 grams per 100 ml for Battalion 2 members from the south. These data suggest some selection of the male groups reflected in the higher levels among the men in the Alaska National Guard. In the adult women, the mean values were 12.4 grams per 100 ml for the northern villages and 12.8 grams per 100 ml for the southern villages. The women at Huslia had the lowest values, the mean being 11.4 grams per 100 ml (Table 36a). (It should be noted that only 8 women from Huslia took part in the biochemical tests.) The children from the northern areas had a mean of 12.2 grams per 100 ml, while the children from the south had a mean of 12.6 grams per 100 ml.

c. Hematocrit

The hematocrits were within the normal range for men, women and children. Men from the northern villages had mean average values of 45.5, the southern group 44.0, the Eskimo guardsmen from the north 47.0 and the Eskimo guards from the south 47.1 percent. The adult women had means of 42.2 and 40.8 percent for the north and south, respectively, while the children at these same locations had values of 41.3 and 40.1 percent.

d. Mean Corpuscular Hemoglobin Concentration

Because the northern villages had slightly lower hemoglobin levels and higher hematocrits than the southern villages, the mean corpuscular hemoglobin concentrations are lower in all age groups in the north. This trend is not noted in the men in the National Guard, where the reverse seems to be true.

e. Serum Ascorbic Acid

The mean ascorbic acid value in the serum was within the "acceptable" range (Table 34b), averaging above 0.40 mg per 100 ml for all the groups except the adult males in the southern villages who averaged 0.32 mg per 100 ml. The Kasigluk group had a mean of 0.27 mg per 100 ml (Table 36b). The highest percentage of subjects having levels of less than 0.1 mg of vitamin C per 100 ml of serum was found in the men of the southern area (26.3 percent). In general, the women and children of this area also had the highest percent with low values.

f. Serum Vitamin A and Carotene

Very few of the men, women and children had mean serum vitamin A and carotene values in the "deficient" range of less than 10 micrograms and 20 micrograms per 100 ml respectively (Table 34b). The men and children at Noatak and the women at Point Hope and Akiak had "low" or "marginal" values for serum carotene (Table 36b).

g. Total Fatty Acids, Phospholipids and Cholesterol

Table 34c presents serum fat analyses for men, women and children by area (northern and southern villages) and for the men in the National Guard. Table 36c further breaks down these data by village, and separates them into two age groups, those over 15 and those less than 15 years of age.

h. Urinary Excretion of Thiamine, Riboflavin and N'-Methylnicotinamide

The thiamine excretions for men, women and children were practically all in either the "acceptable" or "high" range by ICNND standards (Table 34d). The median values for adult males were 190 and 140 micrograms per gram of creatinine for the northern and southern villages, respectively. The lowest recorded median thiamine values were at Newktok in the south (Table 36d).

None of the riboflavin excretion data for men, women and children were in the "low" or "deficient" range (Table 34d). The lowest median adult values of 310 micrograms per gram of creatinine (still in the "high" range by ICNND standards) were at Huslia in the male population (Table 36d).

The N'-methylnicotinamide values for men, women and children were in the "high" range, above 4.3 mg per gram of creatinine, by ICNND standards. Eskimo men in Battalion 1 had a median value of 10.6 and Battalion 2 had a median of 13.5 mg per gram of creatinine. Due to an insufficient quantity of N'-methylnicotinamide standard, these values were computed using a standard curve. Later when the standard was available 202 urine samples were repeated using the internal standard method. These values are compared in Table 35, and average 1.32 mg for the internal standard method and 1.27 mg for the standard curve method. These differences were found not to be significant (P = 0.50).

TABLE 35

ALASKA, NUTRITION SURVEY, MARCH 1958

COMPARISON OF METHODS FOR DETERMINATION OF N'-METHYLNICOTINAMIDE

N'-MN Concentration (mg/100 ml urine)	Internal Standard	Standard Curve
0.1 - 0.4	49	37
0.5 - 0.9	47	64
1.0 - 1.4	42	48
1.5 - 1.9	24	18
2.0 - 2.4	17	5
2.5 - 2.9	4	10
3.0 - 3.9	5	15
4.0 - 4.9	8	4
5.0 +	6	1
TOTAL	202	202
MEAN	1.32	1.27

TABLE 36a

ALASKA, NUTRITION SURVEY, MARCH 1958

TOTAL SERUM PROTEIN AND HEMATOLOGY BY VILLAGE, FOR MEN, WOMEN AND CHILDREN

		Bethel Area						Kotzebue Area					
	Villages 1/	1	2	3	4	5	Total	6	7	8	9	10	Total
Number of Subjects	Children	14	17	14	16	26	87	17	27	23	20	26	113
	Women	16	14	11	7	17	65	18	15	19	13	11	76
	Men	11	19	21	0	5	56	16	5	12	16	14	63
Total Serum Protein Gm/100 ml	Children	7.63	7.83	7.66	7.47	7.71	7.67	6.97	6.91	7.23	7.05	7.14	7.06
	Women	7.60	7.76	7.85	7.75	7.77	7.74	7.18	7.11	7.25	7.32	7.20	7.21
	Men	7.36	7.67	7.54	-	7.31	7.53	7.13	7.16	7.03	7.00	6.89	7.03
Hemoglobin Gm/100 ml	Children	12.5	12.5	12.5	12.6	12.8	12.6	12.0	12.5	12.1	12.3	12.2	12.2
	Women	12.9	12.7	12.7	13.3	12.7	12.8	12.5	12.4	12.2	12.8	11.4	12.4
	Men	14.1	13.3	14.0	-	13.2	13.7	13.3	12.8	13.4	13.3	13.7	13.3
Hematocrit Percent	Children	38.9	40.8	40.2	40.5	39.9	40.1	40.2	41.3	40.8	43.0	41.2	41.3
	Women	40.0	40.2	41.2	42.6	41.0	40.8	42.8	42.6	41.4	43.3	40.6	42.2
	Men	43.0	43.6	45.2	-	42.4	44.0	46.1	44.4	44.6	45.2	46.6	45.5
Mean Corpuscular Hemoglobin Concentration Percent	Children	32.4	30.9	31.1	31.2	32.2	31.6	29.9	30.1	29.8	28.7	29.5	29.6
	Women	32.2	31.7	30.9	31.2	31.9	31.7	29.5	29.1	29.6	29.8	28.1	29.3
	Men	33.0	30.7	31.2	-	31.1	31.4	28.9	28.7	30.1	29.4	29.5	29.4

1/ Identification of villages:

1. Akiak
2. Kasigluk
3. Napaskiak
4. Newktok
5. Hooper Bay
6. Noatak
7. Point Hope
8. Shishmaref
9. Allakaket
10. Huslia

TABLE 36 b

ALASKA, NUTRITION SURVEY, MARCH 1958

SERUM VITAMIN C, A AND CAROTENE, BY VILLAGE

	Villages 1/	Bethel Area						Kotzebue Area					
		1	2	3	4	5	Total	6	7	8	9	10	Total
	Number	44	49	48	30	51	222	43	40	45	45	35	208
Serum	Mean	.49	.27	.53	.35	.33	.39	.46	.34	.63	.40	.52	.47
Vitamin C	S. E.	.06	.04	.04	.05	.04	.02	.03	.03	.04	.04	.03	.02
Mg/100 ml	S. D.	.37	.28	.27	.28	.30	.32	.20	.17	.25	.24	.16	.23
	<0.10	15.9	38.8	4.2	23.3	25.5	21.6	0.0	5.0	0.0	11.1	0.0	3.4
Percentage	0.10-0.19	6.8	14.3	6.2	10.0	9.8	9.5	4.7	20.0	6.7	11.1	5.7	9.6
Distribution	0.20-0.39	18.2	20.4	18.7	26.7	31.4	23.0	44.2	40.0	11.1	28.9	11.4	27.4
	≥0.40	59.1	26.5	70.8	40.0	33.3	45.9	51.2	35.0	82.2	48.9	82.9	59.6
	Number	30	45	46	27	48	196	42	45	39	46	48	220
Serum	Mean	40	29	28	27	32	31	24	25	37	33	29	29
Vitamin A	S. E.	4	2	2	2	3	1	2	1	2	2	2	1
Mcg/100 ml	S. D.	24	14	13	12	19	18	12	9	12	12	10	12
	<10	3.3	2.2	0.0	3.7	6.2	3.1	2.4	2.2	2.6	2.2	0.0	1.8
Percentage	10-19	20.0	24.4	23.9	33.3	22.9	24.5	35.7	33.3	7.7	8.7	10.4	19.1
Distribution	20-49	40.0	66.7	71.7	44.4	52.1	57.1	54.8	60.0	76.9	80.4	85.4	71.8
	≥50	36.7	6.7	4.3	18.5	18.7	15.3	7.1	4.4	12.8	8.7	4.2	7.3
	Number	31	46	46	27	48	198	44	45	41	47	48	225
Serum	Mean	47	65	49	57	63	57	38	44	101	49	53	56
Carotene	S. E.	4	5	4	4	4	2	2	3	5	3	2	2
Mcg/100 ml	S. D.	21	34	26	27	25	28	12	21	34	23	16	31
	<20	6.4	0.0	4.3	3.7	0.0	2.5	2.3	2.2	0.0	4.2	0.0	1.8
Percentage	20-39	41.9	26.1	41.3	14.8	16.7	28.3	54.5	55.6	2.4	44.7	27.1	37.3
Distribution	40-99	51.6	54.3	50.0	77.8	77.1	61.6	43.2	40.0	46.3	51.1	70.8	50.7
	≥100	0.0	19.6	4.3	3.7	6.2	7.6	0.0	2.2	51.2	0.0	2.1	10.2

1/ Identification of villages:

1. Akiak
2. Kasigluk
3. Napaskiak
4. Newktok
5. Hooper Bay
6. Noatak
7. Point Hope
8. Shishmaref
9. Allakaket
10. Huslia

TABLE 36 c

ALASKA, NUTRITION SURVEY, MARCH 1958

MEAN BLOOD FAT LEVELS, BY VILLAGE AND AGE

		Bethel Area						Kotzebue Area					
Villages 1/		1	2	3	4	5	Total	6	7	8	9	10	Total
Number of Subjects	<15	7	9	6	8	20	50	9	8	9	8	18	52
	15+ yrs.	11	16	18	3	10	58	4	5	11	13	15	48
Total Fatty Acids (Mg/100 ml)	<15	236	223	226	211	184	208	198	243	236	260	253	240
	15+ yrs.	313	265	260	234	246	268	262	258	297	276	286	281
Phospholipids (Mg/100 ml)	<15	8.9	8.6	7.9	8.2	7.0	7.8	7.1	8.4	9.0	9.7	8.9	8.6
	15+ yrs.	9.7	9.3	8.1	8.3	8.3	8.8	7.6	8.5	9.9	9.5	9.7	9.4
Total Cholesterol (Mg/100 ml)	<15	192	158	150	163	147	158	146	144	150	200	167	162
	15+ yrs.	258	216	188	184	193	209	184	162	184	180	202	187

1/ Identification of villages:

1. Akiak
2. Kasigluk
3. Napaskiak
4. Newktok
5. Hooper Bay
6. Noatak
7. Point Hope
8. Shishmaref
9. Allakaket
10. Huslia

TABLE 36 d

ALASKA, NUTRITION SURVEY, MARCH 1958

URINARY EXCRETIONS BY VILLAGES FOR MEN, WOMEN AND CHILDREN

Villages 1/		Bethel Area						Kotzebue Area					
		1	2	3	4	5	Total	6	7	8	9	10	Total
Number of Subjects 2/	Children	13	15	13	12	25	78	16	26	21	15	25	103
	Women	17	10	10	6	14	57	18	12	16	10	7	63
	Men	9	18	18	-	5	50	15	7	12	15	10	59
Thiamine Excretion Mcg/gm Creatinine	Medians												
	Children	370	450	480	110	810	450	900	1180	1800	550	260	700
	Women	150	110	100	20	500	130	400	400	150	450	160	330
	Men	110	110	150	-	550	140	290	350	130	210	110	190
Riboflavin Excretion Mcg/gm Creatinine	Medians												
	Children	1250	730	2140	800	1380	1190	800	2020	3740	400	700	1160
	Women	750	680	700	900	900	760	940	1290	800	1000	450	910
	Men	450	600	660	-	1500	640	1330	1500	900	500	310	780
N'-Methylnicotinamide Excretion Mg/gm Creatinine	Medians												
	Children	16.5	18.7	20.0	12.0	16.3	16.3	15.0	20.0	21.2	20.0	11.9	18.3
	Women	12.9	16.5	13.3	12.5	11.7	13.6	14.6	13.0	13.2	22.0	10.0	14.1
	Men	12.5	9.8	12.9	-	12.5	12.2	16.3	13.3	13.3	16.2	9.0	13.6

1/ Identification of villages:

1. Akiak
2. Kasigluk
3. Napaskiak
4. Newktok
5. Hooper Bay
6. Noatak
7. Point Hope
8. Shishmaref
9. Allakaket
10. Huslia

2/ Numbers differ slightly for the different analyses. These are number of thiamine determinations.

3. Discussion

Total serum protein values in this study are slightly higher in women than in children and men. They are higher in the Bethel area by 0.5 grams per 100 ml, compared to the rest of the survey -- this includes comparison with National Guardsmen from the same area, and evidently reflects laboratory variations rather than a real difference. This can be accounted for by the fact that protein was determined on plasma in the Bethel area and on serum in the other areas. A factor of 0.3 grams percent for fibrinogen would make these values comparable.

There is no indication of difference in total serum protein values between the two battalions of National Guardsmen. The variation in the National Guard data is exceptionally low (S.D. = 0.24). There is no evidence of differences between the villages within each group of 5 villages examined.

The slightly higher mean serum protein levels of the Eskimo men, women and children that averaged between 6.9 and 7.8 grams per 100 ml are in agreement with the work of Pett and Lupien(47) who reported values ranging from 7.0 to 7.5 grams per 100 ml for the Eastern Canadian Eskimos. Totter and Shukers(48) in their study found average values of 7.7 grams of protein per 100 ml of serum. Their lowest reported value of 6.5 grams was slightly higher than the lowest value in this study of 6.3 grams. Darby et al.(49) in their study on the Navajo Indian also reported values that ranged from 6.9 to 8.0 grams per 100 ml for adults. In a study on Chinese Nationalist troops Consolazio et al.(50) found the serum protein values ranged from 7.5 to 7.7 grams per 100 ml. In the Newfoundland study(51), the proteins averaged 6.9 grams per 100 ml, with a range of 6.2 to 8.0 grams, which was slightly lower than the values for the Eskimos. Recently in a study on 130 military personnel at the U.S. Army Medical Research and Nutrition Laboratory (USAMRNL) (52), serum protein values were found to range from 6.2 to 6.7 grams per 100 ml for men between the ages of 18 and 49 years. Less than one percent of all the Eskimo and Indian population examined had values below 6.0 grams of protein per 100 ml of serum.

The high serum protein values found in the Alaskan Eskimos may be due to their high protein intake, although it has not been shown in experimental studies that a "super" level of serum protein can be achieved with high levels of dietary protein. A more probable explanation is that the high level of infectious disease among these people has produced an increase of globulin and especially gamma globulin(53). The serum proteins were not fractionated, so that this cannot be evaluated for the present data.

A usual pattern of differences between men, women and children was found in the hematologic studies. Average levels of hemoglobin appear somewhat low, but there is little evidence of gross anemia. Hematocrit levels are not remarkable, so that levels follow the mean corpuscular hemoglobin concentration pattern of low hemoglobin values. In the National Guard, the northern battalion (Battalion 1) had significantly ($P = 0.01$) higher hemoglobin levels than the southern battalion (Battalion 2), but the difference was relatively trivial in size. The northern villages had slightly lower hemoglobin values and higher hematocrit levels than the southern villages, producing considerably lower mean corpuscular hemoglobin concentrations. This, however, is probably a laboratory artifact.

Even though the hematocrit values were in the normal range for the Eskimo, the hemoglobin values, which are indicative of mild anemia, were considerably less than the reported values for normal healthy Americans. These values range from 14.8 to 17.4 grams per 100 ml for Americans as presented by Phillips et al.(55) and from 15.4 to 16.1 grams per 100 ml on military personnel in the USAMRNL study(52). The Eskimo values are approximately 1.5 grams lower than the values found by Darby et al.(49) on Navajo Indian adults and by Consolazio et al. on Chinese Nationalist troops(50), but were in the same range as those found in the Newfoundland study(51). Low hemoglobin values in Eskimos have also been reported by Totter and Shukers(48), Scott et al.(3) and Rodahl(54). Scott et al.(3) have shown that the anemia is often microcytic and hypochromic; and have shown that a great proportion of Eskimos have a moderate normochromic, normocytic anemia, and that iron therapy did not increase the hemoglobin levels. They concluded that iron deficiency and an unknown factor were responsible for the anemia. Recent work by Beutler et al.(56) has shown that plasma iron and iron-binding capacity are not reliable means of diagnosing an iron deficiency except when the hemoglobin levels are below 9 grams per 100 ml of serum. Beutler and co-workers feel that examination of the bone marrow for stainable iron is the most reliable method for differentiating between an iron deficiency and the other forms of anemia.

Approximately 26 percent of the Eskimo and Indian women and 30 percent of the children had hemoglobin values below 11.9 grams per 100 ml of serum. On the other hand, only 0.3 percent of the National Guardsmen and 6 percent of the village men had values below 11.9 grams per 100 ml.

Serum vitamin C levels showed moderate skewness toward high levels, but for convenience in making comparisons mean levels are presented. Medians were in general slightly lower, e.g., in units of mg per 100 ml:

	National Guard		Villages	
	Bn 2	Bn 1	Southern	Northern
Mean	.54	.51	.39	.47
Median	.50	.46	.37	.46

Levels of vitamin C were similar in the two National Guard units and in the northern villages; the somewhat lower levels in the southern villages may be laboratory artifacts. With the exception of Napaskiak an appreciable proportion of subjects had levels below 0.10 mg per 100 ml in all the southern villages. These lower levels were somewhat more prevalent in adults (especially men) than in the children. This finding may be related to the practice of administering a multivitamin capsule to the children in the school room. This capsule contains 50 mg of ascorbic acid.

In the table of distribution 2 percent of the men, 4.6 percent of the women and 3.4 percent of the children in the northern villages had serum ascorbic acid values below 0.1 mg per 100 ml, but in the southern villages these percentages were greater; 26.3 percent of the men, 21.7 percent of the women and 19.5 percent of the children had values below 0.1 mg per 100 ml.

Pett and Lupien(47) in their study found blood vitamin C levels that ranged from 0.78 to 1.15 and 0.81 to 1.15 mg per 100 ml for adult males and females respectively. Their lowest value was 0.40 mg per 100 ml of serum. In the recent USAMRNL study cited above(52) on healthy American military personnel, the vitamin C values ranged from 0.43 to 1.20 mg per 100 ml. Rodahl(54) has shown that there is no increased requirement for vitamin C in Eskimos. Since no scurvy or scorbutic gums were noted by the team clinicians, the puzzling question that arises is from what other source does the vitamin C come, in the foods eaten, or are these low quantities of vitamin C sufficient to prevent nutritional deficiency-indicator lesions from appearing. The dietary study indicates that some green vegetables, willow leaves, seaweed and berries are available in sizeable quantities in the summer. Chemical analysis of these food items has shown that they contain from 50 to 377 mg of ascorbic acid per 100 grams of food. Most of the school children, of course, receive vitamin C in the multivitamin tablet given them by the teacher.

Serum levels of vitamin A and carotene are similar in the two battalions of National Guardsmen. Serum vitamin A was somewhat lower, and carotene much lower, in the village surveys which were similar in both north and south. There were but few cases of serum vitamin A in the zone of "deficient" levels (less than 10 micrograms per 100 ml) or of carotene (less than 20 micrograms per 100 ml). A considerable proportion of subjects were in the borderline "low" zone for vitamin A (10 to 20 micrograms per 100 ml), about 10 percent of the National Guardsmen and 25 percent of the villagers. Only about 2 percent of the National Guardsmen but about 35 percent of the villagers were in the "low" zone for carotene (20 to 40 micrograms per 100 ml). Among the villages, only Shishmaref, a northern Eskimo village, had serum levels of vitamin A and carotene similar to those found in the National Guardsmen; the Athabascan Indian villages Allakaket and Huslia had smaller proportions of cases with "deficient" or "low" serum vitamin A levels.

There was no evidence of differences in serum vitamin A or carotene levels by age or by sex.

It is possible that the carotene levels in the National Guardsmen were elevated by their diet in their few days at the encampment.

Most individuals assume that the Eskimo consumes a considerable quantity of seal oil, walrus oil and whale oil, but as indicated in the dietary section the daily intake of vitamin A of 97 men was only 1,621 I.U. per day. In the USAMRNL study on normal military personnel, the serum vitamin A levels ranged from 35 to 48 micrograms per 100 ml and carotene was between 69 and 114 micrograms per 100 ml. The Eskimo values are slightly higher than those reported in the Newfoundland study(51) and are approximately in the same range as the results reported for Chinese Nationalist troops(50).

In the northern villages the incidence of follicular hyperkeratosis ranged from 20 to 52 percent of the subjects having clinical examinations. In these villages no men had serum vitamin A levels below 10 micrograms per 100 ml and only 3.3 percent of the women and 2 percent of the children had values below 10 micrograms per 100 ml. In the southern villages, 2.1 percent of the men, 1.8 percent of the women and 4 percent of the children had serum vitamin A values below 10 micrograms per 100 ml of serum.

The serum cholesterol, phospholipid and total fatty acid values were in the expected range. These values are in agreement with the work of Pett and Lupien(41) and of Sinclair et al.(57) on the Canadian Eskimos and of Wilber and Levine(58) on Point Barrow Eskimos. The last 6 lines of Table 37 supply cholesterol levels for a U.S. population as drawn from the data of Lawry et al.(59). It is of some interest that the Eskimos, long thought by popular lecturers to be free of heart disease, have cholesterol levels quite similar to those found in people living in the other 49 states.

TABLE 37

ALASKA, NUTRITION SURVEY, MARCH 1958
MEAN BLOOD FAT LEVELS, BY SURVEY AREA AND BY AGE

		Bethel Area				Kotzebue Area			
		Age				Age			
		5-14	15-24	25-39	40+	5-14	15-24	25-39	40+
Total Fatty Acids (Mg/100 ml)	Number	50	14	21	23	52	9	20	19
	Mean	208	250	267	279	240	257	284	289
Phospholipids (Mg/100 ml)	Number	50	14	21	23	52	9	20	19
	Mean	7.8	7.8	9.0	9.2	8.6	9.4	9.2	9.5
Total Cholesterol (Mg/100 ml)	Number	48	14	21	20	44	7	16	11
	Mean	158	184	212	224	162	169	204	174

		Men				
	Age	25-29	30-34	35-39	40-44	45-49
Total Cholesterol (Mg/100 ml)	Number	54	110	184	357	329
	Mean	212	224	230	238	243
	S.D.	42	54	44	46	53

		Women		
	Age	20-29	30-39	40-49
Total Cholesterol (Mg/100 ml)	Number	37	56	208
	Mean	196	209	225
	S.D.	52	32	40

Total fatty acids, phospholipids and cholesterol in the serum all showed somewhat lower values in children (Table 34c), and in adults there was no appreciable rise after age 25 (Table 37). Levels of total fatty acids and of phospholipids were slightly higher in the northern villages surveyed than in the southern ones, with this difference due to higher levels in the two Athabascan Indian villages (Table 36c). Relatively higher levels were found at Akiak than in other southern villages.

There was no relation of serum total fatty acids, phospholipids and cholesterol to weight status, either by sex or by age. Neither was there any relationship of cholesterol to blood pressure.

The median levels of B-vitamin urinary excretions were in all cases quite high (Table 38). Only thiamine showed any appreciable proportion of subjects at low levels of excretion, with the exception of a scattering of a few low riboflavin values in the Bethel area.

Levels of thiamine excretion were generally higher in the northern Eskimo villages surveyed than in the southern villages. Subjects in Huslia (an Athabascan Indian village) had generally lower levels of excretion of all three B-vitamins, though with few very low levels for individuals. In Newktok (a southern Eskimo village) excretion of thiamine was very low, with 7 of 18 subjects excreting less than 27 micrograms per gram of creatinine. Thiamine excretions were exceptionally high at Hooper Bay, compared to other southern villages.

For thiamine and riboflavin, excretion levels were markedly higher in children than in adults, and this difference appeared also, less markedly, in N'-methylnicotinamide excretion. This is possibly related to the expression of excretions in terms of creatinine, an unstable denominator in children. It must also reflect the vitamin supplementation program among school children.

Values for females were slightly higher than for males in general, for children as well as adults.

These high excretion values were comparable to and slightly higher than the USAMRNL study on military personnel(52) consuming a normal garrison ration. In the latter study the thiamine and riboflavin excretion averaged 274 and 850 micrograms per gram of creatinine. In the Newfoundland study the thiamine and riboflavin excretion averaged 117 and 437 micrograms per gram of creatinine, respectively. On the other hand, these values in the Eskimos were comparable to the vitamin enrichment study on Chinese Nationalist troops(50) whose average excretion was 21.4 mg of N'-methylnicotinamide, 846 micrograms of thiamine and 1,526 micrograms of riboflavin per gram of creatinine.

Data on pregnant and lactating women have not been included in the foregoing tables. Biochemical data were obtained on such women in the Bethel area, and are presented in Table 39.

It may be remarked that hemodilution lowers the total serum protein, hemoglobin and hematocrit values during pregnancy, and that B-vitamin excretions are increased at that time. In these few studies, serum vitamin A does not appear to be lower or carotene higher than would be true under normal conditions.

TABLE 38

ALASKA, NUTRITION SURVEY, MARCH 1958

URINARY EXCRETIONS OF B-VITAMINS, VILLAGE AREAS, BY AGE AND SEX

		Bethel Area				Kotzebue Area			
		< 15 yrs.		15+ yrs.		< 15 yrs.		15+ yrs.	
		Boys	Girls	Men	Women	Boys	Girls	Men	Women
Thiamine	Number	42	36	50	57	56	47	59	63
Excretion	Median	380	600	140	130	570	820	190	330
(Mcg/gm Creatinine)	< 200	33.3	25.0	64.0	56.1	17.9	8.5	52.5	36.5
	200-399	21.4	13.9	12.0	19.3	17.9	17.0	23.7	19.0
Percentage	400-599	11.9	11.1	6.0	8.8	17.9	8.5	8.5	22.2
Distribution	≥ 600	33.3	50.0	18.0	15.8	46.4	66.0	15.3	22.2
Riboflavin	Number	41	37	51	60	56	48	59	64
Excretion	Median	900	1440	640	760	1080	1230	780	910
(Mcg/gm Creatinine)	< 200	17.1	2.7	9.8	8.3	7.1	6.2	11.9	4.7
	200-599	17.1	8.1	33.3	30.0	19.6	22.9	28.8	26.6
Percentage	600-999	22.0	18.9	39.2	26.7	21.4	14.6	18.6	25.0
Distribution	≥ 1000	43.9	70.3	17.6	35.0	51.8	56.2	40.7	43.8
N'-Methylnicotinamide	Number	41	38	49	60	47	44	52	59
Excretion	Median	15.4	17.0	12.2	13.6	17.9	18.6	13.6	14.1
(Mg/gm Creatinine)	< 6.0	14.6	5.3	10.2	8.3	12.8	9.1	7.7	8.5
	6.0- 9.9	12.2	13.2	26.5	25.0	14.9	13.6	23.1	13.6
Percentage	10.0-19.9	39.0	47.4	46.9	43.3	27.7	31.8	38.4	47.5
Distribution	≥ 20.0	34.1	34.2	16.3	23.3	44.7	45.5	30.8	28.8

TABLE 39

ALASKA, NUTRITION SURVEY, MARCH 1958

BIOCHEMICAL FINDINGS, BY REPRODUCTIVE STATUS,
ESKIMO VILLAGERS IN THE BETHEL AREA

	Not Pregnant or Lactating	Pregnant	Lactating
Number of Samples (Mean Values)	65	12	9
Total Serum Protein Gm/100 ml	7.74	7.13	7.93
Hemoglobin Gm/100 ml	12.8	11.4	12.7
Hematocrit Percent	40.8	36.5	39.6
M.C.H.C. Percent	31.7	31.2	32.4
Serum Vitamin C Mg/100 ml	0.37	0.49	0.40
Serum Vitamin A Mcg/100 ml	34	29	23
Serum Carotene Mcg/100 ml	54	58	45
Number of Samples (Mean Values)	38	8	6
Total Fatty Acids Mg/100 ml	279	332	246
Phospholipids Mg/100 ml	9.0	11.0	8.8
Total Cholesterol Mg/100 ml	213	227	136
Number of Samples (Median Values)	57	9	7
Thiamine Mcg/gm Creatinine	130	280	110
Riboflavin Mcg/gm Creatinine	760	1500	900
N'-Methylnicotinamide Mg/gm Creatinine	13.6	18.8	16.2

All the biochemical data were examined according to age of the subject, and the National Guard data are presented without regard to age as there was no indication of age trends. Children under 10 years have been combined with those 10 to 14 years of age, as the two groups showed no differences. Subjects 15 to 39 years of age are, with some exceptions, presented together with those 40 years and over, as these two groups in general showed no difference.

All the biochemical data from the National Guard were examined according to percentage of "standard weight" of the men; no correlations were found of biochemical level to the subjects' weight status, except a weak positive relation to hemoglobin level, with hemoglobin average levels rising by about 0.5 gm/100 ml between the extremes of underweight and overweight. The village data were examined concerning this point, and the relation was not present for either men or women.

No correlation between serum vitamin C and serum carotene could be found. The relationships between serum levels of ascorbic acid or of vitamin A and certain clinical signs have been discussed above in the clinical section.

4. Summary

A biochemical nutrition survey was conducted in Alaska in which blood and urine samples were collected on 826 adult males, 145 adult females and 209 children of Eskimo and Indian origin, a total of 1,180 individuals.

The hemoglobin values were approximately 1.5 grams per 100 grams less for men, women and children than the reported values for healthy normal white Americans.

The average ascorbic acid levels in the serum were in the normal "acceptable" range.

The vitamin A and carotene levels in the serum were lower by comparison with the values for normal American standards. The recorded dietary intake of vitamin A averaged 1,621 I.U. per day.

The average urinary excretions of N'-methylnicotinamide, thiamine and riboflavin were in the "acceptable" range for all the groups examined. These "acceptable" excretions may be due to the high consumption of fresh meat and fish and to the vitamin therapy program that includes most children of school age and all individuals in the tuberculosis chemotherapy program.

The average values for blood levels of cholesterol, phospholipid and total fatty acid were all in the normal range.

TABLE 40

SUGGESTED GUIDE TO INTERPRETATION OF BIOCHEMICAL DATA[1/]

A. BLOOD DATA, YOUNG ADULT MALES

	Deficient	Low	Acceptable	High
Hemoglobin Gm/100 ml:				
Sea Level	< 12.0	12.0-13.9	14.0-14.9	≥ 15.0
5,000 ft. (1500 M.)	< 12.3	12.3-14.2	14.3-15.6	≥ 15.6
12,000 ft. (3700 M.)	< 13.3	13.3-15.4	15.5-17.2	≥ 17.2
14,000 ft. (4500 M.)	< 14.4	14.4-16.7	16.8-18.9	≥ 19.0
Hematocrit (PCV) in percent:				
Sea Level	< 36	36-41	42-45	≥ 46
5,000 ft. (1500 M.)	< 38	38-43	44-47	≥ 48
12,000 ft. (3700 M.)	< 42	42-48	49-56	≥ 57
14,000 ft. (4500 M.)	< 46	46-52	53-65	≥ 66
Total Plasma Protein:				
(TPP) Gm/100 ml	< 6.0	6.0-6.4	6.5-6.9	≥ 7.0
Plasma Ascorbic Acid:				
Mg/100 ml	< 0.1	0.10-0.19	0.20-0.39	≥ 0.4
Plasma Vitamin A:				
Mcg/100 ml	< 10	10-19	20-49	≥ 50
Plasma Carotene:				
Mcg/100 ml		20-39	40-99	≥ 100

B. URINARY EXCRETION DATA, YOUNG ADULT MALES

	Deficient	Low	Acceptable	High
N'-Methylnicotinamide:				
Mg/6 Hours	< 0.2	0.2-0.59	0.6-1.5	≥ 1.6
Mg/gm Creatinine	< 0.5	0.5-1.59	1.6-4.2	≥ 4.3
Riboflavin:				
Mcg/6 Hours	< 10	10-29	30-99	≥ 100
Mcg/gm Creatinine	≤ 27	27-79	80-269	≥ 270
Thiamine:				
Mcg/6 Hours	< 10	10-24	25-49	≥ 50
Mcg/gm Creatinine	< 27	27-65	66-129	≥ 130

1/ From ICNND Manual for Nutrition Surveys (10).

VII - GENERAL CONCLUSIONS

The Alaskan aboriginal people have had, and continue to have a remarkably successful adaptation to their rigorous and unique food supply. This adaptation is imperiled in the cultural transition they are now undergoing.

Specific nutritional deficiencies are not a health problem at this time. Infectious disease is the main health problem and no obvious way appears whereby nutritional improvement will affect this situation. Housing and medical care seem more important than dietary improvement.

Two dietary riddles appear among these people. The intake of vitamin C is often very low but scurvy is not seen. This may be accounted for by a sporadic intake of a few exceptionally rich sources of vitamin C in the diet, e.g., willow leaves and cloudberries, aided by effective if unpremeditated ways of preserving these during winter.

The other riddle involves vitamin A. The food sources of vitamin A are rich and plentiful, and yet the plasma levels are often low, and clinical signs suggesting past or present deficiency are seen. It is suspected but not established that vitamin A deprivation may contribute to the problem of phlyctenular keratoconjunctivitis. Studies of the absorption and utilization of vitamin A in these people are needed.

Dental disease is rampant and increasing. It appears related to the cultural transition, being a more serious problem in the more acculturated groups. There are two opportunities presented (a) to study the pathogenesis of dental disease and (b) to minimize the ravages of a diet perhaps damaged by the introduction of refined carbohydrates.

The Eskimo people deserve and need medical and technical help. It appears inevitable that they will be acculturated and in turn will leave their barren ground. Unless the meager medical and social assistance which the state and federal governments and private charities now give is augmented this noble and resourceful people is in danger of being decimated and destroyed. The white man now has an opportunity to compensate in part for the injustice he worked on the American Indians.

VIII - SPECIFIC RECOMMENDATIONS

1. The Department of Health, Education, and Welfare should aid and abet the extension and completion of the existing dietary study of Dr. Heller in Alaska. Methods for improving and facilitating data collection and summarization should be adopted. The dietary studies should be extended to additional villages and a systematic seasonal collection of data should be continued. This will require additional personnel. The necessary food analyses should be obtained, probably by contract with a research laboratory; the planning and interpretation of such studies would be facilitated by the appointment of a small advisory board of medical and nutritional scientists.

2. The dietary surveys should be augmented by the consultant services of a physician trained in nutrition science who should at intervals, probably annually, visit the Native Health Service Hospitals for an evaluation of the status of nutritional disease, and, as necessary, visit villages for examination of subjects. At his discretion, materials for a single or a continuing biochemical examination of persons with suspicious clinical signs should be returned either to the nearest ANHS Hospital Laboratory, the AHRC Laboratory, or to a specialist laboratory in the continental United States for analyses.

3. A nutrition educator with experience in maternal and child health should be assigned to the Eskimo areas on a continuing basis. Working through the teachers and missionaries, this person could materially aid the dietary transition which the Eskimos are making.

4. The school lunch and vitamin supplementation programs should be continued.

5. The Alaska Department of Health and the Department of Health, Education, and Welfare should attempt to place more medical personnel and facilities, especially for transport of doctors and patients, in the Eskimo areas.

6. A research study of the causation of phlyctenular keratoconjunctivitis should be undertaken. Such a study should consider both infection and nutrition as probable agents.

7. A research study of the behavior of coronary heart disease in this exotic population should be started.

8. A study of the relation of diet to dental caries should be initiated while an excellent opportunity for observation exists among these people.

IX - APPENDIX A

CRITERIA FOR ORAL EXAMINATIONS, ALASKA NATIONAL GUARD

Dental caries: Each tooth in the mouth was recorded as free of caries, or decayed, or missing, or filled. Frank cavitation was required before a lesion was recorded as carious. A tooth with a crown so destroyed by caries that filling was impracticable was recorded as indicated for extraction and tabulated as a missing tooth. In tabulation a tooth with a filling and a separate carious lesion was counted, once only, as a filled tooth.

In arches so crowded that no room remained for eruption of one or more bicuspids these teeth were considered to be unerupted rather than missing if the unerupted crown could be palpated below the gingivae at the margin of the alveolar crest.

Findings are presented as the mean numbers of decayed plus missing plus filled teeth (the DMF mean) per man, based on the 28 permanent teeth exclusive of the third molars. These are cumulative data and describe the total caries experience from the age of about six years (when the permanent teeth begin to erupt) to the time of examination.

Periodontal score: The condition of the tissues supporting each tooth was scored on the following scale, which is based on the clinical syndrome in marginal periodontitis:

Score	Observation
0	supporting tissues negative for specified signs
1	presence of an overt area of gingivitis, not circumscribing the tooth
2	presence of an overt area of gingivitis circumscribing the tooth
6	presence of gingivitis plus a frank periodontal (not gingival) pocket; ie., external evidence of destruction of deeper tissues
8	evidence of tissue destruction so advanced that function of the tooth is seriously impaired.

These findings are presented as the mean score per man for the teeth remaining in his mouth. This is a morbidity measure; it disregards evidence of past disease not presently active.

Gingival recession: In each mouth the number of teeth in which gingival recession had exposed the root were counted and tabulated as a percentage of the total number of teeth in that mouth.

These findings are presented as the mean percent per man. This figure supplements the morbidity index described above, in that it furnishes a useful estimate of cumulative, or lifetime, tissue destruction.

APPENDIX B

FOOD CONSUMPTION, MALES - ALASKA, 1956-1958

(Daily average intake, calculated from dietary records for dates indicated)

AGE GROUP: 16-25

NAME - AGE AREA - NO. DAYS MO. YR.	Calories	Protein gm	Fat gm	Carbohydrate gm	Calcium mg	Phosphorus mg	Iron mg	Vitamin A I.U.	Thiamine mg	Riboflavin mg	Niacin mg	Vitamin C mg
[redacted] - 16 yrs Huslia - 5 days - Dec '56	2256	242.0	56.3	200.6	450	1039	16.4	1070	0.65	3.70	21.1	68
[redacted] - 16 yrs Hooper Bay - 7 days - Mar '57	1184	40.5	72.5	111.6	376	526	3.5	1385	0.26	1.18	4.5	66
[redacted] - 16 yrs Huslia - 7 days - Dec '56	2125	206.4	45.6	225.6	512	1043	15.0	628	0.65	3.03	14.8	39
[redacted] - Napaskiak - 4 days - Feb '57	1047	100.1	34.0	92.3	1301	984	7.4	408	0.15	0.61	19.5	10
[redacted] - 16 yrs Hooper Bay - 7 days - Mar '57	1117	48.6	38.2	135.1	721	734	3.8	3664	0.26	0.82	5.5	8
[redacted] - 17 yrs Napaskiak - 7 days - Feb '58	1924	184.7	87.6	93.7	894	475	4.0	1279	0.55	0.82	9.1	68
[redacted] - 17 yrs Huslia - 4 days - Jan '58	1440	60.2	51.0	185.6	196	714	6.9	845	0.43	0.89	11.5	19
[redacted] - 17 yrs Huslia - 2 days - Dec '56	1872	147.5	53.4	203.7	653	1265	15.4	1666	0.47	1.86	19.4	18
[redacted] - 17 yrs Huslia - 7 days - Dec '56	2119	186.3	45.3	242.1	543	1193	18.2	652	0.70	2.79	19.3	38
[redacted] - 18 yrs Huslia - 2 days - Dec '56	2155	144.5	71.2	229.0	523	1059	14.5	1529	0.54	2.69	12.1	13
[redacted] - 18 yrs Huslia - 3 days - Dec '56	2123	104.0	61.4	284.3	629	1125	16.8	2677	0.66	0.81	10.3	13
[redacted] - 18 yrs Napaskiak - 7 days - Feb '58	887	113.7	5.5	93.4	173	478	3.7	272	0.73	0.19	10.4	9

[redacted] - 21 yrs Huslia - 3 days - Dec '56	1417	84.8	24.2	217.7	523	1305	16.9	486	0.33	1.20	19.2	11
[redacted] - 21 yrs Newktok - 3 days - Nov '57	1693	155.3	89.1	88.8	3585	1111	8.8	1550	1.58	3.82	21.1	32
[redacted] - 22 yrs Huslia - 3 days - Dec '56	959	53.6	17.4	163.3	421	518	6.1	114	0.34	0.86	7.5	8
[redacted] - 22 yrs Huslia - 7 days - Dec '56	2408	119.4	59.6	354.8	1073	1446	17.0	2523	0.72	1.40	20.3	34
[redacted] - 22 yrs Huslia - 7 days - Dec '56	2354	111.1	57.4	354.4	663	939	9.8	1884	0.53	1.72	9.7	22
[redacted] - 23 yrs Huslia - 5 days - Dec '56	3263	321.1	72.7	345.3	859	2354	25.6	1881	1.02	3.60	23.0	100
[redacted] - 23 yrs Napaskiak - 4 days - Feb '56	1677	46.2	141.6	95.5	553	372	3.7	2178	0.23	0.32	5.4	36
[redacted] - 23 yrs Hooper Bay - 2 days - Mar '57	809	89.6	18.0	74.2	224	779	9.5	357	0.39	1.27	11.7	88
[redacted] - 23 yrs Huslia - 3 days - Jan '58	2845	237.9	70.1	313.7	1229	1653	21.0	462	0.83	3.15	26.5	32
[redacted] - 24 yrs Huslia - 3 days - Jan '58	1605	194.3	39.1	121.4	618	1350	16.9	252	0.38	2.95	20.9	37
[redacted] - 24 yrs Shishmaref - 7 days - Mar '58	3215	126.9	224.4	139.7	1803	2123	24.9	2213	0.29	1.90	27.8	81
[redacted] - 25 yrs Newktok - 3 days - Nov '57	2216	169.3	84.7	189.9	4018	1719	13.8	2090	0.51	1.50	37.0	25
[redacted] - 25 yrs Newktok - 3 days - Oct '57	1659	85.6	110.8	119.6	951	865	4.1	1904	2.78	3.29	12.6	17
[redacted] - 25 yrs Huslia - 4 days - Jan '58	2930	182.5	105.8	315.3	1407	1606	10.6	2290	0.83	2.66	14.1	22

APPENDIX B (continued)

FOOD CONSUMPTION, MALES - ALASKA, 1956-1958

(Daily average intake, calculated from dietary records for dates indicated)

AGE GROUP: 26-40

NAME - AGE AREA - NO. DAYS MO. YR.	Calories	Protein gm	Fat gm	Carbohydrate gm	Calcium mg	Phosphorus mg	Iron mg	Vitamin A I.U.	Thiamine mg	Riboflavin mg	Niacin mg	Vitamin C mg
[redacted] - 26 yrs Newktok - 3 days - Oct '57	1820	138.6	69.5	157.4	500	809	5.7	1237	0.25	1.81	23.3	16
[redacted] - 26 yrs Shishmaref - 5 days - Mar '58	2127	93.2	134.5	148.8	408	747	6.9	3333	0.62	0.99	6.5	62
[redacted] - 27 yrs Hooper Bay - 7 days - Mar '57	1272	22.9	60.1	159.6	497	391	2.9	36	0.22	0.08	3.4	1
[redacted] - 27 yrs Point Hope - 7 days - Mar '57	921	26.0	39.2	115.9	445	454	3.4	323	0.17	0.53	3.1	3
[redacted] - 27 yrs Hooper Bay - 7 days - Mar '57	1713	144.1	48.2	178.6	1196	958	7.3	516	0.69	1.15	13.6	16
[redacted] - 29 yrs Hooper Bay - 7 days	1290	49.9	39.9	185.7	426	760	5.6	727	0.68	0.62	4.5	30
[redacted] - 28 yrs Shishmaref - 4 days - Mar '58	3709	312.0	192.4	208.6	987	2145	30.5	2303	0.53	3.65	35.1	75
[redacted] - 28 yrs Newktok - 3 days - Oct '57	830	115.5	23.8	37.5	3521	683	9.2	532	0.16	1.38	15.9	28
[redacted] - 29 yrs Napaskiak - 7 days - Feb '58	2290	87.0	158.7	130.7	199	381	4.5	3241	0.53	0.91	3.0	66
[redacted] - 29 yrs Napaskiak - 4 days - Feb '58	1672	42.3	128.4	89.0	486	438	3.2	2287	0.20	0.65	6.5	36
[redacted] - 29 yrs Newktok - 3 days - Oct '57	1482	161.7	76.6	57.7	378	1399	10.1	2755	0.65	1.67	27.2	21

[redacted] - 29 yrs Hooper Bay - 7 days - Mar '57	1176	162.9	14.4	99.1	892	1074	8.9	325	0.67	0.90	15.5	18
[redacted] - 30 yrs Kasigluk - 7 days - Mar '57	2810	276.0	114.5	174.8	1022	1652	12.8	1745	1.62	1.13	20.9	101
[redacted] - 31 yrs Newktok - 3 days - Oct '57	1619	110.1	88.3	102.6	303	1032	7.4	2115	0.39	0.83	20.4	28
[redacted] - 31 yrs Newktok - 3 days - Nov '57	2461	183.8	127.2	146.4	6151	2002	14.0	2843	0.87	3.44	42.6	106
[redacted] - 31 yrs Hooper Bay - 7 days - Mar '57	917	48.2	26.4	122.1	326	446	2.4	935	0.23	0.48	5.4	5
[redacted] - 31 yrs Napaskiak - 4 days - Feb '58	730	52.4	29.2	73.3	549	504	3.5	405	0.12	0.33	8.6	5
[redacted] - 33 yrs Hooper Bay - 7 days - Feb '57	1767	68.4	102.6	144.1	510	1113	7.1	1618	0.44	1.27	12.1	128
[redacted] - 34 yrs Huslia - 4 days - Jan '58	1929	171.0	77.4	168.2	954	1443	16.9	1946	0.99	2.28	23.3	55
[redacted] - 34 yrs Huslia - 3 days - Dec '56	2387	211.5	69.8	234.5	1134	1722	18.2	2893	0.92	3.22	18.7	42
[redacted] - 34 yrs Hooper Bay - 6 days - Feb '58	908	77.0	32.9	67.4	141	473	5.1	361	0.21	0.87	8.4	73
[redacted] - 35 yrs Hooper Bay - 7 days - Mar '57	2791	147.8	87.4	380.1	911	1268	17.2	8839	0.66	1.41	12.5	16
[redacted] - 36 yrs Newktok - 3 days - Oct '57	1216	65.3	65.7	107.2	1513	914	4.6	1157	0.25	0.61	10.4	19
[redacted] - 37 yrs Hooper Bay - 7 days - Mar '57	3780	321.7	185.6	197.9	462	2891	9.2	707	0.96	0.42	13.2	13
[redacted] - 37 yrs Hooper Bay - 7 days - Mar '57	939	46.8	40.1	100.2	1071	521	4.8	361	0.59	1.33	8.4	11

APPENDIX B (continued)

FOOD CONSUMPTION, MALES - ALASKA, 1956-1958

(Daily average intake, calculated from dietary records for dates indicated)

AGE GROUP: 26-40

NAME - AGE AREA - NO. DAYS MO. YR.	Calories	Protein gm	Fat gm	Carbohydrate gm	Calcium mg	Phosphorus mg	Iron mg	Vitamin A I.U.	Thiamine mg	Riboflavin mg	Niacin mg	Vitamin C mg
[redacted] - 38 yrs Point Hope - 7 days - Mar '57	1841	165.1	64.4	193.3	411	1104	13.2	1305	0.97	2.32	14.6	22
[redacted] - 40 yrs Point Hope - 6 days - Mar '57	4290	715.1	68.5	205.2	881	3631	46.8	6456	4.90	9.69	60.0	61
[redacted] - 40 yrs Napaskiak - 4 days - Feb '58	995	96.5	32.3	78.1	1256	884	7.4	685	0.15	0.56	17.0	11
[redacted] - 40 yrs Kasigluk - 7 days - Mar '58	963	63.7	43.0	80.6	554	440	4.6	526	0.17	0.64	8.6	29

APPENDIX B (continued)

FOOD CONSUMPTION, MALES - ALASKA, 1956-1958

(Daily average intake, calculated from dietary records for dates indicated)

AGE GROUP: 41-54

NAME - AGE AREA - NO. DAYS MO. YR.	Calories	Protein gm	Fat gm	Carbohydrate gm	Calcium mg	Phosphorus mg	Iron mg	Vitamin A I.U.	Thiamine mg	Riboflavin mg	Niacin mg	Vitamin C mg
[redacted] - 41 yrs Huslia - 7 days - Dec '56	2296	162.3	26.6	349.3	433	1029	10.9	543	0.52	2.28	12.2	34
[redacted] - 41 yrs Napaskiak - 4 days - Feb '58	831	47.2	32.2	88.5	602	453	3.3	1002	0.13	0.33	4.7	5
[redacted] - 41 yrs Napaskiak - 7 days - Feb '58	1137	136.7	6.1	133.7	200	543	4.3	329	0.88	0.22	6.7	12
[redacted] - 40 yrs Huslia - 3 days - Dec '56	2350	124.3	69.8	312.4	439	1076	16.5	2421	0.80	0.86	8.4	16
[redacted] - 41 yrs Kasigluk - 2 days - Mar '57	2337	160.7	110.3	164.9	1585	1149	9.8	2114	0.72	2.83	14.0	145
[redacted] - 41 yrs Point Hope - 2 days - Mar '57	1667	148.4	44.7	133.9	610	1040	8.6	509	0.82	1.90	11.0	15
[redacted] - 42 yrs Napaskiak - 4 days - Feb '58	1080	52.7	50.1	97.4	661	139	1.4	1820	0.09	0.44	1.1	36
[redacted] - 42 yrs Hooper Bay - 7 days - Mar '57	1338	109.4	41.0	168.7	710	836	6.3	778	0.85	0.92	11.3	30
[redacted] - 43 yrs Huslia - 7 days - Dec '56	1640	179.2	32.4	167.8	553	1108	13.8	417	0.44	2.40	19.9	31
[redacted] - 44 yrs Kasigluk - 2 days - Mar '57	2337	242.9	63.6	199.1	2663	1828	13.3	1032	1.08	1.91	35.7	27
[redacted] - 45 yrs Huslia - 2 days - Dec '56	889	57.1	14.6	138.4	180	421	6.9	343	0.10	0.74	5.3	5

[redacted] - 48 yrs Point Hope - 5 days - Mar '57	2405	83.4	152.3	180.7	217	536	7.7	297	0.25	1.44	7.1	7
[redacted] - 49 yrs Kasigluk - 7 days - Mar '57	3674	379.5	132.4	242.0	5320	2871	22.9	2390	1.98	3.46	55.2	128
[redacted] - 49 yrs Napaskiak - 4 days - Feb '58	2509	181.0	116.0	164.1	239	903	4.4	2102	0.45	1.08	10.3	16
[redacted] - 49 yrs Newktok - 3 days - Oct '57	2002	123.9	118.8	107.8	280	1103	5.8	2177	0.56	0.96	21.9	7
[redacted] - 50 yrs Hooper Bay - 7 days - Mar '57	988	62.4	37.7	101.2	208	368	4.5	27	0.02	0.89	4.9	11
[redacted] - 50 yrs Shishmaref - 7 days - Mar '58	2605	155.7	129.6	179.6	741	1010	12.6	3520	0.46	2.83	10.0	71
[redacted] - 51 yrs Napaskiak - 7 days - Feb '58	2530	241.5	107.8	146.8	224	1025	8.1	1246	0.70	1.02	17.7	21
[redacted] - 51 yrs Point Hope - 6 days - Mar '56	2919	151.8	159.8	226.3	850	1432	14.7	3306	0.85	2.80	15.7	22
[redacted] - 52 yrs Point Hope - 7 days - Mar '58	2557	152.6	88.4	283.4	1310	1717	12.5	3156	0.85	3.13	10.8	11
[redacted] - 52 yrs Point Hope - 7 days - Mar '57	1402	45.8	66.4	155.4	612	651	3.4	1747	0.27	0.83	1.4	3
[redacted] - 52 yrs Newktok - 3 days - Nov '57	2456	273.4	89.1	137.6	8302	1929	15.4	2910	0.25	3.47	55.8	55
[redacted] - 54 yrs Point Hope - 5 days - Mar '57	1281	66.1	15.0	226.4	275	469	7.6	4368	0.28	1.18	6.7	17
[redacted] - 54 yrs Hooper Bay - 7 days - Mar '57	1174	42.2	38.7	167.4	582	846	6.9	850	0.61	0.85	4.6	2

APPENDIX B (continued)

FOOD CONSUMPTION, MALES - ALASKA, 1956-1958

(Daily average intake, calculated from dietary records for dates indicated)

AGE GROUP: 55-75

NAME - AGE AREA - NO. DAYS MO. YR.	Calories	Protein gm	Fat gm	Carbohydrate gm	Calcium mg	Phosphorus mg	Iron mg	Vitamin A I.U.	Thiamine mg	Riboflavin mg	Niacin mg	Vitamin C mg
[redacted] - 56 yrs Napaskiak - 7 days - Feb '58	1861	179.0	76.2	116.8	1198	1178	10.4	3813	0.80	0.91	25.5	52
[redacted] - 58 yrs Huslia - 7 days - Dec '58	2490	144.9	57.6	364.5	891	1145	9.6	1722	0.69	1.73	17.7	22
[redacted] - 50 yrs Huslia - 3 days - Dec '56	3485	186.9	184.3	278.3	632	1700	20.5	6421	0.97	1.69	38.5	30
[redacted] - 60 yrs Point Hope - 7 days - Mar '57	1254	42.4	35.0	193.0	576	621	3.5	172	0.19	0.44	4.1	40
[redacted] - 64 yrs Kasigluk - 7 days - Mar '57	2603	176.0	157.3	122.5	3055	1115	10.1	3174	1.10	2.59	28.7	218
[redacted] - 64 yrs Hooper Bay - 3 days - Mar '57	1044	80.5	37.8	96.4	1328	786	6.0	642	0.97	1.61	14.1	15
[redacted] - 67 yrs Kasigluk - 7 days - Mar '57	1564	234.4	39.7	72.0	4361	1834	14.6	1002	0.85	1.99	39.9	41
[redacted] - 67 yrs Hooper Bay - 7 days - Feb '57	1266	68.6	66.6	100.1	670	610	5.3	1276	0.52	1.31	8.3	77
[redacted] - 68 yrs Hooper Bay - 7 days - Feb '58	1544	128.7	66.3	109.1	1621	1206	9.8	1064	0.47	1.53	20.4	33
[redacted] - 70 yrs Napaskiak - 4 days - Feb '58	1702	40.8	124.2	108.2	417	365	2.5	2181	0.20	0.61	5.4	35
[redacted] - 70 yrs Huslia - 3 days - Jan '58	1231	112.2	38.2	148.3	602	1783	18.6	350	1.69	1.94	17.9	15
[redacted] - 70 yrs Shishmaref - 7 days - Mar '58	1762	171.7	89.2	94.0	785	890	10.3	2689	0.31	1.15	16.0	68

[redacted] - 70 yrs Huslia - 3 days - Dec '56	1950	97.6	43.0	305.2	391	949	14.8	680	0.52	1.51	16.7	18
[redacted] - 70 yrs Huslia - 4 days - Jan '58	1058	41.2	44.0	128.4	290	477	5.3	671	0.26	0.54	8.0	23
[redacted] - 72 yrs Point Hope - 1 day - Mar '57	2292	151.5	74.2	250.7	768	1291	12.7	1078	0.59	2.20	11.7	9
[redacted] - 73 yrs Napaskiak - 4 days - Feb '58	605	51.5	19.7	57.8	355	318	2.5	229	0.21	0.28	6.6	6
[redacted] - 75 yrs Huslia - 3 days - Dec '56	1375	145.4	36.2	167.4	424	741	9.3	1559	0.73	1.66	8.5	17
[redacted] - 75 yrs Shishmaref - 7 days - Mar '58	2464	128.6	160.5	134.3	668	1755	20.3	2245	0.25	2.15	29.3	74

APPENDIX C

FOOD PATTERNS BY VILLAGE

(Data gathered by Dr. Christine A. Heller, Arctic Health Research Center)

Akiak: Akiak is an Eskimo village located on the Kuskokwim River northeast of Bethel. It has a population of about 187 Eskimos and six whites.

Akiak was at one time a more flourishing village than it is today. A Native Service Hospital was located here; it was also headquarters for a rather extensive reindeer repopulation project. Akiak was and still is a sort of meeting place for the mountain, tundra and river Eskimos.

Most of the homes in Akiak are of frame or log construction and a few of them are fairly large with several rooms. Only a few sod houses remain.

THE SEASONAL HUNTING AND FISHING CYCLE - AKIAK

Month	Kind of Food	and Remarks
January February March April Early May	Ling Cod (lush) Whitefish Pike Blackfish Sheefish	These fish are caught intermittently throughout the winter -- the lush, whitefish and blackfish in willow root traps; an occasional pike or sheefish by hooking through the ice. None are caught in large amounts -- usually only enough to provide an occasional meal of fresh fish.
February	Beaver	Only 5 Akiak Eskimo men trapped beaver seriously in 1958. These men obtained the maximum catch allowed which varied from 10 to 25 depending on the drainage area trapped. The fur is sold. The meat is eaten.
	Caribou	Only an occasional caribou is taken, usually when the men are out beaver trapping and other food is scarce.

Akiak - Continued

Month	Kind of Food	and Remarks
May	Muskrats	Caught at spring camp sites--not too many taken.
	Ground Squirrel	Only a few snared at spring camp. The fur of the ground squirrel is highly prized for parkas; it is light and warm. The meat is eaten fresh cooked or dried for later use and then cooked.
	Smelts	After the ice break-up in the river in late April or early May smelts are obtained in good quantity by dip netting. Much of the catch is dried for later use for both human consumption and dog feed.
	King Salmon	Obtained in good quantity. Used fresh in season, but most of the catch is dried for winter use. Small amounts are salted or smoked and canned.
	King Salmon Eggs	Most of the salmon eggs are stored in barrels or kegs in the smoke house and used for dog feed. Small amounts, usually 25-50 pounds per family, are prepared for human consumption. The eggs are partially dried in the shade--never in the sun-- and then packed solidly in clean kegs or other containers, covered tightly, stored in a cool place and left undisturbed until the following spring. They are then eaten in small amounts, usually with dried fish. In early days the partially dried salmon eggs were buried at the fish camp site in a birch bark-lined pit about 2 feet deep and 2 feet across. They were covered first with birch bark, then grass, and then mud or dirt to seal tightly.

Akiak - Continued

Month	Kind of Food	and Remarks
May - continued	King Salmon Eggs continued	They were allowed to ripen until the following spring at which time the families on their way to Spring camp would remove them for use. This material was eaten in small amounts with dried fish or used as a soup ingredient.
May June	Bird Eggs	Collected from the tundra in small amounts.
June July	Dog Salmon	Obtained in quantity. Used fresh in season but most dried for winter use. The dried dog salmon is used as human food when other fish and meat sources are not available. It is put up for winter dog feed.
	Tipnuk	Tipnuk is putrefied fish. It is prepared in either of two ways:
	No. 1	Whole dog salmon are laid tightly in ground pits 2 to 3 feet deep and 2 feet across and lined with grass or small branches; when full the pit is covered, first with large leaves(Petasites ssp.) and then with mud to seal tightly. The fish is allowed to putrefy for several months. In the winter, when frozen, pieces are cut off and eaten either frozen or defrosted, usually with dried fish.
	No. 2	The pit with bottom and sides lined with a thick layer of grass is filled tightly with the fish heads, the liver and the pancreas of either the king or dog salmon. It is then covered first with a layer of grass, then with boards, and sealed tightly with a layer of mud. After about 3 weeks the

Akiak - Continued

Month	Kind of Food	and Remarks
June - continued July	Tipnuk - continued	material in the pit is ready for human consumption. Only enough for immediate use is removed at a time. The material must be thoroughly washed. It is then eaten with fresh or dried fish. The material left in the pit after about 4 weeks is used only as dog feed.
August	Silver Salmon	Available in good quantity. It is used fresh in season. The rest is either dried or salted for winter use.
	Whitefish Sheefish	Obtained in moderate amounts by netting and with fish traps.
	Cranberries Salmonberries Blackberries	Berries are used fresh in season and from 50 to 200 pounds are stored by each family for winter use.
	Seal Oil	In the memory of some of the older members of the community a few seal were caught in the river at Akiak. The Eskimo feels that they no longer come up the river because of the use of outboard motors on their boats. Seal oil is now obtained by purchase or barter every fall from either the Kipnuk or Nunivak Island people. Each family purchases 1 to 2 seal pokes of oil, weighing an average of 65 pounds apiece. Seal oil is used with dried fish and dried meat and in the making of agutuk or other special Eskimo dishes.
September	Moose	Most of the active hunters in the village get one each during the regular hunting season and another when special hunts are scheduled.

Akiak - Continued

Month	Kind of Food	and Remarks
September-Continued	Black Bear	Only a few are caught in the foothills - usually 2 to 5 each year for the entire village.
	Mink	Only fair trapping in the area. The meat is eaten.
	Ducks Geese	Available in the fall but usually only enough for immediate needs.
	Land Otter	Only an occasional one caught.
	"Mouse Nuts"	"Mouse nuts" are gathered in moderate amounts. They are bits of roots and the seedlings of Eriophorum ssp. (Alaska Cotton) which are stored in underground caches around lakes and ponds by the tundra mice. Eskimo women hunt out these caches. The people of Akiak use "mouse nuts" in making agutuk or Eskimo ice cream. "Mouse nuts" used to be stored in unlined ground pits which were then closed very tightly. Nowadays they are stored in gunny sacks and kept in a cool place.

HOOPER BAY:

Hooper Bay is one of the largest Eskimo villages in Alaska with a population of about 435. It is located on the Bering Sea coast about halfway between the mouths of the Yukon and Kuskokwim Rivers. The tundra in back of the village is a wonderful wildfowl breeding area and was probably the original reason for the establishment of a village at this site. The ducks, geese, swans and other wildfowl not only provided food but their skins were used to make parkas. Although bird parkas are no longer used, and the practice of rounding up immature birds has been discouraged in the interests of conservation, wildfowl and their eggs are still an important part of the spring and fall diet.

The village itself is located on a slight rise of ground, which is actually a series of low hillocks. The surrounding low lying area, interlaced and dotted with sloughs, ponds and swamps, is often flooded by the incoming tide. An exceptionally high tide isolates the village entirely.

Sea hunting is especially difficult in this area. Shore ice conditions can be and often are treacherous and the tide movements must always by considered. This village has many stories of men lost while hunting. Sudden changes of weather off the coast are always of grave concern to the entire village and there is much worry and activity until all seal hunters are accounted for. Early boat captains and navigators learned to avoid this particular coastline because of these sudden storms, the treacherous shallows, and dense fogs. They called it "The Smoky Sea."

Except for wildfowl, the Hooper Bay area is not too favorable a location for hunting and fishing. Small scattered family groups roaming from campsite to campsite apparently did quite well in the past, but the heavy concentration of population at the village sites of Hooper Bay and nearby Chevak has put a severe strain on local food resources in this fairly circumscribed area. This population group experiences recurrent stress during those times when wildlife populations are at the low ebb of their cycle or when some disaster in nature suddenly interferes with normal food-gathering activities.

Cash income opportunities are very limited for the Hooper Bay people. The village, because of frequent unfavorable weather conditions, has difficult transportation problems, often being completely isolated for several weeks at a time. This is especially true in the spring and early summer when seasonal employment opportunities away from the village are most available. This past year, for the first time in several years, some of the men did secure work in the Bristol Bay canneries and their take-home pay ranged from $200.00 to $700.00 for the season.

The sale of muskrat and mink skins and grass basketry does not contribute a great deal to the total income.

For the past several years welfare has been a considerable source of village income.

THE SEASONAL HUNTING AND FISHING CYCLE - HOOPER BAY

Month	Kind of Food	and Remarks
January	Needlefish	Small sticklebacks obtained from certain sloughs in the Hooper Bay-Scammon Bay area; from 100 to 500 pounds per year per family are obtained. Used for both human and dog food.
February		
March		

Hooper Bay-Continued

Month	Kind of Food	and Remarks
January February March - Continued	Lush (ling cod)	Trapped through ice in the lake and river 20 miles from the village. Requires a two- to three-day trip away from home and is only obtained sporadically.
	Seal	A few are obtained depending on weather and ice conditions in the bay. March is usually the most stormy month and is the least productive of seal. Sealing was especially good during the winter of 1958.
April May	Seal	Seal hunting is usually fair, but in 1957, because of poor shore ice conditions and early ice break-up, it was very poor.
	Tomcods	A good supply is available if shore ice conditions are good, but the supply is extremely variable from year to year.
	Muskrats	Hunting starts in late April and May after the ice in the sloughs and swamps begins to melt. They are not plentiful in the area.
May June	Herring	The 1957 run was good, but sometimes the run completely bypasses Hooper Bay. The herring run is in May.
	Clams	A short season. Up to 20 qts. per family are usually secured.
	Wild Fowl Eggs	Available spring and early summer from the tundra. Very few are stored for winter use.
	Greens	Mostly sourdock (Rumex arctica). If the spring is early they may be obtained in May but usually they are not available until June.

Hooper Bay - Continued

Month	Kind of Food	and Remarks
May June - Continued	Greens - Continued	Greens are enjoyed while fresh and small amounts are stored for winter use.
	Cheetak	Available in May or June, but usually only a few are caught every year.
	Salmon	Silver and dog salmon. The salmon run usually lasts about two weeks in June. In 1957 it occurred at the same time the ship North Star was in, and the men had to help lighter the supplies ashore and did not have much time to fish.
July	Salmon	Sometimes available the first part of the month if there is a favorable north wind.
	Geese	Formerly obtained during the last part of the month before the geese could fly, but this practice is now unlawful.
August	Berries	Cranberries, crowberries, cloudberries. Women and children gather berries. Sometimes 100-300 pounds per family are stored for winter use.
	Geese	And other wild fowl.
	Whitefish	Not available in quantity.
September	Tomcods	Usually lots of tomcods are obtained from the river; but none were available in 1956.

Hooper Bay - Continued

Month	Kind of Food	and Remarks
September - Continued	"Mouse Food"	Or "mouse nuts." Young tender seedlings of a native grass and bits of edible roots which the field mice have gathered and cached for their own winter use. The women hunt these caches around the edges of lakes and ponds. Sometimes a very high tide will flood the area and kill off the field mice so this food is not always available. This happened in 1957. Usually 1/2 to 2 full gunny sacks a year per family are collected. This food is used in an Eskimo soup dish.
October	Tayahuk	(Hippuris vulgaris). A plant collected from the ponds after freeze-up in the fall. It is used to make an Eskimo soup dish. Not available in large quantities.
October November December	Blackfish	Caught in traps in sloughs but not in large amounts - usually only enough for a few meals at a time.
November December	Whitefish	Caught from the Cottock River in the mountains 20 miles away by net through the ice. It is usually necessary to be away from home 1 to 2 weeks at a time in order to make this trip.
	Mink	Hunted and trapped after freeze-up. Meat used mostly as dog food. The Hooper Bay area is not good mink country.
November through January	Needlefish	See remarks at beginning of list.

KASIGLUK:

Kasigluk is a tundra village located northwest of Bethel on the Willidulli Slough near the confluence of the Johnson and Kuskokwim Rivers. The entire area is one of lakes, ponds, swamps, sloughs and rivers.

The village of Kasigluk is fairly new. Most of the residents came from the nearby tundra village of Nunachuk. The total population numbers about 180. There is considerable population movement between Bethel and Kasigluk and Nunachuk and Kasigluk.

There is no trading post at Kasigluk. All store purchases are made at either the nearby village of Nunapitchuk or at Bethel. Shortage of fuel is a constant problem at Kasigluk as there is none available at the village site. The men go almost daily to the river, several miles from the village, for driftwood.

Cash income is highly variable from family to family and from year to year. For the past several years a few men have obtained well-paying summer construction jobs and a few find other summer employment in the Bethel area. Some cash income is also available from the sale of mink and muskrat furs. There is very little arts and crafts activity in Kasigluk. Welfare is probably the greatest single source of cash income during the winter months. This includes welfare payments from the Bureau of Indian Affairs, Aid-to-Dependent-Children and Old-Age Assistance.

From May until late August or early September most of the villagers go to their family camping grounds on the banks of the Kuskokwim River near Bethel. Here they get their salmon, the most important food item in their economy.

THE SEASONAL HUNTING AND FISHING CYCLE-KASIGLUK

Month	Kind of Food	and Remarks
May	Whitefish	Obtained in good quantity from the slough after the ice is gone. Much of the catch is dried for winter use. The liver and oil from the whitefish and the roe from both pike and whitefish are used to make several favorite Eskimo dishes.
	Muskrats	Eaten fresh and dried for future use. Not available in large quantities.

Kasigluk - Continued

Month	Kind of Food	and Remarks
May June July	Salmon King Silver Dog	Salmon is not available at the village site. Almost the entire village spends the summer at their traditional family camps on the banks of the Kuskokwim River near Bethel. The people leave Kasigluk in May soon after ice break-up and do not return until late August or early September. Fresh fish is used abundantly while available but most is prepared and dried for winter use. It is the most important winter food for both humans and dogs. The salmon heads are strung on grass and dried for dog feed. Both fish heads and whole fish are put in leaf-lined ground pits about 2 feet deep, covered tightly and allowed to putrefy. It takes several weeks for the flesh to ripen and soften. This is called tipnuk. It is used for both human and dog food.
August September	Cloudberries Blueberries Crowberries Low-bush Cranberries	Cloudberries, low-bush cranberries, blueberries and crowberries are harvested at both Bethel and Kasigluk. From 100 to 200 pounds are stored for winter use by many families, considerably less by others.
	Ducks Geese	Ducks and geese are available mostly in the fall of the year. Enough to use fresh and to salt for winter use are obtained.
September - March	Pike Whitefish Blackfish Lush	These fish are obtained throughout the fall and winter from the Willidulli Slough in front of the village and from other sloughs and ponds in the vicinity. In the fall of the year a fish fence,

Kasigluk -- Continued

Month	Kind of Food	and Remarks
September- March- Continued	Pike, etc.,- Continued	constructed of willows, is placed across the Willidulli Slough, the boats are moored at the fence and the men dip nets from the boats day and night as long as the fish run lasts. Fish in excess of immediate family needs is dried. The liver, stomach, intestine and fat depots around the entrails of the whitefish are saved and used as human food. Whitefish oil is highly prized. Fish is caught throughout the winter usually only in amounts to meet day-to-day needs. Blackfish are eaten either raw or boiled. They are 2" to 4" long. A man may eat as many as 30 or 40 at a meal.
November	Mink	The meat is eaten or used as dog food. The furs are sold.
November December	Rabbits	Caught by snares. Not available in large amounts.
February March April	Ptarmigan	The willow ptarmigan is caught with snares in winter and spring. Not usually available in large amounts.

NAPASKIAK:

Napaskiak is a small tundra Eskimo village with a total population of about 137. It is located on the banks of the Kuskokwim River near Bethel. Most of the houses are of log or frame construction, usually with two or three rooms.

There is no store in the village. Food and other items are purchased at Oscarville directly across the river and at nearby Bethel.

Salmon is the most important local food used. It is on the daily menu throughout most of the year. It is used fresh in season, but most of it is eaten after drying. According to the Bureau of Indian Affairs village report for 1957, approximately 28,000 pounds of king salmon, 8,000 pounds of red salmon and 10,000 pounds of silver salmon were caught during the year by the people at Napaskiak and nearby Oscarville. One hundred eighty people and 205 dogs were dependent on this supply. The frequent damp, overcast weather sometimes makes it difficult to dry fish adequately and to protect it from mold while in storage. Pike, ling cod, whitefish, blackfish, wildfowl, seal, muskrat and moose meat are seasonal substitutes for the usual dried salmon.

Cash income is similar to that of other tundra villages. A few men secure cannery, mine, or construction work in the summer, most men of the village trap muskrat and mink, a few belong to the National Guard, and some income is made from the sale of arts and crafts, especially from skin sewing. Welfare is available to several families.

THE SEASONAL HUNTING AND FISHING CYCLE-NAPASKIAK

Month	Kind of Food	and Remarks
January February March	Sheefish	A large whitefish. It is caught through ice from the river, but only occasionally.
February	Willow Ptarmigan	Some years very few.
	Rabbits	Caught with snares.
April May	Willow Ptarmigans Pike Blackfish	Many people still go to their spring camp on the nearby tundra. They snare willow ptarmigans and get pike and blackfish with willow root traps in tundra sloughs, lakes and ponds after the ice is gone.
	Muskrats	The season opens in May but muskrats are not available in large quantities most years.

Napaskiak - Continued

Month	Kind of Food	and Remarks
June	Whitefish	Caught with dip nets from nearby sloughs.
	King Salmon	Caught from the Kuskokwim River with nets. The excess beyond immediate needs is dried for winter use.
July	King Salmon	Only occasionally caught.
	Red and Dog Salmon	Available in quantity. Most of it is dried but small amounts are putrefied. This is done by lining a pit 1-1/2 to 2 ft. deep with leaves and then piling in fish heads or whole fish and covering with leaves and then mud. The fish is allowed to ripen or soften for a month or two. It is used for both human and dog food.
	Sourdock	Collected in wet places on the tundra. It is mostly used fresh, but small amounts are stored for winter use. The sourdock is cooked in water, to cover, and then stored in kegs and cached for future use.
August	Whitefish Silver Salmon and Pike	White fish and silver salmon are available from the river in fairly good amounts. Only an occasional pike is caught.
	Cloudberries Low-Bush Cranberries Blueberries Crowberries	Available from surrounding tundra. Only small amounts are stored for winter use.
	Whistling Ducks	Only occasionally
	Geese	Used fresh. Some are salted for winter use.

Napaskiak - Continued

Month	Kind of Food	and Remarks
August September	Moose	Not available near the village but a few men go farther up the river during the open season. Only 2 or 3 moose are brought back to the village each year.
September	Whitefish Lush	Caught from the river, but usually only sufficient numbers to satisfy daily needs.
	Seal Seal Oil	A few men go sealing at the mouth of the Kuskokwim River, but most obtain their seal meat and oil by barter or purchase from the coastal people. The usual cost is $5 to $10 per carcass. An estimated 2,000 pounds is purchased yearly by Napaskiak and nearby Oscarville.
October	Blackfish Whitefish	Probably about one third or more of the village still go to Fall Camp, where they get blackfish and whitefish from tundra lakes, ponds and sloughs. These fish are not available in large amounts.
November	Ling Cod Sheefish Pike	Caught through the ice in river. Not available in large quantity.
	Mink	Available later part of month.
	Rabbits Willow Ptarmigan	Caught with snares. Most years not many are available. Estimated total rabbit meat is about 200 pounds for entire village.

NEWKTOK:

Newktok is a small tundra village located on a slough not too far from Hazen Bay near Nelson Island. The present village site is only about five years old. It was formerly just a camp site, but trapping

and hunting were thought to be good enough in the area to warrant establishing the village here. Most of the people came from the old village of Keyaluvik. Transportation in and out of the village is mostly by boat from late spring to freeze-up in the fall and in winter by dog team. There is no regular plane or mail service. There are about 20 families at Newktok with a total population of about 118. The oldest resident in the village is 55 years of age.

There are a few frame houses in Newktok, but most families live in sod igloos which are of necessity small because of the lack of building and heating materials. These sod igloos are used only in winter from about late October to April. The rest of the year most families live in tents.

In April almost the entire village goes to their sealing camp Nlulugak, six miles from Tanunak on Nelson Island. Here they do their spring sealing and later herring and flounder fishing. Many families stay at this camp from spring through late summer.

The most important local foods are seal, seal oil, muskrat, tomcods, blackfish, needlefish, herring, flounders, berries, ducks and geese and their eggs.

There are three small stores in Newktok, one a local cooperative, the other two individually owned and operated. None of them carries a large stock. Deliveries are made once a year during the summer and most of their items are used up by December. Additional food purchases are made at Tanunak on Nelson Island which is about 1-1/2 to 2 hours away by outboard boat but requires an overnight trip when made by dog team in winter.

Cash income is usually less than for most other tundra villages although more men obtained summer cannery work in 1958 than usual. Nine men made an average of $550.00 each for the season in 1958. In addition the sale of mink and muskrat fur, grass basketry, ivory carving, and occasional odd jobs at lightering and helping in the construction of buildings and boats augments the family cash income. For the past year approximately $700.00 per month has come into the village in the form of welfare payments, mostly assistance to families with a tuberculosis problem and aid-to-dependent children.

THE SEASONAL HUNTING AND FISHING CYCLE-NEWKTOK

Month	Kind of Food	and Remarks
June	Flounders	Caught at sea and in the big river with nets. Some is eaten fresh but most is dried for dog feed.
July		
August		

Newktok - Continued

Month	Kind of Food	and Remarks
June July August - continued	Herring	Caught off Nelson Island. The herring fish are gutted and strung on grass, and then dried and stored for winter use.
	Herring Eggs	Dried and stored in gunny sacks. When ready to use they are soaked in water and eaten without cooking.
	Seals	Only an occasional one is caught.
	Geese Ducks	Used fresh as caught. There is never enough to store for winter use.
	Sourdock (Rumex arctica)	Only used fresh. There is never sufficient quantity for winter storage.
August	Muskrats	The meat is eaten and the fur sold.
September	Tomcods	Mostly dried for winter use.
October	Tomcod Livers	Used fresh in season.
	Cloudberries Crowberries Blueberries Low-Bush Cranberries	Used fresh in season; some are stored for winter use but not in large amounts. Low-bush cranberries are the most abundant.
	Blackfish	Caught from September throughout the winter from lakes and small streams using willow root traps. Eaten cooked or raw and frozen.
	Mukluks (large bearded seal) Spotted Seal	Only occasionally caught.
November December	Needlefish	Used fresh, raw, cooked, or frozen and raw. Used as food for both humans and dogs.

Newktok - Continued

Month	Kind of Food	and Remarks
November	Seals	Hunting is started after Christmas, mostly on overnight trips from the village.
December continued		
	Muskrats	Meat eaten, usually cooked. Skins sold.
	Mink	Meat eaten, usually cooked. Skins sold.
April	Seals	April through May on Nelson Island near Tanunak.
May	Herring	May and June.
June	Smelts	Sometimes obtained after the herring run but not every year. None in 1957.

POINT HOPE:

Point Hope is an arctic Eskimo village of approximately 315 people. It is located on a gravel spit called "Tigara" by the Eskimos, which means "the point that runs out like a forefinger." Tigara has been occupied by the Eskimo for at least 1,000 years and possibly longer.

The spit on which the village is located is bounded on three sides by the Arctic Ocean and five to six miles east of the village are high cliffs and almost treeless rolling hills. The actual village site on the spit has been changed several times throughout the centuries as the action of the sea wore away the shore line. Some of the older men of the community can remember when Tigara Point extended much farther out into the Arctic Ocean. Only a few vestiges of this particular village site remain; the rest are under water. These old village ruins have been a productive source of archeological artifacts. The older people also say that the water depth along the north shore of the spit was once deep enough for the large bow whale and that they were caught within sight of the village. Today they are hunted much farther out in the ocean.

Point Hope is very favorably located for the hunting of sea mammals and other game. One to five large whales are caught yearly by the village hunters. In addition a good hunter may catch as many as 100 or more seal or oogruk, one or more polar bears and several caribou a year. The people also obtain limited quantities of trout, grayling, tomcod, crab, bird eggs and eider duck. Occasionally when ocean current conditions are favorable, walrus are caught. In times past certain plant roots and berries were gathered and used, but this is not done much today.

According to archeological findings, Point Hope at one time supported 1,000 or more people, but for many years the population has been somewhat stationary at about 275, more or less. In 1957 the population had risen to about 315, due to the migration of several families from Point Lay, a village farther north on the Arctic Coast. Point Lay was originally settled by emigrants from Point Hope.

In addition to the "local" foods, imported foods are available since considerable cash income is earned by the Point Hope people. These people are vigorous and aggressive and find many opportunities for summer work in construction and mining. Some men go as far as Fairbanks for summer employment although the family usually stays in the village. This seasonal employment interferes very little with their normal hunting and fishing activities.

In addition to summer work, income is derived from the sale of archeological artifacts, ivory carvings, sewing of mukluks and fur parkas and other crafts; from the sale of seal hides, polar bear skins and fox skins, and for the past two years from acting as guides for polar bear hunters. Even so it is estimated that about one-fifth the cash income for the village is from welfare (Aid-to-Dependent-Children and Old-Age Assistance) and unemployment insurance.

THE SEASONAL HUNTING AND FISHING CYCLE - POINT HOPE

Month	Kind of Food	and Remarks
January February	Polar Bear	The skins are sold by the foot. Fifty to 100 or more polar bear are caught per year by the village hunters. This has been a good source of income for several years. The meat is edible and used for both human food and as dog feed.
	White Fox	The skins are sold. For the past few years, because of the low price, this is only a meager source of income.
	Tomcod	Caught by jigging through holes in ice. Usually done by the women and older men of the village.
	Caribou	A few are killed in the fall and winter. In 1957-58 the hunting was exceptionally good.
Late February Early March	Crab	A very small variety and available in small amounts only.

Point Hope - Continued

Month	Kind of Food	and Remarks
April May	Whale	One to five large baleen whales are caught every year. The meat and blubber are stored in old sod igloos which serve as fairly effective year round cold storage. The annual whale feast celebration is held in early June.
June	Oogruk	Oogruk is the large bearded seal, weighing from 200-600 pounds. It is hunted until the shore ice goes out. There is usually excellent hunting of this animal at Point Hope in 1957 the shore ice receded early and so fast that very few were taken.
July August		Most able-bodied men leave the village for summer wage work at Kotzebue, Fairbanks, etc.
September		Sporadic fishing off the coast at the village site.
	Gull and Crowbill Eggs	Gull and crow bill eggs are obtained from shore cliffs. Edible portion of gull eggs averages 112 grams; crowbill eggs 87 grams. An estimated 830 dozen eggs are gathered each year.
Late September through Mid-November	Grayling	Caught with a pole or net at Kukpuk River located in the hills to the east of the village. Usually several families camp at a particular location.
	Caribou	For several years only a few have been killed, but in the winter of 1957-58 they were plentiful. Usually obtained during four- to five-day hunting forays away from the village.
	Birds	Especially eider ducks, snowy owls, and to a lesser extent ptarmigan. Obtained during migrations only.

Point Hope - Continued

Month	Kind of Food	and Remarks
Late October through December	Seal and Oogruk	Hunted from late October or after the shore ice becomes solid enough for walking and dog teaming. Hunted in open leads. A good hunter may get 100 or more a year.
	Polar Bear	Meat used as human food and dog feed.
	White Fox	Skins sold.

SHISHMAREF:

Shishmaref is an Eskimo village located on a small narrow sandy island just off the northwestern coast of Seward Peninsula. The village faces the Arctic Ocean and immediately behind it is an 18-mile wide lagoon or inlet into which flow two mainland rivers, the Arctic and the Serpentine.

Shishmaref village has been moved several times in the past. The original site is thought to have been inland on the banks of the Arctic River. At one time the inlet and the entrance to it from the ocean were apparently much deeper than they are now, for whale were hunted in it. Whale spear heads similar to those that were used at Point Hope can be found in the old village ruins. There is no whale hunting today nor apparently has there been for several hundred years. There are several old village sites near the present village indicating successive moves.

The population of Shismaref is approximately 175, but there is considerable population movement between Nome and Shishmaref. Some families go to Nome only in the summer for wage work, usually with the mining company. For the past several years, however, many Shishmaref families have established permanent residence in Nome. A few families have moved to Anchorage and Seattle. Several of the Shishmaref men are exceptionally good carvers and etchers. Two of Alaska's outstanding Eskimo artists, George Agupuk and Wilbur Walluk, come from Shishmaref.

In addition to summer wage work, cash income is obtained from ivory carving, skin sewing, and the sale of archeological artifacts. Old-Age Assistance, Aid-to-Dependent-Children and unemployment insurance contribute significantly to the total village income. There is one trading post in Shishmaref which is owned and operated by the village. However, significant food purchases are made in Nome during the summer by many families, and intermittently at Teller throughout the year.

Because of the summer employment opportunities, and a fair income for at least a few of the village families, a wider variety of store-bought foods are used than in many villages.

Shismaref is very favorably located for the hunting of seal and oogruk, the large bearded seal, although in some years persistent bad weather and ice conditions along the coast create serious food shortages. This is especially so in late winter and early spring. March is the most critical month and is sometimes referred to as the "hunger month."

At one time reindeer herds were locally owned and operated, serving as an important source of meat. The fawn skins were used in making winter parkas. These herds no longer exist locally but some meat is shipped into the local trading post from Teller.

THE SEASONAL HUNTING AND FISHING CYCLE - SHISHMAREF

Month	Kind of Food	and Remarks
November through June	Seal	There is sporadic seal hunting, depending always on the weather, from November through June, beginning after the shore ice is solid enough for walking and dog team travel and continuing until the ice goes out sometime in June. Usually the men eat a very light meal or not at all before going out for the day on a hunt. They claim a heavy meal makes them logy and less alert. Many do take a thermos of hot tea or coffee with them.
	Polar Bear	Only a few, sometimes none, are caught on the ice off Shishmaref.
	Tomcod Flounders Bullheads	These fish are caught by jigging through the ice in the lagoon back of the village, usually by the older people and the women. They go out whenever the weather permits. The fresh cooked or raw frozen fish provides welcome variety to an otherwise monotonous meat diet.

Shishmaref - Continued

Month	Kind of Food	and Remarks
November through June - Continued	Ptarmigan Rabbit	Throughout the winter and early spring before the ice break-up, rabbits and ptarmigan are hunted whenever weather permits trips to the mainland. They are not found in abundance but do furnish welcome variety to the diet.
April - May+	Willow Bark (Salix alaxensis)	The inner bark (Keeleeyuk), meaning "the scrape," of this plant is collected in early spring, at about thaw time when the sap begins to run. The outer bark is carefully cut and removed and the thin inner layer is scraped off with a knife and eaten. Men on hunting forays along the mainland rivers often bring some of this choice delicacy home to the family. It is not used in significant amounts.
May - June	Oogruk (bearded seal)	The oogruk is hunted and usually captured in good quantity on the pack ice in late May and June, or as long as the pack ice persists and is safe. Some hunters make daily forays from the village, but many family groups still go to their traditional campsites farther up the coast. A good hunter during a good hunt year may capture 12 to 14 oogruk at this time as well as many smaller seal. The meat is air-dried, cut in strips and stored either dry or in seal oil. The blubber is cut into fairly small pieces, stuffed into seal pokes, and stored in a cold place, either in pits dug in the sand or in old camp dwellings. During a good year enough seal and oogruk are caught within a two- to three-week period to furnish almost an entire year's supply of dried meat and oil.

Shishmaref - Continued

Month	Kind of Food	and Remarks
May - June - Continued	Qogruk - Continued	Young boys 13 to 14 years old often accompany the older hunters at this time. The boy's very first catch goes to the oldest man in the camp by tradition. This particular hunt is an extremely busy one for everybody, often involving "around-the-clock" activity. The men bring the catch to camp, laying it out on the shore ice to keep cold until the women can butcher and prepare the meat for drying. After this is done the women prepare the seal pokes and then flense the blubber from the skin and prepare it for storage; then the skins are cleaned. Some are later used to cover the comiak (skin boats); some are stretched on frames and dried and eventually used to make the soles of Eskimo boots or mukluks, or cut into rawhide strips. There is no waste. Whatever is not suitable or needed for human use is fed to the dogs. Prize young seal skins are especially handled and later tanned and used to make sealskin parkas and sealskin pants. The women usually have several weeks work after the hunting is over. Many of the able-bodied men leave for Nome immediately after the ice goes out in search of summer employment. The women stay behind to finish up their work.
	Birds, Bird Eggs	Geese and other birds are available in small amounts during the northward migration and during the nesting season. Seagull eggs are sometimes gathered in fairly good amounts.

Shishmaref - Continued

Month	Kind of Food	and Remarks
May - June - Continued	Greens and Other Plants: Sourdock (Rumex arctica)	Sourdock is the most important local wild green collected. Each family tries to put up several small (25 to 60 pounds) barrels of this green. It is found in wet swampy places around tundra lakes and ponds. It is cooked before storage. In the fall and winter it provides a tasty tid-bit. It is sometimes mixed half and half with crowberry (Empetrum nigrum).
	Sedum roseum	Both the leaves (Eveeakluk) and the roots (Ekutuk) of this plant are favorite local plant foods, and used in season.
	Marsh Marigold (Caltha palustris)	This plant is found in profusion around the shallow edges of tundra lakes and ponds. Women and children usually gather sufficient for several meals during the short time they are available. It is cooked before eating.
	Arctic Ground Willow (Salix ssp.)	The young tender leaves of arctic ground willow (Surrah) are usually collected in sufficient quantities to store for winter use. They are marinated lightly with seal oil before storage in a cool place and have an exceptionally high ascorbic acid value.
	Woolly Lousewort (Pedicularis lanata)	The flower of this plant (Nahzakmetak) is sometimes collected, stored in water, and allowed to ferment. This is an old-time practice that is almost obsolete now. This plant grows in abundance in the Shishmaref area.

Shishmaref - Continued

Month	Kind of Food	and Remarks
June - July	Herring	A small but significant herring run occurs along the coast near Shishmaref. Excess fish are dried for winter use.
	Salmon	There is a small salmon run in July. Small amounts are dried for winter use.
August September	Berries: Crowberries (Empetrum nigrum) Blueberries (Vaccinium ssp.) Cranberries (Vac. vitis idaea) Cloudberries (Rubus chamaemorus)	These berries are often available in significant amounts from the mainland tundra. Crowberries and cloudberries are the favorites and stored, sometimes 50 to 100 pounds each by most families, for winter use. Properly stored, cloudberries retain significant amounts of the original high ascorbic acid value. These berries are used in making Eskimo ice cream (agutuk) and other choice Eskimo dishes.

APPENDIX D

FOOD AND NUTRITION BOARD, NATIONAL RESEARCH COUNCIL
RECOMMENDED DAILY DIETARY ALLOWANCES 1/, REVISED 1958

Designed for the Maintenance of Good Nutrition of Healthy Persons in the USA
(Allowances are intended for persons normally active in a temperate climate)

	Age Years	Weight kg (lb)	Height cm (in)	Calories	Protein gm	Calcium gm	Iron mg	Vitamin A I.U.	Thiamine mg	Riboflavin mg	Niacin 2/ mg equiv.	Ascorbic Acid mg
Men	25	70 (154)	175 (69)	3200 3/	70	0.8	10	5000	1.6	1.8	21	75
	45	70 (154)	175 (69)	3000	70	0.8	10	5000	1.5	1.8	20	75
	65	70 (154)	175 (69)	2550	70	0.8	10	5000	1.3	1.8	18	75

1/ The allowance levels are intended to cover individual variations among most normal persons as they live in the United States under usual environmental stresses. The recommended allowances can be attained with a variety of common foods, providing other nutrients for which human requirements have been less well defined.

2/ Niacin equivalents include dietary sources of the preformed vitamin and the precursor, tryptophan. Sixty milligrams tryptophan equals one milligram niacin.

3/ Caloric allowances apply to individuals usually engaged in moderate physical activity. For office workers or others in sedentary occupations they are excessive. Adjustments must be made for variations in body size, age, physical activity and environmental temperature.

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